# Candidate Conservation Agreement with Assurances for Fishers on the SPI ownership in the Klamath, Cascade, and Sierra Nevada Mountains

between

Sierra Pacific Industries

and

U.S. Fish and Wildlife Service

This Candidate Conservation Agreement with assurances (CCAA), effective and binding on the date of last signature below, is between Sierra Pacific Industries (SPI), A California Corporation (Applicant), and the U.S. Fish and Wildlife Service (Service).

The Administrators of this CCAA are:

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# 1 AUTHORITIES

## 1.1 SIERRA PACIFIC INDUSTRIES

Sierra Pacific Industries (**SPI**) and all related entities enters into this Candidate Conservation Agreement with Assurances (**CCAA**) under the inherent authority of the corporate management of Sierra Pacific Industries.

## 1.2 U.S. FISH AND WILDLIFE SERVICE

Sections 2, 7, and 10 of the Endangered Species Act of 1973, as amended (ESA), and the Fish and Wildlife Coordination Act, allow the United States Fish and Wildlife Service (**Service**) to enter into this CCAA. Section 2 of the ESA encourages interested parties, through Federal financial assistance and a system of incentives, to develop and maintain conservation programs as a key to safeguarding the Nation's heritage in fish, wildlife, and plants. Section 7 of the ESA requires the Service to review programs that it administers and to utilize such programs to further the purposes of the ESA. By entering into this CCAA, the Service is utilizing its Candidate Conservation Program to further the conservation of the Nation's fish, wildlife, and plants. Section 10(a) of the ESA authorizes the issuance of permits to "enhance the survival" of a listed species. The Service's implementing regulations at 50 CFR 17.22 (d) and 17.32(d) provide the application requirements and issuance criteria for CCAAs.

## 1.3 PURPOSE

The purpose of this CCAA is to provide a regulatory mechanism for SPI to implement conservation measures that support fishers *(Pekania pennanti)* of the West Coast Distinct Population Segment (**Covered Species**) in a manner that allows the Service to issue an Enhancement of Survival (ESP) permit for the majority of SPI's California timberland ownership (**Enrolled Lands**). This CCAA will contribute to the Service's fisher conservation goals in a manner that, should other necessary properties contribute a similar level of conservation, the potential need to list the fisher is avoided. As discussed in Section 7.3 -- Conservation Measure Standards, portions of the existing Mixed land class on SPI lands that currently provide fisher habitat will be maintained for the duration of the CCAA at the 10,000 acre and female fisher territory scale. The retention of key elements will ensure the continued existence of important habitat features (den sites, rest sites, areas of canopy cover) including habitat for small mammals and other fisher prey items in areas receiving vegetation management treatments.

This CCAA provides SPI regulatory certainty concerning land use restrictions that might otherwise apply, should the fisher become listed under the ESA. Likewise, the CCAA provides the Service certainty that a substantial portion of the Enrolled Lands will remain in the Mixed land class, areas currently identified as providing for fisher conservation on SPI's land will be maintained, and habitat elements important to fishers will be identified and maintained on the Enrolled Lands during forest management activities. For the purpose of maximizing the beneficial impact of the CCAA, the Conservation Measures will begin to be implemented on January 1, 2016, or earlier if the agreement is signed prior to that date.

## 1.4 DURATION OF CCAA AND PERMIT

The term for this CCAA and the associated Enhancement of Survival Permit (ESP) will be 10 years. The Enhancement of Survival Permit issued with the approved CCAA will become effective if the fisher becomes listed, and will remain in effect for the duration of the CCAA. If the Service, in consultation with SPI, determines the conservation benefits of the CCAA are valuable and it is in the public interest to continue the commitment to fisher conservation beyond the current 10-year permit, SPI may seek to renew the CCAA and the Permit beyond the specified term of 10 years. If SPI chooses to seek renewal of the permit, a notification should be provided to the Service in writing no less than 12 months prior to the expiration of the existing permit. If the Service and SPI agree to work to renew the permit, the Service and SPI will initiate the renewal process in accordance with USFWS regulations in effect at the time (currently 50 CFR 13 and 50 CFR 17). The Service must reevaluate the CCAA at the time of renewal to determine if the CCAA will continue to meet the CCAA standard.

### 1.5 COVERED SPECIES

This CCAA will cover fishers, *Pekania pennanti (=Martes pennanti*).

## 2 RESPONSIBILITIES OF THE PARTIES

SPI will be responsible for implementing this CCAA through programs of habitat management and decisions about where and when to harvest timber on their lands they own beginning on January 1, 2016, or earlier if the agreement is signed prior to that date. By harvesting at the rate specified in their projection of Long Term Sustained Yield Option A Document (SPI Option A), developed per the California Forest Practice Rules (CFPRs)(14 CCR 933.11), the quality of den habitat for fishers on the enrolled lands is expected to improve. SPI's rate of harvesting, placement of harvest units within the landscape, and retention of essential habitat elements will maintain and develop fisher habitat of sufficient condition and quality to allow for continued occupancy by fishers where they currently exist, which is anticipated to provide for a stable or increasing fisher population. Within the historic range of the species, SPI will maintain and develop habitat that allows for the expansion of fisher populations into areas that are currently unoccupied. Upon approval of the CCAA, should the fishers be listed under the ESA in the future, the Section 10(a)(1)(A) permit issued to SPI by the Service shall become effective and, in accordance with 50 CFR 17.22 and/or 17.32, a specified level of incidental take shall be authorized on the Enrolled Lands. Regulatory assurances, consistent with 50 CFR 17.22 (d)(5) and 17.32(d)(5) shall be provided. The level of authorized take (described in Section 9 of the CCAA and in the Enhancement of Survival Permit issued by the Service) shall not be exceeded.

## 3 ENROLLED LANDS

### 3.1 LOCATION AND DISTRIBUTION OF ENROLLED LANDS

The Enrolled Lands are described in Appendix S and shown on a general map of Covered Species Conservation Areas (CSCAs) in Figure 3.1-1. SPI habitat management areas are segregated into 16 CSCAs and includes ownership, totaling approximately 1,570,963 ac. (Table 3-1).

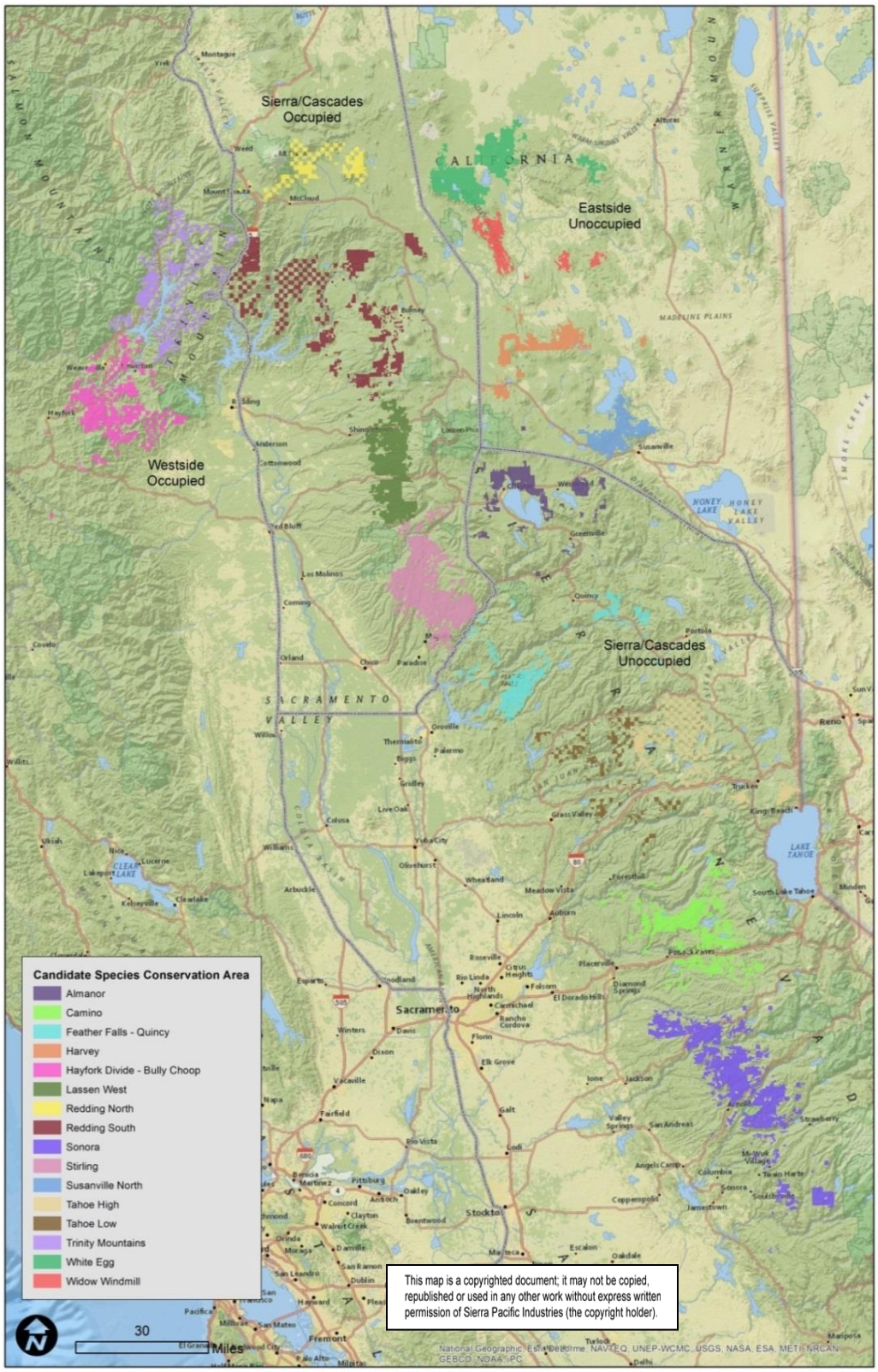
Table 3-1 -- Covered Species Conservation Areas (CSCAs) on Enrolled Lands

| CSCA Westside Occupied | Acres | Sub-Totals |
|---|---|---|
| Hayfork Divide - Bully Choop | 124,652 | |
| Trinity Mountains | 118,009 | **242,661** |
| **CSCA Occupied Sierra/Cascades** | | |
| Redding North | 43,238 | |
| Redding South | 160,491 | |
| Lassen West | 116,625 | |
| Stirling | 158,798 | **479,153** |
| **CSCA Unoccupied Sierra/Cascades** | | |
| Almanor | 60,720 | |
| Feather Falls-Quincy | 73,133 | |
| Tahoe High | 79,054 | |
| Tahoe Low | 49,111 | |
| Camino | 120,927 | |
| Sonora | 198,789 | **581,734** |
| **CSCA Unoccupied Eastside** | | |
| White Egg | 112,760 | |
| Widow Windmill | 40,120 | |
| Harvey | 58,232 | |
| Susanville North | *56,303* | **267,415** |
| **ALL CSCA Grand Total** | **1,570,963** | |

Note: all acreage data circa 1/1/2012 (Hexagon Analysis)

In this CCAA the term **Occupied Range** refers to those Enrolled Lands that are within the Sierra Cascades occupied and Westside occupied CSCAs. Other general uses of the term occupied range will not be capitalized.

Figure 3.1-1 Regions and Covered Species Conservation Areas



### 3.2 INCREASING OR DECREASING ENROLLMENT

Enrolled Lands may increase or decrease under this agreement as the result of the sale, purchase, or exchange of lands. Any increase or decrease in the Enrolled Lands will be reported annually to the Service. The Conservation Measures in the CCAA will be applied on the newly acquired lands and the Service notified regarding the legal description of the added property.

The enrollment of new property or the disposal of previously enrolled property will not change the authorized level of incidental take or require an increase or decrease in the level of commitment to fisher conservation already specified in the CCAA.

Incidental take on newly added lands will not be authorized until the Service provides SPI written notification that the newly added lands have been incorporated into the CCAA. Once incorporated, incidental take will be authorized per the terms of the Enhancement of Survival Permit (ESP) and the amount of permitted take specified in the ESP shall not be exceeded regardless of changes in Enrolled Lands.

The addition of property to the Enrolled Lands will be considered a minor change to the CCAA. Enrolled Lands may decrease by as much as 10% in any individual CSCA, cumulatively (in that CSCA) over the life of the permit, of the acreage enrolled on the day the CCAA agreement is signed, without invoking the need for review and potential changes in the CCAA. Any decrease in Enrolled Lands that is cumulatively greater than 10% of the Enrolled Lands will require prior written notice to the Service (See Section 11.2.3). Decreased enrollment resulting from land transfers to the United States of America will not be counted towards the 10% cumulative total. Upon receiving notice that cumulatively the Enrolled Lands will decrease more than 10%, the Service will then have the discretion to either concur that the purposes of the CCAA are being met, or the Service may require that the CCAA be amended in accordance with all applicable legal requirements.

## 4 COVERED ACTIVITIES

Covered Activities include Timber Operations as defined by the California Forest Practice Rules (CFPRs) (Title 14, California Code of Regulations Chapters 4, 4.5, and 10) when they are included in an approved Timber Harvest Plan (THP) or Emergency or Exemption Notification in accordance with the CFPR. These include: felling and bucking timber, yarding timber, loading and landing operations, transportation of forest products and equipment, chipping, timber salvage, transport of wood products, water, and rock, road construction, road reconstruction, and road maintenance, crossing facility placement and maintenance, site preparation, mastication, and prescribed burning. Each of these activities is further described in detail when they occur as part of an approved THP, which satisfies California Environmental Quality Act (CEQA) analysis requirements.

Covered Activities also include actions that are not Timber Operations, but may be conducted as part of a THP and its accompanying CEQA analysis. These may include, but are not limited to, herbicide applications, machinery maintenance, machinery fueling, and fuel storage.

Covered Activities also include other management actions that are not defined as Timber Operations and that do not require THP or Notifications under the CFPR, but are covered by CEQA analysis under other statutes. These analyses occur under applicable regulatory frameworks relating to Regional Water Quality Control Board Waste Discharge permits or waivers, California Department of Fish and Wildlife Streambed Alteration (Fish and Game Code Section 1600) permits, the Surface Mining and Reclamation Act of 1975 (SMARA, Public Resources Code, Sections 2710-2796), or California Department of Pesticide Regulations. Government oversight of the implementation of these regulations is provided through California Department of Forestry and Fire

Protection (CAL FIRE), California Department of Fish and Wildlife, the Regional Water Quality Control Boards, the California Department of Conservation's Office of Mine Reclamation (OMR), the State Mining and Geology Board (SMGB), and County Agricultural Commissioners. SPI personnel and their contractors that are responsible for these activities have the appropriate licenses from the State of California. A Registered Professional Forester (RPF) must consult with other resource professionals in cases where additional expertise is required. Violations of these regulations can result in civil and criminal penalties for the responsible party. These Covered Activities that are covered by a CEQA analysis or other statutes are specified in Section 4.1 below.

Covered Activities that do not require THPs or Notifications under the CFPR or specific CEQA analysis are discussed under Section 4.2.

Measures to reduce the impacts of Covered Activities are contained in Section 7.3 of this CCAA.

## 4.1 MANAGEMENT ACTIONS COVERED BY CEQA ANALYSIS

Covered Activities include management actions that are not defined as Timber Operations and that do not require THP or Notifications under the CFPR, but are covered by CEQA analysis under other statutes. These include: rock pit development, rock processing, rock hauling, and watercourse crossing installations. Many of these actions are extremely unlikely to affect fishers; however, for clarity all of the activities are included as Covered Activities for the rare event that some level of incidental take occurs or the action is construed as reasonably likely to take a fisher.

### 4.1.1 Rock Pit Development and Rock Processing

Rock pit development is done to acquire aggregate for use on SPI's forest roads. These activities are done in compliance with California's Surface Mining and Reclamation Act (SMARA). Rock pit development rarely requires tree removal because the depth of the soil over the rock layer being accessed is usually shallow, and thus large mature trees rarely grow there. Rock source development involves the removal of vegetation (if present), excavation of the overburden (soil), and then excavation of the aggregate. The average rock pit excavation generally disturbs less than one acre of land. Most rock pits are adjacent to existing roads. Rock pits may gradually increase in size over time but generally do not exceed 5 acres. Excavation of aggregate may be done by ripping and pushing with a tractor crawler and/or digging with an excavator. Depending on the rock formation, aggregate extraction may require drilling and blasting. Aggregate may also require mechanical crushing in order to achieve the desired size and uniformity. Rock aggregate of various sizes is used to strengthen a road prism, road surface, and crossing facilities. Rock pit development and reuse of a rock source is intermittent. The conservation measure in 7.3.6 will minimize the impact of rock pit development and use.

### 4.1.2 Transport of Aggregate Products and Heavy Equipment

Transportation of aggregate and heavy equipment involves semi-trucks traveling to and across the transportation network within the Enrolled Lands. Semi-trucks used for hauling materials and equipment include water trucks, end-dump trucks, low beds, and belly dump trucks. Due to the alignment and grade of the transportation system, hauling operations generally occur at speeds less than 25 mph.

#### 4.1.3 Watercourse Crossing Installation

Activities that significantly alter the bed, bank, or stream channel of a watercourse require a permit from the California Department of Fish and Wildlife. Watercourse crossings are designed to minimize their impact to water resources and the surrounding riparian vegetation. The watercourse permitting process requires a CEQA analysis.

#### 4.1.4 Communication Site Construction and Maintenance

Other activities and facilities that occur on the Enrolled Lands include communication site construction and maintenance. There are 17 communication sites in the Occupied Range. Communication sites in the county zone districts encompassing the Occupied Range require a discretionary use permit. A county- issued discretionary use permit requires CEQA review.

Communication sites occur generally on high elevation ridges or peaks that provide the desired coverage for a communication company. Communication sites are generally accessed by existing roads; however new road construction may be necessary in some instances. Appropriate measures of the CFPR will address the harvest of trees at these sites. Communication sites have one or more metal lattice or pole towers, multiple antennae, and one or more small 16 ft. x 20 ft. equipment shelters. The sites are equipped with one or more diesel powered electrical generators. Site perimeters typically have 8 ft.-high cyclone fencing to control access. Vegetation removals may be necessary to accommodate the construction and maintenance of a communication site, including overhead or underground electrical power distribution lines. Communication site maintenance includes vegetation management for fire prevention using mechanical and/or herbicide treatments. Herbicide treatments are prescribed by a California Certified Pest Advisor and applications supervised by a California Certified Qualified Applicator under the authority of the California Department of Pesticide Regulation's pesticide program.

### 4.2 MANAGEMENT ACTIONS NOT COVERED BY CEQA ANALYSIS

Covered Activities include routine road maintenance, mastication of vegetation within road rights of way, placement and use of water tanks, timber cruising, timber harvest preparation, pre-commercial thinning, construction and operation of communication sites, scientific research, and fire suppression. These minor forest activities are not subject to THP approval or other CEQA review.

These Covered activities may be conducted by SPI employees, contractors, agents, or other assigns.

With the exception of fire suppression, these activities do not generally affect the physical environment significantly in a manner that would likely take a fisher.

#### 4.2.1 Road Maintenance

Road maintenance is done on an as-needed basis to ensure the integrity of the road prism, road drainage, and associated crossing facilities. Road maintenance does not require substantial changes to the road prism and therefore does not require a permit. Road maintenance does not require the removal of substantial amounts of vegetation and is limited to small brush and tree seedlings, branches or grass that has grown in the travel-way.

#### 4.2.2 Mastication of roadway rights of way

Mastication of right-of-way brush and small trees may be conducted in order to maintain sight distance along the roadway, and also so that the road can function more effectively as a fuel break, by reducing the flammability of the fuels adjacent to the road. Mastication of roadway rights -of-way targets limbs of larger trees, brush, and trees up to 6 in. diameter breast height (dbh). Masticating roadway rights-of-way is applied in a narrow corridor adjacent to existing roads and does not target vegetation that is large enough in diameter to hold a fisher den; thus, impacts to fishers are extremely unlikely.

#### 4.2.3 Placement and Use of Water Tanks

Water tanks are placed and maintained to create a water source for use in dust abatement. Water tanks are situated on stable, level ground. Water diversions requiring the alteration of the bed or banks of a watercourse require permit approval from the California Department of Fish and Wildlife. Water tanks will be covered in a manner that excludes fishers and/or designed or equipped such that fishers or other wildlife are not entrapped. As such, take of fishers associated with drowning in water tanks is not reasonably likely to occur. SPI, through its normal operational activities, will continue to identify and, if necessary, remediate water tanks that are a threat to fishers, within the term of the permit. The conservation measures in 7.3.7 will minimize the impact of water tank placement and use.

#### 4.2.4 Timber Harvest Preparation

THP preparation includes foresters driving to the plan area and then traversing the plan area on foot, flagging watercourse buffers, road alignments, and unit boundaries, performing archaeological reconnaissance and, watercourse assessments, and marking timber. Virtually no impacts to the physical environment result from timber cruising or THP preparation activities. Timber preparation activities are very unlikely to impact fishers.

#### 4.2.5 Pre-commercial thinning

Pre-commercial thinning of conifer plantations occurs generally when the planted conifer trees are approximately 10 years old. Pre-commercial thinning involves chain-sawing felling of unwanted small diameter (<5”dbh) trees in the plantation to achieve a desired crop tree density. Pre-commercially thinned trees are sawn into chunks (lopping) to prevent that material from becoming infested with pine beetles. Pre-commercial thinning does not require approval of a THP because the operations are non-commercial. Pre-commercial thinning occurs in either restored substantially damaged timberland or in a Regeneration harvest (clearcut) unit. Clearcuts average approximately 17 acres in size and are scattered across the landscape. In every case, pre-commercial thinning targets trees that are too small to contain a fisher den. While retained structures are in Regeneration units, their use by fishers is not anticipated until after 10 years of development. Because of these factors, pre-commercial thinning is not likely to take a fisher.

#### 4.2.6 Research and Data Collection Activities

Research on SPI land covers many topics, and is done at varying scales ranging from landscape-wide mesocarnivore inventories and water quality assessments to localized investigations

of plant populations or wildlife use of a particular structure or site. The following group of activities involves a crew driving on the Enrolled Lands and, if necessary, walking to the point of interest to perform data collection activities.

Research also includes a network of weather stations located strategically throughout the Enrolled Lands. Weather stations are both permanent structures and temporary installations. Permanent weather stations have a very small foot print (10 ft. x 10 ft.) and are designed to operate using solar panels for power. However, removal of trees may be necessary to improve the footprint of the facility and antennae effectiveness. These clearings are generally less than 0.5 ac. in size. Site perimeters typically have 8 ft.-high cyclone fencing to control access. Temporary installations only require minimal removal of understory (brush and sapling) vegetation.

Botanical surveys occur in areas where special interest plant habitat is located within a THP boundary. Botanical surveys are conducted throughout the spring and summer months depending on the flowering or fruiting characteristics of the plant of interest. Botanical surveys are a visual inspection of plant habitat, conducted on foot.

Wildlife surveys are conducted where THPs are within the range of special interest, threatened, or endangered species. Wildlife surveys require vehicle travel on existing roads and may also include the placement of photo-stations, attractant/bait, or broadcasting calls to elicit a response from the target species. If species of interest are detected, surveys also often involve site-specific efforts to find the reproductive sites in order to provide necessary protection. Whenever SPI works with animal species, all required permits are first obtained from the California Department of Fish and Wildlife and/or the Service. Because of limited area and intensity, other research activities are extremely unlikely to impact fishers.

Timber cruising involves crews driving to a particular road location on the Enrolled Lands and then walking transects that traverse the ownership, stopping every 4 chains (1 chain = 66 feet) and taking measurements of the forest vegetation. Timber cruising does not require a permit. Timber cruising activities are not reasonably likely to result in take of fishers.

#### 4.2.7 Fire Suppression

Fire suppression activities by SPI contractors are undertaken to stop a wildfire from burning the Enrolled Lands. Fire suppression actions either directly or indirectly limit or stop the spread of fire across the landscape. Fire suppression activities include building fire line by hand or mechanically with crawler dozers. Other fire suppression activities include water drafting, spraying water, spraying retardant, and lighting backfires. Fire suppression activities are coordinated with and often carried out by state and federal agencies. Fire suppression activities are only conducted during fire emergencies to contain wildfire. There is some small risk that fisher may be impacted by these activities, but the risk may be reduced because most fires occur after the denning season.

### 4.3 ACTIVITIES NOT COVERED

#### 4.3.1 Wind Power Facilities

Wind Power Facilities will not to be covered activities. These facilities may occur on the Enrolled Lands; however the locations where such a facility would be considered feasible are presently unknown, and therefore must be addressed on an individual project basis as part of its environmental review (CEQA, ESA, CFPR as appropriate).

#### 4.3.2 Trespass

Trespass does occur on the Enrolled Lands. Trespass usually involves breaking the locking mechanism of a gate for the purpose of gaining access for hunting or firewood cutting. Gates that are easily accessible or secure large blocks of land are more frequently patrolled than those more remote gate locations that may only control access to smaller parcels. Remote cameras are placed at some locations where trespass is a consistent problem. In some ownership patterns (especially "checker board") gates are not a feasible way to control trespass due to public access. To discourage trespass or other unauthorized (illegal) use of the property, all of SPI's lands are routinely monitored throughout the year by SPI patrolmen and Forestry staff.

#### 4.4.3 Illegal Use of the Property

Illegal uses of the property have been identified as the illegal mining of a perennial watercourse, cutting firewood without a permit, or the cultivation of marijuana. In terms of risk to the fisher, the most important illegal uses of SPI property are the cultivation of marijuana and cutting firewood.

Mining in a perennial watercourse is not considered a risk to fisher since the activity generally is confined to the wetted surface of a watercourse and fisher are a terrestrial species.

Among the known illegal uses of the property, cultivation of marijuana may pose the largest risk to the fisher. While illegal planting sites are uncommon, cover small acreages, and are usually at the outer periphery of our ownership, marijuana cultivation is a risk because these illegal operations sometimes use rodenticides to prevent the crop plants or irrigation lines from being eaten or chewed by rodents. This rodenticide may then be ingested by fishers when they consume baits or contaminated individuals as prey. A secondary risk to fishers from the cultivation of marijuana could be the cutting of a den tree by growers preparing a site or tending their plants. Although den trees having micro-structures appear to be widespread, they occur relatively infrequently in proportion to the total number of trees on the landscape (SPI 2013b) but still exist at multiple structures (trees) per acre on average.

The other illegal use of SPI property that is a risk to the fisher is firewood cutting. Firewood cutting is allowed seasonally by permit in selected areas. Permitted firewood cutting is restricted to dead and down material. Illegal firewood cutting tends to target snags and green hardwood trees that are near access roads. This activity also involves the concomitant additional risk of human caused wildfires.

Illegal uses of the property are identified wherever it is evident. Foresters, biologists, loggers, and patrolmen all keep an eye out for suspicious trails, road use, and altered vegetation that is not part of a THP. When an illegal activity is identified, the appropriate law enforcement personnel are contacted. Following the conclusion of the law enforcement activity, SPI participates in the restoration and remediation of the site. Remediation can include re-establishing erosion control measures, removal and proper disposal of trash, and cleanup of hazardous materials. The handling of hazardous materials and any necessary cleanup is done in compliance with the appropriate state and local agencies (county sheriff's offices, California Department of Pesticide Regulations, Department of Toxic Substances, CALEPA, the California Regional Water Quality Control Board, etc.)

## 5 CALIFORNIA FOREST PRACTICE RULE WILDLIFE PROTECTIONS

The California Forest Practice Rules (CFPRs) provide wildlife protections for listed and unlisted species in a variety of ways. Two general provisions of the CFPR that provide protections for wildlife

and their habitat are found in 14CCR § 897(b)(1)(B) and 14CCR § 897(b)(2), which describe the principles the Director or their designee of the California Department of Forestry and Fire Protection (CAL FIRE) will use while determining whether a THP conforms to the intent of the Forest Practice Act. Those pertinent portions of 14 CCR § 897 read:

> (b)(1)(B) Maintain functional wildlife habitat in sufficient condition for continued use by the existing[1] wildlife community within the planning watershed.
>
> (b)(2) Individual THPs shall be considered in the context of the larger forest and planning watershed in which they are located, so that biological diversity and watershed integrity are maintained within larger planning units and adverse cumulative impacts, including impacts on the quality and beneficial uses of water are reduced.

Section 898.2 of the CFPRs precludes the approval of a THP that will result in unauthorized take of federally listed species. Each THP area has unique conditions that the preparer must consider. If the RPF does not possess the expertise to evaluate a particular condition it is his or her responsibility to consult with other qualified professionals.

THPs are reviewed by a multi-disciplinary review team including CAL FIRE, the California Regional Water Quality Control Board, the California Department of Fish and Wildlife, and the California Department of Mines and Geology. Areas covered under THPs are inspected in the field by State Agencies during their implementation and following completion. These inspections are done to ensure the activities are implemented as described in the THP.

Specific provisions for wildlife habitat and forest protection are included in the silviculture section of the CFPR 14 CCR § 933.11/953.11(a)(1). The goal of this section is to achieve Maximum Sustained Production of High Quality Timber Products (MSP). MSP will be achieved by producing the yield of timber products specified by the landowner, taking into account biologic and economic factors, while accounting for limits on productivity due to constraints imposed from consideration of other forest values, including but not limited to, recreation, watershed, wildlife, range and forage, fisheries, regional economic vitality, employment, and aesthetic enjoyment.

Specific provisions for wildlife protection are included in the watercourse and lake protection zone rules 14 CCR § 936/956. The intent of this section of rules is to, among other things, ensure that timber operations do not potentially cause significant adverse site-specific and cumulative impacts to the beneficial uses of water, native aquatic and riparian-associated species, and the beneficial functions of riparian zones. Riparian buffer zones shall provide for vegetation structure diversity for fish and wildlife that maintains: vertical diversity; snags; microclimates; surface cover; large woody material; nesting; roosting and escape cover; and terrestrial migration.

The Wildlife Protection Practices 14 CCR § 939/959 have specific provisions for wildlife protection. One provision is the retention of snags for wildlife in all logging areas except for several exceptions relating to safety laws, human habitable structures, or merchantable snags as specified in the plan. SPI has a snag policy that requires, where practical, non-merchantable snags and green culls (≥15 in. dbh) be left standing in place during harvesting, salvage, and site preparation activities, unless the LTO or RPF determine that they pose a safety hazard or a regulation requires their removal, in which case they will be felled and either left in place or moved to a safe location within or adjacent to the harvest unit. A snag or green cull is considered non-merchantable when it

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**1** Note: After signing the CCAA SPI will commit to maintain functional wildlife habitat for species that currently don't exist in each planning watershed; for example fisher in the unoccupied range.

contains <25% merchantable volume that can be recovered as lumber. If felled because of worker safety or knocked down as a result of normal harvest disturbance, these snags become downed large woody debris.

Candidate species covered by the California Endangered Species Act (CESA) are protected by provisions integrated into individual THPs that avoid the potential for killing an individual of that species. The Pacific fisher is a candidate species for listing under CESA and receives the protections while it is being considered for listing by the California Fish and Game Commission. While in the candidate status under CESA, Department of Forestry and Fire Protection (CAL FIRE) has provided guidance to RPFs to address fishers so as avoid causing Take under the CESA. On August 5, 2015 the California Fish and Game Commission affirmed the CDFW's recommendation and chose not to list the Northern California ESU and to list the Southern Sierra Nevada ESU. Findings developed by the CFGC are pending.

Listed and unlisted species receive consideration in the cumulative impacts analysis for THPs (14 CCR § 932.9/952.9 Technical Addendum #2(C)(1), (4)(a)-(h)). The cumulative impacts assessment analyzes the past, current, and reasonably foreseeable future projects, together, in order to identify potential long-term significant adverse effects that could result from past, present and reasonably foreseeable future projects working together. The cumulative impacts assessment will need to include a demonstration of how the plan will mitigate potential long term significant adverse effects to less than significant. "Significant" means harm or damage which is substantial and threatens the use of forest-related benefits (i.e., other beneficial uses of the air, water, soil, fish, or wildlife resources). Under the CFPRs, "Harm" is the same as the ESA when addressing federally listed species and means an act that where it actually kills or injures a federally listed wildlife species. Such acts may include a significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. A long-term significant adverse effect on fish, wildlife, or listed species known to be primarily associated with late succession forest stands means an effect that creates an identifiable trend or set of conditions which provide a substantial level of scientific evidence that a population of one or more species of fish, wildlife, or listed species primarily associated with late succession forest stands will become extirpated from a significant portion of its current range in the Forest District within the planning horizon.

As noted above this CCAA relies on the California Forest Practice Rules and the review and monitoring of THPs by CAL FIRE. The take minimization practices and the application of the Conservation Measures in the CCAA combine to result in an overall benefit to fishers that would not occur in the absence of the CCAA and associated ESP.

Moreover, 14 CCR 898.2(d) of the CFPRs is a section that is specifically designed to avoid take of listed species unless specifically authorized by the appropriate agency. In some cases the federal agency (either the Service or NOAA Fisheries) has provided input to the rule making process or provides Technical Assistance to CAL FIRE upon request to ensure that operations conducted under a specific THP or the CFPRs in general, do not result in take of any listed species.

# 6 FISHERS' DISTRIBUTION, POPULATION STATUS, HABITAT DESCRIPTION, AND THREATS

A considerable body of published information exists regarding habitat relationships for fishers. In the following sections, we summarize pertinent information regarding the distribution, status and habitats used by fishers as thoroughly described in Lofroth et al. (2010), CDFG (2010), USFWS 2014

and CDFW 2015. The following detailed descriptions of important biological factors, current population status and threats to fishers lay the foundation of this CCAA.

## 6.1 NATURAL HISTORY

Fishers are members of the weasel family found in forested habitats in much of Canada and the northern portion of United States. The USFWS (2004) (69 Fed. Reg. 18770) has defined the fisher population in the Pacific states and British Columbia as the West Coast Distinct Population Segment (DPS). Distribution, population status, and habitat use are described in further detail in the following sections of this CCAA.

In California, body mass of male fishers range from 2.7 to 5.0 kg, and females from 1.52 to 2.65 kg ((as summarized in James et al. (2008, p. 12). (Note that the study by James et al. (2008) was incorrectly cited as Reno et al. (2008) in Lofroth et al. (2010) and other places). In this CCAA, the fisher study conducted at SPI's South Weaverville Study Area (SWSA) will be referred to as James et al. (2008)). Adult and juvenile fishers are prey for various other carnivorous mammals, especially bobcats and mountain lions (various authors summarized in Lofroth et al. 2010). In addition, adult male fishers prey on juvenile fishers. Denial of access to predators is apparently an important factor in the females' selection of arboreal cavities with small entrance holes as natal and maternal dens.

Female fishers bear 1 to 4 young during March and April and at different study areas average 1.8-2.8 (Lofroth et al. (2010, Ch. 6, p. 55). Sweitzer et al. (2015) reported an average fisher litter size of 1.6 (N=89) for the period between 2007 and 2013 in the southern Sierra Nevada region.

After several weeks in the natal den (where the young are born), the females often move the young to larger maternal dens. In some instances, the young are moved several times, perhaps to avoid detection of the dens by predators. This requirement for multiple specialized den sites is a critical part of habitat suitability, as further discussed below in Sections 7.1.3.1 & 7.1.4.

In addition to den sites, resting sites are also important features of fisher habitat and have been described at the "structure" and "micro-structure" scale. The structure and micro-structure are the finest scale at which habitat for fisher has been described (Lofroth et al. 2010, Ch. 7, p. 81 and Lofroth et al. 2011, Ch. 1, p. 6). Fisher selection of den/rest strata, den/rest trees and their micro-structures has provided the most consistent habitat association results (Raley et al. 2012, p. 26). Fishers use a wide variety of arboreal micro-structures for resting, including large limbs, cavities, and platforms such as deformities, mistletoe brooms, and old nests of squirrels and raptors. Raley (2012, p. 8) stated, "…available evidence indicates that the incidence of heartwood decay and cavity development is more important to fishers for denning than is the tree species." On SPI forests 85% of known fisher dens were in Black oak (*Quercus kelloggii*).

Fishers also rest within and under downed logs although this is believed to be infrequent in California. Many of these structures (either standing or downed material) containing suitable micro-structures are not typically found in young forests, unless left as a legacy tree from previous catastrophic events or human management. The specific requirements for the location of structures as they relate to the establishment of a home range are not well understood (Raley et al. 2012, p.27).

Fishers prey primarily on mammals, especially tree squirrels, ground squirrels, and chipmunks. Birds, reptiles, amphibians, and insects also make up a minority portion of the fisher's diet, as well as certain plant materials such as berries. (Lofroth et al. p. 75; Golightly et al. 2006, p. 31).

## 6.2 DISTRIBUTION

The distribution of fishers in Washington, Oregon, and California is thoroughly described in Lofroth et al. (2010). Historically, the west coast population of fisher extended south from British Columbia through the Cascades and the coast ranges of Washington and Oregon, the north coast ranges in California; the Klamath-Siskiyou Mountains in Oregon and California; and the Sierra Nevada in California (Powell and Zielinski 1994). In California, fishers historically occurred in portions of seven ecological subregions: Northern California Coast, Klamath Mountains, Northern California Coast Ranges, Northern California Interior Coast Ranges, Southern Cascades, Sierra Nevada, and Sierra Nevada Foothills (Grinnell et al. 1937; McNab and Avers 1994) (Figure 6.2-1).

At present, fishers occur in scattered, disjunct regions of the historic range, including portions of British Columbia; the Olympic Peninsula of Washington (a recently reintroduced population) (Lewis et al. 2012); and the southern Cascade Range in Oregon (the descendants of a reintroduced population) (Aubry and Lewis 2003). The species is apparently absent from its former range in much of the Washington and Oregon Cascades and Coast Ranges. The general distribution of fisher populations in Southern Oregon and California are depicted in Figure 6.2-2.

Figure 6.2-1 -- Approximate Historic / Potential Range of fishers in California

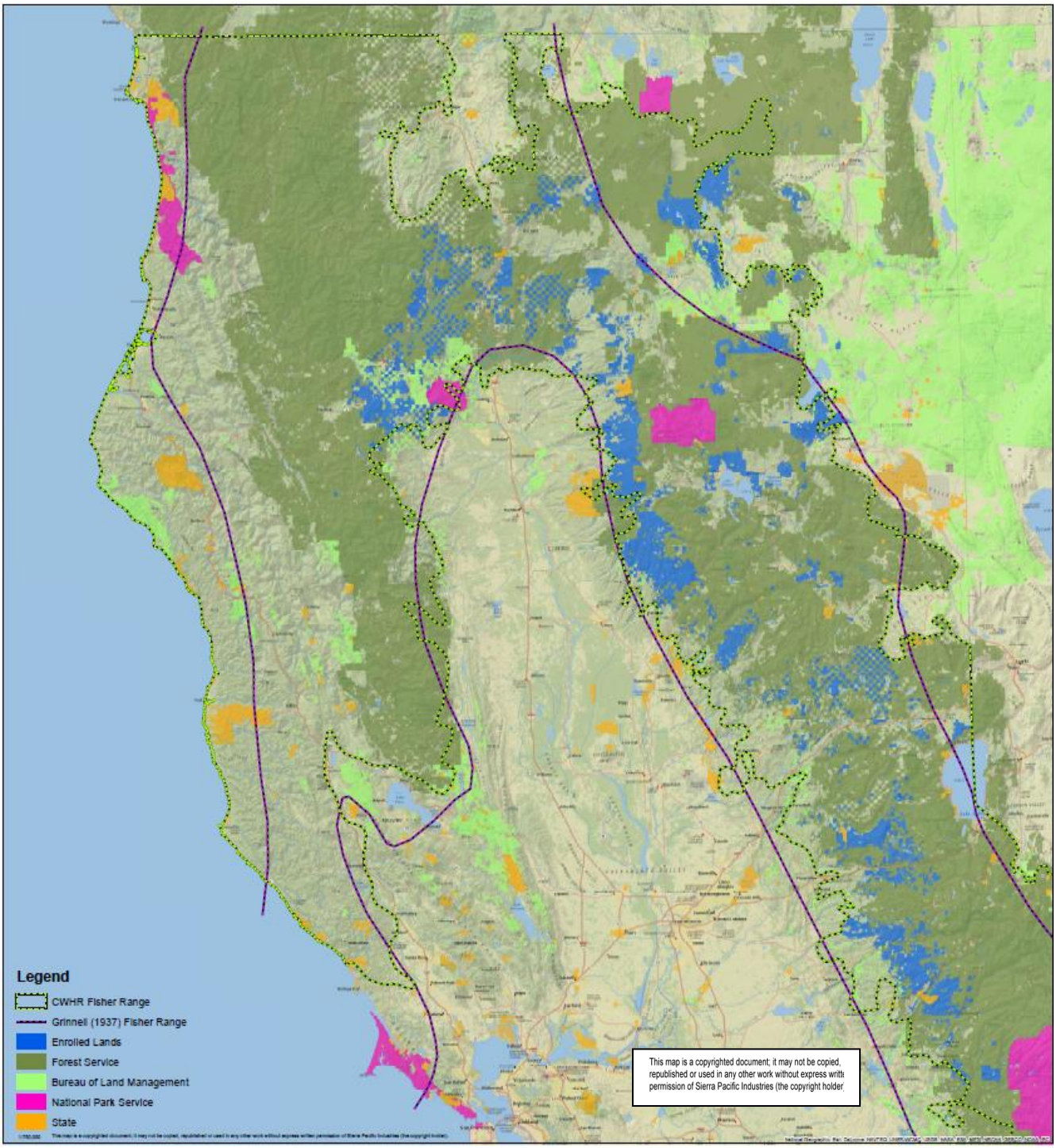
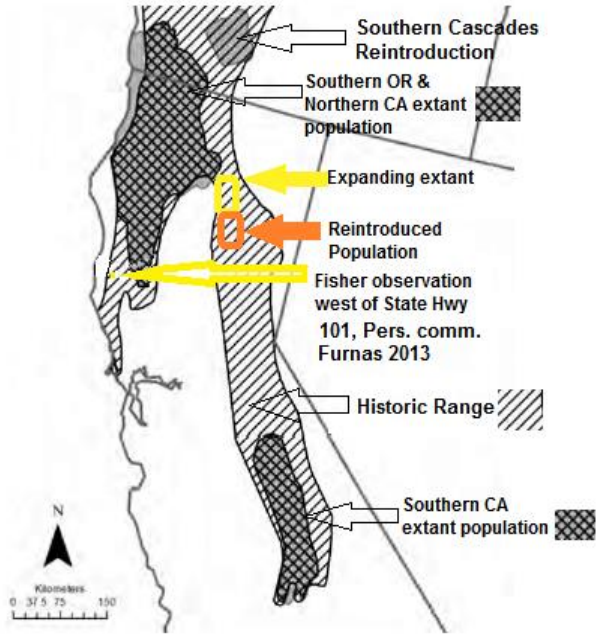


Figure 6.2-2- Fisher populations in Southern Oregon and California, 2013




Fishers remain well distributed in the Klamath-Siskiyou Mountains of northwestern California and southwestern Oregon, and in the north coast ranges of California (CDFG McCamman 2010).

This population now occurs in the southern portions of Curry, Josephine, and Jackson Counties in southwestern Oregon; and in Del Norte, Siskiyou, Humboldt, Trinity, Shasta, and northern Mendocino Counties in northwestern California (Zielinski et al. 1995; Slauson and Zielinski 2007; Furnas 2013 pers. comm; Yaeger 2012 (unpublished)).

A recently re-introduced population occurs on SPI lands (Stirling Management Area) in the southern Cascades/northern Sierra (Powell et al. 2012, p.13) of northern California, and an isolated population remains in the southern Sierra Nevada between Yosemite National Park and northern Kern County, California. (Zielinski et al. 2005). Prior to the recent reintroduction on SPI lands in the northern Sierra Nevada, a gap of approximately 244 miles (390 km), which includes large amounts of apparently suitable habitat, existed between the populations in the northern and southern Sierra Nevada. The southern California population appears to have been isolated (using genetic comparisons) from the northwestern California/southern Oregon population for at least 1,000 years (Tucker et al. 2012, p. 8). As noted by CDFW (2015 introduction, and page 49) "Although the location and size of the gap (or gaps) separating these populations is unknown, it is reasonable to conclude that the gap was smaller than it is today based on records of fishers from that region during the late 1800s and early 1900s."

## 6.3 POPULATION STATUS

Lofroth et al. (2010) summarized the limited information available regarding estimates of fisher population size and density. Much of the existing information remains in unpublished reports from localized population studies. More recently, the USFWS Species Report (2014) included a discussion of the current knowledge regarding fisher population estimates and densities.

Contemporary surveys and recent field studies suggest the northwestern California/southwestern Oregon population is the largest in the western United States, though formal estimates of the number of individuals have not been reported. The only quantitative estimate for the northwestern California/southwestern Oregon population is from an unpublished report by Self et al. (2008), who projected a population estimate of about 4,616 animals. According to the U.S. Fish and Wildlife Service personal communication with Spencer (2014) and Rustigian-Romsos (2013) the Northern California- Southwestern Oregon population was estimated between 2790 to 3990 individuals (USFWS 2014, p.38). Swiers (2013, p.17) could not discern a decline at the Eastern Klamath study area, where an estimated 10% of the local population was removed during 2009-2011 for the Northern Sierra fisher translocation project.

Lamberson et al. (2000) estimated the number of fishers in the isolated southern Sierra Nevada population at 100 - 500 individuals; more recently this population has been estimated to contain about 300 individuals (Spencer et al. 2011, p. 801) and <500 individuals (Sweitzer et al. 2015). Zielinski et al. (2013, p.10) reported that the small southern Sierra Nevada population was apparently stable , but Sweitzer et al. (2015) were not able to determine if this population was increasing, stable or decreasing (Lambda was calculated at between 0.78 and 1.15). Nonetheless, this population has apparently persisted for thousands of years as a separate population (Tucker et al. 2012, p. 7).

The Enrolled Lands in this CCAA include portions of the northwestern California range of the fisher. In addition, the CCAA covers areas currently unoccupied by fishers in the southern Cascades, and in the large gap in the distribution between the southern Cascades and the southern Sierra Nevada.

On SPI lands, fishers currently occur in the Hayfork Divide – Bully Choop, Redding North, Redding South, Lassen West and Stirling CSCAs. Collectively, the occupied CSCAs in this CCAA are termed the **Occupied Range**. If the species expands or is reintroduced elsewhere in the Sierra Nevada, it may occupy lands in the Almanor, Feather Falls – Quincy, Camino, Tahoe Low, Tahoe High, and Sonora CSCAs. A map showing the occupied and unoccupied regions of the Enrolled Lands is shown in Figure 7.3.6.1. The extent of past and potential occurrence of fishers in the areas designated as unoccupied is unknown; such use is likely limited by local and regional habitat conditions, impacts of historic trapping, and dispersal capabilities of fishers.

In 2004, the USFWS (2004)(69 Fed. Reg. 18770) found that the West Coast Distinct Population Segment (DPS) of fisher warranted listing under the U.S. ESA, but the listing was precluded by other higher priority actions. In 2011, the USFWS (2011, 76 Fed. Reg. 66389) assigned this DPS of the fisher to Candidate Category 6, using the following rationale: "The magnitude of threats is high as they occur across the range of the DPS resulting in negative impacts on fisher distribution and abundance. However, the threats are non-imminent as the greatest long-term risks to fishers in its west coast range are the subsequent ramifications of the isolation of small populations and their interactions with the listed threats." The threats under consideration are discussed in Section 6.5 of this CCAA. In 2013, as a result of the Multidistrict Litigation Settlement Agreement (http://www.fws.gov/endangered/improving_esa/joint_motion_re_settlement_approval_filed.pdf) involving 851 species, the USFWS (2013, 78 Fed. Reg. 16828) opened a new status review for the fisher West Coast DPS fisher to analyze whether listing as endangered or threatened is warranted. On October 7, 2014 the Service published FWS–R8–ES–2014–0041, which is a proposed rule to list the west coast DPS of fisher (79 Fed. Reg. p. 60419), and on April 14, 2015 extended the date for the final determination until April 2016 (80 Fed. Reg. p. 19953).

In 2010, the California Fish and Game Commission (CFGC Commission) (CFGC 2010) denied a petition to list the fisher under the California Endangered Species Act. Their finding was based on the recommendation of the California Dept. of Fish and Game (now the California Department of

Fish and Wildlife (CDFW) (CDFG 2010), whose conclusions stated that population trend and population-level effects of ongoing habitat modification could not be determined with existing information. Due to technical irregularities a California Court has ordered the Commission to redo the CDFW status review and reconsider its decision. Thus at this time the species is listed as a candidate species by the California Fish and Game Commission. Most recently, the CDFW recommended to the California Fish and Game Commission that the fisher Northern California Evolutionarily Significant Unit (ESU) is not warranted for listing as threatened or endangered under CESA (CDFW Bonham 2015). However, within the Southern Sierra Nevada ESU the CDFW believes that listing fishers as threatened under CESA is warranted at this time within the Southern Sierra Nevada ESU (CDFW Bonham 2015). On August 5, 2015 the California Fish and Game Commission affirmed the CDFW's recommendation and chose not to list the Northern California ESU and to list the Southern Sierra Nevada ESU. Findings developed by the CFGC are pending and expected to be released in April 2016.

In summary, the fisher population appears to have declined within the historic range. There are two remaining extant populations known to occur; the northwestern California/southern Oregon (>10million acres) and the southern Sierra Nevada (approximately 2.6 million acres) (CDFG McCamman 2010, USFWS 2014). Although the actual size of the current fisher population is unknown, it has likely declined within the historic range, and state and federal agencies are evaluating the need for regulatory protections.

## 6.4 HABITAT USE

Lofroth et al. (2010, 2011) thoroughly reviewed and summarized results of fisher habitat use studies conducted throughout the range of the species. Herein, we review information of particular relevance to this CCAA especially data from habitat studies in interior northern California. We also include some information reported subsequent to both Lofroth papers.

As summarized in Lofroth (2010), habitat for fishers has been described at several scales: 1) landscape; 2) home range and foraging habitat; 3) stands within the home range that contain sites used for resting or denning; 4) denning sites; and 5) denning tree and micro-structure. A commonly described attribute of fisher ecology is the selection of habitats at multiple spatial scales (Raley et al. 2012, Weir et al. 2012, Schwartz et al. 2013, Sauder and Rachlow 2014). Fisher habitat selection follows hierarchical patterns at the landscape, stand, site, and element (microsite) scales. Raley et al (2012) stated that "…fishers were associated with complex vertical (e.g., large trees and snags) and horizontal (e.g., large logs and dense canopy) structure characteristic of late-seral forests. Fisher distribution (first-order selection) was associated consistently with expanses of low- to mid-elevation mixed-conifer or conifer-hardwood forests with relatively dense canopies. Fisher home ranges (second-order selection) were characterized by a mosaic of available forest types and seral stages, including relatively high proportions of mid- to late-seral conditions, but low proportions of open or non-forested environments. Patterns of habitat use or selection by fishers were strongest at finer spatial scales (third- and fourth-order selection), and demonstrated that the fisher is a structure-dependent species in western North America."

North et al. (2012, p. 49) stated, "The typically high diversity of tree sizes surrounding fisher resting sites suggests the need for complex vertical structure, but may be an artifact of past logging practices and fire suppression, which altered forest conditions from stands dominated by large trees and snags to dense stands with size class distributions that include more small stems and fewer large stems (Goforth and Minnich 2008, Minnich et al. 1995)."

Lofroth et al. (2010) provided the following generalized depiction of fisher habitats: Landscapes used by fishers generally occur in a variety of low and mid-elevation forested plant

communities. Moderate to dense contiguous forest canopies are the most important predictor of fisher occurrence at the landscape scale, and home ranges typically include a diversity of forest successional stages and plant communities. Active fishers (as identified through radio-telemetry studies) are frequently associated with complex forest structure. Their rest sites are strongly associated with moderate to dense forest canopy and elements of late-successional forests. They typically rest in large, deformed or deteriorating trees and logs and den in arboreal cavities. At the most site-specific scale, cavities in large trees are a critical resource for reproduction.

At the broader landscape and home range scales, fishers appear to be relatively flexible in habitat association, as long as basic requirements for extensive dense to moderately dense overstory and sufficient prey are met. Fishers in the southwestern Oregon – northwestern California area are known to occur in the following forest plant communities, described by McNab and Avers 1994: Douglas-fir; Douglas-fir – ponderosa pine; Douglas-fir – tanoak; Jeffrey pine; mixed-conifer; white fir; and redwood. In the southern Sierra, fishers are known to occur in mixed-conifer, ponderosa pine, Jeffrey pine, white fir, red fir, lodgepole pine, and giant Sequoia plant communities (Lofroth et. al 2010, p.90). Most studies in California have found that fisher home ranges include a broad range of successional stages, but that structurally complex areas (for instance, including greater densities of large live trees and large woody structures such as snags and down logs) are used preferentially, and forests with mast-producing hardwoods that support prey communities are particularly important (Lofroth et al. 2010).

Across the Pacific region, Lofroth et al. (2010) reported that female home ranges averaged 18.8 km2 (4,646 ac.), and male home ranges averaged 53.4 km2 (13,195 ac.). In northwestern California, Lofroth et al. (2010, Ch. 6, pg. 68) reported that mean male home ranges varied from 1,828 ac. to 9,464 ac., and mean female home ranges from 420 ac. to 5,807 ac. Differences in methodology, season of studies, and geographic region complicate general description and comparison of fisher home range size and composition across the range. Home range sizes are substantially different among sexes (with male home ranges about three times larger), and also increase with latitude (Lofroth et al. 2010). Home range size is believed to be indicative of overall habitat quality, with prey and cover resources at higher densities in smaller home ranges (Zielinski et al. (2004b, p. 654); Lofroth et al. (2010, Ch. 6, p. 69)).

Fishers are dietary generalists, depending on a variety of small mammals, birds, insects, and reptiles, and their diets in California are more diverse than elsewhere in the range (Lofroth et al. 2010). In California, mammals such as woodrats, squirrels, and other rodents appear particularly important. These prey species are widespread in many California conifer and mixed hardwood–conifer forests (Zielinski et al. 1999 p. 964), but may vary in their contribution to the diet in different areas of the fisher's range (Golightly et al. 2006, p. 964). Hares and porcupines do not occur in California diets to the extent prevalent further north in the fisher's range, probably because the range of the snowshoe hare and the fisher do not extensively overlap in California, and porcupine numbers are generally low or absent (Zielinski et al. 1999, p. 962).

At more localized scales, the fisher is more of a habitat specialist, in that both sexes depend heavily on certain types of micro-structures (e.g., arboreal cavities, platforms and mistletoe brooms, and large down logs) for resting, and in particular, on tree cavities for natal and rearing dens. All documented natal and pre-weaning dens are in cavities in standing live or dead trees, including both conifers and hardwoods (Lofroth et al. 2010). Most of these trees are relatively old and large. For instance, across five studies in interior California reporting on a total of 154 den sites, the dbh ranged from 66 cm. to 110 cm. (30 in. to 43 in.) (Lofroth et al. 2010, p. 115). In California, the majority of identified dens were in hardwood species (especially black oak and live oak). Specific trees that provide cavities suitable (e.g., size of opening and size of cavity) for reproductive behaviors have been suggested to be the most limiting habitat feature required by fishers, however

Raley et al. (2012, p.28), indicated that there are few studies that investigated the abundance or spatial distribution of potentially limiting resources.

Generally, the history of timber harvesting on private lands, including the lands presently owned by SPI, has resulted in present-day forests that are younger and have trees with a smaller average diameter at breast height (dbh) than on federal lands. Thus, the habitats used by forest wildlife on private lands usually include fewer large trees. While the average diameter measurements of trees with den micro-structures on private lands are similar to those on public lands, the range of tree diameters (dbh) is wider and the trees within 1 acre of the den structure (tree) are typically smaller in diameter (dbh) (SPI 2013a; Zielinski et al. 2004a).

The importance of evaluating habitat elements at local scales can be demonstrated by comparing three recent studies: Zielinski et al. (2010); Zielinski et al. (2012); and Niblett et al. (2014 (Appendix M)). Each described or predicted likelihood of fisher occurrence in northwestern California based on habitat features. These studies evaluated habitat at different scales with different methodologies.

Here we evaluate their application to SPI's South Weaverville Study Area (SWSA). The 45,000-acre SWSA provides a useful site for comparison of the Zielinski 2010 and 2012 habitat models because an earlier study (James et al. 2008) used radio-telemetry to document habitat use by five reproductive female fishers in that area. Zielinski et al. (2010 & 2012) modeled and mapped fisher detection probability across the Klamath Province, and used expert opinion and previous studies to assign values to eleven categories of landscape-scale predictor variables including: climate; topography; linear features (roads and streams); vegetation cover type; habitat type (based on California Wildlife Habitat Relationships [CWHR] system; California Department of Fish and Game 1992); vegetation density; tree size class; landscape arrangement; landscape diversity; disturbance; and potential mammalian prey habitat values. The values were assigned to geographic positions based on satellite image pixels that were 100 meters square (2.5 ac). The habitat maps characterized the SWSA as a heterogeneous mix of habitat with most of the area assigned values representing areas strongly selected against by fishers ("poor habitat"). There were some areas that had a high strong positive selection value ("good habitat"), but these areas were relatively uncommon. Although a formal site-specific comparison has not been conducted, the model results generally under-predict the detection likelihood because 34 individual fishers were trapped at the SWSA. The results may indicate that the fishers' actual habitat use was not fully reflected in the habitat parameter valuations chosen by the modelers.

Zielinski et al. (2012) developed Relative Resting Habitat Suitability (RRHS) values based on published descriptions of habitat variables used by fishers, and modeled RRHS across broad areas of the fishers' range in California. Vegetation was represented by data from the USFS Forest Inventory Analysis (FIA) system (Bechtold and Patterson 2005). The FIA system uses a grid of fixed plots at a density of one per 6,000 ac., and thus is only representative of average conditions across large areas. According to the review of Zielinski et al. (2012) by Niblett et al. (2014), sixteen of eighteen FIA point plots on the SWSA were characterized as neutral. The characterization of the SWSA as poor fisher habitat primarily resulted because average measured basal area (the cross sectional area of all tree boles in a stand measured at breast height) was lower than values rated highly in the model. Thus, in the comparison conducted by Niblett et al. (2014), the Zielinski et al. (2012) model rated most SWSA habitat as poor and did not classify any habitat as good, even though the area was occupied by multiple reproducing fisher females. It appears that Niblett et al. (2014) found a correlation between the RRHS value and the den neighborhoods they describe due to the difference in the sampling intensity (1 per 4 ac. versus 1 per 6000ac) and Zielinski et al.'s inclusion of the structure tree in describing the surrounding "resting habitat."

In an effort to further refine the understanding of observed habitat use by fishers in the SWSA, Niblett et al. (2014) applied the model of Zielinski et al. (2012) to the 10,609 SPI forest inventory point plots in the SWSA. (SPI's forest inventory system uses a grid of fixed point plots at a density of about 1 point plot per 4 ac., resulting in about 400,000 point plots across the ownership.) Approximately 81% of the point plots in the SWSA were rated as poor (strongly dissociated) using the criteria of Zielinski et al. (2012), and less than 1% of the SPI point plots were good (strongly associated) with fisher habitat. However, the Niblett et al. (2014) analysis demonstrated a novel means of analyzing the habitat in a manner that appears to better predict the actual suitability of the habitats at the SWSA. Niblett et al. (2014) indicated that fishers strongly selected sites that were significantly different than the surrounding heterogeneous forest. Using its forest inventory point plots, SPI can make finer scale assessments of tree size and density across their ownership to identify areas containing these high value sites. These patches of occupied habitat were too small to be identified in the broad scale modeling by Zielinski et al. (2012), and evidently were inadequately recognized by the vegetation classification of Zielinski et al. (2010).

These findings demonstrate fishers successfully use habitat elements that occur at lower densities than can be identified by broad-scale habitat models or low intensity forest inventory methods. Thus, fishers may occupy areas of smaller diameter forest than predicted by available broad-scale models, provided that desirable habitat elements are sufficiently abundant at local and wider scales.

## 6.5 FACTORS AFFECTING FISHERS

This section is organized to conform to the factors evaluated by the USFWS in a determination of the need to list a species under the US ESA (50 CFR 424.11(c)). This section summarizes information on existing threats to fishers that may be relevant to this CCAA. Impacts of this CCAA related to these factors are addressed in Section 7.3. The conservation measures to be implemented by SPI under the CCAA are specifically designed to reduce threats identified in the FWS proposal to list (79 Fed. Reg. p. 60419) related to insufficient habitat, insufficient den and rest structures, loss of habit due to catastrophic fire, entrapment in water tanks, and exposure to illegally applied toxic materials.

### 6.5.1 The present or threatened destruction, modification, or curtailment of its habitat or range.

The USFWS (2004; 69 Fed. Reg. p. 18770-18792) concluded that loss of forested habitat throughout the range constituted a threat to fishers, and subsequently in the 2011 Candidate Notice of Review (USFWS 2011) the USFWS (76 Fed. Reg. p. 66389) and the FWS Proposal to list (79 Fed. Reg. p. 60419) reiterated some of the threats to the species regarding habitat loss, as follows:

"Major threats that fragment or remove key elements of fisher habitat include various forest vegetation management practices such as timber harvest and fuels reduction treatments. Other potential major threats in portions of the range include: Large stand-replacing wildfires, changes in forest composition and structure related to the effects of climate change, forest and fuels management, and urban and rural development."

In a 2007 facilitated workshop, thirteen experts on fishers assessed and ranked various perceived threats to the species in various regions (Threat Evaluation Areas - TEAs) of the Pacific States and British Columbia (Naney et al. 2012). In the combined opinion of this panel of experts,

across the multi-state range the "most immediate and challenging threat" derives from the small, isolated nature of fisher populations, and the attendant high risk of extirpation from stochastic events. Effects on habitat such as overstory reduction, reduction of structural elements, and fragmentation were also rated highly as threats prevalent throughout the assessment area. Uncharacteristically severe wildfire was rated as a very important threat in several TEAs, especially in California.

This CCAA includes portions of two of the TEAs evaluated by Naney et al. (2012): northwestern California - southwestern Oregon (the portions of the range occupied by fishers), and the Sierra Nevada (the portion between the Lassen and Yosemite regions, which were unoccupied by fishers at the time of the assessment.) In both TEAs, the highest-rated existing threats were uncharacteristically severe wildfire, overstory removal, and reduction of structural elements.

No estimates are available regarding the amount of habitat available for fishers throughout their range, or the trend in that habitat. Because the covered activities under this CCAA are primarily intensive timber harvesting and even-aged forest management, the threats related to overstory removal and reduction of habitat elements are particularly germane.

#### 6.5.2 Overutilization for commercial, recreational, scientific, or educational purposes

Trapping of fishers for the fur market is believed to have been a very important cause of the species' decline throughout its range in past decades (USFWS 2004, McCamman 2010, Lofroth 2010). All of the states covered in the Conservation Assessment by Lofroth et al (2010) (i.e., Montana, Idaho, Washington, Oregon, and California) had banned trapping of fisher by 1946. In 1998, Fish and Game Code §3003.1 banned body-gripping traps (including snares and leg-hold traps) for commercial or recreational trappers. Licensed individuals trapping for purposes of commercial fur or recreation in California are now limited to the use of cage live-traps. Trappers or their designee are required by regulation to visit all traps at least once a day (McCamman 2010). Trappers in California cannot target fishers and any fishers inadvertently captured must by law be released unharmed. However, populations are still at risk from incidental trapping because the fisher populations in California are considered small, therefore the threat of this impact was considered significant USFWS (2004) (69 Fed. Reg. 18770). No Covered Activities under this CCAA contribute towards this threat. There are no known effects to fisher populations related to overutilization for scientific or educational purposes at this time. As such, these activities are not further addressed in this CCAA.

#### 6.5.3 Disease or predation

As stated by the USFWS (2004, 2011) threats to fishers that lead to direct mortality and injury include: Collisions with vehicles; predation; rodenticides; and viral borne diseases such as rabies, parvovirus, and canine distemper. Impacts of these threats to fishers at the population level are unknown at this time (Lofroth et al. 2010). With the exception of predation, Naney et al. (2012) regarded these threats as low to moderate in severity across most of the range, directly associated with human development, and of greater importance at the scale of individual animals than at the scale of a population. However, in the Northern Sierra TEA, these threats were regarded as moderate because of the extent of development in that region.

Naney et al. (2012) rated predation upon fishers as a moderate threat throughout the range, and the panelists noted that reduction of understory vegetation (e.g. fuels reduction treatments) may increase predation risk. Other researchers (M. Higley, pers. comm.) also have speculated that

habitat fragmentation may favor predators of fishers such as bobcats and mountain lions. More recently, Gabriel et al. (2015) quantified causes of mortality in fishers in California. Predation and disease remained the leading cause of death among fishers; starvation and exposure to illegally applied pesticides were also noted as causes of mortality.

#### 6.5.4 Inadequacy of existing regulatory mechanisms

The USFWS (2014, p.137-138) stated:

"The California Environmental Quality Act (CEQA) can provide protections for a species that, although not listed as threatened or endangered, meets one of several criteria for rarity (CEQA guidelines; Cal. Code Regs. Title 14 § 15380). Fishers meet these criteria. Under CEQA a lead agency can require that adverse impacts be avoided, minimized, or mitigated for projects subject to CEQA review that may impact fisher habitat."

The USFWS (2014, p.141) summarized the in-place regulatory mechanism in California as follows:

"In terms of effects to fisher habitat or incidental harm to fishers from timber harvesting or other types of land disturbing projects, California has regulations that act in combination to disclose, avoid, or mitigate environmental degradation. Cumulative effects analysis to listed and non-listed species is required in both CEQA and the California Forest Practice Rules."

The CDFW fisher status review (Bonham, 2015, p.69) under the California Endangered Species Act stated:

> "Fishers are known to establish home ranges and successfully reproduce within forested landscapes that have been and are being intensively managed primarily for timber production, including industrial ownerships where ongoing intensive even-aged management is the norm. The long-term viability of fishers across their range in California will depend on the continued presence of suitable denning and resting sites and habitats capable of supporting foraging activities. While such structures and habitats are critical to fisher reproduction and survival, the Department is not aware of evidence indicating that habitat modification resulting from timber harvesting and forest management is currently limiting fisher populations in California."

#### 6.5.5 Other natural or manmade factors

As stated by the USFWS (2004, 2011) and CDFG (2010), collisions with vehicles constitute a threat to the species, but that threat has not been quantified. On SPI lands, threats associated with vehicle collisions are low due to typically low vehicle speeds.

Recent research has identified anti-coagulant rodenticides as a potentially important source of fisher poisoning and mortality (Gabriel et al. 2015, p.6). These rodenticides are known to be used at illegal marijuana growing sites in forested areas of California, and are apparently ingested by fishers preying upon or scavenging on affected rodents, and consuming baits (Gabriel et al. 2012 and 2015). Studies of the frequency and magnitude of the ecological effects of exposure to illegally applied pesticides are ongoing. Illegally applied pesticides have been characterized as a potentially significant threat to fishers (Gabriel et al. 2015). The threat of accidental entrapment and drowning in improperly constructed and/or maintained water tanks has been identified as a threat.

### 6.6 CONSERVATION PLANNING EFFORTS

### 6.6.1 Northwest Forest Plan (NWFP)

The Northwest Forest Plan (NWFP)(USDA/USDI 1994a) remains the primary management guidance on federal lands throughout the range of the northern spotted owl (NSO) in Washington, Oregon, and northwestern California. Within that region, the range of the NSO closely overlaps the occupied and former range of the fisher. Thus, the NWFP provides the primary management guidance for federal forests occupied by fishers. (Management guidance in the Sierra Nevada, which is outside the range of the NSO, is discussed in the next section of this CCAA). The Enrolled Lands within the occupied range in northwestern California are closely associated with federal lands covered by the NWFP.

Initial analysis of the impacts of the NWFP on fisher (USDA/USDI 1994b; App. J2, p. J2-54) expressed concern over the impacts of the potential degree of forest fragmentation and loss of coarse woody debris in matrix lands outside the network of Late Successional Reserves. The analysis also suggested that these concerns could be substantially alleviated by mitigation during project planning at local levels. It was projected that such implementation would increase the likelihood to above 80 percent that "Habitat is of sufficient quality, distribution, and abundance to allow [fisher populations] to stabilize, well distributed across federal lands." It is beyond the scope of this CCAA to evaluate the implementation and effectiveness of these measures on federal lands.

### 6.6.2 Sierra Nevada Forest Plan Amendment

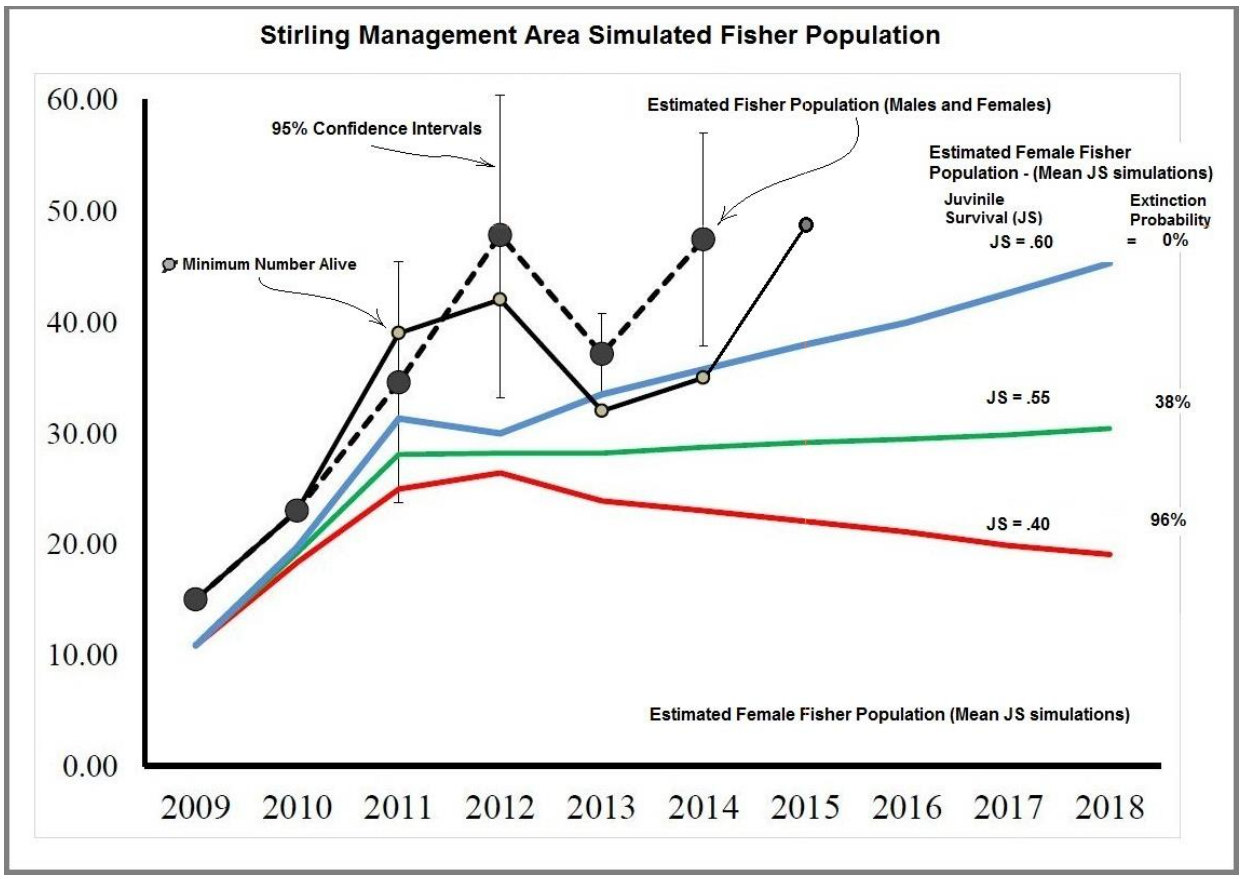
Existing management direction of fisher habitat in the National Forests in the Sierra Nevada is described in Sierra Nevada Forest Plan Amendment Supplemental Environmental Impact Statement (USFS 2004). The purpose of and need for the proposed action includes reduction of the size and intensity of stand-replacing fires in the Sierra Nevada. Maintenance of fisher habitat within that context is a stated goal, and the Standards and Guidelines (Appendix A in USFS 2004) include numerous measures intended to attain that goal. In general these include:

- retention of a minimum canopy closure of 40%,
- minimization of habitat fragmentation
    - connected habitat linkages suitable for wildlife dispersal in riparian areas and ridge top saddles,
    - retention of large trees, including 40% of the existing basal area in westside forests and 30% in eastside forests in the largest size class available,
- recruitment of large trees over time, and
- planned activities that affect approximately 25-30% of the forested land base

### 6.6.3 Reintroduction in the Northern Sierra Nevada

In 2008, SPI, CDFG, USFWS, and North Carolina State University began implementing a project reintroducing fishers to the northern Sierra Nevada. This project is covered by a Translocation Plan (CDFG 2008a), an evaluation under the California Environmental Quality Act (CEQA) (CDFG 2008b), and a CCAA under the U.S. Endangered Species Act (USFWS 2008). By 2013, 40 fishers had been captured in northwestern California and released in SPI's Stirling Management Area in the mountains of Butte Co., California. (Powell et al. 2012) There are 7 primary objectives for the reintroduction research at Stirling (Powell et al. 2013). The first three primary objectives are to: 1)

Document survival, reproduction and use of land cover by released fishers as well as their descendants during the first 5 years following the initial release. 2) Predict use of habitat by fishers using existing models and a model that we develop and to test the models using location data for fishers on Stirling. 3) Predict placement, sizes, and shapes of home ranges using models of optimal home range choice and to test the predictions using location data for fishers on Stirling. The reintroduction has been successful at establishing a population at the Stirling Management Area. The question remains how persistent will this population of fisher remain. The chart below is the estimated population trend for the fisher at the Stirling Management Area developed by the North Carolina State University research team in the winter of 2015 and shows the results of the 2015 trapping effort.




6.6.4 Conservation Assessment

Following the USFWS (2004) determination that the status of the fisher West Coast DPS warranted listing under the ESA, several agencies cooperatively developed a series of documents collectively titled "Conservation of Fishers (*Martes pennanti*) in South-Central British Columbia, Western Washington, Western Oregon, and California." Presently, this assessment consists of three completed volumes: Vol. I: Conservation Assessment (Lofroth et al. 2010); Vol. II: Key Findings from Fisher Habitat Studies (Lofroth et al. 2011); and Vol. III: Threat Assessment (Naney et al. 2012). Vol. IV: Conservation Strategy (Finley 2012) is currently under review by the agencies (L. Finley, pers. comm.). Together, these documents provide an extensive review of available literature and

scientific opinion regarding the status of the West Coast DPS of the fisher. The draft Vol. IV is intended to provide conceptual guidance for conservation efforts throughout the range of the West Coast DPS.

#### 6.6.5 Southern Sierra Nevada Conservation Assessment and Conservation Strategy

As introduced by the authors, the Southern Sierra Nevada Fisher Conservation Strategy (Spencer et al. 2015) "is a multi-agency effort to develop a scientifically sound approach for sustaining and recovering an isolated population of Pacific fisher (*Pekania pennanti*) in the southern Sierra Nevada."

The Southern Sierra Nevada Conservation Strategy Area (SSNCSA) is defined by 1009 hexagonal grid cells (2,493,239 acres), which delineate the analysis area and includes the majority of actual or potential fisher habitat in the Southern Sierra Nevada. The finest scale of analysis is the individual grid cell (2,471 ac.), which are considered a proxy for a female fisher home range. The next larger size of analysis is the landscape scale (10,000 ac.), which is considered to contain 4 female home ranges and provide sufficient breeding capacity to facilitate fisher dispersal and genetic interactions at the landscape scale. The SSNCSA is then segregated into 7 Core Areas, which are very large areas that are joined/separated at physiographic areas considered important linkages.

The Southern Sierra Nevada Conservation Strategy's biological goal is to maintain or increase fisher population size and distribution. The steps to achieve this goal include: "(1) the amount of suitable home range habitat be relatively stable or increasing over time, and (2) currently unoccupied but suitable habitat becomes occupied in the future. Using grid cell scores as a proxy for home range habitat suitability, this requires (1) maintaining or increasing the number of suitable cells in each core area, and (2) increasing the proportion of suitable cells that are occupied by female fishers (especially in unoccupied Cores 6 and 7)" (Spencer et al. 2015).

### 6.7 HABITAT CONDITION AND TREND FOR FISHERS ON PUBLIC LANDS

The USFWS (2014) provided gross estimates of available habitat for fishers throughout the analysis area using their "fisher habitat model". The USFWS fisher habitat model classified potential habitat as having a high, intermediate, and low selection potential. The quantity of high, intermediate, and low selection potential for the Northern California – Southern Oregon extant range for fisher are provided in the table 6.5.1-1 (derived from USFWS 2014 unpublished data). The USFWS (2014) projected reductions in fisher habitat due to vegetation management and wildfire over the next several decades, but did not balance that loss with ingrowth, so an overall trend could not be determined.

Table 6.5.1-1

| Occupied Acreage<br>Physiographic Area | Selected For | Intermediate | Selected Against | Grand Total |
|---|---|---|---|---|
| Oregon | 733,327 | 599,043 | 503,401 | 1,835,772 |
| Klamath/Cascade | 4,236,116 | 3,186,662 | 3,321,800 | 10,744,578 |
| **Grand Total** | **4,969,443** | **3,785,706** | **3,825,201** | **12,580,350** |

The amount and trend of habitats suitable for fisher is important in assessing the context and the potential impacts of the CCAA. Estimates of the trends in fisher habitat on the Enrolled Lands are provided in this CCAA. Trends for fisher habitat on other ownerships are not available. However, forests generally categorized as mid- to late-seral may provide habitat for fishers. Thus,

estimates of such habitat may provide a surrogate for general evaluation of trend in habitat for fisher.

Occupied and unoccupied portions of the Enrolled Lands occur within the range of the California spotted owl (CSO). Subsequent to the USFWS status reviews for the CSO (USFWS 2003, 2006), the USFS reported that, based on remote sensing methods, both mid- and late-seral closed canopy forest habitats have increased substantially (by 17% and 31%, respectively) from 1990 to 2008 (per USDA Forest Service 2010, Table 5) across the National Forests in the range of the California spotted owl. Thus, the amount of habitat for the fisher appears to be increasing on Federal lands in the Sierra Nevada, despite effects of burning over 280,000 ac. in moderate and severe wildfires from 2000 to 2007.

Outside the range of the CSO, fishers occur or potentially occur in areas of Washington, Oregon, and northwestern California managed under the Northwest Forest Plan (NWFP), (which corresponds to the range of the northern spotted owl (NSO)). Moeur et al. (2011) estimated the amount and trend of late successional and old growth forest (LSOG) in the area of the NWFP, using multiple methods of analysis and a broad definition (forests with greater than 10% canopy cover and mean quadratic tree diameters equal to or greater than 20 inches (Moeur et al. 2011, p7)). The canopy cover is the percentage of area covered by live crowns of dominant and codominant conifers, corrected for overlap. The QMD is calculated from the dominant and codominant conifers. Moeur et al. (2011, p7) acknowledged that this definition does not contain the complexity of other LSOG definitions; however they also stated that a more complex definition would not necessarily be more accurate. Moeur et al. (2011, p 6) stated a primary reason for use of this definitions is that it "corresponds closely to the definition of late-successional forests used for mapping purposes by the Forest Ecosystem Management Assessment Team (FEMAT) (FEMAT 1993, Table II-3, p. II-22) and therefore can be used to assess assumptions about the amount and distribution of older forest upon which the Plan was founded." Because the condition of other tree types, canopy layers and down wood were not considered, the extent to which this definition of LSOG, to an unknown extent, may be representative of fisher habitat is unknown. They concluded that between 1996 and 2006 in Washington and Oregon, and between 1997 and 2007 in California, there has been an apparent overall loss of LSOG forest of between (1.8 and 0.6), (2.7 and 3.6) and (1.9 and 3.0%), (which for California is from 7.3 to 7.1 million ac.), but that this apparent trend could not be regarded as statistically significant due to various sources of possible measurement error. Most of the loss was to due to wildfire.

Mouer et al. (2011, p 31) stated that estimates of LSOG recruitment, primarily in stands with increasing mean diameter, nearly overcame the losses due to wildfire. However, the largest losses to wildfire were in areas with important fisher populations, i.e., the Oregon Klamath and California Klamath Provinces. Overall LSOG losses in the Oregon Klamath Province were estimated from 7.9 to 11.6% between 1996 and 2006, and in the California Klamath from 0.9 to 4.9% between 1997 and 2007.

Mouer et al. (2011, p. ii) also noted a trend of reduction of LSOG on private lands, in which harvest was a more important factor than on federal lands. "Federal lands contained less than half of the total forest land, but the federal share of total LSOG increased from 65 to 67% over the monitoring period. Harvesting removed about 13% (approximately 491,000 ac) of LSOG on nonfederal lands. Loss of LSOG on federal lands resulting from harvest was less than 0.5% (approximately 32,100 ac)."

Habitat suitable for nesting and roosting by NSO is considered a surrogate for habitat for fishers in areas where those species overlap (USFWS 2014, p 85). In estimating the amount and trend of nesting and roosting habitat for NSO on federal lands in the area of the Northwest Forest Plan, Davis et al.(2011, p 35-42) used more restrictive and detailed habitat definitions than the LSOG

definitions of Mouer et al. (2011). Davis et al. (2011, p 45) reported overall losses of NSO nesting/roosting habitat of about 3.4% range wide, including 1994 through 2007 in California, and 1996 through 2006 in Oregon and Washington. Almost 80% of this loss was due to wildfire. Some of the most important losses were in the Oregon Klamath and California Klamath Provinces, which sustained losses of 10.2 and 5.2%, respectively (Davis et al. 2011, p. 46, Figure 3-12).

Although forests suitable for fisher have been lost to wildfire and timber harvest, recruitment is also occurring as young forests mature. However, as noted by Davis et al. (2011, p 53) it is difficult to account for recruitment at landscape scales using current remote sensing technologies. Using the broader definition of LSOG, Moeur et al (2001, p. 31) stated: "The LSOG losses associated with wildfire on federal lands apparently were roughly balanced by recruitment, but recruitment is much more difficult to map reliably with available data and technology." The assessment of NSO nesting habitat by Davis et al. (2011, p. 51) was unable to detect recruitment into that category using existing technology, but did note an overall increase in dispersal quality NSO habitat, with declines in some regions. Additionally, as stated by Davis et al. (2011, p.38), “Habitat development is not a mechanistic process, and there is considerable variability in predictions of habitat (Courtney et al. 2004) …the transition from unsuitable to suitable conditions is more complex than a simple increase in a stand’s average tree diameter and canopy closure. In addition, species composition is also important; for instance, late-successional/old-growth ponderosa pine forests do not function as [NSO] nesting/roosting habitat, nor do older subalpine forests.” For the purposes of evaluating the potential effect of this CCAA on fishers we draw the following conclusions from this evaluation of habitat trend:

Late seral habitat is increasing in the Sierra Nevada despite large wildfires. Late-seral habitat is approximately stable in the range of the northern spotted owl (which includes a portion of the occupied fisher range), but there have been important losses to wildfire in the Oregon and California Klamath regions. Throughout the ranges of the fisher on federal lands, late seral habitat increases are occurring as ingrowth from younger forests; the quality of this habitat cannot be ascertained with remote sensing methods. However, we must note that the definition of fisher habitat that relies solely on late seral forest is not broad enough to characterize all the occupied amount of fisher habitat that exists currently. Thus the trends in late seral forests only represent an unknown portion of the actual habitat trend.

## 6.8 DESCRIPTION OF EXISTING CONDITIONS WITHIN ENROLLED LANDS

The following sections describe the Enrolled Lands in terms of land classifications and Habitat Forms as defined by SPI. The Enrolled Lands are subdivided into management units called a Covered Species Conservation Area (CSCA) (See figure 7.3.5.1). The current amount of each Habitat Form represented in a CSCA is generally the result of past management histories and/or wildfire events. For the purposes of this CCAA, the rate, distribution and process of both retention and harvesting of suitable stands combined with prompt regeneration activities and stand density control, programmatic identification and retention of essential fisher habitat elements (large old green trees and cull, large snags and downed wood, large select hardwoods) and other vegetation management to improve stand vigor, combined with growth within existing habitat, will over the next 10 years maintain suitable fisher habitat at both first order (10,000 acre landscape) and second order (2,000 acre female fisher territory) scales of selection on the Enrolled Lands. The management and biological processes over time will create a mosaic of Habitat Forms that will maintain self-sustaining populations of the fisher on Sierra Pacific Industries forest land.

### 6.8.1 Land Classification

It is important to establish an understanding of the management regimes that created existing forests on SPI lands, and that will create the forests of the future. Approximately 90% of SPI's forests were acquired by SPI during the past three decades. These forests have been managed under various methods by previous owners and by SPI. The forests on SPI's lands presently occur in five land classes as categorized by SPI, based on conditions and the age structure created by the management history. These five classes are: Mixed, Inoperable, Non-Forest, Regen, and Even. Comprehending differences between these classes is fundamental to understanding the present and projected future habitat for fisher.

**Mixed:** These land class stands were created by various types of uneven-aged management, which left many trees un-harvested during harvest entries. The Enrolled Land that is capable of growing forest vegetation (i.e., excluding rocky areas, meadows, etc.) and suitable (accessible and manageable), together are the **Capable Land**. The Capable Land has the soil site quality of growing trees into HF4 over time. The Mixed land class currently comprises about 74.2% of the Capable Land. In most cases, these forests contain a mix of trees in various sizes and ages. Generally speaking, these stands rarely contain conifers ≥40 in. dbh, because those commercially valuable trees were harvested in past decades. The Mixed land class often includes stands of trees which generally are larger than 80 acres. Canopy closures are typically well over 50%. These forests include a wide variety of habitat conditions, especially in terms of the presence of hardwoods, large snags, and down logs, most of which exist as legacies left during past harvests. The amount of understory brush also varies substantially.

Virtually all the habitat for fishers on the Enrolled Lands today is in the Mixed land class, existing as a legacy of past management by SPI and previous owners. Hardwoods and deformed conifers that were not commercially valuable (and to a lesser extent, large snags) were normally left standing during selection harvests of the past. These structural elements, surrounded by relatively dense forest of mixed ages, provide many of the existing denning opportunities for fisher.

Most of the Mixed land class stands are not growing at their maximum potential, because the highest quality trees have been removed and spacing between remaining trees is not optimal for growth. SPI's objective under their "SPI Option A" approved by CAL FIRE is to maximize individual tree and stand growth by emphasizing even-aged silviculture wherever such intensive stand treatments are not superseded or constrained by non-timber resource values. The pace of conversion of the Mixed land class to Regen and Even land classes is limited by the management path chosen by SPI in its Option A Plan, so that overall, at least 50% of the Capable Land enrolled in the CCAA will still be in the Mixed land class at the end of the CCAA permit period (i.e., 10 years).

In about 14% of the Mixed forests, non-timber values (such as aesthetics, soil resources, wildlife, archeological sites, botanical resources, and water quality) constrain the use of clearcut silviculture. In these areas, the Mixed land class will be converted more slowly to Even stands, using techniques such as shelterwood steps or group selection. There is an additional 12% of the entire land base that will never be harvested utilizing even-aged silviculture (predominantly watercourse and lake protection zones). In these lands very long interval individual tree selection silviculture will be utilized. Once an area of Mixed forest land class is clearcut and re-planted, it enters into the "Regen" land class and eventually grows into the Even class.

**Inoperable:** Such areas are forested but not available for economic management due to location, condition, or physical constraints or are areas with suitable soils that are not economical to stock with commercial species due to access. Examples include un-roaded brush fields, areas with poor soils and tree stocking, areas with low tree density that are not roaded adequately, and un-roaded areas with forest cover that won't economically support helicopter logging. Inoperable areas, which comprise about 6% of the property, will not be considered further in this document.

**Non-Forest:** These areas consist of lands that do not support conifer species, such as rock outcrops, talus slopes, quarries, grasslands, lakes, and wet meadows. Non-Forest, which comprises less than 5% of the property, will not be considered further in this document.

**Regen:** The Regen land class is made up of artificially regenerated stands. Regen stands originate after emergency salvage operations or silvicultural practices such as shelterwood systems, group selection areas, brush field rehabilitation, or clearcuts. Regenerated stands of all age classes presently comprise about 25.8% of SPI's Capable Lands. Regen stands are replanted by hand, with rarely one and usually two or more mixed-conifer tree species. Trees in the Regen land class are typically all the same age and similar in height, except where older trees were left as individuals or in small habitat retention stands during the previous clearcut harvest. In Regen stands, brush species may be treated with herbicides to assist the growth of young trees. Regen stands typically are pre-commercially thinned at about 7-10 years of age. After such treatment they are considered "free to grow."

**Even:** When a Regen stand is old enough and sufficiently dense to cruise, and has been cruised with our standard inventory methodology, it is moved into the Even land class. The distinction between Regen and Even is primarily for growth modeling and silvicultural planning purposes. These stands will be commercially thinned twice, depending on the soil site classification, and will be completely harvested in a clearcut harvest at about 80 years of age. After a decade or several decades of growth, Even stands can provide areas of dense trees of sufficient size that may provide foraging or dispersal habitat for fishers. However, to provide the structural elements required by fishers for denning, sufficient numbers of large trees having micro-structures must be intentionally and continually retained and recruited during the conversion from Mixed to Regen stands, and during the pre-commercial and commercial thinning harvests in the Regen and Even stands.

SPI began their current practice of programmatically converting the Mixed land class into well distributed even-age stands only about 15 years ago. Thus, very few of the existing stands have grown from the Regen land class into the Even land class at this time. Mixed stands are converted to Regen stands and present Regen stands continue to mature, an increasing proportion of the den habitat will be provided by the Even land class. (The amount of habitat that is projected to be available at various intervals will be discussed in detail in Section 7.) The suitability of the existing and future habitat for fisher is one of the key issues for long-term fisher management beyond the term of this CCAA.

The criteria for habitat suitability and accounting in both Mixed and Even-aged stands are further discussed below in Section 7 and also in the following White Papers: SPI 2013a, SPI 2013b, SPI 2013c. SPI 2014a (*RRHS as an Indicator of Heterogeneity*) and SPI 2014b (*Forest Conditions within Hexagons-Interstitial Space*).

### 6.8.2 SPI Option A Demonstration of Maximum Sustained Production

The Sierra Pacific Industries' management actions are guided by its long term management plan, the SPI Option A Demonstration of Maximum Sustained Production (SPI Option A). Growth and yield values were developed using a proprietary planning model that integrates G-Space, Cactos and Systum-1 as growth models and the SPI forest inventory point plots (SPI Northern Option A Sierra Pacific Industries, 1/1/99, pp. 14-15). All subsequent growth and yield scenarios developed to model this 100-year planning horizon have been submitted to CAL FIRE for confidential review, which was completed prior to CAL FIRE's approval of the SPI Option A. The planning tool approved by CAL FIRE is an expert based simulation model of growth, harvest, and quantitative constraints on management intensity such as: stream classification, areas having a high visual

aesthetic, high use recreation areas, sensitive geology and soils, known archeological sites, and endangered species.

### 6.8.3 Habitat Classification

A standardized definition of forest habitats suitable for fishers is needed for describing and quantifying existing habitat, predicting trends in habitat, defining objectives, and tracking progress toward meeting those objectives under the CCAA. SPI refers to habitat categories as Habitat Forms. Habitat Form categories aggregate forest types by expected species use. Assignment of anticipated species use is guided by literature review and by a relational comparison of a Habitat Form to forest types described in the California Wildlife Habitat Relationships system (WHR) (Mayer and Laudenslayer 1988). As further described in SPI 2013a the Habitat Form system was designed to improve on some of the limitations of the WHR system.

The parameters that SPI uses to define or delineate the Habitat Forms are 1) tree size class, as represented by the quadratic mean tree diameter (QMD) (i.e., the quadratic mean diameter of all trees >5 in. dbh) in a given stand; 2) large tree component, as represented by the number of trees per acre (tpa) of a specified size threshold; and 3) canopy cover classifications, as represented by the percent of the sky obscured by foliage when viewed vertically from below.

Habitat Form classifications are applied at the stand scale. SPI defines a forest stand as a forested area that can be distinguished from neighboring areas either visually and through measurements. SPI identifies and delineates stands using a combination of air photo analysis and inventory plot data. Usually, a distinct stand can be easily identified within the surrounding forest because of differing management history. This is especially true in areas in which intensive even-aged management has been applied, i.e., where clear-cut or variable retention harvest, brush field rehabilitation, and re-growth have created distinct stands with clear edges against surrounding stands of different ages. In areas where even-aged management has been applied, the Regen stands average about 17 acres in size, as a result of CFPRs limitations on clear-cut size. In Mixed stands with more varied management history, the stand may be defined by its recognizable borders with neighboring stands, or by the legacy of various harvest prescriptions or logging methods.

The progression of Habitat Forms follows a trend of growth indicative of the soil productivity and reflects the management activities that occur within the stand. Habitat Form 1 (HF1) is the youngest Habitat Form and is usually the result of even-aged clearcut harvesting, the rehabilitation of brush fields to conifer trees, or fire salvage harvesting of substantially damaged timberlands. The HF1 will persist for between 15-30 years depending on the soil site classification. Habitat Form 1 consists of the WHR 1 and 2 size classes, regardless of density class and is associated with ground vegetation that includes the grass, forb, seedling and sapling stages of forest development. HF1 stands grow into Habitat Form 2 (HF2) stands following a pre-commercial thinning that will occur at stand age 8-15 depending on the soil site classification, effects of animal browsing, and the effectiveness of controlling competing vegetation.

HF2 and HF2Hv stands can be either in the Mixed or Even land class. Habitat Form 2 consists of WHR 3M & D (6-11” QMD with >40% canopy closure). Habitat Form 2Hv consists of WHR 4M & D stands that are ≥ 11” and <13” dbh with >50% canopy closure. HF2 and HF2Hv stands that are in the Mixed land class are stands that on average are approximately 100 years old, contain numerous large trees, especially hardwoods, and based upon sampling, contain many potential nesting/denning structures for forest wildlife species including the fisher (SPI 2013b). Because of numerous small diameter trees and variable sized openings, these HF2 stands have a QMD of between ≥6-10.9”dbh and canopy cover of 40-100%. HF2 stands in the Mixed land class also have many trees greater than 22” dbh present, but their contribution to the stand is not substantial

enough to increase the QMD to >10.9 inches. Most HF2 stands in the Mixed land class will not be thinned prior to clearcutting, unless basal areas over time reach levels that risk attack by bark beetles. HF2 stands that are in the Even land class will receive a commercial thinning when necessary to avoid individual tree mortality. This generally will occur at between age 30 and 60 depending on the soil site classification. HF2 stands grow into HF2Hv, which has a QMD of ≥11 dbh and canopy cover ≥50%. HF2Hv stands in the Mixed land class have many trees greater than 22" dbh present, but their contribution to the stand is not substantial enough to push the QMD ≥13 inches. HF2Hv stands grow into Habitat Form 4 (further described below) over time when left uncut.

Habitat Form 3 (HF 3) stands have a QMD of ≥6"dbh and canopy cover of 10-39%. HF3 stands can have trees ≥22" dbh however they are not numerous enough to cause the canopy closure to exceed 40%. HF3 makes only a minor contribution to the Mixed land class.

HF2 and HF2Hv are the dominant habitat on the Enrolled Lands. HF2 and HF2Hv will contribute on average more than 50% to the total habitats available until the middle of the 5th decade of the SPI Option A.

Over the course of the permit term the proportion of the total HF2 provided by Mixed will decline but that which remains will mature over time. Even though the total number of acres in the Mixed land class decrease due to harvest, the silvicultural choice and voluntary constraints on harvest in the Mixed land class (described below in Section 7.2.8 Hexagon Analysis Results & 7.2.9 Summary Territory Opportunity Trends) will cause the amount of timber inventory in HF4 and HF2Hv to increase and remain at proportionally higher levels than today in aggregations that could function as female fisher territories. The transition from HF2 and HF2Hv to HF4 is not a qualitative estimate but relies on inventory data collected in the field and grown consistently using modeling that has been evaluated and found acceptable by CAL FIRE biometricians in 1999 and again in 2014.

The continued willingness of SPI to invest in increasing the growth rates of its forest and to choose not to harvest otherwise available stands, allowing them to accrue continued growth, will be an essential part of the SPI Option A and the success of the CCAA.

### 6.8.4 Den Habitat

#### 6.8.4.1 Habitat Form 4

Based on descriptions of fisher habitat in the literature (Lofroth et al. 2011, p. 73; Purcell et al. 2009, p. 2701; Higley and Mathews 2006, p. 9), the SPI stand classification that includes the dense stands of large trees that represents the best fisher habitat on the property is Habitat Form 4 (HF4) in the Mixed land class. A detailed description of the derivation of HF4 is contained in SPI (2013a Appendix G). Appendix G also includes comparisons of HF4 to other classification systems. SPI has conducted research using radio telemetry to locate areas and sites used by fishers in the Sacramento Canyon north of Redding in Shasta County, and southwest of Douglas City in Trinity County (Self and Kerns 2001, James et al. 2008, Niblett et al. 2014). This research, and measurements at additional dens at the Stirling Translocation Study Area (https://r1.dfg.ca.gov/portal/FisherTranslocation/tabid/832/Default.aspx), described the structure (tree) used for 149 den sites and 65 rest sites. A "cross plot" transect system was used to describe the 1.05-acre sites immediately adjacent to these features. Table 6.8.4.1-1 summarizes the data describing SPI den sites.

Table 6.8.4.1-1 Forest Stand Characteristics in the Immediate Vicinity of Den Trees

| | Age | Canopy Closure Average | QMD | Basal Area Total | Basal Area Hardwood | Trees/acre ≥ 6" dbh | Conifer TPA ≥ 30" dbh | Hardwood TPA ≥ 22"dbh | Conifer Snags(S) SPA ≥ 24" dbh |
|---|---|---|---|---|---|---|---|---|---|
| average | 111 | 80 | 14.1 | 184.97 | 41.93 | 174.40 | 5.68 | 2.60 | 1.38 |
| median | 90 | 86 | 13.1 | 163.33 | 30.31 | 170.31 | 3.37 | - | - |
| stdev.s | 61 | 16 | 4.8 | 111.91 | 44.00 | 81.11 | 7.31 | 5.43 | 2.66 |
| min | 31 | 18 | - | - | - | - | - | - | - |
| max | 439 | 98 | 33.5 | 866.93 | 208.66 | 419.86 | 40.47 | 33.72 | 10.12 |

Fisher researchers and habitat modelers have consistently stated that a high degree of canopy cover is a very important feature of habitat used by fishers (Zielinski et al. 2004a, p. 488; Thompson et al. 2011, p. 1165; Purcell et al. 2009, p. 2701; Lofroth et al. 2010, sec. 7.2.2). SPI has recognized this need by establishing a canopy cover of ≥60% for HF4, and ≥50% for HF2Hv. The methodology for estimating canopy cover is described in SPI (2013a).

Research on fishers has often described habitat in forests made up of large trees, and modeling of habitat for predictive use has used large tree size as an important variable (Zielinski et al. 2004a, p.485; Zielinski et al. 2006, p.1018). In general, because of past management history, SPI's Mixed forests have a smaller average tree diameter than many of the unmanaged late successional forests where other fisher habitat has been described (Purcell et al. 2009, p.2696; Thompson et al. 2011, p. 1165). Fisher den sites on SPI lands and elsewhere are often in small stands of trees larger than those in the surrounding landscape (Weir and Corbould 2008, p. 103; Niblett et al. 2014).

SPI's descriptions of conditions around nest/den structure trees (Table 6.8.4.1-1) informed the tree size criteria for HF4. To qualify as HF4, a stand must have a Quadratic Mean Diameter (QMD) greater than 13"dbh. (For further discussion of QMD, see Appendix G, SPI (2013a)). This is equivalent to the median QMD at the 1.05-acre sites surrounding known fisher nest dens on SPI lands. Thus, the HF4 definition provides a conservative tree size standard for qualification as denning habitat, which is summarized in Table 6.8.4.1-2.

Table 6.8.4.1-2 Threshold Criteria Values for Habitat Form 4

| LAND CLASS | CANOPY COVER | TREE SIZE | TREES /ACRE ≥22 in. dbh |
|---|---|---|---|
| Mixed | ≥60 % | Stand QMD ≥13 in. dbh | At least 9 trees |
| Even | ≥60 % | Stand QMD ≥13 in. dbh | At least 20 trees |

The HF4 threshold criteria for average tree size (QMD) and canopy cover are the same for Mixed and Even stands. The important difference in the criteria for the two land classes is in the minimum threshold for tpa ≥22 in. dbh. Because of concern over possible reduction in large trees in the Even land class, greater numbers of large trees are required to qualify as HF4 in the Even stands.

It is important to understand the intended use of the HF4 definitions. Fundamentally, the definition is NOT a management standard; i.e., neither the Mixed stands nor the Even stands will be managed with the intent of barely exceeding or being harvested repeatedly down to the minimums

of the definitions. Rather, the definitions provide the threshold for inclusion into the HF4 category for quantitative accounting of the projected change in amount of habitat, as the Mixed stands are steadily removed and eventually replaced by Even stands, and growth continues within the remaining Mixed stands.

The habitat thresholds described in Section 7.1 and the habitat analysis described in Section 7.2 will provide a reasonable general estimate of the change in habitat suitable for fishers during the period of the CCAA. It must be recognized that the use of these Habitat Form thresholds and the methods for estimating future female fisher Territory Opportunities, will not provide a precise estimate of fisher habitat because of the imperfect understanding of what specific habitat thresholds and juxtaposition are necessary to effect fisher vital rates. We acknowledge these thresholds and methods for various reasons may under or over-estimate the actual amount of fisher habitat. For example the method probably under-estimates because fisher are known to den at sites that, in a minority of instances, are in stands that are lower (smaller diameter stands) than the criteria used for this CCAA. It may overestimate the available habitat where required habitat elements are not present even though the stand meets the criteria. Also, habitat actually exists in a spectrum of suitability rather than a yes/no condition. Despite these factors these criteria are necessary to provide a reasonable estimate of occupied habitat in the existing Mixed land class stands.

HF4 in the Mixed land class is and will be the primary habitat type providing denning habitat, and the presence of fishers probably depends on the sustained presence of sufficient amounts of HF4 Mixed land classes that are properly spatially arranged, structurally complex, and contain adequate numbers of den and rest sites. However, SPI's measurements at reproductively successful sites on their ownership, along with scientific literature from elsewhere in the fishers' range, include descriptions of the species' use of stands with somewhat smaller QMDs than those established for inclusion in HF4. In fact, 61 of SPI's den sites and one of the rest sites occurred in HF4 Mixed land class (Table 6.8.4.1-3). The remainder of SPI's sites occurred in Mixed land class stands of HF2Hv (33 den sites and 7 rest sites), and HF2 (21 den sites and 6 rest sites). The HF2 and HF2Hv stand characteristics are further described in Section 6.8.4.2 and 6.8.4.3 below.

Table 6.8.4.1-3 Habitat Type on SPI Lands at Den and Rest Trees

| Habitat Form | Natal Den | Maternal Den | Rest Tree | Grand Total |
|---|---|---|---|---|
| 1 | 4 | 9 | 1 | 14 |
| 2L | 5 | 28 | 6 | 39 |
| 3 | 0 | 0 | 1 | 1 |
| 2H | 8 | 31 | 7 | 46 |
| 4 | 24 | 37 | 1 | 62 |
| Grand Total | 41 | 105 | 16 | 162 |

Because stands with the smaller parameters of HF2 supported fewer of the observed denning use, SPI believes that it would not be appropriate to use these site descriptions as the threshold criteria for quantification of the primary denning habitat. However, it may be appropriate to include HF2 stands, from the Mixed land class, as habitat contributing to the presence of fisher territories.

#### 6.8.4.2 Habitat Form 2

Habitat Form 2 (HF2) is the stand condition that is the precursor to HF2Hv. HF2 has moderate to dense canopy cover (40% - 100%) and a QMD of ≥6 in.-11in. dbh.

At present, most of SPI's HF2 stands are in the Mixed land class (see Section 6.4.1 for description of land classes), and are the legacy of various intensities of selection harvest carried out over past decades by various owners. While quite variable in condition, the HF2 stands in the Mixed land class sometimes do contain numbers of large trees, especially hardwoods, and according to sampling, potential den/rest sites occur at the rate of approximately 1 to 2 per acre (SPI 2013b, Appendix H). However, HF2 stands usually have QMD lower than stands typically used for denning by fisher, and while the threshold for HF2 canopy is ≥40%, most of these stands have canopy cover >60%. HF2 stands currently occupy about 30% of the Enrolled Lands. During the period of the CCAA, about 6% of today's acreage of HF2 will be clearcut and converted to Regen and Even land classes. The remainder of today's Mixed HF2 will continue to grow, and much of it will become Mixed HF2Hv and HF4 during the plan period. Meantime, many HF1 Regen stands will grow into Even HF2 and HF2Hv.

#### 6.8.4.3 Habitat Form 2Hv

Habitat Form 2Hv (HF2Hv) is the stand condition that is the precursor to HF4. HF2Hv has moderate to dense canopy cover (50% - 100%) and a QMD of ≥11in. dbh. The broad range of conditions included in HF2 Mixed land class (as described section 6.8.4.2) includes some stands that provide denning habitat for fishers, but in most cases denning use is in HF2Hv Mixed land class. While a component of larger trees may be present in a stand designated as HF2Hv, and/or QMD can be >11in. dbh (and in rare instances ≥13 in. dbh), HF2Hv stands do not satisfy all the criteria of HF4. HF2Hv Mixed stands currently occupy about 30% of the Enrolled Lands. During the term of the CCAA, approximately 6% of today's acreage of HF2Hv will be clearcut and converted to Regen and Even land classes. The remainder of today's Mixed HF2Hv will continue to grow, and much of it will become Mixed HF4 during the plan period. The QMD criterion for inclusion in this category is ≥ 11 in. dbh, and the criterion for canopy cover is ≥50%.

Stands of this description are known to have been used as denning habitat by fisher, but only in a minority of the cases described. Stands of HF2Hv also provide habitat for the prey used by fishers when foraging. However, in HF2Hv stands, denning is largely dependent on presence of remnant elements from previous stands, such as large hardwoods and snags. Appendix I provides more detailed description of the use of HF2Hv by fishers and their prey.

Table 6.8.4.3-1 Threshold Criteria Values for Habitat Form 2Hv in the Mixed Land Class

| LAND CLASS | CANOPY COVER | TREE SIZE | TREES /ACRE ≥22" dbh |
|---|---|---|---|
| Mixed | ≥50 % | Stand QMD ≥11" dbh | No standard applied |

#### 6.8.4.4 Denning Structures

As stated above, the Habitat Form system is based on attributes directly measured in SPI's forest inventory system. These include canopy cover and tree size by species. Other features, especially

cavities suitable for natal and maternal denning and platforms for resting, also are known to be elements of fisher habitat, but have not been identified in the forest inventory system.

To evaluate the presence of denning and resting structures, SPI has visually surveyed a randomly selected sample of 81 stands of HF4 and 74 stands of HF2 to evaluate the presence of cavities and other microsites that appear to be usable by fishers for denning (Appendix H, SPI 2013b). We found an average of 1.9 such microstructures per acre in the HF4 and 2.3 structures per acre in HF2. At least one structure was noted in 92 percent of the stands surveyed. While we cannot be certain that the microstructures found were actually suitable for use by fishers, the widespread presence of visible microsites indicates that most stands of HF4 and HF2 in the Mixed land class contain potential sites for use by fishers.

#### 6.8.4.5 Relative Resting Habitat Suitability (RRHS)

Literature describing fisher habitat often uses terms such as "structural diversity," but this attribute is rarely expressed in a quantified form. The term generally refers to a forest that has trees of varying ages and sizes, snags and down logs, a shrub layer, and a variety of structures provided by large limbs, broken and multiple tops, deformities, parasitic mistletoe infections, and other features that provide micro-habitats for fishers and their prey, but the presence of these features can be quite variable (Zenner 2004). We sought a methodology that might provide an indication of the presence of the attributes of structural diversity for purposes of evaluation and classification, and thus quantify the structural diversity of our forest stands using our existing inventory.

Zielinski et al. (2010) proposed an index of Relative Resting Habitat Suitability (RRHS) for fishers, which evaluated the presence of potential fisher resting structures. Fisher resting structures include large snags, large trees with cavities and deformities, and large limbs. Calculating the RRHS at a point in a stand includes variables that infer the degree of variability and complexity present (Zielinski et al. 2010, p. 1579). The RRHS calculation is intended to interpret inventory plot data that is relevant to fisher habitat management at the microhabitat scale (Zielinski et al. 2012., p. 39). We propose to use the RRHS value as an indicator of the presence of structural diversity contributing to fisher habitat.

Using data (1.05 acre cross plots) from 149 known fisher denning sites and 65 known fisher rest sites on SPI lands, we calculated RRHS values representing these sites (SPI 2014a). The RRHS calculation did not include the den/rest trees. The mean RRHS value at den sites was 0.22, which was slightly higher than at resting sites. Almost 62% of the den site values were lower than the mean value of 0.22. Thus we regard 0.22 as a conservative value (since nearly two thirds of the den sites had lower RRHs values) for representing heterogeneity within denning habitat on SPI lands.

In an effort to examine characteristics of the sites where fishers were known to den or rest at a finer scale, we considered the values at individual plots rather than combining plot data into larger stands. As further described in Appendix J, (SPI (2014a) and in Table 6.8.4.5-1 below, an average of over 30 percent of the inventory plots in HF4 in the Mixed land class have a RRHS value ≥ 0.22. Additionally, an average of over 20 percent of the inventory plots in the Mixed land class that qualify as HF2hv have a RRHS value ≥ 0.22. Thus, we conclude that HF4 and HF2hv have sufficient structural diversity to provide for the needs of fishers.

Table 6.8.4.5-1: RRHS Values for Inventory Plots in HF4, HF2Hv and HF2 Habitat Forms

| RRHS Plot Stats (plots with RRHS >= 0.22) for 7 CSCAs and Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | RRHS >= 0.22 | | | | | | | | |
| | HF4 | | | HF2Hv | | | HF2 | | |
| CSCA | % of plots | Ave RRHS | StDev | % of plots | Ave RRHS | StDev | % of plots | Ave RRHS | StDev |
| Hayfork Divide - Bully Choop | 21.5% | 0.3870 | 0.1368 | 15.1% | 0.3827 | 0.1372 | 17.5% | 0.3834 | 0.1358 |
| Trinity Mountains | 24.3% | 0.3814 | 0.1315 | 17.3% | 0.3799 | 0.1299 | 15.1% | 0.3798 | 0.1241 |
| Redding North | 32.0% | 0.3494 | 0.1096 | 21.5% | 0.3079 | 0.0885 | 20.0% | 0.3203 | 0.1000 |
| Redding South | 31.7% | 0.3777 | 0.1249 | 20.6% | 0.3775 | 0.1272 | 22.7% | 0.3664 | 0.1194 |
| Stirling | 34.9% | 0.4077 | 0.1407 | 23.6% | 0.3968 | 0.1370 | 23.0% | 0.3899 | 0.1364 |
| Camino | 39.1% | 0.4311 | 0.1517 | 29.6% | 0.3823 | 0.1404 | 21.7% | 0.3734 | 0.1234 |
| Sonora | 32.8% | 0.4109 | 0.1430 | 19.5% | 0.3851 | 0.1323 | 15.9% | 0.3789 | 0.1315 |
| **All Area Weighted Average** | **33%** | **0.4018** | **0.1381** | **21%** | **0.3818** | **0.1323** | **19%** | **0.3779** | **0.1288** |

### 6.8.5 Summary of Habitat Conditions and Projected Changes

As noted above the HF2, HF2Hv, and HF4 habitat forms currently comprise about 74% of the Enrolled Lands considered Capable Land. These habitat types will be reduced by about 18%, thus reducing the total amount of Mixed habitat over the term of the permit. The remaining 56% of the Enrolled Lands that are in the Mixed land class will continue to grow and may develop into higher quality fisher habitat.

Table 6.8.5-1: Amount of HF2Hv and HF4 Mixed Land Class over Time

| Total SPI Ownership in 5170 Hexagons > 50 acres | | 1,432,135 | | | | |
|---|---|---|---|---|---|---|
| Decade | Amt Mixed | Mixed as % of total lands | Amt HF2Hv in Mixed | Amt HF4 in Mixed | Amt HF2Hv and HF4 | HF4 & HF2Hv as % of total lands |
| Start | 1,059,780 | 74% | 398,002 | 357,011 | 755,012 | 53% |
| 10 yrs | 801,996 | 56% | 346,405 | 425,837 | 772,243 | 54% |
| 20 yrs | 615,818 | 43% | 104,144 | 511,674 | 615,818 | 43% |
| 30 yrs | 544,211 | 38% | 5,201 | 539,010 | 544,211 | 38% |
| 40 yrs | 501,247 | 35% | (77,694) | 501,247 | 423,553 | 30% |
| | Values from 1999 SPI Option A(where mixed vs even were not tracked) | | | | | |

## 7. BIOLOGICAL GOALS AND OBJECTIVES

### Introduction to Biological Goals and Objectives

The primary biological goal of this CCAA is to provide aggregations of habitat that are representative of female fisher territories across both the Occupied Range and unoccupied portions of its range at the 10,000 acre scale (See Section 7.2.11). This goal will be addressed through Conservation Measures One through Four found in Sections 7.3.1-7.3.5.

The secondary biological goal is to reduce threats and minimize potential impacts to fishers on the Enrolled Lands and thereby promote colonization of currently unoccupied habitat and increase the fisher population. By avoiding killing, injuring, or disturbing fishers during their reproductive and rearing periods and reducing or eliminating physical threats associated with water tanks, exposure

to toxic materials, and loss of habitat to catastrophic fire, self-sustaining and genetically diverse populations of fishers will begin to recolonize currently unoccupied areas of suitable habitat on and adjacent to the Enrolled Lands. This goal will be addressed by Conservation Measure Five, which is presented in more detail in Section 7.3.6.

As stated in the Service's "Five Point Policy Guidance," the biological goals and objectives of an ESA Habitat Conservation Plan may be either habitat or species based (Federal Register Vol.65, No. 106, p. 35251). For several reasons, SPI has chosen to express biological goals of this CCAA in terms of habitat rather than numbers of fishers. The number of existing fisher territories currently present on the 1.5 million acres in the Enrolled Lands is not accurately known, and the resources and time required to confidently estimate a population baseline and trends are potentially prohibitive. Research on fishers has found large variations in home range size that may be related to temporal, geographic, and physical variations in prey availability and weather, as well as habitats available (Powell 1994, Ch. 5, p. 89, 91, 94; Zielinski et al. 2004b, p.654; Zielinski 2010, p.1580). Based on review of available literature, predicting a population response to changes in habitat variables has not yet been attempted. And, because individual fishers have home ranges large enough to extend beyond ownership boundaries, they may be subject to substantial effects outside of SPI's control.

Therefore, SPI proposes that the primary biological goal will be evaluated in terms of habitat amounts sufficient to provide territories for fisher that include denning stands, territory core areas, and territory support core areas, all of sufficient size to support reproductive fishers and are present at the broader 10,000 acre landscape scale. This approach is based on four important assumptions: 1) that sufficient prey resources are available; 2) that there are sufficient den/rest structures available; 3) that the amount and spatial arrangement of the Mixed land class can be accurately estimated and monitored at the scales relevant to fisher territories; and 4) that the proportional contribution of habitat at the scales of the qualifying hexagon and a 10,000 acre area, adequately addresses the proportion of those habitat threats that SPI can control on its property (USFWS Draft CCAA Handbook 2003, p5).

Regarding the first assumption, fishers are generalist predators and SPI Mixed land class habitat is known to be occupied by fishers. There is an abundance of Mixed land class on the Enrolled Lands; therefore, prey availability should not be a limiting factor.

Second, the assumption that denning opportunities are available in Mixed stands relies on the inventory conducted in the fall of 2012 and reported in *Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas* (SPI 2013b). Third, the spatially explicit hexagon analysis indicates that habitat will be aggregated in a manner that is representative of a female fisher territory as described in Section 7.1 below. Lastly, because the SPI's Enrolled Lands comprise only a portion of the occupied range and the SPI lands are in many areas discontinuous, SPI can only contribute amounts of habitat proportional to their ownership. In combination, this means that the habitat accounting discussed in Sections 7.2.5, 7.2.6, and 7.2.7 is supported with carefully reasoned assumptions. The hexagon reasoning supporting the individual hexagon analysis is found in Section 7.2.3. The Conservation Benefit provided at the 10,000- acre scale is discussed in Section 7.2.11.

Throughout the following discussion, it should be remembered that the estimation of the representative size and characteristics of den stands, territory cores, territory support cores and territory opportunities is for the purpose of producing a quantified estimate of the number of female fisher territories that SPI supports through its proportional contribution within each qualifying hexagon and in broader 10,000- acre areas. This method of accounting for fisher habitat also provides a means of estimating harm by habitat modification.

## 7.1 FISHER HABITAT ANALYSIS

### 7.1.1 Introduction to Habitat Analysis

The biological goal for the enrolled lands will be expressed as the amount of potential suitable female fisher habitat and territories on the Enrolled Lands, evaluated at the scale of a 10,000- acre area. The larger evaluation area will provide a landscape level assessment of these territories' connectivity to other potential fisher habitat areas. In most cases, both presently and in the future, the actual occupancy of these potential territories will remain unknown (except for sampling at intervals as described in Section 13.2), but the proportional habitat contribution is and will be present in amounts and configurations suitable to provide territories for use by fishers. Therefore, we will refer to these areas as Territory Opportunities.

Mitchell and Powell (2002, Ch. 5, p.121) suggested that the definition of habitat should be based on the spatial scale and ecological resolution of interest. The intensive spatial analysis applied in the CCAA is based on the component parts of a territory of a reproductive female fisher. The habitat descriptions and amounts are at scales representative of the female fisher's den stand, the surrounding core area, and the necessary additional habitat in the form of support cores, to provide a potential territory. These component parts are and will be used for analyzing the Enrolled Lands for presence of Territory Opportunities that occur within 10,000-acre evaluation areas over the term of the agreement.

The spatial analysis of wildlife habitats often uses hexagons rather than circles to avoid problems of overlap or gaps that would occur if circles were used to represent habitat units. (For examples, see Noon and McKelvey (1996), Franklin and Stephens (1996), Hof and Bevers (2000), and Zielinski et al. (2006)). For our analysis we overlaid a fixed grid of 500-acre hexagons and aggregated data from inventory point plots into analysis areas in a manner that avoids overlap (which would cause double counting errors) and gaps (which would cause omission errors). We aggregated four qualifying hexagons into potential Territory Opportunities as further described below. The following Sections 7.1.3 through 7.1.5 describe the derivation of the scale of Territory Opportunity components. Section 7.1.6 describes the habitat standards that comprise the Territory Opportunity components. Section 7.2.2 describes how each hexagon is classified as a territory component. Section 7.2.5 describes the rule set for classified hexagons being aggregated into Territory Opportunities. Section 7.2.6 describes the rule set for identifying when harm to a Territory Opportunity occurs. How these Territory Opportunities fit into the larger landscape to provide Conservation Benefit is discussed in 7.2.11. The methods used in annual accounting for harm are described in 7.2.10.

#### 7.1.1.1 Data Quality Assumptions for Estimating Habitat Descriptions and Amounts

In the following sections 7.1.2 through 7.1.6, we describe how we derived various thresholds and standards for the inclusion of forest stands into estimates of the number of Territory Opportunities for female fishers. These standards include: 1) minimum levels of forest stand measurements such as stand QMD, canopy cover, and numbers of large trees that describes suitable habitat; 2) the size in acres of the components of a Territory Opportunity, including den stands, core areas, and territories; and 3) amounts of habitat necessary in each component of a Territory Opportunity. In each case, the standards were derived from literature on fishers, from data collected on SPI lands, remotely-sensed data, and where data were insufficient, on reasoned analysis.

Before going into the detail of these standards, we should acknowledge the potential error that is inherent in the estimates. This potential error arises from the methods of habitat typing and quantification that were used in the original works upon which we rely. We have attempted to recognize potential error throughout our analyses, and at various points in the following sections, we will note important sources of error in our estimates and point out some of the implications. In the following paragraphs, we provide a brief general description of the sources of error in habitat measurement and quantification.

Use of vegetation structure inventory is ubiquitous in management of forests and forest wildlife. As stated by Ohmann and Cohen (2002, p. 193), stand level vegetation structure inventory data provides criteria for associating ecological, social, and economic values into an integrated framework for analysis and decision-making. Throughout the scientific literature regarding the fisher (and other wildlife as well), habitat descriptions are generally provided as descriptions of vegetation strata. In forest management, vegetation strata are categories (polygons) that describe groups or stands of trees that have similar species composition, size, and density characteristics.

Interpretation of species habitat associations typically relies on radio telemetry or direct observational data placed into human- (or human-GIS-) delineated polygons of described vegetation (strata). When a species appears to select a vegetation stratum more frequently than the stratum's proportional contribution to some scale of analysis, that stratum is considered preferred by the species. (For general discussion of habitat selection and preference, see Krausman (1999, p. 86). For discussion of selection and preference of habitat by fishers, see Lofroth et al. (2010, Chapter 7)). Thus, the accuracy of the vegetation strata boundaries, descriptions, and quantification are central to a wildlife researcher's ability to correctly describe preferred habitat at any scale.

Many of the sources cited in the following sections derived estimates of habitat type and quantity from interpretation of aerial photography or other remote imagery. The methods used to classify and quantify habitat and to assess accuracy were described to widely varying degrees, but generally did not provide enough specific information regarding the classification rules or mapped polygon data to evaluate the cover type classification system. Several authors (Biging et al. 1991, p. 10, 12, 14; Congalton 1991, p. 42; Magnussen et al. 2000, p. 365; Congalton 2005, p. 151-153) have stated that there is a high possibility of error in the methods that produced the available descriptions of habitat characteristics and quantities. However, it is not feasible for SPI to assess the accuracy of all of these estimates, and in most cases we have accepted them at face value. In a few cases, we have noted the implication of possible error to our process in the appropriate section.

We must note that the one of the strengths of the extensive SPI forest inventory (which is installed at a rate of one point plot approximately every 4 ac.) is that its use reduces the possibility of compounding the error inherent in the application of standards derived from the literature. SPI's stands are delineated using aerial photographs, but the descriptions of tree size, species composition, and canopy cover within those polygons are derived from the SPI forest inventory. Thus, for example, where a description of average tree size derived from literature (which may contain an unknown degree of error) is applied to stands as a threshold in this CCAA, at least there is a high likelihood that the SPI stand actually meets that standard, without compounding any error through additional interpretation of photos or satellite images or modeling. The utility of relying on SPI forest inventory data in lieu of remotely-sensed data is further discussed in Section 7.2.3.

### 7.1.2 Fisher Territory Components

SPI uses an approach to estimate the number of Territory Opportunities based on habitat amounts defined by scientific literature and available data from SPI lands to 1) define the spatial extent of each territory component, 2) describe the characteristics and amount of suitable habitat at

the scale representative of the territory, territory core, and den stand for fisher, 4) estimate the present number of Territory Opportunities based on SPI's contribution of such habitat configurations in hexagons on the Enrolled Land, and 5) establish a rule set for determining when harm via habitat modification occurs. Thus, the analyses will lead to an estimate of the number of available Territory Opportunities for female fishers, using representative values for the amount of SPI HF4 and HF2hv at the three scales: den stand, core, and territory, based on literature and on data gathered on SPI lands.

### 7.1.3 Den Stand Concepts

As defined in this CCAA, the primary prerequisite for a territory is a den stand. The den stand is a the contiguous forest stand that contains at least one den structure (tree) with a suitable micro-structure (cavity), and presumably provides the escape cover, microclimate, and access to forage necessary for reproductive success. The contiguous forest stand that is considered a fisher den stand is named a Contiguous Core Stand (CCS).

#### 7.1.3.1 Den Stand Size Determination

We found no published literature that described the actual sizes of stands used for denning, leaving us to use inference to derive a stand size sufficient for use by fishers and amenable to analysis. Determining a representative stand size in the field is confounded by the species' tendency to change den sites several times during the period of rearing young. For example, the breeding female fishers at SPI's South Weaverville Study Area (SWSA) switched dens between 4 and 9 times. Niblett et al. (2014) suggested that for evaluative purposes, the den stand size is the area encompassed by a circle whose radius is half the average distance moved by a female fisher between dens (See Appendix M). Niblett et al. (2014) referred to these areas as "neighborhoods," which on SPI's SWSA were 40 ac. in size. We found no other published data on the average distance moved by denning fisher reported in a manner that can provide an estimate of den stand size. Therefore, this CCAA uses the value suggested by Niblett et al. (2014) as a guide, and designates 50 ac. as the minimum CCS for a female fisher.

We recognize that fisher use multiple den trees, and thus multiple den tree stands; however, to satisfy the animals' need for additional den opportunities outside the CCS (primary den stand), we will rely on HF4 and HF2Hv stands within the remaining Territory Opportunity because these habitat forms are most likely to contain additional suitable den and rest trees, have dense canopy and larger trees, and generally are older and more structurally complex than other habitat forms. Additional den stands are reasonably expected to occur, as described in SPI (2013a, 2013b) and Niblett et al. (2014). Such stands need not be contiguous to the CCS, but are connected by areas of high canopy cover as a requirement of inclusion in the designation of the territory and support cores, as described below.

### 7.1.4 Territory Core and Support Core concepts

The concept of the territory core has been widely applied in published literature. As stated by Samuel and Green (1988) "The existence of core areas within an animal's home range provides an important conceptual framework for delineating selected areas that contain home sites, refuges, and dependable food sources." The concept has often been applied to avian forest raptors ((e.g., the northern and California spotted owls (Franklin et al. 2000; Seamans and Gutiérrez 2006) and the northern goshawk (Woodbridge et al. 2012, Ch. 5, p. 119)). And, the territory core concept has been

applied to other mid-size mammalian carnivores, such as the bobcat (Tucker et al. 2010, Riley 2006) and the gray fox (Riley 2006).

The concept of the territory core may apply somewhat differently to fishers than other species, because female fishers annually use multiple den structures to bear and raise young. Den structures may be at varying distances from productive foraging areas, and thus interpretation of the size of the territory core may be influenced by the variability of the forests used by fishers, and the availability of den structures and the distance between them, as well as by the quality of the data describing the sites utilized.

However, despite these difficulties in interpretation, the concept of the territory core does seem to apply to the fisher. Higley and Matthews (2006, p. 5) reported denning behavior being "characterized by a sudden change in behavior from using numerous rest sites per week across the majority of the home range to more restricted movements in a small portion of the home range and repeated use of the same structure while inactive."

#### 7.1.4.1 Territory Core Size Determination

While the concept of core area has been widely applied, determining the size of areas to represent a core for assessment or management is less straightforward, especially when the central point is not fixed, as is the case for fishers (see below), or when radio-telemetry data are not available to assist in determination of areas actually used. We sought a supportable size of territory core that could be applied in estimation of availability of Territory Opportunities on the Enrolled Lands.

Niblett et al. (unpub. data) described home ranges of five telemetered reproductive female fisher using kernel density estimates (KDE) at SPI's SWSA. The 25% KDE for the female fisher (i.e., the area within which the densest 25% of use locations were observed) consisted of several non-contiguous polygons within portions of the 50% and 75% density kernels. The average total size of the polygons comprising the 25% KDE for the five females at SWSA was 514 ac and ranged from 404 ac. – 676 ac. The 25% KDE was constructed using year-round location data, but about 60% of the observations were during the denning period. Because a substantial portion of the observations were outside the breeding season and because the 25% KDE polygons were not contiguous, the question of whether a 500-ac. area is a reasonable approximation of the size area used during the denning period was investigated further by SPI.

Using the SPI GIS and the fisher locations reported by James et al. (2008) and analyzed by Niblett et al. (unpub. data), we placed a 500-ac. hexagon in a "best fit" manner over each of the five female fisher's natal and maternal den locations observed during the two years they were tracked. The "best fit" placement attempted to situate the 500-acre hexagon over as many of the den sites as possible. The inclusion of den locations within the "best fit" placement of 500-ac. hexagons over the den observations ranged from 66% -100%.

Because a substantial majority of the den sites of each individual fisher could be contained in a 500-ac. hexagon on the SWSA, we inferred that a 500-ac. hexagon is a reasonable representation of the size of a female fisher core area. However, because an important fraction of the denning sites in some territories were not contained in the 500-ac. core, we recognize the need for additional area to adequately represent an appropriately sized territory. We address this need by providing additional area in the form of a "support core" as described in Sections 7.1.6.

### 7.1.5 Concepts: Home Range and Territory

A commonly cited home range definition is that of Burt (1943, p. 351): "that area traversed by the individual in its normal activities of food gathering, mating and caring for young." The home range can be estimated by radio-telemetry, but because transmitter life is somewhat limited and locations are usually separated in time, the area described may not encompass the animal's actual use area over an extended period. Thus, home range descriptions are usually described as estimates. Home ranges of neighboring individuals often overlap considerably.

Within the home range, there may be great variation in frequency of use of smaller areas (Powell et al. 1997). The analysis of home ranges has evolved over the last several decades, from initially reporting an individual's area of use as a minimum convex polygon (MCP), which encompasses all of the points where an individual was detected, to two dimensional relative frequency distributions in smaller areas, to multi-dimensional, non-parametric kernel estimates of use (Kie et al. 2010, p. 2222). If ecologically relevant associations can be made between animal habitat use and other processes, those associations may be used to develop heuristic models and guidelines for making land use decisions (Fleishman et al. 2002, p. 78).

An animal's territory is the area within its home range that it defends from other animals, thus establishing an area of exclusive use. For more thorough descriptions of the territory concept applied to the fisher and other forest carnivores see Lofroth et al. (2010, p.67), Woodbridge et al. (2012, p. 114-118 & p. 123), Zabel et al. (1992, Ch. 6, p.149), Lee et al. (2012, p. 794), and Powell (1993, Ch. 9, p. 179).

In most cases, the actual limits of a territory cannot be determined, so some authors have estimated the size of the exclusively used territory by halving the distance to the nearest neighbors. This requires extensive knowledge about the spatial distribution of the entire population in the study area, which would be exceedingly difficult to obtain for fishers. Thus, we have used available information to aggregate forest characteristics into modeled representations of areas potentially used by fishers (See Figure 7.2.5-1).

The following sections will describe our attempt to define the size of the component parts of representative fisher territories, in order to derive estimates of the number of potential territories that may be present currently and at various intervals in the future. A Territory Opportunity will use multiple combined core areas to represent a female fisher territory of appropriate size.

#### 7.1.5.1 Determination of Fisher Territory Size

Fishers exhibit intrasexual territoriality (i.e., female territories are different from those of males), which is thought to be necessary based on the availability of prey of appropriate size (Powell 1993, Ch. 9, p. 172). Because resources necessary for breeding (i.e., multiple cavities of suitable size for natal and maternal use) by female fishers are probably limited, and because female home ranges (and presumably territories) are smaller than those of males, we intend to estimate the numbers of Territory Opportunities for female fishers. Fishers identify their territories using scent marking, which if respected by other fishers, should limit overt aggression (Powell 1993, Ch. 9, p.170). Because these scent markers are not detectable by humans, the physical boundaries of exclusively-used territories cannot be practically determined, and the bounds of territories must be inferred by other methods.

We have found no published report of nearest neighbor distances for fishers, so the method of using half the mean nearest neighbor distance for territory estimation is not readily available. And, as discussed below, review of available radio-telemetry studies provided basis for only limited conclusions regarding territory size.

Lofroth et al. (2010) summarized MCP minimum convex polygon estimates of home range size for telemetered female fishers from several studies, but did not address the issue of territory size.

Those studies did not report on exclusively used area, which can only be determined where overlap of home ranges has been observed.

Potentially, kernel density estimates (KDE) could be used to discern areas of exclusively-used area among neighboring fisher home ranges. James et al. (2008) and Niblett et al. (unpub. data) both analyzed the data from five fishers radio-tracked by James et al. (2008) in the SWSA. Using different statistical methods, these two studies derived different estimates of the amount of area in the home range of the same animals. James et al. (2008) calculated a MCP minimum convex polygon and Niblett et al. (unpublished data 2014) calculated the 75% KDE and also the 25%, 50%, and 100% KDE (unpublished data) for these five animals.

Several other fishers also were captured in the SWSA near the five home ranges analyzed, but did not provide sufficient radio-telemetry data to contribute to the analysis. Thus, it is possible that habitat use by unknown fishers overlapped with those analyzed. Among the five, there was only observed overlap between the KDEs of two fishers. Not only did the areas used by these two fishers overlap at the 100% (home-range) KDE scale, they overlapped to a small degree at the 75% and 50% KDEs.

Garner (2013) analyzed KDE's at the 85% and 50% densities for fisher in the southern Sierra Nevada, but did not report the data for the 50% kernel, nor address the issue of overlap. Thompson et al. (2011) reported on the 95% KDEs of fishers in the southern Sierra Nevada, but did not report regarding overlap of home ranges or KDEs at other scales.

Powell et al. (2015) reported data for the 95% probability of use density contours at the northern Sierra Nevada translocation study, but did not report the data for the 25% or 50% kernel. They provided a map of home ranges indicating a high degree of overlap among eleven home ranges in a single year, but did not provide quantitative analysis of overlap.

Due to the observed home range overlap at the SWSA and the Sierra Nevada translocation study, the potentially confounding presence of other fishers that did not contribute to the analysis at the SWSA, and the lack of data from other studies, we are left without a supportable estimate for the exclusively-used territory size for a female fisher (and indeed are left uncertain to what degree the traditional concept of the territory can be applied to the fishers). Therefore, for purpose of estimation of present and future Territory Opportunities, we have concluded that the home-range scale must be used as the metric.

Home ranges are often described by using the MCP encompassed by telemetry observations. In that interpretation, the home range is equivalent to the 100% KDE; i.e., it contains all of the radio telemetry observations for an individual over a described period.

Home ranges reported by various fisher investigations varied by geographic region, by sex, and by year. Buck et al. (1983) reported an average female fisher MCP of 988 ac. in the Big Bar area in Trinity County, CA. Zielinski et al. (2004b, p. 652) reported average female MCPs of 1,303 ac. for the Southern Sierra Nevada and 3,702 ac. for areas of western Trinity and eastern Humboldt Counties, CA. Yeager (2005, p.18) reported an average female MCP of 5,799 ac. in the Shasta-Trinity National Forest and an average female MCP of 415 ac. at the Hoopa Indian Reservation in 1998. However, Matthews et al. (2011, p. 70) reported that the average female fisher MCP on the Hoopa Indian Reservation was 1,798 ac. in 2005. Regarding fishers in the southern Sierra Nevada, Spencer et al. (2011, p. 798) stated: "We believe that population (or carrying capacity) estimates based on the smallest territory size we tested (500 ha, or 1235 ac) are inflated and that estimates based on larger territory sizes (860–1200 ha (2125-2965 ac)) are more defensible." The average 100% KDE among the five female fishers telemetered at the SWSA was 1,865 ac. and the median was 1,932 ac. (Niblett et al. unpub. data). The considerable range of home range sizes and fisher density is, in most occasions, a reflection of the habitat quality present within the bioregion being sampled (R. Powell, pers. comm. 2014).

Amid the uncertainty described above, and considering the wide range of observed home ranges, which is reflective of the of the habitat quality present within the bioregion being sampled (R. Powell, pers. comm. 2014), and considering the site quality across the Enrolled Lands and the territory data collected on SPI property (Niblett et al. 2014 unpublished data) we have decided to use 2,000 ac. as representative of the size of an important portion of a female fisher home range. A Territory Opportunity for a female fisher will be counted on the basis of four 500-acre hexagons aggregated together. An individual hexagon will not contribute to multiple Territory Opportunities, and thus our Territory Opportunities will be unique. The Territory Opportunity must be a discrete area so that we can count them and evaluate their change over time to estimate harm.

However, because actual home ranges are known to overlap, our estimate of Territory Opportunities may under-estimate the actual number of home ranges to an unknown degree. Conversely, the potential for over- estimating the number of Territory Opportunities may occur where SPI owns a small minority of the Territory Opportunity and therefore the estimated hexagon condition may not match the adjacent ownership condition. A discussion of such an instance as it relates to the habitat contribution and harvest intensity assumptions is provided in Section 7.2.3. The discussion in Section 7.2.3 indicates why the proposed methodology conservatively accounts for and neutralizes this potential for over- estimation of Territory Opportunities.

#### 7.1.5.2 Summary of the Size of Territory Components

The previous sections 7.1.3 through 7.1.5 described how we determined the size of the areas that will comprise Territory Opportunities for the purpose of estimating present and future numbers of Territory Opportunities. In summary, for each fisher Territory Opportunity, the CCS is at least 50 ac. of SPI ownership, the territory core is 500 ac. (classified by the habitat condition on SPI), and the territory is 2,000 ac. A Territory Opportunity for female fishers will be combinations of four 500-acre territory and support cores totaling 2,000 ac. While these acreage limits of 500 and 2,000 are used, the modeling of the habitat within the hexagons is limited to what is available from the SPI portion. Further discussion relating the analysis of habitat within hexagons can be found in Section 7.2.

### 7.1.6 Habitat Descriptions at the Scales of the Contiguous Core Stand, the Territory Core and Support Core, and the Territory or Home Range.

Lofroth (2010, Chapter 7) summarized the characteristics of forested habitat within fisher home ranges. SPI has incorporated the results of these studies into HF4 (described in detail in SPI (2013a) (Appendix G)) and HF2Hv (described in detail in SPI (2013 c) (Appendix I)). With the exception of areas east of the crest of the Sierra Nevada and southern Cascades (the East Side), further described below, we intend to use the presence of habitat described as HF4 and HF2Hv, in quantities described in sections 7.1.6.1—7.1.6.3, as the standard for inclusion in estimation of the presence of Territory Opportunities for female fishers.

At the present time, the range of the fisher is not known to extend east of the crest of the Sierra Nevada and southern Cascades (the East Side). However, it is possible that fishers could occupy that area during the CCAA period. Because of lower site productivity and colder, drier climate, East Side forest stands generally have smaller QMD and less canopy closure. For instance, East Side territory core habitat for northern goshawks is dominated by forests that generally have lower canopy cover and smaller diameter trees than on the west side of the Sierra (Woodbridge et al. 2012, Ch. 10, p. 320). Lacking specific data for fishers, we assume that HF2Hv will provide the tree size and density sufficient to qualify as habitat for East Side fisher cores, even in the absence of

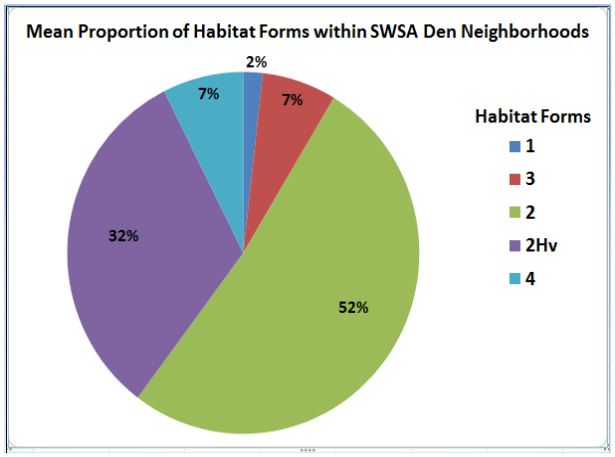
HF4. However, for accounting purposes we utilized the same criteria for estimating presence of Territory Opportunities on the East Side as the other CSCA regions. The proposed delineation between west side and east side forest types is depicted in Figure 7.3.5.1.

### 7.1.6.1 Threshold Quantity of Den Habitat in a Den Stand

As described in sections 7.1.3.1, we have chosen 50 contiguous acres as the area representative of a CCS for fishers. There is general agreement in the literature that the forest stand values (canopy closure, QMD, presence of large trees) similar to SPI's Habitat Form 4 are usually present in fisher denning stands. Structural complexity is not captured by the SPI habitat classification, but at least RRHS may be calculated from the forest inventory data (see Section 6.8.4.5). SPI's GIS contains spatially explicit stand data that shows the spatial extent and juxtaposition of habitat forms. However, no published information is available to inform selection of meaningful criteria regarding habitat quantity for fisher at this scale.

Using Niblett et al. (unpub.) KDE data, SPI conducted an analysis of Habitat Forms within the den neighborhoods at the SWSA. SPI intersected Niblett et al. (unpub.) Den quadrature point plots with the SPI stand strata to derive the proportional quantity of Habitat Forms in the 47 den quadratures. The results found averages of only 7 percent Habitat Form 4 and 32 percent Habitat Form 2Hv present in the 47 den neighborhoods measured at SWSA (Fig. 7.1.6.1-1). Recognizing that many fisher den sites throughout the range are probably in stands with larger proportions of large timber than in the SWSA, we have decided that a qualifying CCS will consist of a contiguous area of at least 50-acres containing at least 30 ac. of HF4, with the remaining acres consisting of HF2Hv. Defining a den stand thusly avoids arguing whether stands with smaller average QMD qualify as denning habitat, even though it appears that fisher are using those stands at SWSA.

Figure 7.1.6.1-1




### 7.1.6.2 Threshold Quantity of Den Habitat in a Territory Core

As described in SPI (2013a), Mixed HF4 is representative of den habitat for fishers based on stand measurement criteria (QMD, canopy closure, and the number of trees per acres greater than 22" DBH). SPI (2013a) related these stand measurement criteria to the following publications: Lofroth et al. (2010, sec. 7.2.2), Zielinski et al. (2010), Lofroth et al. (2011, p. 73), Truex et al. (1998), and Zielinski et al. (2004a). While the characteristics of core habitat have been described, there is

very limited literature that informs determination of the threshold amount of den habitat necessary for fisher territories to occur and persist on a landscape.

#### 7.1.6.2.1 Habitat Amount in Fisher Territory Core

Using Niblett et al. (unpub.) KDE data, SPI conducted an analysis of Habitat Forms within the 25% KDE at the SWSA, which per section 7.1.4.1 above is equivalent to a 500 ac. core. SPI intersected Niblett et al. (unpub.) 25% KDE with the SPI stand strata to derive the proportional quantity of Habitat Forms in the 25% KDE. The amounts of Habitat Forms in the 25% KDE at SWSA the mean amount of Habitat Forms are found in Table 7.1.6.2.1-1. At SWSA all acres of HF2, HF2Hv and HF4 are in the Mixed land class.

Table 7.1.6.2.1-1 Mean Amount of Habitat Forms in 25% KDE at SWSA

| | SWSA Study Area | 25% KDE | |
|---|---|---|---|
| Habitat Form | Percent of Acres. | Ave. Percent of 25% KDE. | Range |
| 1 | 7% | 5% | 0-7% |
| 3 | 9 | 5% | 0-16% |
| 2 (excluding 2Hv) | 54% | 44% | 20-63% |
| 2Hv | 27% | 39% | 32-49% |
| 4 | 3% | 5% | 0-17% |
| Total | 100% | 100% | |

This indicates that the amount of large mature dense forest can be quite low, so long as the requisite numbers of den and rest trees are present and there is sufficient dense canopy cover available. Considering the information above, we have chosen a threshold of 150 ac. (30%) of HF4 and an additional 100 ac. (20%) of HF2Hv and HF4 combined as sufficient representative components of a 500-acre fisher territory core. These thresholds provide significantly more dense forest of large trees in the territory core than exists in the any of the five fisher territories analyzed in the SWSA. Thus, our count of Territory Opportunities will be quite conservative and likely will underestimate the numbers of existing territories.

#### 7.1.6.3 Habitat Amount in Fisher Home Ranges

Zielinski et al. (2004b) described habitat in fisher home ranges in western Trinity and eastern Humboldt Counties, CA. In that study area, which was mostly dominated by true fir and Douglas-fir with a low proportion of hardwood types, a mean of over 70% of female home ranges (mean home range about 3,700 acres ( Section 7.1.5.1)) was forested with conifers described as “mid-seral” and “late-seral.” These types were not described as to diameter and canopy cover, but we presume they are roughly analogous to SPI’s Habitat Forms HF2Hv and HF4. Zielinski et al. (2004b) also reported on canopy density classes and tree size classes in fisher home ranges in the southern Sierra Nevada, but did not combine these metrics into habitat classifications. According to the summary by Lofroth et al. (2010, p.91), female fisher home ranges in the southern Sierra Nevada had an average of about 72% of the area in canopy cover of over 60%, but the size distribution of vegetation contributing was not described. These limitations in available descriptions hamper quantification of habitat types that would inform our effort to describe a threshold amount in a fisher home range.

Using Niblett et al. (unpub.) KDE data, SPI analyzed Habitat Forms within the 100% KDE at the SWSA. SPI intersected Niblett et al. unpublished 100% KDE with the SPI stand strata to derive the proportional quantity of Habitat Forms in the 100% KDE. The Habitat Forms present within the SWSA and the non-overlapping acres for the five female fisher 100% KDE (Niblett unpub. data) are shown in Table 7.1.6.3. Note the relatively low proportion of HF4 within the SWSA and 100% KDE.

Table 7.1.6.3-1 Mean Amount of Habitat Forms in 100%KDE at SWSA

| | SWSA Study Area | 100% KDE | |
|---|---|---|---|
| Habitat Form | Percent of Acres. | Ave. Percent of 100% KDE | Range |
| 1 | 7% | 4% | 0-9% |
| 3 | 9 | 7% | 2-13% |
| 2 (excluding 2Hv) | 54% | 46% | 25-62% |
| 2Hv | 27% | 38% | 30-53% |
| 4 | 3% | 5% | 0-17% |
| Total | 100% | 100% | |

#### 7.1.6.3.1 Foraging and Cover

Foraging opportunities are presumed to be vital to core habitat suitability. However, habitat used for foraging by fishers has not been well described in the literature. As stated by Lofroth et al. (2012, p.87), "…the most consistent predictor of fisher occurrence at large scales was moderate to high amounts of contiguous canopy cover rather than any particular forest plant community." Summaries in Lofroth et al. (2010) and Lofroth et al. (2011) consistently indicated that areas with canopy cover greater than 50 percent received higher use by fishers, but differences in methodology and the focus of most studies on resting and denning sites limit our ability to draw conclusions about foraging habitat. In general, we assume that foraging habitat is probably more suitable for use by fishers when high degrees of canopy cover are present.

The problem is stated in Raley et al. (2012 p. 241); "Thus, the lack of strong habitat-association patterns for active fishers may be due to the sampling of multiple behaviors, each of which could be linked to different forest conditions. Alternatively, if fishers are primarily foraging when they are active, the lack of consistent patterns could reflect their diverse diets (e.g., Zielinski et al. 1999, Weir et al. 2005, Aubry and Raley 2006) and varying habitat associations among prey species, or the forest conditions in which fishers are most effective at capturing prey (see Buskirk and Powell 1994). Regardless, more focused investigations are needed to understand the habitat associations of active fishers and the relations between fishers and their prey. Improved sampling methods that enable investigators to better distinguish among active behaviors would benefit such efforts."

As described in Appendices G and I, some important fisher prey species are known to be associated with Mixed land class late mature/dense canopy (HF4) and (HF2Hv). The amount of Mixed land class will decline over the term of the permit. Meanwhile, due to growth, the amount of the remaining Mixed land class that is HF2Hv and HF4 will increase. However, as a result of the continuing cycle of harvest and growth of stands, up to 50% of the area within core hexagons may be in other younger Habitat Forms early in the plan period. The regenerating stands and remaining Mixed land class stands may provide prey species diversity as they progress through early-seral seedling/sapling (Habitat Form 1), small tree/pole sized/medium-dense (Habitat Form 2), and open forest/low-medium (Habitat Form 3).

Habitat components that improve prey diversity and abundance in each Habitat Form include down woody debris and logs, snags, hardwoods, large stumps, and brush species. These components are known to occur in Habitat Form 4 and HF2hv in today's Mixed stands (SPI Forest Inventory, SPI 2013b), and the same diversity of plant species in the Mixed land class is expected to be present in Even stands of those types (James et al. 2012). These elements occur as a result of retention standards, stand growth, and natural recruitment over the decades of stand development, as wind throw, lightning, snow breakage, forest pests, and other factors cause the formation of snags and trees with broken or multiple tops, create brooms, and induce bole decay (Franklin et al. 2002, p. 413). Many of these factors are related to weather and thus are not predictable, so the timing and extent of these disturbances are impossible to model. The role of such disturbances as lethal and sub-lethal agents of damage to trees generates structural complexity and diversifies niches (Franklin et al. 2002, p. 414).

The amount and rate of development of vegetation in the early stages of regenerating clearcuts is variable and depends on plantation management techniques and site quality. The openings and young forests will provide habitat for a diversity of small mammals, passerines, and ungulates. However, for simplicity, newly planted stands less than 10yr of age will be considered non-habitat for fishers. After 10 years, a clearcut will be considered potential habitat for prey species because it will have been fully regenerated with conifer trees and will have ≥50% canopy closure at a height of two feet above ground (Murphy 2008, unpublished, Appendix R), a diversity of other plants would have re-populated the area (James et al. 2012) and small mammals will be present at varying density depending on adjacency of watercourses, older forest, and retained down wood (Gray 2014).

The relatively broad spectrum of prey consumed by fishers includes but is not limited to grey squirrel, brush rabbit, wood rat, mice, ground squirrel, chipmunk, reptiles, carrion, insects, bird young, and bird eggs (Zielinski 1999, pp. 966-967; Campbell 2004 p. 101). The variability in prey resources exploited by fisher is presumed to mean that a broad variation in habitat can be considered suitable for prey production and available for fisher foraging. Because of the variation in fisher food resources and the lack of published quantitative data regarding prey production in various vegetation types, we are unable to predict the amount of prey available for fishers presently or in the future. Thus we have established no threshold for foraging habitat in our standards for Territory Opportunities, except for the thresholds provided for Habitat Forms 4 and 2Hv. We presume that the diversity of timber types provided in both Mixed and Even stands will provide sufficient prey for fishers at densities comparable to those currently observed in forests of the species' existing range.

#### 7.1.6.4 Summary: Territory Opportunity Components

It is infeasible to produce counts of actual territories or individual animals present on the Enrolled Lands. We will use **Territory Opportunity** as the metric for describing the estimated proportional contribution of habitat containing elements to provide present and future female fisher territories. A Territory Opportunity consists of 2,000 acres in the form of four contiguous 500-acre hexagons that satisfy several requirements in terms of habitat types and amounts.

To be counted as a Territory Opportunity, the four contiguous hexagons must include at least one Territory Core, which is a 500-acre hexagon containing a CCS and at least 30% HF4 and an additional 20% HF2Hv or HF4.

The prerequisite CCS has at least 30 ac. of contiguous HF4 that is also contiguous to at least an additional 20 ac. of HF2Hv, for a total of 50 ac. or more.

The remaining three contiguous Support Cores that complete the Territory Opportunity are 500-acre hexagons that might not have a CCS, but each have at least a total of 50% HF4 and/or HF2Hv combined.

Foraging habitat will not be quantified and is not specified as a component of Territory Opportunities, but is expected to be present in all Habitat Forms in Mixed stands and in future Even stands, once regenerating stands are established.

These minimum thresholds are the points at which a forest stands begin to be considered contributing to fisher habitat and/or the minimum configuration on the landscape where combinations of stands begin to function as fisher habitat. However, if the establishment of minimum thresholds is perceived as the intended goal or maximum of such habitat SPI intends to provide, this perception is incorrect. At the stand scale, the habitat threshold is the first point in a stand's life when it can be considered suitable habitat and be counted as such when evaluating the hexagon classification in which it resides. At the hexagon scale, the habitat thresholds are the minimum amounts at which there is enough suitable habitat to begin to function as fisher Support or Den Cores.

## 7.2 ANALYZING HABITAT WITHIN HEXAGONS

### 7.2.1 Introduction to the Methods

The hexagon analysis segregates the Enrolled Lands into a seamless layer of 500-acre hexagons. Hexagons in this grid overlay SPI ownership as well as adjacent areas not owned by SPI. To be included in the analysis at least 50 acres of SPI's Capable Land needed to be included within the hexagon. Each hexagon contains stands whose boundaries are delineated using aerial photo interpretation, and assigned to a size and density class based on the SPI forest inventory data. These strata level data provide spatially explicit amounts and juxtaposition of HF2Hv and HF4 existing in all hexagons that meet minimum acreage contribution requirements at the present time. For the projection of growth in the CSCAs, SPI developed a referencing system so that detailed modeled growth projections from a representative 15% sub-sample could be applied to hexagons with similar environmental conditions throughout the ownership. That provided a process that allows us with reasonable confidence to estimate and display spatially the Territory Opportunity trend over time, for the entire hexagon set. Additionally, SPI is continuing the spatial modeling across its land base, and will substantially complete that over the next 5 years. The analytical method is described in more detail in Sec 7.2.4 and in Appendix O.

### 7.2.2 Hexagon Habitat Contribution Testing Methods

Each modeled or referenced hexagon has been categorized by the values from data gathered on SPI lands within that hexagon, which provides a fisher hexagon classification. In some cases SPI owns the entire hexagon. In other cases SPI owns only a portion of the hexagon. For a hexagon to be included in the analyzed set, SPI must own at least 50 acres of Capable Land. Since the minimum criteria for 2nd order selection is a 50-acre Contiguous Core Stand, if the ownership within the hexagon was not capable of providing a 50-acre den stand at any time in the future, we took it out of the analysis set. Based on the data collected on the portion of SPI ownership within each hexagon, the constituent Habitat Forms and thus its potential contribution to a territory are assigned. The SPI ownership within modeled and referenced individual hexagons has been tested for three conditions that will distinguish them for their fisher hexagon status (i.e. Territory Core, Support Core, or Currently Below Threshold (CBT)). The three variables tested are:

a) At least 30% HF4
b) At least 50% HF4 and/or HF2Hv
c) At least one contiguous 30 ac. stand of HF4, which is also contiguous to at least an additional 20 ac. of HF2Hv, for a total of 50 ac.

Testing using logic expressions that return Yes (Y) or No (N), results in 8 potential outcomes for tests a), b), and c): YYY; YYN; NYY; NNN; NNY; YNN; NYN; YNY.

Hexagons that return YYY for the variables a), b), and c) are considered a Territory Core. Territory Cores have a value score of five. Hexagons that return YYN, NYY, or NYN are considered a Support Core. Support Cores have a value score of one. Hexagons that return YNY, YNN, NNY, or NNN do not meet the Support or Core habitat thresholds, and even though they likely provide foraging habitat, are considered Currently Below Threshold (CBT) for the purposes of Territory Opportunity accounting. Currently Below Threshold hexagons receive a value score of zero. While these hexagons are classified as Currently Below Threshold, this is often because these hexagons do not meet one of the minimum thresholds to qualify as a Territory Core or Support Core. However, they are generally forested areas that are close to the habitat thresholds of HF2Hv and HF4 and contribute some degree of habitat (See Figure 7.2.7-2). Assigning values to individual hexagons and Territory Opportunities is discussed in section 7.2.5.

### 7.2.3 Habitat Contribution Assumptions

The SPI ownership pattern in the Enrolled Lands is generally discontiguous, with large areas of "checker board" ownership or irregular parcel configurations. Fishers are wide ranging and have a relatively large home range. Therefore, a habitat evaluation must evaluate the landscape in aggregate, at a scale important to fisher survival.

This CCAA uses 2,000 non-overlapping acres, representing the scale of female home ranges, as the primary scale to aggregate habitat and assess potential harm by habitat modification. In order to aggregate habitat at the 2,000-acre scale, where the Enrolled Lands are discontiguous or in irregular parcel configurations, the intervening ownerships need to be accounted for. Accounting for the habitat condition on other ownerships will allow for reasonable estimations of the presence of suitable habitat in aggregate (2,000 acres), and therefore will allow for a reasonable estimation of the available habitat available from SPI's management decisions and of harvest impacts to habitat (harm) at a scale meaningful to fisher.

The random distribution of hexagons across the Enrolled Lands provides a matrix to assess and aggregate the available habitat for fisher at the female territory scale. SPI's inventory data is easily evaluated at this scale. The available data on adjoining properties is sufficient to assess the current habitat condition in a general sense, but cannot be used to project its future condition on those lands.

Because the adjoining property needs to be included in the analysis to aggregate habitat at a meaningful scale for fisher (i.e., the female territory scale) and because SPI must not rely on the other ownerships for providing benefit towards our accounting of fisher habitat, SPI designed its hexagon analysis accordingly.

To accomplish those goals, SPI used two primary assumptions that make the habitat accounting a conservative estimate of the current and future habitat conditions. The first assumption is that the other ownership within each hexagon has an equal or better habitat condition as that found on the portion of the hexagon owned and controlled by SPI. The second

assumption is that the neighboring owner will harvest their property at an equal intensity and rate as SPI.

The first assumption is predicated on two observations. First, the other ownerships within a given hexagon are close enough to have similar environmental conditions such as precipitation, slope, soils, and vegetation type (Mixed Conifer, Sierran Mixed Conifer, Montane Conifer Hardwood, etc.). Second, the primary adjacent landowner, the US Forest Service, has not managed their property as intensively as SPI in the past 20 years, so their mature forest habitats are probably as good as or better than those on SPI within each corresponding hexagon. We evaluated those assumptions as discussed below.

To check the first assumption, the habitat conditions on other ownerships in the Occupied Range were estimated using remotely-sensed data from the CALVEG system (2014). These data do not contain the same detail provided by SPI's forest inventory plot system, and therefore cannot be used to project its future condition; however they do provide the ability to characterize the vegetation in its current condition. The CALVEG data also reports habitat classes, which other remotely sensed data such as Land Fire (2013) and GNN (2012) currently do not. Land Fire and GNN currently can provide estimates of the density of vegetation species occurrence at a site, but those multiple and independent vegetation values have not been synthesized into habitat classifications. The habitat classes reported from CALVEG are the California Wildlife Habitat Relationship (WHR) habitat classes. Using the CALVEG WHR data (2014), SPI assessed all of the other ownerships in each hexagon in the occupied portion of the Enrolled Lands to evaluate the relative accuracy of projecting the SPI forest inventory onto the adjoining property (Other Owner).

The accuracy assessment involved a GIS process that "clipped" theCALVEG WHR habitat classification by the hexagon layer and the SPI ownership layer. TheCALVEG WHR habitat classes were then converted to the appropriate Habitat Form (Cal Veg Habitat Forms) using the associations found in Table 7.2.3-1 below. The Other Owner Habitat Forms on portions of hexagons that are not SPI could then be quantified in acres.

Next, the Other Owner Habitat Form acres were combined with the SPI Habitat Form acres for each hexagon. We called this result the combined ownership habitat values. The combined ownership habitat values were tested against our hexagon classification criteria (see Section 7.2.2) to determine the hexagon's overall fisher hexagon classification (i.e., Currently Below Threshold, Support Core, Den Core). Then the combined ownership fisher hexagon classification (CHC) was compared to the original fisher hexagon classification (OHC) based only on SPI only lands, to determine if the resulting estimate represented an decrease, equal, or increase in the fisher hexagon classification. For example, if the CHC resulted in a Support Core designation, and the OHC resulted in Currently Below Threshold, the test result would be considered an increase in the habitat classification and the OHC would be considered a more conservative classification. If the CHC resulted in a Currently Below Threshold designation and the OHC was Support Core, the OHC classification would be considered a decrease in the habitat classification and the OHC would be considered a less conservative classification.

Overall, the comparison of the CHC to the OHC showed that 95% of the time, the OHC was neutral or more conservative. In other words the CHC was equal or higher than the OHC. This means that using only the data available on the SPI portion of a hexagon to classify the whole hexagon's fisher habitat value, the outcome is a more conservative approach than using other "best available" data for other ownerships in combination with the SPI data. This testing of other "best available" data demonstrates that using only SPI data to classify the fisher habitat in each hexagon is accurate, conservative, and therefore appropriate.

Table 7.2.3-1: SPI Habitat Form association with CAL_Veg CWHR classes.

| CWHR class | Habitat Form 1 | 3 | 2L | 2H | 4 | CWHR class | Habitat Form 1 | 3 | 2L | 2H | 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| _D | x | | | | | 2S | x | | | | |
| _M | x | | | | | 3D | | | x | | |
| _X | x | | | | | 3M | | | x | | |
| 0D | x | | | | | 3P | | x | | | |
| 0P | x | | | | | 3S | | x | | | |
| 0S | x | | | | | 3X | | x | | | |
| 1_ | x | | | | | 4D | | | | | x |
| 1D | x | | | | | 4M | | | | x | |
| 1M | x | | | | | 4P | | x | | | |
| 1P | x | | | | | 4S | | x | | | |
| 1S | x | | | | | 5D | | | | | x |
| 1X | x | | | | | 5M | | | | x | |
| 2D | x | | | | | 5P | | x | | | |
| 2M | x | | | | | 5S | | x | | | |
| 2P | x | | | | | 6M | | | | | x |

We then evaluated our assumption that the adjoining property will be managed at an intensity less than or equal to SPI. We asked specialists at the Bureau of Land Management (BLM) Redding District, and the Shasta-Trinity National Forest (STNF) Supervisor's Office about their future management activities planned in the occupied range of the fisher.

The BLM has designated the fisher as sensitive species, and with the listing decision pending, the BLM seeks and secures technical assistance for fisher from the FWS to achieve a standard of "not likely to adversely affect" (Gary. Diridoni, Fisheries and Wildlife Biologist; pers. comm.). BLM's future vegetation management practices will mostly involve improving forest health. The recent pace of 100 – 300 acres of timber harvesting occurring currently will likely continue into the future (Jeffrey Bellaire, Forester, pers comm.). Mr. Bellaire stated that the acreage of timber harvesting includes pre-commercial thinning and individual tree selection thinning.

The USFS also has designated the fisher as a sensitive species, and with the listing decision pending, attempts to achieve a standard of "not likely to adversely affect" (K. Wolcott, Wildlife Biologist; pers. comm.). The STNF (which manages about 2.2 million acres) annually treats approximately 5-6,000 acres with fuels treatments and 4,000 acres with timber sale or stewardship contacts, and expects a similar amount of treatments in the near future (G. Staudacher, Silviculturist, pers. comm). Fuels treatments include using prescribed fire alone or in conjunction with treating the understory vegetation to modify the potential fire intensity, with the objective of retaining the overstory trees and large down logs. Timber sale or stewardship contacts are almost exclusively thinning prescriptions, which focus on removing ladder fuels (suppressed and intermediate crowns) and thinning of co-dominant trees to increase forest health and resilience. The canopy cover after treatments varies with site conditions and habitat type. In areas designated as late successional, habitat treatments leave forested canopies as high as 50-70%.

Figure 7.2.3-1: Annual Timber Harvest Volume Public and Private (Bonham 2015)

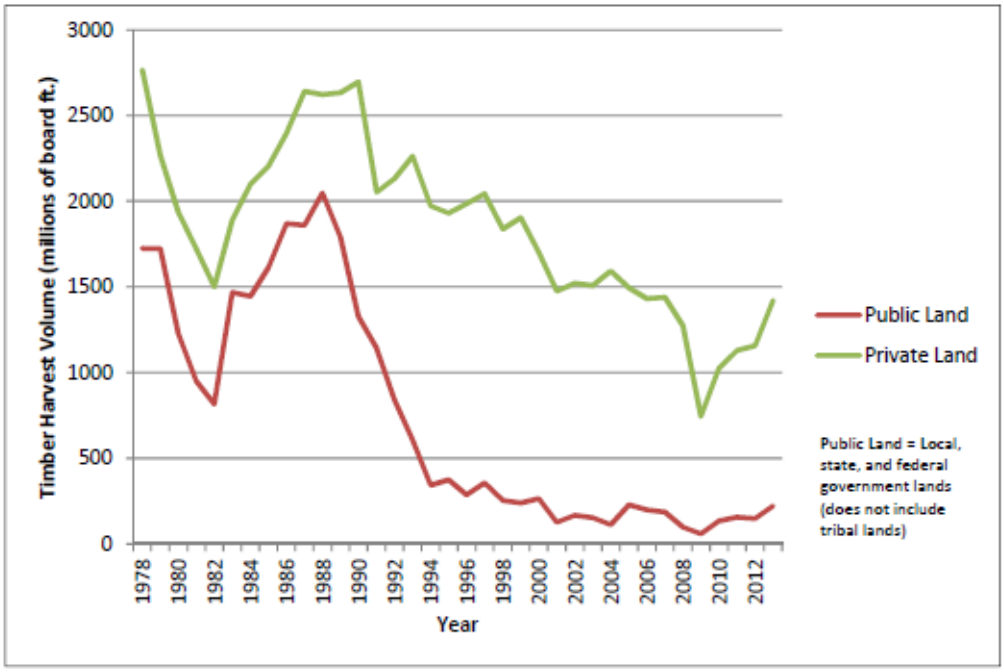
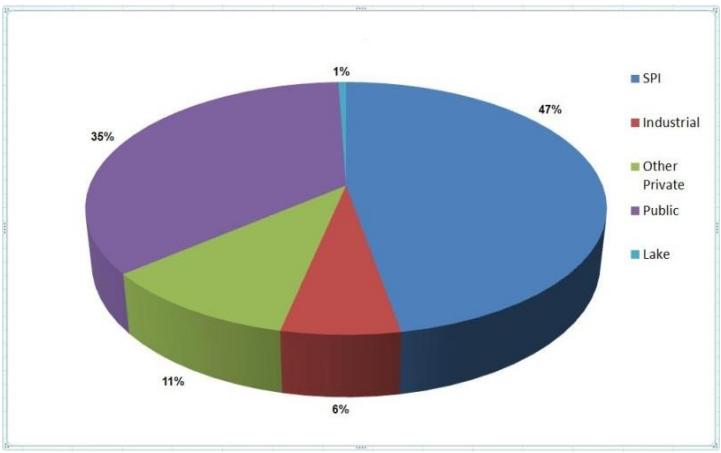



Figure 15. Volume of timber harvested on public and private lands in California (1978-2013) (California Timber Harvest Statistics n.d.).

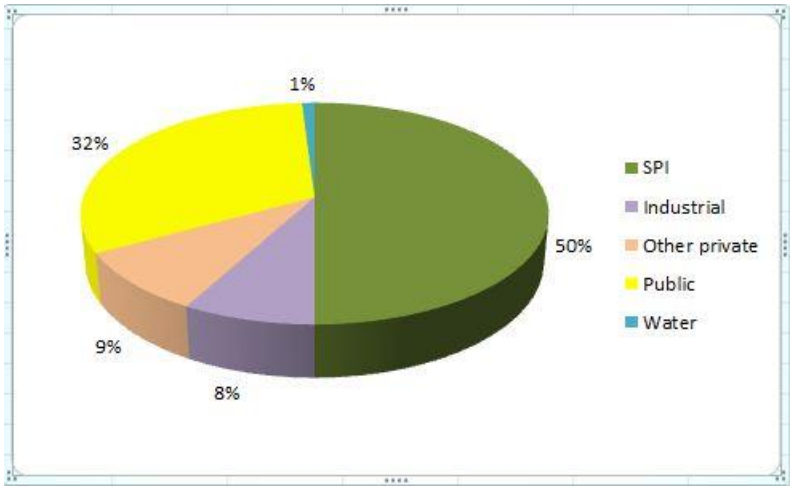
SPI owns approximately 6.4% of the area within the occupied range in northern California, while Federal forests comprise 52% of the total area. However, the proportional SPI forest ownership is higher within the qualifying hexagons. The Federal forest ownership is the next most commonly occurring contributor in qualifying hexagons other than SPI. The following figures show the proportional ownership found within the qualifying hexagons (which must contain ≥50 ac. of SPI Capable Land), analyzed in the Occupied and unoccupied range (Figure 7.2.3-2 and Figure 7.2.3-3). The spatial distribution of ownerships adjoining SPI is shown in Figure 7.2.3-4.

Figure 7.2.3-2: Percentage of Ownership within qualifying hexagons in Occupied and unoccupied range combined



SPI lands are also bordered by other private timberlands. These include both industrial and small timberland owners. Other industrial owners would be expected to employ all silvicultural prescriptions including clear-cutting, as part of their overall forest management plan. Therefore, harvesting timber on other industrial timberlands is anticipated to have an equal impact on fisher habitat as those practices conducted on SPI.

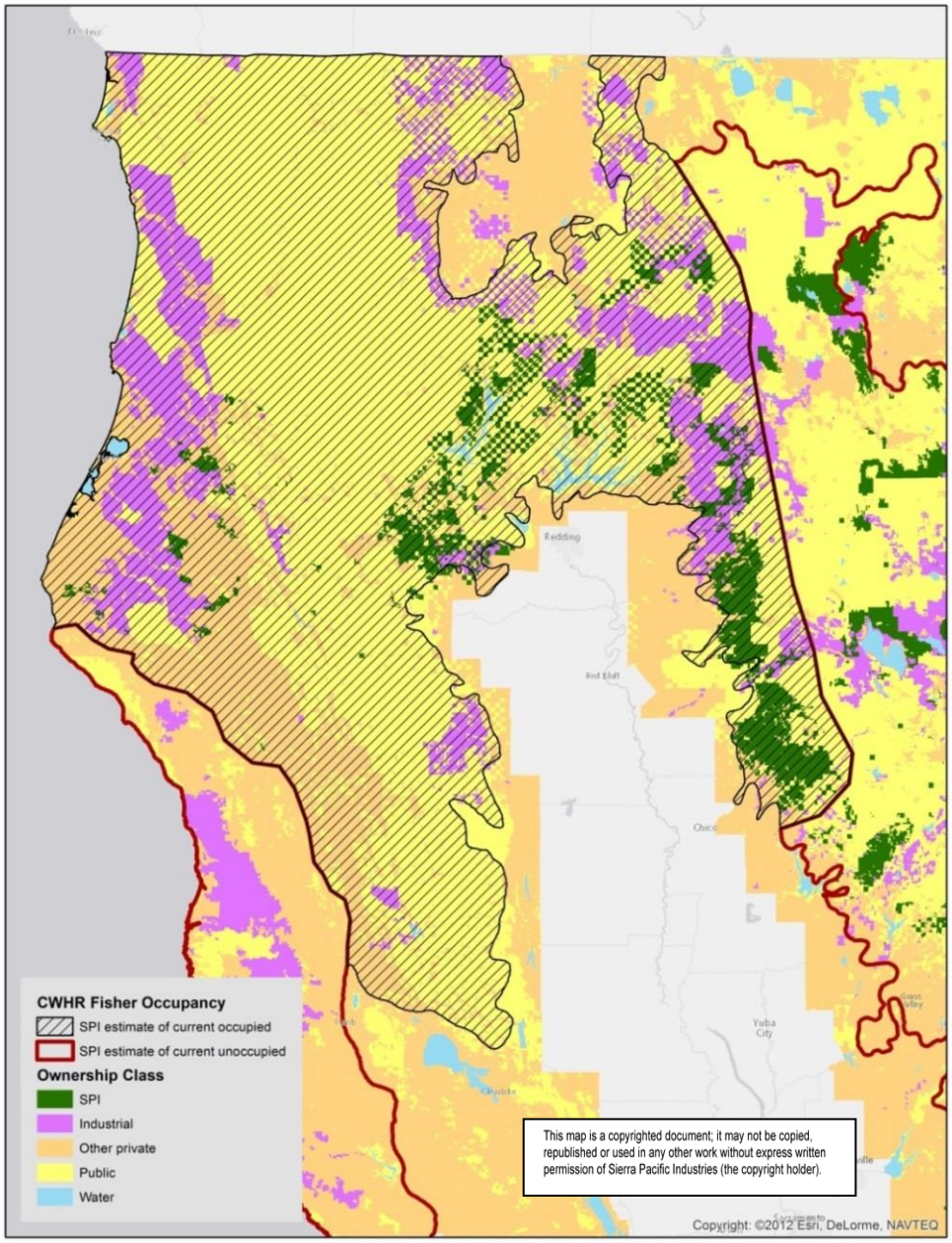
Figure 7.2.3-3: Percentage of Ownership within qualifying hexagons in the Occupied Range




Harvesting timber on other non-industrial private timberlands consists mainly of individual tree selection harvesting. Selection harvesting avoids the capital expense of tree planting required in clearcut harvesting. Due to the basal area stocking requirements of the CFPRs, selection harvesting requires that continuous forest cover be maintained. Removal of any non-merchantable biomass (down logs or hardwoods) is limited because it is rarely feasible to remove it economically; therefore the hardwood component is left relatively unchanged and the heterogeneity of the understory vegetation remains generally intact. Therefore, we expect that harvesting on non-industrial private ownerships is and will be less intensive than the harvesting occurring on SPI parcels.

Thus, considering that harvesting occurring on the neighboring properties will be equal to or less intensive than that planned on SPI property, it is appropriate to use the planned harvest intensity on SPI to estimate the habitat impacts on those other properties.

Figure 7.2.3-4: Ownerships adjoining SPI lands within the occupied range of fishers in northwestern California.




As stated earlier, the hexagon classification using only SPI data provides accurate habitat classification 95% of the time when comparing it to an evaluation that combines SPI data and remotely sensed CALVEG data from other ownerships. The harvesting on SPI is equivalent to or more impactful than the habitat impacts caused by the neighbors' harvesting activity. Therefore a method of analysis that uses 1) only SPI forest inventory data to characterize the habitat in the whole hexagon, and 2) planned SPI harvesting to account for habitat impacts, is appropriate for estimating the current hexagon habitat condition and its trend over time.

The total number of Territory Opportunities will be calculated in whole numbers and will be representative of the number of Territory Opportunities that SPI directly supports through its proportional contribution within each qualifying hexagon. This accounting method recognizes that

the habitat condition on the adjoining property is not under the control of SPI, but the analysis accounts for adjoining property by conservatively estimating the likely habitat condition on those properties in a manner that accounts for the "worst case" scenario that involves both the federal lands and other private owners.

This method of quantifying benefit is not intended to estimate the number of female fisher that are or will be present, but instead will demonstrate the change in habitat contribution by SPI at the beginning and completion of the permit period quantitatively and at spatially relevant scales.

#### 7.2.4 Modeling Future Hexagon Conditions

As discussed in section 6.4, SPI has invested in detailed ground-based inventory point plot methodology at an approximate resolution of one sample plot point every 4 ac. of SPI ownership, laid out on a 4-chain by 10-chain grid. The level of detail provided by this measured inventory of point plots allows very precise estimation of stand parameters, and as discussed in Section7.2.3, a good estimate of the other ownerships in each hexagon. This detailed data provides the necessary information to use computer-based growth and yield models to project harvest and growth with high reliability into the future. This data and GIS technology was used by SPI to develop its 100-year plan used to demonstrate long-term sustainability under the California sustained yield regulations. The accuracy of these inventory techniques and growth projections were reviewed and validated by CAL FIRE in its approval process of the SPI Option A sustained yield document. This original effort was non-spatial, and therefore had limited value for examination of distribution and location-specific estimation of territory opportunities for wildlife.

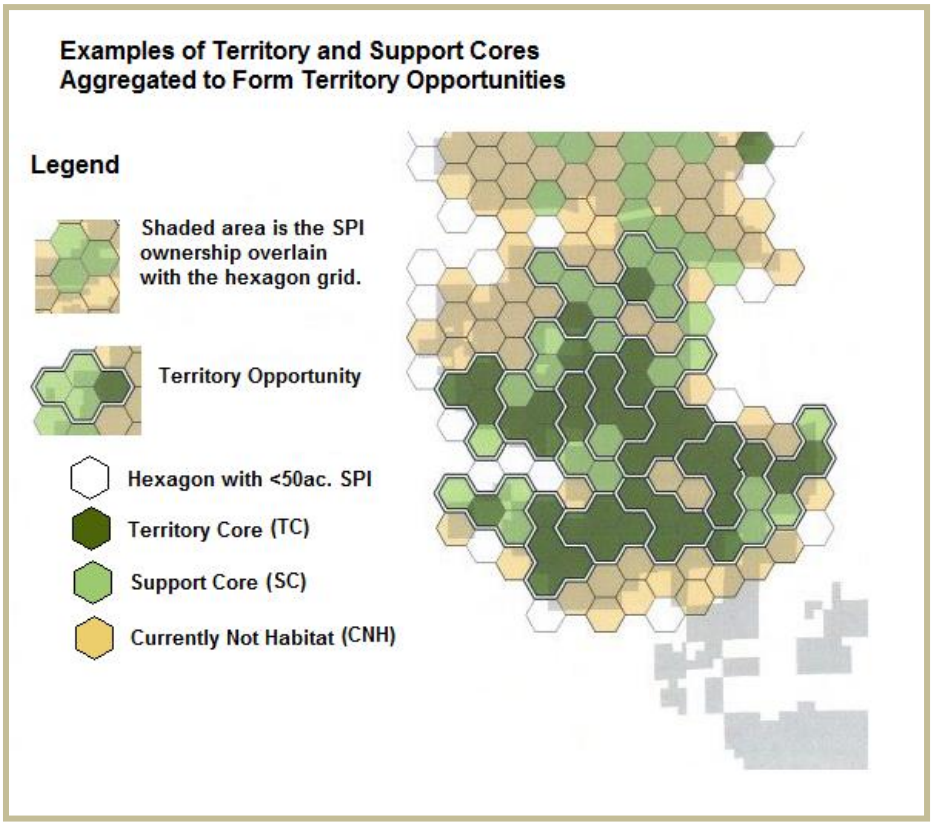
Since that original planning effort, SPI has begun a more detailed spatial application of these GIS tools, both for wildlife habitat analysis and for development of carbon sequestration estimation for the carbon offset market. The individual carbon sequestration projects are referred to by SPI as Carbon Assessment Areas (CAA). The CAAs are evaluated by the California Air Resources Board (CARB) for accuracy and compliance with the Cap-and-Trade Regulation (Title 17, California Code of Regulations, §95800 – 96022). To date SPI has completed seven CAAs including spatially specific level of future projections of harvest, growth and habitat changes over time on 241,783 acres.

Following similar efforts from Raphael et al. (1998, p. 68) for NSO's in the 1990s, who used hexagonal analysis systems to model NSO populations over time, we have developed a hexagon analysis methodology to analyze habitat conditions at various scales overtime. The continuous network of hexagons was overlaid across the Enrolled Lands from a random starting location south and west of SPI's land base in California. The SPI ownership intersected 6,651 hexagons in the hexagon network. Of those, 1,481 had less than 50 ac. of SPI land (totaling 26,753 ac., or 1.8% of the ownership, excluding the eastside CSCAs) within their perimeter, and therefore were not included in any further analysis. The 50-ac. minimum contribution of Capable Land to a hexagon by SPI was established because this is the minimum size of a den stand, which is the smallest piece of strata contributing to a fisher Territory Opportunity. The remaining 5,170 hexagons (1,432,136 ac.) that met the ownership criteria included 802 hexagons (241,783 acres) which had detailed spatial future modeling completed. Using a detailed specific referencing system we were able to use a performance index to reference "adopt" each of the other 4,368 hexagons to one of these 802 hexagons, which do have extensive spatially related inventory data. A detailed description of this methodology is available in Appendix O. The analysis provided a process that allows us with reasonable confidence to estimate and display spatially the change in the entire hexagon set (5170 hexagons) over the term of the permit and the next 30 years beyond that initial 10 years. Additionally, SPI is continuing the spatial future modeling across its land base and will have substantially completed that over the next 5 years.

### 7.2.5 Identifying Territory Opportunities

As stated in Section 7.1.6.4, a suitable Territory Opportunity for female fishers will be composed of at least one Territory Core and three more adjacent Territory or Support Cores that together make up 2,000 acres. The hexagon value (5, 1, or 0) are inferred based on the stand inventory data (starting condition) on SPI land and the referencing process associated with the hexagon modeling analysis. To count a fisher Territory Opportunity, one Territory Core will need to be adjacent to at least 3 Support or Territory Cores. Adjacency is satisfied when a Support Core is touching the Territory Core or if it is touching another Support Core that is directly touching a Territory Core. Whether in a line or clustered, our adjacency rule requires that a linear distribution of support core hexagons is limited to a maximum length of two, if an additional Territory Core is not present. A representative sample of how hexagons may be aggregated to form Territory Opportunities is shown in Figure 7.2.5-1.

Figure 7.2.5-1




As used by SPI, a Territory Opportunity for fisher (Territory Core + 3 Support Cores) may take on a branched appearance due to the distribution of suitable hexagons. Niblett et al. (unpub. data) reported female fisher at the SWSA had both branched and more circular shaped territories. However, when identifying potential Territory Opportunities the most compact configuration of hexagons has been utilized, while maximizing the Territory Opportunity count.

The hexagon quality score for a Territory Core, Support Core and Currently Below Threshold is five, one and zero respectively. The hexagon quality scores are used to determine the Territory Opportunity quality ranking (Q score). The Q score can be 8, 12, 16, or 20 depending on the number

of Territory Cores that contribute to the Territory Opportunity. Because Territory Cores have a higher habitat threshold for average stand diameter (QMD), canopy, and large trees, these hexagons may be considered better habitat than those with a lower score. The relative abundance and distribution of this higher quality habitat, in amounts and juxtaposition favorable for a female fisher therefore, can be expressed in the Q score of Territory Opportunities in each CSCA (Appendix A).

Using the complete set of modeled hexagons described in section 7.2.4, which classified all the hexagons as Territory Core, Support Core, or Currently Below Threshold and the rules for aggregating hexagons into Territory Opportunities described above, the Enrolled Lands were allocated into Territory Opportunities for the analysis period. The objective for this exercise was to aggregate as many qualifying hexagons as possible into Territory Opportunities at the beginning of each decade of the analysis period. After the Territory Opportunities were identified in each decade, harm accounting (Section 7.2.6) could occur by modeling the anticipated harvest effects on the individual hexagon score (5, 1, 0) and the overall Territory Opportunity Q score.

#### 7.2.5.1 Identifying Barriers to a Territory Opportunity

The Enrolled lands have natural and man-made features that could potentially be barriers to the establishment of a Territory Opportunity. The Occupied CSCAs were evaluated for barriers that could negatively affect the ability of a female fisher to use a Territory Opportunity that spanned such an obstruction. The barriers that were reviewed were highways, rivers, lakes, and towns. The highway identified as a barrier was Interstate 5, due to its 4-lane width and median barrier. Highway 299 was considered a barrier where it was associated with either the Trinity River or large cuts/fills that permanently removed large portions of habitat within the subject hexagons. The Pit River was identified as a barrier where it formed portions of hydroelectric impoundments. There were 7 hexagons considered barriers to use along Trinity Lake. All of the identified barriers occur in the Bully Choop, Trinity Mountain and Redding South CSCAs. The hexagons affected by these natural and man-made features were designated barriers and excluded from contributing to a Territory Opportunity.

### 7.2.6 Modeled Harm Accounting

Continued harvesting in fisher habitat has the potential to result in “harm” as defined in the ESA and regulations (see CCAA Section 9 below). Therefore, we must develop criteria for estimation of harm. In this CCAA the existing Territory Opportunities will be used to quantify the amount of harm that occurs as the result of timber harvesting in fisher habitat.

A Territory Opportunity is a set of 4 hexagons that meet the requisite quality class and spatial positioning rules to be considered a Territory Opportunity. While the identification of Territory Opportunities in Section 7.2.5 required maximizing the number of Territory Opportunities, their delineations were arbitrary since numerous different configurations may have been possible while achieving the same number of Territory Opportunities. In order to measure harm consistently the original Territory Opportunity configurations are considered “fixed” for the purposes of harm accounting.

Modeled harm for this CCAA is defined as a negative change in habitat in hexagon(s) that causes a reduction in either habitat quality or spatial arrangement such that an existing Year 0 Territory Opportunity no longer qualifies at the end of the decade. Harm is not considered to have occurred if there is a reduction in habitat quality in hexagon(s) that are not contributing to a Territory Opportunity. This assumes that if there weren’t enough suitable habitats available to form

a Territory Opportunity, then a female fisher would not den there due to a lack of available resources.

At the beginning of a decade (Year y), the model subjects all hexagons to the entire anticipated decades' harvest. Year 0 is the beginning of the permit period, and y + 10 (Year 10) for the beginning of the second decade and end of the permit term). The effect on individual stands is calculated, and then stand growth is modeled ("grown") for 10 years. The resulting stand conditions are then evaluated and reclassified to produce the year y +10 hexagon values (5, 1, or 0). The harm accounting process overlays the original Territory Opportunity hexagon configuration at Year 0 onto the subsequent decade's "beginning" hexagon classification (year y + 10 or Year 10). A comparison determines if those same hexagons that formed a Territory Opportunity in Year 0 are capable of forming the same Territory Opportunity following the harvest and growth that occurred during that decade.

Harm accounting for this CCAA relies on the premise that all Territory Opportunities are maximized at each accounting period. This is important because it causes the maximum number of hexagons to be included in a Territory Opportunity and thus the maximum potential for harvest effects on suitable fisher habitat to be evaluated.

The harm analysis identifies two kinds of changes in contributing hexagons that result in the assignment of an instance of harm. The first category of harm pertains to a Territory Core or Support Core, classified in year y, being reduced in habitat quality such that its classification in the subsequent decade (year y+10) is Currently Below Threshold.

The second category of harm pertains to a Territory Core being reduced in habitat quality such that its classification in year y +10 is Support Core. This change in habitat quality may be ameliorated if there is another Territory Core within the Territory Opportunity in Year y and that Territory Core remains in Year y+10.

For the purpose of this exercise, only one instance of harm can be assigned in a given Territory Opportunity within a decade because the modeling only evaluates (harvest and growth) in the Territory Opportunity once a decade. The potential discrepancy between the modeling results and the current vegetation condition and actual effects of a THP will be adjusted through the THP harm accounting described in Section 7.2.10.

The harm accounting tracks and accounts for the overall quality of Territory Opportunities available in year y as compared to those same territory delineations in y+10. This harm accounting is displayed, using patterned symbology, as a stacked column between decades in Appendices B, C, D, and E.

Examples of when harm occurs:

In a Territory Opportunity, if there is a single Territory Core in hexagon 1) and adjacent hexagons 2, 3, and 4 are Support Cores, and hexagon 1 changes to Support and hexagons 2, 3, or 4 become the Territory Core hexagon, "harm" has occurred. This is because the timing of the growth that occurred in hexagons 2, 3, or 4 relative to the timing of the harvest is unknowable at this early stage of the CCAA. This method conservatively accounts for the projected harvesting in a worst case scenario. While this method of harm accounting provides an estimate of the expected level of harm, the actual "real-time" accounting of harm is discussed in Section 7.2.10 below.

In a Territory Opportunity, if there are two Territory Cores (hexagons 1 and 2) and hexagons 3 and 4 are Support Cores, and hexagon 1 changes to Support and hex 2, 3, or 4 remain the same quality, "harm" has NOT occurred. This outcome reflects the persistence of den habitat (Territory Core) through the decade. The reduction of habitat quality within the Territory Opportunity will be reflected by the Territory Opportunity quality score being reduced from Q=12 to Q=8.

### 7.2.7 Hexagon Analysis Results

The hexagon analysis spans 30 years. While the analysis time frame is much longer than the proposed permit term, it was conducted and included in order to demonstrate the longer term trend in Territory Opportunities across all of the Enrolled Lands anticipated by SPI's management decisions. The following management decisions are responsible for the positive trend:

1) Restricting the overall harvest rate (Non-declining yield),

2) Restricting the quantity of regeneration harvesting in the Mixed land class (maintaining the Mixed land class) such that >50% of the existing Mixed land class is retained during the first ten years,

3) Placing regeneration units without prioritization by Site, Volume, Age, (i.e., cut according to what's in the landscape, "the average"),

4) Requiring placement of regeneration units adjacent to a previous decade's regeneration unit. This adjacency rule combined with the slowing rate of regeneration harvest, minimizes the fragmentation of the Mixed land class and stabilizes HF4 and HF2Hv stands in large (~200 acre ) contiguous areas.

The management decisions, in combination, increase the number of Territory Opportunities through the 10 year permit period and beyond, as represented in Figures 7.2.7-1 and 7.2.7-2. As shown in Figure 7.2.7-1, in the Occupied Range, the number of Territory Opportunities is initially 224 and will grow steadily to 257.

Figure 7.2.7-1: Occupied Range - Net Territory Opportunities, and Territories Lost, and Territory Opportunities per 10,000 ac. (TOD) During the Permit Term.

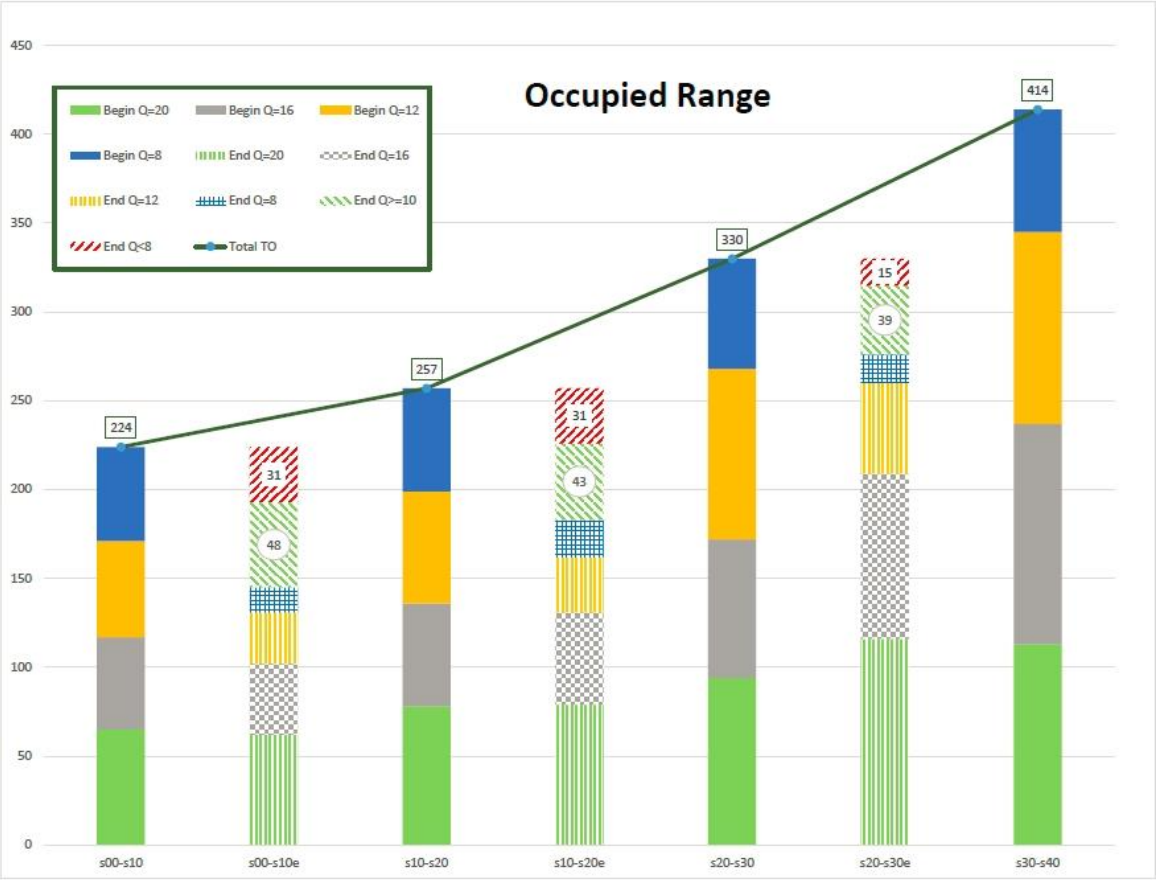


Figure 7.2.7-2 Territory Opportunities trend for the Enrolled Lands

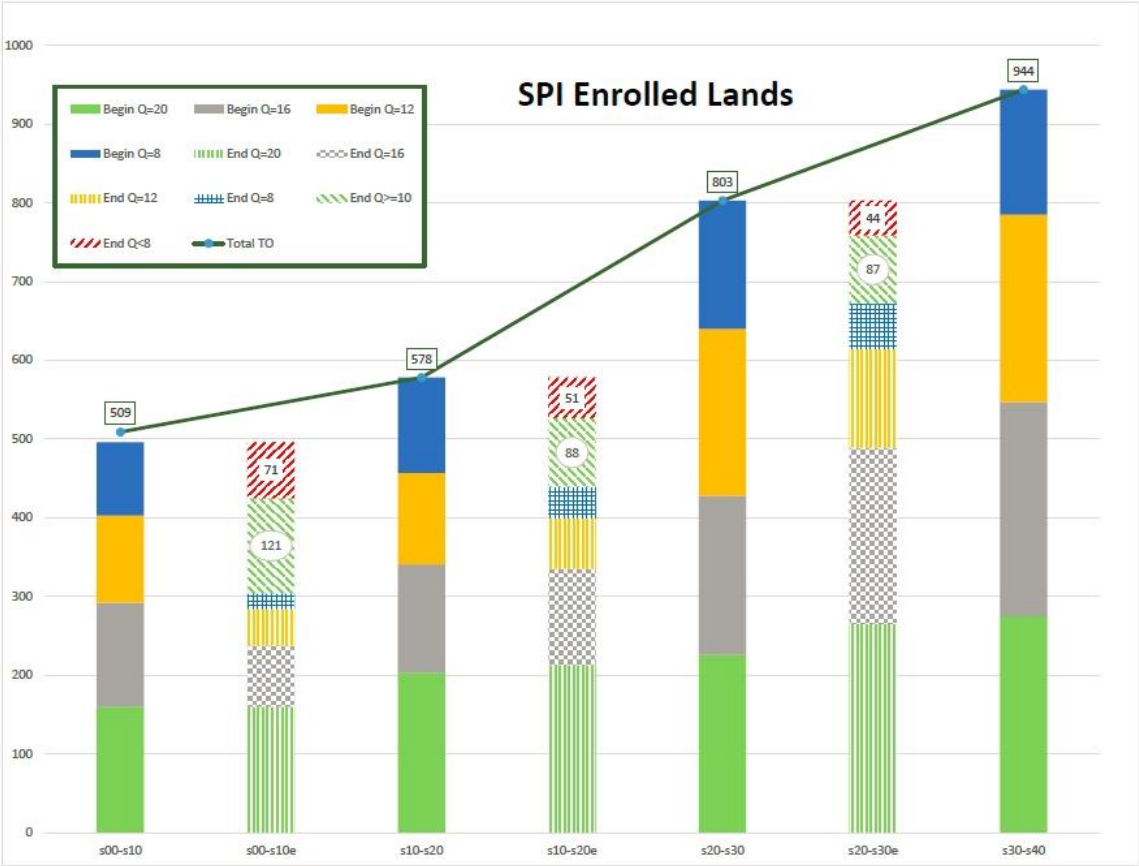



Figure 7.2.7-2 illustrates 514 Territory Opportunities identified at the beginning of the permit term in the Enrolled Lands. The number of total Territory Opportunities increases at an average rate of 26% per decade to 586 Territory Opportunities at the end of the 10 year permit term. Note that in the Occupied Range a loss of a Territory Opportunity was considered harm, whereas in the unoccupied range it was simply recorded as a loss (since there are no fishers there to harm). These trends demonstrate how well the gross quantity of fisher habitat is aggregated in Territory Opportunities.

The hexagon analysis also demonstrated the continued cohesion of den stands in the Mixed land class with the statistic for the average size of the **Contiguous Core Stands** (CCS). A CCS is a contiguous stand ≥50 ac. of at least 30% HF4 and/or containing up to 20% 2Hv, present in a hexagon. In the Occupied CSCAs, the CCS in individual hexagons averages 206 ac. in year zero, and in year 30 the modeled cumulative area of CCS will be quite similar, averaging 200 acres.

The average condition of SPI lands in each hexagon is shown in Table 7.2.7-3, including; amount of SPI ownership and amounts of Habitat Forms HF4, HF2Hv and HF4 and HF2Hv combined. The maintenance of relatively large contiguous areas of den and support habitat, at the scale of a 500-ac. hexagon, means that the number of potential Territory Cores is maintained. This fact is demonstrated by the Territory Opportunity quality scores (Q score) in the Occupied Range remaining steady (see Appendix A).

Table 7.2.7-3 – The Average Acres of SPI Ownership in Each Fisher Hexagon

| All Hexagons | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Den Core Hexagons | | | | | Support Core Hexagons | | | | | Currently Below Threshold | | | | | |
| | (YYY) | | | | | (YYN, NYY, NYN) | | | | | (YNY, YNN, NNY, NNN). | | | | | |
| Year | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Hexagon # Check |
| 0 | 324 | 1476 | 176 | 76 | 76% | 247 | 1414 | 32 | 135 | 72% | 265 | 2280 | 23 | 41 | 23% | 5170 |
| 10 | 317 | 1717 | 182 | 50 | 73% | 245 | 1727 | 32 | 141 | 69% | 270 | 1726 | 34 | 44 | 29% | 5170 |
| 20 | 317 | 2305 | 170 | 60 | 71% | 247 | 1673 | 47 | 137 | 73% | 241 | 1192 | 35 | 39 | 32% | 5170 |
| 30 | 316 | 2721 | 156 | 80 | 74% | 235 | 1642 | 48 | 123 | 74% | 231 | 807 | 43 | 34 | 36% | 5170 |

| Occupied Range Hexagons Only | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Den Core Hexagons | | | | | Support Core Hexagons | | | | | Currently Below Threshold | | | | | |
| | (YYY) | | | | | (YYN, NYY, NYN) | | | | | (YNY, YNN, NNY, NNN). | | | | | |
| Year | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Hexagon # Check |
| 0 | 338 | 606 | 178 | 77 | 77% | 257 | 641 | 38 | 134 | 73% | 272 | 1078 | 25 | 41 | 24% | 2325 |
| 10 | 336 | 718 | 182 | 53 | 71% | 246 | 771 | 33 | 131 | 68% | 278 | 836 | 37 | 40 | 29% | 2325 |
| 20 | 329 | 925 | 172 | 56 | 70% | 261 | 784 | 47 | 137 | 70% | 250 | 616 | 31 | 37 | 31% | 2325 |
| 30 | 319 | 1193 | 153 | 89 | 75% | 249 | 751 | 53 | 123 | 74% | 251 | 381 | 40 | 37 | 36% | 2325 |

| Un-Occupied Range Sierra Cascade Hexagons Only | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Den Core Hexagons | | | | | Support Core Hexagons | | | | | Currently Below Threshold | | | | | |
| | (YYY) | | | | | (YYN, NYY, NYN) | | | | | (YNY, YNN, NNY, NNN). | | | | | |
| Year | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Hexagon # Check |
| 0 | 313 | 840 | 174 | 75 | 75% | 209 | 511 | 35 | 116 | 73% | 221 | 699 | 33 | 29 | 26% | 2050 |
| 10 | 299 | 942 | 181 | 47 | 74% | 204 | 528 | 31 | 126 | 71% | 232 | 580 | 41 | 39 | 31% | 2050 |
| 20 | 300 | 1098 | 168 | 55 | 71% | 186 | 497 | 39 | 107 | 75% | 226 | 455 | 42 | 38 | 33% | 2050 |
| 30 | 305 | 1143 | 157 | 74 | 74% | 196 | 613 | 43 | 104 | 73% | 190 | 294 | 37 | 29 | 35% | 2050 |

| Un-Occupied Range Eastside Hexagons Only | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Den Core Hexagons | | | | | Support Core Hexagons | | | | | Currently Below Threshold | | | | | |
| | (YYY) | | | | | (YYN, NYY, NYN) | | | | | (YNY, YNN, NNY, NNN). | | | | | |
| Year | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | % HF4 & 2Hv combined | Hexagon # Check |
| 0 | 373 | 30 | 200 | 112 | 80% | 297 | 262 | 11 | 174 | 67% | 310 | 503 | 4 | 59 | 19% | 795 |
| 10 | 373 | 57 | 188 | 75 | 71% | 293 | 428 | 32 | 177 | 66% | 318 | 310 | 12 | 63 | 25% | 795 |
| 20 | 348 | 282 | 171 | 92 | 75% | 298 | 392 | 56 | 177 | 75% | 251 | 121 | 31 | 59 | 37% | 795 |
| 30 | 340 | 385 | 163 | 71 | 69% | 284 | 278 | 48 | 166 | 75% | 268 | 132 | 67 | 40 | 38% | 795 |

The overall trend of increasing Territory Opportunities across the Enrolled Lands is due to several factors. First, the increase is due to increasing QMD in today's younger Mixed stands, which will bring them into HF2Hv and HF4. Thus, even while the total amount of Mixed land class decreases due to harvest, the quantity of HF2Hv and HF4 Mixed increases due to growth in the remaining Mixed stands. Over time, a mosaic of relatively large (>50 acre) stands of HF4 and HF2Hv will persist in the Mixed stands as adjacent HF2 and HF2Hv stands grow into the HF4 and HF2Hv categories. These large stands will persist because SPI's even-aged management strategy includes a decrease in the acres regenerated over time, and because our self-imposed constraint places regeneration harvest units adjacent to the previous decade's unit in future decades. The theoretical minimum SPI acreage in hexagons contributing to a Territory Opportunity (200 ac. SPI) never occurs; in fact the average SPI ownership for all individual hexagons is 278 ac. (See Table 7.2.7-3) and the average SPI ownership in Territory Opportunities is 1,275 acres (see Appendix A).

Regarding the available habitat for fisher found in the "remainder" of the hexagon, the Table 7.2.7-3 indicates that the average amount of HF4 and HF2Hv in Territory Core hexagons are 176 acres and 76 acres, respectively. The amount of HF4 and HF2Hv in Territory Support hexagons are 32 acres and 135 acres respectively, and the amount of HF4 and HF2Hv in "Currently Below Threshold" hexagons are 23 acres and 41 acres respectively. The average SPI ownership in Territory Opportunities is 1,318 acres, of which, 551 acres is HF4 (43%) and 339 acres is HF2Hv (27%)(See Appendix A). The vegetation conditions on other ownerships within the hexagon are discussed in Section 7.2.3.

### 7.2.9 Summary: Territory Opportunity Trends

Overall the trend in Territory Opportunities is increasing across all of the Enrolled Lands. The positive trend occurs due to the following management decisions:

1) Restricting the overall harvest rate (Non-declining yield),

2) Restricting the quantity of regeneration harvesting in the Mixed land class (maintaining the Mixed land class) such that >50% of the existing Mixed is retained during the ten-year permit period,

3) Placing regeneration units without prioritization by Site, Volume, Age, (i.e., cut according to what's in the landscape, "the average"),

4) Requiring placement of regeneration units adjacent to a previous decade's regeneration unit. This adjacency rule combined with the a planned decline in the rate of regeneration harvest, minimizes the fragmentation of the Mixed land class and stabilizes HF4 and HF2Hv stands in large (~200 acre contiguous areas)

The proportion of regeneration harvest in the Mixed land class is small (approximately 1.8% per year or 18% total within the term of the permit) compared to the total, and therefore results in only an incremental decreases in the quality of some hexagons, while the remaining hexagons improve in habitat quality. The "harm accounting" column (Figures 7.2.7-1, 7.2.7-2, and Appendix B) is the column between decades that has the patterned symbology, which depicts this residual habitat quality remaining in the "harmed" and "unharmed" Territory Opportunities. The green, left angled stripe ( ) symbology represents the tally of Territory Opportunities with at least two Territory Cores remaining (Q score of 10, 11, or 15), even though the Territory Opportunity was lost. The resultant individual Q score for each Territory Opportunity where harm occurs is summed and depicted as a label on the colored symbology ( )or ( )in Figures 7.2.7-1 and 7.2.7-2. The net increase in Territory Opportunities is the result of management decisions that maintain these residual, high value hexagons, combining with other hexagons whose habitat has improved during that decade, to form new Territory Opportunities added to those Territory Opportunities that persisted without loss of territory status.

### 7.2.10 Annual Harvest Harm Accounting

The modeled future harvest harm accounting provides an initial estimate of the likely harm that will occur as the result of implementing the CCAA during the permit period. While the identification of Territory Opportunities in Section7.2.5 attempted to maximize the number of Territory Opportunities, their delineations were somewhat arbitrary, and other possible configurations might have achieved the same number of Territory Opportunities. However, the original Territory Opportunities delineations are considered fixed for the purposes of harm accounting (also see Section 7.2.6).

Regulations require that the USFWS be notified in advance when take is expected to occur (50 CFR 22(d)(3)(ii). The modeled accounting of potential harm does not provide adequate advance take notification. The actual timing of any harm that may occur will coincide with harvesting of individual timber harvest units. Therefore, in the Occupied Range of the fisher, the impacts of individual timber harvest units implemented during the permit period will be evaluated prior to planned harvesting annually to provide an advance accounting of harm occurrences and a cumulative tally of authorized take.

The annual review of potential harm described in this section will include all Year 0 Territory Opportunities. This review of potential harm occurrences associated with individual harvest units (regeneration and non-regeneration harvest areas) will be conducted in the following manner.

Wherever a proposed harvest unit intersects any portion of the hexagons contributing to a modeled Year 0 Territory Opportunity, SPI will conduct a site-specific analysis of the proposed harvest unit impacts on that Territory Opportunity prior to initiating Timber Operations. This annual harvest unit impact analysis will initially use the spatially explicit Year 0 (2012) stand data to establish a pre-harvest condition and hexagon value. SPI will use the most recent stand inventories if available. The annual proposed harvest units will be intersected with the most current pre-harvest stand data (including growth updates), and the resulting changes in stand condition will be calculated (i.e., subtracting the values of harvested acres from the pre-harvest acres), resulting in a post-harvest stand condition and post-harvest hexagon classification value (i.e. Core, Support, or Currently Below Threshold). The post-harvest hexagon classification values will then be applied to the original Territory Opportunity (using the criteria established in Section 7.2.2) to determine if harm will result from the annual proposed harvest units. Harm is considered to occur when the change in hexagon value causes the Territory Opportunity to no longer qualify, based on the rules established in Section 7.2.5.

Approved THPs are valid for seven years, and, depending on various environmental and business factors, may be operated wholly or partially during that period. Within 30 days after the permit is signed, and on February 28th of each year thereafter, SPI will provide the USFWS a list of all harvest units planned for operations in the current calendar year that intersect a Territory Opportunity and are projected to cause harm (using the criteria established in Section 7.2.6).

Each year the projected harm occurrences will be updated based on actual amount of harvest accomplished. The actual cumulative harm will be compared to the total permitted harm. The updated harm report will be included with the list of current year planned timber harvest units provided to the USFWS by February 28th of each year, commencing after the first year of operations under the permit.

#### 7.2.11 Landscape Evaluation using LEAFs

The Territory Opportunities are aggregations of four 500-acre hexagons, which meet both minimum acreage and habitat thresholds. These minimum acreage and habitat standards might be perceived as insufficient if considered in isolation. Therefore the following landscape scale evaluation is provided.

The successful long-term conservation of fishers is believed to require landscapes that provide habitats at several scales: stand, core, territory, and landscape. Raley (2012, p.26) stated, "Habitat use or selection by fishers was strongest and most consistent at finer spatial scales (third-and fourth-order selection)." The third and fourth order selection scales (i.e., the den/rest stand and den/rest structure (Raley et al. 2012, p. 5) were discussed previously in Section 7.1.6 of this CCAA.

Raley (2012, p. 26-27) stated that "Currently, there is limited information on the factors that may influence the selection of home ranges by fishers (second-order selection)." In this CCAA, we have analyzed habitat at the scale of second order selection in aggregations of suitable amounts of habitat for a reproducing female fisher. As discussed in Section 7.1.5.1 and 7.1.6, these aggregations occur within 2,000-acre areas that form important portions of annual female fisher home ranges and are designated as Territory Opportunities, and used for habitat and harm accounting purposes.

As noted by Lofroth et al. (2011, p.1) "There is no universally appropriate scale for investigating fisher habitat associations because the scale must match the questions being asked." The question at the larger landscape scale for this CCAA is whether the Territory Opportunities are near enough to other suitable fisher habitat that can provide foraging opportunities, dispersal, and genetic interactions between individuals at a larger (population) scale,

and thus influence population performance. For this CCAA, the landscape scale that will incorporate the distribution and connectedness of habitats at a larger landscape scale (first order) is a contiguous 10,000-acre area. The 10,000-acre size is thought to be appropriate because it can contain enough suitable habitat to allow one or more female fishers to reside and reproduce, provide some flexibility in the second order selection of habitat due to its size, and give their offspring the resources to establish their own home range or disperse into adjoining areas.

Our analysis of the first order landscape scale grouped the same hexagons used for evaluating habitat at the second-order scale (Territory Opportunities) into approximately 10,000-acre areas called a "Landscape Evaluation Area-Fisher" (LEAF). Because the Enrolled Lands are discontiguous or have irregular parcel configurations, each LEAF contained lands owned by SPI as well as land owned by others. The LEAF delineations were primarily intended to analyze the habitat composition available on SPI lands, so they focused on hexagons containing SPI ownership. The shape of a LEAF was meant to be compact, but sometimes they were elongated to accomplish connections between LEAFs and maintain a 10,000 acre size. Occasionally hexagons were excluded where they did not contain SPI ownership, even when they occurred in the middle of a LEAF.

The LEAF analysis used remotely-sensed vegetation data for non-SPI lands in combination with the SPI forest inventory plots to evaluate the extent of densely forested Mixed habitats and areas of sparse canopy cover at the 10,000-acre scale. The available remotely-sensed GIS data included CALVEG (2014), GNN (2012), and Landfire (2013). Using several habitat and acreage criteria in combination with the Year 0 Territory Opportunity distribution, the LEAF areas were evaluated for their capacity to provide conservation benefits for fishers. The initial criteria for evaluating LEAFs that might contribute to fisher conservation include the following:

1) The LEAF must be in the currently Occupied Range.
2) The LEAF must have >25% SPI ownership.
3) The LEAF must have at least one Year0 Territory Opportunity
4) The LEAF must have >50% combined HF2, HF2Hv, or HF4 in the Mixed land class, or equivalent vegetation size and density.
5) No more than 20% of the LEAF area may be devoid of vegetative cover.

The LEAF analysis was restricted to the Occupied Range because that is where the most important benefit to fisher can be provided during the term of the permit.

The 25% SPI ownership threshold is meaningful because it represents an area 25% larger than a Territory Opportunity (2,500 ac. versus 2,000 ac.). This amount of ownership is a reasonable threshold because where it is met, SPI's land contribution could support other suitable habitat in the LEAF outside the Territory Opportunity. This also limits consideration of conservation benefit to only those LEAFs in which SPI is a significant owner with respect to the amount of habitat required by fishers.

The quantity of 50% or more of dense forest is important because that habitat characteristic is strongly associated with fisher presence in southwestern Oregon and northern California (Lofroth et al. 2011, p. 42). The available quantities of Mixed HF2, HF2Hv, or HF4 or equivalent vegetation size and density were derived from the SPI forest inventory and a combination of CALVEG, Landfire and GNN. The GNN data estimated tree canopy cover, but provided no data on average stem diameter. Landfire data provided a shrub and tree canopy estimate, grouped into three broad categories.

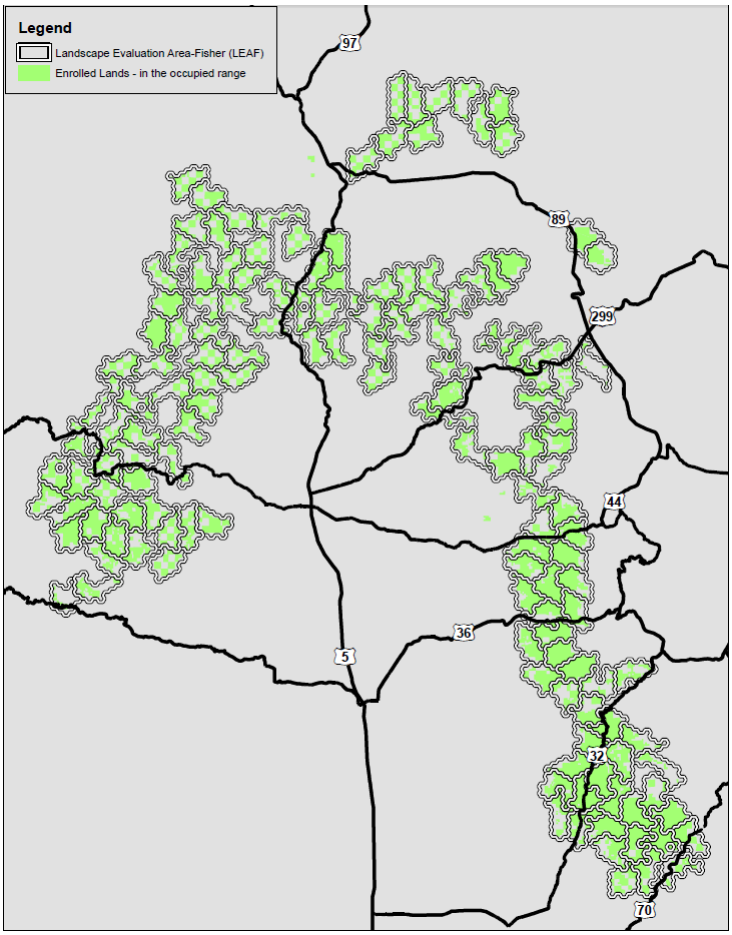
The presence of at least one existing Territory Opportunity is important because it provides enough den and support habitat in close proximity to support a denning female fisher and her offspring.

LEAFs that failed any of the four criteria above are considered Support LEAFs. After dropping Support LEAFs from further analysis, the remaining LEAFs were evaluated further to confirm that those remaining LEAFs provide a conservation benefit. The secondary criteria for confirming LEAFs that contribute to conservation benefit include the following:

1) Quantity of Wildland Urban Interface (WUI)
2) Proximity of Territory Opportunity to other high quality habitat (SPI or other owner)
3) Known fisher presence (FWS data compilation (unpublished data))
4) Presence of hardwoods
5) Presence of Legacy hardwoods (defined in Section 7.3.4.1.3)
6) Ratio of HF4 to HF2Hv
7) Distance between patches of HF4 and HF2Hv

These factors were evaluated by examining the various available remotely-sensed images and data. These other secondary, relative criteria, except quantity of WUI, are considered beneficial to fishers. Naney et al. (2012, p.2) reported that proximity to WUI was a negative factor reducing the suitability of habitat for fishers.

Figure 7.2.11-1: Landscape Evaluation Area-Fisher (LEAF) and Enrolled Lands in the Occupied Range



#### 7.2.11.1 Conservation Benefit LEAFs

Of the 149 LEAFs evaluated, 54 met all of the above criteria (Sec. 7.2.11) and thus are designated Conservation LEAFs. The remaining 95 are designated as Support LEAFs, because they failed one or more of the Conservation LEAF criteria. However, Support LEAFs will provide breeding or dispersal habitat to some degree in association with the Territory Opportunities within them.

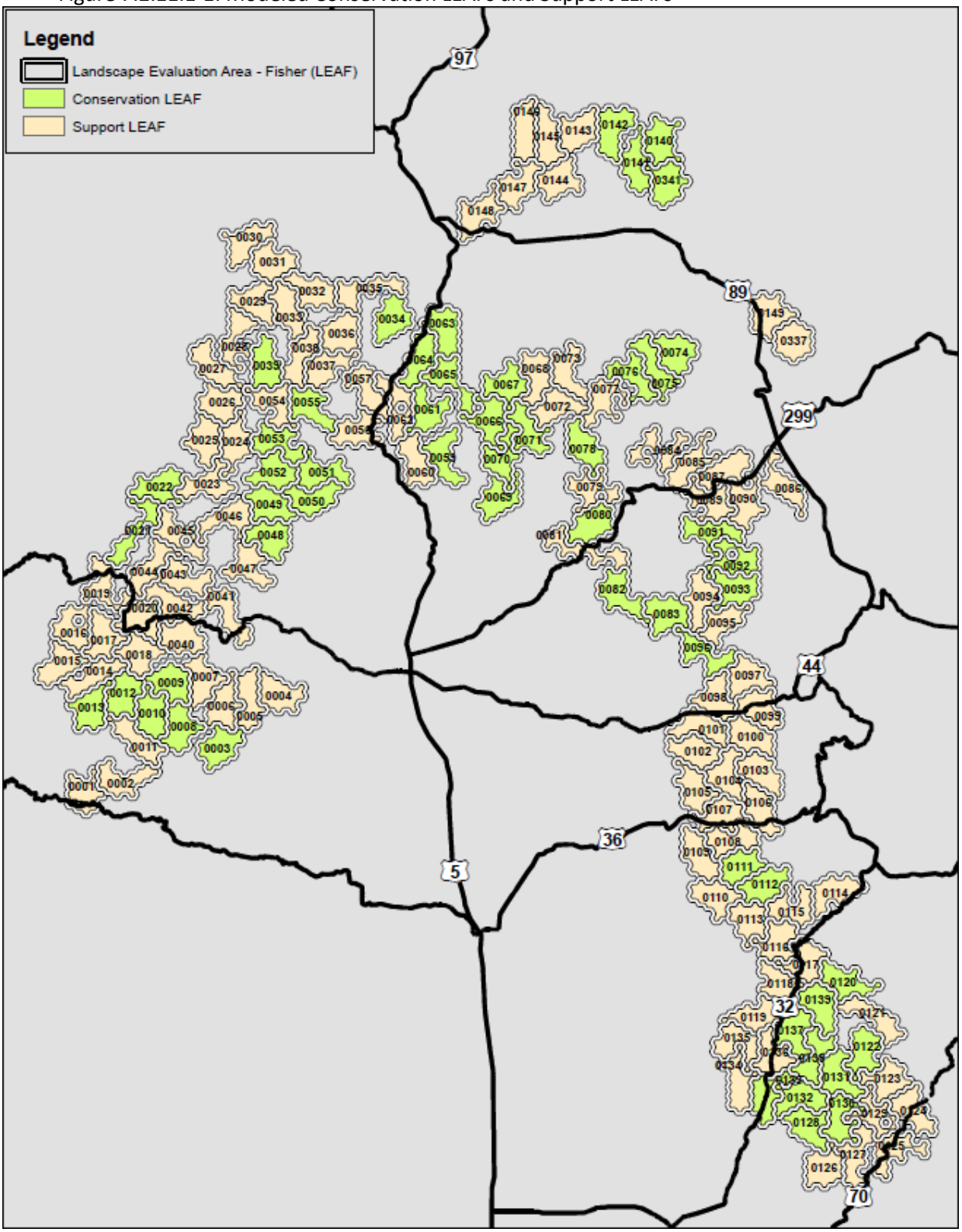
A Conservation LEAF will be designated a Conservation Benefit LEAF if it has any four hexagons that meet the definition of one Territory Opportunity in Year 0 and annually throughout the term of the permit. This standard for designation of a Conservation Benefit LEAF is appropriate because the Territory Opportunity (second order of selection) definition supports a denning fisher, and additional third and fourth order of selection habitat is available at the larger landscape scale (i.e., the 10,000-acre LEAF). Meeting the habitat requirements at these different scales will provide a matrix of widely-distributed habitat with the components to allow a female fisher to reproduce successfully and the young to disperse into adjoining areas, to potentially establish their own home ranges (in other Conservation LEAFs or Support LEAFs), and maintain a stable or growing population.

In combination with other measures in this CCAA, the Conservation Benefit LEAFs provide the means of meeting the CCAA policy standard regarding benefits of conservation measures (USFWS 1999; 64 Fed. Reg. , p.32727).

Based on the Draft Fisher Conservation Strategy (Finley et al. 2011) and guidance from the Service, SPI proposes that the CCAA will provide the necessary conservation benefit by maintaining at least 80% of the original Conservation LEAFs as Conservation Benefit LEAFs. These Conservation Benefit LEAFs will be capable of continuing to support fisher populations throughout the permit period and into the future.

To determine whether the 54 Conservation LEAFs will meet the Conservation Benefit LEAF definition through the permit period, they were evaluated for potential harm, using the projected distribution of timber harvest units. Based on this projected harm analysis, it is estimated that in 43 (80%) of these 54 Conservation LEAFs at least one Territory Opportunity will remain through the end of the permit term (see Figure 7.2.11.1-1), thus providing the necessary conservation benefit to meet the CCAA standard. The continued function of Conservation Benefit LEAFs will be assessed during THP review as noted above in Section 7.2.10 and as further described below.

Figure 7.2.11.1-1: Modeled Conservation LEAFs and Support LEAFs



#### 7.2.11.2 Conservation Benefit LEAF Accounting

As defined above in Section 7.2.11.1, a Conservation LEAF will be designated a Conservation Benefit LEAF if it has any four hexagons that meet the definition of one Territory Opportunity in Year 0 and annually throughout the term of the permit. When a harvest unit is proposed in a Conservation LEAF, a hexagon evaluation will be performed concurrently with the harvest unit(s) harm accounting (Section 7.2.10) to determine whether any four hexagons in the Conservation LEAF continue to meet the definition of a Territory Opportunity. Though take may occur through harvest within a Territory Opportunity, a conservation benefit can still be achieved if another Territory Opportunity can be identified using Year 0 hexagons.

The updated hexagon analysis will indicate whether any hexagon classification (See Section 7.2.2) will be modified to Currently Below Threshold (CBT) by harvesting. Any hexagon that is modified by harvest to CBT during the term of the permit will not qualify as one of the four hexagons contributing to the required Territory Opportunity. If this analysis indicates that a Conservation LEAF maintains a Territory Opportunity, it will remain a potential Conservation Benefit LEAF, pending the analysis of additional future harvest units.

## 7.3 CONSERVATION MEASURES AND STANDARDS

### 7.3.1 Introduction

Conservation measures provide the means for achieving the biological goals and objectives of a CCAA (65 Fed. Reg. p. 35251). These conservation measures will be included in individual Timber Harvest Plans (THPs) or Emergency or Exemption Notification in accordance with the CFPR, and related Covered Activities.

The primary biological objective of this CCAA is to provide sufficient habitat for life history needs of fishers to support populations across an important portion of their existing range, and secondarily, across a significant portion of their historic range in California. To achieve this objective, this CCAA will carry out four basic Conservation Measures.

**Conservation Measure One** maintains 80% of the 54 Conservation LEAFs as Conservation Benefit LEAFs.

**Conservation Measure Two** maintains at least 50% (roughly 700,000 acres) of the Capable Land in the Mixed Land Class for the duration of the permit.

**Conservation Measure Three** establishes provisions for retention of habitat elements for both regeneration harvest and non-regeneration silvicultural practices. These measures provide for the retention and recruitment of desirable elements within and beyond the plan period. These provisions are discussed in sections 7.3.4 and 7.3.4.1 – 7.3.4.4.

**Conservation Measure Four** establishes standards for the rehabilitation of substantially damaged timberlands. These standards are discussed in section 7.3.4.5 and include retaining habitat elements that will increase the habitat quality of these regenerating stands.

A second biological objective is minimizing the potential to kill or disturb a fisher. Two conservation measures address this objective.

**Conservation Measure Five** establishes provisions for identifying, avoiding, and protecting potential fisher den and rest structures during harvest operations in the denning period (thus minimizing the potential for taking through killing or harassing). These measures are discussed in sections 7.3.6.

**Conservation Measure Six** reduces drowning risk related to human facilities. These measures are discussed in section 7.3.7.

A third biological objective is to reduce the potential impact of exposure to hazardous materials or catastrophic fire. Two conservation measures address this objective.

**Conservation Measure Seven** is intended to reduce the potential impact of exposure to materials hazardous to fishers deposited as a result from trespass on the Enrolled lands. These measures are discussed in section 7.3.8.

**Conservation Measure Eight** is intended to reduce the potential impact of catastrophic fire by creating a strategic and systematic network of fuel breaks. These measures are discussed in section 7.3.9.

### 7.3.2 Conservation Measure 1: Maintenance of Conservation LEAFs

Conservation Measure One establishes a commitment to maintain 80% of the Conservation LEAFs as Conservation Benefit LEAFs.

The Conservation LEAFs have been evaluated quantitatively and qualitatively using criteria important to fisher habitat. The annual evaluation of THPs will track Conservation LEAFs to ensure that 80% of the Conservation LEAFs will have at least one Territory Opportunity throughout the permit term. If the number of Conservation LEAFs falls below 80% of the initial value due to factors outside of SPI's control, this would constitute a Changed Circumstance as described in Section 11.1.2.

### 7.3.3 Conservation Measure 2: Maintain at least 50% in the Mixed Land Class

Conservation Measure Two is to maintain at least 50% of the Capable Lands in the Mixed Land Class for the duration of the permit. This goal is not spatially explicit and will be measured at the Enrolled Lands scale. This conservation measure provides a coarse measure of the available fisher habitat on the Enrolled Lands. If the amount of habitat in the Mixed land class falls below 50% of the amount of Capable Lands present at the beginning of the term of the agreement (about 700,000 acres) due to factors outside of SPI's control, this would constitute a Changed Circumstance as described in Section 11.1.1

### 7.3.4 Conservation Measure 3: Management for Habitat Elements

The third Conservation Measure for this CCAA specifies SPI's commitment for the retention and recruitment of Habitat Elements into harvest planning and operations. The retention standards are intended to allow the Mixed land class to continue and the Even land class to develop as prey producing, foraging, and denning habitat. As discussed in SPI (2013c, Appendix I), prey species for fishers rely on snags, down logs, brush, and hardwoods capable of significant mast production. Habitat elements are currently adequately represented in HF4, HF2Hv, and HF2 stands in the Mixed land class. By retaining habitat elements amid the climatic forces and biological processes that are formative to their natural development, the measure ensures that many of these elements persist immediately after harvest or continue to be produced through time. This retention and recruitment of elements will enable the Even land class stands to better function as prey production habitat as they develop through HF1, 2, and 2Hv. As these young stands mature, the elements retained from the previous stands, or that develop naturally through time from stochastic climatic forces and biological processes, will not only provide prey habitat, but also provide den structures within future

stands of HF2Hv and HF4. These future HF2Hv and HF4 habitats are not expected to contribute to the fisher Territory Opportunities during the term of the CCAA, but are likely to do so later in time.

The primary provisions of this Conservation Measure are listed here. Further rationale and discussion of each provision is contained in subsequent sections. Provisions will be provided for regeneration harvest units (even-aged silvicultural prescriptions) and for non-regeneration harvest areas (selection, salvage, and intermediate silvicultural prescriptions).

Road construction and rock pit development will not include the management of habitat elements. Because these activities remove all the vegetation and overburden from a site it is infeasible to retain habitat elements.

A. SPI will retain "**Wildlife Trees**" (defined in section 7.3.4.1.2), where available, at a rate of one per 5 acres, in regeneration units, rehabilitation of understocked timberland areas, substantially damaged timberlands, and non-regeneration harvest. Regardless of harvest type, Wildlife Trees may be unevenly distributed with the objective of leaving an average of 4 per 20 acres. Wildlife Trees will be selected from among the oldest and largest available with a target size of >30 in. dbh for a live conifer and >22 in. dbh for hardwood species. These Wildlife Trees should be selected for their potential to function as a den structure either presently or in the future. Known den trees will be included as Wildlife Trees. If Wildlife Trees of the requisite minimum diameters are unavailable, then the next highest value Wildlife Trees will be selected and may include smaller diameter trees; preference will be given to hardwoods and other trees with wildlife characteristics.

In the rare circumstances where the requisite numbers of Wildlife Trees are not available, Wildlife Trees will not be designated, but retention of existing trees will still occur in Habitat Retention Areas (HRA) (see below).

Wildlife Trees will be preferentially retained within or at the edge of a HRA.

B. SPI will retain **Habitat Retention Areas** (HRA) (defined in section 7.3.4.1.1) at a rate of 2% of each harvest area. In regeneration harvest areas HRAs will occur at a rate of 2% of the regeneration area. The distribution of HRAs in other harvest areas larger than 20 acres will occur at a rate of 2% per each 20 ac. In all harvest areas of greater than 2.5 acres and less than 20 acres HRAs will occur at 2% of the harvest area. No HRAs are required in harvest areas less than 2.5 ac. Acreage of required WLPZs is excluded from both the calculation of the unit area and the 2% retention standard. HRAs will preferentially contain one or more Wildlife Trees, Legacy Trees, and if available, large woody debris that contributes towards fisher habitat. HRAs will consist of representative co-dominant and dominant trees based on tree diameter classes present before harvest. In regeneration and rehabilitation of understocked timberlands or substantially damaged timberlands the HRAs will remain un-entered through the end of the designated rotation. In non-regeneration harvest areas the HRAs will remain un-entered until the next harvest entry, at which time they will be retained or re-designated. HRAs will not be entered for salvage harvesting.

C. SPI will retain **Legacy Trees** (as defined in section 7.3.4.1.3), wherever they exist. Legacy Trees will be preferentially retained within or at the edge of a HRA. The only exceptions to this retention standard are if the Legacy Tree has been determined to be an OSHA safety hazard, other regulation requires their removal, and the exception specified in Management for Den Structures (Section 7.3.4.1).

D. SPI will retain fisher den structures, wherever they exist. Fisher den structures known to be currently or previously active will be identified with a SPI wildlife tag. These den structures shall be retained in HRAs.

E. In all non-regeneration harvest areas, SPI will retain at least two hardwoods greater than 22 in. dbh per acre, when available. If unavailable, the next largest diameter hardwoods will be retained at a rate of two per acre.

F. In regeneration harvest units, SPI will retain small hardwoods (<6"dbh) or regenerate stump sprouting hardwoods at a rate of two per regenerated acre where they exist, and maintain them as co-dominants for the rotation of the stand. These retained/regenerated trees may be clumped within the harvested area.

G. During all regeneration or non-regeneration harvest activities, SPI will retain, as feasible, non-merchantable snags and green culls (≥ 15 in. dbh) unless determined to be a safety hazard or a regulation requires their removal. "Feasible" refers to the fact that some snags and green culls are accidentally knocked over or must be felled to carry out harvest operations. A non-merchantable conifer contains <25% merchantable volume that can be recovered as lumber. SPI does not pay for the falling, yarding or delivery of non-merchantable conifers. The result has been an increase in the number of non-merchantable conifers being retained standing in the forest for the benefit of wildlife including fishers. If felled for safety reasons or knocked down during operations, trees or snags will be left on site or, if necessary, moved to a nearby safe location. Retention will not occur in road right-of-ways.

H. During pre-commercial and commercial thinning of plantations, SPI will leave 2% of the area un-thinned, which will remain for the rotation. Preferentially, such areas would contain previously retained habitat elements (See section 7.3.4.2.3).

I. In regeneration harvest units, SPI will retain additional small hardwoods (>6"dbh) or conifers (>10" dbh) such that there are no locations that exceed a distance of 150' to any retained elements (HRAs, Wildlife Trees, Legacy Trees) in or adjacent to the unit, or between a retained element and the existing forest edge. For this purpose a forest edge is a stand that is HF2, HF3, HF2Hv, or HF4. Where such a forest edge does not exist, additional small hardwoods or conifers shall be retained along that edge every 300' to meet the desired spacing between retained elements. Preference will be given to hardwoods.

#### 7.3.4.1 Management for Den Structures

Trees containing fisher den structures known to be currently or formerly active will be identified with a SPI wildlife tag. Such trees shall be retained in HRAs, with the following exception. In the rare circumstance where required HRAs around den trees and HRAs surrounding Legacy Trees would exceed 3% of the unit area (example 0.6 acres in a 20 acre unit), SPI may notify the Service and propose that specified Legacy Trees and their proposed HRAs be available for harvest. The overall objective will be to maximize conservation value while limiting impacts to re-stocking the unit. The Service will determine whether field review is warranted in order to render a decision. If the Service has not replied in 10 working days, Timber Operations may proceed as proposed by SPI.

##### 7.3.4.1.1 Habitat Retention Areas

The primary measure to maintain and recruit habitat elements into future stands will be the establishment of HRAs in all regeneration harvest units. A HRA will consist of a representative

sample of the species and diameter classes present among co-dominant and dominant trees prior to harvest, retained at a rate of 2% of the total harvest unit area, excluding acres within WLPZs. HRAs will be retained for the life of the plantation and thus are intended to become potential rest and den sites within those stands over the next 80 to 100 years as the crop trees grow larger and the stand becomes denser.

The cross plot inventory SPI conducted on known den sites in its forests (SPI 2013a, Appendix G), as well as other literature, showed that a den site is often a small dense stand of large trees surrounding the den structure. Thus, known den sites, and whenever possible Wildlife Trees (potential den structures), will be included within or at the edge of a HRA, so that the retained HRA patch influences the physical conditions around the potential den structure in the eventual potential denning stand. The arrangement of HRAs will be variable. For example, in a 20 acre harvest area there will be one to four small groups ranging in size from 0.1-0.4 ac., which will consist of a representative sample of retained co-dominant and dominant trees based on tree diameter classes present before harvest. These small groups of trees are expected to persist, grow, and develop age-related defects during the stand's rotation period. The HRAs will be retained for the entire stand rotation period and not be thinned or salvage harvested.

Retention of HRAs will provide elements of older forest structure, ensuring management options at the end of the rotation period. Those options may include continued retention of the entire HRA, or any portions thereof, or designation of other stand elements of higher wildlife value, as replacement for these structural components.

##### 7.3.4.1.2 Wildlife Trees

The retention of Wildlife Trees is specifically intended to provide potential den and rest structures in all future stands outside WLPZs.

A Wildlife Tree is a hardwood ≥22 in. dbh or a non-merchantable live green conifer ≥30 in. dbh with the characteristics described below. If Wildlife Trees of the requisite minimum diameters are unavailable, preference will be given to hardwoods that have the next highest wildlife value. Next highest value Wildlife Trees may include smaller diameter trees, in which case the priority is on other wildlife characteristics. Wildlife characteristics include: age, diameter, longevity/persistence, signs of previous use by wildlife (excavated cavities), indication of current or incipient heart rot (conks, natural cavities), species (hardwoods preferred), presence of large mistletoe broom, crooks, reformed tops, forks or large lateral limbs, etc. Known den trees will be included as Wildlife Trees. Prior to the unit being harvested, Wildlife Trees will be marked for retention and monitoring.

##### 7.3.4.1.3 Legacy Trees

A Legacy Tree is any hardwood tree ≥36 in. dbh or non-merchantable live green conifer ≥30 in. dbh. Prior to the unit being harvested, Legacy Trees will be marked for retention and monitoring.

##### 7.3.4.1.4 Additionally Retained Trees

The spatial distribution of structural elements and areas of dense cover are important components of fisher habitat, and fishers have been shown to avoid large openings (Lofroth et al. 2011 pp 14). In order to limit the distance to a Wildlife Tree, Legacy Tree, hardwood, HRA, or a forested edge (as described above) to a maximum of 150 feet (approximately one per two acres), additional trees will be retained in regeneration units. These additionally retained trees can be conifers at least 10" dbh or hardwoods that are at least 6" dbh. Hardwoods are preferred, and in

practice, the minimum diameters probably will be exceeded in many cases due to the irregular distribution of candidate trees in a given harvest unit. The retention of these trees provides conservation benefits for fishers both immediately following harvesting and into the future as the retained trees and the surrounding forest stands mature. These additionally retained trees will provide cover for fishers foraging in younger stands and may develop den or rest site characteristics over time. If additionally retained conifers are allowed to persist in an "open grown" condition, they are more likely to develop characteristics often found in fisher den and rest trees, such as large lateral branches, high live crown ratios, and low height to diameter ratios (Sensenig et al. 2013 p. 97). Habitat for fishers will be further enhanced, as these additionally retained trees create another scattered height class to promote vertical heterogeneity.

#### 7.3.4.2 Enhancement of Heterogeneity to Promote Fisher Habitat

The intent of all the retention measures is to allow fisher den/rest sites, habitat for prey production, and stand structural complexity to be maintained or developed across the Enrolled Lands. Retention and recruitment of habitat elements that provide cover or are known to support prey production will also enhance the reproductive output and survival of fishers.

##### 7.3.4.2.1 Results of Retention in Regeneration Units

As described elsewhere in this CCAA, hardwoods are important to fishers for den and rest structures and for promoting prey production. All mature hardwoods retained as individual Wildlife Trees, Additionally Retained Trees, and within the HRAs will, over time, contribute to meeting the large hardwood retention goal of supplying denning and resting structures and mast production. Regenerating sprouting hardwoods may or may not be evenly distributed within the unit, but will generally reflect their distribution prior to harvest. In other words, where hardwoods are found in a clumpy distribution, they will be regenerated in a clumpy distribution. Alternatively, where hardwoods are more evenly distributed across the landscape, they will be regenerated in a generally even distribution. The retained or regenerated sprouting hardwoods will be in addition to HRAs.

The total number of tree retained by each of the measures is shown below in Table 7.3.4-1. The estimate for the number of trees ≥ 12" dbh per unit that will be found in HRAs at 2% area retention was based on inventory plot data from HF4 and HF2 Mixed land class stands within a sample of seven CSCAs, covering approximately 760,000 acres. Among these CSCAs, the retention standards will result in an average per 20 acres of 32.1 trees being retained (3.8 trees/acre averaged over the unit) and contributing to future stand structural heterogeneity (See Diameter Distributions_Zoom_CSCA_Structure -Supplement 3_V2). These trees will be retained for the entire 80 year rotation. Also, these values are based upon retention standard minimums, which quite often are exceeded in practice, and do not include existing retained snags and other scattered residual or advanced stocking.

While these elements are expressed in average values as shown in Table 7.3.4-1, their actual distribution within the harvest units will be highly variable, depending on the pre-harvest distribution of key elements within those units.

Table 7.3.4-1

| Estimated Trees per Acre Retained in Even-aged Harvest Unit, by Retention Category | | | | |
|---|---|---|---|---|
| **HRA**: Trees per acre ≥12 in. dbh averaged over 20ac.unit. | **Wildlife Trees:** Total number of (4) averaged over 20ac. unit per acre. | **Regenerated Hardwood Trees:** Hardwood <6"dbh or stump sprouting per acre. | **Legacy Trees**: Hardwoods ≥ 36" dbh or Conifer Wildlife Trees ≥ 30" dbh | **Additionally Retained Trees:** A maximum of 150 feet, approximately one per two acres. (6" dbh hardwood or 10" dbh conifer) |
| 1.6 | 0.2 | 2.0 | 0 to 0.3 | 0 to 1 |

Note: The distribution of the Wildlife Trees is unknown prior to the field work being completed, but this standard is expected to lead to approximately 0.2 trees per acre retained (averaged over the unit).

#### 7.3.4.2.2 Snags, Green Culls, Down Logs

In addition to individual Wildlife Trees, other structural elements will be retained to provide late/mature legacy structures in the Even and Mixed land classes. Snags will be retained that are not hazardous or are not obstructions to timber operations in regeneration and non-regeneration harvest units. Hazardous or obstructive snags ≥15 in. dbh that are felled (and others toppled by operations) will be left on the ground as operationally feasible for the purposes of providing down wood. Wherever they exist, large non-merchantable logs (≥20 in. large end) will be retained during harvesting and site preparation activities. A non-merchantable log contains <25% merchantable volume that can be recovered as lumber. To the extent practicable, these logs should be left undisturbed. If accumulations of snags and down wood create excessive fuel loading and thus prevent meeting the purposes of CFPR 14 CCR §915/935/955 (Site Preparation), the RPF may propose treatments to alleviate those conditions. In such cases, the RPF must balance snag and log retention with management of excess fuels. Large cull logs or trees may be removed if they are a safety hazard or detrimental to the future health of the plantation. It should be noted that green cull trees felled due to the multiple risks (shading, disease vectors, safety hazard) they represent would then be treated as down logs, and retained or treated as described above.

#### 7.3.4.2.3 Tree Density Control to Promote Vegetation Heterogeneity

Numerous authors have suggested that “structural complexity” (or other equivalent terminology) is an important part of habitat for fishers. However, our literature review finds that this attribute has never been well defined in quantified terms relative to fishers.

Spies (1998) suggested four important components of forest structure: 1) tree size and distribution, 2) vertical foliage distribution, 3) horizontal canopy distribution, and 4) dead wood. Other components that occur in fisher habitat that might contribute to “complexity” could include understory brush, and a diversity of tree species that includes both hardwoods and conifers. Obviously each of these components can be measured in quantitative terms. But “structural complexity” expressed as some combination of these components apparently has never been actually measured as a variable in fisher habitat, or in habitat for prominent fisher prey species, and thus has not been correlated with any measure of fisher occupancy or performance. Thus, proposals for provision of structural complexity must be based on judgment and feasibility.

Along with the retention of elements from previous stands as described above, measures will be taken in growing Even stands to promote structural complexity. Even stands are those that grow from Regen (i.e. planted) stands. The shift from Regen to Even is basically a record-keeping exercise in the SPI timber inventory that occurs when a plantation (Regen) reaches an age where it is cruised (measured) for inventory volume and reclassified as Even.

In Regen units, newly planted areas will be stocked to a density of approximately 258 to 360 trees per acre (13' x 13' spacing for pine and Douglas-fir, 11' x11' for true fir). The wide spacing between planted conifers will provide adequate sunlight between the conifer seedlings to promote and maintain the establishment of a second layer of vegetation. The second layer of vegetation will generally be composed of a mix of grass, herbs, brush, and volunteer conifer and oak seedlings. The preponderance of this vegetation will become established following the herbicide release treatment that some plantations will receive in their second year of growth. The effects of the herbicide treatment on the plant community species diversity have been shown to last for only two years (James et al. 2012, p. 67). The subsequent establishment of understory vegetation provides the "over fisher" canopy levels reported in Murphy (2008), and habitat for small mammals and birds.

The conifers will be pre-commercially thinned to 18' x 18' spacing (approximately 134 trees per acre) by at least age 10. As well as encouraging rapid diameter growth of the crop trees, this wide spacing will encourage additional growth in the understory vegetation and promote vertical structural complexity. It is anticipated that the 18' x 18' spacing will prevent the "competitive exclusion phase" (Franklin et al. 2002, p. 411) of stand development (where conifer crowns totally dominate and exclude understory plants) until the end of the third decade, and although some understory vegetation will be lost (run over, crushed) during treatments, it will not be intentionally removed, bladed off, uprooted etc., and will quickly return to pre-treatment condition.

During the pre-commercial thin, two percent of the treated stand (0.4 acre/20 acres) will be retained at 13' x 13' spacing. This retention is intended to promote natural density-induced mortality, which will increase the likelihood of recruitment of snags, estimated to be 16"-18" dbh, in each of the retained islands. While snags of this size may be of limited value as fisher den or rest sites, they will provide habitat for fisher prey species and important forest ecosystem function. Pre-commercial thinning also will maintain the regenerating hardwood trees (2 per acre) in a co-dominant / dominant crown position. HRAs retained in the previous clearcuts will remain un-entered.

When they reach an average height of approximately 70 feet (i.e., approximately 40 years old), the crop trees will be commercially thinned to 26' x 26' spacing (approximately 65 trees per acre). This thinning is timed to avoid tree mortality predicted to occur by the University of California Research Cooperative G-space tree growth model. During the commercial thin, two percent of the treated stand (or 0.4 acre/20acres) will be retained at the 18' x 18' spacing. The reason for this retention is to promote natural density-induced mortality. This retention will increase the likelihood of recruiting snags projected to be 24"dbh or larger in each of the retained islands. This tree spacing will again allow sunlight to reach the forest floor and rejuvenate and reinvigorate the understory vegetation. Commercial thinning of Even stands also will maintain the regenerating hardwood trees (2/acre) in a co-dominant/dominant crown position.

Thus, this Conservation Measure will increase the plant diversity in the understory of planted stands (James et al. 2012). It is anticipated that adequate cover will persist for fishers to hunt and travel though these stands and avoid predation.

#### 7.3.5 Conservation Measure 4: Mitigation of Substantially Damaged Timberlands

Conservation Measure Four establishes retention standards that apply during the salvage harvesting of Substantially Damaged Timberlands (defined in CFPRs 14 CCR 895.1) to ensure functional forest structures remain available to fisher in these areas. Substantially Damaged Timberlands are the result of unpredictable events that kill trees. Under the CFPRs, all dead, dying, or damaged trees may be harvested immediately to recover their economic value. SPI typically conducts an Emergency Notice of Timber Operations on Substantially Damaged Timberlands as soon as possible. Un-damaged green trees within the Substantially Damaged Timberlands are not allowed to be cut under an Emergency Notice of Timber Operations and will be left where they exist, except as provided in CFPR 14-CCR 1052.1(e).

For this CCAA, SPI commits to retention of snags, wildlife trees and HRAs within an Emergency Notice of Timber Operations. Retention within an Emergency Notice of Timber Operations on Substantially Damaged Timberlands will include the retention standards in sections 7.3.4.1, 7.3.4.1.1, 7.3.4.1.2, 7.3.4.1.3, 7.3.4.1.4, and 7.3.4.2.2, and all undamaged green trees within the Substantially Damaged Timberland. If all the trees are dead, these standards will be met with dead trees. Where known den structures are located within a burned area and all the surrounding trees are dead, the den structure does not need to be included in a HRA.

As in the regeneration harvest standard, HRAs will be established at a frequency of 0.4 ac. in every 20 ac. salvaged, excluding required WLPZs. HRAs will be established around individual Wildlife Trees where available and will include un-damaged green trees that are likely to persist. The dead, dying, damaged or diseased conifer trees in Substantially Damaged Timberlands usually have >25% merchantable wood, and thus are not snags as defined and would not be retained.

The standards for Additionally Retained Trees (Section 7.3.4.1.4) are not useful in a fire-killed environment. The minimum diameters of the Additionally Retained Trees are too small for them to persist and they will not grow larger because they are dead; therefore the following standard will apply. The fire-killed hardwood trees in a burn area will be retained at a density of 1 per 2 acres. The target diameter for hardwood retention is 12” dbh. If larger hardwoods are available (>22”dbh) those should be preferentially retained. This standard is an exception to Section 7.3.4.1.4.

If Substantially Damaged Timberlands occurs across an area larger than 2,500 acres the USFWS will be notified and the event will be evaluated as a Changed Circumstance per Section 11.2.1

Note: Reforestation is not a CFPR requirement for an Emergency Notice of Timber Operations on Substantially Damaged Timberlands and is not a condition of this CCAA. SPI has voluntarily reforested the timber capable areas where salvage harvest operations occurred in the past.

### 7.3.6 Conservation Measure 5: Reduction of Potential Impacts at Reproductive Sites

The second biological objective is minimizing the potential to take fishers by killing or disturbing them in their natal and maternal dens. This applies only in the Occupied Range, and will be addressed through Conservation Measure Five.

#### 7.3.6.1 Feasibility of Detecting Fishers

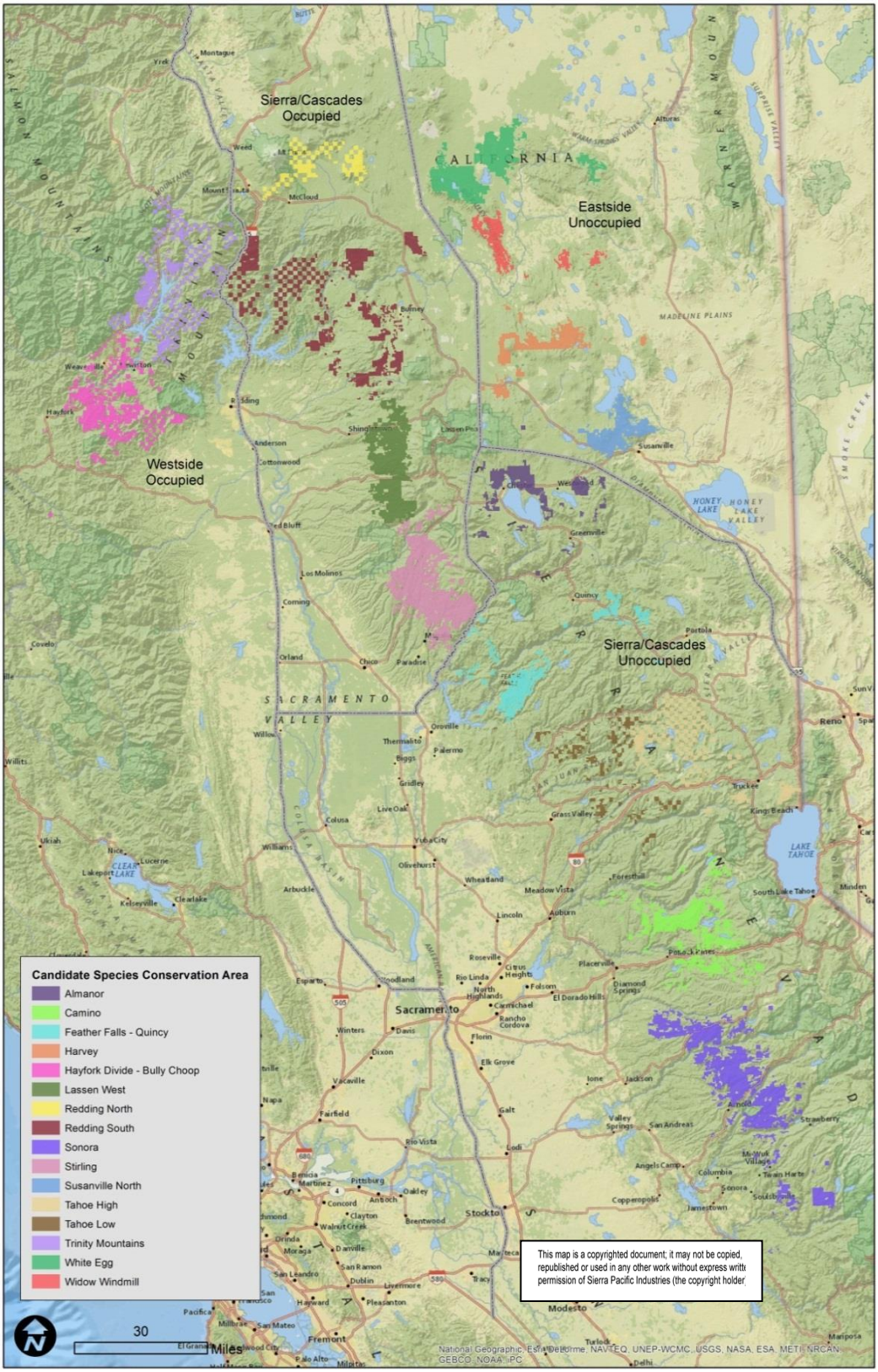
Pre-operational surveys for fisher were considered as an alternative to minimize take; however, investigation into this option revealed issues that made surveys infeasible. Because of the difficulty, probability of error, and expense of obtaining location-specific data on fisher dens using any known method, including those discussed below, within the Occupied Range of the fisher (see figure 7.3.6.1) SPI will assume that fisher may be present in harvest units and plan protective measures accordingly.

Fisher are elusive, are not easily detected visually, and do not respond to an auditory call. Fishers are normally detected using cameras at bait stations, which may attract fishers into the area from denning sites of unknown distance. Thus, detection of a fisher at a bait station is inconclusive as to presence of a den near the harvest unit. Also fishers have been known to elude detection at den trees even with camera stations deployed. Because fishers are a highly mobile animal, its main risk of injury or death from timber harvest operations is when it and/or its kits are residing in a den. Dens are nearly always a cavity in a standing live or dead tree, which can rarely be located without attaching a radio telemetry device to the animal.

Scat detector dogs are capable of locating fisher scats and thus indicating where a fisher has been present. However, their success rate depends heavily on the training and skills of the dog and its handler. Genetic testing of scats collected by experienced scat detector dogs and their handlers in the southern Sierra Nevada indicated approximately 55% of collected scats were actually from fishers (Thompson et al. 2012, p. 4, ). Without genetic testing of scats, it is likely that "false positive" errors will be commonplace (Peter Figura, DFW, pers. comm.). Additionally, the use of scat detector dogs to conduct presence/absence surveys is challenging in difficult terrain. To some extent, both dog and handler generally follow the path of least resistance when surveying, even when trying to cover all ground within a survey unit. Therefore, unless a fixed, systematic survey grid is followed, the likelihood that detector dogs will fail to detect existing fisher scats is likely to increase with increasing terrain complexity (e.g., steep slopes, thick brush, extensive woody debris, etc.).

Because of the above issues, we have decided that it is not feasible to implement surveys to detect the presence of fisher dens in advance of timber harvest. Thus, protective measures are based on assumptions regarding the likelihood of presence and are detailed below.

Figure 7.3.6.1 Regions and Covered Species Conservation Areas



#### 7.3.6.2 Fisher Take Minimization

The following take minimization measures will be applied within the Occupied Range.

##### 7.3.6.2.1 Seasonal Restrictions

To minimize disturbance during the natal denning season (the time most likely to have a direct impact), timber harvest activities within the Occupied Range during the natal denning period of March 1st to May 15 (Appendix N) will be limited to no more than 25% of SPI's yearly planned volume in any one year, and a rolling 3-year average will not exceed 20%.

As an additional minimization measure, SPI will not harvest tractor harvest units that have ≥75% HF4 during the natal denning period of March 1st to May 15th. This presumes that denning is most likely in these older stands. This will apply to tractor harvest units only, due to the cost of moving cable logging equipment.

In order to understand the context of this conservation measure, roughly two years of approved regeneration harvest units in the Occupied Range were evaluated for their respective yarding method and percentage of HF4. The results showed 23.8% were cable units and only 27% of those had ≥75% HF4. To confirm if this sample reflects the amount of tractor and cable acreage that occurs in the occupied land, the estimated proportion of Tractor and Cable acreage, based on the percent slope of the land in the Occupied Range, is found in Table 7.3.5.2.1-1. The approved unit sample is nearly double the amount of cable acreage available and thus is a conservative estimate.

Table 7.3.6.2.1-1. Percent Tractor and Cable in the Occupied CSCAs

| Sum of GIS_ACRES | Slope class (percent) | | | | |
|---|---|---|---|---|---|
| CSCA | <55 | 55+ | Grand Total | Percent Tractor | Percent Cable |
| Hayfork Divide - Bully Choop | 91,580 | 33,072 | 124,652 | 73% | 27% |
| Lassen West | 113,207 | 3,418 | 116,625 | 97% | 3% |
| Redding North | 42,525 | 713 | 43,238 | 98% | 2% |
| Redding South | 125,396 | 35,095 | 160,491 | 78% | 22% |
| Stirling | 144,676 | 14,122 | 158,798 | 91% | 9% |
| Trinity Mountains | 96,045 | 21,964 | 118,009 | 81% | 19% |
| **Grand Total** | 613,430 | 108,383 | 721,813 | **89%** | **11%** |

Approximately 33% of approved tractor units were comprised of ≥ 75% HF4. Therefore, the estimated percentage of cable units where harvesting during the natal period may occur was calculated by multiplying the proportion of ≥75% HF4 (27%) by the proportion of units that were cable (0.27*0.238), which resulted in an estimate of 6.4% of the units having ≥75% HF4 that might be harvested during the natal period in the Occupied Range. Therefore, it is estimated that take will be minimized in nearly all other units that contain ≥75% HF4 (93.6%) in the Occupied Range by applying this harvest timing restriction. Tractor logging during the natal period will only occur in units with <75% HF4. This adjustment would minimize the likelihood of directly killing or injuring denning fishers.

##### 7.3.6.2.2 Sighting Fishers During Harvest Operations

If a fisher is sighted within the vicinity of a THP area during timber operations, all vegetation disturbing activities that could affect the site will be immediately suspended until a company biologist determines whether further surveys or operational restriction are necessary or prudent. If

a den site of a fisher is discovered or strongly suspected because of visual evidence, all vegetation disturbing activities will be suspended within a 375-foot radius and the FWS will be immediately notified.

Following confirmation of a den site, all vegetation disturbing activities will be suspended until August 1 of that year. The den structure will receive a wildlife tag and a HRA will be designated around the site (see Section 7.3.4.1).

#### 7.3.6.2.3 Definitions of Potential Den Tree

Minimization measures relating to the cutting of potential den trees are provided in Section 7.3.6.2.4. We define a hardwood tree as a potential den tree when it is ≥15 in. dbh (dead or alive) and has indications of cavity formation or visible cavity openings of the size (≥3.5") that can accommodate fishers. We define a green conifer as a potential den tree when it is ≥22 in. dbh and has the same cavity indications as above.

#### 7.3.6.2.4 Take Minimization During the Natal and Maternal Den Periods

Potential den trees will not be felled during the natal den period of March 1 to May 15. In a few select instances, a tree meeting the definition of a potential den tree may be felled in a cable unit to allow for feasible yarding. In those instances, a SPI wildlife biologist will assess the tree visually for cavities that might be used as a natal den. If a suitable cavity is not visually apparent the tree may be felled; however, if a cavity is present, felling will be avoided until after May 15.

During the maternal den period of May 16 to July 31, potential den trees will not be cut until the day after all other trees intended to be felled within a ten-acre area (a 375-ft. radius) have been felled. This will allow fishers to move from the area in response to the harvest disturbance. SPI's RPF will specifically instruct the Licensed Timber Operator (LTO) detailing these take avoidance measures, including the LTO's required implementation of these felling restrictions with their employees and timber fallers.

For more information related to these minimization and mitigation measures, please see *"Fisher Natal Den Use on Managed Timberland in California"* (2012) (Appendix N).

### 7.3.7 Conservation Measure 6: Minimize Risk of Drowning in Water Tanks

Fishers have been documented drowning in uncovered water tanks. Thus, a water tank in occupied fisher habitat is a threat to fishers if the openings of the tank are large enough to allow entry but do not provide a means of escape.

The placement and maintenance of a water tank for dust abatement is a Covered Activity. Water tanks are situated on stable, level ground near watercourses. Construction or reconstruction of water diversions require a Fish and Game Code 1600 permit from the California Department of Fish and Wildlife, which includes a CEQA analysis as part of an associated THP approval.

Currently there are no known tanks within the Enrolled Lands that are a drowning threat to fishers. If SPI installs or discovers a tank on its lands, its opening(s) will be adequately screened or closed to prevent a fisher from entering or animal escape ramps will be installed to allow these tanks to be "fisher safe". If the tank is no longer needed, it will be opened/breached in a way that allows fishers an exit route. SPI, through its normal operational activities will continue to identify, and if necessary remediate, water tanks that are a threat to fishers within the term of the permit. It is anticipated that all water tanks on the Enrolled Lands will be inspected and made "fisher safe" within the term of the permit.

### 7.3.8 Conservation Measure 7: Reduction of Potential Impact from Illegal Marijuana Cultivation and Firewood cutting.

Illegal uses of the property may negatively impact fishers. Among the known illegal activities, toxicants associated with the cultivation of marijuana probably pose the largest risk to fishers (Higley 2013). Fishers may be directly or indirectly exposed to toxicants when they consume contaminated baits or animals. Illegal planting sites on SPI lands are uncommon and cover small acreages, and are usually at the outer periphery of our ownership. Results from the Stirling Management Area (SMA) translocation project have not shown toxicants to be a significant threat to fishers (A. Facka, pers. comm.), perhaps in part due to access control and cooperative law enforcement activities. A secondary risk to fishers from the cultivation of marijuana could be the cutting of a den tree by growers preparing a site or tending their plants. Because marijuana cultivation on SPI property is infrequent, it is unlikely that the loss of a den structure in this manner is a significant threat.

The other illegal use of SPI property that is a risk to fishers is firewood cutting. Illegal firewood cutting tends to target snags and green hardwood trees that are near access roads. This activity also involves the concomitant additional risk of human caused wildfires.

Illegal use of the property is limited by controlling access where feasible. Illegal use of the property is identified wherever it is evident. Foresters, biologists, loggers, and patrolmen all keep an eye out for suspicious trails, road use, illegal firewood cutting, and altered vegetation that is not part of a THP. When an illegal activity is identified, the appropriate law enforcement personnel are contacted. Following the conclusion of the law enforcement activity, SPI participates in the restoration and remediation of the site. Remediation can include re-establishing erosion control measures, and removal and proper disposal of trash and hazardous materials. The handling of hazardous materials is done in compliance with the appropriate regulating agency.

### 7.3.9 Conservation Measure 8: Reduction of Potential for Catastrophic Fire

Catastrophic fire is a stand replacing fire that alters forest habitat at a scale that can threaten the persistence of a species that is not widely distributed, or may cause a significant barrier to gene flow if the species does not emigrate rapidly. The threat to a species can occur where loss of habitat due to catastrophic fire out-paces the regrowth of habitat.

Reduction of the risk of catastrophic fire consuming suitable fisher habitat will be accomplished through the continued use of even-age management. Harvesting in an even-aged system dramatically reduces ladder fuels and, over time, creates stands that reduce the tendency for ground fires to become large crown fires. As more of the landscape is placed in an adjacency-driven pattern of Even land class, the resulting fuel structure conditions create a landscape that becomes increasingly resistant to crown-propagated wildfire.

Initially, young even-aged stands, like any early seral stage, are quite flammable, but compared to forests with continuous ladder fuels, they grow out of this state of flammability, especially with created spacing (pre-commercial and commercial thinnings). Even-structured stands are generally discontinuous in relation to the adjoining stands due to differing heights, and thus slow the spread of crown fires. Even units also provide for greater firefighting efficiency and safety, as the young planted forests provide safer locations for firefighters to escape to and stage from.

Given many other constraints, the rate at which the landscape can be converted into these Even structures is limited. To reach a more resilient state more quickly, this approach will be supported by the systematic construction of a network of fuelbreaks. Fuelbreaks provide some

reduction in spread of low-intensity fire, but often are not effective in reducing spread of high intensity wind-blown fire. Their primary objective is to limit the advance of wildfires by providing a functional space and safety zone for conducting fire suppression operations, including an already-prepared area from which to conduct backfires. Fuelbreaks can be effective because they strategically address sources of ignition (lightning and human-caused) and focus on locations with access by suppression forces.

In evaluating the application of fuelbreaks, our land managers analyze the environmental and investment resources at risk, regional historic fire patterns, regional climate patterns, forest type, topography, usefulness to fire suppression resources, and how the project may be incorporated into a larger landscape scale fire risk management strategy. Where fuelbreaks are deemed appropriate, the THP process is used to incorporate reduction of surface and ladder fuels, and create wide spacing between live tree crowns to prohibit an advancing crown fire from continuing to propagate through the fuelbreak.

It is estimated that fuelbreaks will compose approximately 2-3% of SPI lands over the term of the permit. Investment in a fuelbreak will only be made when its potential effectiveness is commensurate with the values at risk. CCAA retention standards will not be applied in fuelbreaks.

In combination, Even units and the fuelbreaks will reduce the ability of large crown fires to spread rapidly across large areas, because the tree crowns are generally discontinuous in relation to the adjoining stands at a linear landscape scale.

# 8. EXPECTED BENEFITS FOR FISHERS

The proposed CCAA is expected to provide the following benefits for fishers: 1) Maintain suitable fisher habitat in the occupied range, as measured by the Conservation LEAFs (See Section 7.2.11). 2) Provide sufficient amounts of suitable fisher habitat, as measured by maintaining at least 50% of the Capable Land available when the permit begins (roughly 700,000 acres) in the Mixed land class, for the duration of the permit. 3) Manage habitat elements important to fishers and its prey, in all existing and harvested stands. 4) Manage HRAs. 5) Support fisher conservation efforts on Federal land and private land, and provide an in-place regulatory mechanism to deliver these benefits across a large portion of the private land in the fishers' range in California. 6) Implement take minimization measures to protect existing fisher populations. 7) Manage water tanks to minimize accidental drowning of fishers. 8) Prevent illegal use of the property and remediate sites that have hazardous materials considered harmful to fisher. 9) Reduce the potential for catastrophic fire.

## 8.1 MANAGE AND MAINTAIN SUITABLE FISHER HABITAT

The delineation and evaluation of LEAF areas is discussed in Section 7.2.11. Conservation LEAFs are the primary mechanism for achieving conservation benefit for this CCAA. In combination with other measures in this CCAA, they provide the means of meeting the CCAA policy standard regarding benefits of conservation measures (USFWS 1999 CCAA Policy; 64 FR 116, p.32727).

Using the Draft Fisher Conservation Strategy (Finely et al., 2011) and guidance from the Service, SPI proposes that the conservation benefit threshold will be maintenance of 80% of the Conservation LEAFs in a condition that is likely capable of supporting reproductive female fishers and as a result fisher populations.

Meeting the habitat requirements at the different scales evaluated in LEAFs and embedded in the Territory Opportunity analysis will provide a matrix of widely-distributed habitat, and also

includes maintaining at least 50% of the currently available Capable Land in the Mixed land class for the duration of the permit. This abundant habitat will have the components to allow a female fisher to reproduce successfully and the young to disperse into adjoining areas, to establish their own home ranges, and maintain a stable or growing population.

SPI's maintenance of Conservation LEAFs will alleviate the threat of the excessive loss of den/rest habitat, and will allow these lands to continue to support fishers in the occupied range.

### 8.2 MANAGE HABITAT ELEMENTS

Maintaining and recruiting habitat elements (see Section 7.3.4) that either exhibit or will likely develop suitable den structures will ensure that stands harvested using a variety of silvicultural systems, including emergency salvage operations, will have den structures present during the life of the future stand. This is important considering that many den trees are >150 yr. old and the average rotation age for the Enrolled Land is 80 years. Maintaining and recruiting habitat elements will also allow the Even-aged stands to function as prey producing habitat, since many of the features to be retained are associated with the habitat of fisher prey (Woodbridge et al. 2012, Table 8.1, p176). SPI's retention and recruitment of habitat elements will alleviate the threat of loss of structures essential to den/rest habitat.

### 8.3 MANAGE HABITAT RETENTION AREAS

The management of HRAs, in the near term and in the future, will provide small groups of residual trees that are generally more closely spaced and larger than trees present in the surrounding future stand. The HRAs will provide edge habitat between mature and younger stands, and will be capable of producing seed or acorn mast immediately. HRAs left in a dense condition will also promote density-induced mortality contributing to natural snag recruitment. Where HRAs contain one or more suitable den structures, it is anticipated that these sites may become active den sites sometime in the future. SPI's retention of HRAs will alleviate the threat of lack of den/rest habitat in the future.

### 8.4 SUPPORT CONSERVATION EFFORTS ON PUBLIC AND PRIVATE LANDS

SPI owns approximately 4% of the forests in California, while in the occupied range it owns approximately 6.4%. In comparison, the Federal forests comprise 55% and 52% respectively. An important region of the fisher's California range includes low elevation forests with relatively high numbers of hardwoods. In the unoccupied range, a relatively small portion of these low elevation forests are in federal ownership, and a substantial portion is owned by small non-industrial forest landowners, along with SPI. Within the mixed ownership pattern, this CCAA will provide important linkages for fishers between lower elevation private land and Federal forests, and thus will contribute to conservation efforts on Federal forests. The CCAA will support conservation practices on non-industrial private lands because those ownerships are much smaller, and may provide habitat that functionally satisfies only one life requisite behavior. SPI forests will support all three life requisite behaviors (cover, forage, and breeding), and therefore will augment the habitats found on small non-industrial landowners, potentially allowing those lands to be exploited by fishers.

The conservation actions combined in this CCAA will provide an in-place regulatory mechanism that the Service can rely on for the term of the permit. The strength of this cooperative effort is that it delivers benefits for the species in an immediate time frame. Absent this CCAA, there would be no in-place regulatory mechanism for maintaining habitat for fisher expansion on

non-federal land. The CCAA will provide habitat in currently unoccupied areas to support fishers should they expand their range or be reintroduced.

The USFWS CCAA Policy recognizes that early implementation of meaningful conservation measures is more likely to successfully conserve species and avoid further species declines and listing actions (USFWS 1999, 64 Fed. Reg. 64 p. 32731).

## 8.5 MINIMIZE THE TAKE OF INDIVIDUALS

While there are numerous fisher den sites known to have been used on SPI lands (n=162), the likelihood of an occupied fisher den within a planned harvest unit is very small (as described in Appendix F). The low probability of harvest unit overlap is because fishers occur at a relatively low density, and the SPI harvest acreage is small as a percentage of the total available habitat. During the denning period, SPI will limit the total volume of timber harvested and avoid cutting potential den trees, and will limit harvesting in the best den habitat (HF4) during the natal denning period. These and other proposed measures for minimization of take will further reduce the chance that harvest activities will kill, injure, or harass fishers, and thus provide conservation benefit.

## 8.6 MINIMIZE FISHER DROWNINGS

If SPI installs any water tanks, they will be designed to prevent entrapment of fishers. If SPI discovers a tank capable of entrapping a fisher on its lands, the opening(s) will be adequately screened or closed to prevent a fisher from entering or animal escape ramps will be installed to allow these tanks to be “fisher safe”. SPI, through its normal operational activities, will continue to identify and remediate water tanks that are a threat to fishers within the term of the permit. Identifying and eliminating water facilities that pose a risk of fisher mortality will reduce a known threat, and thus provide a conservation benefit.

## 8.7 PREVENTING ILLEGAL PROPERTY USE AND REMEDIATION OF SITES

Illegal use of the Enrolled Lands is limited by controlling access where feasible. Illegal uses of the property that are a threats to fishers primarily include illegal marijuana grows and firewood cutting. When any illegal activity is identified, the appropriate law enforcement personnel will be contacted. Following the conclusion of the law enforcement activity, SPI will participate in the restoration and remediation of the site. Identifying and eliminating illegal uses of the property will reduce a threat of fisher mortality, and thus provide a conservation benefit.

## 8.8 REDUCTION OF POTENTIAL FOR CATASTROPHIC FIRE

The use of Even-aged management will cause the forest stands’ structural characteristics to reach a more fire resilient state over the course of several decades. In the interim, and in support of this ongoing process, the systematic construction of a network of fuelbreaks will be established. Fuelbreaks provide some reduction in spread of low-intensity fire, but often are not effective in reducing spread of high intensity wind-blown fire. Their primary objective is to limit the advance of wildfires by providing a functional space and safety zone for conducting fire suppression operations, including an already-prepared area from which to conduct backfires. Fuelbreaks can be effective because they strategically address sources of ignition (lightning- and human-caused) and focus on locations with access for suppression forces. The use of Even-aged management and strategically

placed fuelbreaks will aid in preventing the potential for catastrophic fire destroying large areas of fisher habitat, and thus provide a conservation benefit.

## 9. INCIDENTAL TAKE

Under Section 9 of the U.S. ESA, take of listed species is prohibited. Under Sec. 3(19) of the US ESA, the term ''take'' means to" harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Incidental take" is defined at 50 CFR 17.3 as "any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

Under ESA Sections 10(a)(1)(A) and (B), private parties can receive authorization for various forms of incidental take. Under the CCAA policy (USFWS 1999; 64 Fed. Reg. p. 32731), private parties can establish plans that establish conditions in advance under which incidental take of unlisted species is authorized at such time as they become listed. Under the CCAA policy, a CCAA must determine the extent and impact of the proposed incidental taking, in a manner similar to that specified under ESA section 10(a)(1)(B).

SPI foresees the potential that Covered Activities may incidentally take the fisher by killing, injuring, harassing, or harming. While the statute and regulations use the terms "kill" and "injure," those terms are not further defined in the regulations (apparently being self-explanatory.) "Harass" and "harm" are defined in 50 CFR 17.3 as follows:

*Harass* means "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering."

*Harm* means "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering."

In the following sections we evaluate the potential that various types of incidental take might occur, estimate the amount of such taking, and assess the impact of the taking to the fisher. This evaluation does not take into account the measures in CCAA Section 7.3.6, which are designed to substantially reduce the likelihood that incidental take in the form of killing, injuring, harassing, or harming might occur. Instead, the evaluation assumes that no minimization measures are in place, in order to derive an estimate of the maximum amount that might reasonably be expected to occur, for the purposes of estimating overall impact and seeking incidental take authorization.

As proposed in this CCAA, these categories are not additive in determining the amount of incidental take, because harvest at certain units may reach the threshold for multiple forms of take, and thus double-count fishers taken. Also, the timing of occurrence of killing, injuring, and harassing is separate from that of harming. For purposes of accounting of take, we assume that killing, injuring, or harassing takes place during the reproductive season, while harm results from long-term conditions. Therefore, the impact of killing, injuring, and harassing will be evaluated separately from the impact of harm.

The CCAA guidance requires an assessment of the impacts of the taking. However, the total fisher population in California, as well as that on the Enrolled Lands, is unknown, as is the true impact of timber harvest on fishers at the individual and population levels. We have made a reasoned attempt to estimate and quantify impacts, but each of the values produced to contribute

to this analysis is based on multiple assumptions and judgments, and the error in these values may be compounded as they are combined arithmetically. Even the rounding of values following decimal points has substantial influence on the outcome. These caveats must be fully recognized in the interpretation of the following analysis.

In the following sections, we estimate the number of fishers that may be taken under each of the categories: kill/injure, harass, and harm. We then evaluate the impact of this estimated take at the population scale on SPI lands and on the entire population.

## 9.1 POTENTIAL FOR COVERED ACTIVITIES KILLING, INJURING, OR HARASSING FISHERS

The regulatory guidance for CCAAs and associated recovery permits requires quantification of and description of the impacts of authorized incidental taking (64 FR p. 32733, 32735); (USFWS draft handbook 2003, p. 15); (50 CFR 17.22(b)(1)(iii)(A); (50 CFR 17.32(b)(iii)(B) &(C)(1) .

Fishers can be detected using cameras, track plates, or hair snares, but these detection locations do not delineate boundaries of a territory. Fisher territories cannot be identified without radio telemetry, and few radio telemetry studies have been conducted within the region of the CCAA. Therefore, the locations of fisher territories are not known throughout most of the fisher's occupied range in northern California, including most of SPI's property. Because of cost and the limitations of survey results, SPI does not intend to survey proposed timber harvest units for presence of fishers.

Thus, the numbers, locations, and territories of fishers on SPI lands are presently unknown and will remain so, except for limited areas that will be sampled under the monitoring program described in Section 13. And, as stated above, no information is available on the effects of site-specific habitat modification on fishers. As a result of these issues, evaluation of habitat modification on specific existing territories in specific landscapes will not be possible.

For much of the year, fisher adults and young are quite mobile and capable of avoiding Covered Activities that might subject them being killed, injured, or harassed. In general, adult fishers have acute hearing and vision, and are attentive, reclusive, and highly mobile, so they are presumably much less vulnerable than juveniles that have not yet left their mother's care (about six months old) to being killed, injured, or harassed by the Covered Activities. The likelihood of impacts from Covered Activities increases during the breeding period, when the reproductive activities are focused within specific locations for several weeks or months, and mobility is constrained. The variety of fisher behaviors during this time creates different types and degrees of vulnerability to being killed, injured, or harassed. The behaviors that create vulnerability to being killed, injured, harassed are discussed below, along with estimates of the expected amount of take due to killing, injuring, or harassing.

### 9.1.1 Risk of Killing, Injuring, or Harassing Adult or Juvenile Fishers

Because adult male fishers are highly mobile and not constrained to any particular physical location at any time of year, we assume that their relative risk of being killed, injured, or harassed by Covered Activities is very low. We further assume that adult female fishers and their kits would only be vulnerable to being killed, injured, or harassed by the Covered Activities during the period that they are confined to reproductive dens, which, as defined by Lofroth et al. (2010, p. 59), includes all dens used during the reproductive season: natal; pre-weaning; and post-weaning. Several reproductive dens are often used over a period of about seven months, from birth of kits in March or April, to separation of kits from their mother in late fall (Lofroth et al. 2010, pp. 55-59). Although juvenile dependence lasts through late fall (Lofroth 2010, p. 56) the focus of the minimization of

direct kill and harass relies on SPI's den data (Fisher Natal Den Use On Managed Timberland In California, 2012) that suggests most denning activity is over by mid-July.

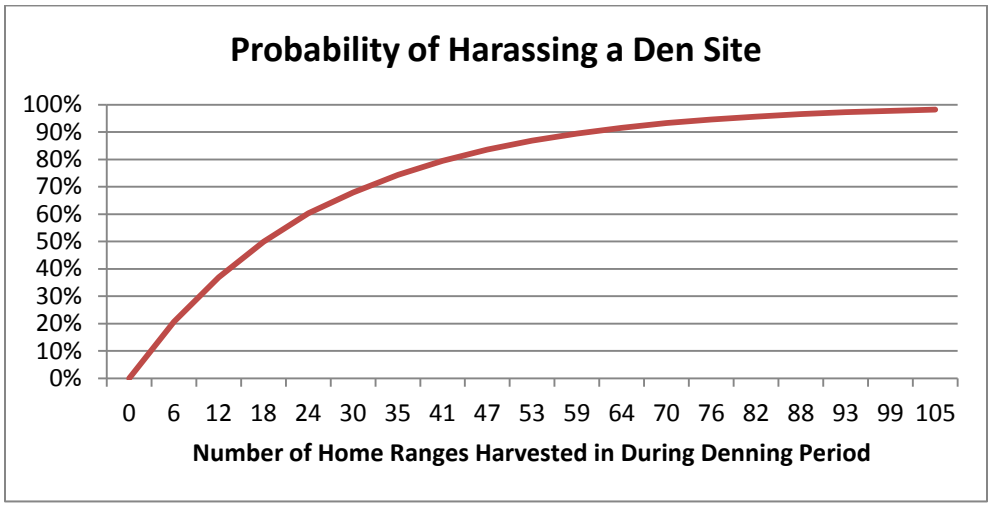
There is no information in the literature regarding direct disturbance effects of timber harvest on denning fishers. We assume the removal of mature trees and the associated noise and human activity during timber harvesting in an occupied female fisher home range will alter the way that that resident female perceives and uses that portion of her home range. Because adult female fishers typically move their young several times during rearing, we assume that they are capable of moving young away from sources of disturbing timber harvest activities. The difficultly with estimating the impacts to fishers is that the effect of the disturbance is unknown.

On average, SPI has about 21 harvest operations underway in a year within the occupied range. For purposes of this analysis, we assume that the operations are distributed across the landscape such that not more than one of the 21 operations occurs within a 5000-acre area. Our calculation used an assumed density of two reproductive female fishers per 10,000 acres, and assumed that an occupied den site contains an adult female and two kits. Thus the 21 harvest operations are operating within approximately 21 female fisher home ranges (the "Distributed Harvest" scenario in Appendix F.)

We assume that timber harvest will kill or injure fishers if the harvest occurs during the denning season within the same acre that contains an active den site. The likelihood that a timber harvest unit would include an acre that contains an active fisher reproductive den (and thus resulting in a directly killed or injured fisher) is very low. An assessment of the statistical probability is included in Appendix F (Table F-1, cell XVII). This calculation used an assumed density of two reproductive female fishers per 10,000 acres. This analysis found that at the beginning of the permit term, the probability that harvest may directly impact an occupied den site is less than three-hundredths of one percent per year for SPI's entire annual harvest in the Occupied Range.

For purposes of this analysis, we assume that timber harvest will harass fishers if the harvest occurs during the denning season within the same 50-acre stand that contains an active den site. The likelihood that a timber harvest unit would intersect a portion of one active 50-acre den stand (and thus harass fishers) is approximately 55% when harvesting is occurring within 21 home ranges. The function used for this calculation is expressed in graphical form below. A detailed description of the harass calculations can be found in Appendix F (Table F-1).

Figure F-1: Probability of harassing a fisher den site, based on the number of 5,000-acre home ranges harvested in during the denning period.



Based on the analysis in Appendix F, we propose to seek incidental take coverage for the possibility of accidental killing or injuring of two adult female fishers and four kits or juvenile fishers per year (60 over the ten year permit period), and for an additional 18 fishers (180 over the ten-year permit period) that might accidentally be harassed. These estimates do not account for the likely reduction that would result from seasonal restrictions on harvest area and protection of potential den trees contained in the minimization efforts included in the CCAA Conservation Measures, which would be expected to substantially reduce the chances of killing, injuring, or harassing fishers.

## 9.2 ESTIMATING POTENTIAL HARM

For any species, the evaluation of the likelihood of taking through harm, per the definition of harm provided in Section 7.2.6, requires understanding of the effects of habitat modification on the species. Unfortunately, no studies have directly addressed questions regarding impacts of habitat modification on fishers. Moreover, conclusive determination of thresholds is very difficult, due to natural variation in habitat conditions and animal response to habitat change, along with the challenges of conducting large-scale, long-term field studies. Therefore, we will use the limited available information and reasoned analysis to estimate the potential that habitat modification will impair breeding, feeding, or sheltering, to the extent that a fisher will be killed or injured as the result of Covered Activities.

### 9.2.1 Impact of Habitat Modification on Fishers

We found no studies that attempted to attribute changes in survival or reproductive success of individual fishers to changes in habitat at local scales. Studies summarized by Lofroth et al. (2010, p. 91) reporting on habitat selection and avoidance varied in the strength of their conclusions, but generally indicated that fishers avoided open habitats, such as will be created by activities under this CCAA. However, the degree to which varying amounts of habitat modification may affect fishers in our area is unknown. Following, we provide a brief review of the most relevant literature.

Weir and Courbold (2010, pp. 407-408), evaluated home ranges of ten female fishers located about once per ten days over a two-year period in British Columbia. They reported that estimated relative probability of occupancy by fishers at the landscape scale decreased by 50% with every modeled increase of 5% in wetland or recently harvested forest, and that potential home ranges with greater than 20% in openings without forest canopy were not occupied by fishers. Given the small sample and different geographic and ecological conditions, it is doubtful that these results can be appropriately applied to our area (R. Weir, pers. comm.).

More locally, several other studies made inferences regarding thresholds of habitat conditions required at various scales to maintain occupancy by fishers. Thompson et al. (2011) used the range of habitat conditions known to be occupied by fishers in the southern Sierra Nevada to estimate projected impacts of proposed forest fuel treatments. They concluded that some treatments would modify habitat to a condition not representative of known habitat, especially where canopy cover would be substantially reduced. However, these modeling results were not tested in the field, and actual fisher responses to such treatments remain un-described.

Garner (2013, p. 42-44) investigated the effects of fuels treatments that reduced stem density in fisher habitat. He reported on fisher habitat selection at the second order (home range and core-use area) and third order (resting and foraging sites). He noted avoidance of treated areas in forests composed of mostly conifers, but where hardwoods were retained within a mixed-conifer forest, such avoidance was not evident. However, Garner did not provide pre-treatment and post-

treatment stand inventory data that might inform the establishment of a habitat retention threshold for consideration of harm.

Niblett et al. (2014) analyzed radio-telemetry data collected by James et al. (2008) and SPI's forest inventory data to evaluate habitat conditions in five known female fisher home ranges at SWSA. These home ranges (100% KDE) consisted of up to 9% open areas, including burns and recent clearcuts. Whether these fishers would have tolerated more openings in their home range is unknown.

Subsequent to the SWSA telemetry study of 2006-2007 (James et al. 2008), SPI has harvested an additional 12% of the area (7% clearcut and 5% Alternative prescription). In January of 2015 approximately 41% of the SWSA was surveyed using camera stations that included hair snares. The area surveyed overlaid the two female fisher home ranges found in 2006-2007 in the southern portion of the SWSA. The genetic analysis of the 2015 hair samples showed a minimum of two unique females and six unique males occupying the area. This sex ratio is similar to the number of females to males captured during the trapping done during the initial trapping stage of the SWSA telemetry work (James et al. 2008, p.9). This study area lies within the occupied range of fisher in northwestern California, but the extent to which the habitat conditions at the SWSA can be applied to other parts of the fisher's range on SPI lands is unknown.

All of these studies described apparent selection of territories related to landscape condition, rather than fishers' response to habitat modification events, which might proceed differently. None of these studies established a lower threshold of forested habitat necessary to maintain occupancy, so the degree of habitat modification that actually crosses the threshold of harm to individual fishers is unknown. Even if a clear threshold had been described for a given study area, the area of landscape over which it could be applied would be unknown.

The issue of estimating harm is complicated further by the fact that displacement of fishers (or any species) in response to habitat modification does not in itself constitute harm as defined at 50 CFR 17.3, if the displacement does not result in killing or injuring "by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering." Thus, if sufficient habitat exists to support breeding, feeding, or sheltering after Covered Activities are completed and the fisher's use this habitat without a substantial impairment of these life functions, harm has not occurred.

The preceding discussion demonstrates the difficulty in establishing a standard by which likelihood of harm can be evaluated. We are unlikely to know whether specific Covered Activities are actually taking place within the territory of a fisher, or the boundaries of that territory. But, given the broad distribution of habitat and fishers in the occupied range in California and the large size of home ranges, it is reasonable to expect that our activities will regularly occur within fisher territories to some extent.

### 9.2.2 Estimating Harm

Estimating the amount of incidental take in the form of harm (defined at the beginning of Section 9 above) that may be caused by Covered Activities requires incorporating a threshold of habitat modification beyond which harm is assumed to occur. The following discussion describes our process for deriving a threshold for estimating and projecting the amount of harm for this CCAA.

As stated above, the location of fisher territories is unknown, and no information is available on the effects of habitat modification on fishers at the home range scale. As a result of these issues, evaluation of habitat modification on specific existing territories in specific landscapes will not be possible. Thus, we must rely on reported patterns of habitat selection to make inferences as to quantity and characteristics of habitat where fishers may occur, establish a general estimated

habitat threshold on that basis, and estimate the number of instances when Covered Activities might reduce habitat to below that threshold.

As a result, any habitat threshold selected for estimating the amount of harm is subject to considerable error, and any estimated amount of harm over time will be imprecise. With these caveats, in the following discussion we provide a reasonable and replicable method for estimating harm, based on assumptions about habitat occupancy and impacts of habitat modification.

The overall quantity of habitat on SPI and on adjacent owners within the Occupied Range has been considered in our assumptions regarding harm. Within the hexagons in the Occupied Range that include more than 50 acres of SPI ownership, SPI owns approximately 47% of the habitat. Another 35 % is in public ownership. Outside the area of intermixed ownership, the proportion of public ownership is even higher. The distribution of habitat on SPI was evaluated by the Territory Opportunity method, and in combination with other ownerships in the LEAF evaluation. Based on these analyses, we conclude that at the landscape level, fisher habitat is abundant and well distributed. Adult males and juveniles that are no longer dependent on their mothers (>6 months old), are highly mobile and not constrained to limited areas by the requirements of bearing and raising young. Therefore, for purposes of estimating harm, we assume that neither adult male fishers nor juveniles >6 months old are subject to harm by the Covered Activities. Thus we did not establish a harm threshold for adult male and juveniles >6 months of age.

We incorporate only adult females in the estimate of harm, because we assume that any juveniles that are too young to escape harvest activities would be accounted for in the kill and harass estimate. Outside the denning period juveniles are assumed to be mobile enough to disperse from the affected territory before being harmed.

In Sections 6.8.1 through 7.2.6, we explained our use of a hexagonal grid and the SPI timber inventory system with specified amounts of contiguous habitat to delineate Territory Opportunities. To estimate the projected quantity of harm, we used the hexagon analysis described in Section 7.2.1-7.2.6 to calculate the number of Territory Opportunities, beginning in year 2012 (Year 0, the most recent modeling interval) and projected through the ten-year period of the CCAA. For the purpose of modeling harm, when a Territory Opportunity is affected by projected timber harvest to the extent that it no longer qualifies as a Territory Opportunity, one instance of projected harm has occurred.

For the purposes of this estimation, we will assume that a female fisher occupies every Territory Opportunity on the landscape, and we will assume that harm will occur any time timber harvest changes an existing Territory Opportunity to a condition where it no longer qualifies as a Territory Opportunity. This provides an estimate of harm based on a density of females that is higher than the presumed density for the kill/injure /harass calculation (i.e., 224 Territory Opportunities based on habitat quality vs. 133 breeding females based on two breeding sites per 10,000 acres.) This approach incorporates the premise that harm is related to habitat, and a territorial female can be subject to harm even in a year when she is not present in a reproductive den subject to kill/injure/harass. Based on the hexagon analysis described in Section 7.2 and summarized in Appendix A, we estimate that 79 of the 224 Year 0 Territory Opportunities (35%) will be reduced to a condition that no longer qualifies as a Territory Opportunity, and thus, 79 adult female fishers will be incidentally taken due to harm.

This method probably overestimates the actual amount of harm that will occur for several reasons. In particular, it seems unlikely that every Territory Opportunity is actually occupied by a unique female fisher in every year. And, this analysis ignores nearby Federal lands, which in many cases provides substantial amounts of habitat that will remain available after SPI's harvest nearby. Also, it is seems unlikely that a small amount of habitat modification that changes the status of a Territory Opportunity will always result in harm.

Conversely, harm might be underestimated using our proposed methodology if harvested habitat being used by fishers did not initially qualify as a Territory Opportunity. As an example, at the SWSA, several fisher territories (located by radio telemetry) did not meet our minimum habitat threshold for designation as a Territory Opportunity, primarily because the average tree diameter (QMD) was below the criteria for HF4 or HF2Hv.

We recognize that these potential errors of overestimation and underestimation are related to the choice of criteria for habitat description and the required amount. Given the range of biological variation and the very limited data available, we believe our choices of criteria are reasonable, but we can only estimate the effects of habitat modification. Therefore the projected amount of harm is only an estimate.

We propose to seek authorization for incidental take due to harm for all of the estimated loss of Territory Opportunities. Assuming that each Territory Opportunity is occupied by an adult female fisher, this translates to 79 adult female fishers that we estimate will be harmed over the 10-year CCAA period within the Occupied Range.

## 9.3 SUMMARY OF REQUESTED INCIDENTAL TAKE

Based on the preceding analyses, we are seeking authorization for incidental take of up to 60 fishers via kill/injure, and up to 180 via harass over the term of the permit. We are also seeking authorization for incidental take of up to 79 fishers via harm over the term of the permit. Regardless of the uncertainty as to when or whether incidental take will actually occur via kill/injure or harass, we will assume that these levels of take will occur, barring other circumstances. Therefore, the total incidental take requested is 319 fishers. The take is anticipated to be distributed approximately equally on an annual basis. As stated previously, because of possible double counting of incidental take, this total may be an overestimate.

## 9.4 IMPACTS OF THE TAKING

As described in Appendix F for the purposes of this evaluation, we assume that there are 133 territories occupied by female fishers annually on SPI lands (one per 5,000 acres on 663,278 acres of Mixed land class available in the Occupied Range) and that each has two kits in a den site during the reproductive season. Assuming a sex ratio of one adult male to two adult females (Truex et al. 1998 and Zielinski et al. 2004 cited in Self et al. 2008), there are about 66 adult males in the population under consideration. In assessing the impact of the taking during the permit period, it is not appropriate to compare the total take over the ten-year period against the initial population size, because annual reproduction and mortality in the remaining population is not accounted for over the period. Therefore, we regard the annual proportional impact as the most accurate representation of the impact to the population.

To examine the potential effects of SPI's projected incidental take via kill and harass or harm during the term of the CCAA, we investigated other studies involving removal of fishers. In California there is only one source that estimated effects of removal. Swiers (2013) evaluated the effects of removal of adult fishers during two consecutive years from the Eastern Klamath study area (EKSA) in northern California for reintroduction in the Stirling Management Area. The results are not directly comparable to SPI's projected take because of differences in the removal rate, the period of effect, the population density, the amount of area involved, and possible difference in timber harvest regimes. However, the study by Swiers (2013) does provide valuable perspective, and we will refer to it in several ways in the following discussion.

### 9.4.1 Impacts of Killing and Harass

Based on the assumptions stated above and all the other assumptions incorporated into Appendix F and Sections 9.1 and 9.2, 398 adult female and juvenile fishers are associated with occupied den sites during the reproductive season in the population under consideration, of which about 24 fishers may be killed, injured, or harassed annually. Expressed as a percentage, this comprises about 6.0% of the assumed total female fisher and kit population estimate on SPI lands annually, and about 2.6% of the total population including adult males.

Importantly, Conservation Measures in 7.3.6.2 are designed to substantially minimize the amount of taking by killing, injuring, or harassing, so we do not expect take by these means to occur at the level projected in Appendix F and Section 9.1.1, even though we are seeking authorization for the projected amount.

### 9.4.2 Impacts of Harm

In terms of overall impact to a population, the relative effect of take by harm is probably greater than take by killing, injuring, or harassing, because harm through habitat modification eliminates or substantially modifies a basic resource for population stability. Conversely, where the habitat is not removed during population reductions, (e.g. see Swiers 2013), the remaining population of adults and annual recruitment of offspring can reoccupy the habitat where individuals have been removed.

Based on estimated values produced in Section 7.2 and Figure 7.2.7-2, harvesting would annually cause about eight of the 224 Territory Opportunities to fall below the threshold for inclusion as a Territory Opportunity (an estimated total of 79, or 35%, during the ten-year permit period). This change would result in assumed harm to about 3.5% annually of the adult females on all ownerships in the Occupied Range hexagons.

The modeled loss of Territory Opportunities is estimated to change 11 of the 54 Conservation LEAFs to non-Conservation LEAF status, leaving approximately 80% of the Conservation LEAFs functioning. Harm will occur in Support and Conservation LEAFs at similar rates, approximately 36%, as a proportion of the total number of Territory Opportunities in those LEAF categories. Conservation LEAFs that persist to provide Conservation Benefit will be distributed across the Occupied Range (see Appendix E).

Changes in one geographic location deserve further discussion. In the South Redding CSCA there are five Conservation LEAFs that will not persist according to the projections. The apparent impact of these modeled instances of harm on fishers would likely be greater than the actual impact, due to the preponderance of USFS ownership in those LEAFs. The average amount of USFS ownership in these five Conservation LEAFs is 51% (Appendix E; Redding South CSCA Ownership Map: Conservation LEAFs to Support LEAFs).

Swiers (2013) did not discuss existing amounts of habitat or ongoing habitat modification within his study area during the period of his analysis. Because the amount of habitat removed is germane to a comparison with the effects of SPI's projected harvest during the term of this CCAA, we analyzed the amount of timber harvesting in the EKSA. Our review of CAL FIRE timber harvest records indicated that timber harvesting was occurring in the study area throughout the study period (Table 9.3-1). Assuming that there were no retention measures specifically intended to maintain fisher denning/resting habitat, an unknown portion of the non-regeneration harvesting could have made those areas unsuitable in addition to the effects of the regeneration harvest. Using the CAL FIRE THP records and SPI's GIS, and assuming that no harvest took place on federal

land, we estimate that the amount of habitat removed was approximately 11.5% of the total EKSA acres in the ten-year period preceding and including the fisher removals from the study area.

Table 9.4.2 –1 Private timber harvest 12 years prior to, and during fisher removals in the EKSA.

| | Silvicultural Treatments | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Harvest Year | Alternative Practice | Clearcut | Commercial Thin | Rehabilitation | Sanitation Salvage | Shelterwood Prep Cut | Shelter-wood Removal | Shelter-wood Seed Cut | Selection | Seed Tree Removal | Total Acres Harvested |
| 1997 | 303 | 270 | 59 | | | | 217 | 25 | 142 | | 1017 |
| 1998 | 93 | 315 | 126 | | 10 | | 144 | 85 | | | 774 |
| 1999 | 278 | 18 | 85 | | 8 | 36 | 103 | | 6 | | 533 |
| 2000 | 92 | 58 | 86 | | | | 95 | | | 38 | 371 |
| 2001 | 3 | | 46 | 85 | 69 | | 80 | | | | 284 |
| 2002 | 2505 | 751 | 256 | | | 12 | 443 | 9 | 605 | | 4693 |
| 2003 | 417 | 539 | 56 | | 72 | | 208 | 13 | | | 1306 |
| 2004 | 133 | 278 | | | | | | | | | 411 |
| 2005 | 850 | 384 | | | | | 494 | | | | 1660 |
| 2006 | 83 | 517 | | | | 8 | | | 13 | | 620 |
| 2007 | 85 | 176 | 59 | | | | | | | | 321 |
| 2008 | 154 | 418 | | | | | 63 | | 57 | | 698 |
| 2009 | 833 | 479 | | | | | 116 | | | | 1428 |
| 2010 | 1739 | 382 | | | | | 5 | | 5 | | 2151 |
| Total Acres | 7566 | 4586 | 774 | 85 | 159 | 56 | 1856 | 132 | 827 | 38 | 16265 |
| Percent EKSA | 6.0% | 3.6% | 0.6% | 0.1% | 0.1% | 0.0% | 1.5% | 0.1% | 0.7% | 0.0% | 12.9% |

Using Swiers' (2013) population estimate, and an assumed sex ratio of 2 females to 1 male as estimated above, the crude landscape density of female fishers in his study area prior to removal was about one per 3,743 acres, or roughly 2.7 per 10,000 acres. This density is about 35% higher than the presumed density of Territory Opportunities at the beginning of the analysis period across SPI's lands within the fisher's occupied range in northern California.

Given lack of data regarding habitat condition, the differences in rate of harvest, and the different population density, we conclude that valid comparisons cannot be drawn between the population effects of habitat modification in Swiers' (2013) study and the proposed amount of habitat removal in this CCAA.

### 9.4.3 Summary of Impacts of Taking Fishers Under the CCAA

Swiers' (2013) analysis and the available timber harvest data for his study area indicate that regional fisher populations can withstand removal of individuals equivalent to killing the animals and can persist in forests that are subject to ongoing management. However, the limited available data and the differences in the situations preclude meaningful comparison between his study and the proposed effects of the CCAA. And we have no rigorous population estimates for the species. Thus we have no quantitative basis for comparing the impacts of taking under this CCAA and other studies.

As shown in Figure 7.2.3-3, SPI owns about 47% of the available habitat in the hexagons in the Occupied Range. Only SPI inventory data is used for classifying hexagons in the establishment of Territory Opportunities and in our criteria for harm based on modification of Territory Opportunities. In reality, considerably more habitat exists on other ownerships in the Occupied Range, including 32% federal ownership. We do not wish to make explicit assumptions about persistence of this habitat, but it is possible that sufficient habitat will remain in these Territory Opportunities to avoid actual take of fishers.

SPI's ownership provides a substantial fraction of available habitat in the areas of mixed ownership. However, there are large areas of the fisher's range where the U.S Forest Service is the dominant owner, and overall, SPI owns only about six percent of the area within the fisher's occupied range in northern California. Thus the area where the take will occur is limited, and the amount of take is quite small in proportion to the potential population of the entire occupied range.

In the remaining Mixed stands, continued growth and the influence of natural forces would be expected to improve forage habitat for fisher prey species by creating more snags and down logs, and further increase the number and size of available denning cavities. Thus, habitat improvement through growth should help offset the impact of the taking.

Despite the loss of Territory Opportunities, 80% of all the existing Conservation LEAFs will be maintained with habitat on SPI lands, providing for a remaining population distributed throughout the Occupied Range. And, the amount of habitat retained on the Enrolled Lands will be in excess of 50% of the entire Capable Land present at the beginning of the permit.

Therefore, we anticipate no important population impacts of the proposed taking by either habitat modification or impacts to occupied den sites and stands.

## 10. ASSURANCES PROVIDED

In accordance with the ESA regulation 50 CFR 17.22(d)(5), through this CCAA SPI seeks assurances from the Service that no additional conservation measures or additional land, water, or resource use restrictions, beyond those voluntarily agreed to and described in this CCAA, will be required should fishers become listed as a threatened or endangered species during the permit period. In the event the fisher is listed under the U.S. ESA, of listing the fisher, we anticipate that these assurances will be authorized with the issuance of an enhancement of survival permit under section 10(a)(1)(A) of the ESA.

## 11. ASSURANCES PROVIDED TO PROPERTY OWNER IN CASE OF CHANGED OR UNFORESEEN CIRCUMSTANCES

The regulatory assurances provided by the Permit are linked to the existence of changed circumstances and unforeseen circumstances. As defined in 50 CFR 17.3, "Changed circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan or agreement that can reasonably be anticipated by plan or agreement developers and the Service and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events)."

As also defined in 50 CFR 17.3, "Unforeseen circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan or agreement that could not reasonably have been anticipated by plan or agreement developers and the Service at the time of the conservation plan's or agreement's negotiation and development, and that result in a substantial and adverse change in the status of the covered species."

The proposed assurances listed below apply only to SPI's Enrolled Lands where the Section 10(a)(1)(A) permit and the CCAA itself are being properly implemented, and are applicable only with respect to fishers, the species covered by this CCAA.

### 11.1 CHANGED CIRCUMSTANCES NOT PROVIDED FOR IN THE CCAA

The threat of effects to fishers related to climate change, while anticipated, is not considered a Changed Circumstance for this CCAA. We cannot describe the likely conditions caused by climate change with enough detail to select a threshold for creating a changed circumstance. Potential effects of climate change will be gradual and likely be unmeasurable during the term of this CCAA. We do acknowledge that climate change may affect SPI forests and operations, primarily due to changes in the natural disturbance regimes. The potential outcomes of climate change are incorporated within the sections describing natural disturbances as changed circumstances.

## 11.2 CHANGED CIRCUMSTANCES PROVIDED FOR IN THE CCAA

Service CCAA guidance (USFWS 2003, p.16-17) states the following regarding Changed Circumstances:

*Changed circumstances provided for in the Agreement.* If additional conservation measures are necessary to respond to changed circumstances and the measures were set forth in the Agreement's operating conservation program, the Permittee will implement the measures specified in the Agreement.

*Changed circumstances not provided for in the Agreement.* If additional conservation measures not provided for in the CCAA's operating conservation program are necessary to respond to changed circumstances, the Service will not require any conservation measures in addition to those provided for in the CCAA without the consent of the Permittee, provided the CCAA is being properly implemented.

The Changed Circumstances provided for in the Agreement are: 1) Substantially damaged timberlands as defined in 14 CCR 895.1 ; 2) Failure to maintain Conservation LEAFs due to factors beyond SPI's control; 3) Listing of other species; and 4) Lack of Wildlife Trees available for retention in Harvest Units. There are no other Changed Circumstances provided for in the Agreement.

Conditions that may result in a determination of Changed Circumstances, and measures to address such circumstances are discussed below.

### 11.2.1 Changed Circumstance: Natural Disturbance Causing Substantially Damaged Timberlands

The potential natural disturbances addressed in this CCAA are: fire, wind throw, hail storm, drought, pathogens, and pests. Each of these threats can kill or damage large numbers of mature trees over extensive areas. Where natural disturbance has killed or damaged trees to the extent that the stocking requirements of the FPRs are not met, the area is referred to as Substantially Damaged Timberlands in the FPR (14 CCR 895.1). The location, timing, and extent of the impacts to the Enrolled Lands from such natural disturbances are not predictable.

A natural disturbance of 2,500 contiguous acres or larger on the Enrolled Lands that creates the condition of Substantially Damaged Timberlands will be considered a Changed Circumstance.

In SPI's view, replanting a new forest is most important for rapidly restoring the area as suitable fisher habitat, as well as for erosion control and economic productivity. Therefore, the mitigation for substantially damaged timberlands will usually include salvage harvesting. Salvage harvesting in Substantially Damaged Timberland will include the Conservation Measures specified in Section 7.3.5. Typically, emergency salvage harvesting will begin as soon as possible on Substantially Damaged Timberland. SPI will conduct salvage harvest operations as necessary and in compliance with the FPRs (14 CCR, 931-949.7, and 1052-1052.5), to recover the dead and dying timber and complete restoration work.

SPI will notify the Service within 30 days of such events. Notification will include a map including the area affected by the natural disturbance and the approximate area where emergency salvage harvesting is to occur. The notification will include a statement that estimates the number of Conservation LEAFs that exist and percentage of Mixed expected to persist on the Enrolled Lands following the salvage operations. The USFWS may observe active Emergency Salvage operations concurrent with Timber Operations, contingent upon 48-hr notification to SPI so that personnel safety can be adequately addressed.

SPI anticipates that if 43 or more Conservation LEAFs are intact and are likely to persist for the term of the permit, after the Substantially Damaged Timberlands have been salvaged, the conservation benefit is considered met. If the Substantially Damaged Timberlands results in a reduction of Conservation LEAFs below 43, then the USFWS will need to determine in writing whether the conservation benefit derived from the CCAA in total continues to contribute substantially to the conservation of fishers or whether the impacts of the Substantially Damaged Timberlands are so significant that the Service must re-evaluate the Permit.

SPI anticipates that if more than 50% of the Mixed land class available at the beginning of the permit is intact and are likely to persist, after the Substantially Damaged Timberlands have been salvaged, and all other CCAA measures remain in place, the conservation benefit is still considered met. If the substantially damaged timberlands results in a reduction of Mixed below 50% of the Enrolled Lands, then the Service will need to determine in writing whether the conservation benefit derived from the CCAA in total continues to contribute substantially to the conservation of fishers, or whether the impacts of the Substantially Damaged Timberlands are so significant that the Service must re-evaluate the Permit. SPI's standard practice of SPI shifting logging operations from "green" sales to salvage reduces the loss of Mixed land class and should prevent the 50% limit from being exceeded.

### 11.2.2 Changed Circumstance: Failure to Maintain Conservation LEAFs

As described in Section 7.3.1, SPI commits through this CCAA to maintain at least 43 of the 54 Conservation LEAFs (80%) during the permit term. If the number of Conservation LEAFs maintained falls below 43 due to factors beyond the control of SPI, this will constitute a Changed Circumstance. SPI will notify the Service if harvesting by another landowner and/or a natural disturbance will cause the number of Conservation LEAFs to fall below 43. The Service will determine in writing whether the conservation benefit derived from the CCAA in total continues to contribute substantially to the conservation of fishers, or whether the impacts of the loss of Conservation LEAFs are so significant that the Service must re-evaluate the Permit.

### 11.2.3 Changed Circumstance: Listing of other species

Listing of an additional species within the Enrolled Lands as threatened or endangered under the U.S. ESA, subsequent to the approval of this CCAA, will be considered a Changed Circumstance.

In the event the Service lists a new species that might occur on the Enrolled Lands and may be "taken" by the Covered Activities, SPI will request technical assistance with the Service for the newly listed species such that unauthorized take is avoided.

### 11.2.4 Changed Circumstance: Lack of Wildlife Trees Available in Harvest Units

As described in Section 7.3.4, Wildlife Trees are to be identified in all harvest units at a rate of 1 per 5 acres or 4 per 20 acres. The SPI structure inventory (SPI 2013b & Appendix H) (Nesting /

Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas) indicates a high frequency of potentially suitable den trees in the Mixed land class (2 per acre). Because the frequency of potential Wildlife Trees is high, the expectation is that Wildlife Trees will be available to be identified in nearly all harvest units and the retention standard will be met.

The intent of the conservation measure is to meet the Wildlife Tree standard in all harvest units. If monitoring as described in section 12.2.3.2 determines that the appropriate number of Wildlife Trees were not available for retention in more than 5% of the harvest units, it will constitute a Changed Circumstance. Failure to meet this standard will require the parties to meet and discuss why Wildlife Trees were not available and/or what corrective actions will be implemented to ensure the full complement of Wildlife Trees are retained. The annual third party certification (SFI) report will include a provision tracking the fulfillment of the Wildlife Tree requirements.

### 11.3 UNFORESEEN CIRCUMSTANCES

If natural disturbances result in substantially damaged timberland on more than 250,000 ac. cumulatively of SPI's Enrolled Land, during the permit period, it will constitute an Unforeseen Circumstance. In the event of an Unforeseen Circumstance, SPI and the Service will meet and confer regarding a course of action.

(A) If additional conservation measures are necessary to respond to unforeseen circumstances, the Director may require additional measures of the permittee where the Agreement is being properly implemented, but only if such measures are limited to modifications within the Agreement conservation strategy for the affected species, and only if those measures maintain the original terms of the Agreement to the maximum extent possible. Additional conservation measures will not involve the commitment of additional land, water, or financial compensation, or additional restrictions on the use of land, water, or other natural resources available for development or use under the original terms of the Agreement without the consent of the permittee.

(B) The Service will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. These findings must be clearly documented and based upon reliable technical information regarding the status and habitat requirements of the affected species. The Service will consider, but not be limited to, the following factors:

(1) Size of the current range of the affected species;
(2) Percentage of range adversely affected by the Agreement;
(3) Percentage of range conserved by the Agreement;
(4) Ecological significance of that portion of the range affected by the Agreement;
(5) Level of knowledge about the affected species and the degree of specificity of the species' conservation program under the Agreement; and
(6) Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

## 12. IMPLEMENTATION MONITORING & REPORTING

### 12.1 MONITORING & REPORTING

Monitoring of the conservation measures proposed in Section 7.3 is intended to ensure that SPI's commitments to and progress towards meeting the standards established in the CCAA.

Monitoring will be done systematically, efficiently, and utilize methods and timing that provide accurate and reliable information. The timing for monitoring will vary depending on the measure being evaluated. Some monitoring will be conducted by third party certification entities already conducting audits of SPI practices, and some will be done by CAL FIRE during THP administration. Third party certification monitoring will include annual reports that are provided to the Service by June 30th of each year. CAL FIRE monitoring will only generate a report (Notice of Violation) when the implementation of a Conservation Measure is not met. The retention measures described in 7.3 and other conservations measures provided for in this CCAA will become part of the operational requirements of individual THPs submitted by SPI for operations on the Enrolled Lands. Once these measures are incorporated into THPs, the CAL FIRE regulatory monitoring methodology can be relied on such that compliance is assumed unless a violation of an enforceable standard (conservation measure) is identified. SPI and FWS will work cooperatively to accomplish the intent of the Conservation Measures in section 7.3.4. This cooperative effort should entail an educational exchange of information during pre-operational or post-operational field reviews.

#### 12.1.1 USFWS Compliance Monitoring

The USFWS has the prerogative to inspect any of the Enrolled Lands at any time following 48 hrs. notice to SPI for the purpose of confirming that the Conservation Measures in this CCAA are being implemented.

### 12.2 REPORTING ON CONSERVATION MEASURES, HARM, AND TAKE MINIMIZATION

Reporting will be scheduled such that the USFWS US Fish and Wildlife Service is informed in a timely manner regarding the minimization of take, implementation of Conservation Measures, the accounting for incidental take and Changed Circumstances.

The purpose of reporting is to verify that the conservation measures are being implemented, to ensure that the level of take authorized is not exceeded, and to provide the FWS with the opportunity to remove fishers when take is imminent (although this is an unlikely scenario). The reporting for this conservation agreement is structured to efficiently provide the Service with this important information at the appropriate time or stand age/condition, such that the results are a reliable estimation of the conditions that will persist in harvested areas across the Enrolled Lands.

Attainment of the standards committed to in Section 7.3.4 will be monitored by a third party during audits conducted as part of the Sustainable Forestry Initiative (SFI) certification process. Currently one-third of SPI's land base is audited each year, such that every 3 years all lands have been audited under the third party Sustainable Forestry Initiative (SFI) certification program. SFI audit reporting will be summarized and reported annually in the fall of the year following their summer field audits of the property. The third party SFI audit report is published on the internet and SPI will provide the Service with copies of this report when it is published each year. In addition, as noted above SPI will include the management of den structures (see Section 7.3.4.1) and snags, green culls, and down logs (see Section 7.3.4.2.2) as enforceable language in our THPs, which therefore will be monitored by CAL FIRE. CAL FIRE administrative review of active THPs is done annually and concurrent with operations. CAL FIRE violations (should any occur) that relate to these conservation measures will be forwarded to USFWS within 7 days of being received by SPI.

During the term of the permit SPI commits to continuing audits in the SFI or other third party certification process acceptable to both SPI and the Service. Data that will be used for reporting will be collected in a manner that mutually satisfies the SFI or other third party certification process and the USFWS.

An annual report of the findings compiled by the third party sustainability certification auditors will be prepared by SPI and delivered to the Service in a hard copy and electronic copy by June 30th of each year that this CCAA is in effect. This report will include the following:

- The amount of the Mixed land class persisting using the most up to date inventory data.
- A map of the Conservation LEAFs, showing where harm was assumed to have occurred in a Territory Opportunity and where the Territory Opportunities within each Conservation LEAF persist.
- A summary and quantification of the application of retention standards.
- A summary description and quantification of take minimization practices.
- A summary of water tanks that were remediated.
- A summary of marijuana grow sites that were identified and remediated.
- A summary of implementation of strategic fuels reduction.
- A summary of any observed strengths or weaknesses SPI perceives in the implementation of the CCAA and suggestions for improvements.

SPI will implement the Conservation Measures described in this CCAA on all harvest units that have not commenced silvicultural operational activities before January 1, 2016. A list of harvest units in THPs that are not yet completed and where silvicultural operational activities have commenced prior to January 1, 2016 will be provided to the Service prior to any third party audit (by June 30th 2016).

### 12.2.1 Harm Accounting

Annual instances of assumed harm occurrences associated with the implementation of covered activities in individual harvest units will be reported in the manner detailed in Section 7.2.10 (Annual Harvest Harm Accounting). Other covered activities that may result in harm via changes in Territory Opportunities shall also be included in the annual report. Each year the projected harm occurrences will be updated based on actual amount of harvest accomplished and other Covered Activities undertaken. The actual cumulative harm will be compared to the total permitted harm. The updated harm report will be included with the list of current year planned timber harvest units provided to the USFWS by February 28th of each year, commencing after the first year of operations under the permit.

Beginning February 28th, 2016 or within 30 days after the permit is signed, and on February 28th of each year thereafter, SPI will provide the USFWS a list of all harvest units and other covered activities that are planned for operations in the current calendar year that intersect a Territory Opportunity and are projected to cause harm (using the criteria established in Section 7.2.5).

### 12.2.2 Take Minimization

Take minimization monitoring reports will be summarized at the scale of the occupied range. Reporting will occur annually for harvest minimization actions. Natal den period harvest volume minimization (see Section 7.3.6.2.1) includes limits on harvest volume occurring between February 15th and May 15th. SPI will maintain a cumulative summary of these harvest amounts and they will be reported with the annual harm report. Since all harvest volume is required to be reported to the California State Board of Equalization (SBE), the SPI log accounting system which produces the SBE

reports also produces the bi-weekly logger payments, there is significant third party oversight to these reports, but if necessary SPI could make these records available to the Service to verify these volumes.

SPI will include the potential den avoidance felling practices (see Section 7.3.6.2.4) as enforceable language in our THPs. Therefore, these measures will be monitored by CAL FIRE and thus would not require reporting, except that SPI will provide the Service any CAL FIRE violation issued that indicates these measures were not implemented. CAL FIRE also maintains a violation database that the Service could audit if necessary. SPI will in the annual harm report also include a listing of all proposed tractor units that meet the ≥75% HF4 standard, which precludes commencing harvesting prior to May 15th. THPs that contain these units will include enforceable language that will preclude them from being harvested between March 1 and May 15th. Instances where operational limits require the falling of adjacent trees prior to falling potential den trees during the maternal denning period (May 16 through July 31) shall also be reported. Reports of observations of fishers in the vicinity of timber operations as described in Section 7.3.6.2.2 and the outcome of the follow-up investigation shall be reported to the Service immediately.

### 12.2.3 Retention

#### 12.2.3.1 Timing Issues in Monitoring and Reporting Retention

In even-aged harvest units, following timber harvest, site preparation usually occurs. Site preparation can involve one or more of the following: clear felling all sub-merchantable trees, deep tilling of compacted soil, tractor piling, and broadcast burning. These site preparation activities usually occur immediately following harvesting activities, if weather permits, and each treatment has the potential to degrade or remove retained structures in the even aged harvest units. The even-aged units are planted with conifer tree seedlings, generally in the spring of the year, following site preparation. Following site preparation activities SPI generally files a “Completion Report” with CAL FIRE. The Completion Report indicates to CAL FIRE that Timber Operations are complete and all erosion control, fuel hazard reduction, crossing facilities and roads are in a condition that complies with CFPRs and the specific requirements stated in the THP. Upon certification of the Completion Report by CAL FIRE, the maintenance period for the THP begins and timber operations can no longer be conducted on the THP, except for routine road maintenance.

Following the planting of even-aged units, the next management activity may be one or more herbicide treatments to control competing vegetation that is impacting the survival and growth of the conifer tree seedlings. These herbicide applications have the potential to reduce the number of regenerating hardwood trees in the even-aged unit. Herbicide treatments usually occur 1- 4 yr. following the planting of conifer seedlings, if deemed necessary. When the conifer trees are approximately 8-12 yr. old, the even-aged unit will be pre-commercially thinned. Pre-commercial thinning is done to reduce the tree density in the even-aged unit. Pre-commercial thinning also has the potential to reduce the number of regenerating hardwood trees in the even-aged unit. Even-aged units are considered free to grow following pre-commercial thinning and no further management activities will occur, for the next several decades, until the first commercial thin.

During the time period between site preparation and the pre-commercial thinning, there is the risk of incidental/illegal harvesting of standing hardwoods, retained conifers, or snags for firewood. This is because tractor skid roads are not yet overgrown with brush and saplings and the retained hardwoods or snags are easily seen and present an inviting target to would-be firewood cutters. SPI has a policy of controlling firewood cutting to only very limited areas of its ownership and restricting the cutting to dead or downed wood. Firewood cutting is by permit only. When a

permit to harvest firewood is issued, the harvesting area is described and limited to personal use firewood cutting. The process of managing firewood cutting is intended to reduce the amount of illegal firewood cutting while providing an opportunity for the public to utilize some of the waste material. Although SPI controls vehicle access wherever feasible, and prohibits firewood cutting of standing trees or snags, there are many areas (checker board ownership) where the public can and does drive roads that cross SPI forestland. SPI employs forest patrolmen to make sure its access gates are locked and persons are following the company firewood cutting policy.

#### 12.2.3.2 Individual Element Retention

Attainment of the postharvest implementation of habitat elements standards committed to in Section 7.3.4 will be monitored by a third party during audits conducted as part of the Sustainable Forestry Initiative (SFI) certification process.

Monitoring will confirm that SPI is implementing these habitat element standards. SPI proposes that monitoring and reporting on the successful retention of individual wildlife trees, snags, and down logs, and the regeneration of hardwoods, within even-aged units and emergency fire salvage areas be completed after such areas have been pre-commercially thinned (PCT). A post pre-commercial thinning unit report would be the most meaningful because it would be completed at a time beyond which most of the risks to those trees and structures would have passed, allowing the report to be more indicative of what will persist until the commercial thin. Given the permit term, it is unlikely that many (any) harvest units operated conducted under these standards will reach pre-commercial age, so SPI would be ready to implement a more detailed post PCT report if the CCAA is extended beyond 10 years.

Audits and reporting would be completed on a randomly chosen sample of SPI regeneration and non-regeneration units annually, from approximately 30% of the Enrolled Lands. Audits would be conducted as part of the sustainability certification program SPI is participating in. Currently 1/3 of SPI's land base is audited each year such that every 3 years all lands have been audited under the third party Sustainable Forestry Initiative (SFI) certification program. Such auditors will confirm whether the required retention standards have been met at sites where their audit occurs. These annual "early audit" areas will ensure that the retention standards are being implemented.

Additionally, ongoing monitoring by CAL FIRE during their THP compliance reviews will confirm annually whether the Conservation Measures in 7.3.4.1.2 – 7.3.4.1.4 and 7.3.4.2.2 are being implemented correctly.

#### 12.2.3.3 Habitat Retention Areas

SPI recommends that monitoring on Habitat Retention Area establishment in all harvest areas will be done in a manner that satisfies the SFI or other third party certification process. SPI proposes additionally that it will provide a more complete numerical support for this annual monitoring at a five year interval for regeneration harvests. In regeneration harvesting this numerical report timing should allow for completion of all site preparation activities that might negatively affect the persistence of the established HRAs. Reporting for the Habitat Retention Area (HRA) standards in regeneration units will require SPI to maintain a complete list of all units harvested after 1/1/2016. After five years of CCAA implementation, and using the latest National Agricultural Imagery Program (NAIP) image available that shows a subset of units that were harvested after 1/1/2016, in conjunction with the SPI GIS system, will be used to calculate the size of the HRA islands retained in this subset of regeneration units. This sample will be used to report compliance with the HRA area retention requirement.

Additionally, ongoing monitoring by CAL FIRE during their THP compliance reviews will confirm annually whether the Conservation Measures in 7.3.4.1.1 is being implemented correctly.

#### 12.2.3.4 Instances of suspected exposure to toxicants

SPI shall report via live voice communication to the USFWS, any instances of potential fisher exposure to toxicants that are discovered on the Enrolled Property within 24 hours of discovery. The USFWS may respond to investigate the likely impact to fishers including conducting a carcass search of the area. Exposure to toxicants will be assumed in any instance where toxic material (fertilizer, pesticides, etc.) is located such that fishers would have access to this material.

#### 12.2.3.5 Water tanks posing a risk of entrapment

SPI shall within 7 days report the discovery of and remedy applied to any water tank that poses an entrapment risk to fishers on the Enrolled Lands.

#### 12.2.3.6 Mortality reporting

SPI shall report via live voice communication to the USFWS, any incidence of known fisher mortality, regardless of cause, on the Enrolled Lands (within 24 hours) of discovery.

# 13. BIOLOGICAL EFFECTIVENESS MONITORING

## 13.1 INTRODUCTION

In order to help assess the effectiveness of the Conservation Measures on the fisher population, monitoring will be conducted for the continued presence of fishers. It is anticipated that implementing the CCAA conservation measures will sustain fishers use of the SPI forest land for all requisite life processes, and provide for increasing use of the non-occupied forestland should immigration or translocation of fishers occur in the future. SPI and the Service recognize that while much is known about the biology and behavior of fishers, a well-considered population occurrence reporting methodology will improve our knowledge of use of managed landscapes and provide information to guide adaptive management strategies that improve the suitability of the SPI managed timberlands for fishers.

In addition to a formal occupancy monitoring sample, SPI will also report any sightings/occurrences of fisher confirmed by SPI biology staff to the California Fish and Wildlife Natural Diversity Data Base (NDDB). A NDDB query will therefore reflect accurately the observations of this species across the extent of the SPI ownership.

## 13.2 FISHER OCCUPANCY MONITORING

Monitoring fisher occupancy will be done prior to the end of the 10 year permit period through some type of sampling effort. To sample the Occupied Range as defined in this CCAA, SPI anticipates using a non-invasive survey strategy presently being developed by the Stirling Fisher Translocation project, if it is determined to be both reliable and cost effective. Alternatively, SPI will conduct detection sampling per Zielinski and Kucera (1995, Appendix P) to monitor the presence of fisher on its ownership. The initial survey will be initiated by the spring of 2021.

In the unoccupied range, SPI will sample portions of the leading edges of the extant populations on the Enrolled Lands prior to the end of the 10-year permit term to help determine if the current populations are expanding. The reporting for this sample of the population distribution will begin within five years of the date of permit signing and be completed prior to the end of the 10-year term of the permit.

Over the course of the 10-yr agreement, it is likely that improved monitoring methodology will be developed. Therefore the parties will meet two years in advance of selecting the methodology and locations for these sampling efforts, to discuss which methodology should be used to monitor fisher populations, such that the most efficient and cost effective technique is employed. All sampling efforts will be conducted after soliciting information and attempting to coordinate with other parties conducting fisher investigations, such that efforts are not confounded or duplicated.

### 13.3 ADAPTIVE MANAGEMENT

SPI has submitted a CCAA with a proposed term of 10 years. Given that limited duration, it is unlikely that SPI or the Service will be able to conduct monitoring and analysis of fisher populations upon which to base adaptive management changes to the CCAA. Nevertheless, SPI commits to continue its involvement in on-going research into many aspects of forest and wildlife management as they relate to sustainable forest management. If that continuing commitment leads to the ability to achieve greater or equal benefit at equal or lower costs, SPI will propose such adaptive management changes to the Service for its consideration. Similarly, SPI expects the Service will continue fostering new research and increased knowledge, and expects that the Service would propose changes to the CCAA that achieve greater or equal benefit at equal or lower costs. SPI will consider those under the assurances policy and adopt those it finds appropriate.

If efforts to detect fishers in areas that are currently known (as of 2015) to be occupied fishers are not successful, an evaluation of potential reasons for presumed fisher absence will be conducted to develop an adaptive management strategy. The failure to detect fishers in areas where they have been previously known to occur may trigger the need to re-evaluate the ability of the agreement to achieve the CCAA standard.

If monitoring indicates that the agreed upon retention standards are not being applied or that their application is not resulting in the desired condition (for example if many retained trees blow over or do not remain standing, or if retained hardwoods are killed by herbicides), the Service and SPI will meet and cooperatively determine how to correct this situation by retaining additional trees, trees with different characteristics, or by altering practices such as the placement of retained elements as part of an adaptive management strategy.

## 14. NOTIFICATION OF TAKE REQUIREMENT

By signature of this CCAA, SPI, to the extent they can determine in advance that a potential take is going to occur, agrees to notify the Service at least 30 days in advance of an activity that would cause such a take. Potentially, actual take of fisher in the form of killing, injuring, or harassing could occur due to harvesting in or near a known occupied den stand. If possible the Service will be notified at least 30 days in advance of the activity that could cause such a take. If the potential take is imminent, the relevant Covered Activity will cease and the Service will be notified immediately. Due to the low likelihood of detecting fishers that are present, and especially due to the very low probability of a harvest unit overlapping a fisher den, this situation is extremely unlikely to occur.

Instances of projected harm as described in Section 7.2.10, or related to other Covered Activities, will be identified during planning by SPI. A comprehensive list of THPs and other Covered Activities that are projected to cause harm within the fisher Occupied Range will be provided to the Service on February 28th of each year. Assessment of other Covered Activities will be done on a project by project basis by a SPI Registered Professional Forester. In addition to the February 28th list of THPs where harm has been projected, the Service will be notified of any other potential take of fisher 30-days prior to the commencement of timber operations on approved THPs where projected harm has been modeled to occur.

## 15. DURATION OF CCAA AND PERMIT

This CCAA will be for the duration of 10 years from the date the Service signs and enters into the Agreement and issues the permit. The section 10(a)(1)(A) permit will become effective on the date of a final rule that lists fishers as threatened or endangered and continues through the end of the CCAA term. Should the permit become effective due to listing of the fisher, SPI will be allowed to take fishers, so long as the take is consistent with the terms of the CCAA. The Enrolled lands will be maintained in their existing and/or improved states as described above, from the date the land is enrolled under the CCAA until the end of the 10 year permit term. The permit and CCAA may be extended beyond the specified terms prior to permit expiration, with the agreement of the Parties in accordance with those USFWS regulations in place at the time of permit renewal.

## 16. MODIFICATION OF THE CCAA

During the term of the CCAA, the Service shall adhere to the Assurances described above and act in good faith according to the "No Surprises" policy and guidance provided for in 50 CFR 17.22(d)(5). Any party to this CCAA may propose modifications or amendments to this CCAA by providing written notice to, and obtaining the written concurrence of, the other Parties. Such notice shall include a statement of the proposed modification, the reason for it, and its expected results. The Parties will use their best efforts to respond to proposed modifications within 60 days of receipt of such notice. Proposed modifications will become effective upon the other Parties' written concurrence.

Modifications to the CCAA will occur occasionally, through the removals or additions of land to the enrolled lands through sale, purchases, or land exchanges. These changes are not expected to annually comprise more than 5% of the aggregate acreage of the enrolled lands. These changes are considered minor in nature, and at the landowner's discretion, and shall be included or excluded from the CCAA, with written notification to the Service in the annual take minimization report. Removals of land from the Enrolled Lands exceeding 10% cumulatively, in the Occupied Range, over the life of the permit, which will not continue to be bound by the requirements of this CCAA, will require SPI to provide written notice and obtain written concurrence from the Service and may require the Service to amend the permit in accordance with all applicable legal requirements. The changes in the land base as described above shall not alter the expected conservation benefits for fisher, shall not alter the amount of incidental take authorized, the accompanying analysis of the impacts of such taking, or the commitment by SPI to provide the prescribed amount of habitat over the term of the permit, or the commitment by SPI to maintain 80% of the Conservation LEAFs over the term of the permit.

## 17. AMENDMENT OF THE PERMIT

The permit may be amended in accordance with all applicable legal requirements including, but not limited to the ESA, the National Environmental Policy Act, and the Service's permit regulations at 50 CFR 13 and 50 CFR 17. Either SPI or the Service can propose an amendment. The party proposing the amendment shall provide a statement describing the proposed amendment and the reasons.

## 18. TERMINATION OF THE CCAA

As provided for in Part 8 of the Service's CCAA Policy (64 Fed. Reg. p. 32726), SPI may, for good cause, terminate implementation of the CCAA's voluntary management actions prior to the CCAA's expiration date, even if the expected benefits have not been realized. If the CCAA is terminated, SPI is required to surrender the enhancement of survival permit at termination, thus relinquishing take authority (if fishers have become listed at time of termination) and the assurances granted by the permit. SPI is required to give 60 days written notice to the other Parties of intent to terminate the CCAA. SPI must give the Service and CDFW an opportunity to relocate affected fishers. Relocation of such affected fishers is not mandatory.

If SPI and the Service agree to a subsequent HCP or CCAA that includes the enrolled lands in this HCP or CCAA, this CCAA may terminate upon signing of such a new HCP or CCAA pursuant to terms established therein, and SPI will surrender the permit for this CCAA in accordance with 50 CFR 13.26.

This CCAA analyzes the Stirling Management Area (SMA) CCAA Enrolled Lands in anticipation of incorporating those lands into this CCAA and thereby superseding the terms of the SMA CCAA. The terms associated with the surrender of the ESA section 10(a)(1)(A) enhancement of survival permit, issued under 50 CFR part 17, for the Stirling CCAA shall be adhered to as described in that CCAA (CCAA number TE166855-0).

## 19. PERMIT SUSPENSION OR REVOCATION

The Service may suspend or revoke the permit for cause in accordance with the laws and regulations in force at the time of such suspension or revocation (50 CFR 13.28(a)). The Service may also revoke the permit if continuation of permitted activities would likely result in jeopardy to any listed species, or directly or indirectly alter designated critical habitat such that it would result in adverse modification or destruction of the critical habitat, in accordance with 50 CFR 17.22(d)(7). Before revoking a permit, the Service, with work cooperatively with SPI to pursue all appropriate options to avoid revocation.

## 20. REMEDIES

Each party shall have all remedies otherwise available to enforce the terms of this CCAA and the permit, except that no party shall be liable in damages for any breach of this CCAA, any

performance or failure to perform an obligation under this CCAA or any other cause of action arising from this CCAA.

## 21. DISPUTE RESOLUTION

The Service and SPI agree to work together in good faith to resolve any disputes, using dispute resolution procedures agreed upon by all Parties.

## 22. SUCCESSION AND TRANSFER

This CCAA and its ESA section 10(a)(1)(A) permit shall be binding on and shall inure to the benefit of SPI and respective successors and transferees in accordance with applicable regulations in 50 CFR 13.24 and 13.25.

In accordance with 50 CFR 13.24, successors other than the permittee will have the same obligations and rights with respect to the enrolled lands under the CCAA and ESA section 10(a)(1)(A) permit if all provisions and qualifications for a successor are met.

Pursuant to 50 CFR 13.25, the rights and obligations under this CCAA and the ESA section 10(a)(1)(A) permit are transferable to subsequent nonfederal property owners. If the CCAA and permit are transferred, the new landowner(s) will have the same obligations and rights with respect to enrolled lands as SPI. The new landowner(s) must agree, in writing, to become a Party to the original agreement and permit. In accordance with 50 CFR 17.22(d)(3)(i), SPI shall notify the Service, in writing, of any transfer of ownership of any portion of CCAA enrolled lands.

## 23. AVAILABILITY OF FUNDS

The Parties acknowledge that the Service will not be required under this CCAA to expend any federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing. Implementation of this CCAA is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this CCAA will be construed by the Parties to require the obligation, appropriation, or expenditure of any money from the U.S. Treasury.

## 24. RELATIONSHIP TO OTHER AGREEMENTS

## 25. NO THIRD-PARTY BENEFICIARIES

This CCAA does not create any new right or interest in any member of the public as a third-party beneficiary, nor shall it authorize anyone not a party to this CCAA to maintain a suit for personal injuries or damages pursuant to the provisions of this CCAA. The duties, obligations, and responsibilities of the Parties, SPI and Service, to this CCAA with respect to third Parties shall remain as imposed under existing law.

## **26.** NOTICES AND REPORTS

A list of items to be included in the annual implementation report can be found in Section 12.2. Any notices and reports, including monitoring and annual reports, required by this CCAA shall be delivered to the persons/position listed below, as appropriate:

Sierra Pacific Industries designee:

_____ _____
Date

Dan Tomascheski
Vice President for Resources
Sierra Pacific Industries
P.O. Box 496014
Redding, CA 96049-6014
19794 Riverside Ave.
Anderson, CA 96007

Service designee:

_____ _____
Date

Jenny Ericson
Acting Field Supervisor
Yreka Fish and Wildlife Office
1829 South Oregon St.
Yreka, CA 96097

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Agreement to be in effect as of the date that the Service issues the permit.

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Appendix A: Enrolled Land Spreadsheet of Trends in Territory Opportunities: Quality Scores, Acreage of SPI, and Percent HF4 / HF2Hv by Decade.

**Territory Opportunity (TO) Summary Statistics: Enrolled Lands, Occupied only, Unoccupied only**

Some Definitions for this TO analysis
**Note: The TO's that have less than 500 acres of SPI are flagged as "Moderate Confidence" see Column "Mod. Confid."**
Q=20 is a 4 hex area with all 4 TO's individually meeting SPI definition of a Territory Core
Q=16 is a 4 hex area with 3 TO's individually meeting SPI definition of a Territory Core and the rest meet the Support Core definition.
Q=12 is a 4 hex area with 2 TO's individually meeting SPI definition of a Territory Core and the rest meet the Support Core definition.
Q= 8 is a 4 hex area with 1 TO's individually meeting SPI definition of a Territory Core and the rest meet the Support Core definition.

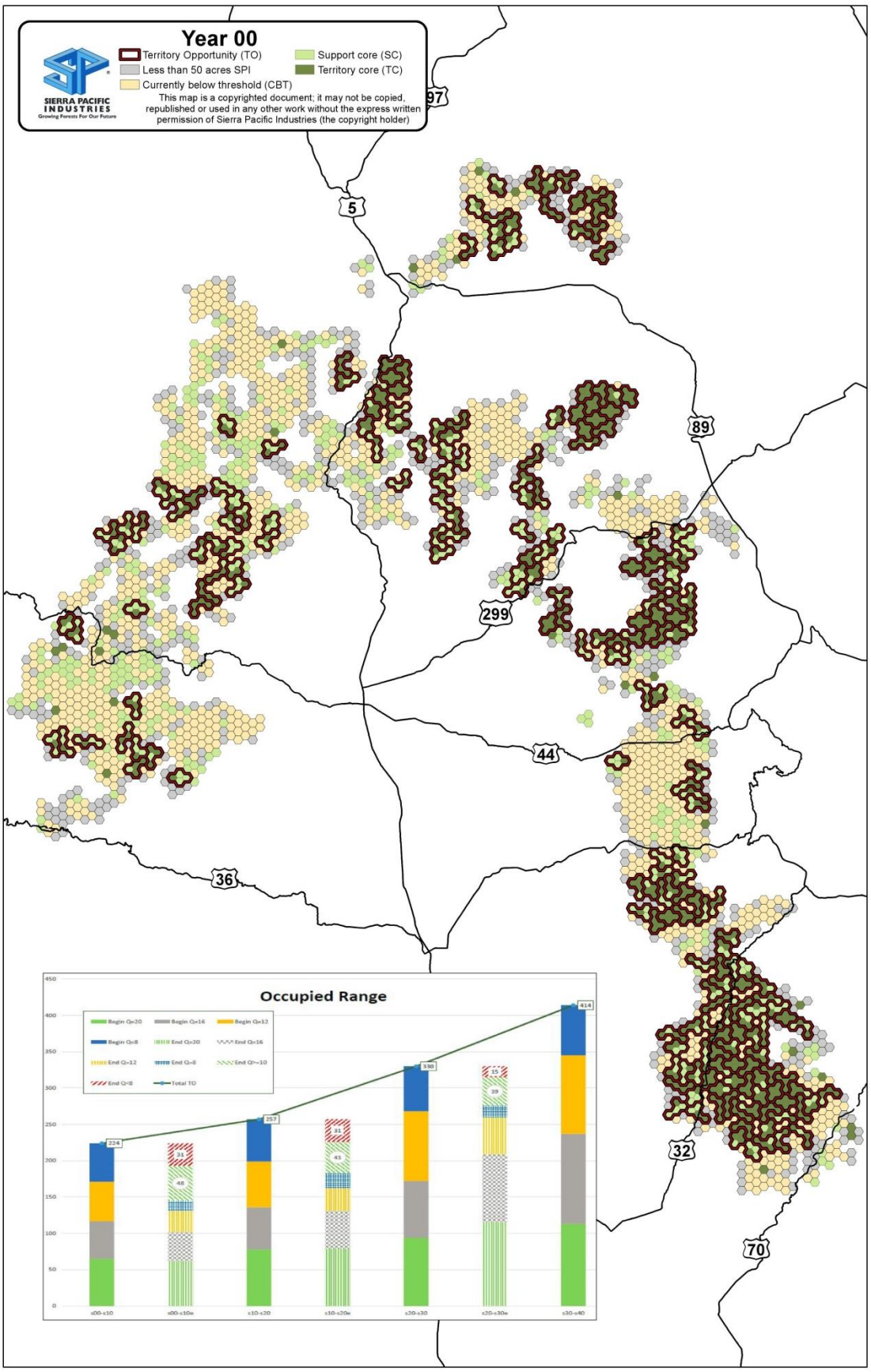
All TO Summary

| Time Period | | Total TO Count | Ave. TO Q Score | Total SPI ac. in TOs | Total ac. SPI HF2Hv in TO's | Total ac. SPI HF4 in TO's | Total TO Count | TO Count by Q score Q=20 | TO Count by Q score Q=16 | TO Count by Q score Q=12 | TO Count by Q score Q=8 | Ave. SPI acres in TO | Ave. SPI ac. HF2Hv in TO | Ave. SPI ac. HF4 in TO | Ave. % SPI HF2Hv in TO | Ave. % SPI HF4 in TO | Mod. Confid. | % Mod Confid. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| s00 | | 509 | 14.82 | 652,295 | 173,305 | 282,487 | 509 | 162 | 133 | 116 | 98 | 1,282 | 340 | 555 | 26.6% | 43.3% | 10 | 2.0% |
| s10 | | 578 | 14.93 | 737,238 | 180,970 | 323,602 | 578 | 203 | 138 | 116 | 121 | 1,275 | 313 | 560 | 24.5% | 43.9% | 11 | 1.9% |
| s20 | | 810 | 14.57 | 1,048,320 | 283,873 | 430,914 | 810 | 236 | 207 | 209 | 158 | 1,294 | 350 | 532 | 27.1% | 41.1% | 10 | 1.2% |
| s30 | | 944 | 14.81 | 1,207,570 | 366,049 | 469,036 | 944 | 275 | 271 | 239 | 159 | 1,279 | 388 | 497 | 30.3% | 38.8% | 15 | 1.6% |

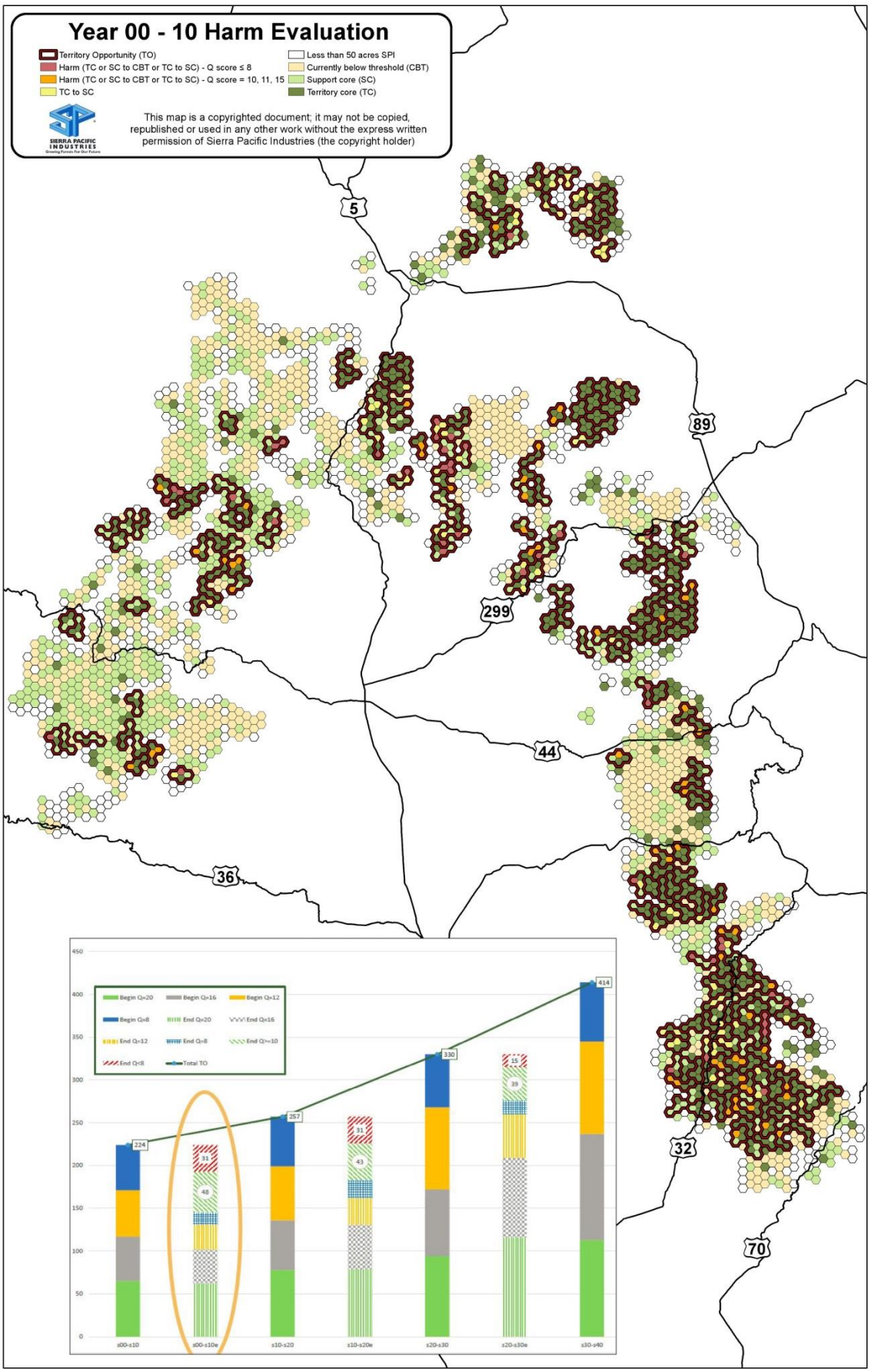
| Time Period | | Total TO Count | Ave. TO Q Score | Total SPI ac. in TOs | Total ac. SPI HF2Hv in TO's | Total ac. SPI HF4 in TO's | Total TO Count | TO Count by Q score Q=20 | TO Count by Q score Q=16 | TO Count by Q score Q=12 | TO Count by Q score Q=8 | Ave. SPI acres in TO | Ave. SPI ac. HF2Hv in TO | Ave. SPI ac. HF4 in TO | Ave. % SPI HF2Hv in TO | Ave. % SPI HF4 in TO | Mod. Confid. | % Mod Confid. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| s00 | | 224 | 14.30 | 298,774 | 88,466 | 119,292 | 224 | 65 | 52 | 54 | 53 | 1,334 | 395 | 533 | 29.6% | 39.9% | 4 | 1.8% |
| s10 | | 257 | 14.43 | 338,217 | 82,324 | 138,369 | 257 | 78 | 58 | 63 | 58 | 1,316 | 320 | 538 | 24.3% | 40.9% | 2 | 0.8% |
| s20 | | 330 | 14.47 | 442,390 | 113,285 | 176,604 | 330 | 94 | 78 | 96 | 62 | 1,341 | 343 | 535 | 25.6% | 39.9% | 1 | 0.3% |
| s30 | | 414 | 14.71 | 542,819 | 173,103 | 203,575 | 414 | 113 | 124 | 108 | 69 | 1,311 | 418 | 492 | 31.9% | 37.5% | 3 | 0.7% |

| Time Period | | Total TO Count | Ave. TO Q Score | Total SPI ac. in TOs | Total ac. SPI HF2Hv in TO's | Total ac. SPI HF4 in TO's | Total TO Count | TO Count by Q score Q=20 | TO Count by Q score Q=16 | TO Count by Q score Q=12 | TO Count by Q score Q=8 | Ave. SPI acres in TO | Ave. SPI ac. HF2Hv in TO | Ave. SPI ac. HF4 in TO | Ave. % SPI HF2Hv in TO | Ave. % SPI HF4 in TO | Mod. Confid. | % Mod Confid. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| s00 | | 285 | 15.23 | 353,521 | 84,839 | 163,195 | 285 | 97 | 81 | 62 | 45 | 1,240 | 298 | 573 | 24.0% | 46.2% | 6 | 2.1% |
| s10 | | 321 | 15.33 | 399,022 | 98,646 | 185,233 | 321 | 125 | 80 | 53 | 63 | 1,243 | 307 | 577 | 24.7% | 46.4% | 9 | 2.8% |
| s20 | | 480 | 14.64 | 605,930 | 170,588 | 254,311 | 480 | 142 | 129 | 113 | 96 | 1,262 | 355 | 530 | 28.2% | 42.0% | 9 | 1.9% |
| s30 | | 530 | 14.88 | 664,752 | 192,946 | 265,461 | 530 | 162 | 147 | 131 | 90 | 1,254 | 364 | 501 | 29.0% | 39.9% | 12 | 2.3% |

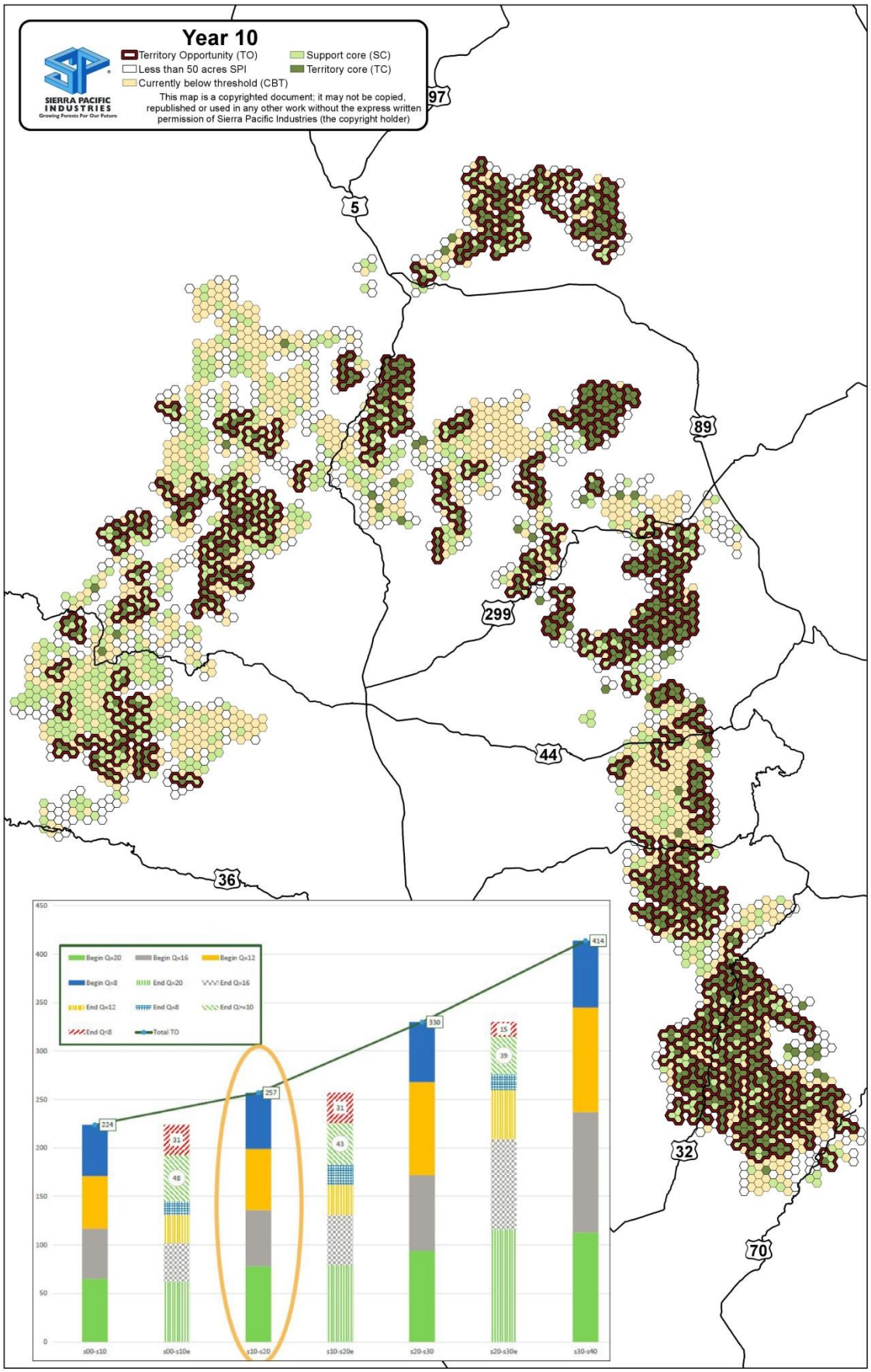
Appendix B: Occupied Region Map Territory Opportunities and Harm by Decade.



Appendix B: Occupied Region Map Territory Opportunities and Harm by Decade.



Appendix B: Occupied Region Map Territory Opportunities and Harm by Decade.



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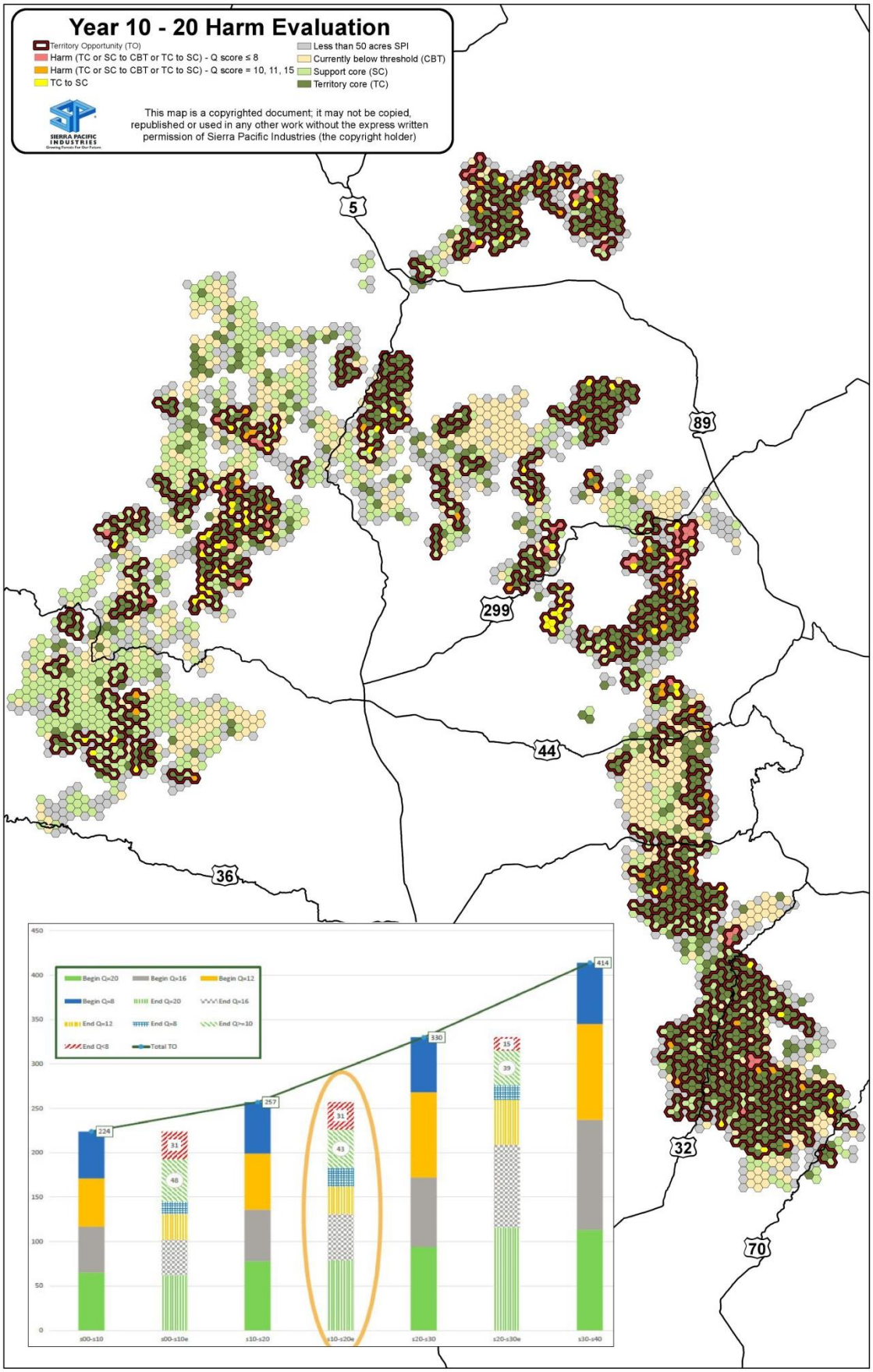

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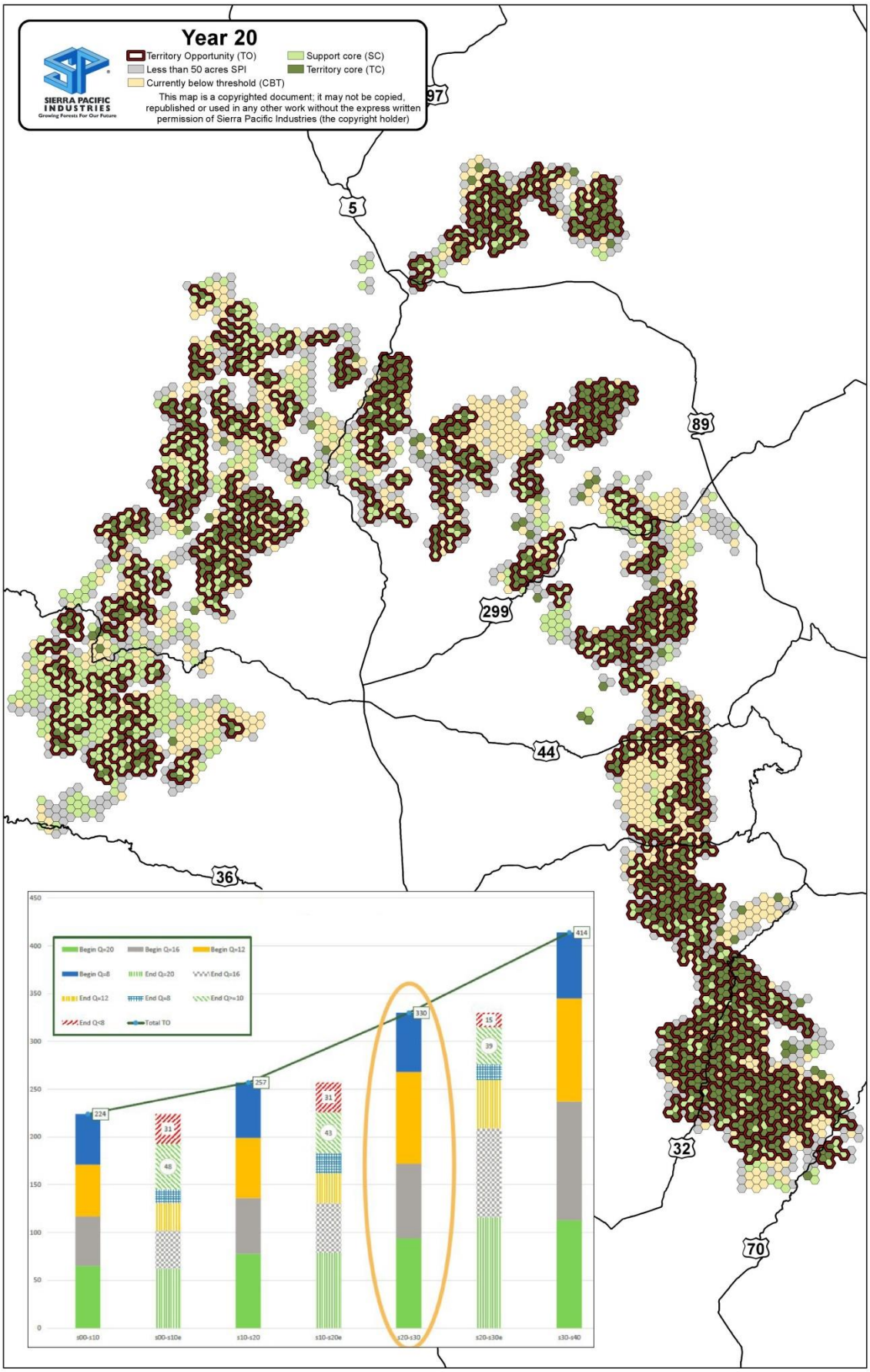

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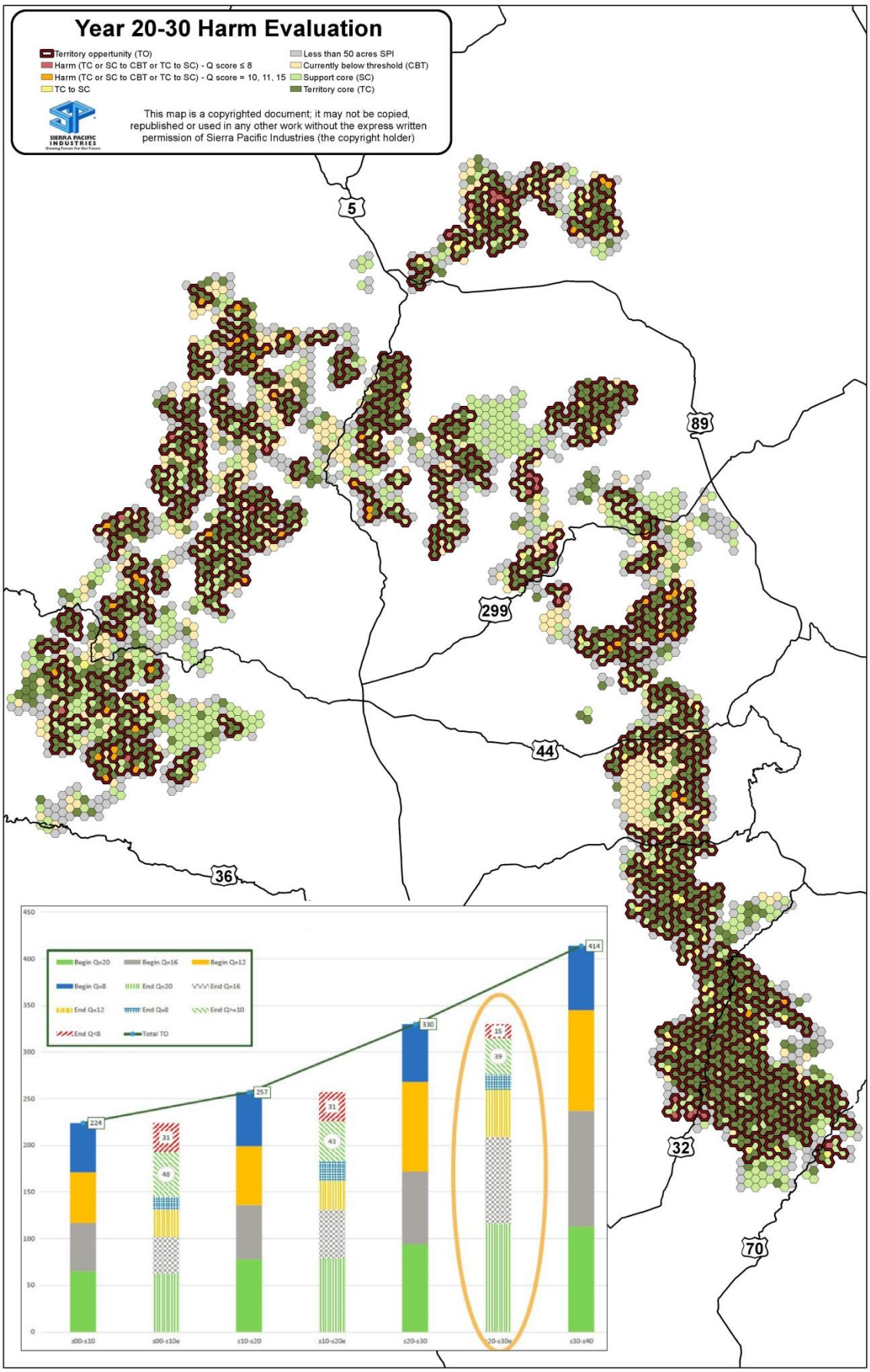

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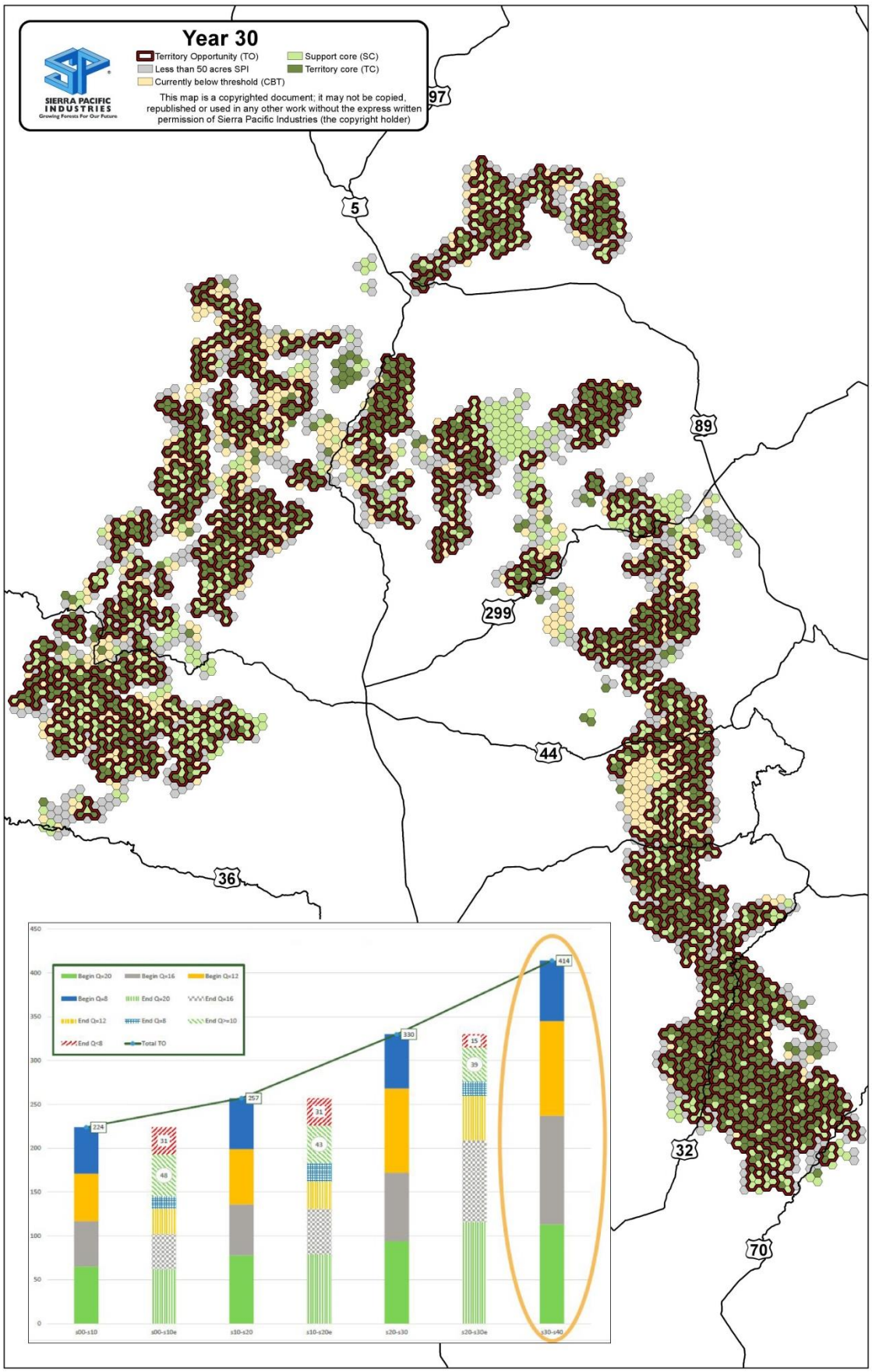
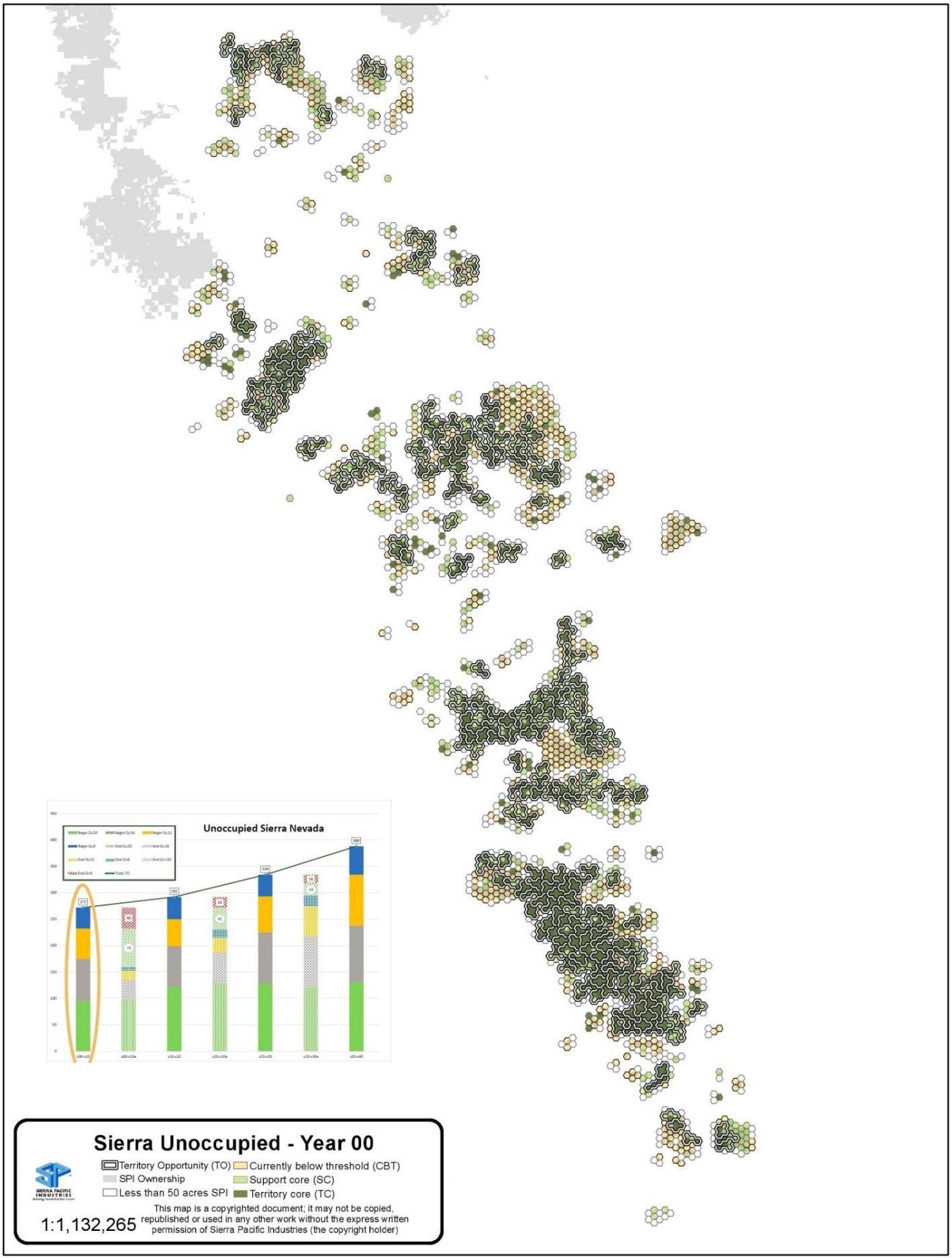


Appendix C: Unoccupied Sierra/Cascades Region Map Territory Opportunities, Quality Scores and Harm by Decade.



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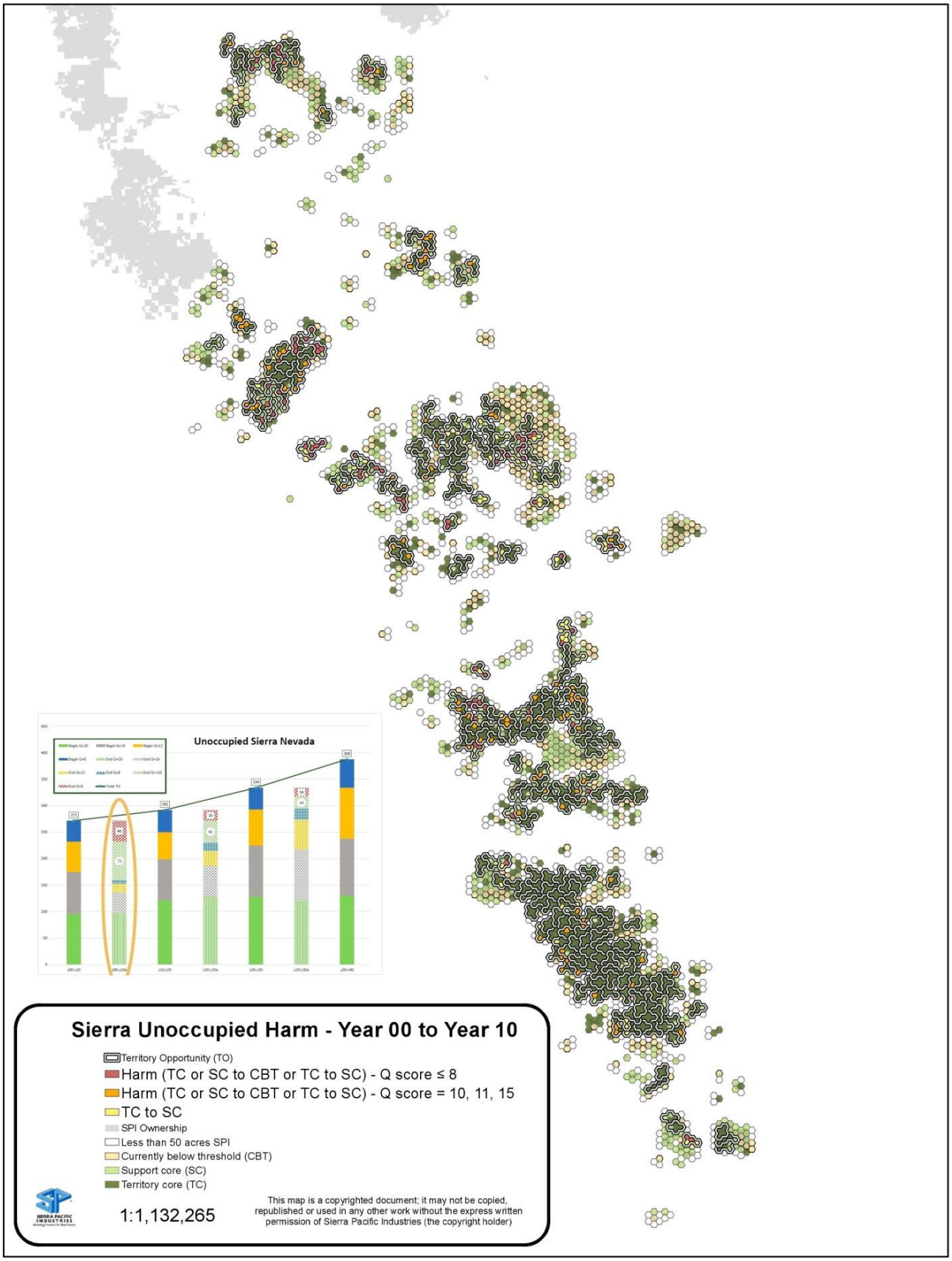

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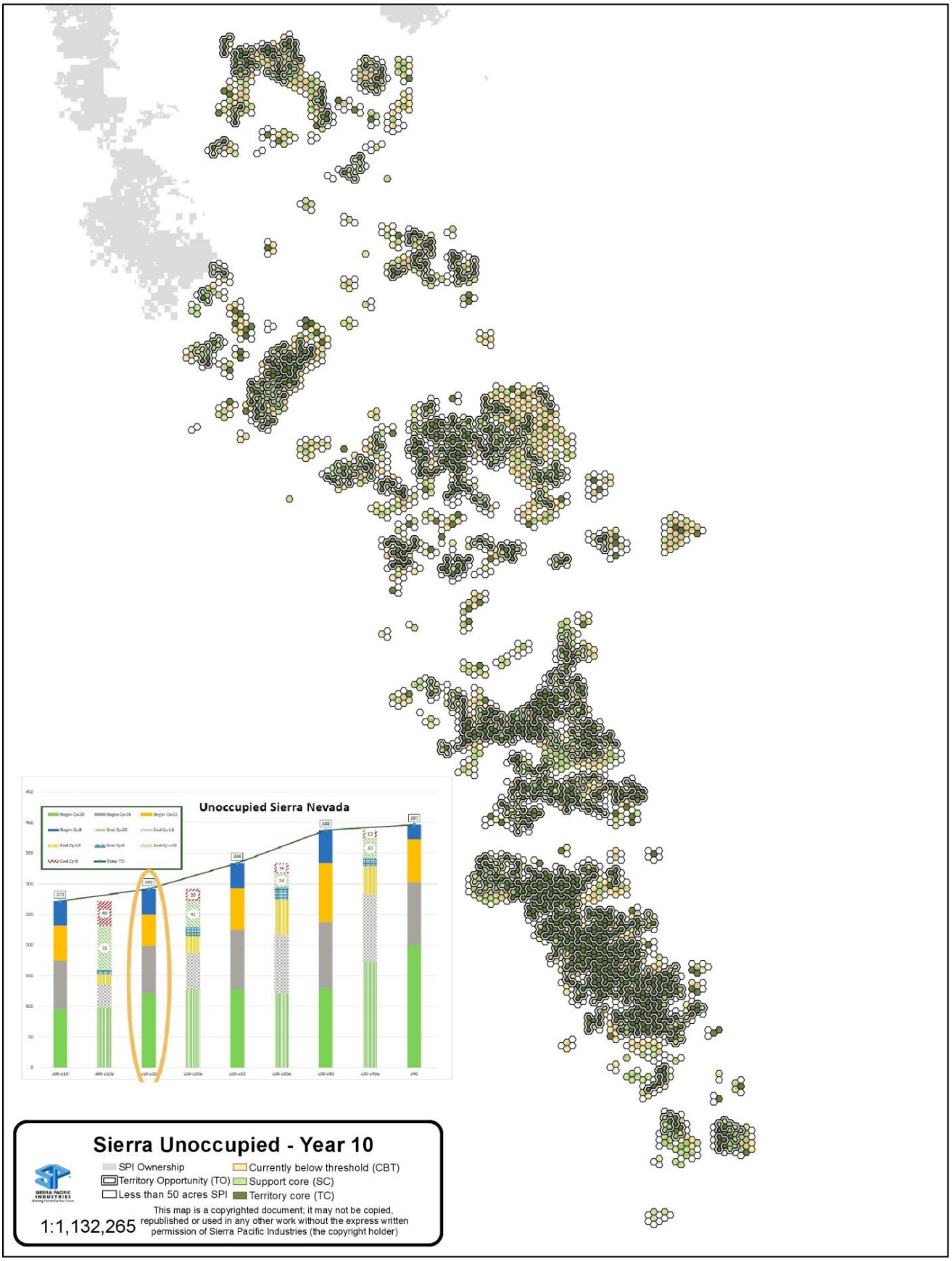

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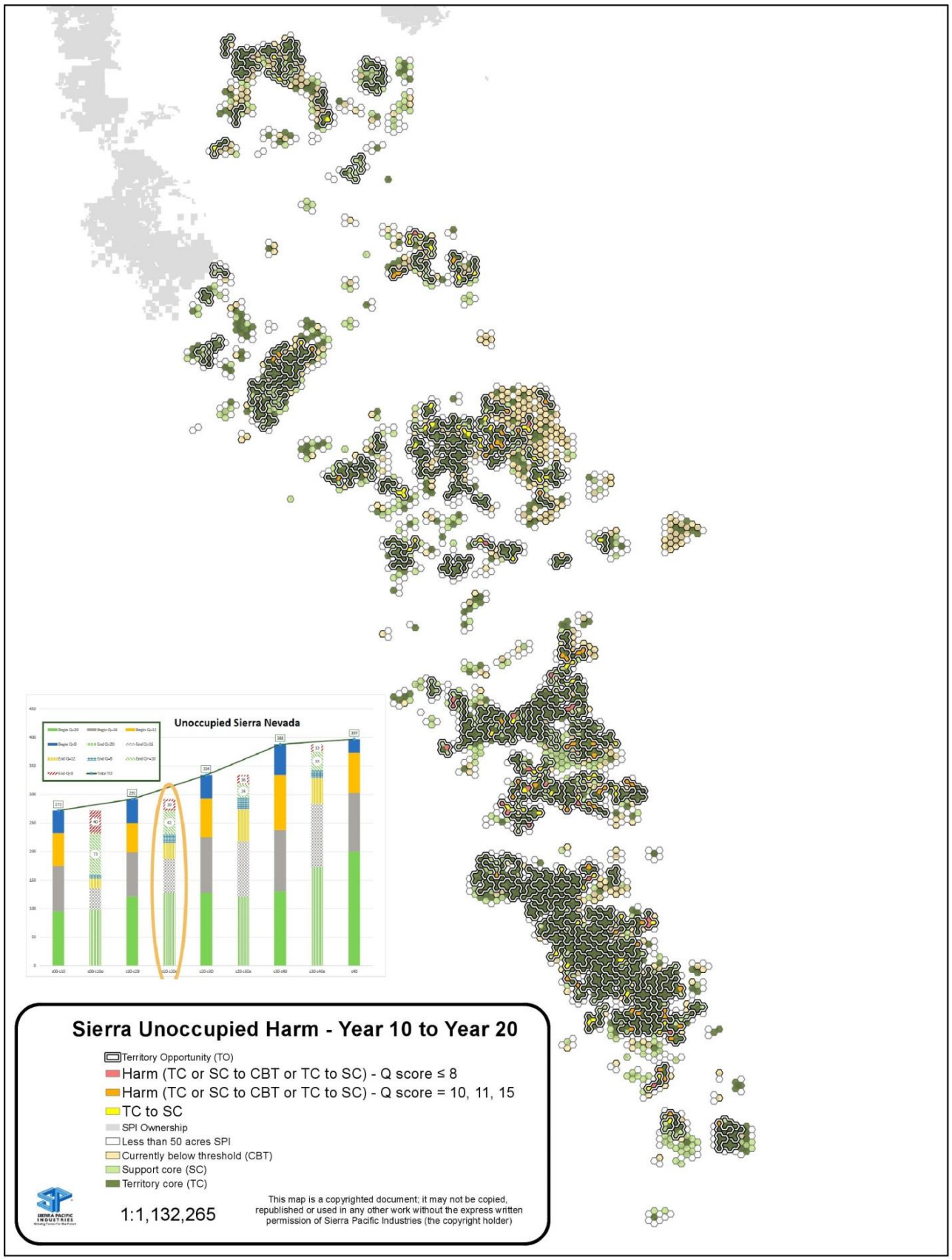

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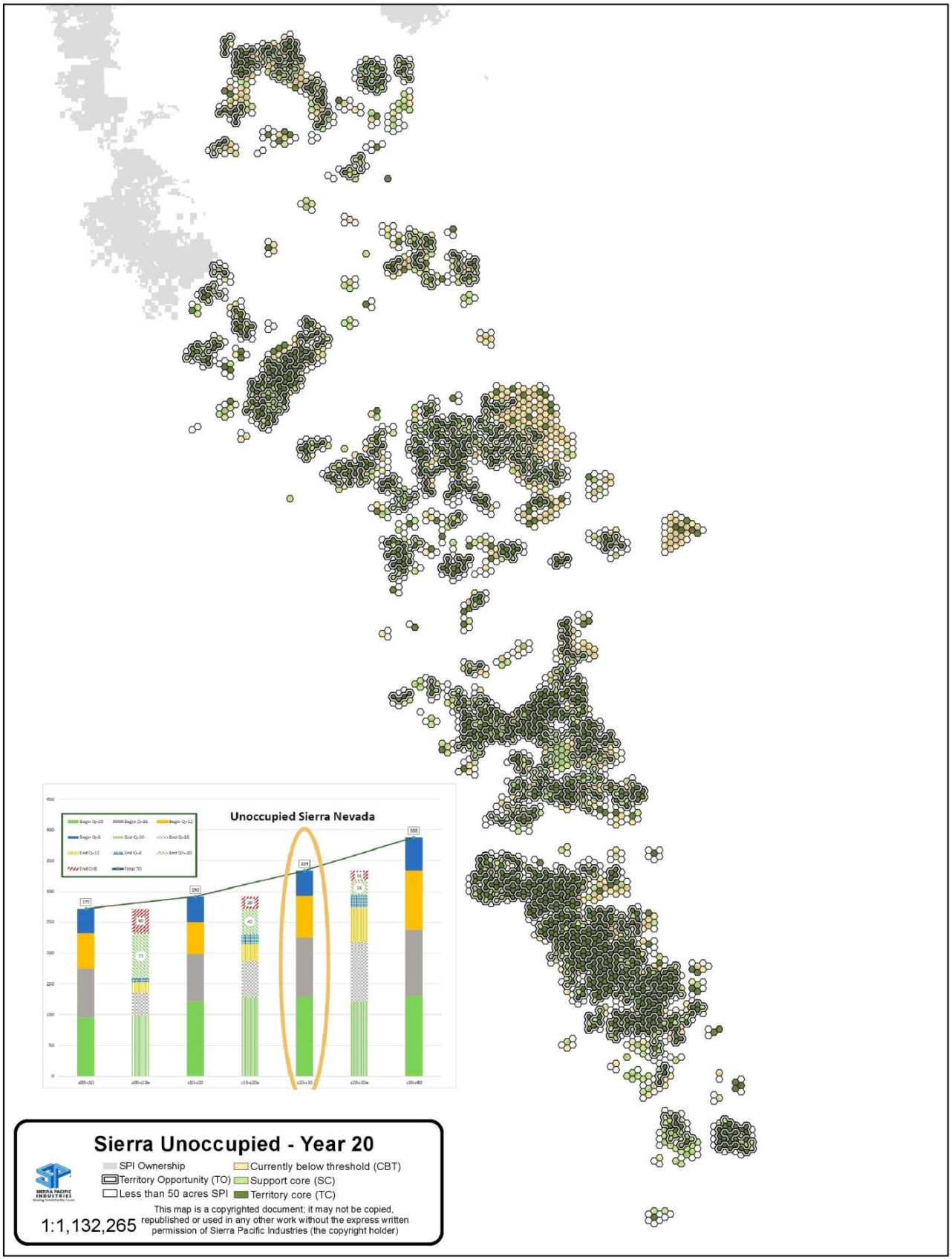

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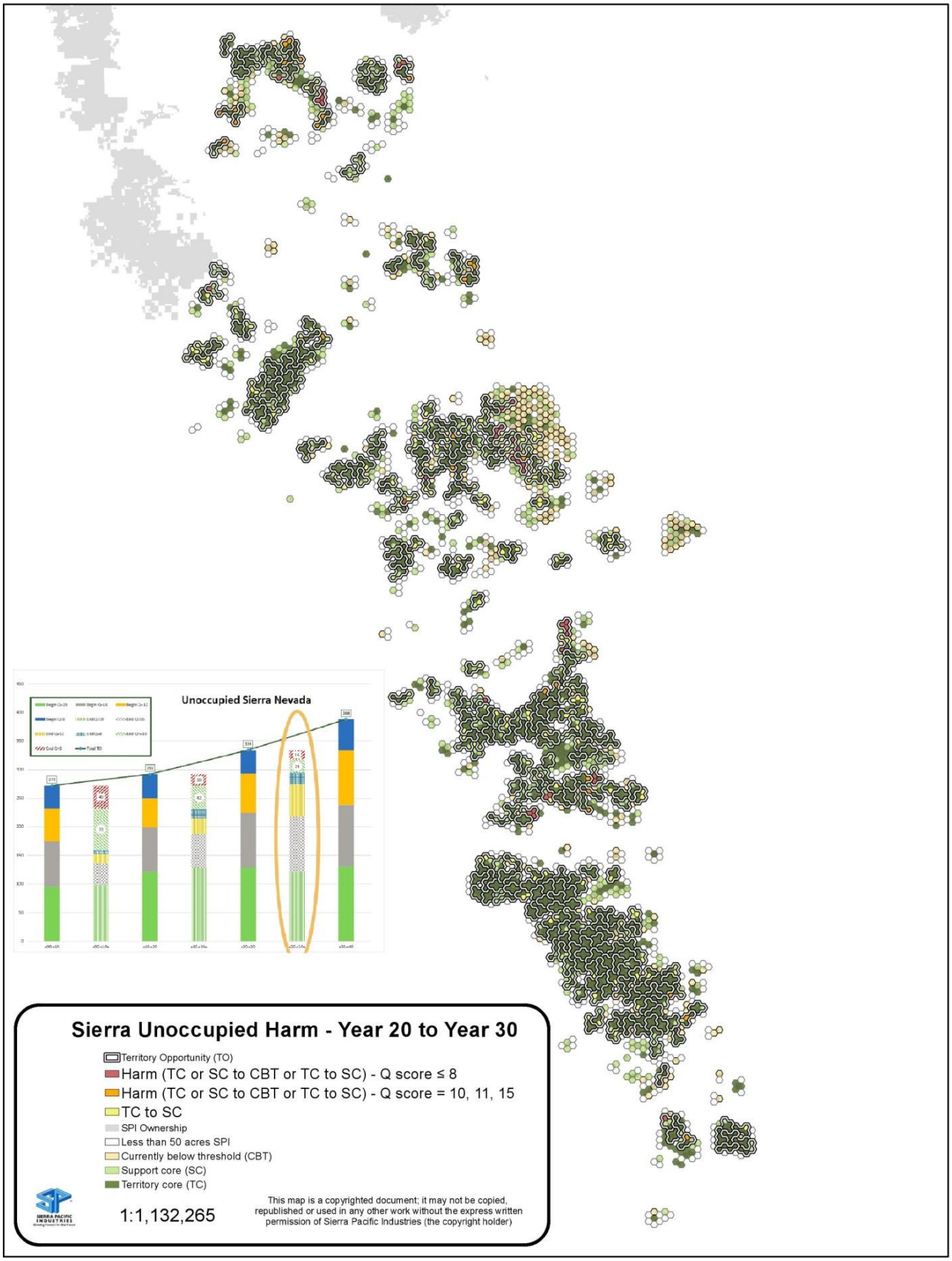

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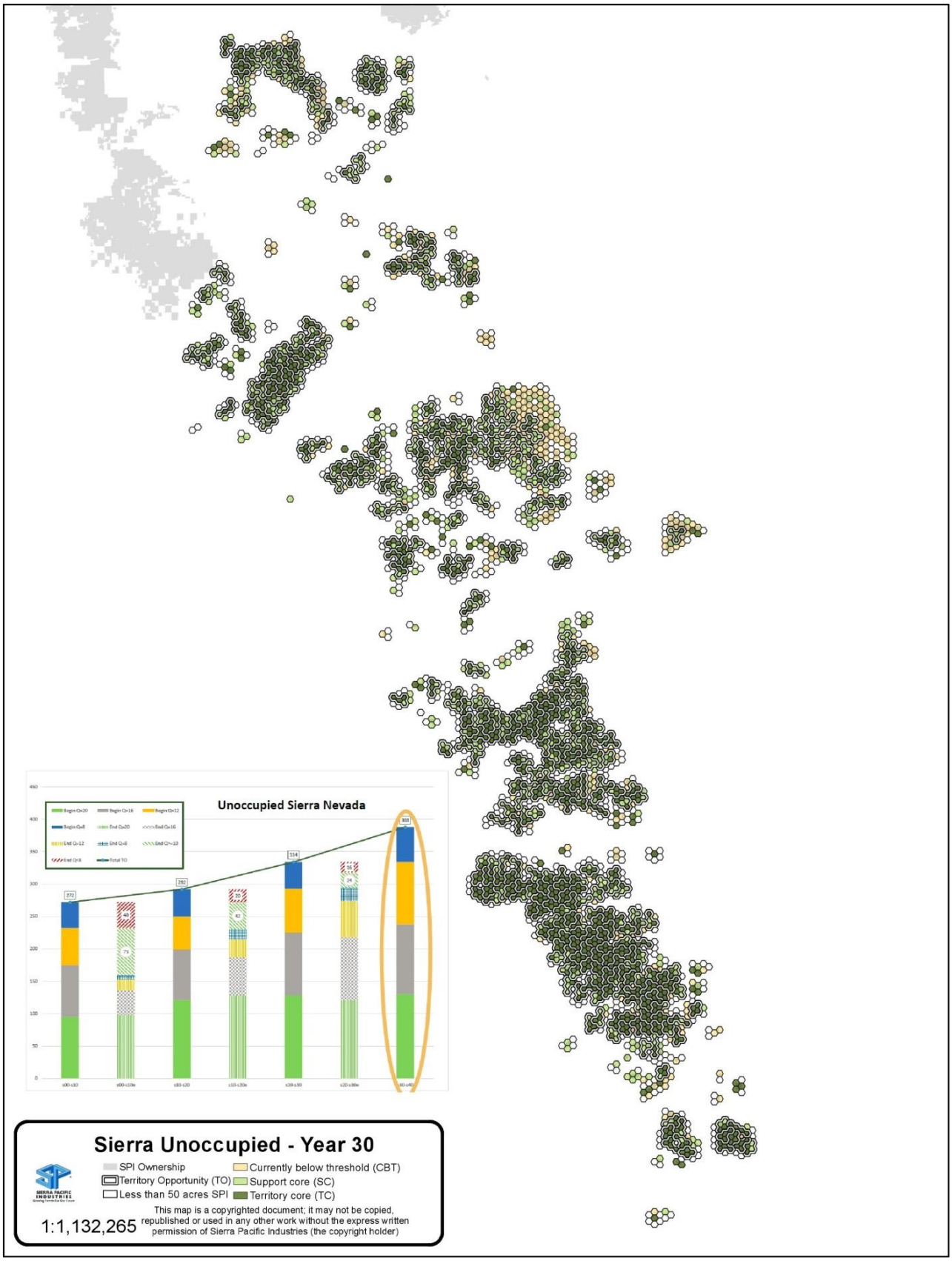
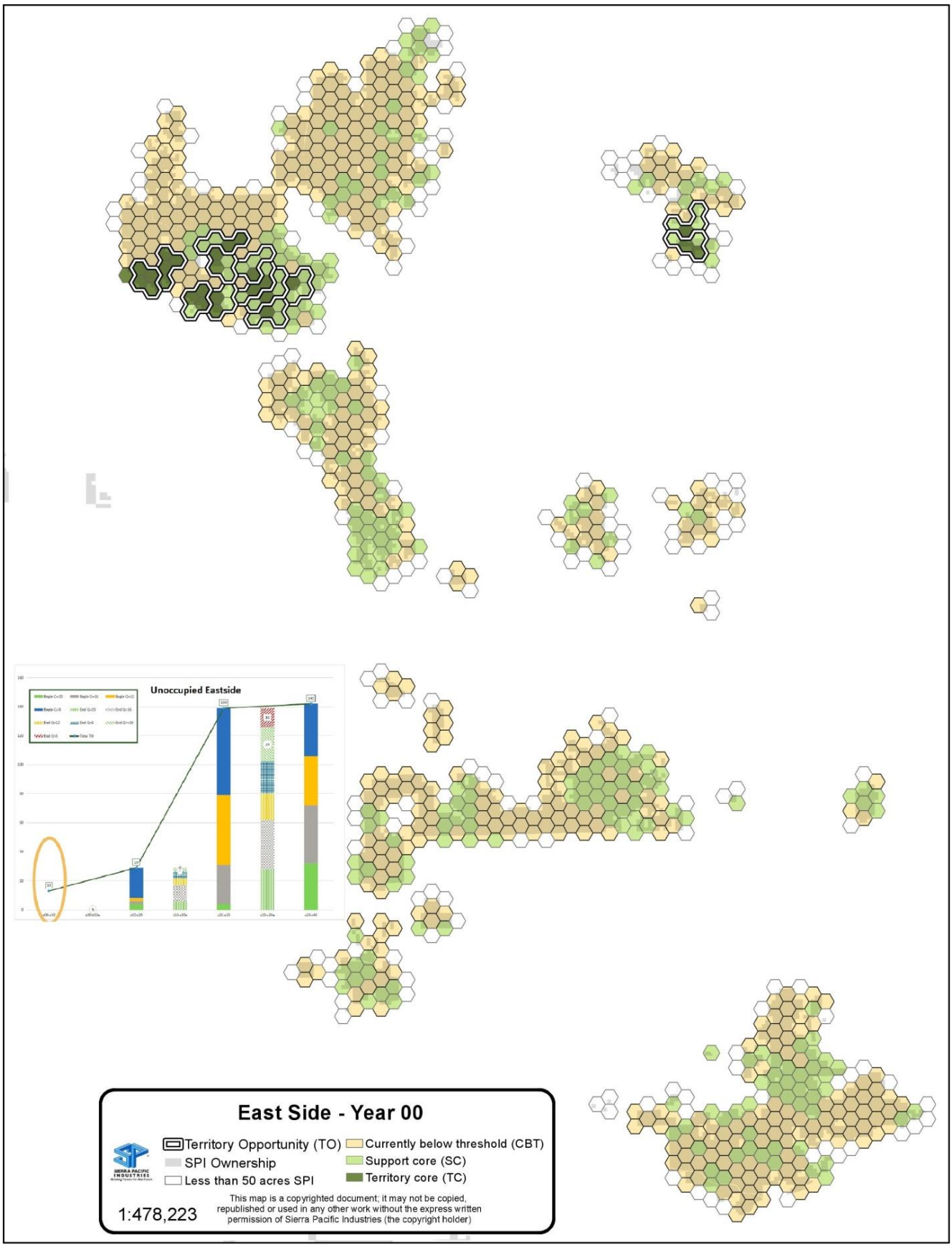


Appendix D: Unoccupied Eastside Region Map Territory Opportunities, Quality Scores and Harm by Decade.



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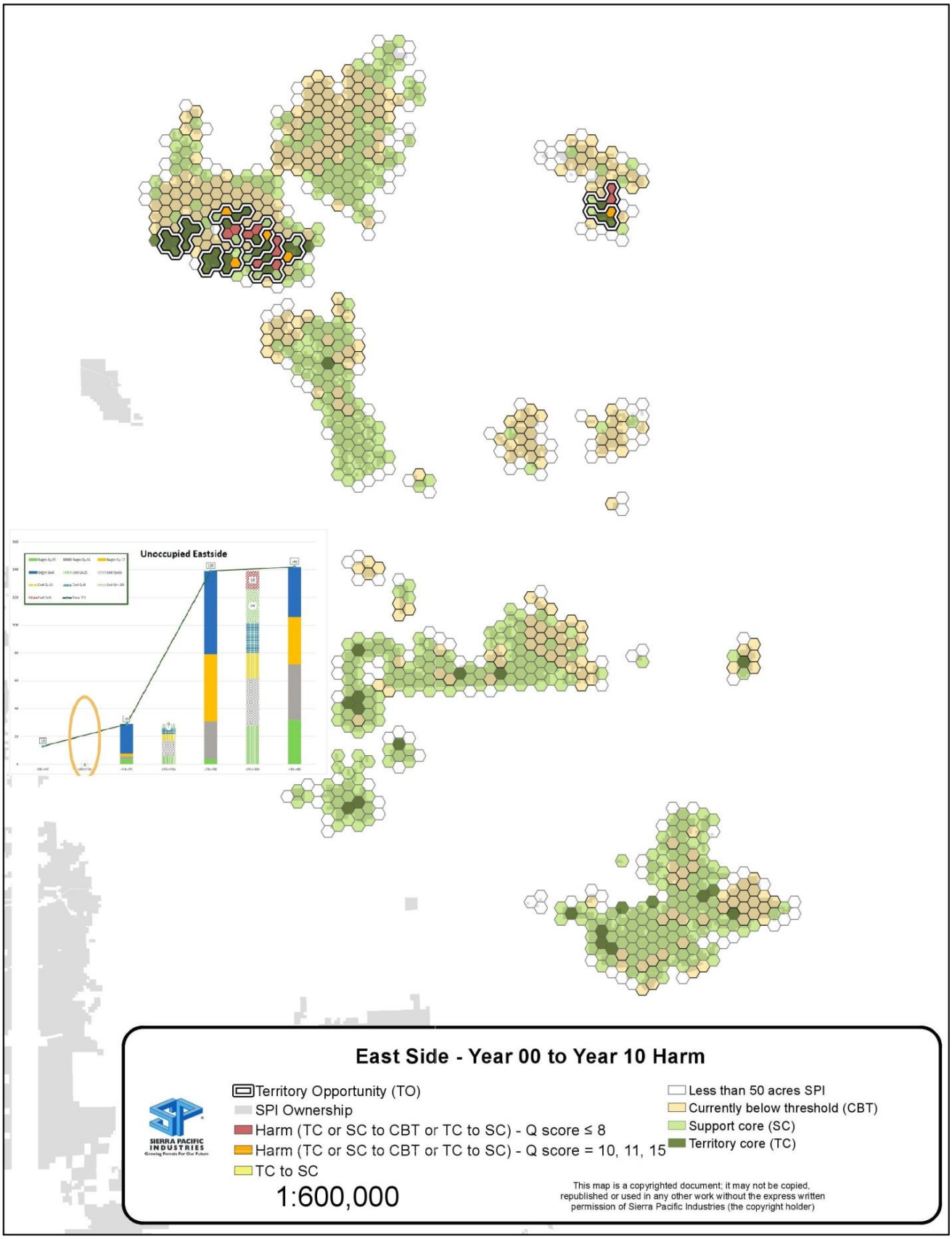
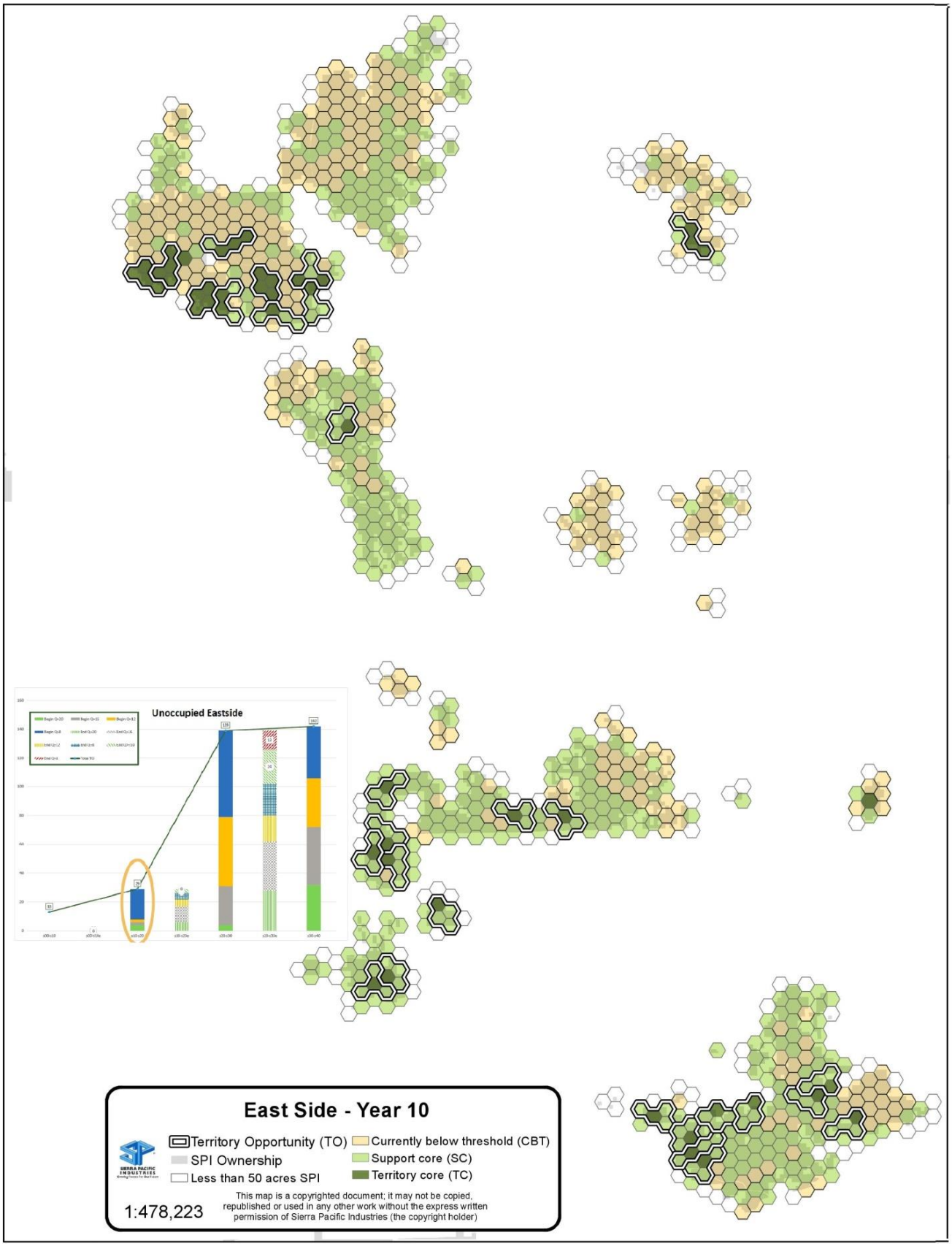


Appendix D: Unoccupied Eastside Region Map Territory Opportunities, Quality Scores and Harm by Decade.



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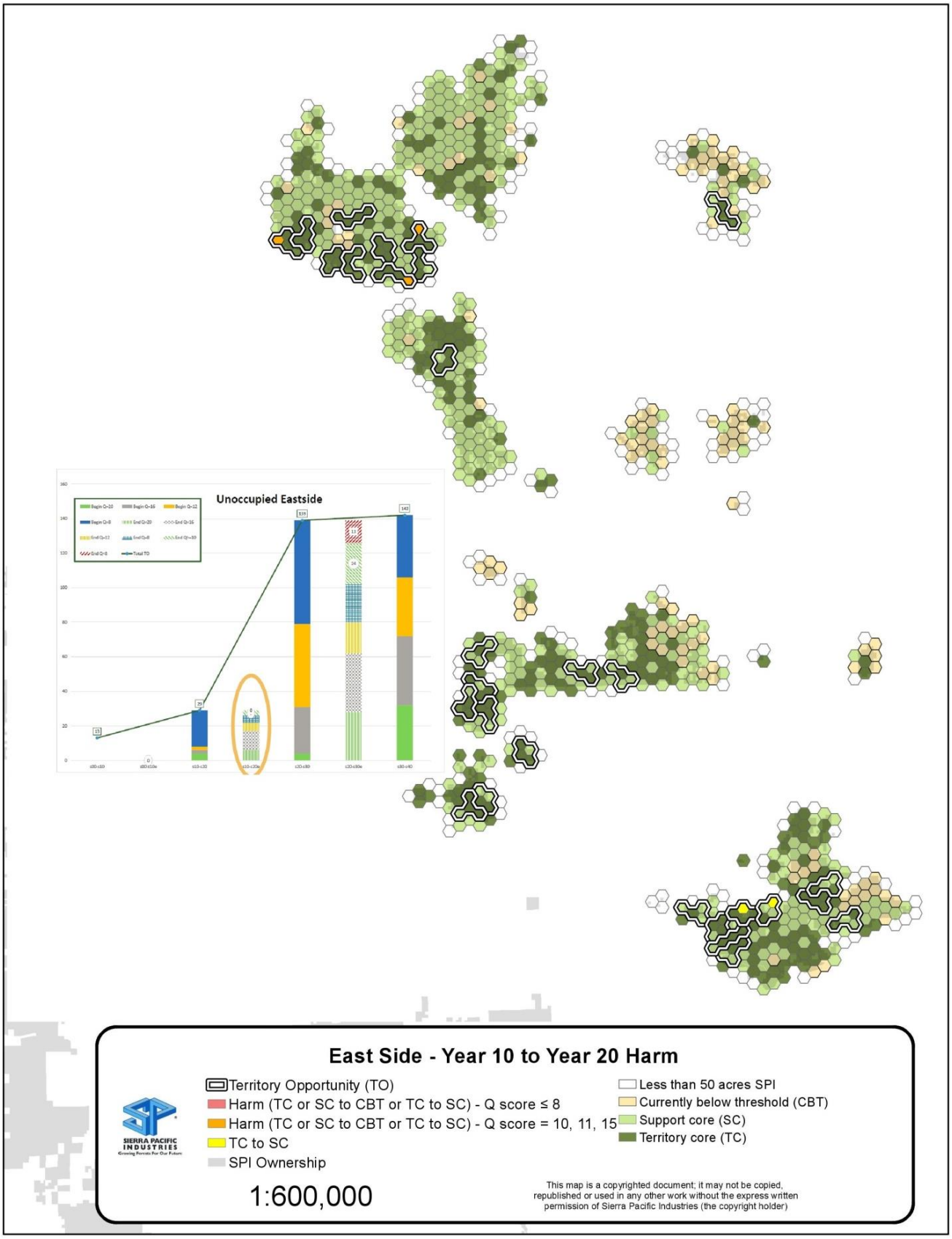
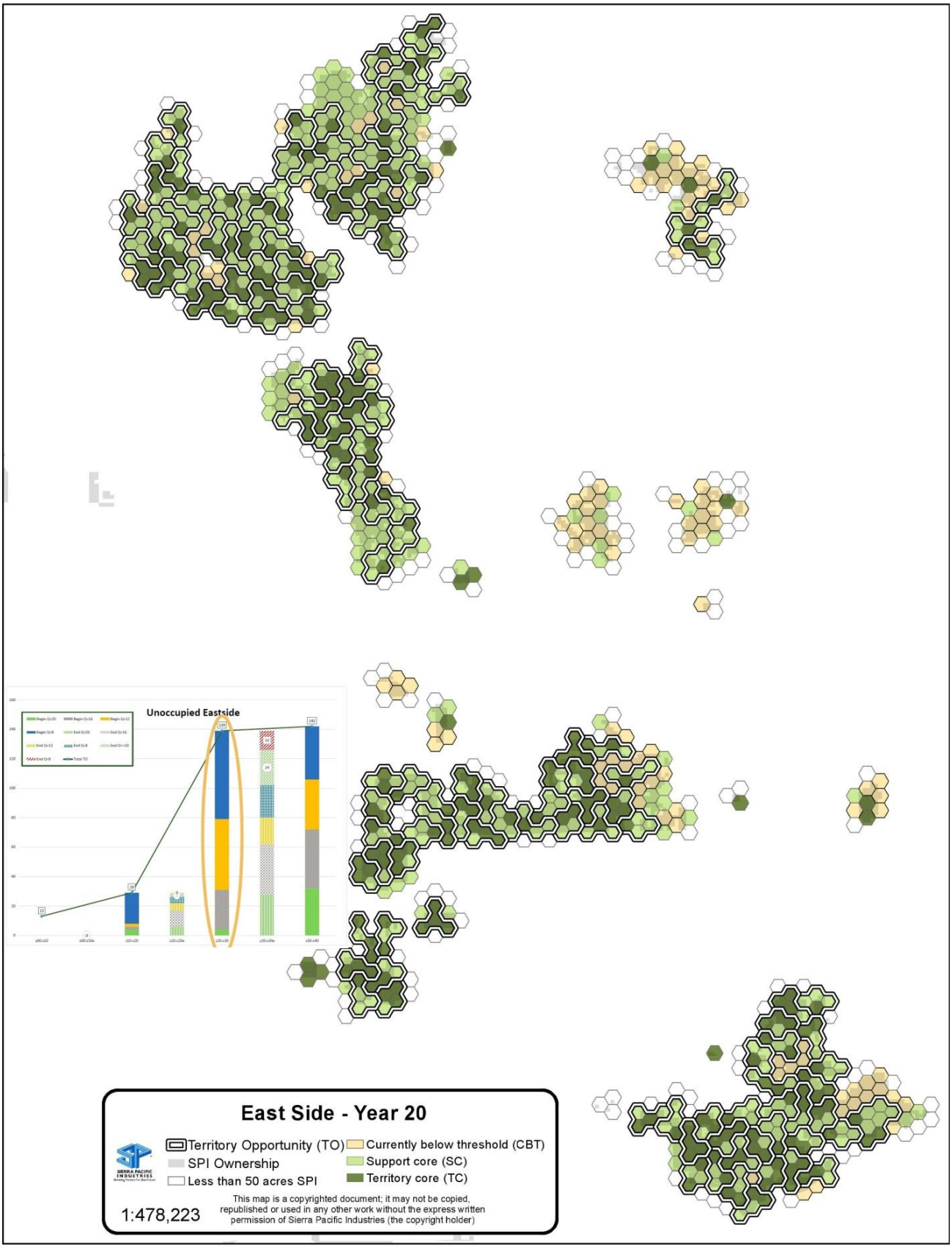


Appendix D: Unoccupied Eastside Region Map Territory Opportunities, Quality Scores and Harm by Decade.



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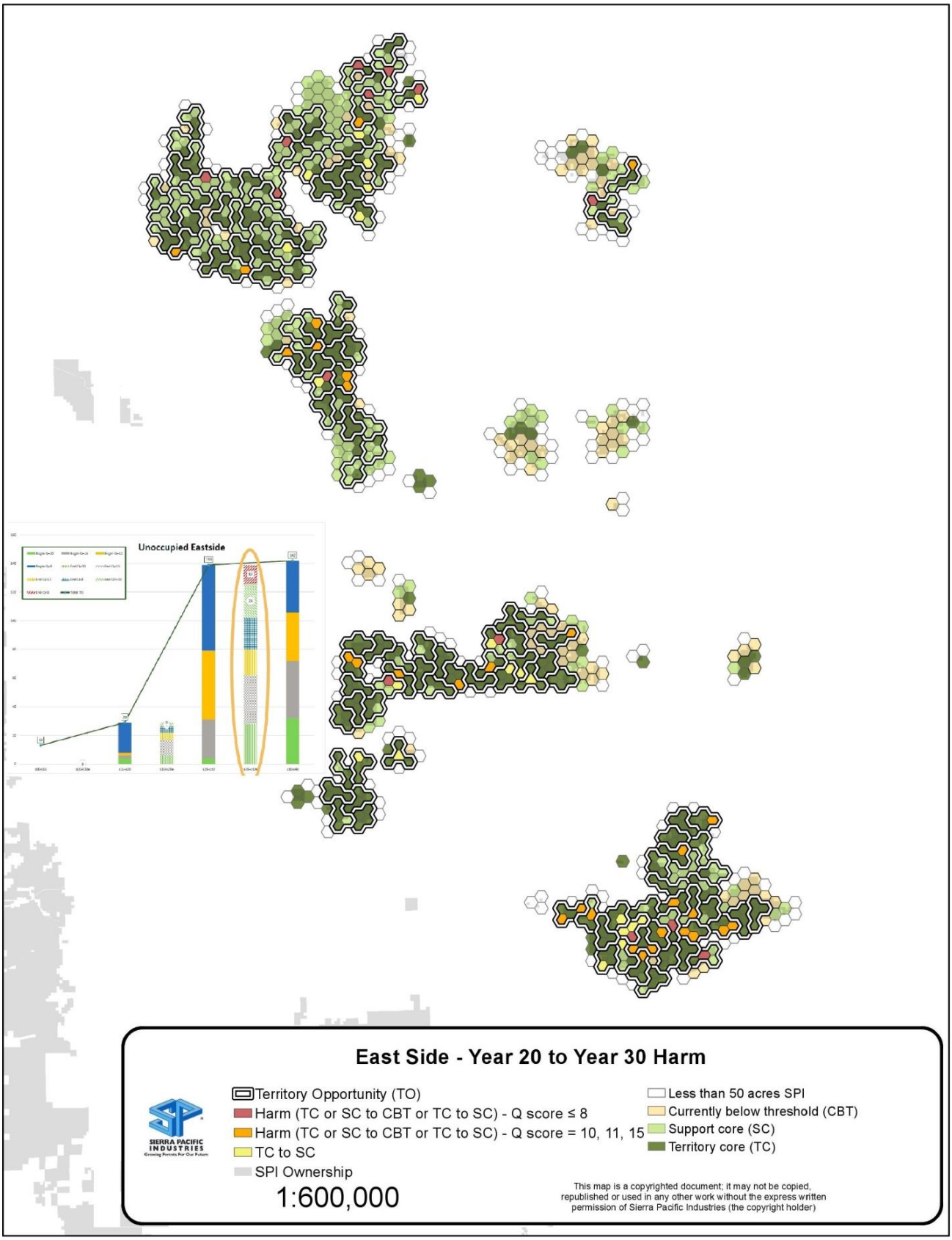

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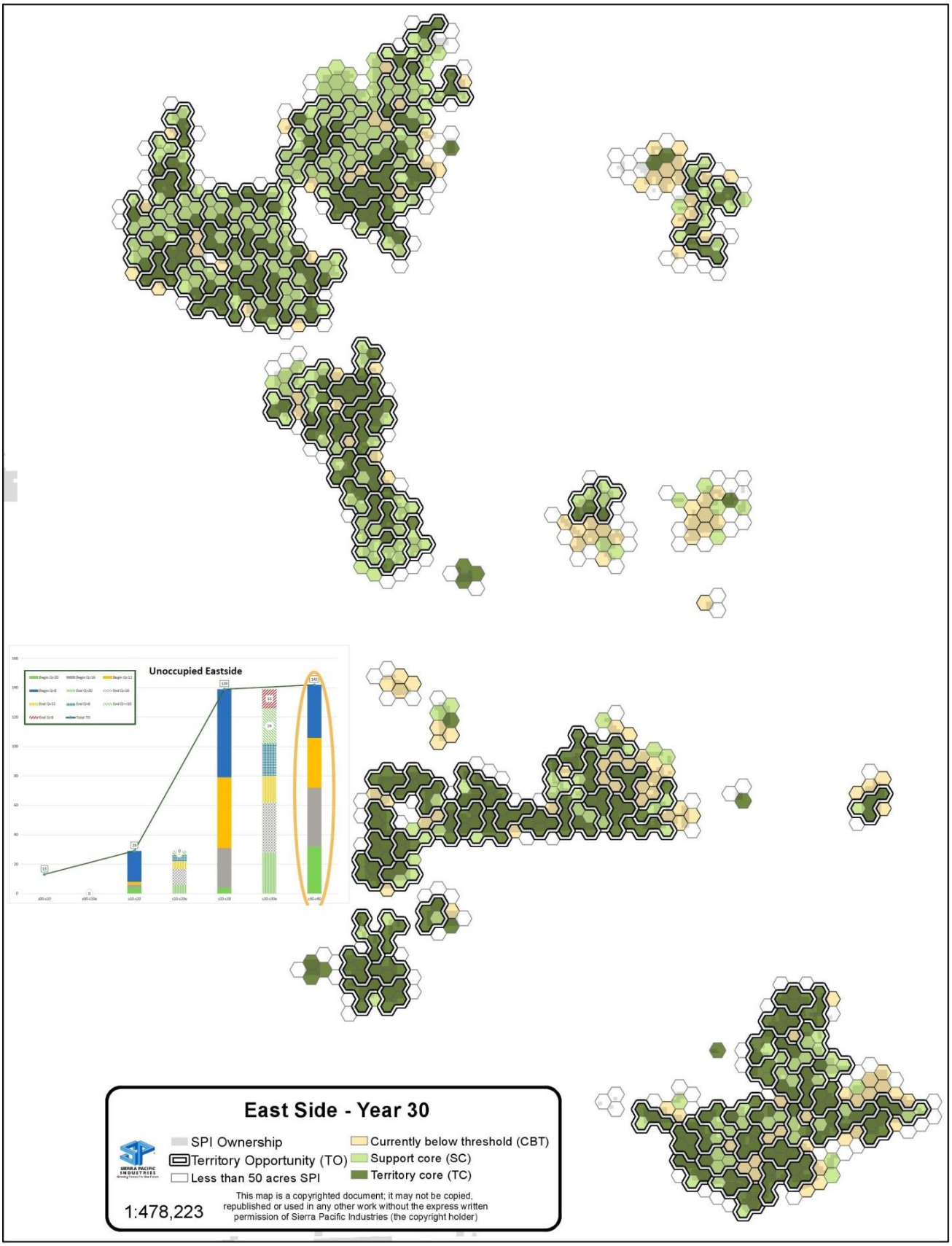
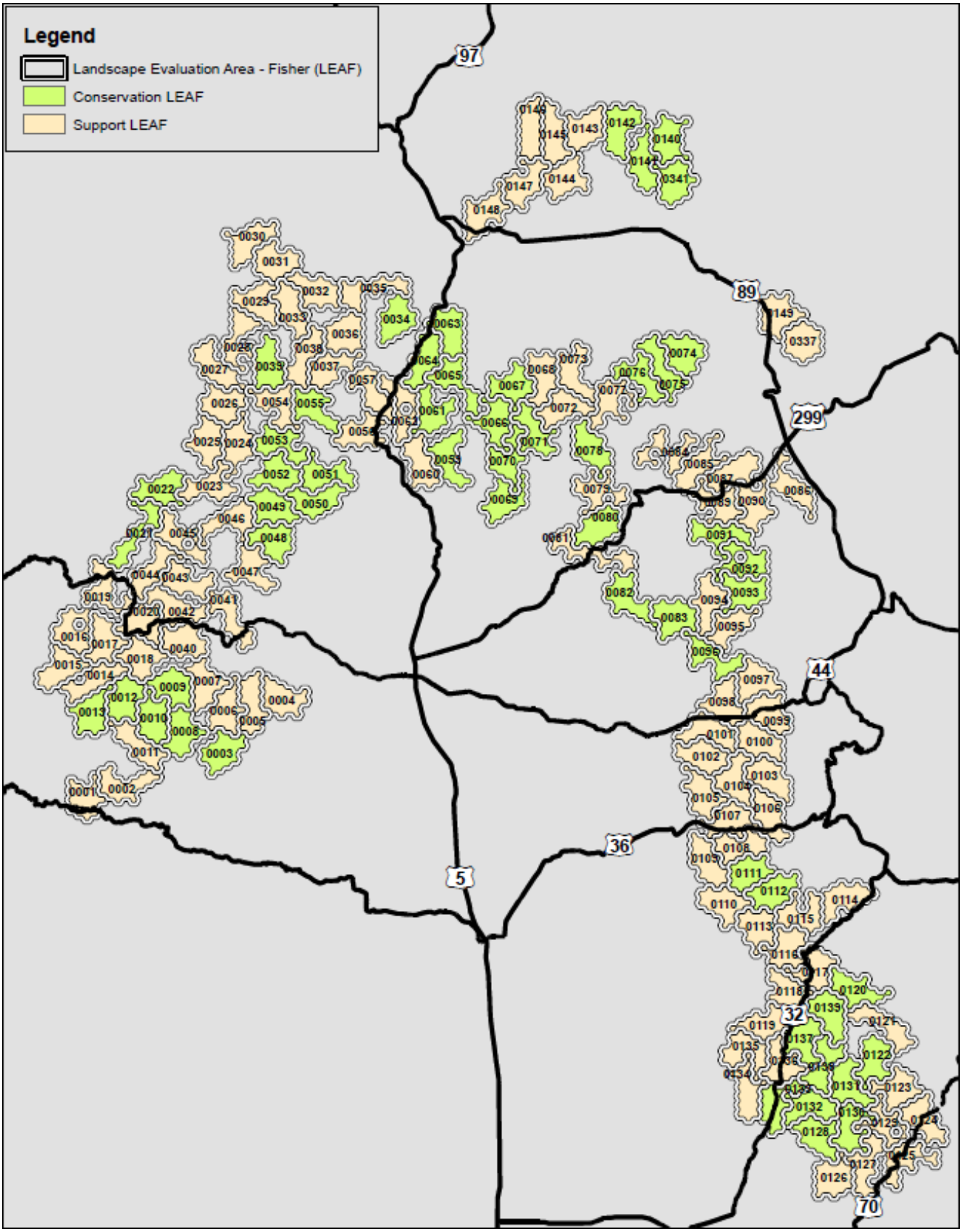
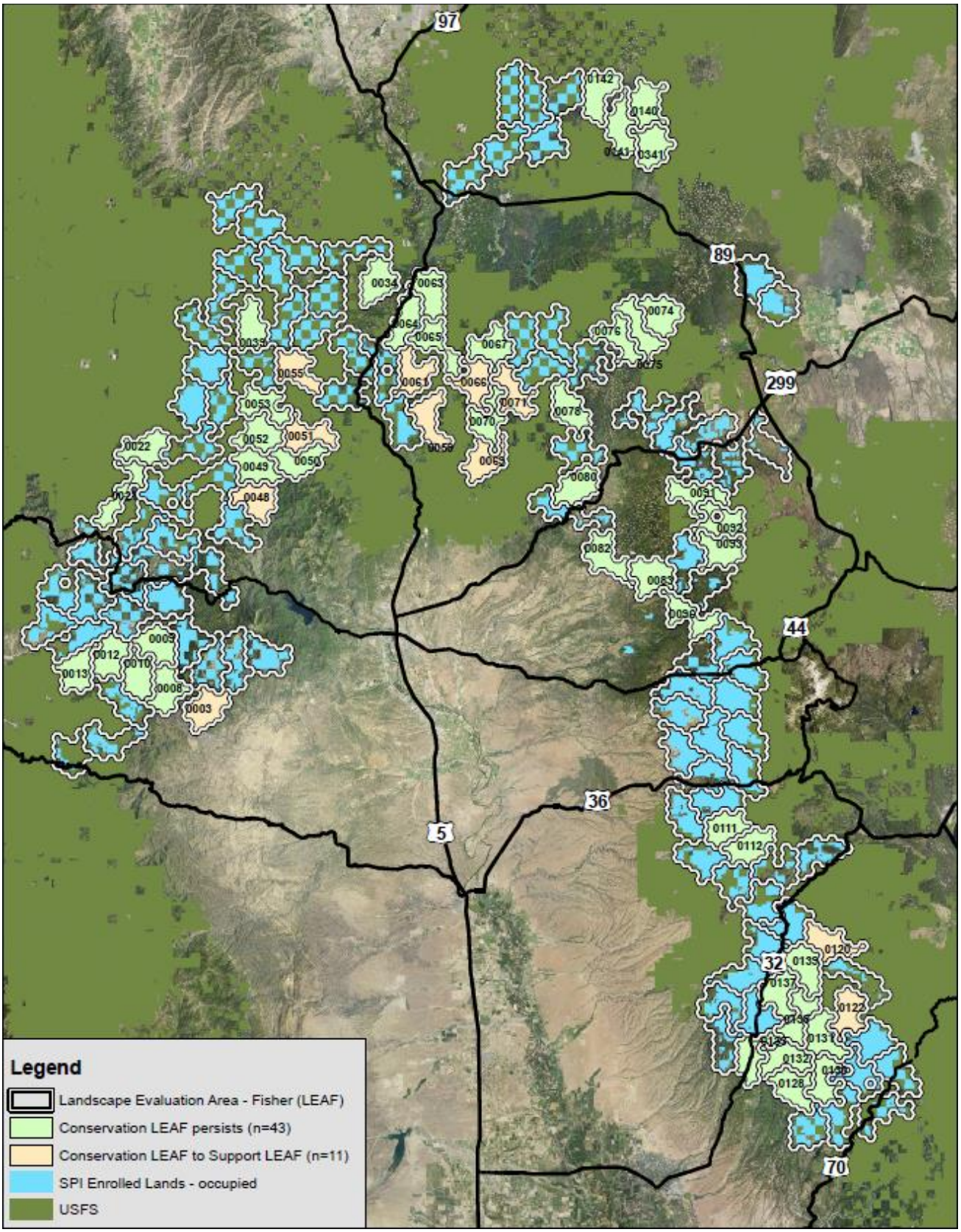


Appendix E: Conservation and Support LEAFs Map

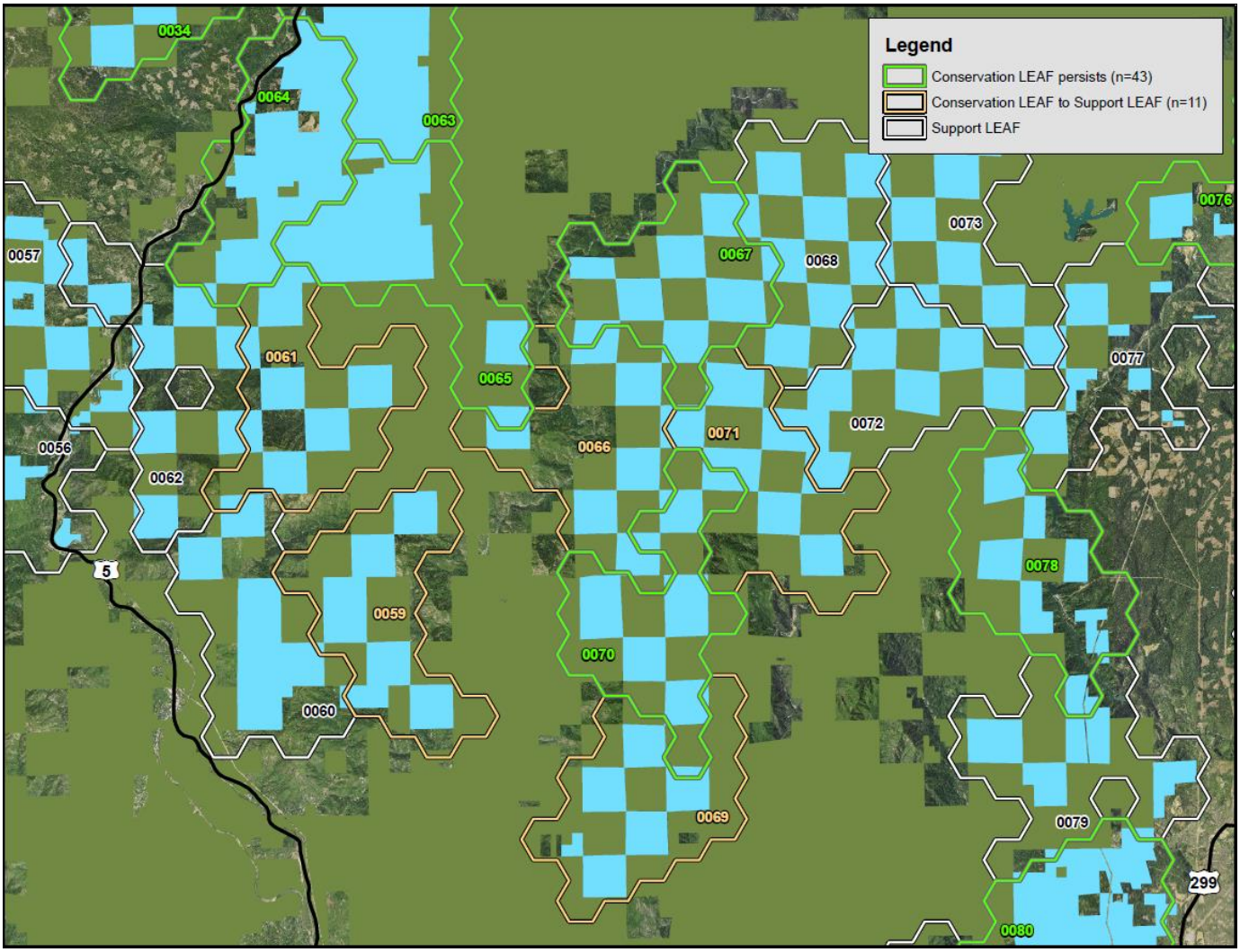


Appendix E: Conservation and Support LEAFs Map



Appendix E: Conservation and Support LEAFs Map

Redding South CSCA Ownership Map: Conservation LEAFs to Support LEAFs



## INTRODUCTION

Pursuant to CCAA guidance, we must develop an estimate of the potential amount of incidental take, including killing, injuring, or harassing. The fisher is naturally very wary and appears to avoid interactions with people and human activities. The greatest likelihood of these direct forms of take will probably occur at occupied den sites during the breeding season. Therefore it is assumed that only harvesting that occurs in the natal and maternal denning season can cause take by killing, injuring, or harassing

The locations of fisher territories and fisher dens are not known throughout most of the fisher's occupied range, including most of SPI's property. Because of cost and the limitations of survey methods and results, SPI does not intend to survey proposed timber harvest units for presence of fishers. Therefore, the numbers and locations of fishers on SPI lands are presently unknown and will remain so.

To evaluate the risk that timber harvest activities might directly impact an unknown active fisher den, resulting in take by killing, injuring, or harassing, we have calculated the probability of the annual risk that harvesting operations will directly interact with an individual female fisher at an occupied den site or den stand. Based on these probabilities, we will estimate the number of fishers killed, injured, and harassed annually.

## DATA AND ASSUMPTIONS

### Harvest Acreage

This analysis is based upon data from SPI's harvest accounting system. SPI's harvest accounting is confidentially audited by Cal Fire each decade to confirm that SPI is meeting the State -mandated sustained yield requirements, in order to satisfy SPI's Option A Demonstration of Maximum Sustained Production (SPI Option A). SPI's most recent compliance report, which was a summary of all silviculture activities for the first decade of the SPI Option A, was compiled in 2010 for the ten years 1999 through 2008, "the first decade." (Note that this is not the same as the first decade of the CCAA period). SPI's sustained yield harvest levels have not changed significantly between the first and second decade. In the Option A compliance report there are a total of 1,432,135 acres. 1,062,644.45 of these acres are in the Mixed land class, of which 663,278.25 acres are in the Occupied range. It is assumed that all regeneration and non-regeneration harvest will occur in the Mixed Land class during the term of the permit.

Table F-1 demonstrates the sequential calculations for deriving the number of acres of Mixed land class subject to harvest in the occupied range during the denning period in a given year. Based upon the silviculture summary for SPI's Option A, 74.2 % of the Enrolled Land is commercially available (Capable Land) in the Mixed land class at the beginning of the first decade (cell III in Table F-1). The acreage of anticipated harvesting is a key factor in estimation of the risk that a harvest acre will overlap any acre within the Mixed land class. However, SPI does not track acres harvested in time periods shorter than annually. SPI does closely track volume harvested bi-monthly throughout the year for administrative purposes.

While the actual acreage of harvest per period is not available, the volume per month is assumed to be approximately representative of the monthly percentage of the total acreage harvested. Using the bi-monthly volume-harvested reports from the prior seven years, the percentage of total harvest area that was impacted during the denning periods can be estimated. Over the last seven years, SPI harvested an average of approximately 46% of its annual harvest volume during the March – July denning period. These values are reflected in cells IX and X of Table F-1.

Appendix F: Analysis of Harvest Risk to Cause Kill and Harass

For calculating the risk of injuring, killing, or harassing a fisher, we use an estimate of the density of reproductive female fishers in the Mixed land class of 1.0 per 5,000-acre home range.

Table F-1: Calculation of annual SPI acres harvested in the occupied range.

| I<br>**Total SPI Acres in Occupied Range** | III<br>Number of SPI acres available for Harvest (Mixed) in the Occupied range | IV<br>Percentage of total acres Harvested by Regeneration during the permit period (10 years) | V<br>Percent of the total acres in the Mixed land class at the beginning of this decade (i.e. available for harvest) | VI<br>Probability of regeneration harvest occuring on any acre of the Mixed land class during the permit period (10 years) | VII<br>Percentage of total acres harvested by non-regeneration during the permit period (10 years) | VIII<br>Probability of Non-Regeneration Harvest Occuring on any acre in the Mixed land class during the permit period (10 years) | IX<br>Percent of the volume harvested (assumed to equal area) during natal denning period. |
|---|---|---|---|---|---|---|---|
| **663,278** | III = (I *V) | SPI Option A | Value From SPI | $0.74x = 0.18$<br>$x = 0.18/0.74$<br>VI = IV/ V | SPI Option A | $0.74x = 0.11$<br>$x = 0.11/0.74$<br>VIII = VI / VII | Value From SPI |
| | | | | | | | |
| | **492,152.28** | 18% | 74.2% | 24.3% | 11% | 14.8% | 11.2% |
| X<br>Percent of the volume harvested (assumed to equal area) during maternal denning period. | XI<br>The probability of non-regeneration harvest occuring on any acre during the Natal Period, during the permit period (10 years). | XII<br>The probability of a non-regeneration harvest occuring on any acre during the maternal period, during the permit period (10 years) | XIII<br>The probability of regeneration harvest occuring on any acre during the natal period, during the permit period (10 years) | XIV<br>The probability of regeneration harvest occuring on any acre during the maternal period, during the permit period (10 years) | XV<br>The annual probability of any acre in the available Mixed land class being harvested during the entire denning period (March 1 to July 31st). | XVI<br>Total annual acres of available Mixed land class harvested in the occupied range during the entire denning period (March 1 to July 31st). | XVII<br>Probability of any acre of Mixed being a occupied Fisher Den site where the fisher density is 2.0 per 10,000 acres. (i.e. two 1-acre den sites per 10,000 acres). |
| Value From SPI | XI =(VIII * IX) | XII=(VIII * X)*S | XIII =VI * IX | XIV=VI * X | XV=(XI+XII+XIII+XIV)/10 | XVI = XV * III | T=(2*1/(10000*V)) |
| 34.5% | 1.66% | 5.11% | 2.72% | 8.37% | 1.8% | **8,790.42** | 0.027% |

## Fisher Denning Periods and Timing of Harvest

In general, adult fishers have acute hearing and vision, and are attentive, reclusive, and highly mobile, so we assume they are much less vulnerable than juveniles to being killed, injured, or harassed by the Covered Activities. We assume that adult male fishers will not be killed, injured, or harassed by Covered Activities, because they are highly mobile and not constrained to any particular physical location at any time of year. We assume that adult female fishers and their kits would only be vulnerable to being killed, injured, or harassed by the Covered Activities during the natal and maternal denning period.

Fisher denning behavior is related to the birthing and early rearing of fisher kits. Kits are born and nursed in a natal den for approximately 60 days. After the natal period, the female fisher usually begins to move the kits to alternate den locations, beginning what is termed the maternal period. Thus, to determine the risk of overlap between SPI harvest and denning fishers, we need to define the denning periods. Based upon denning by radio-telemetered fishers observed on SPI lands, the natal den period extends from March 17th through May 9th. (See: Fisher Natal Den Use on Managed Timberland in California at the following link:

http://www.spi-ind.com/html/pdf_forests/FisherNatalDenUse_Dec2012.pdf)

To account for possible variability in the denning period, we chose to extend the period of risk to natal dens from harvest to March 1st to May 15th, which is over three weeks longer than observed at the South Weaverville Study Area (SWSA) or the Stirling Management Area (SMA). Our estimate of the period of risk for the maternal period then extends until the end of July. Thus, the total period of potential impact to active fisher dens extends from March 1 through July 31, or 153 days.

## CALCULATIONS

Our calculations for estimating the probability of killing, injuring, or harassing fishers are derived from the likelihood of harvesting overlapping a den site (kill/injure) or den stand (harass). A den site is the one-acre area surrounding the den tree. Any harvest within the den site during the denning period is assumed to kill or injure the adult female fisher and two kits (Lofroth et al. 2010, p. 55). The den stand is the 50-acre area surrounding the den site. Any harvest within the den stand during the denning period is assumed to harass an adult female fisher and two kits, and in our analysis, cause the mortality of the two kits.

SPI ownership is composed of individual parcels and groups of parcels. The distribution of the ownership is irregular in many cases. The distribution of harvest activities is well distributed over the course of a decade, but can be somewhat concentrated during any one year in a specific watershed area. The interaction between the probability of any single acre of SPI land containing a den tree and that acre being harvested in a given year, along with the total number of acres harvested and the distribution of that harvest, affects the results of the kill/injure and harass calculations. For illustrative purposes, we have calculated risk probabilities for kill/injure and for harassing under two different scenarios of distributed harvest.

The first scenario ("Concentrated Harvest") shows a harvest pattern that is maximally compact, forcing the annual harvest acres during the natal and maternal den period (collectively the denning period) to occur in the fewest number of female home ranges. The second scenario (Dispersed Harvest) is based on an average annual distribution of SPI harvest operations. Although the first is an unrealistic scenario, in combination they suggest the trade-offs in risk associated with varying distribution of harvest.

(Note: Neither of these scenarios accounts for the seasonal restrictions on harvest area and protection of potential den trees contained in the minimization efforts included in the CCAA Conservation Measures.)

For all scenarios, the estimated annual total number of Mixed acres harvested during the denning period in the occupied range (8,790 ac.) was derived using the calculations shown in Table F-1 above. These scenarios also assume that SPI owns all the land in the hypothetical home range.

## FIRST SCENARIO – Concentrated Harvest

### Direct Overlap (Kill or Injure) under Concentrated Harvest

To derive the area of suitable habitat (Mixed) within a 5,000-acre home range, the home range area is multiplied by the percent capable Mixed land class (0.742, based on the property-wide average) found in each home range:

$$HR_{AmtMixed} = 5{,}000 \times 0.742 = 3710\ acres$$

The probability that any single acre in a 5,000 acre area (at 74.2% mixed) contains a den is:

$$P_{Den} = \frac{1}{3{,}710\ ac.} = .00027$$

The probability that any single acre of harvest occurs on a den site acre can then be derived, where *n* = number of tries taken (acres harvested= 1,450 ac):

$$P_{Harvest_Den} = 1{,}450\text{ac.} \times \left(\frac{1}{3{,}710 ac.}\right) = 0.3908$$

The total acreage harvested in the decade is assumed to occur in one operating season in those areas operated that year as provided by the SPI Option A and is applied to all acres of capable land both Even and Mixed (all acres). To determine the maximum number of total acres that could be harvested annually in a home range, the home range size (5,000ac.) is multiplied by the amount of Regeneration (18% of all acres) and non-Regeneration (11% of all acres) harvesting expected during the term of the permit, and those products are summed.

$$Regen_{Amt} = 5{,}000 \times 0.18 = 900\ acres \qquad Non\text{-}Regen_{Amt} = 5{,}000 \times 0.11 = 550\ acres$$

$$HR_{MaxHarvest} = 1{,}450 \text{ acres}$$

Using these SPI Option A percentages and the amount of volume harvested during the denning period (assumed to correspond to acres), the total acres of Mixed land class harvested annually during the denning period in the occupied range is calculated above in Table F-1 and reported in cell XVI:

$$Total_Harvest_Mixed_Occupied_{Denning} = 8{,}790 \text{ acres}$$

To derive the number of home ranges harvested in annually when all the planned harvest is concentrated into the minimum number of home ranges:

$$HR_{Operated} = Total_Harvest_Mixed_Occupied_{Denning} \div HR_{MaxHarvest}$$

$$HR_{Operated} = 8{,}790 \div 1{,}450 = 6.06$$

The estimated number of fisher dens taken annually in the 6.06 home ranges operated during the denning period in the occupied range can then be calculated:

$$Dens_{taken} = HR_{Operated} \times P_{Harvest_Den}$$

$$Dens_{taken} = 6.06 \times 0.3908 = 2.37$$

The estimated number of fishers at each den is three (one female and two kits). The total number of dens directly impacted from harvest is then rounded to the last whole territory because it is not reasonable to have partial territories containing den sites. Thus, the estimated number of fisher killed or injured annually is calculated:

$$Fishers\ killed\ or\ injured = 2.0 * 3 = 6.0$$

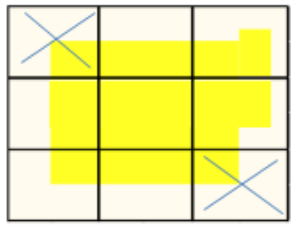
## Harass under the Concentrated Harvest Scenario

Harass is considered to have occurred where any harvest units intersect the 50-acre den stand during the denning period. The maximum number of units that may impact any den stand is nine, as portrayed in Figure F-1. The shaded area is the 50 -acre stand and the black boxes are contiguous 20-acre harvest units. SPI is in the second decade of its Option A, and at least two 20–acre units have

already been harvested in the 1st decade, so the number of potential harvest units that may intersect the den stand is reduced by two (Figure F-2).

Figure F-1

Figure F-2



Given the $HR_{MaxHarvest}$ = 1,450 acre and a unit size of 20 acres, the total number of potential harvested units and the maximum number of available units in a 5000-acre home range are derived: (Note: 3,710 is used instead of 5,000 because this analysis assumes fishers will only den in Mixed habitat.)

$$\#Unit_{total} = 3{,}710 \div 20 = 185.5 \qquad \#Unit_{MaxHarvest} = 1{,}450 \div 20 = 72.5$$

To calculate the potential for harassing a fisher in a home range containing harvest operations, we first calculate the probability of a harvest unit not intersecting a den stand:

$$P_{notHarass} = 1 - \left(\frac{\#\ of\ cut\ units\ potentially\ harassing\ a\ den\ stand}{\#\ of\ cut\ units\ representing\ a\ home\ range}\right)^{\#UnitMaxHarvest}$$

$$P_{notHarass} = 1 - \left(\frac{7}{185.5}\right)^{72.5} = 0.0615$$

The potential for harassing a fisher in a home range with harvest operations is calculated by subtracting from 1 the probability of a harvest unit not intersecting a den stand:

$$P_{Harass} = 1 - 0.0615 = 0.9385$$

In the occupied range, the estimated number of fisher den stands harassed annually in the 6.06 home ranges operated during the denning period can be calculated:

$$Dens_{harassed} = 6.06 \times 0.9385 = 5.69$$

The total number of dens harassed is then rounded to the last whole territory because it is not reasonable to have partial territories containing den sites. The estimated number of fishers harassed is reduced by the number of fishers killed or injured, because we assume that these fishers cannot be harassed. This avoids double counting potential take. This difference is then multiplied by two, which assumes that when a den stand is harassed the female lives, but the kits die. The estimated number of fishers harassed is calculated:

$$Fishers\ Harassed = (5.0 - 2.0) * 2 = 6.0$$

### Total Take – Concentrated Harvest

The total estimated annual number of fishers killed or injured, and harassed, is calculated:

$$\textit{Total Fisher Killed and Harassed} = 6.0 + 6.0 = 12.0$$

Assuming the same density of female fishers occur across all of SPI's capable acres in the occupied range (663,278.25ac), and there are one adult female and two juveniles present at every site, the amount of this taking can be expressed as a percentage of the total female and kit fisher population on SPI lands.

$$\textit{Total Fishers} = (663{,}278.25 \div 5{,}000) \times 3 = 398$$

$$\textit{Percentage of the Population Taken} = (12.0 \div 398) = 3.2\%$$

## SECOND SCENARIO – Distributed Harvest

The maximum concentration of harvest operations into just 6.06 home ranges, as evaluated in the first scenario, is not realistic because all of the planned harvest for the Enrolled Lands in the occupied range is never concentrated in that few localized areas. To describe a more realistic scenario, we distributed the harvest into 21 fisher home ranges, based on the average annual number of SPI logging operations in the occupied range of the fisher.

### Direct Overlap (Kill or Injure) under Distributed Harvest

Increasing the distribution of harvest activities increases the number of home ranges being affected. Total acres harvested in the season (Table F-1, Cell XVI) does not change, but the number of acres harvested in any one home range declines when the realistic number of operations is spread over the landscape. Using the number of operations, the new $HR_{MaxHarvest}$ can be calculated:

$$HR_{Operated} = 8{,}790 \div HR_{MaxHarvest}$$

$$21 = 8{,}790 \div HR_{MaxHarvest}$$

$$HR_{MaxHarvest} = \frac{8{,}790}{21} = 419 \; acres \; per \; home \; range$$

The probability that any single acre in a 5,000 acre area (at 74.2% Mixed) contains a den is:

$$P_{Den} = \frac{1}{3{,}710 \; ac.} = .00027$$

The probability that any one of the distributed harvest units occur on a den site acre can be derived, where *n* = number of tries taken (acres harvested = 419 acres):

$$P_{Harvest_Den} = 419\text{ac.} \times \left(\frac{1}{3{,}710 ac.}\right) = 0.1128$$

The estimated number of fisher dens taken annually in the 21 home ranges operated during the denning period in the occupied range can then be calculated by multiplying:

$$Dens_{taken} = HR_{Operated} \times P_{Harvest_Den}$$

$$Dens_{taken} = 21 \times 0.1128 = 2.37$$

Note that the reduction in acres harvested in a home range proportionally reduces the probability that harvest occurs on a den site in a home range. However, the number of dens taken is the same as the concentrated scenario, where fewer (6.06) home ranges are entered and the probability of harvest occurring on a den is higher (.3908). This result occurs because the number of acres harvested during the denning period is constant, and when those acres are evenly distributed into any given number of home ranges the result is the same. Therefore under these assumptions the number of dens taken is constant under both the concentrated and distributed scenarios and can be expressed:

$$Dens_{taken} = \frac{1}{3{,}710} \times 8{,}790 = 2.37$$

The estimated number of fishers at each den is three (one female and two kits). The total number of dens directly impacted is then rounded to the last whole territory because it is not reasonable to have partial territories containing den sites. Thus, the estimated number of fishers killed or injured annually is calculated:

$$Fishers\ killed\ or\ injured = 2.0 * 3 = 6.0$$

## Harass under Distributed Harvest

In the distributed harvest scenario the total number of potential units in a home range does not change, but the maximum number of units harvested in a home range decreases:

$$\#Unit_{total\ in\ home\ range} = 3{,}710 \div 20 = 185.5 \qquad \#Unit_{MaxHarvest} = HR_{MaxHarvest} \div 20$$

$$\#Unit_{total\ in\ home\ range} = 3{,}710 \div 20 = 185.5 \qquad \#Unit_{MaxHarvest} = 419 \div 20 = 20.9$$

The potential for harassing a fisher in an affected home range is calculated by first finding the probability of a harvest unit not intersecting a den stand:

$$P_{notHarass} = 1 - \left(\frac{\#\ of\ cut\ units\ potentially\ harassing\ a\ den\ stand}{\#Unit\ total\ in\ home\ range}\right)^{\#UnitMaxHarvest}$$

$$P_{notHarass} = 1 - \left(\frac{7}{185.5}\right)^{20.9} = 0.4471$$

$$P_{Harass} = 1 - 0.4471 = 0.5529$$

In the occupied range, the estimated number of fishers harassed annually in the 21 home ranges operated during the denning period can be calculated:

$$Dens_{harassed} = 21 \times 0.5529 = 11.61$$

The total number of dens harassed is then rounded to the last whole territory because it is not reasonable to have partial territories containing den sites. The estimated number of fishers harassed is reduced by the number of fishers killed or injured, because we assume that these fishers cannot be harassed (to avoid double counting). This difference is then multiplied by two, which assumes that when a den stand is harassed the female escapes and lives, but the kits die. The estimated number of fishers harassed is calculated:

$$Fisher\ Harass = (11.0 - 2.0) * 2 = 18.0$$

The total estimated fishers killed and harassed is calculated.

$$Total\ Fisher\ Killed\ and\ Harassed = 6.0 + 18.0 = 24.0$$

Assuming the same density of female fishers occur across all of SPI's capable acres in the occupied range (663,278.25ac), and there are one adult female and two juveniles present at each site, the amount of this taking can be expressed as a percentage of the total female and kit fisher population on SPI lands.

$$Total\ Fisher = (663{,}278.25 \div 5{,}000) \times 3 = 398$$

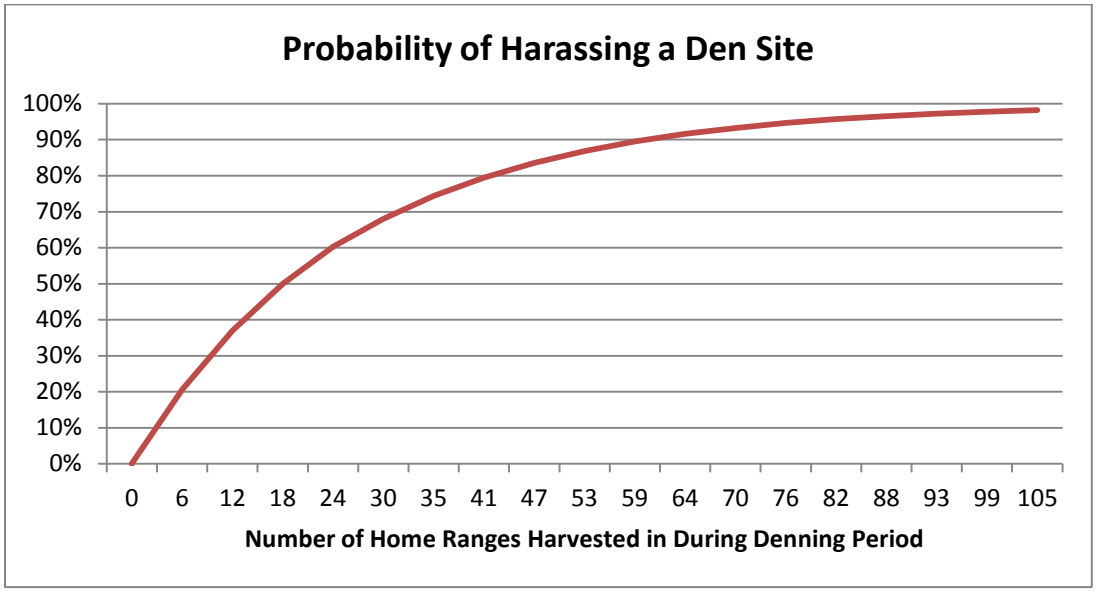
$$Percentage\ of\ the\ Population = (24.0 \div 398) = 6.03\%$$

## DISCUSSION

The probability of a harvest unit overlapping a den site (kill or injure) is affected by the amount of suitable habitat available and how much acreage of suitable is harvested. The number of animals killed or injured will depend on this probability of unit overlap and the density of animals. In the above scenarios these factors were held constant, and therefore the number of animals killed or injured remained constant, regardless of the degree to which harvest operations were concentrated.

The concentrating of harvest operations did have an effect of lowering the amount of harassing that could occur. This resulted from limiting the harvest impacts to the smallest number of home ranges; therefore, the total number of animals potentially affected was minimized. Because the probability of a harvest unit overlapping any part of a 50-acre den stand is much higher than a one-acre den site, it does not take many chances (harvest units) to result in a harass in a home range. Therefore, limiting the home ranges entered limits the amount of harassment occurring. This is expressed in the power function that calculates the probability of not harassing a fisher and is evident in the graph of the function shown in Figure F-1 below.

Figure F-1 Probability of harassing a fisher den site, based on the number of 5,000-acre home ranges harvested in during the denning period.




In this analysis, we have chosen to maximize the amount of risk under consideration in several ways. We use the high estimate of regeneration harvesting (18%). We apply a very high estimate of reproductive activity (one breeding female and 2 kits per 5,000 acres) and assume that every 5,000 acre home-range is occupied every year. Our definition of harass assumes that any harvest within an 833' radius of a den tree (50 acre den stand) would harass the fisher. We have chosen to extend the period of risk to natal dens from harvest to March 1st to May 15th, which is over three weeks longer than observed at the SWSA or the SMA. Also, we chose to assume that risk remains constant throughout the denning period, even though female fishers move kits as part of normal behavior, and the juveniles become increasingly mobile later in the denning period.

## REFERENCES:

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Appendix G: SPI 2013a. "HABITAT FORM 4" As a Representative of Habitat for California Spotted Owl, Northern Goshawk, and Fisher.

"HABITAT FORM 4" AS A REPRESENTATIVE OF HABITAT FOR COVERED SPECIES
Draft v3.2 February 7, 2013

**SUMMARY**

A standardized definition of habitat is needed to support the development of a Candidate Conservation Agreement with Assurances (CCAA) by Sierra Pacific Industries (SPI). Each of the three wildlife species (fisher, California spotted owl, and northern goshawk) (Covered Species) planned for coverage under the CCAA is known to use dense forests of large trees for requisite nesting and denning behavior. In addition, each species uses special habitat elements that may occur in relatively low numbers per acre. This paper describes SPI's categorization of forests into Habitat Forms and specifically "Habitat Form 4," which is intended to conservatively account for and provide nest / den habitat for the three species at the landscape and home range levels. As described below, parameters of forest canopy cover, average tree size (QMD), and minimum number of large trees that comprise Habitat Form 4 are consistent with the descriptions of those parameters from numerous habitat studies for each of the three Covered Species.

**INTRODUCTION**

Sierra Pacific Industries (SPI) is working toward a Candidate Conservation Agreement with Assurances (CCAA) for three species occurring on their timberlands. These species are the fisher (*Martes pennanti*) (West Coast Distinct Population Segment), the California spotted owl (*Strix occidentalis occidentalis*), and the northern goshawk (*Accipiter gentilis*) -- collectively, the Covered Species.

A standardized definition of forest habitat suitable for these species is needed for describing and quantifying existing habitat, predicting trends in habitat, defining objectives, and tracking progress toward meeting those objectives under the CCAA. This paper is a preliminary work product designed to demonstrate that Habitat Form 4 is an appropriate generalized description of habitat within the proposed CCAA. Subsequent papers may describe other Habitat Forms and special elements to be provided by the CCAA.

This paper does not address questions of how much habitat is needed by the Covered Species, or how much will be provided over time under the CCAA. Habitat quantity and landscape distribution will be addressed in a subsequent paper.

Several years ago, SPI staff produced a classification system for the company's forests that grouped forest types into classes based on commonality of habitat elements used by wildlife species. That classification system was called the Lifeform system. More recently, during early stages of development of the CCAA, SPI refined the Lifeform system to focus on the needs of the Covered Species, and now refers to those habitat categories as Habitat Forms. Habitat Form categories aggregate forest types by expected species use. Assignment of anticipated species use is guided by literature review and by a relational comparison of a Habitat Form to forest types described in the California Wildlife Habitat Relationships system (WHR) (Mayer and Laudenslayer 1988). In particular, Habitat Form 4 was further refined by analyzing field data (cross plots) collected at reproductive sites of the covered species.

The following discussion describes the forest land classes included in relevant Habitat Forms, and then compares the Habitat Forms with habitat parameters from literature describing habitat for the Covered Species. The intent of this discussion is to provide documentation and support for accepting the Habitat

Form system as sufficiently representing the Covered Species' habitat, allowing for use of Habitat Forms as the standard for general habitat quantification in the CCAA.

**SPI's FOREST CATEGORIES**

Before describing the Habitat Forms, it is important to establish an understanding of the management regimes that created existing forests on SPI lands, and that will create the forests of the future. Approximately 90% of SPI's forests were acquired by SPI during the past four decades. These forests have been managed under various methods by previous owners and by SPI. The forests on SPI's lands presently occur in five land classes as categorized by SPI, based on conditions and the age structure created by the management history. These five classes are: **Mixed, Inoperable, Non-Forest, Regen, and Even**. Comprehending differences between these classes is fundamental to understanding the present and projected future habitat for Covered Species.

**Mixed:** These land class stands were created by various types of uneven-aged management, which left many trees un-harvested during harvest entries. The Mixed land class currently comprises about 69% of SPI's ownership. In most cases, these forests contain a mix of trees in various sizes and ages. Generally speaking, these stands rarely contain conifers ≥40 in. dbh, because those commercially valuable trees were harvested in past decades. The Mixed land class often consists of extensive stands of trees where the average diameters range between 12 to 24 in. Canopy closures are typically well over 50%. These forests include a wide variety of habitat conditions, especially in terms of the presence of hardwoods, large snags, and down logs, most of which exist as legacies left during past harvests. The amount of understory brush also varies substantially.

Virtually all the habitat for Covered Species on the property today is in the Mixed land class, existing as a legacy of past management. Hardwoods and deformed conifers that were not commercially valuable (and to a lesser extent, large snags) were normally left standing during selection harvests of the past. These structural elements, surrounded by relatively dense forest of mixed ages, provide many of the existing nesting, roosting, and denning opportunities for Covered Species, especially for the fisher and California spotted owl.

Most of the Mixed land class stands are not growing at their maximum potential, because the highest quality trees have been removed and spacing between remaining trees is not optimal for growth. SPI's objective under their "SPI Option A" approved by the California Dept. of Forestry and Fire Protection is to maximize individual tree and stand growth by emphasizing even-aged management wherever such intensive stand treatments are not superseded or constrained by non-timber resource values. The pace of conversion of the Mixed land class to Regen and Even land classes is limited by the management path chosen by SPI in its Option A Plan, so that overall, about 44% of today's Mixed land class will still be in that class at the end of the CCAA permit period (i.e., 50 years).

Under this projection, over the next 50 years, approximately 40 to 55% (depending on market conditions, stochastic events and modeling accuracy) of today's acreage of the Mixed land class will gradually be harvested using clear-cut methods, to convert them to even-aged management. However, on about 14% of the Mixed forests, non-timber values (such as aesthetics, soil resources, wildlife, archeological sites, botanical resources, and water quality) will constrain intensive even-aged management. In these areas, the Mixed land class will be converted more slowly to even-aged stands, using techniques such as shelterwood steps or group selection. There is an additional 12% of the entire landbase that will never be harvested

utilizing even-aged management (predominantly watercourse and lake protection zones). In these lands very long interval uneven-aged silviculture will be utilized. Once an area of Mixed forest land class is clearcut and re-planted, it enters into the "Regen" land class and eventually grows into the Even class.

**Inoperable:** Such areas are forested but not available for economic management due to location, condition, or physical constraints or are areas with suitable soils that are not economical to stock with commercial species due to access. Examples include un-roaded brush fields, areas with poor soils and tree stocking, areas with low tree density that are not roaded adequately, and un-roaded areas with forest cover that won't economically support helicopter logging. Inoperable areas, which comprise about 6% of the property, will not be considered further in this document.

**Non-Forest:** These areas consist of lands that do not support conifer species, such as rock outcrops, talus slopes, quarries, grasslands, lakes, and wet meadows. These areas will not be considered further in this document.

**Regen:** The Regen land class is made up of artificially regenerated stands. Regen stands originate after emergency salvage operations or silvicultural practices such as shelterwood systems, group selection areas, brush field rehabilitation or clearcuts. Regenerated stands of all age classes presently comprise about 23% of SPI's lands. Regen stands are replanted by hand, with rarely one and usually two or more mixed-conifer tree species. Trees in the Regen land class are typically all the same age and similar in height, except where older trees were left as individuals or in small habitat retention stands during the previous clearcut harvest. In Regen stands, brush species may be treated with herbicides to assist the growth of young trees. Regen stands typically are pre-commercially thinned at about 7-10 years of age. After such treatment they are considered "free to grow."

**Even:** When a Regen stand is old enough and sufficiently dense to cruise with our standard inventory methodology, they are transitioned into the Even land class. This older regeneration class distinction is primarily for growth modeling and silvicultural planning purposes. These stands will be commercially thinned between ages 30 through 60 years, depending on the soil site classification, and will be completely harvested in a clearcut harvest at about 80 years of age. After several decades of growth, Even stands can provide areas of dense trees of sufficient size to comprise foraging habitat for the Covered Species. However, to provide the structural elements required by Covered Species for nesting, roosting, and denning, sufficient numbers of large trees and structures must be intentionally and continually retained and recruited during the conversion from Mixed to Regen stands, and during the pre-commercial and commercial thinning harvests in the Regen and Even stands.

SPI began their current practice of programmatically converting the Mixed land class into well distributed even-age stands only about 15 years ago. Thus, very few of the existing stands have grown from the Regen land class into the Even land class at this time. Existing habitat for the Covered Species is almost entirely in the Mixed stands, but as Mixed stands are converted to Regen stands and present Regen stands continue to mature, an increasing proportion of the nest / den habitat will be provided by the Even land class. (The amount of habitat that will be available at various intervals will be discussed in detail in a subsequent document.) The suitability of the existing and future habitat for Covered Species is one of the key issues for the CCAA.

Because today's unplanned, mixed-origin habitat for the Covered Species in the Mixed land class will steadily be replaced by habitat produced in the Even-aged land class, we have established different criteria to account for habitat in Mixed and Even-aged classes. The Mixed habitat exists as found, and is described and

quantified primarily for description of the baseline. In contrast, habitat in Even-aged stands is the planned result of management activities, and must be designed to ensure that such areas will function as habitat in the future. The criteria for habitat accounting in both Mixed and Even-aged stands are further discussed below.

## APPLICATION OF THE HABITAT FORM 4 DEFINITION

It is important to understand the intended use of the Habitat Form 4 definitions. Fundamentally, the definition is NOT a management standard; i.e., neither the Mixed stands nor the Even stands will be managed with the intent of barely exceeding or being harvested repeatedly down to the minimums of the definitions. Rather, the definitions provide the threshold for inclusion into the Habitat Form 4 category for quantitative accounting of the projected change in amount of habitat, as the Mixed stands are steadily removed and eventually replaced by Even stands.

The regulatory criteria for approval of the CCAA require estimation of projected impact of the permitted action, which logically calls for estimation of the change in habitat amount. However, any quantified estimate of habitat amount is subject to error based on the criteria selected for inclusion of a given area into that habitat estimate. Forested wildlife habitat does not exist in a present/absent configuration, but instead occurs in degrees of suitability. A broad definition may include habitat that is occupied but that does not provide for self-supporting populations. But in most cases, demographic parameters are unknown, and thus there is no precise basis for selection of criteria. Therefore, SPI has selected these minimum thresholds based on data from successful nest / den sites on their lands, guided by the published literature.

The comparison of the amounts of habitat described by the criteria for Mixed and Even stands will provide a reasonable general estimate of the change in habitat suitable for the Covered Species during the period of the CCAA. But it must be recognized that this method will not provide a precise estimate at this early date in the process. Also, because the Covered Species are known to nest / den at sites that, in a minority of instances, do not meet the criteria, the method probably under-estimates occupied habitat in both the existing Mixed stands and the future Even stands. And, it should be recognized that these criteria do not establish a "floor" for management; rather they only provide a means of accounting for estimation of habitat change.

## GENERAL DESCRIPTION OF HABITAT FORMS

In general terms, all three of the Covered Species are known to primarily use relatively dense conifer and mixed hardwood-conifer forests for shelter and reproductive sites. Each of the three Covered Species uses habitats in somewhat different ways, especially at localized scales, with general similarities increasing at broader, landscape scales. The Habitat Form classifications are most relevant for each of the species at these broader scales.

As mentioned above, the Habitat Form system is based on the predicted habitat use by wildlife species. In this regard, the Habitat Form system is based upon the species use analysis in the California WHR system (Mayer and Laudenslayer 1988), but there are key differences. It is important to note that assignment of a stand into a SPI Habitat Form category is not "cross walked" following assignment of the area into a WHR type. Instead, Habitat Form category assignment is based solely upon extensive on-the-ground sampling of stand characteristics. However, because many readers may be familiar with WHR, and because some

scientists and agencies describe habitat in terms of WHR categories, we will provide comparisons of the two systems in a later discussion of Habitat Forms and Covered Species.

The primary parameters that define or delineate the Habitat Forms, as well as in other forest habitat classification systems, are 1) tree size class, as represented by the quadratic mean tree diameter (QMD) (i.e., the quadratic mean diameter of all trees >5 in. dbh) in a given stand; 2) large tree component, as represented by the number of trees per acre (tpa) of a specified size threshold; and 3) canopy cover classifications, as represented by the percent of the sky obscured by foliage when viewed vertically from below. Measurement and description of forest parameters are subject to substantial error related to methodology and interpretation (Congalton and Green 2008). As such, caution is required when comparing the numerical standards used by the Habitat Form system with the habitat descriptions produced in research studies of the Covered Species. The following sections include discussion of methodological differences and potential implications.

In general, a measurement and classification system that depends on large numbers of samples in the field can be expected to provide more accuracy than systems with fewer field samples and greater dependence on interpretation of remote sensing images or other modeling methods. SPI's stand inventory system is one of the most intensive in the field of forest management. This system consists of one plot approximately every four acres on a pre-determined grid, resulting in about 400,000 plots across the ownership. For comparison, the Forest Inventory Analysis (FIA) sampling system used by the U.S Forest Service places a group of 4 sub-plots within individual fixed plots that are spaced at a density of one sample cluster per 6,000 acres (Bechtold & Patterson 2005). In a similar-sized area, SPI's system contains about 1,500 sample plots. Thus, it is reasonable to expect that SPI's descriptions of landscape stand conditions are more accurate than those on neighboring federal lands.

**Average Tree Size**

Tree size is typically expressed in terms of the mean diameter of trees in a given area. This may be accomplished by actual measurements at sample plots, or estimated from the breadth of tree crowns viewed from above in aerial photos. Because large numbers of small stems within a stand of larger trees can skew the statistical description of a stand, it is standard practice to not include stems less than 5 in. dbh in the calculation of Quadratic Mean Diameter (QMD). Depending on sample size, actual measurement of tree diameters can provide substantially more accurate QMD calculations than estimation using aerial photo interpretation. However, when lumped into general size classes, this difference may become less important, except at the margins of the size classes, where some error is likely (Congalton & Green 2008). SPI's description of mean tree size is based on their intensive sampling system of actual tree diameters, so stands should be assigned to classes with relatively high accuracy.

**Large Tree Component**

In the Habitat Form system the number of large tpa is estimated from sampling at the standard forest inventory plot system previously described. The selection of tree size for inclusion as "large tree" is further described below.

**Canopy Cover**

SPI estimates canopy cover in a plot or stand by applying a canopy index based on tree species and diameter from a compilation of approximately 80,000 individual non-overlapping tree crown diameter measurements

from trees ≥5 in. dbh (SPI Cruise Manual (Maw 2012)). The vertical projection of the stand canopy cover is modeled using the inventory plot tree list and the canopy index. This methodology differs from estimation of canopy cover based on interpretation of aerial photographs or the use of sampling devices such as solar pathfinders, densiometers, densitometers, or "sight tubes." The use of non-overlapping crown measurements in this methodology results in conservative total canopy estimates.

Various authors have described and compared methods for estimating canopy cover (e.g., Biging et al. 1991; Nakamura 2000, Gill et al. 2000; Congalton & Green 2008). Error within and between methods is commonly reported. Aerial photo interpretation for canopy estimations can have accuracy as low as 34% to 45% (Biging et al. 1991) and a standard error for exceptional work is no better than ± 10% (Congalton & Green 2008). When describing stands in terms of general categories, and lacking extensive and costly inventory data, the error may be deemed acceptable (Gill et al. 2000). But when successful wildlife use of stands for specific life history stages appears to depend on a relatively narrow range of canopy cover conditions (e.g., Richter 2005, Blakesley et al. 2005), accuracy and comparability of measurement methods becomes more critical. SPI's method, which applies a canopy cover index to a dense grid of inventoried plots, is believed to substantially reduce error in assigning a value (Gill et al. 2000). But the degree of difference between various methods remains uncertain.
The modeled vertical projection of canopy using tree inventory data most closely resembles values attained using a vertical sight tube and generally produces lower canopy values than a densiometer (Ed Murphy, SPI, pers comm.). Because canopy cover is height independent, whereas canopy closure is dependent on the height of the vegetation, different stands that have the same canopy cover can have different canopy closure (Jennings et al. 1999). Evaluating different methods at a specific site, Nakamura (2000) reported that vertical cover measured by sight tube was 50%, while the measurements obtained by solar pathfinder and spherical densiometer were 80 to 90%. Thus, vertical canopy cover of ≥60% derived by SPI's method generally corresponds with ecological or shade canopy cover of ≥85% reported in studies that used densiometers.

**"Stands" as Areas of Measurement**

Habitat Form classifications are applied at the stand scale. SPI defines a forest stand as a forested area that can be distinguished from neighboring areas either visually or through measurements. SPI identifies and delineates stands using a combination of air photo analysis and inventory plot data. Usually, a distinct stand can be easily identified within the surrounding forest because of differing management history. This is especially true in areas in which intensive even-aged management has been applied, i.e., where clear-cut or variable retention harvest, brush field rehabilitation, and re-growth have created distinct stands with clear edges against surrounding stands of different ages. In areas where even-aged management has been applied, the Regen stands average about 17 acres in size, as a result of CFPRs limitations on clear-cut size. In Mixed stands with more varied management history, the stand may be defined by its recognizable borders with neighboring stands, or by the legacy of various harvest prescriptions or logging methods.

Characteristics of the stand including species composition, average tree diameter, basal area, and components such as snags and hardwoods, are measured in SPI's sample plot inventory system. The descriptive stand characteristics data are aggregated in databases and become the basis for estimates of existing amounts of Habitat Forms across wider areas. Growth and harvest models used in calculating sustained yield estimates also allow projection of the amount of Habitat Forms expected to be present at various intervals in the future.

Appendix G: SPI 2013a. "HABITAT FORM 4" As a Representative of Habitat for California Spotted Owl, Northern Goshawk, and Fisher.

**HABITAT FORM 4**

Based on published studies reporting habitat use by the Covered Species and upon data gathered at their nest / den sites used on SPI lands, SPI regards Habitat Form 4 as the most important because it is where each of the three species reproduces. Habitat Form 4 is also important from a management perspective, because of all the Habitat Forms; it takes the longest time to develop. Thus, if Habitat Form 4 is in limited supply, it cannot be created as quickly as earlier seral Habitat Forms. The following discussions describe the characteristics of Habitat Form 4, compare Habitat Form 4 with the other classification systems, and summarize existing information supporting the selection of Habitat Form 4 as representative of good quality habitat for the Covered Species.

SPI's Habitat Form 4 threshold criteria values are summarized in Table 1. The values are derived from literature regarding the Covered Species and from data describing reproductive nest / den sites occupied by the Covered Species on or near SPI lands. This information is further discussed in a subsequent section entitled "Habitat Form 4 and the Covered Species."

**Table 1**. Threshold Criteria Values for Habitat Form 4

| LAND CLASS | CANOPY COVER | TREE SIZE | TREES /ACRE ≥22" dbh | OTHER |
|---|---|---|---|---|
| Mixed | ≥60 % | Stand QMD ≥13" dbh | At least 9 trees | At least one suitable Nest / Den structure per stand. |
| Even | ≥60 % | Stand QMD ≥13" dbh | At least 20 trees | |

As shown in Table 1, the Habitat Form 4 threshold criteria for average tree size (QMD) and canopy cover are the same for Mixed and Even stands. The important difference in the criteria for the two land classes is in the minimum threshold for tpa ≥22 in. dbh.

The stands chosen by the Covered Species across their respective ranges include un-harvested, un-managed "late seral" forests (almost entirely on federal land), as well as forests that have been harvested and managed to various degrees (on both federal and private lands). Regardless of the specifics of past and future management, in stands of relatively small-sized trees, each of the Covered Species show preference for the presence of some trees that may be substantially larger than the average. However, most studies that report habitat parameters for the Covered Species do not describe the dispersion of tree size measurements that exist within stands classified as habitat.

The following sections describe the derivation of values specified in Table 1.

**<u>Canopy Cover</u>**

Table 2 describes canopy cover values measured at the 1.05-ac. sites surrounding 258 nests and dens of Covered Species on SPI property. These sites were described using a cross plot sample (described in Appendix A) to quantify the structural attributes. These canopy measurements were taken with spherical

densiometers. Per the discussion above, the average values of approximately 80% are commensurate with the 60% canopy cover threshold criteria in Table 1 above.

**Table 2**. Canopy Cover at Nest / Den Sites (measured by spherical densiometer).

| | Canopy Closure | | | |
|---|---|---|---|---|
| | PAFI | NOGO | CSO | All |
| n= | 131 | 92 | 35 | 258 |
| Average | 79.9 | 81.1 | 88.0 | 81.4 |
| Median | 85.4 | 84.1 | 90.0 | 86.1 |
| Std Dev | 18.1 | 14.3 | 8.7 | 16.0 |
| Min | 11.5 | 34.9 | 60.9 | 11.5 |
| Max | 99.4 | 99.4 | 99.9 | 99.9 |

**Average Tree Size**

Table 3 characterizes 258 individual nest / den trees and surrounding 1.05-ac. sites on SPI property. Each of these structures was a reproductively successful nest or den used by the Covered Species. The surrounding 1.05-ac. sites were described using a cross plot sample (described in Appendix A) to quantify the nest / den site attributes. There was a wide range in tree size among the nest/den structures, and the surrounding site generally included trees smaller than the nest / den tree. The minimum diameter of structures used by any of the Covered Species was 12 in. dbh. The lower bound of one standard deviation for all sites used by the Covered Species included use of sites with a QMD as small as 9.9 in. dbh.

**Table 3**. Nest / Den Structures and Nest / Den Site Characteristics

| | **Pacific Fisher** | **Northern Goshawk** | **California Spotted Owl** |
|---|---|---|---|
| **Nest / Den STRUCTURE** | | | |
| Number | 131 | 92 | 35 |
| Mean DBH | 30.6 | 28.4 | 36.2 |
| Range | 12.0 – 74.8 | 13.0 – 79.1 | 17.0 – 76.1 |
| Mean -/+1 SD | 17.91 – 43.24 | 15.7 – 41.1 | 21.6 – 50.7 |
| Median | 27.4 | 25.0 | 32.1 |
| | | | |

**Nest / Den SITE QMD data (1.05-ac. plot)**

| | Pacific Fisher | Northern Goshawk | California Spotted Owl |
|---|---|---|---|
| Number of 1.05-ac. plots measured | 131 | 92 | 35 |
| Mean QMD | 13.4 | 17.4 | 16.5 |
| Range | 6.2 – 33.3 | 10.3 – 40.1 | 10.5 – 22.3 |
| Mean -/+1 SD | 9.9 – 16.9 | 12.9 – 21.8 | 13.7 – 19.4 |
| Median | 13.0 | 17.4 | 16.2 |

The values in Table 3 demonstrate that the QMD criterion of ≥13 in. adequately describes habitat for the Covered Species.

**Large Tree Component: Size and Number**

**Large Tree Size**

Various studies report that the Covered Species often focus nest and den use on structures and sites that include trees generally larger than those in the surrounding landscape (Roberts et al. 2011). In both managed and un-managed forests, this situation results in lower canopy closure and fewer large tpa as distance increases from the nest / den structure. However a stand with a QMD of ≥13 in. can theoretically include very few large trees, especially in a developing stand created through even-aged management. Therefore, to ensure that a component of large trees exists in stands described as habitat, Habitat Form 4 includes a threshold number of large trees at the stand scale.

Figure 1 contains histograms showing the presence of larger trees at nest / den sites for the covered species. The percentage of sites with at least one tree larger than a given threshold value decreases as the threshold diameter increases. Based on data depicted in Fig.1, SPI chose 22 in. dbh as the size threshold indicating that the need for the presence of large trees appears to begin being satisfied. As shown in Fig.1, less than ten percent of the sites did not include any trees ≥22 in. dbh or larger. Thus, about 90% of the sites known to be used for successful nesting or denning are included in the quantification of Habitat Form 4 when the threshold size class is set at 22 in. dbh.

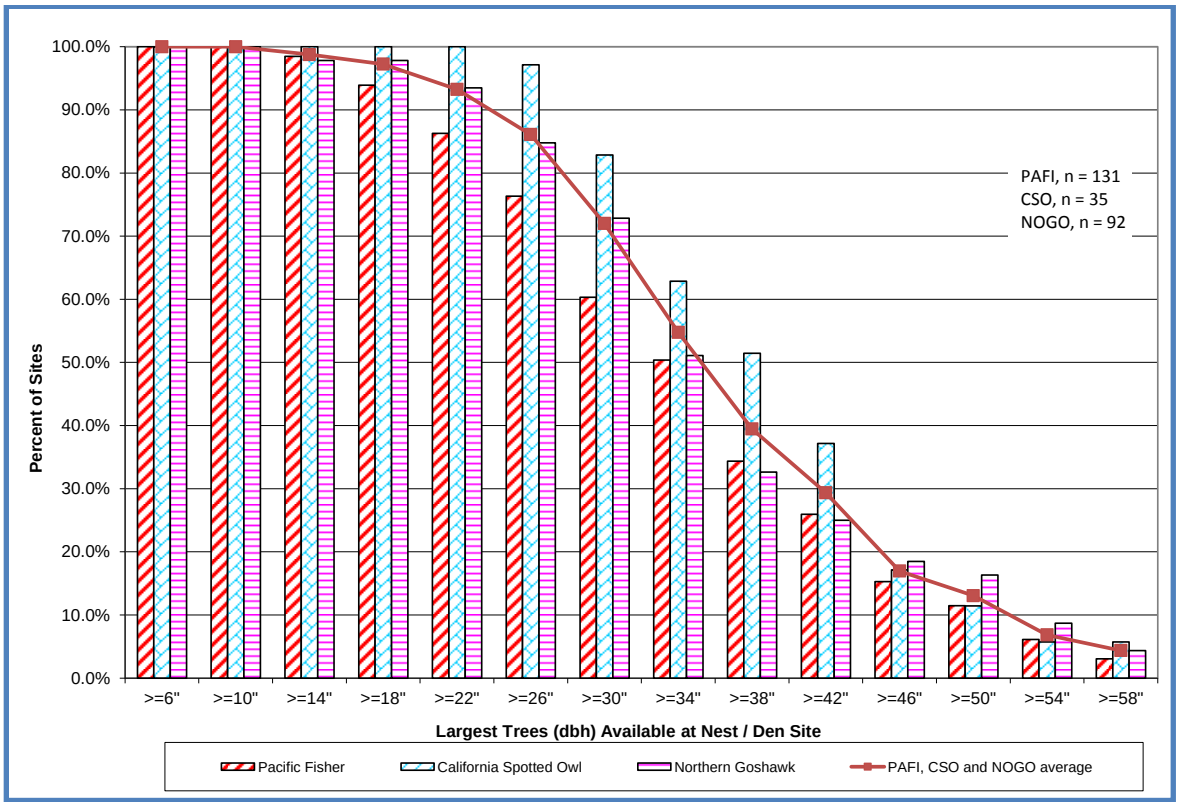


**Figure 1** Percent of Covered Species Nest or Den Sites with At Least One Tree Greater Than or Equal to an Indicated Threshold DBH. n=258

Note: Figure 1 is based upon having only 1 tree per acre present, while the HF4 criteria for Mixed stands is set at 9 tpa.

**<u>Number of Large Trees</u>**

The Habitat Form 4 definition also includes criteria for the number of tpa ≥22 in. dbh for the Even and Mixed land classes. The threshold criteria for the number of tpa ≥22 in. dbh in these land classes considered the tree data gathered at 1.05-ac. cross plots at successful nest / den sites.

In Mixed stands, 9 tpa ≥22 in dbh is the threshold criteria for inclusion in Habitat Form 4. This threshold includes most, but not all, of the 1.05-ac. sites around known nest / den locations of the three Covered Species on SPI lands (Table 4). In fact, in a minority of the nest / den locations, there were no trees ≥22 in. dbh at the time the site was used. Therefore, by excluding the sites with few trees ≥22in.dbh the criterion of 9 tpa results in some degree of under-estimation of the current amount of habitat available for use by the Covered Species. However, based on the literature, it appears that forest with few or no trees ≥22 in. dbh may be lower quality habitat. For that reason, SPI has chosen a criterion that includes only those sites more typical of the conditions occupied by the Covered Species across their range.

**Table 4** Trees per Acre ≥22in. dbh at Nest / Den Sites. n=258

| | TPA ≥ 22 | | | |
|---|---|---|---|---|
| | PAFI | NOGO | CSO | All |
| n= | 131 | 92 | 35 | 258 |
| Average | 15.1 | 31.3 | 28.7 | 22.7 |
| Median | 13.5 | 30.4 | 27.0 | 20.2 |
| Std Dev | 12.5 | 21.0 | 10.4 | 17.3 |
| Min | 0.0 | 0.0 | 10.1 | 0.0 |
| Max | 57.4 | 87.7 | 54.0 | 87.7 |

A different issue affects the selection of criteria for the Even land class. At present, most Even land class stands on SPI lands are too young to provide such habitat, so there are no known ND sites available for analysis in Even land class stands. The growth and management of Even stands is not expected to result in persistent stand conditions with as few as 9 tpa ≥22 in. dbh, so the Mixed criterion is not relevant in Even stands. Stands meeting the Even criteria of 20 tpa ≥22 in. dbh are more similar to "typical" habitat described in the literature, and 20 tpa ≥22 in. dbh approximates the mean and median number of such trees in ND sites on SPI lands Figs. 2, 3, 4, and 6. With 20 tpa ≥22 in. dbh as the criterion, one-third of the trees in the stand will be of this size, alleviating potential concerns that the stands do not contain a substantial large tree component.

Because the Covered Species are known to use stands of smaller trees as shown in Figs. 2, 3, 4, and 6, the Habitat Form 4 large tree criteria probably results in under-estimation of habitat that could be occupied by the Covered Species in Even land class stands. However, it should represent higher quality habitat than if lower values for tree size and number per acre had been chosen.

**Nest / Den Structure Tree**

In addition, to qualify as Habitat Form 4, the stand must include at least one tree or snag large enough and with attributes that could provide a nest or den structure for the Covered Species. Because modeling presence of habitat structures into the future is not feasible, it will be assumed that suitable nest / den structures exist if the stand includes either one hardwood tree or snag ≥22 in. dbh, or one green conifer or snag ≥30 in. dbh. Trees of these size classes are potentially large enough and old enough to have been subjected to the processes that would have caused a nest / den structure to develop.

## COMPARING HABITAT FORM 4 AND WHR CATEGORIES

As a foundation for the discussion, the basic WHR categories are summarized as follows:

**Tree size classes:** 1 (Seedling)(<1 inch dbh); 2 (Sapling)(1-5.9 in. dbh); 3 (Pole)(6-10.9 in. dbh); 4 (Small tree)(11-23.9 in. dbh); 5 (Medium/Large tree)(>24 in. dbh); 6 (Multi-layered Tree in PPN and SMC) (Mayer and Laudenslayer 1988).

**Canopy Closure classifications:** S=Sparse Cover (10-24% canopy closure); P= Open cover (25-39% canopy closure); M= Moderate cover (40-59% canopy closure); D= Dense cover (60-100% canopy closure).

The WHR system has provided a standard method of habitat categorization for several decades. The system was established by first delineating various categories of tree size and canopy cover, and then describing wildlife species habitat use of the categories based on literature review (Mayer and Laudenslayer 1988). Subsequently, numerous Habitat Suitability models have been constructed that are applicable to areas mapped in WHR categories (for instance see Timossi et al. 1995).

Although the WHR system is widely used for general categorization of wildlife habitat in California, descriptions of wildlife species' habitat in terms of WHR's general categories are sometimes known to be inaccurate. Importantly, several authors have expressed dissatisfaction with WHR as an accurate habitat descriptor for California spotted owls and northern goshawks, which are among the Covered Species of the proposed SPI CCAA. In the case of the Covered Species, this problem particularly results from the broad range of canopy cover represented in WHR Cover Class D, and in the broad range of tree sizes represented in WHR Size Class 4.

For example, regarding nest sites used by northern goshawks, Richter (2005) stated "….goshawks in this study were concentrating on the upper 50% of the canopy closure class D (81-100%), the upper 33% of the size class 4 (50-60cm (20-24 in.)), and size class 5 (61 cm (24 in.) and over). This points out that these two WHR classes of size (4) and canopy (D) have much too large a range of values to accurately reflect what the goshawks are really using as nesting substrate." And, regarding nest sites of California spotted owls, Keane (2010) stated "…. Of the 38 sites located in size class 4 polygons, 25 (66%) were in size class 4 polygons with a large tree component (i.e., presence of >24 inch dbh trees)."

Each of these cases, among others, indicates that simply describing WHR Size Class 4 stands as suitable habitat for Covered Species is inappropriate. In fairness, it is unlikely that any generalized categorization system can capture all of the variability in wildlife habitat use. However, in regard to tree size class, SPI's Habitat Form 4 definition provides a more accurate representation of habitat for the Covered Species than does WHR, because the Habitat Form 4 definition requires that large trees be present in the stands along with a QMD ≥13 in. dbh and because meeting the diameter threshold is based on an extensive field inventory, not inferred from aerial photography.

The description of canopy cover presents a different issue in comparing the Habitat Form 4 criteria with the WHR system. Because reported values for canopy cover are obtained using different methodologies, they may not be directly comparable. For instance, the values at sites near goshawk nests reported by Richter (2005), and near CSO nests by Blakesley et al. (2005), were estimated using a spherical densiometer. Bond et al. (2004) reported values near CSO nest sites and random plots using a vertical densitometer.

Meanwhile, Keane et al. (2010) estimated canopy cover at CSO sites using a crown cover index applied to measured tree diameters within stands, a method similar to that used by SPI.

As reviewed in an earlier section, canopy cover estimates obtained using SPI's method are typically substantially lower than those obtained at the same site using spherical densiometers. Therefore SPI believes that application of the Habitat Form 4 canopy cover criteria of 60% or greater is commensurate with descriptions of higher canopy cover that were obtained with spherical densiometers. Estimates reported using densitometers (sight tubes) should be similar to those obtained using SPI's method. Thus, the criteria for inclusion in Habitat Form 4 should provide habitat with canopy cover commensurate with the values for dense forest reported under the WHR system.

## HABITAT FORM 4 AND USFS CLASSIFICATION SYSTEMS

(Note: All metric values have been converted to the English system for ease of interpretation.)

The USFS sometimes classifies timber stands using a "strata" system that provides more detail than WHR, and some researchers (e.g. Bond et al. (2004); Blakesley et al. (2005)), have used this system to classify habitat used by California spotted owls. In this system, Size Class categories are: zero (no trees), 1 (seedlings; <6 in. dbh), 2 (small trees; 6-12 in. dbh), 3 (medium trees; 12-24 in. dbh), and 4 (large trees; > 24 in dbh). Canopy Cover categories are: zero (<10%), S (sparse; 10–25%), P (poor; 25–40%), N (normal; 40–70%), and G (good; >70%). Large tree density categories (number of trees ≥30 in. dbh per ha) were: zero (<1.2), 1 (1.2–4.9), 2 (4.9–14.8), and 3 (>14.8). (Note that in the large tree density category, the lower diameter limit is larger than the minimum for inclusion in the large tree size class.) Thus, a forest stand dominated by trees from 12 to 24 in, dbh with 50% canopy cover and 2 large trees ≥30 in. dbh per 3 ac. would be coded as 3N1.

While the strata system does provide more detail than WHR, it too may suffer from the breadth of the categories. For instance, Bond et al. (2004) found that while all CSO nest trees in their study were strata size class 4 ( >24 in. dbh), all of those nest trees were actually above 30 in. dbh, so that the classification system did not adequately describe the data. In that case, even though a stand meets the classification criteria for strata size class 4, it might not provide any nesting structures. Blakesley et al. (2005) reported similar issues regarding classification of stands that contained CSO nest trees, and commented: "Our use of broad canopy cover and dominant tree size class may have limited our ability to draw stronger inferences from our data."

Additionally, the ability to compare studies that describe habitat in terms of USFS strata may be limited by the low number of field plots used to describe habitat in the strata system. For instance, Blakesley et al. (2005) noted that interpretation of air photos and photo ortho-quads underestimated the presence of large remnant trees over 30 in dbh. SPI's plot inventory system is more likely to locate trees of this size because the inventory is performed at a much higher density.

In summary, SPI's Habitat Form system improves upon weaknesses of the WHR and USFS strata habitat classification systems. No generalized system can precisely describe the amount of wildlife habitat on a given landscape. However, SPI believes that the Habitat Form system, combined with their inventory plot system, provides a more accurate method of estimation than either of the other two systems.

## HABITAT FORM 4 AND THE COVERED SPECIES

The following discussion provides more specific rationale for establishing Habitat Form 4 as representative habitat for the three Covered Species.

### Habitat Form 4 as Habitat for Fishers

In this section we summarize existing research relevant to consideration of Habitat Form 4 as an appropriate surrogate for suitable habitat for fishers. We rely heavily on the summaries provided by Lofroth et al. (2010) and Lofroth et al. (2011). We will separate the discussion into three characteristics of fisher denning habitat: canopy cover, tree size, and special structures.

First we acknowledge that almost all fisher habitat studies only describe landscapes, home ranges, stands, localized sites, and structures that fishers are known to use. No studies have identified thresholds at which habitat becomes unsuitable, and there is no information linking habitat characters to demographic parameters. Thus, we must operate on the assumption that providing habitat within the range of exhibited use by fishers is a sufficient strategy for managing the species. Our evaluation of the characters of Habitat Form 4 relative to the available descriptive information on fisher habitats is based on that assumption.

### Canopy Cover

The findings of numerous studies related to canopy closure are summarized in Lofroth et al. (2010, sec. 7.2.2). Virtually all studies in the Pacific Northwest have identified high degrees of forest canopy closure (greater than 50 to 60%) as an important variable in fisher habitat at all scales. ((The primary exception is from interior British Columbia, where fisher home ranges included use of wooded areas with canopy closure down to 20% (Weir & Harestad (2003), as summarized in Lofroth et al. (2011)). Of particular relevance, Zielinski et al. (2010) identified the amount of dense forest as one of the most important variables in predicting occupancy of fishers within interior northern California, where most SPI lands occur. Differing measurement methods render direct comparisons among studies infeasible, but clearly fishers select forests with dense cover, and avoid open areas for the most part. In studies where fishers used forests with lower degrees of overhead forest canopy cover, an understory of brush was present providing cover. High canopy cover was particularly prevalent at more localized scales, especially the stand and sites surrounding resting and denning locations.

The attribute of high canopy cover is provided within Habitat Form 4, as the definition requires that all stands must exhibit tree canopy cover of 60% or greater, based on SPI's canopy methodology.

### Tree Size

Based on overall summaries provided in Lofroth et al. (2010), reviews of individual studies provided in Lofroth et al. (2011), and review of particular studies from the fisher's occupied range in California, there is considerable variation in the size of trees observed in habitat used by fishers, especially at the landscape, home range, and stand scales. Unfortunately, only a few of the studies conducted in California and southwestern Oregon have described forests used by fishers in terms of tree sizes at the landscape, home range and stand scales. Studies that have described forests in these terms (e.g., Self & Kerns 1992, 2001; Zielinski et al. 2004b as summarized in Lofroth et al. 2011, p. 73) often have reported that fisher use occurs

in forests that can be classified as WHR size 4 (i.e., 11 – 23.9 in. dbh) or larger. Other studies have shown associations with stands of smaller trees (e.g., see Carroll et al. (1999), as summarized in Lofroth et al. (2011) p. 83, and Mathews et al. (2008) as summarized in Lofroth et al. (2011), p. 55).

Average tree size in stands categorized as SPI's Habitat Form 4 is consistent with or larger than average tree diameters reported in the literature for the landscape and home range scales. Thus, we expect that landscapes and home ranges with substantial amounts of stands of Habitat Form 4 will provide habitat similar to that occupied by fishers elsewhere in their range.

Initial analysis at landscape and home range scales indicates that average tree sizes are smaller in SPI's South Weaverville fisher study area than in study areas summarized above. These results will be reported at a later date.

More habitat descriptions are available for the localized sites of fisher rest and den structures than for the broader landscape and home range scales. Stands that include sites of fisher resting and denning consistently include trees of large size, and often these stands are made up of trees larger than those typical of the surrounding home range and landscape. Average tree measurements in stands surrounding California rest and den sites, although gathered under varying methods, range from 18 in. to 27 in., with large standard deviations (Truex et al. (1998), Zielinski et al. (2004a); all as summarized in Lofroth et al. (2011), p 74; SPI unpublished data in Table 3). While the average QMD required for inclusion of stands in SPI's Habitat Form 4 is somewhat smaller than observed in studies conducted in older forests, it is within one SD of the average tree diameters reported in the literature for the stand and site scales on the Shasta-Trinity National Forest, and is consistent with values reported from studies on SPI lands. Additionally, the requirement for larger tree diameters should provide structures of size similar to reported values.

The individual trees and logs that provide fisher rest sites, and particularly the trees that provide denning sites for female fisher (collectively, nest / den structures) are critical elements of fisher habitat. Because they can be specifically located by tracking radio-telemetered fishers, hundreds of these structures have been found and described within the fisher's range ((see Lofroth et al. (2010), sections 7.2.6 and 7.2.7.)) In California and southern Oregon, trees used for resting range upwards from 30 in dbh for conifers and 17 in for hardwoods. Trees used for denning range upwards from 15 in. dbh.

SPI's measurements from 131 fisher den trees and sites in the Mixed land class are found in Table 3. The results show a wide range of numbers of trees ≥22 in. dbh, as portrayed in Figure 2. No trees ≥22 in dbh were observed at 13.7% of these cross plots. The mean number of trees ≥22in. in. dbh was 15.1 tpa, with a standard deviation of 12.5 tpa. Because of the wide range of the number of tpa ≥22in. dbh, and assuming that the data are normally distributed, 2/3 of all sites and the upper tail (another 1/6$^{th}$) of the population would be included above a threshold of 2.55 tpa ≥22 in. dbh. Thus, a threshold of 9 tpa ≥22 in. dbh excludes denning sites with fewer large trees and results in a conservative estimate of the amount of useable habitat.

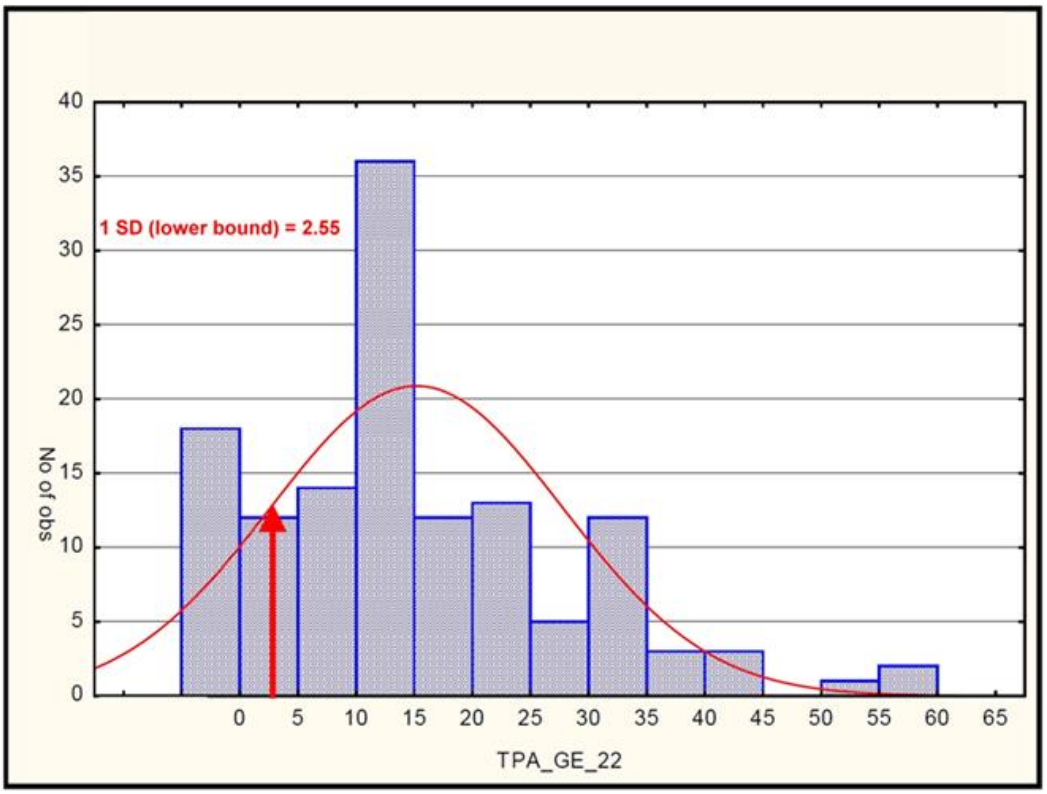


**Figure 2.** Estimated Normal Distribution of TPA ≥22 in. dbh at fisher den sites on SPI. n=131

Based on the above review, we conclude that Habitat Form 4 provides the canopy cover and tree size elements of fisher denning habitat.

**Habitat Form 4 as Habitat for Northern Goshawks**

In this section we summarize existing research relevant to consideration of Habitat Form 4 as an appropriate surrogate for suitable habitat for northern goshawks. We rely heavily on the summaries provided by Woodbridge et al. (2012). We will separate the discussion into three characteristics of goshawk nesting habitat: canopy cover, tree size, and special structures.

**Canopy Cover**

Hansen et al. (2012) reported that in 364 territories evaluated, an average of 74% of the area contained over 40% canopy cover, and an average of 19% of the area contained over 60% canopy cover. Modeling of habitat at occupied territories in the Sierra Nevada found amount of canopy cover of over 40% to be the second most important variable, following suitable habitat for prominent prey species (Dunk et al. 2012). At smaller scales closer to the nest site, most studies have found canopy cover over 60% (e.g., see Hansen et al. (2012) Table 9.9; Richter (2005)).

SPI's Habitat Form 4 provides the attribute of high canopy cover, as the definition requires that all stands classified as Habitat Form 4 must exhibit tree canopy cover of 60% or greater, as measured by SPI's cover density methodology.

**Tree Size**

Goshawks are known to select nest sites and nest trees in the some of the largest trees available in their territories. Hansen et al. (2012, Table 9.8) summarized data describing over 200 nest trees in the Sierra Nevada Cascade bioregion. Outside of Yosemite National Park, where the mean and range of nest tree size was markedly larger, the mean nest tree size from different study areas ranged from 22 in. to 34 in. dbh. Mean nest tree size on study areas that included substantial areas of privately owned forests ranged from 22 to 26in. dbh.

Hansen et al. (2012, Table 9.9) also summarized the results of several studies that described the sites (ranging from 0.1 to 2.5 ac. in different studies) surrounding goshawk nest trees. Sites on private lands contained substantially fewer trees larger than 30 in. dbh and larger than 22 in. dbh. These authors summarized data from Farber et al. (2003), who compiled data from plots surrounding 22 goshawk nest trees on private lands. Eight 0.1-ac. plots contained an average of 22 tpa over 22 in. dbh, while fourteen 2.5-ac. plots contained an average of 26 trees over 24 in. dbh. Earlier, Farber et al. (1998) reported a minimum number of nine trees over 22 in. dbh in 0.1 ac. plots at 13 sites analyzed on private timberlands.

Data collected at goshawk nests (n=92) on SPI property are summarized in Table 3 above. The mean nest tree size was 28.2 in. dbh, with a standard deviation of 13 in.. Thus, about 15% of the nest trees sampled were less than 15 in. dbh. The median nest tree size of 23.4 in. dbh indicates that about half of the nest trees were smaller than the standard for presence of 22-in. trees established by Habitat Form 4.

In the 92 nest sites (1.05-ac.) in the Mixed land class on SPI ownership, there is a wide range of numbers of trees ≥22 in. dbh, as shown on Figure 3. No trees ≥22 in. were observed at 6.5% of the cross plots. The mean number of trees ≥22 in. dbh at these 92 sites was 31.3 trees/ac, and the standard deviation was 21.0. Assuming that the data are normally distributed, the selection criteria of 9 tpa ≥22 in. dbh is therefore

representative of about 80% of the described sites. The exclusion of sites with fewer large trees results in a conservative estimate of the amount of useable nesting habitat.

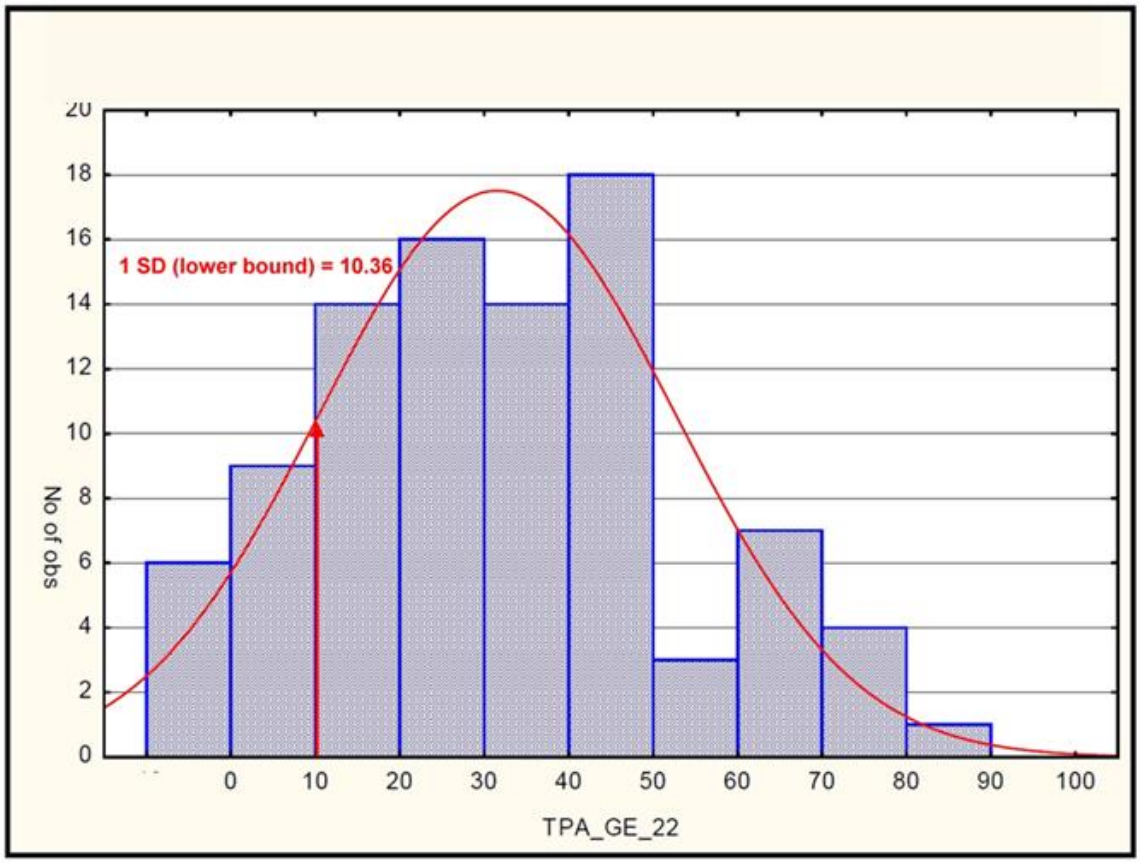


**Figure 3.** Estimated Normal Distribution of TPA ≥22 in. dbh at Northern goshawk nest sites on SPI land. n=92

**Special Structures**

Richter (2005) reported that 45% of 157 goshawk nests analyzed were constructed in a deformity (e.g., deformed top, mistletoe). Nest trees with deformities had smaller average dbh (56 cm; 22 in.) than the average DBH (71cm; 28 in.) of nest trees without deformities, or than the average DBH (94 cm, 37 in.) of trees supporting nests located out on a limb.

SPI's definition of Habitat Form 4 requires the presence of a structure suitable for a nest or den. This requirement provides a certainty of presence of a structure beyond the general likelihood of deformities commonly present in forest stands due to natural causes.

The criteria for SPI's Habitat Form 4 comply with the descriptions of goshawk habitat summarized above for the nest site and nest tree. Therefore, we conclude that Habitat Form 4 provides nesting habitat for northern goshawks on SPI lands.

**Habitat Form 4 as Habitat for California Spotted Owls**

In this section we summarize existing literature relevant to consideration of Habitat Form 4 as an appropriate surrogate for suitable habitat for California spotted owl. We will rely on summaries provided by the USFWS (2003, 2006) and the USFS (2004), and on more recent literature. Habitat for CSO can best be described at several scales: 1) home range and foraging habitat, 2) stands within the home range that contain nesting or roosting sites, and 3) nest structures (nest trees). We will separate the discussion into three characteristics of CSO nesting, roosting, and foraging habitat: canopy cover, tree size, and special structures.

**Canopy Cover**

Foraging habitat for CSO generally is described as including stands of conifers and mixed hardwood-coniferous forest with canopy closure above 40%, with mean quadratic diameters ≥13 in. dbh (numerous sources cited in USFWS (2003 & 2006). Irwin et al. (2007) found that canopy cover at over 1000 foraging locations averaged 69%, as measured by SPI's canopy cover methodology.

The USFWS (2003 & 2006) summarized numerous sources that described CSO nesting habitat. Nesting and roosting habitat for CSO is generally described as dense stands of trees with high degrees of canopy cover. Keane (2010), Irwin (2007), and North et al. (2000) all reported canopy covers of greater than 60% at nest sites. While these conclusions may have been derived using different measurement methods, they are generally consistent in their descriptions.

Canopy cover requirements under SPI's Habitat Form 4 (≥60% per canopy cover index) are consistent with the parameters described above.

**Tree Size**

Among the three Covered Species, California spotted owls use the largest structures for their breeding sites, and many nests are in relatively uncommon structural locations. As described in USFWS (2003): "California spotted owls nest in a variety of tree/snag species in pre-existing structures such as cavities, broken top trees, and platforms such as mistletoe brooms, debris platforms and old raptor or squirrel nests (Gutiérrez *et al.* 1992, 1995). Nest trees are often large, over 89 cm (35 in.) average dbh (Gutiérrez *et al.* 1992, Steger *et al.* 1997, LaHaye *et al.* 1997), and larger than other trees in the same stand (Gutiérrez *et al.* 1992). Nest trees are also often greater than 200 years old (Gutiérrez *et al.* 1992, North *et al.* 2000). However, approximately 25% of nest trees out of a sample of over 250 were less than 76 cm (30 in.) dbh (Gutiérrez *et al.* 1992). Although old, large trees are important to California spotted owls, intermediate sized (28 to 61 cm (11 to 24 in.)) trees were also selected by nesting owls (LaHaye *et al.* 1997); and trees 51 to 76 cm (20 to 30 in.) dbh) by roosting (Moen and Gutiérrez 1997), and foraging (Laymon 1988) owls."

In summarizing photo-interpreted analysis of stands surrounding 103 CSO nest sites at the USFS Plumas-Lassen study area, Keane (2010) stated "Approximately 53% of the nest sites were located within CWHR 5M, 5D and 6 size classes…. An additional 37% of the sites were located within CWHR size class 4M and 4D polygons. CWHR size class 4 is defined as stands with average tree sizes of 12-24 in. dbh trees. Of the 38 sites located in size class 4 polygons, 25 (66%) were in size class 4 polygons with a large tree component (i.e., presence of >24 in. dbh trees). Overall, about 90% of the sites were located within CWHR 4M, 4D, 5M, 5D,

and 6 size classes. The remaining 10 sites were located in more open, smaller-tree size polygons, with nests or roosts located within remnant, scattered larger trees."

Bond et al. (2004) modeled CSO nesting habitat selection, based on comparison of 0.5-ac. plots around 22 known nesting sites and random plots within apparently suitable habitat in El Dorado and Placer Counties. The probability of use for nesting by CSO increased with the number of trees larger than 30 in. dbh and higher degree of canopy cover.

Blakesley et al. (2005) described CSO nesting areas on the Lassen National Forest. They found that 90% of nests occurred in trees greater than 30 in. dbh, and that 56% of nesting attempts occurred in stands with dominant and codominant trees that averaged over 24 in. dbh. Among the 44% of nesting areas that were in stands of smaller trees, the presence of larger remnant trees was very important. Twenty-two % of nest attempts occurred in stands dominated by trees between 12 and 24 in. dbh that also had remnant large trees of over 30 in. dbh at a density of less than 1.2 per ha. (2.5 ac) and canopy cover greater than 40%. It should perhaps be noted that this study area is generally at higher elevation than SPI lands, and contains relatively few hardwoods. Also, the dominant prey item in the forests at this elevation is the northern flying squirrel, as opposed to the dusky-footed woodrat at lower elevations. These factors may limit the applicability of this study to SPI lands, which generally occur at lower elevations.

On private lands, size classes of CSO nest trees and stands include somewhat smaller, younger trees. For instance, while the mean dbh of 89 cm (35 in.) among 35 CSO nest trees used successfully on SPI lands was similar to that on Forest Service lands, and the standard deviation was 14.6 in. (i.e., 25 of the 30 trees were greater than 21 in. dbh), the range of nest tree sizes on SPI lands extended down to 17 in. (Table 3). At the scale of the nest site, i.e., 1.05 ac. surrounding the nest structure, the QMD ranged from 10.5 to 22.3 in., and the mean QMD was about 16 in. Thus, in most cases the large legacy nest tree was amid a stand of smaller trees, but in a few cases the nest tree was of a size more similar to the relatively small trees on the surrounding site.

Studies of CSO nest sites on Federal lands have not described the dispersion of tree measurements, and therefore we cannot evaluate the large tree component at those sites. At the 35 cross plot sites (1.05 ac.) in the Mixed land class on SPI ownership, there is a wide range of numbers of trees ≥22in. dbh, as shown in Table 4 and Figure 4. For these 35 sites there were no cross plot samples that measured less than 10 tpa ≥22 in. dbh. Assuming that the data are normally distributed, the selection criteria of 9 tpa ≥22 in. dbh appears to underestimate the CSO populations apparent minimum threshold for this criteria.

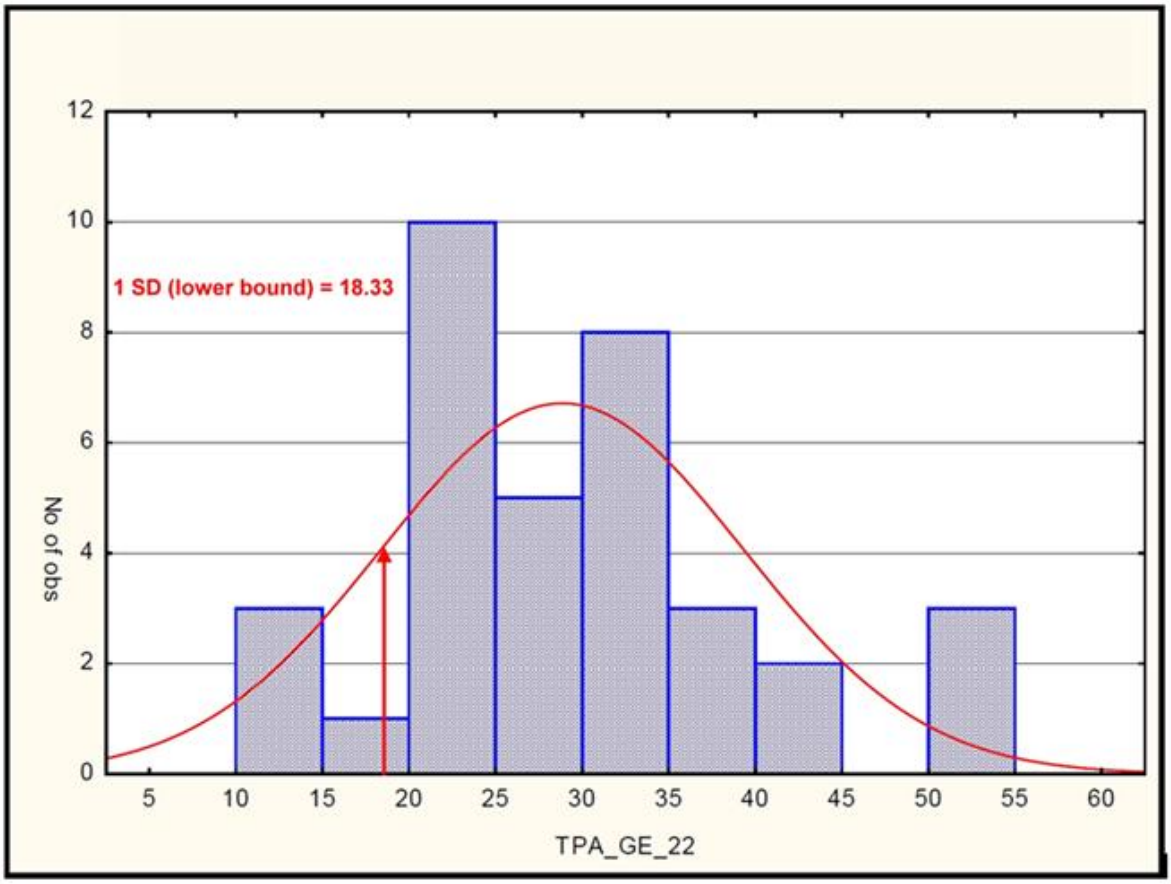


**Figure 4.** Estimated Normal Distribution of TPA ≥22 in. dbh at California spotted owl nest sites on SPI. n=35

While substantial sample sizes exist for nest / den sites of northern goshawks and fishers on SPI lands (n=92 and 131, respectively), SPI's data describing CSO nest sites (Fig. 4) is much more limited (n=35). The small sample size results because CSO sites are usually only surveyed in advance of infrequent nearby timber harvest, the actual nest sites are difficult to locate, and SPI usually avoids nesting areas once they are generally determined to be occupied by owls. In addition, based on SPI's knowledge of the ownership, the existing data appear to be limited to high soil site class areas and lower elevations, and thus are not believed to represent the geographic range of the subspecies, either overall or on SPI's ownership (Fig. 5). These issues lead to concern as to whether Habitat Form 4 reasonably estimates CSO habitat, especially in terms of large tree component, for which few corroborative data are available from published studies on federal lands.

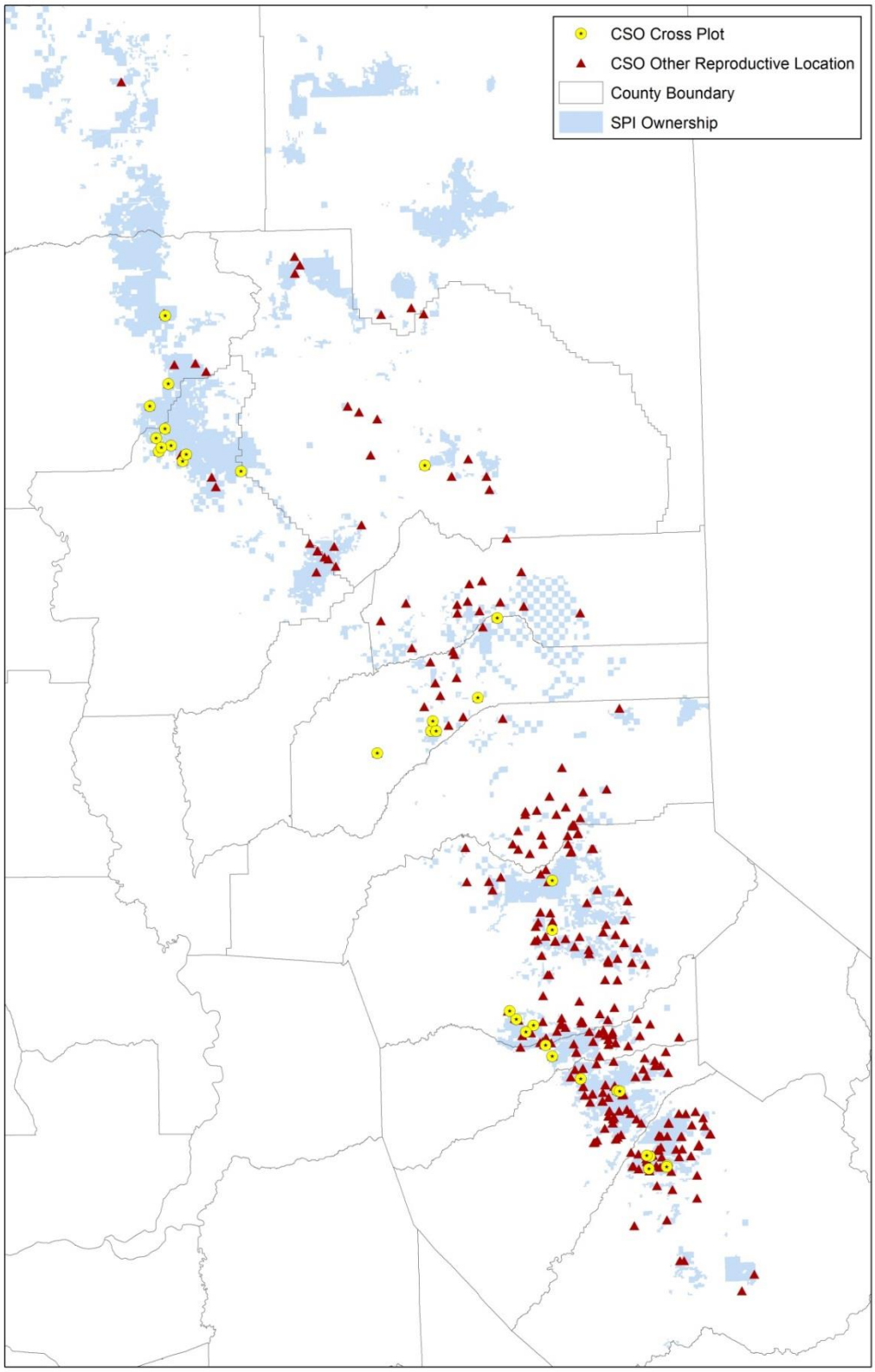


**Figure 5.** Distribution of CSO nest site cross plots and other reproductive CSO sites on or near SPI's ownership.

In order to increase the sample for consideration, we combined the available data for SPI's northern spotted owl (NSO) sites with the CSO data. The NSO is a close relative to the California spotted owl, as evidenced by their tendency to cross breed where their ranges intersect in continuous habitat along the Pit River (Barrowclough et al. 2011). The two subspecies' nesting behaviors are also similar, with each utilizing large tree cavities and platforms in dense forest habitats (Verner et al. 1992, Franklin et al. 2000). Inclusion of these data increase the geographic distribution and range of conditions represented in the sample, and may provide insight regarding the range of conditions used for nesting by CSO.

At the 57 (35 CSO and 22 NSO) 1.05-ac. cross plot sites in the Mixed land class on SPI ownership, there is a wide range of numbers of trees ≥22 in. dbh, as shown on Figure 6. For these 57 combined sites, there were no cross plot samples that measured less than 5 tpa ≥22 in. dbh. The mean number of trees ≥22 in. dbh at these 57 sites was 25.2 trees/ac., and the standard deviation was 12.2. Assuming that NSO sites are generally similar to CSO sites, the variation in CSO nesting habitat is likely better described by the combined data in Fig. 6. Thus, the threshold of 9 tpa ≥22 in. dbh may provide a reasonable threshold for description of CSO habitat. Under these assumptions, Habitat Form 4 underestimates CSO habitat in a manner similar to its representation of ND habitat for the other Covered Species.

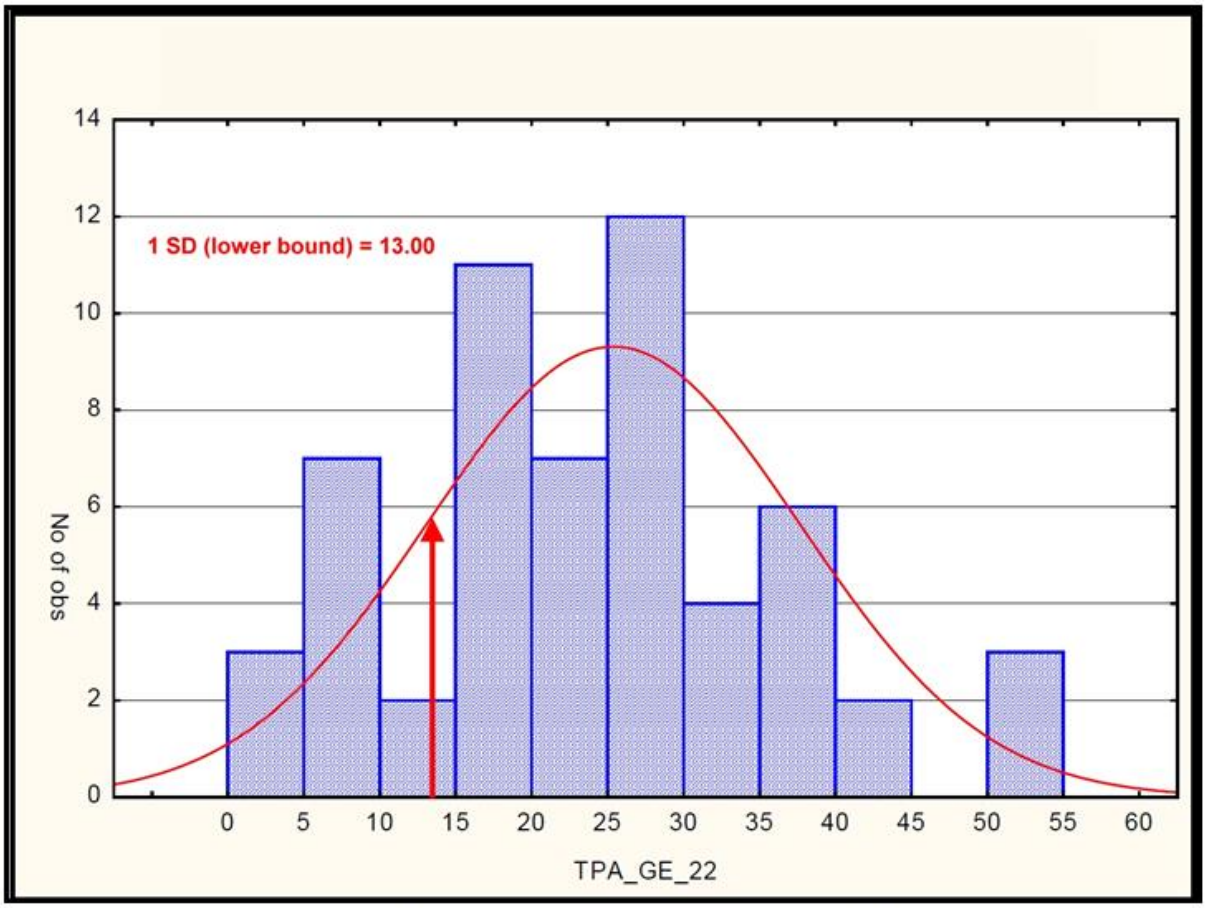


**Figure 6.** Estimated Normal Distribution of TPA ≥22 in. dbh at CSO and NSO nest sites on SPI. n=57

In summary, SPI's definition of Habitat Form 4 provides stands with canopy cover and average tree sizes that are consistent with those recorded in studies of CSO nesting habitat on both public and private lands. It also ensures the presence of a component of large trees in the stand, and provides for at least one suitable nesting structure. Therefore, we conclude that the definitions of Habitat Form 4 for both Mixed and Even land classes are consistent with habitat used for nesting by CSO, as reported in other studies and observed on SPI lands.

**Large Tree Component Applied for the Three Covered Species**

Parameters for QMD and canopy cover are readily available and are similar for all three Covered Species. Thus, regarding these parameters, the evaluation of Habitat Form 4 as representative of habitat for all three Covered Species is relatively straightforward. However, because few data are reported in published studies, the inclusion of the large tree threshold in Habitat Form 4 requires additional reasoned analysis and interpretation, when applied simultaneously to all three Covered Species. Figure 7 summarizes combined tree size data for the 1.05-ac. nest / den sites for the three Covered Species (with NSO data combined with CSO data, per the discussion above). As illustrated in Figure 7, the selection of 9 tpa ≥22 in. dbh is a reasonable estimate of a common threshold at which a stand begins to provide habitat capable of supporting nest / den sites for all three Covered Species. The exclusion of sites with fewer trees ≥22 in.dbh results in some degree of under-estimation of the current amount of habitat available for use by each the Covered Species.

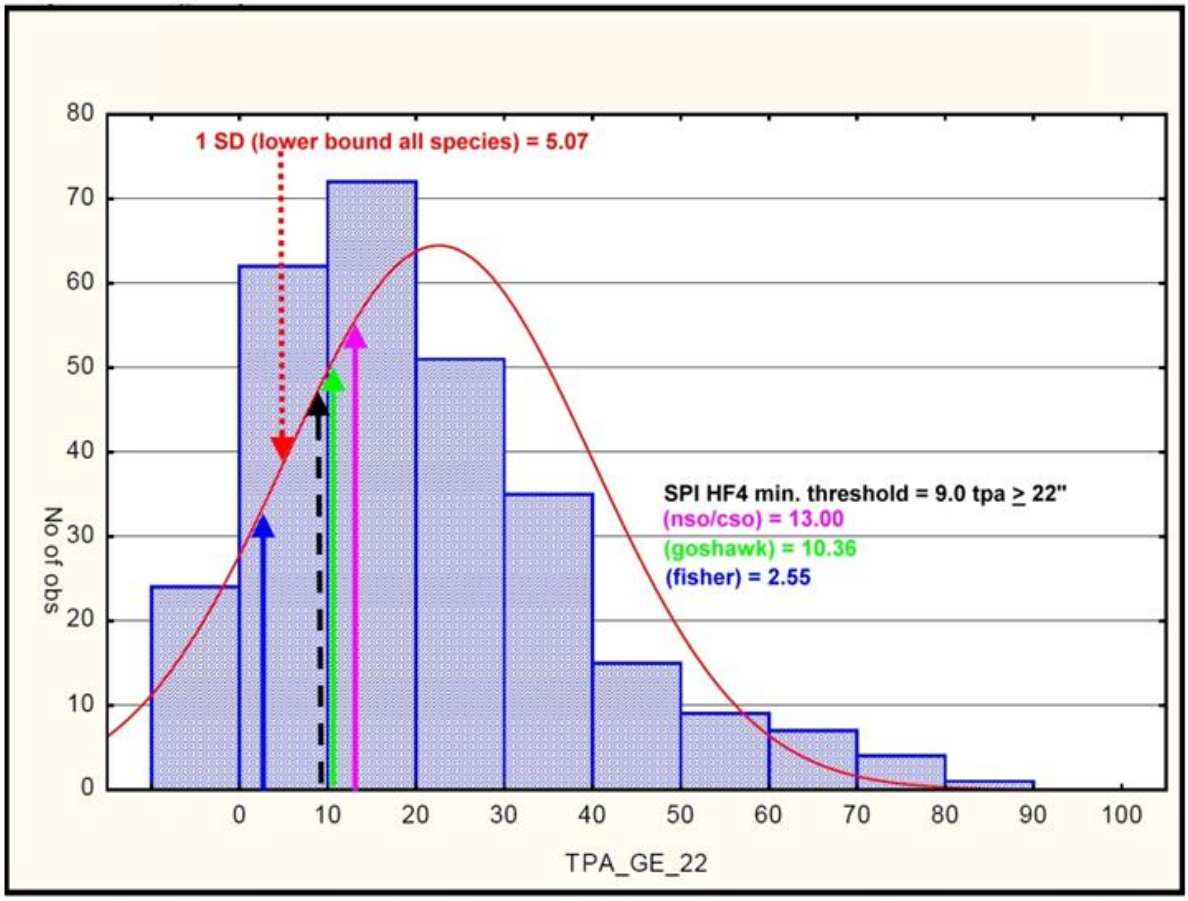


**Figure 7.** Estimated Normal Distribution of TPA ≥22 in. dbh at nest/den sites on SPI. n=280

**CONCLUSIONS**

For ease of description and quantification, a common habitat definition appropriate for all of the three Covered Species is needed for the CCAA. SPI has reviewed the literature on the three Covered Species, and analyzed data for nesting / denning habitat on its ownership. The resulting threshold criteria for inclusion of forested area into Habitat Form 4 provide habitat with values of QMD and canopy cover that are similar to or exceed those reported for nest / den sites on SPI lands and in published studies of the three Covered Species. The inclusion of criteria for the large tree component considers an additional key component of habitat for the three species.

In addition, SPI's inventory system results in more accurate assignment of forested areas into Habitat Form 4 than do other systems that assign lands into suitable habitat categories using more generalized methods or remotes sensing methods.

When all three parameters that make up the criteria for describing HF4 are considered in concert, (canopy cover, average tree size, and number of large trees) there is a high likelihood that the Covered Species will use such stands for nesting and/or denning. Thus, SPI believes that Habitat Form 4 is a valid (and in some ways superior) method for generally describing habitat for the three Covered Species. As such, SPI intends to use Habitat Form 4 as the basis for quantification of present and projected future habitat under the proposed CCAA. It is important to reiterate that the threshold criteria for qualification for the Habitat Form 4 class is not a target for management, but the point in a growing forest condition where we are confident that denning and nesting begins to occur.

This paper does not address questions of how much habitat is needed by the Covered Species, or how much will be provided over time under the CCAA. Habitat quantity will be addressed in a subsequent paper.

Appendix G: SPI 2013a. "HABITAT FORM 4" As a Representative of Habitat for California Spotted Owl, Northern Goshawk, and Fisher.

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APPENDIX A
CROSS PLOT PROCEDURE

Introduction: The purpose of this document is to describe the methods to be used in sampling the vegetation structure and composition of habitats important to wildlife. The emphasis will be on forested habitats, specifically the elements and areas of the forest chosen by individuals of a variety of species for important life functions such as nesting, resting, winter hibernation, etc.

As described in A Guide to Wildlife Habitats of California (Mayer and Laudenslayer, 1988), habitat elements are "specific physical and biological attributes of the landscape without which certain species are not expected to be present, or if present, are at relatively low population numbers." More precise evaluations of wildlife habitat relationships are possible if information about elements is considered. Elements important to wildlife (nest trees, snags, den logs) may occur at non-random distributions and to include the data specific to them when characterizing the site may bias the description of the habitat setting in which they are found. For the purposes of this methodology, a distinction will be kept between the habitat *element* chosen by an animal and the habitat immediately surrounding the element, or the *site*.

Therefore, in addition to collecting data on the feature itself (the nest, roost, resting structure, or den), characterizing the existing habitat will involve two scales of analysis. The first analysis will be at the scale of describing the element(s) of the forest with which the nest, roost, den, etc. is associated e.g. a tree, snag, log, or log complex. The second analysis is to quantify the area immediately surrounding the element of the forest chosen by the animal, i.e. the site.

The sampling methods are derived from those developed by Pious (1990; unpublished; Louisiana-Pacific Corporation, Calpella, CA). Pious based his protocol on the sampling methods described by Bingham (1989; Redwood Sciences Lab, Arcata, CA) and used perpendicular strips that are centered on the habitat element (nest tree, etc.). Further modifications have been made through the years by SPI to the Pious methodology to improve the efficiency of data collection while adequately describing the variables of highest priority.

This is not a stand-alone document for collecting habitat data to add to the SPI wildlife database. It is intended to be used in conjunction with individual field training in this methodology. Alternatively, it could be used simply as a reference for communicating how a variable was collected.

Equipment:

1. map, or better yet a guide, to the feature of interest
2. HP95 handheld programmable calculator with cross (Pious) plot program (+ connecting cable if using two)
3. one set of forms for the 1) Header information 2) the feature and 3) the habitat element
4. > two sets of 6-page-data-sheets per plot + "cheat sheet" for codes & abbreviations (paper forms needed as backup)
5. 75' diameter tape
6. compass
7. clinometer

8. spherical densiometer
9. SPI wildlife tree tags
10. aluminum nails
11. flagging
12. pencil
13. increment borer (long)
14. relaskop (if plot is centered on a tree e.g. a nest or a tree rest site; optional)
15. binoculars or spotting scope (optional)

Methods

Please refer to the attached diagram. Using the approximate center of the habitat element (center of the tree, center of the log den, etc.) as the center of the plot, four strips (or arms), with three suplots per arm are established. Using the 75' diameter tape, the centerline of each arm is identified. Use flagging (tied to vegetation, to a stick jammed in the ground, etc.) to mark the intersection of the centerline with the start of each subplot and the end of the third subplot. The dimensions of each subplot are 32.8 feet X 32.8 feet. A central subplot (32.8 feet X 32.8 feet) surrounds the habitat element where only data to complete the header(s)/cover sheet(s) is collected. Thus, the plot consists of four perpendicular arms of the dimensions 32.8 X 98.4 feet, each starting at a distance of 16.4 feet away from the approximate center of the habitat element, or wildlife structure, being described. Field personnel will collect data within a 16.4 ft distance from the centerline in each arm, according to the sampling protocol detailed below.

Data Collected: All Den/Rest/ Nest sites

- Site ID (or Tag No.)
- T; R; S; QTR; of QTR the Township, Range, and Section legal location, to the nearest sixteenth section
- Date 6 digit date for month, day, year: MM/DD/YY
- Wildlife Species
- Sex (Code)
- Nest/Rest Type
- Name - if wildlife feature being measured is an outcome of a study where individual animals are known by name, or other unique identifier, complete this item.
- Owner SPI, USFS, BLM, PVT (other private landowner)
- Slope
- Aspect
- Elevation
- Cruiser Initials
- Structure Composition - brief description of structure being used by the animal when it was originally identified as a wildlife habitat element; for example: mistletoe broom, broken top, cavity with entrance halfway up the bole, limb, fork of tree, etc.
- Dimensions: W/L/H
- Aspect of Structure or Entrance
- Height of Structure or Entrance
- Position in Tree
- Distance to Trunk
- Overhead Closure at Structure or Entrance
- Location Date

- Comments - record information here regarding observations on the feature characteristics that are not covered by the data but you believe could be important

Data Collected: Den/Rest/Nest Tree

- Tree Species
- Tree Diameter
- Tree Height
- Tree Age (if green
- Canopy Class
- Diameter at Structure or Entrance
- Tree Condition
- Bole Condition
- Cavities
- Position of Tree on Slope
- Distance to Water Source
- Permanence of Water Source
- Water Source Class - from the California Forest Practices Rules
- Distance to Human Disturbance
- Type of Disturbance
- Comments - record information here regarding observations on the habitat element characteristics that are not covered by the data but you believe could be important

Data Collected: Physiography
Physiography data should be collected in subplot 2 of each of the four arms of the plot, however, observations will be made throughout the arm for some variables, e.g. prescription.

- Initials
- Page of
- Plot Tag # and Plot #
- MM/DD/YY
- Owner
- Origin M= Managed, N= Natural, P= Plantation
- Prescription - management prescription previously applied to this stand
- Moisture W= Wet, M= Mesic, D= Dry
- Topography
- Elevation
- Slope %
- Aspect
- P. Stream, A. Stream, Seep/Spr, Lake/Pond, Pri Road, Sec Road: for each item, enter a 1 or 0 to indicate if that feature is visible or not visible from the plot; must be within 400 feet of the plot; if the feature is present within the plot, enter a 3
- Comments

Data Collected: Logs
A log is defined as a bole or piece of wood that is in contact with the ground at least at one end and as coarse woody debris, appears to function as a log, or more so than a snag. If any portion of the log is in the plot, the log is counted. Minimum size criteria are >10.0 in. at the large end and >6 feet length. Do not count a log twice if it extends into more than one arm of the plot.

- Plot size is 98.4 X 32.8 feet

- Species )
- Class - diameter class that describes the large end of the log.
- Decay- decay class that describes the log

Data Collected: Trees >15.75 in. dbh

- Plot Size is 98.4 X 32.8 feet
- Species
- Dbh - nearest two inch diameter class
- Height Class
- Canopy Class

Data Collected: Snags >4.7 in. dbh
A snag is defined as a standing, dead tree (or bottom portion of a tree) >3.3 feet in height.

- Plot Size is 98.4 X 32.8 feet
- Species
- Dbh - nearest two inch diameter class
- Height Class
- Decay Class
- Origin C= snag originated in the current stand
  P= snag originated in the previous stand
- Fire - presence or absence of exposure to fire.
- Cavities - presence or absence of cavities

Data Collected: Trees 5.1-15.75 in. dbh (small trees)

- Plot Size is 32.8 X 32.8; data is collected in subplots 1 and 3 of each arm
- Subplot enter the letter-digit combination to designate the subplot; e.g. N1, N3, E1, etc.
- Species
- Dbh - nearest two inch diameter class
- Height Class
- Canopy Class

Data Collected: Trees <5.1 in. dbh and >6.6 feet tall (saplings)

- Plot Size is 32.8 X 32.8; data is collected in subplots 1 and 3 of each arm
- Subplot enter the letter-digit combination to designate the subplot; e.g. N1, S3, E1, etc.
- Species enter the 2 digit code for species (attachment)
- Height Class enter the two digit code indicating the height class that describes the tree (attachment)
- No. enter the number counted
- Tally if there are more than a few saplings, this field is useful to keep a running tally of the trees in each species/height category

Data Collected: Cover Class

In each subplot 1 and 3, visually estimate the proportion of the area covered by each of the following categories of vegetation, cwd, litter or rock. If any of the elements is present, no matter how small a percentage of the ground cover it represents, 1-5 should be entered. Zero indicates true "absence".

- Plot Size is 32.8 X 32.8; data is collected in subplots 1 and 3 of each arm
- Subplot designate the subplot in which the data is being collected, e.g. N1, N3, E1, E3, etc.
- Conifer Trees - cover of conifer trees less than 6.6 feet tall
- Hardwood Trees - cover of hardwood trees less than 6.6 feet tall
- Evergreen Shrubs
- Deciduous Shrubs
- Ferns
- Rock - (any material >2.8 in. diameter)
- Course Woody Debris - (CWD) 2-6"
- Litter <2" - (leaf, cone, fine twigs and other non-woody material)
- Herbs - herbaceous plants excluding grasses
- Grass
- Moss - mosses and other bryophytes
- Lichen - terrestrial species and epiphytic lichens that have fallen to the ground

Data Collected: Total Canopy Cover

Canopy cover is estimated twice in each arm of the plot, using a concave spherical densiometer

At the intersection of the centerline of each arm with the beginning edge of subplot one and the outermost edge of subplot three, four densiometer readings are taken, in each of the cardinal directions, and averaged for the canopy cover estimate at that point. The densiometer is held away from the observer so that the reflection of the top of the observers head is even with the bottom of the grid. The grid etched in the densiometer consists of twenty-four squares. The observer is to envision four dots placed equidistant inside of each square and count the dots that are covered by the reflection of overhead vegetation. Another way to consider the technique is that the observer makes 96 yes/no decisions, in four directions for 384 decisions, to estimate canopy closure at that point. The correction factor suggested by the manufacturer of the densiometer is not incorporated in the canopy cover estimate for this methodology. The consensus in the scientific literature is that the spherical densiometer does not give a highly accurate measure of canopy closure and the correction factor does not improve this. Canopy closure information from the data collected by this methodology will generally be presented in ranges e.g. 40-59%, which is the moderate canopy closure class in the California WHR system. The uncorrected readings from the densiometer are assumed sufficiently accurate in this context.

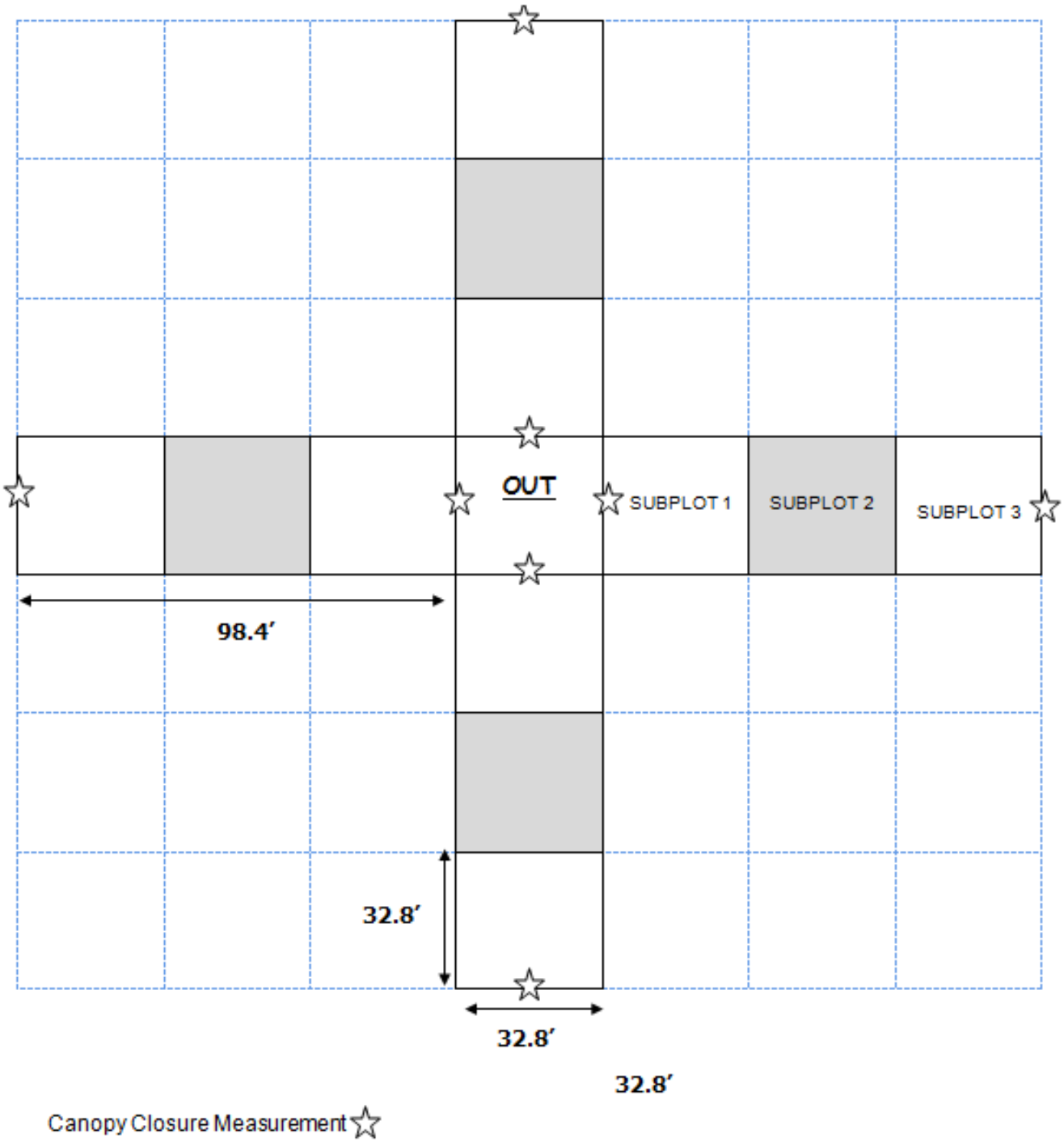
Data Collected: Site Tree

Increment-core three or more dominant or codominant trees per plot. Core more than three trees only if there is significant variation among the ages of the first three trees. Ideally trees will be on the plot, however on occasion trees close to but off the plot will be the most appropriate candidates.

- Species
- Dbh - nearest 0.1 foot

Appendix G: SPI 2013a. "HABITAT FORM 4" As a Representative of Habitat for California Spotted Owl, Northern Goshawk, and Fisher.

- Height - nearest 1 foot
- Canopy Class
- Age increment cores, ring count; note whether age had to be approximated due to rot or extrapolated due to the size of the tree being larger than the increment borer
- Comments



# Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

Draft 6.2

4/16/13

## Introduction

Sierra Pacific Industries (SPI) is developing a Candidate Conservation Agreement with Assurances (CCAA) for the California spotted owl (CSO), northern goshawk (NOGO), and Pacific fisher (PAFI) (Covered Species). SPI uses its Habitat Form classification system to describe forest stands as habitat for wildlife species, such classification is based upon an intensive forest inventory implemented across the SPI ownership at a frequency of one plot every 4 acres.

Habitat Form 4 (HF4) is considered suitable nest / den habitat for the Covered Species by virtue of its dense canopy (≥60%), large stand quadratic mean diameter (QMD) (≥13" dbh), the presence of a large tree component (minimum of 9 ≥22" dbh), and at least one suitable nest / den structure present in the stand. (For detailed information on Habitat Form 4, see "'Habitat Form 4'as a Representative of Habitat for Covered Species", Draft 3.2, Feb. 7, 2013)(SPI 2013).

Habitat Form 2 (HF2) is the stand condition that is the precursor to HF4. HF2 has moderate to dense canopy cover (40% - 100%) and a QMD of ≥6" dbh. While a component of larger trees may be present in a stand designated as HF2 and or QMD can be high, HF2 stands do not satisfy all the criteria of HF4.

The amount and trend of HF4 is intended to provide one of the key metrics of performance of the CCAA. The current baseline amount of HF4 will change through the life of the CCAA as forest stands grow into HF4 from HF2, and as both HF2 and HF4 stands are harvested.

Because the forest inventory was not designed to identify suitable nest /den structures on the sample plots, other confirmation of the presence of nest / den structures is needed to validate the assumption that structures are present in stands that otherwise meet the threshold criteria for HF4.

## Objectives

One objective of this Survey/Inventory was to evaluate whether suitable nest / den structures are present in stands that otherwise meet the threshold criteria for HF2 and HF4 based on the forest inventory. This information will be used to evaluate the accuracy of assignment of stands to the HF4 category. It will also be used to evaluate whether HF2 stands might also have the requisite nest / den structure present and therefore could qualify as suitable nest / den habitat for the Covered Species, either at present or when the HF4 criteria are achieved through growth of the stand.

## Methods

During autumn 2012, HF4 and HF2 stands on SPI lands were visually searched for presence of nest / den structures and sampled using strip plots to estimate abundance of such structures. For sampling, stands were selected from various potential Covered Species Conservations Areas (CSCAs) that will be designated under the CCAA (Fig. 1). The CSCAs investigated were chosen as representative of a wide range of conditions on the SPI ownership, based on experience of biologists and foresters. Two of the selected CSCAs (McCloud and Sacramento Canyon), while in the range of the fisher and goshawk were in the range of the Northern spotted owl (NSO) rather than the CSO; conditions suitable for NSO were assumed to be suitable for CSO.

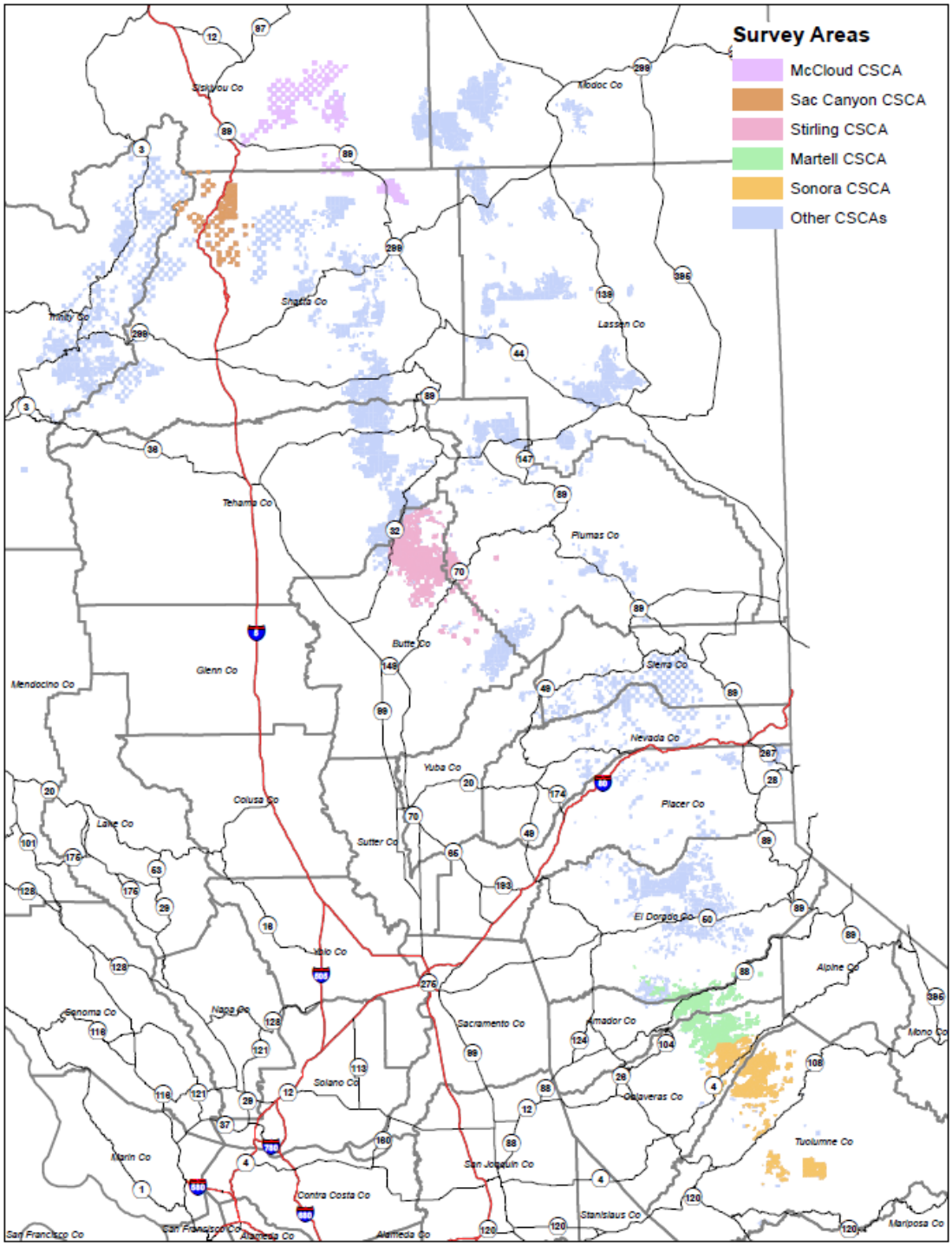



**Figure 1:** Covered Species Conservation Areas inventoried.

## Sample Selection

The initial population consisted of all stands meeting inventory criteria (canopy cover, QMD, and large tree component) for HF4 and HF2 in the five CSCAs identified in Fig. 1. A randomly chosen subset representing five percent of the stands appropriate for analysis was then

selected, using the following process: To provide stands of meaningful size, all stands less than 5 acres were removed from consideration. All stands in Watercourse & Lake Protection Zones (WLPZs) were removed, because they are likely to have been subject to different forms of management than the more typical upland stands. All stands intersecting recent regeneration units that had not yet been re-inventoried and / reclassified in the GIS were removed from the potential sample, so that all areas selected for inventory would be properly classified and their acreage known. The average size of stands remaining eligible for evaluation was about 15 acres.

**Stand Search**

For presence/absence searches of stands, five percent of the stands from among the eligible HF4 population were randomly selected from each of the five CSCAs using a random number generator based on the stand's GIS Feature Index Number. This resulted in a total sample of 94 stands, arrayed in the CSCAs as depicted in Table 1.

Table 1. Numbers of HF4 Stands Selected for Searches per CSCA

| **CSCA** | Count of Stands Selected for Searches |
|---|---|
| McCloud | 7 |
| Martell | 22 |
| Stirling | 33 |
| Sonora | 28 |
| Sacramento Canyon | 4 |

We also wished to evaluate whether structures in HF2 stands are available to contribute to Covered Species use of HF4 stands, so an equal number of HF2 stands were selected from each CSCA for sampling. For efficiency in sampling, the HF2 population was limited to stands within 0.25 mi. of a HF4 stand. HF2 stands were also selected using a random number generator, resulting in 94 HF2 stands chosen for search. Where numbers of HF2 stands within the 0.25 mile proximity requirement were not sufficient to attain the same number of samples as the HF4 stands, the next nearest HF2 stands meeting the criteria were used as the base for sampling.

Once the sample HF4 and HF2 stands had been selected, WLPZ stands contiguous with the chosen sample stands were included in the sample area to be searched, because structures present in contiguous WLPZ stands are available to Covered Species using the adjacent HF4 or HF2 stands. To allow comparison, data collected from these adjacent WLPZs were segregated from data collected in the upland stands. Descriptions of the stands' perimeters were downloaded into a GPS unit for location in the field and to ensure the search was conducted only in the sample stand.

Because of time constraints, presence/absence stand searches were conducted at 73 of the 94 HF2 stands and 81 of the 94 HF4 stands. Thus, in 154 stands, a biologist or forester familiar with the nesting and denning needs of the covered species walked through the stand visually

examining live and dead trees until a structure was located that was apparently suitable for use by each of the Covered Species. All evaluations were taken from the ground and were subjective, but personnel were instructed to perform the evaluation in a critical and conservative manner. The stand search would be complete when a suitable structure for each of the Covered Species was found, or when one hour had elapsed. Thus, the stand search constituted a presence/absence survey and a qualitative assessment of the presence of structures.

Characteristics of apparently-suitable structure trees were described on data forms, including species, diameter at breast height (dbh), and structural attributes such as size of cavity or platform, estimated diameter of broken top, number of re-grown tops, etc. Structures were considered suitable for use if the observer saw one or more of the characteristics found on the data form (Fig. 2). Indicators of suitability included the width of a broken top, epicormic branch diameter and number, complexity of mistletoe broom, the number of forks or leaders in a reformed top, size of a platform, apparent depth of cavity, and evidence of decay. The search focused on locating structures in live trees, because the intent of the CCAA is to provide structures that will persist over time. However, snags were also tallied, because they may provide for the Covered Species, albeit potentially for shorter periods of time.

If a single tree contained multiple structures that might be suitable for more than one of the Covered Species, it was counted only once. In such cases, the hierarchy for assigning suitability was: 1) PAFI, 2) CSO, and 3) NOGO.

Figure 2. Stand Search Data Sheet

| Start time (24 hour) | Time at first observation or suitable structure | Type of structure[1,2] and Diameter of Structure | Covered species structure would support[3] | End Time | Justification of structures utility for Covered Species. Tally of other structures observed. |
|---|---|---|---|---|---|
| | | | | | |
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| | | | | | |

[1] SPI tree species code

[2] 01 = cavity <2-6"; 02 = cavity >6"; 03 = broken top; 04 = reformed top; 05 = platform – mistletoe, 06 = platform – epicormic branching; 07 = platform –stick nest; 08 = platform – broken limb; 09 = basal cavity; 10 = down log with cavity; 11 = snag – cavity; 12 = snag – broken top; 13 = snag – loose bark

[3] A=CSO; B=PAFI; C=NOGO

## Strip Plot Sampling

The intent of the strip plot structure sampling was to estimate the number of existing structures per acre in HF4 and HF2 stands. The strip plot sample consisted of a random selection of half of the above-described 94 sample stands of both HF4 and HF2; thus, a total of 94 stands were sampled. The sampling used a strip plot 66 feet wide (33 feet either side of the center line) and 330 feet long, thus covering an area of 0.5 acre. The starting point at one end of the strip was randomly located within the stand in the SPI GIS. A bearing direction was selected that allowed the complete length and width of the plot to remain within the stand and any contiguous WLPZ. The bearing was selected on a GIS layer with no vegetation information to avoid biasing the bearing selection. The starting point and bearing were downloaded into a GPS unit for location in the field.

The center of the strip was flagged for reference and for determining whether a structure tree was inside the strip. In each strip plot, data were recorded for all structures that appeared suitable for one or more of the three Covered Species (Fig. 3). As in the stand searches, if a single tree contained multiple structures that might be suitable for more than one of the Covered Species, it was counted only once. In such cases, the hierarchy for assigning suitability was: 1) PAFI; 2) CSO; and 3) NOGO.

Figure 3. Strip Plot Data Sheet

| Strip plot # | Structure Number | WLPZ (Yes/No) | Tree Species[1] | Diameter (nearest 2" dbh class) | Structure ID (01-013)[2] | Covered Species Suitability[3] | Comments and Justifications |
|---|---|---|---|---|---|---|---|
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[1] SPI tree species code.
[2] 01 = cavity <2-6"; 02 = cavity >6"; 03 = broken top; 04 = reformed top; 05 = platform – mistletoe; 06 = platform – epicormic branching; 07 = platform –stick nest; 08 = platform – broken limb; 09 = basal cavity; 10 = down log with cavity; 11 = snag – cavity; 12 = snag – broken top; 13 = snag – loose bark
[3] A=CSO; B=PAFI; C=NOGO

## Results

### Stand Search

Results of the presence/absence stand searches are detailed in Table 2. Only one of the 154 stands sampled (an HF2) did not contain at least one suitable structure. Most of the HF2 (86%) and HF4 (84%) stands contained nest / den structures for all three of the Covered Species

Table 2. Number of stands containing at least one structure for the three Covered Species

| | **All Stands Combined** Counts and % of stands with at least one suitable structure for the individual covered species. | | |
|---|---|---|---|
| Total Stands | PAFI | CSO | NOGO |
| 154 | 141 | 148 | 144 |
| | 92% | 96% | 94% |

| | **HF2 Stands** Counts and % of stands with at least one suitable structure for the individual covered species. | | |
|---|---|---|---|
| Total Stands | PAFI | CSO | NOGO |
| 73 | 69 | 70 | 68 |
| | 95% | 96% | 93% |

| | **HF4 Stands** Counts and % of stands with at least one suitable structure for the individual covered species. | | |
|---|---|---|---|
| Total Stands | PAFI | CSO | NOGO |
| 81 | 72 | 78 | 76 |
| | 89% | 96% | 94% |

Of the 154 stands sampled in the presence/absence searches, 18 (11.6%) included area within WLPZs (Table 3). WLPZs begin at the edge of the high water mark of the stream channel and extend away from the stream generally 75 feet from either side of a class **II** and generally 100 feet from class **I** streams depending on slope. As a rule the protection zones become increasingly wider as the slope of the terrain increases. About 6% of the total structures identified were in these WLPZs. In only one case were structures present in the WLPZ but absent in the contiguous upslope unit. Thus, suitable structures do not appear to be concentrated in WLPZs, but are found in the upland stands as well.

Table 3. Number of structures found in WLPZs during Stand Searches.

| Watercourse Class | Number of Stands | Percent of Total Stands Searched (n=154) | Number of Structures | Percent of Total Structures Identified (n=516) |
|---|---|---|---|---|
| STR 1 | 5 | 3% | 7 | 1% |
| STR 2 | 13 | 8% | 24 | 5% |

**Strip Plot Sampling**

Table 4 details the results for the strip plot sampling. For all stands of HF2 and HF4 combined, the average was more than 3 structures per ½-acre plot. Thus, the estimated mean number of suitable structures for one or more of the Covered Species is over 6 per acre. Structures that could support a nesting northern goshawk were most common, followed by structures for the California spotted owl and the Pacific fisher, but the differences were negligible. For all stands combined, the median value for each species was 1.00 structure per ½-acre (or 2 per acre).

Table 4. Numbers of structures for ½-acre strip plots by Covered Species

| | Number of Nest/Den Structures | PAFI | CSO | NOGO |
|---|---|---|---|---|
| | Per 1/2 acre plot - All | | | |
| Average | 3.40 | 1.04 | 1.09 | 1.28 |
| Median | 3.00 | 1.00 | 1.00 | 1.00 |
| Std Dev | 2.25 | 1.37 | 0.99 | 1.04 |
| Min | 0.00 | 0.00 | 0.00 | 0.00 |
| Max | 12.00 | 7.00 | 5.00 | 5.00 |
| | Per 1/2 acre plot - HF2 | | | |
| Average | 3.59 | 1.13 | 1.17 | 1.28 |
| Median | 3.50 | 1.00 | 1.00 | 1.00 |
| Std Dev | 2.29 | 1.31 | 1.06 | 1.05 |
| Min | 0.00 | 0.00 | 0.00 | 0.00 |
| Max | 12.00 | 6.00 | 5.00 | 5.00 |
| | Per 1/2 acre plot - HF4 | | | |
| Average | 3.23 | 0.96 | 1.00 | 1.27 |
| Median | 3.00 | 0.00 | 1.00 | 1.00 |
| Std Dev | 2.23 | 1.43 | 0.92 | 1.05 |
| Min | 0.00 | 0.00 | 0.00 | 0.00 |
| Max | 10.00 | 7.00 | 3.00 | 4.00 |

Five of the 94 strip plots (5.3 %) included portions of WLPZs (Table 4). About 3 percent of the total structures identified in the strip plots were in WLPZs.

Table 4. Number of structures found in WLPZs in Strip Samples.

| Watercourse Class | Number of Different Stands | Percent of Total Stands Searched | Total WLPZ Structures | Percent of Total Structures Identified (n=338) |
|---|---|---|---|---|
| STR 1 | 3 | 3% | 8 | 2% |
| STR 2 | 2 | 2% | 4 | 1% |

**Characteristics of Structure Trees**

In both sampling methods (stand search and strip plot), data were collected on tree species, tree size (dbh), and nest/den structure type.

Structures were present in at least 14 tree species (Table 5). In both samples, structures most commonly occurred in white fir and black oaks.

Table 5. Tree Species Supporting Nesting / Denning Structures

| Stand Search | | | Strip-Plot | | |
|---|---|---|---|---|---|
| Tree Species | # | % | Tree Species | # | % |
| Madrone | 1 | 0% | Alder | 0 | 0% |
| Alder | 2 | 0% | Madrone | 0 | 0% |
| Tanoak | 3 | 1% | Live Oak | 1 | 0% |
| Big Leaf Maple | 5 | 1% | Tanoak | 1 | 0% |
| Live Oak | 9 | 2% | Big Leaf Maple | 2 | 1% |
| Black Oak | 115 | 22% | Black Oak | 54 | 16% |
| White fir | 112 | 22% | White fir | 102 | 31% |
| Douglas-fir | 87 | 17% | Incense-cedar | 47 | 14% |
| Incense-cedar | 58 | 11% | Douglas-fir | 38 | 11% |
| Ponderosa/Jeffrey Pine | 49 | 9% | Ponderosa/Jeffrey Pine | 37 | 11% |
| Red Fir | 38 | 7% | Red Fir | 25 | 8% |
| Sugar Pine | 30 | 6% | Sugar Pine | 22 | 7% |
| Other Conifer | 4 | 1% | Other Conifer | 2 | 1% |
| Lodgepole Pine | 2 | 0% | Western Red Cedar | 1 | 0% |
| Knobcone Pine | 2 | 0% | Lodgepole Pine | 0 | 0% |
| Western Red Cedar | 2 | 0% | Knobcone Pine | 0 | 0% |
| Total | 519 | | | 332 | |

Trees containing structures averaged about 25” dbh (Table 6), with a minimum diameter of 12” dbh. Most of the trees with structures were larger than 16” dbh.

Table 6. Structure Tree Diameters

| | Tree DBH – Stand Search | Tree DBH - Strip plots |
|---|---|---|
| Mean | 24.5 | 26.5 |
| Median | 24.0 | 26.0 |
| Std. Dev. | 8.0 | 9.4 |
| Min. | 12.0 | 12.0 |
| Max. | 54.0 | 72.0 |

In both sampling methods, the most commonly observed nest/den structures were epicormic branching, deformed tops, and cavities 2” to 6” (Table 7).

Table 7. Nest / Den Structure Type

| | Stand Search | | Strip Plot | |
|---|---|---|---|---|
| Nest / Den Type | # | % | # | % |
| Cavity 2 to 6 | 53 | 11% | 27 | 8% |
| Cavity >6 | 34 | 7% | 8 | 2% |
| Broken top | 35 | 8% | 25 | 8% |
| Deformed top | 64 | 14% | 50 | 15% |
| Platform, mistletoe | 25 | 5% | 14 | 4% |
| Platform, epicormic branching | 76 | 16% | 91 | 28% |
| Platform, stick nest | 22 | 5% | 11 | 3% |
| Platform, broken limb | 4 | 1% | 3 | 1% |
| Basal cavity | 5 | 1% | 4 | 1% |
| Down log with cavity | 20 | 4% | 13 | 4% |
| Snag, cavity | 25 | 5% | 10 | 3% |
| Snag, broken top | 17 | 4% | 12 | 4% |
| Snag, loose bark | 4 | 1% | 2 | 1% |
| Multiple | 134 | 29% | 56 | 17% |
| Total | 465 | | 326 | |

**Discussion**

As described in SPI (2013), SPI has proposed that HF4 will be the habitat type used for estimation of the baseline amount of habitat for the three Covered Species and as the metric for projecting trends and tracking achievement of milestones during the period that the CCAA is in effect. Most of the characteristics required for inclusion of forest stands in HF4 (i.e., canopy cover, QMD, and presence of a component of large trees) are measured and recorded during SPI’s standard forest inventory. However, the presence of structures suitable for

nesting/denning use by the Covered Species is not recorded during these inventories. While experience suggests that such structures are present on a regular basis, SPI recognizes that more rigorous validation is needed to support the assumption that stands meeting the other criteria indeed have the important structural features.

This analysis demonstrates that apparently-suitable structures for Covered Species nesting / denning are present in almost all stands of both HF4 and HF2, and that structures are present at rates that far exceed the criterion of one structure per stand required for inclusion as HF4 (see Table 4). Thus, SPI maintains that it is reasonable and appropriate to assume that stands meeting the criteria measured in the forest inventory plot system typically also have sufficient structures available.

The presence of such structures in HF2 stands indicates that as the trees in these stands grow larger and attain the QMD and canopy cover required for re-classification as HF4, the stands will already have a sufficient number of structures to support nesting / denning behavior. Thus, it is appropriate to project an increase in the amount of HF4 according to the modeled growth of stands presently classified as HF2.

It is perhaps worthwhile to consider the origins of SPI's existing HF4 and HF2 forest stands, and the factors that have created the nesting / denning structures. Most of the HF4 and HF2 stands have been acquired by SPI during the past four decades, and they were managed by a variety of other owners in previous decades. For the past 50 to 100 years, barring catastrophic events such as extensive wind-throw or catastrophic fire, most of these forests were typically managed under various forms of repeated selection harvest, in which the largest, most valuable, and most accessible trees were harvested in a series of entries. In most cases, stands were left to regenerate naturally, rather than re-planted. These practices left stands with a variety of conditions that included few large old conifers, numerous hardwoods and smaller conifers, and also conifers of lesser commercial value, including some with "defects" such as broken and reformed tops, fire damage, large mistletoe infections, abnormal limb growth, heart rot and cavities, etc. Fortuitously, many of these commercially undesirable growth forms provide nesting/denning structures for the Covered Species and other wildlife. All trees continuing to grow in these stands remain subject to natural forces such as disease and damage from snow and wind, which create additional structures. Thus, given the history of these stands, these ongoing natural processes, and the results of this sampling, it is reasonable to expect the continued presence of nesting/denning structures.

The threshold criteria (SPI 2013) for inclusion of stands in HF4 were based on data derived from the literature and from measurements at successful nesting/denning sites on SPI property. In order to limit the definition of HF4 to only more typical nesting/denning locations, the HF4 threshold criteria deliberately excluded a minority of the nesting/denning sites that were in stands with relatively small QMD or lower canopy cover, or where there were fewer than 9 trees per acre ≥22"dbh. As a result, a minority of the known reproductive sites did not meet the criteria for the HF4 classification, but were instead classified as HF2. The presence and numbers of suitable structures observed in HF2 stands in this study may help explain the Covered Species' use of these stands that do not yet meet the HF4 classification. Given the demonstrated presence of structures and demonstrated use of some HF2 stands by Covered Species, it may be appropriate to include a subset of HF2 stands with the highest QMD and canopy cover as additional support for HF4 habitats in estimation of habitat amounts.

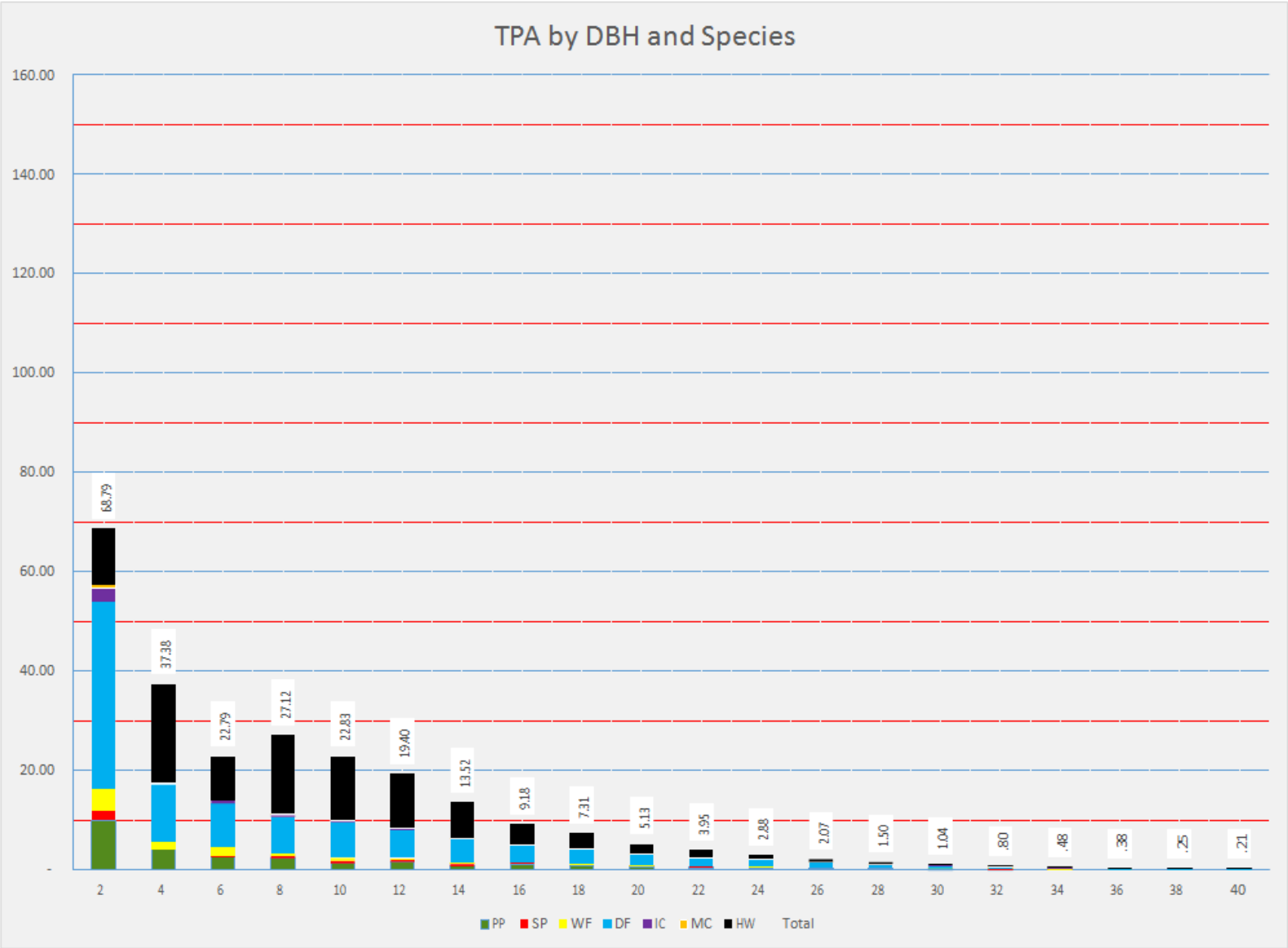
References:

Sierra Pacific Industries 2013. "HABITAT FORM 4" AS A REPRESENTATIVE OF HABITAT FOR COVERED SPECIES, Draft V3.2, Submitted to USFWS, Yreka, CA. February 7, 2013.

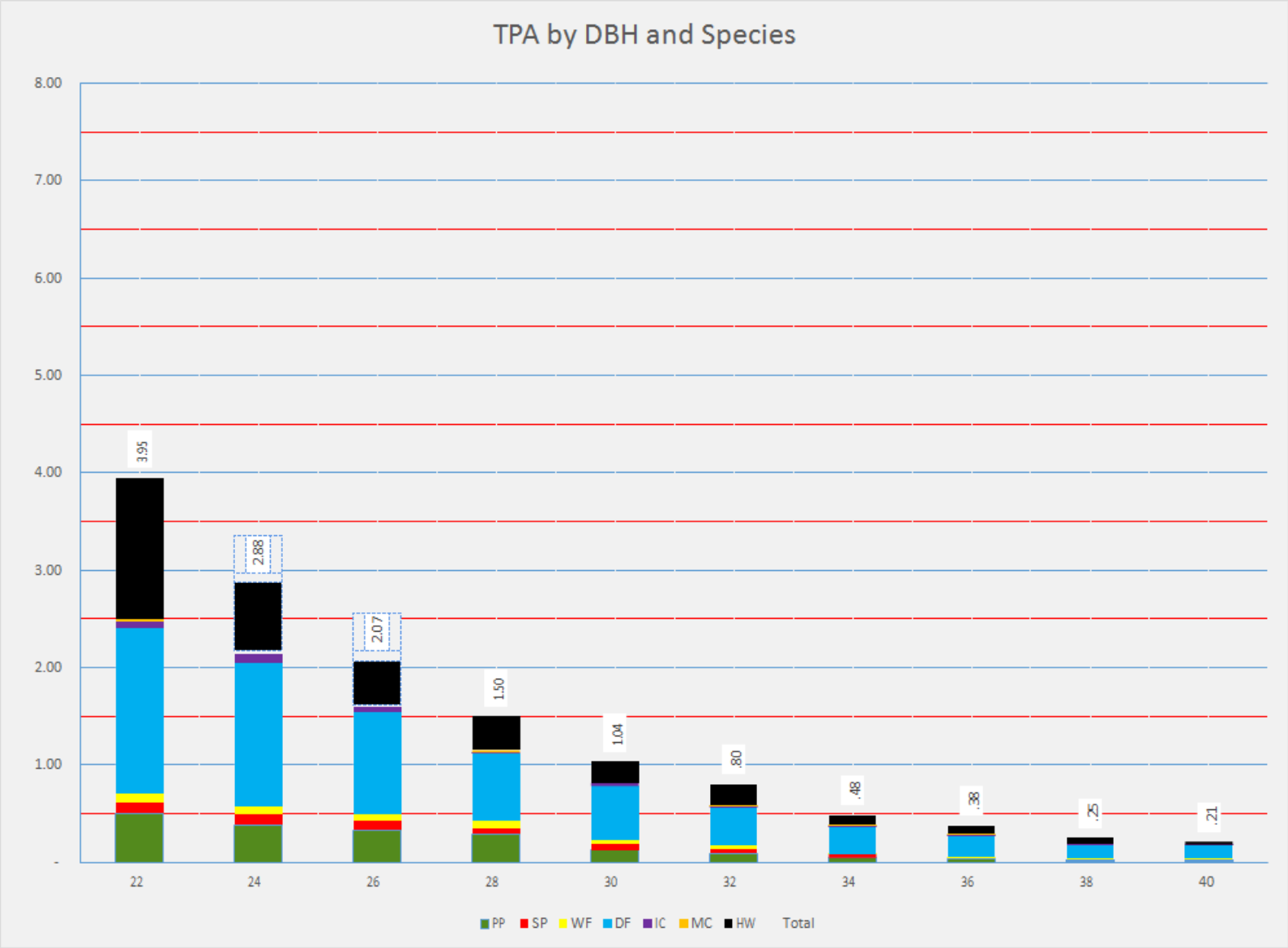
Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 10.8 | (+ or | 13.0 |
| Processed 02/07/2014 at 15:13:53 | | QMD >=5" | 14.0 | (+ or | 12.9 |
| | | Ave Diam All | 8.3 | (+ or | 45.3 |
| Tree Frequency | | Ave Diam >=5" | 12.5 | (+ or | 42.0 |
| Plot Count | 10,526 | TPA >= 12" | TPA >= 22" | 14.0 | |

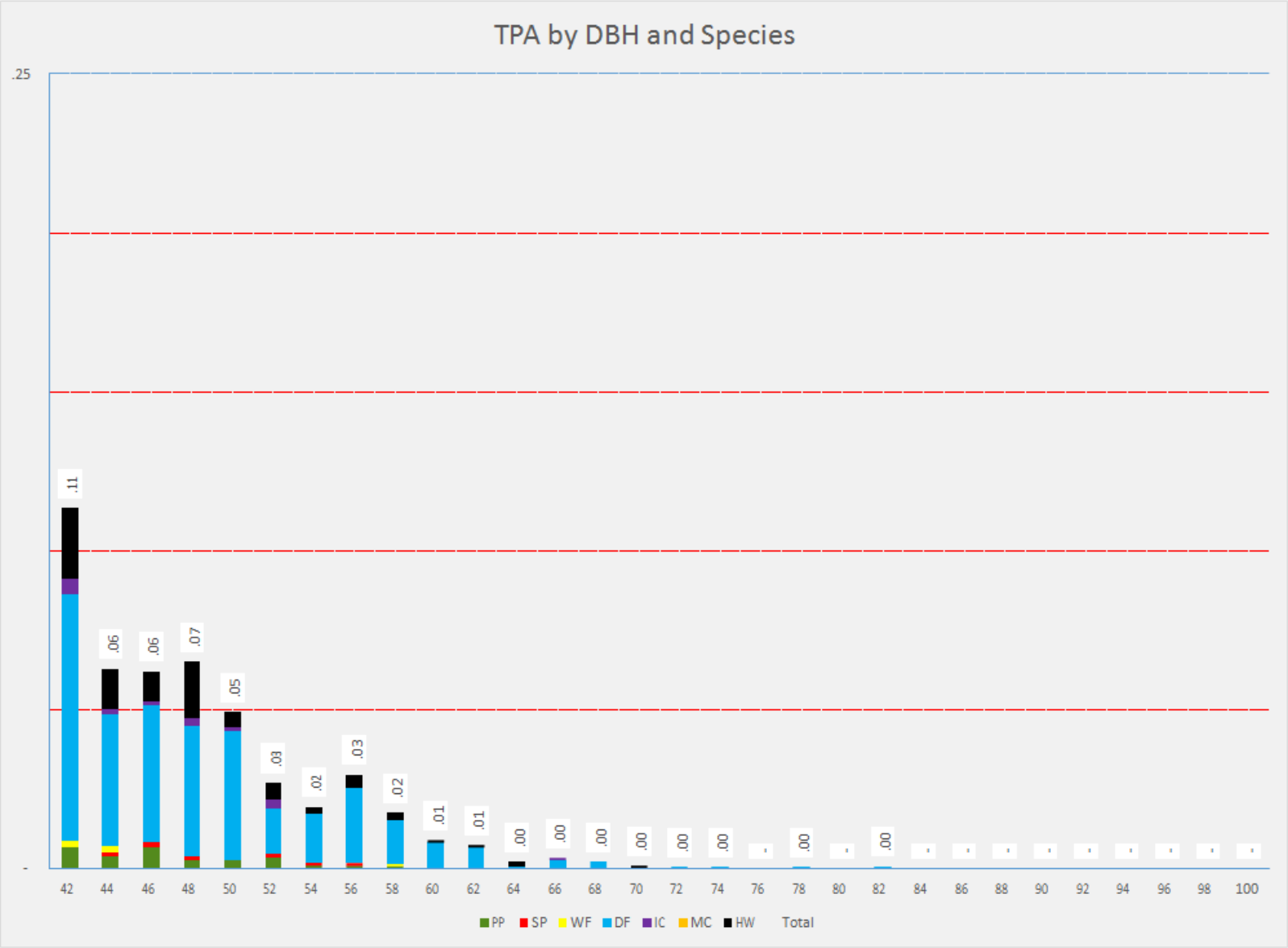
| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 9.94 | 2. | 4.2 | 37.69 | 2.7 | .71 | 11.40 | 68.79 |
| 4 | 4.07 | .09 | 1.5 | 11.53 | - | .18 | 19.95 | 37.38 |
| 6 | 2.65 | .17 | 1.6 | 8.96 | .58 | .09 | 8.75 | 22.79 |
| 8 | 2.33 | .45 | .53 | 7.31 | .50 | .24 | 15.76 | 27.12 |
| 10 | 1.31 | .48 | .58 | 7.26 | .19 | .24 | 12.76 | 22.83 |
| 12 | 1.65 | .40 | .35 | 5.67 | .19 | .08 | 11.07 | 19.40 |
| 14 | .67 | .43 | .24 | 4.68 | .18 | .04 | 7.27 | 13.52 |
| 16 | 1.06 | .28 | .24 | 3.26 | .04 | .09 | 4.22 | 9.18 |
| 18 | .81 | .15 | .27 | 2.89 | .12 | .06 | 3.01 | 7.31 |
| 20 | .64 | .11 | .19 | 2.20 | .10 | .07 | 1.82 | 5.13 |
| 22 | .51 | .10 | .09 | 1.71 | .06 | .04 | 1.45 | 3.95 |
| 24 | .39 | .10 | .08 | 1.48 | .09 | .02 | .72 | 2.88 |
| 26 | .33 | .09 | .07 | 1.04 | .06 | .01 | .47 | 2.07 |
| 28 | .29 | .06 | .07 | .70 | .01 | .02 | .34 | 1.50 |
| 30 | .13 | .06 | .04 | .56 | .03 | - | .22 | 1.04 |
| 32 | .10 | .04 | .04 | .39 | .02 | .00 | .22 | .80 |
| 34 | .05 | .03 | .01 | .28 | .02 | .01 | .10 | .48 |
| 36 | .04 | .01 | .00 | .22 | .02 | .00 | .09 | .38 |
| 38 | .02 | .01 | .01 | .14 | .01 | - | .06 | .25 |
| 40 | .03 | .01 | .01 | .13 | .01 | - | .03 | .21 |
| 42 | .01 | - | .00 | .08 | .01 | - | .02 | .11 |
| 44 | .00 | .00 | .00 | .04 | .00 | - | .01 | .06 |
| 46 | .01 | .00 | - | .04 | .00 | - | .01 | .06 |
| 48 | .00 | .00 | - | .04 | .00 | - | .02 | .07 |
| 50 | .00 | - | - | .04 | .00 | - | .00 | .05 |
| 52 | .00 | .00 | - | .01 | .00 | - | .01 | .03 |
| 54 | .00 | .00 | - | .02 | - | - | .00 | .02 |
| 56 | .00 | .00 | - | .02 | - | - | .00 | .03 |
| 58 | .00 | - | .00 | .01 | - | - | .00 | .02 |
| 60 | - | - | - | .01 | - | - | .00 | .01 |
| 62 | - | - | - | .01 | - | - | .00 | .01 |
| 64 | - | - | - | .00 | - | - | .00 | .00 |
| 66 | - | - | - | .00 | .00 | - | - | .00 |
| 68 | - | - | - | .00 | - | - | - | .00 |
| 70 | - | - | - | - | .00 | - | .00 | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | - | - | .00 | - | - | - | .00 |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | - | - | - | - | - |
| 82 | .00 | - | - | .00 | - | - | - | .00 |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 10 | - | - | - | - | - | - | - | - |
| Total | 27.03 | 5. | 10.2 | 98.42 | 5.0 | 1.90 | 99.79 | 247.49 |




Hayfork Divide-Bully Choop HF4 DBH 2"- 40" Page 2




Hayfork Divide-Bully Choop HF4 DBH 22"- 40" Page 3

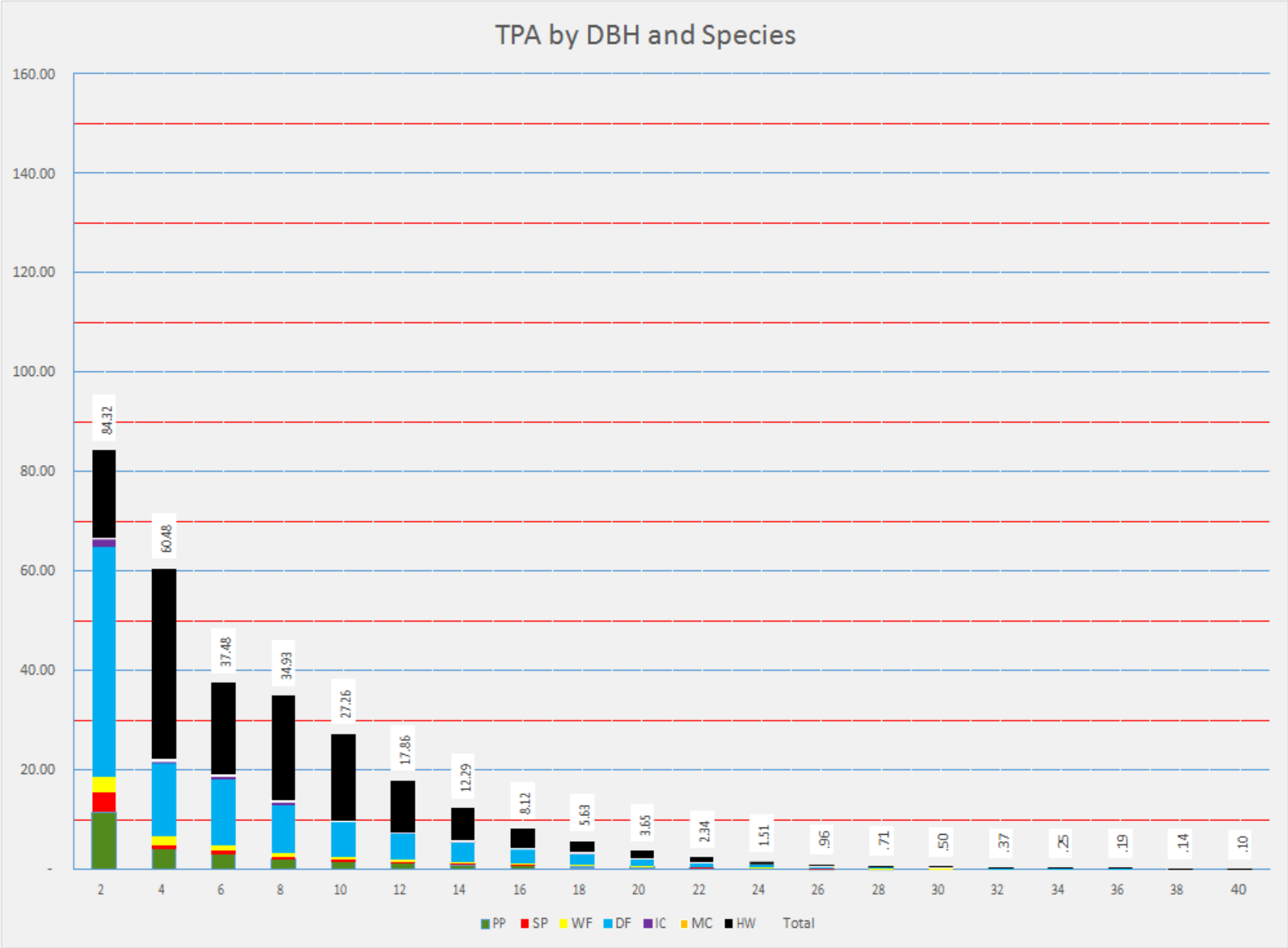



Hayfork Divide-Bully Choop HF4 DBH 42"+ Page 4

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 8.9 | (+ or -) | 12.4 |
| Processed 02/07/2014 at 15:00:07 | | QMD >=5" | 12.0 | (+ or -) | 12.2 |
| | | Ave Diam All | 6.9 | (+ or -) | 45.5 |
| Tree Frequency | | Ave Diam >=5" | 10.8 | (+ or -) | 40.8 |
| Plot Count | 4,958 | TPA >= 12" 54.9 | TPA >= 22" 7.3 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 11.52 | 4.02 | 3.00 | 46.39 | 1.59 | .19 | 17.62 | 84.32 |
| 4 | 4.17 | .68 | 1.92 | 14.59 | .42 | .33 | 38.38 | 60.48 |
| 6 | 3.02 | .87 | .91 | 13.18 | .80 | .23 | 18.47 | 37.48 |
| 8 | 2.07 | .45 | .71 | 9.73 | .66 | .41 | 20.91 | 34.93 |
| 10 | 1.54 | .31 | .74 | 6.87 | .25 | .18 | 17.37 | 27.26 |
| 12 | 1.28 | .20 | .43 | 5.24 | .21 | .14 | 10.36 | 17.86 |
| 14 | .86 | .21 | .29 | 4.04 | .14 | .25 | 6.51 | 12.29 |
| 16 | .71 | .17 | .24 | 2.94 | .13 | .15 | 3.78 | 8.12 |
| 18 | .57 | .14 | .17 | 2.28 | .12 | .10 | 2.26 | 5.63 |
| 20 | .37 | .08 | .14 | 1.51 | .06 | .09 | 1.41 | 3.65 |
| 22 | .25 | .06 | .07 | 1.03 | .03 | .05 | .85 | 2.34 |
| 24 | .20 | .04 | .05 | .70 | .04 | .04 | .45 | 1.51 |
| 26 | .10 | .04 | .01 | .46 | .01 | .02 | .31 | .96 |
| 28 | .08 | .03 | .02 | .33 | .01 | .03 | .21 | .71 |
| 30 | .06 | .02 | .01 | .26 | .01 | .01 | .14 | .50 |
| 32 | .04 | .01 | .00 | .18 | .01 | .01 | .12 | .37 |
| 34 | .02 | .01 | .00 | .14 | .00 | .01 | .07 | .25 |
| 36 | .02 | .01 | .00 | .12 | .00 | .00 | .04 | .19 |
| 38 | .01 | .01 | .00 | .08 | .01 | .00 | .03 | .14 |
| 40 | .01 | .00 | .00 | .07 | .00 | .00 | .02 | .10 |
| 42 | .00 | .00 | .00 | .04 | .00 | - | .01 | .06 |
| 44 | .00 | .00 | .00 | .03 | .00 | .00 | .01 | .04 |
| 46 | .00 | .00 | .00 | .03 | .00 | - | .00 | .03 |
| 48 | .00 | .00 | - | .02 | .00 | - | .00 | .03 |
| 50 | .00 | - | - | .02 | .00 | - | .00 | .03 |
| 52 | .00 | - | .00 | .01 | .00 | - | .00 | .02 |
| 54 | - | .00 | .00 | .01 | - | - | .00 | .01 |
| 56 | .00 | .00 | - | .01 | .00 | - | .00 | .01 |
| 58 | - | - | - | .01 | - | - | .00 | .01 |
| 60 | - | - | - | .01 | .00 | - | .00 | .01 |
| 62 | - | - | - | .00 | .00 | - | - | .00 |
| 64 | - | - | - | .00 | - | - | .00 | .00 |
| 66 | .00 | .00 | - | .00 | .00 | - | - | .00 |
| 68 | - | - | - | .00 | - | - | - | .00 |
| 70 | - | - | - | .00 | .00 | - | - | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | - | - | .00 | - | - | - | .00 |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | .00 | - | - | - | .00 |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | .00 | .00 |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 26.89 | 7.35 | 8.71 | 110.31 | 4.53 | 2.24 | 139.33 | 299.36 |


TPA by DBH and Species
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140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
84.32
60.48
37.48
34.93
27.26
17.86
12.29
8.12
5.63
3.65
2.34
1.51
.96
.71
.50
.37
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2
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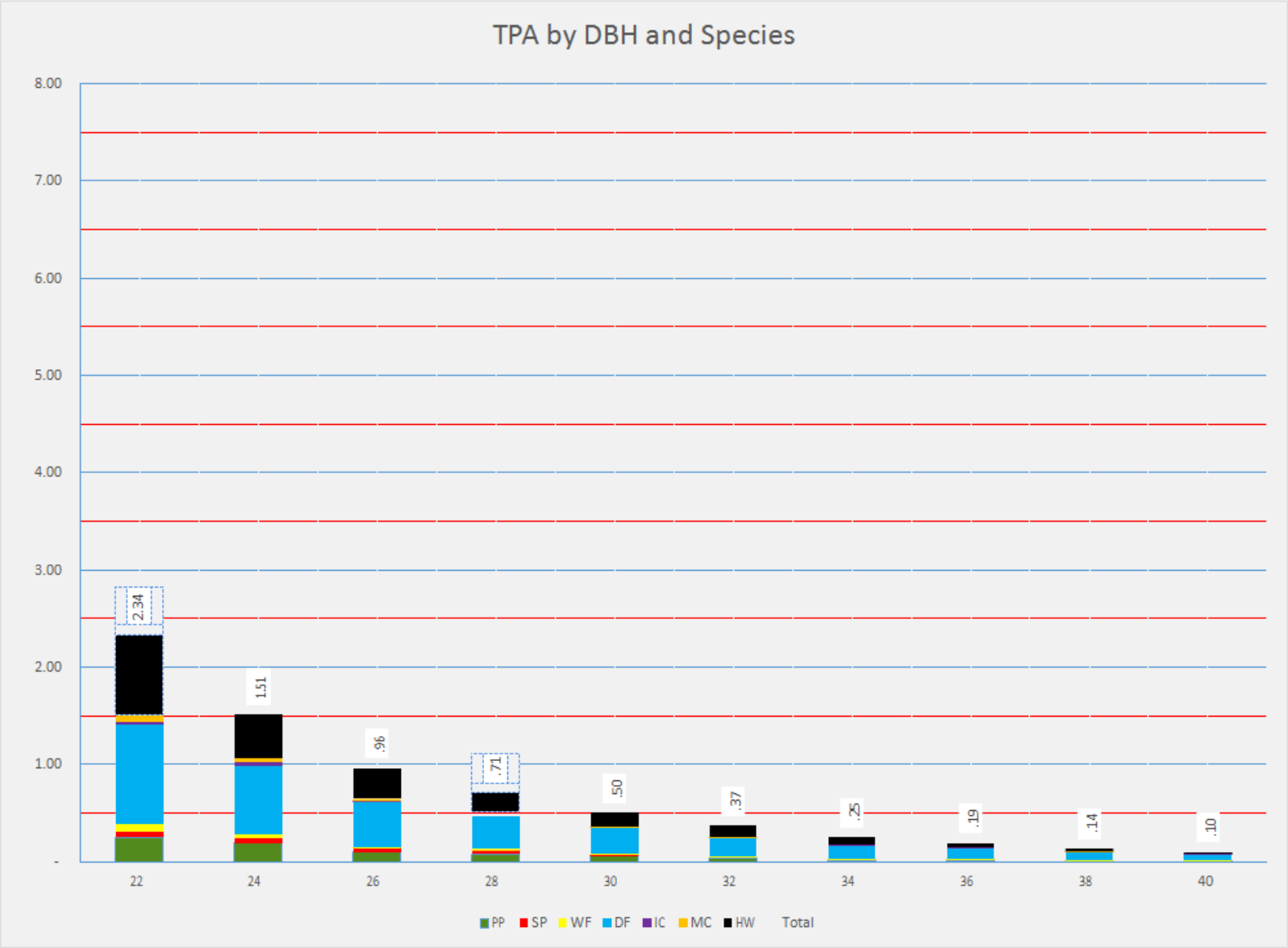
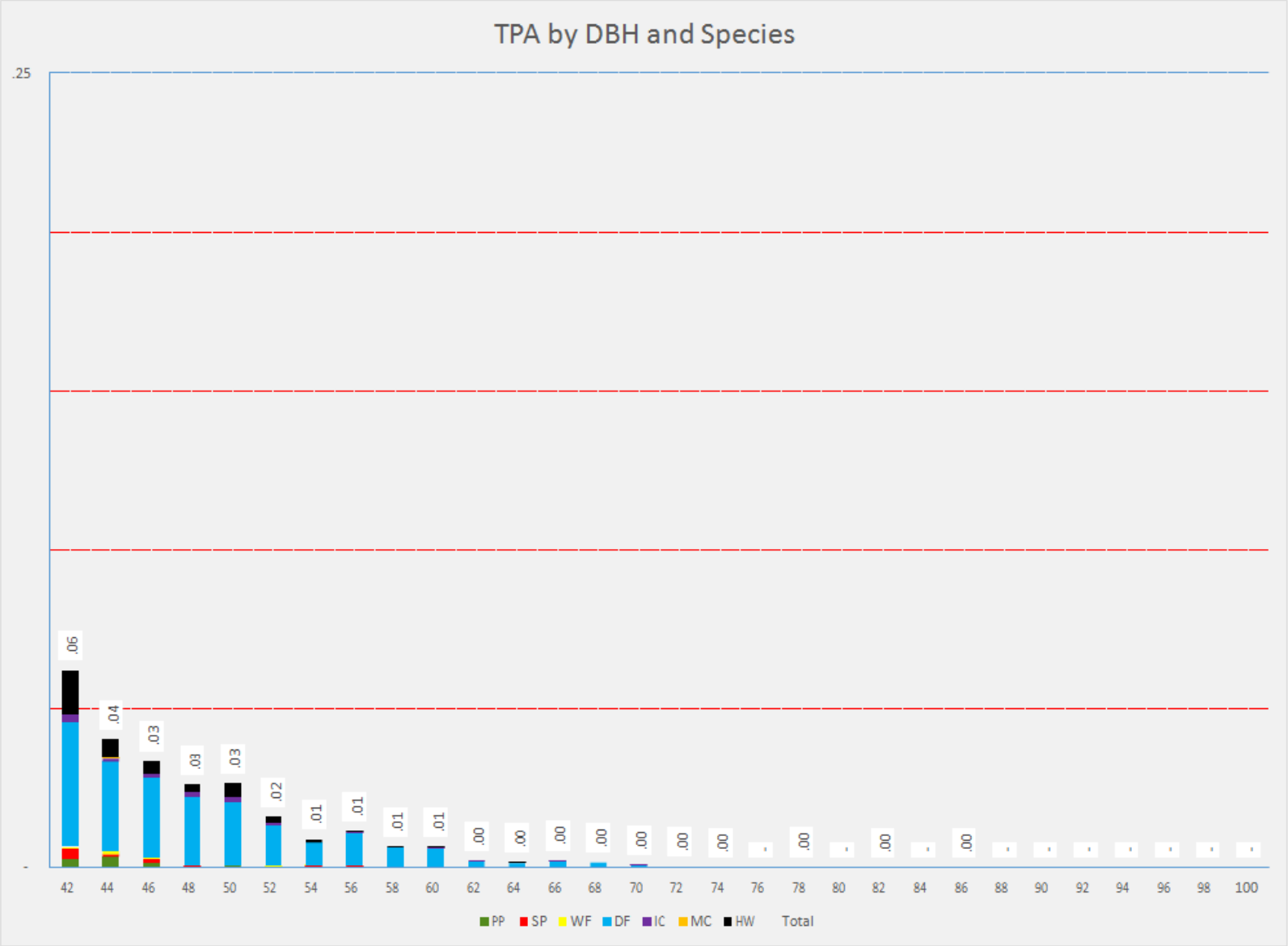



Hayfork Divide-Bully Choop HF2Hv DBH 22"- 40" Page 7




Hayfork Divide-Bully Choop HF2Hv DBH 42"+ Page 8

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 7.5 | (+ or -) | 12.8 |
| Processed 02/07/2014 at 15:00:07 | | QMD >=5" | 9.9 | (+ or -) | 12.5 |
| | | Ave Diam All | 6.1 | (+ or -) | 53.5 |
| Tree Frequency | | Ave Diam >=5" | 8.9 | (+ or -) | 47.4 |
| Plot Count | 4,958 | TPA >= 12" 50.3 | TPA >= 22" | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 16.10 | 6.10 | 3.67 | 61.78 | 3.18 | .24 | 31.08 | 122.16 |
| 4 | 7.24 | 1.38 | 1.52 | 14.06 | .91 | .24 | 68.89 | 94.24 |
| 6 | 7.43 | 1.95 | 2.32 | 31.14 | 1.35 | .24 | 70.93 | 115.36 |
| 8 | 3.64 | 1.08 | .74 | 13.32 | .78 | .16 | 35.88 | 55.61 |
| 10 | 2.02 | .44 | .63 | 8.01 | .24 | .22 | 20.33 | 31.88 |
| 12 | 1.30 | .30 | .43 | 5.48 | .14 | .10 | 11.26 | 19.01 |
| 14 | .74 | .23 | .23 | 3.45 | .15 | .15 | 6.12 | 11.06 |
| 16 | .60 | .16 | .17 | 2.72 | .10 | .04 | 3.35 | 7.14 |
| 18 | .44 | .11 | .10 | 1.82 | .06 | .03 | 1.79 | 4.36 |
| 20 | .32 | .09 | .07 | 1.32 | .07 | .03 | 1.06 | 2.95 |
| 22 | .21 | .08 | .04 | .84 | .05 | .04 | .59 | 1.84 |
| 24 | .15 | .06 | .02 | .54 | .03 | .03 | .30 | 1.12 |
| 26 | .08 | .03 | .02 | .42 | .01 | .01 | .21 | .78 |
| 28 | .05 | .02 | .01 | .30 | .02 | .00 | .12 | .53 |
| 30 | .03 | .02 | .01 | .22 | .01 | .00 | .11 | .40 |
| 32 | .02 | .02 | .01 | .17 | .00 | .00 | .07 | .30 |
| 34 | .01 | .01 | .00 | .12 | .00 | .00 | .05 | .20 |
| 36 | .01 | .01 | .00 | .09 | .00 | .00 | .03 | .15 |
| 38 | .00 | .01 | .00 | .08 | .00 | - | .02 | .11 |
| 40 | .00 | .00 | - | .06 | .00 | - | .01 | .08 |
| 42 | .00 | .00 | - | .03 | .00 | - | .01 | .05 |
| 44 | .00 | .00 | .00 | .03 | .00 | - | .01 | .04 |
| 46 | .00 | .00 | .00 | .03 | .00 | - | .00 | .03 |
| 48 | - | .00 | - | .02 | .00 | - | .00 | .02 |
| 50 | .00 | - | .00 | .02 | .00 | - | .00 | .02 |
| 52 | .00 | .00 | - | .01 | .00 | - | .00 | .01 |
| 54 | - | - | - | .01 | - | - | .00 | .01 |
| 56 | - | - | - | .00 | - | - | .00 | .00 |
| 58 | - | .00 | - | .00 | - | - | .00 | .01 |
| 60 | .00 | - | .00 | .00 | .00 | - | - | .01 |
| 62 | - | - | - | .00 | - | - | - | .00 |
| 64 | - | - | - | .00 | - | - | .00 | .00 |
| 66 | - | - | - | .00 | - | - | - | .00 |
| 68 | - | - | - | .00 | - | - | - | .00 |
| 70 | - | - | - | .00 | - | - | .00 | .00 |
| 72 | - | - | - | - | - | - | - | - |
| 74 | - | - | - | .00 | - | - | .00 | .00 |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | .00 | - | - | - | .00 |
| 82 | - | - | - | - | - | - | - | - |
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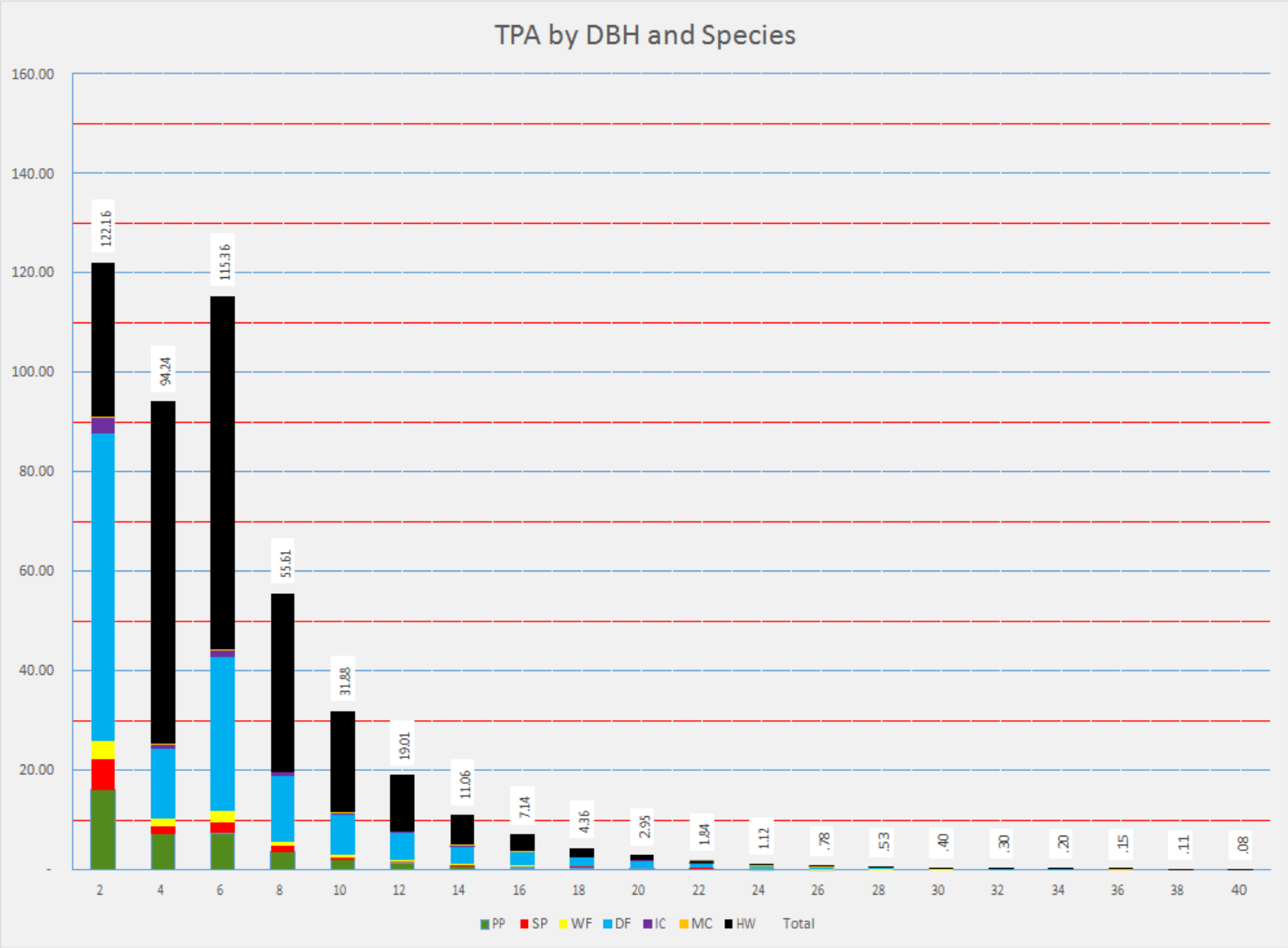
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | .00 | .00 |
| 100 | - | - | - | .00 | - | - | - | .00 |
| Total | 40.40 | 12.11 | 10.00 | 146.10 | 7.12 | 1.55 | 252.22 | 469.51 |


TPA by DBH and Species
160.00
140.00
120.00
100.00
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20.00
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122.16
94.24
115.36
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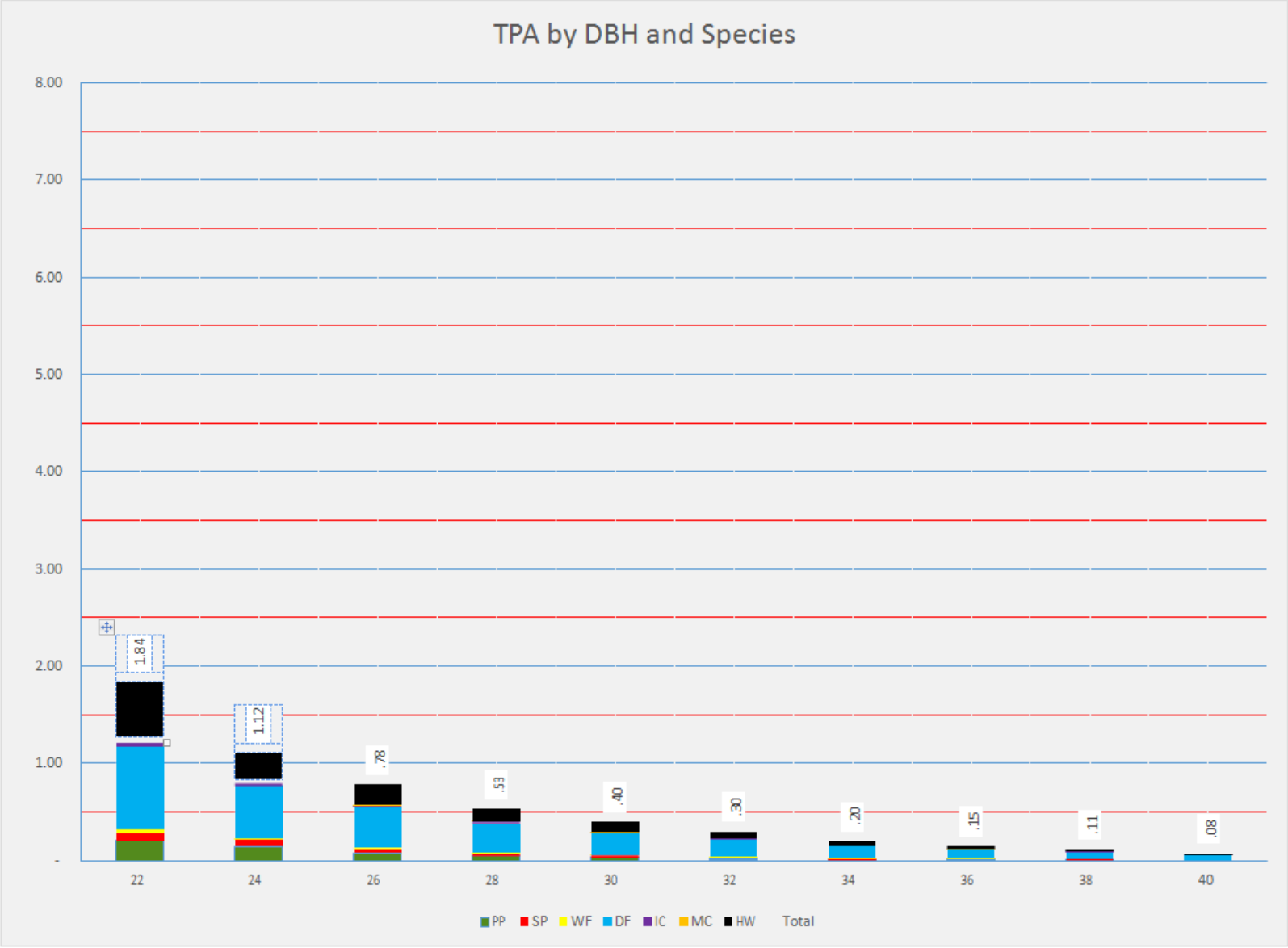
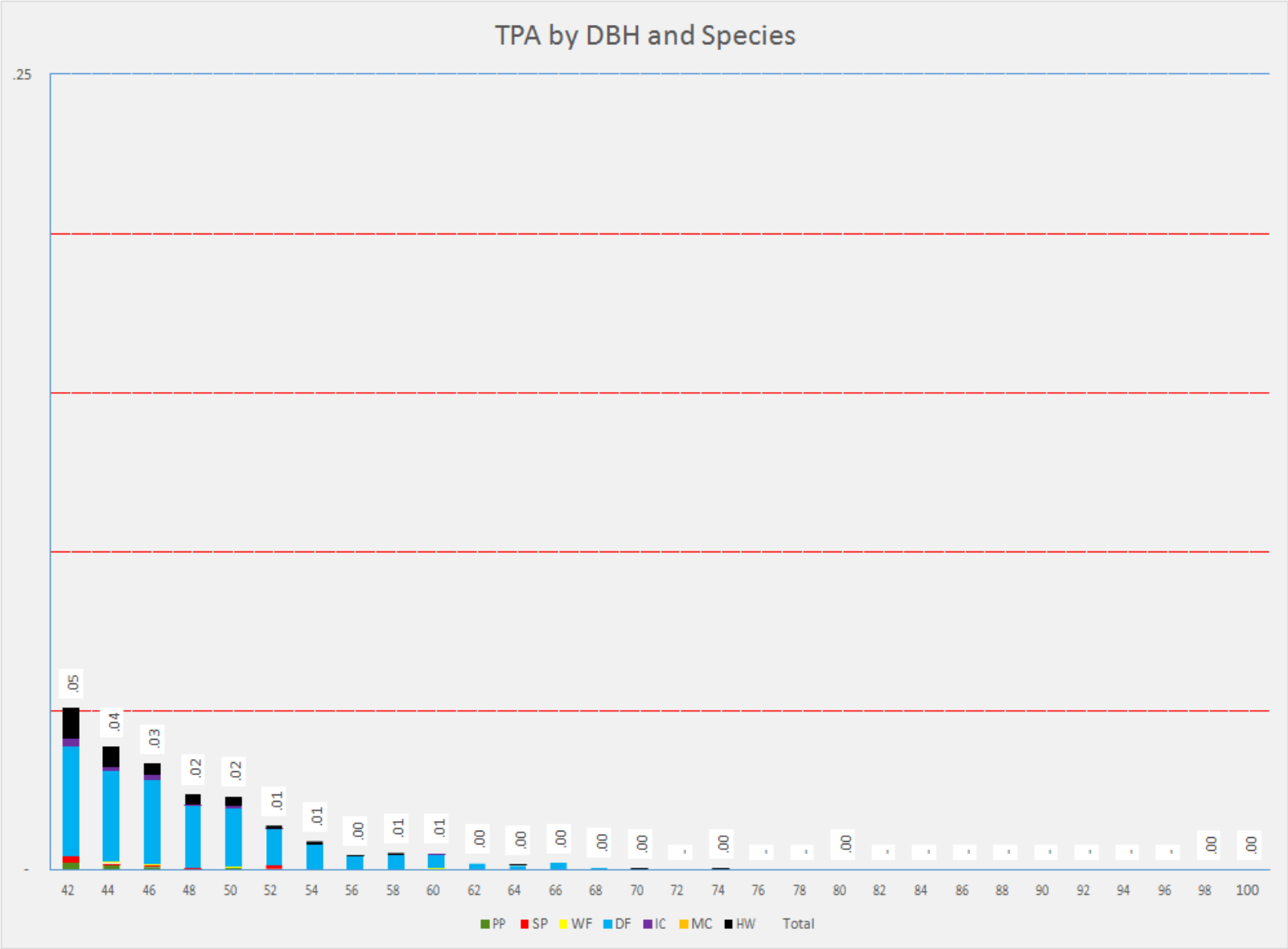



Hayfork Divide-Bully Choop HF2 DBH 22"- 40" Page 11


TPA by DBH and Species
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80
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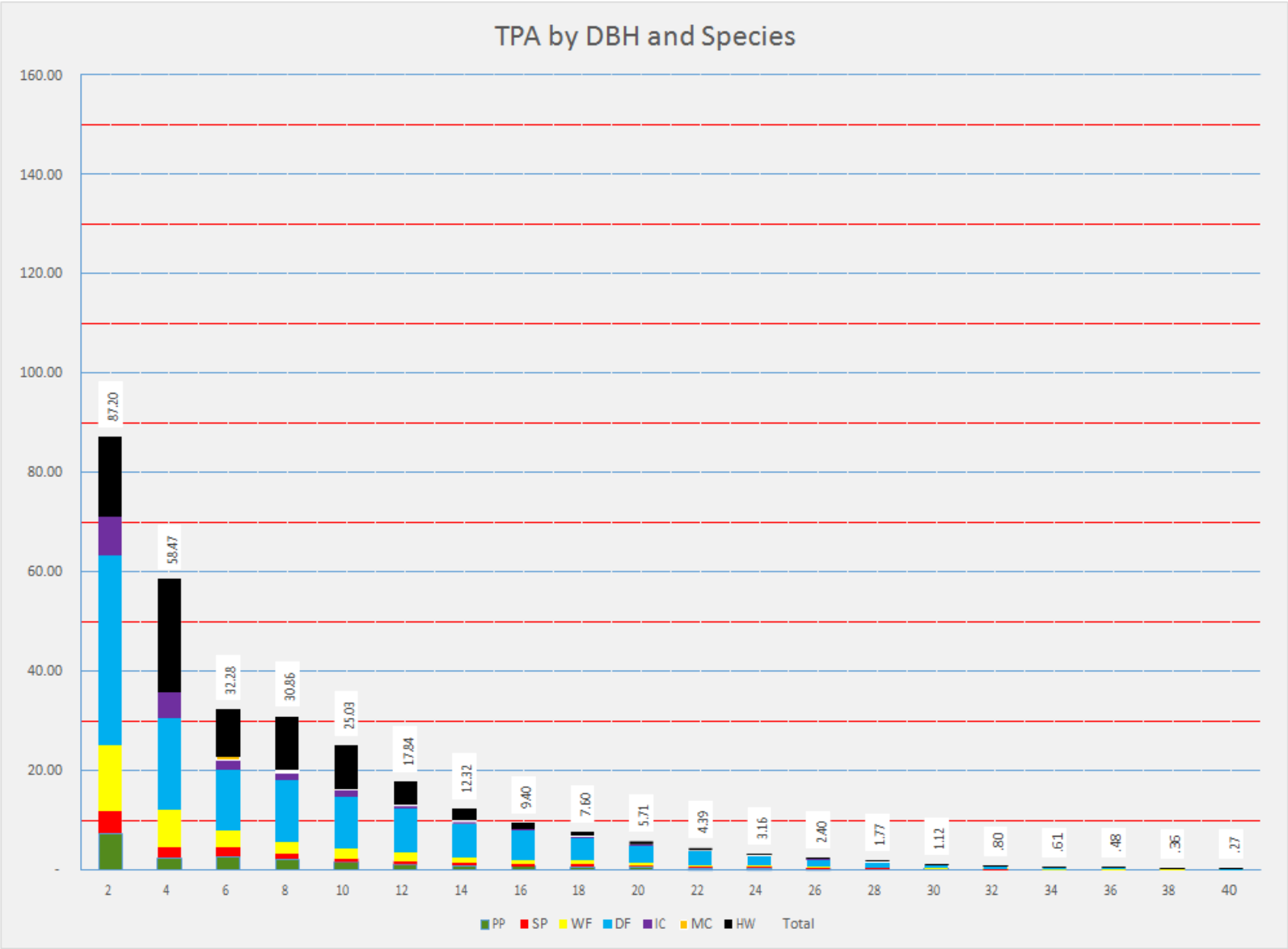
84
86
88
90
92
94
96
98
100
PP
SP
WF
DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | |
|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 10.3 (+ or -) | 13.4 |
| Processed 04/25/2014 at 09:27:34 | | QMD >=5" | 14.0 (+ or -) | 13.2 |
| | | Ave Diam All | 7.7 (+ or -) | 48.3 |
| Tree Frequency | | Ave Diam >=5" | 12.2 (+ or -) | 43.8 |
| Plot Count | 3,537 | TPA >= 12" 68.97 | TPA = 22" 16.10 | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 7.40 | 4.44 | 13.28 | 38.27 | 7.82 | - | 15.99 | 87.20 |
| 4 | 2.48 | 2.02 | 7.56 | 18.55 | 5.25 | - | 22.62 | 58.47 |
| 6 | 2.68 | 1.86 | 3.51 | 12.10 | 1.84 | .80 | 9.49 | 32.28 |
| 8 | 2.17 | 1.15 | 2.35 | 12.41 | 1.58 | .40 | 10.81 | 30.86 |
| 10 | 1.65 | .60 | 2.02 | 10.49 | 1.37 | .17 | 8.73 | 25.03 |
| 12 | 1.17 | .64 | 1.76 | 8.76 | .66 | .17 | 4.69 | 17.84 |
| 14 | .90 | .50 | 1.07 | 6.85 | .47 | .17 | 2.34 | 12.32 |
| 16 | .77 | .39 | .84 | 5.88 | .33 | .09 | 1.10 | 9.40 |
| 18 | .64 | .49 | .70 | 4.56 | .38 | .07 | .77 | 7.60 |
| 20 | .62 | .31 | .49 | 3.51 | .18 | .06 | .53 | 5.71 |
| 22 | .37 | .27 | .33 | 2.82 | .16 | .06 | .37 | 4.39 |
| 24 | .36 | .23 | .27 | 1.87 | .16 | .05 | .23 | 3.16 |
| 26 | .27 | .16 | .19 | 1.47 | .13 | .02 | .15 | 2.40 |
| 28 | .21 | .13 | .13 | 1.10 | .07 | .02 | .11 | 1.77 |
| 30 | .13 | .11 | .08 | .63 | .09 | .01 | .07 | 1.12 |
| 32 | .06 | .08 | .05 | .51 | .04 | .01 | .04 | .80 |
| 34 | .05 | .05 | .03 | .42 | .04 | .00 | .03 | .61 |
| 36 | .04 | .05 | .02 | .29 | .05 | .00 | .03 | .48 |
| 38 | .03 | .03 | .02 | .25 | .02 | .00 | .01 | .36 |
| 40 | .02 | .03 | .01 | .17 | .01 | .00 | .01 | .27 |
| 42 | .01 | .02 | .01 | .13 | .01 | - | .01 | .19 |
| 44 | .01 | .02 | .00 | .09 | .00 | .00 | - | .13 |
| 46 | .00 | .01 | .00 | .08 | .00 | .00 | .00 | .10 |
| 48 | .00 | .01 | - | .06 | .01 | - | - | .08 |
| 50 | .00 | .00 | .00 | .06 | .00 | - | - | .07 |
| 52 | .00 | - | .00 | .05 | .00 | - | - | .05 |
| 54 | .00 | .00 | .00 | .03 | .00 | .00 | - | .04 |
| 56 | - | .01 | - | .02 | - | - | - | .03 |
| 58 | - | .00 | .00 | .01 | .00 | .00 | - | .02 |
| 60 | - | .00 | - | .01 | .00 | - | .00 | .01 |
| 62 | - | .00 | - | .01 | .00 | - | - | .01 |
| 64 | - | - | - | .01 | .00 | - | - | .01 |
| 66 | - | - | - | .00 | - | - | - | .00 |
| 68 | - | - | - | .00 | - | - | - | .00 |
| 70 | - | .00 | - | .00 | - | - | - | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | - | - | .00 | - | - | - | .00 |
| 76 | - | - | - | .00 | - | - | - | .00 |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | .00 | - | - | - | .00 |
| 82 | - | - | - | .00 | - | - | - | .00 |
| 84 | - | .00 | - | .00 | - | - | - | .00 |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 22.05 | 13.61 | 34.73 | 131.51 | 20.68 | 2.11 | 78.12 | 302.81 |


TPA by DBH and Species
160.00
140.00
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100.00
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87.20
58.47
32.28
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25.03
17.84
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9.40
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5.71
4.39
3.16
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PP
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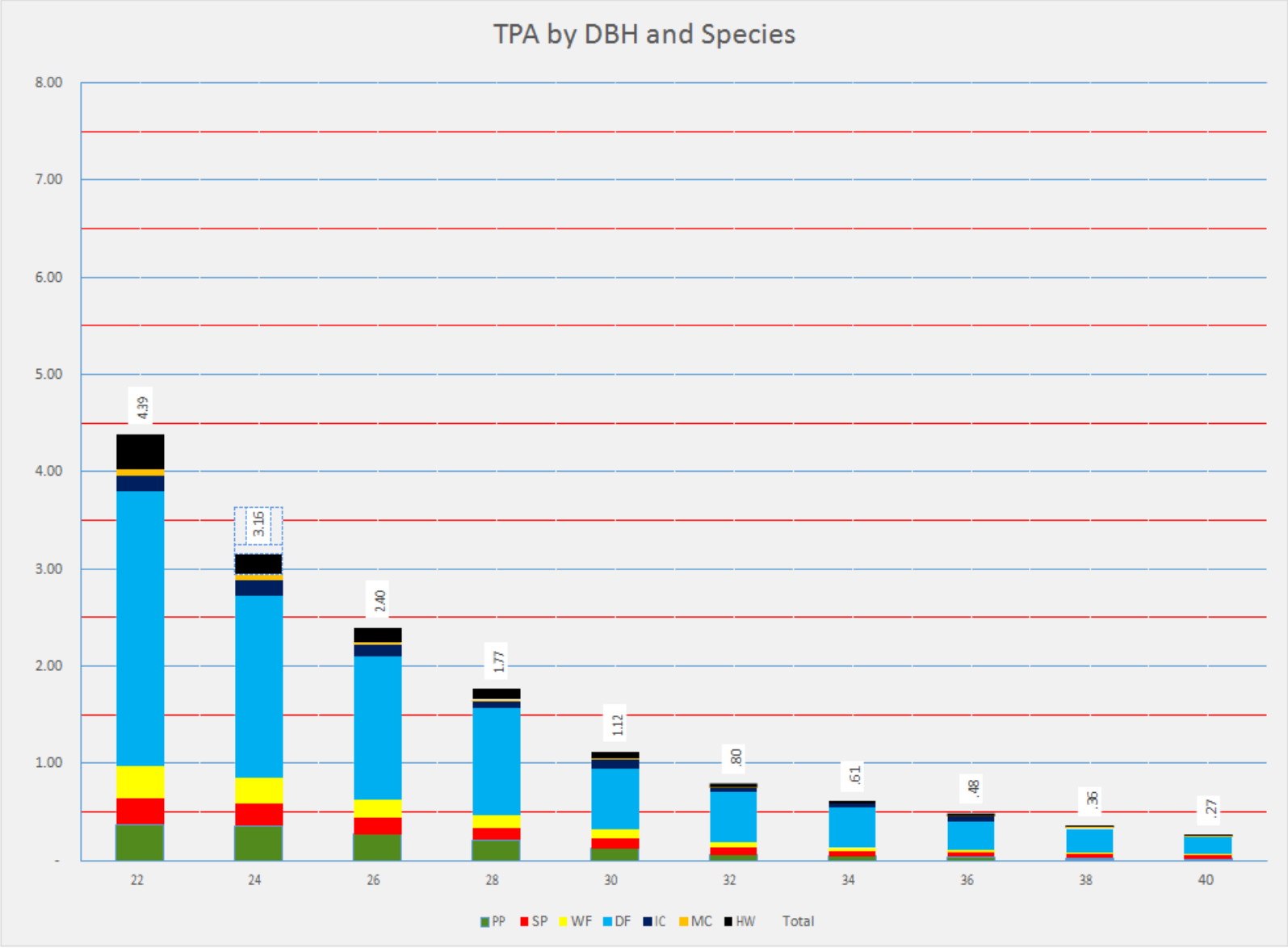
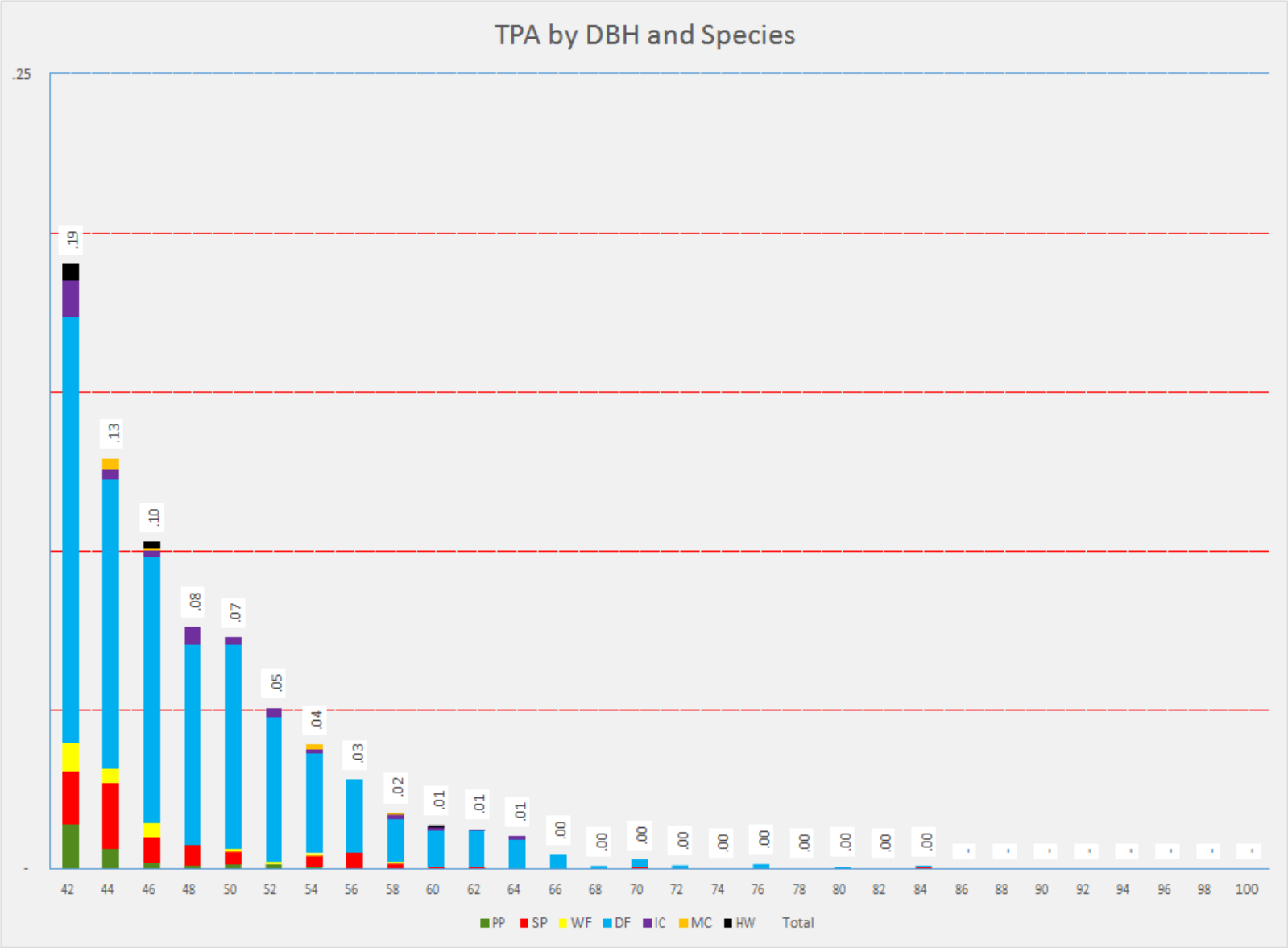
Total




Trinity Mountains HF4 DBH 22"- 40" Page 15


TPA by DBH and Species
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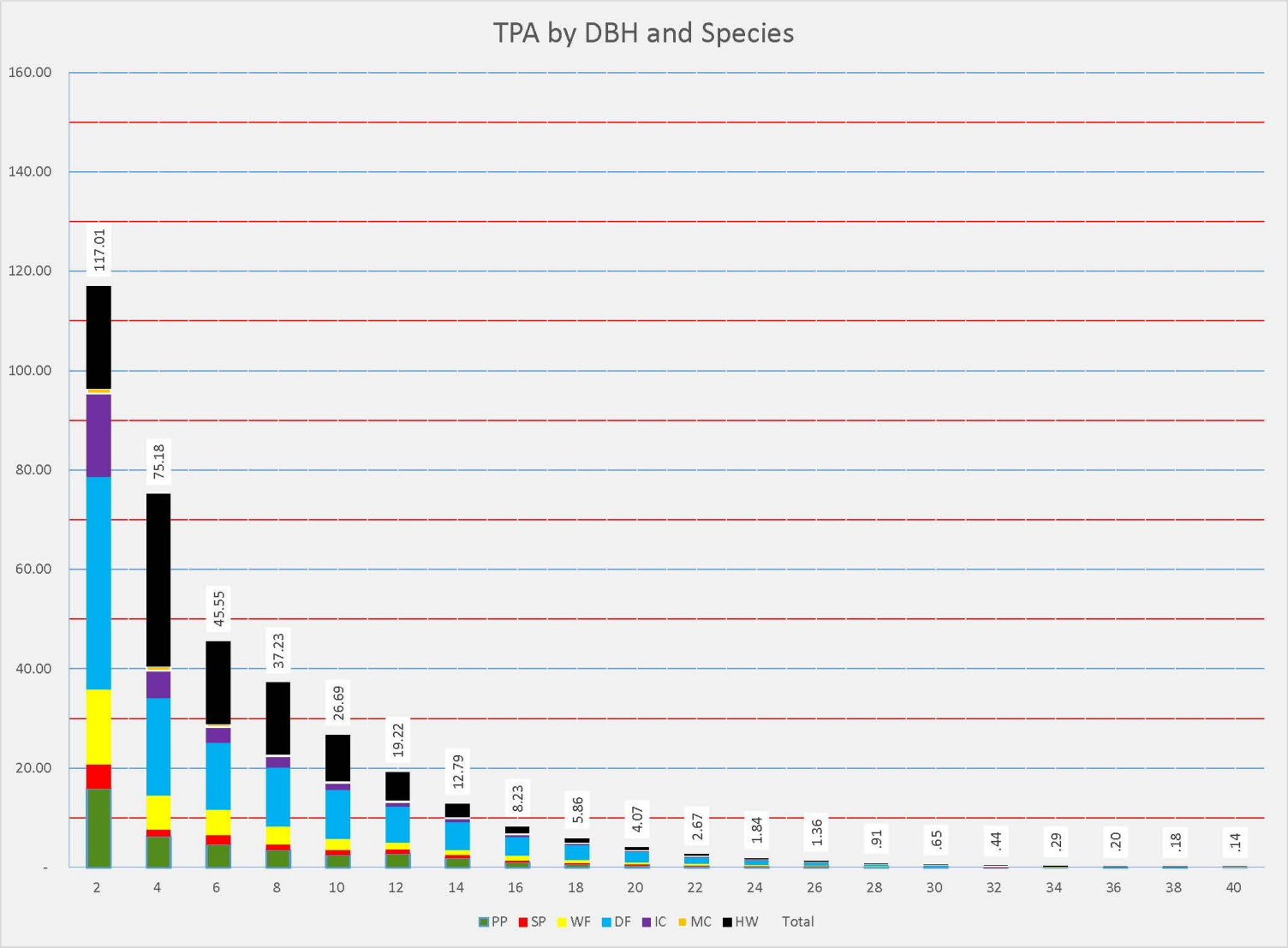
76
78
80
82
84
86
88
90
92
94
96
98
100
PP
SP
WF
DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | |
|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 8.5 (+ or -) | 12.7 |
| Processed 04/25/2014 at 09:21:01 | | QMD >=5" | 12.1 (+ or -) | 12.5 |
| | | Ave Diam All | 6.5 (+ or -) | 48.4 |
| Tree Frequency | | Ave Diam >=5" | 10.7 (+ or -) | 42.5 |
| Plot Count | 13,355 | TPA >= 12" 59.20 | TPA >= 22" 9.03 | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 15.94 | 4.83 | 15.09 | 42.82 | 16.69 | 1.06 | 20.57 | 117.01 |
| 4 | 6.28 | 1.44 | 6.91 | 19.53 | 5.46 | .86 | 34.71 | 75.18 |
| 6 | 4.68 | 1.86 | 5.16 | 13.51 | 3.09 | .56 | 16.69 | 45.55 |
| 8 | 3.60 | 1.13 | 3.55 | 11.93 | 2.24 | .41 | 14.37 | 37.23 |
| 10 | 2.62 | 1.02 | 2.17 | 9.82 | 1.46 | .41 | 9.19 | 26.69 |
| 12 | 2.86 | .84 | 1.34 | 7.24 | .91 | .39 | 5.64 | 19.22 |
| 14 | 2.01 | .55 | 1.06 | 5.54 | .75 | .29 | 2.59 | 12.79 |
| 16 | 1.08 | .42 | .93 | 3.82 | .49 | .23 | 1.26 | 8.23 |
| 18 | .68 | .29 | .59 | 3.01 | .37 | .13 | .79 | 5.86 |
| 20 | .51 | .25 | .39 | 2.09 | .28 | .10 | .45 | 4.07 |
| 22 | .35 | .17 | .27 | 1.35 | .22 | .07 | .25 | 2.67 |
| 24 | .24 | .13 | .20 | .95 | .17 | .02 | .13 | 1.84 |
| 26 | .21 | .09 | .16 | .66 | .13 | .02 | .10 | 1.36 |
| 28 | .14 | .08 | .08 | .43 | .09 | .02 | .07 | .91 |
| 30 | .10 | .07 | .06 | .30 | .07 | .01 | .03 | .65 |
| 32 | .06 | .04 | .04 | .23 | .03 | .01 | .03 | .44 |
| 34 | .04 | .03 | .02 | .15 | .04 | .00 | .02 | .29 |
| 36 | .03 | .02 | .01 | .11 | .02 | .00 | .01 | .20 |
| 38 | .02 | .02 | .01 | .10 | .02 | .00 | .01 | .18 |
| 40 | .01 | .02 | .01 | .08 | .02 | .00 | .00 | .14 |
| 42 | .01 | .01 | .00 | .06 | .01 | .00 | .00 | .08 |
| 44 | .00 | .01 | .00 | .05 | .01 | .00 | .00 | .08 |
| 46 | .00 | .00 | .00 | .05 | .01 | - | .00 | .06 |
| 48 | .00 | .00 | .00 | .03 | .00 | - | - | .04 |
| 50 | .00 | .00 | .00 | .03 | .00 | - | .00 | .03 |
| 52 | .00 | .00 | .00 | .02 | .00 | - | - | .02 |
| 54 | - | .00 | .00 | .01 | .00 | - | - | .01 |
| 56 | - | .00 | .00 | .01 | .00 | - | - | .01 |
| 58 | - | .00 | - | .01 | - | .00 | - | .01 |
| 60 | .00 | .00 | - | .00 | .00 | - | .00 | .00 |
| 62 | - | .00 | - | .00 | - | - | - | .00 |
| 64 | - | .00 | - | .00 | - | - | - | .00 |
| 66 | - | - | - | .00 | .00 | - | - | .00 |
| 68 | - | - | .00 | .00 | .00 | - | - | .00 |
| 70 | - | .00 | - | .00 | - | - | - | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | .00 | - | - | - | - | - | .00 |
| 76 | - | - | - | .00 | .00 | - | - | .00 |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 41.47 | 13.31 | 38.08 | 123.94 | 32.58 | 4.59 | 106.91 | 360.87 |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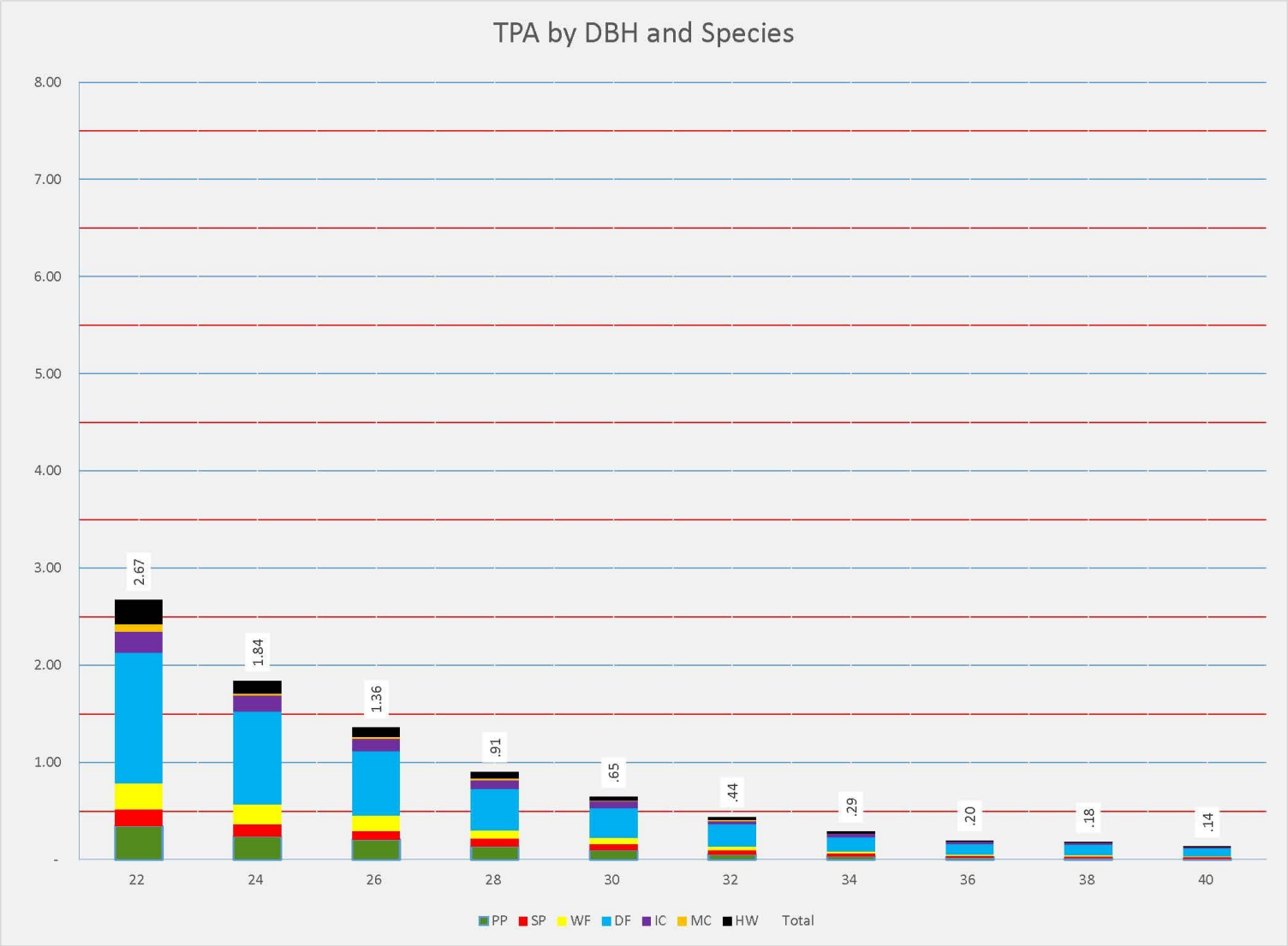
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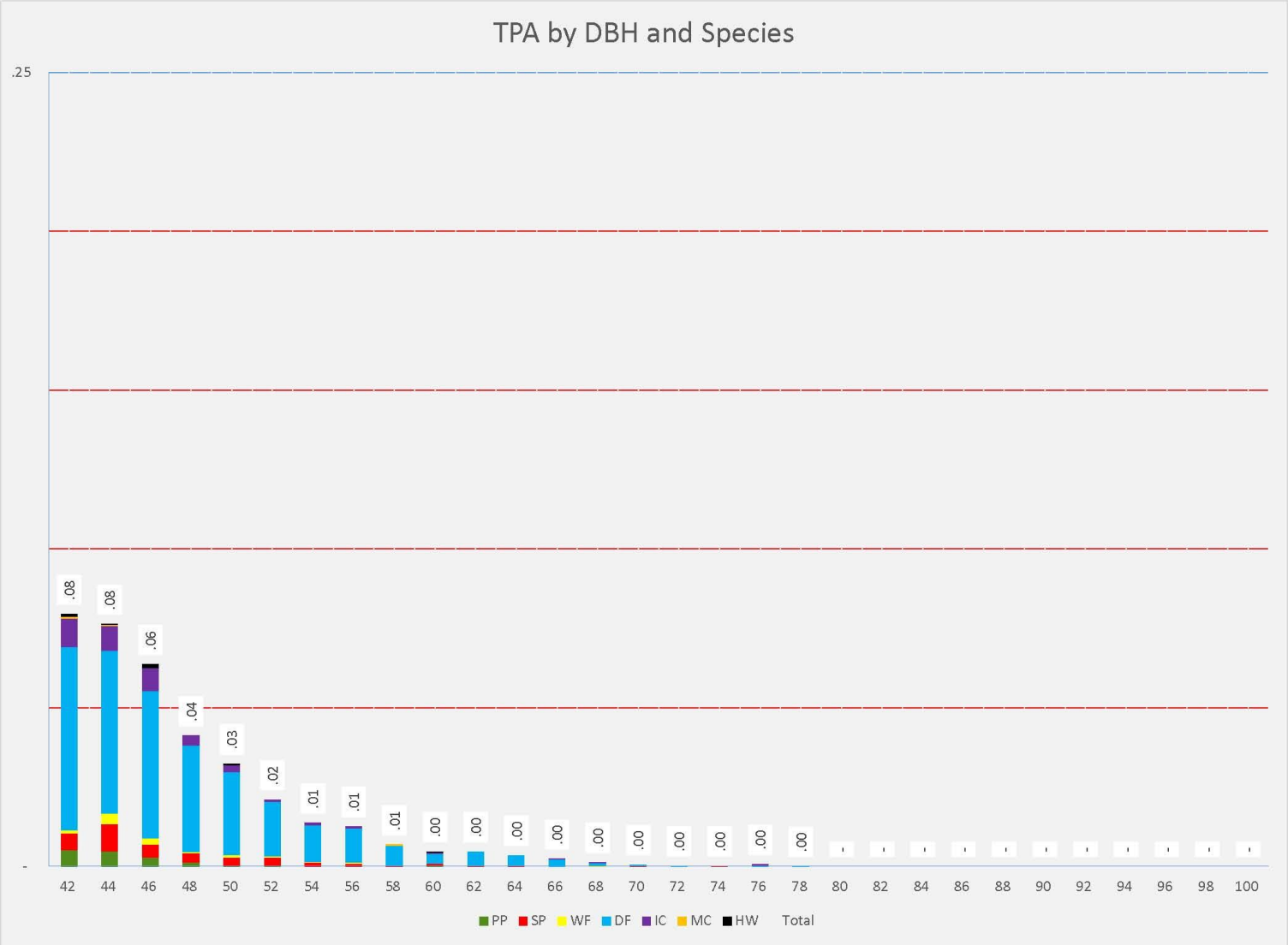
TPA by DBH and Species
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78
80
82
84
86
88
90
92
94
96
98
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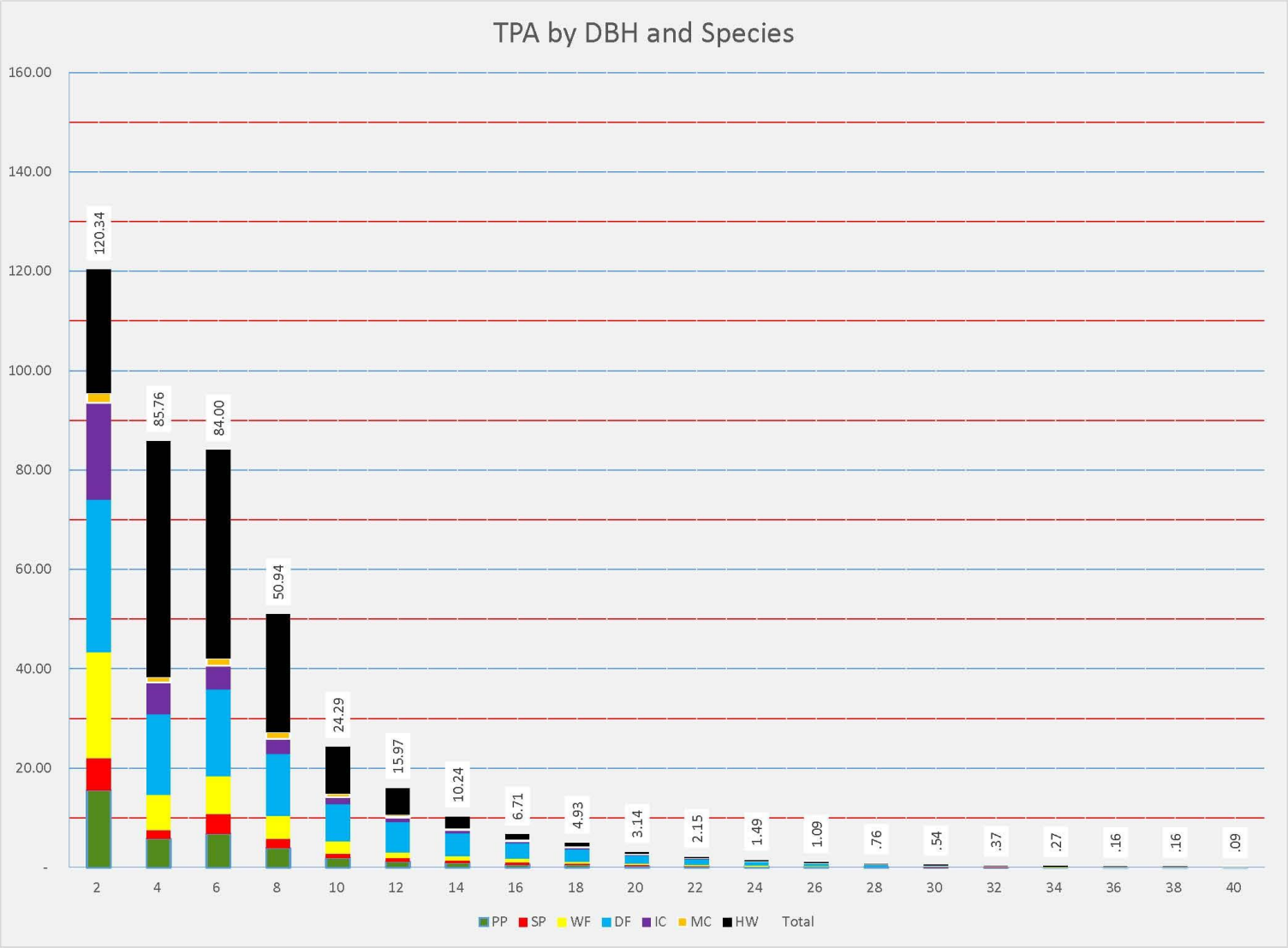
HW
Total

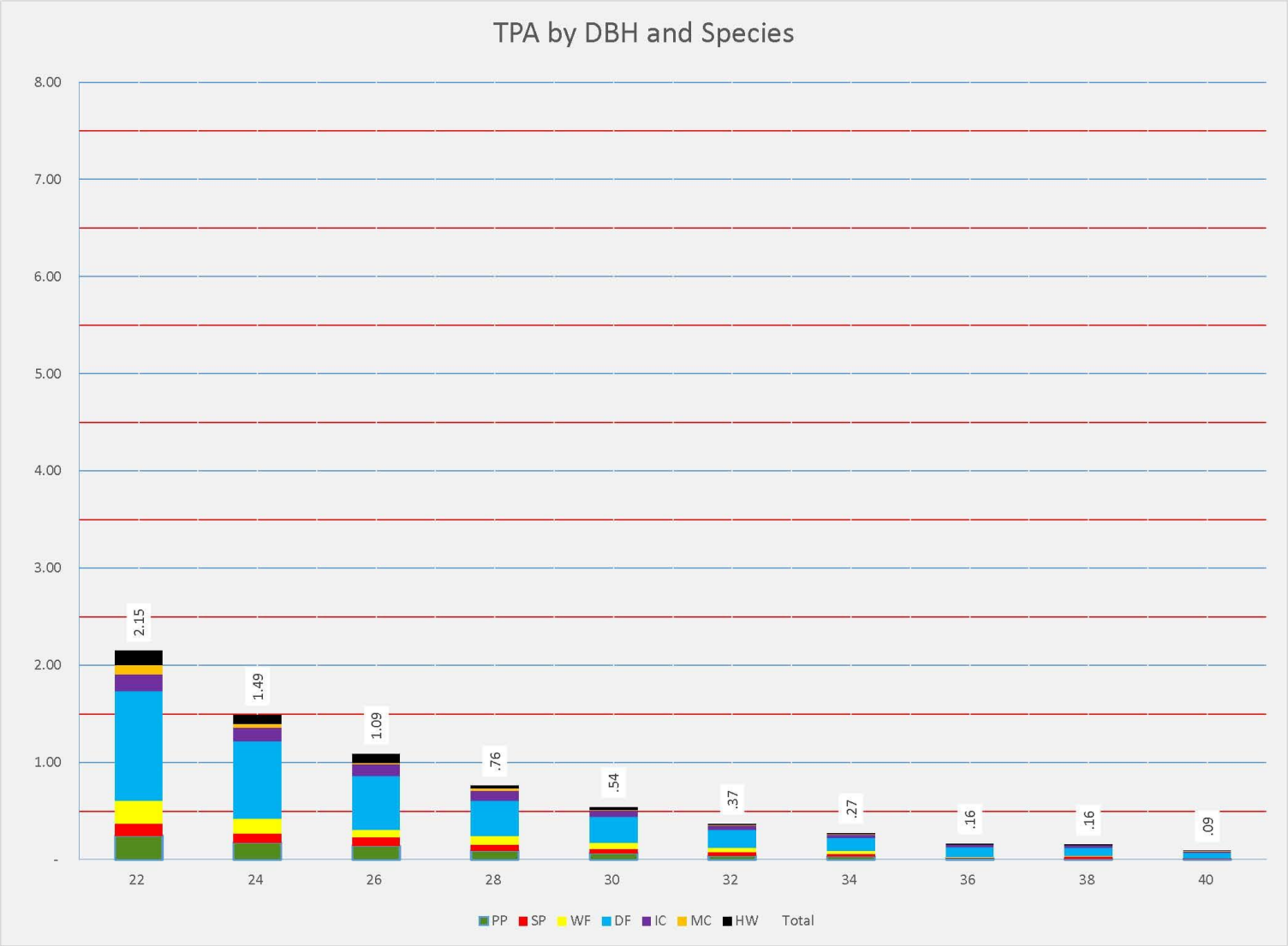
Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | |
|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 7.8 (+ or -) | 12.6 |
| Processed 04/25/2014 at 09:21:01 | | QMD >=5" | 10.6 (+ or -) | 12.3 |
| | | Ave Diam All | 6.1 (+ or -) | 50.3 |
| Tree Frequency | | Ave Diam >=5" | 9.4 (+ or -) | 44.1 |
| Plot Count | 13,355 | TPA >= 12" | TPA >= 7.3794 | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 15.61 | 6.51 | 21.23 | 30.75 | 19.40 | 2.03 | 24.81 | 120.34 |
| 4 | 5.81 | 1.73 | 7.09 | 16.25 | 6.34 | 1.20 | 47.33 | 85.76 |
| 6 | 6.81 | 3.97 | 7.71 | 17.44 | 4.70 | 1.56 | 41.82 | 84.00 |
| 8 | 3.93 | 1.92 | 4.58 | 12.49 | 2.97 | 1.42 | 23.63 | 50.94 |
| 10 | 1.92 | .90 | 2.58 | 7.47 | 1.33 | .78 | 9.32 | 24.29 |
| 12 | 1.19 | .72 | 1.20 | 6.05 | .96 | .59 | 5.26 | 15.97 |
| 14 | 1.03 | .48 | .80 | 4.58 | .64 | .40 | 2.30 | 10.24 |
| 16 | .63 | .48 | .69 | 3.16 | .43 | .32 | 1.01 | 6.71 |
| 18 | .55 | .24 | .44 | 2.46 | .34 | .32 | .56 | 4.93 |
| 20 | .34 | .24 | .33 | 1.56 | .24 | .10 | .34 | 3.14 |
| 22 | .25 | .12 | .23 | 1.13 | .17 | .09 | .15 | 2.15 |
| 24 | .18 | .10 | .15 | .80 | .14 | .04 | .09 | 1.49 |
| 26 | .15 | .09 | .08 | .55 | .12 | .01 | .09 | 1.09 |
| 28 | .10 | .06 | .09 | .37 | .10 | .02 | .03 | .76 |
| 30 | .07 | .04 | .06 | .27 | .06 | .01 | .03 | .54 |
| 32 | .04 | .04 | .05 | .18 | .05 | .00 | .01 | .37 |
| 34 | .03 | .03 | .03 | .13 | .03 | .01 | .01 | .27 |
| 36 | .01 | .01 | .01 | .10 | .02 | .00 | .00 | .16 |
| 38 | .01 | .02 | .01 | .08 | .03 | .00 | .00 | .16 |
| 40 | .01 | .01 | .00 | .06 | .01 | .00 | .00 | .09 |
| 42 | .00 | .00 | .00 | .04 | .01 | .00 | .00 | .06 |
| 44 | .00 | .00 | .01 | .04 | .01 | .00 | - | .06 |
| 46 | .00 | .00 | .00 | .02 | .00 | - | - | .03 |
| 48 | .00 | .00 | .00 | .03 | .00 | - | - | .04 |
| 50 | .00 | .00 | - | .02 | .00 | .00 | - | .03 |
| 52 | - | .00 | .00 | .01 | .00 | - | - | .02 |
| 54 | - | - | - | .01 | .00 | .00 | - | .01 |
| 56 | - | .00 | - | .01 | .00 | - | - | .01 |
| 58 | .00 | .00 | - | .00 | .00 | .00 | - | .01 |
| 60 | - | - | .00 | .00 | - | - | - | .00 |
| 62 | - | .00 | - | .00 | - | - | - | .00 |
| 64 | - | .00 | - | .00 | - | - | - | .00 |
| 66 | - | - | .00 | .00 | - | - | - | .00 |
| 68 | - | - | - | .00 | - | - | - | .00 |
| 70 | - | - | - | .00 | - | - | - | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | - | - | - | - | - | - | - |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | .00 | .00 |
| 94 | - | - | - | .00 | - | - | - | .00 |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 38.68 | 17.74 | 47.38 | 106.09 | 38.10 | 8.93 | 156.79 | 413.70 |




Trinity Mountains HF2 DBH 2"- 40" Page 22


TPA by DBH and Species
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
-
2.15
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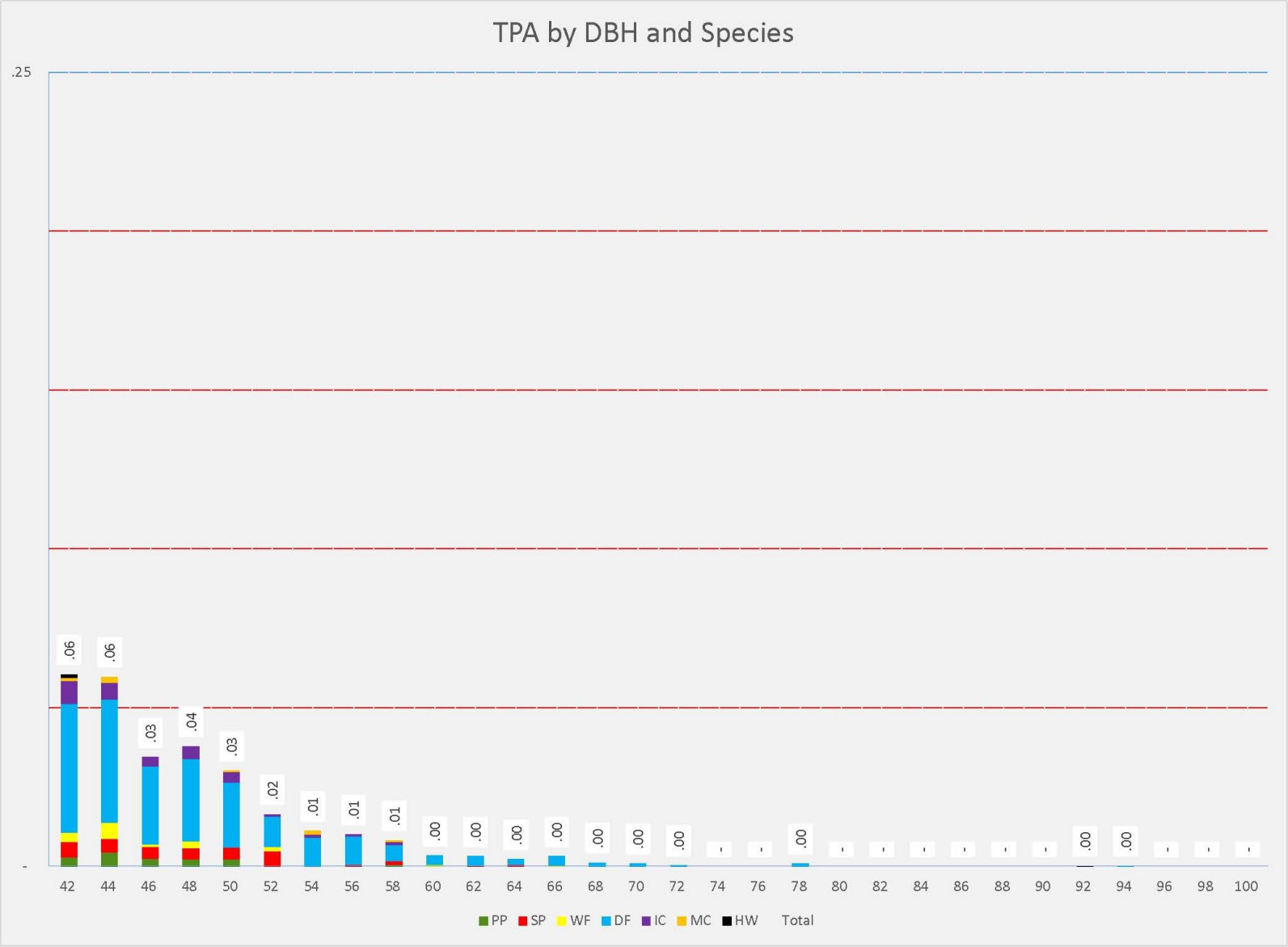
1.09
.76
.54
.37
.27
.16
.16
.09
22
24
26
28
30
32
34
36
38
40
PP
SP
WF
DF
IC
MC
HW
Total


TPA by DBH and Species
.25
-
.06
.06
.03
.04
.03
.02
.01
.01
.01
.00
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.00
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44
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56
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60
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68
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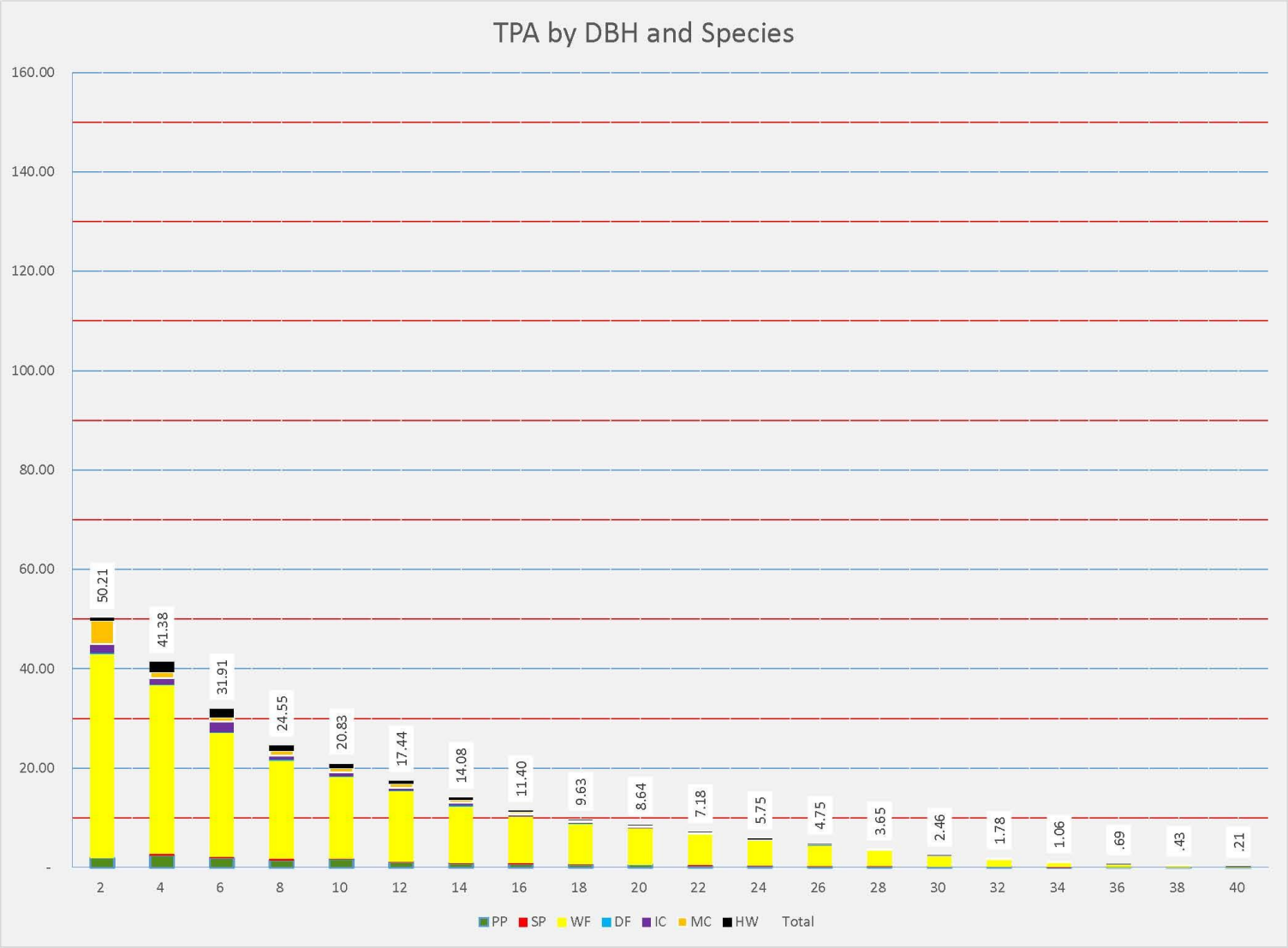
72
74
76
78
80
82
84
86
88
90
92
94
96
98
100
PP
SP
WF
DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 12.6 | (+ or -) | 14. |
| Processed 02/07/2014 at 13:40:43 | | QMD >=5" | 15.5 | (+ or -) | 14. |
| | | Ave Diam All | 9.9 | (+ or -) | 50. |
| Tree Frequency | | Ave Diam >=5" | 13.7 | (+ or -) | 47. |
| Plot Count | 3,774 | TPA >= 12" 89.5 | | TPA >= 22" 28.3 | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 1.96 | - | 41.03 | .29 | 1.71 | 4.75 | .48 | 50.21 |
| 4 | 2.50 | .39 | 33.94 | .11 | 1.22 | 1.30 | 1.92 | 41.38 |
| 6 | 1.95 | .32 | 24.85 | .17 | 2.06 | .99 | 1.57 | 31.91 |
| 8 | 1.44 | .35 | 19.77 | .20 | .78 | .99 | 1.02 | 24.55 |
| 10 | 1.73 | .17 | 16.44 | .14 | .71 | .92 | .72 | 20.83 |
| 12 | 1.04 | .14 | 14.30 | .06 | .54 | .81 | .55 | 17.44 |
| 14 | .83 | .18 | 11.37 | .19 | .52 | .66 | .33 | 14.08 |
| 16 | .78 | .15 | 9.34 | .07 | .42 | .55 | .10 | 11.40 |
| 18 | .57 | .15 | 8.11 | .12 | .25 | .39 | .04 | 9.63 |
| 20 | .54 | .09 | 7.33 | .04 | .23 | .37 | .04 | 8.64 |
| 22 | .37 | .18 | 6.12 | .08 | .14 | .27 | .03 | 7.18 |
| 24 | .30 | .14 | 5.05 | .03 | .11 | .12 | .01 | 5.75 |
| 26 | .20 | .12 | 4.19 | .04 | .11 | .08 | .01 | 4.75 |
| 28 | .20 | .11 | 3.21 | .02 | .08 | .03 | - | 3.65 |
| 30 | .10 | .07 | 2.17 | .02 | .06 | .04 | .00 | 2.46 |
| 32 | .08 | .04 | 1.61 | .01 | .02 | .02 | - | 1.78 |
| 34 | .03 | .06 | .93 | .01 | .02 | .01 | - | 1.06 |
| 36 | .03 | .04 | .58 | .00 | .02 | .01 | .00 | .69 |
| 38 | .01 | .04 | .35 | .00 | .01 | .01 | - | .43 |
| 40 | .01 | .02 | .16 | .01 | .01 | .00 | .00 | .21 |
| 42 | .01 | .01 | .09 | .00 | .00 | .00 | .00 | .12 |
| 44 | .00 | .01 | .06 | - | .01 | - | - | .08 |
| 46 | .00 | .01 | .04 | - | .00 | .00 | - | .05 |
| 48 | .00 | .00 | .02 | - | .00 | - | - | .02 |
| 50 | .00 | .01 | .01 | - | .00 | .00 | - | .02 |
| 52 | - | .00 | .01 | .00 | - | .00 | .00 | .01 |
| 54 | - | .00 | .00 | .00 | - | - | - | .01 |
| 56 | .00 | .00 | .00 | - | - | .00 | - | .00 |
| 58 | .00 | .00 | .00 | - | - | - | - | .00 |
| 60 | - | - | - | - | - | - | - | - |
| 62 | - | - | - | - | - | - | - | - |
| 64 | - | - | - | - | - | - | - | - |
| 66 | - | .00 | - | - | - | .00 | - | .00 |
| 68 | - | - | .00 | - | - | - | - | .00 |
| 70 | - | - | .00 | - | - | - | - | .00 |
| 72 | - | - | - | - | - | - | - | - |
| 74 | - | - | - | - | - | - | - | - |
| 76 | - | - | .00 | - | - | - | - | .00 |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 14.69 | 2.79 | 211.10 | 1.60 | 9.03 | 12.31 | 6.83 | 258.35 |


TPA by DBH and Species
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
-
50.21
41.38
31.91
24.55
20.83
17.44
14.08
11.40
9.63
8.64
7.18
5.75
4.75
3.65
2.46
1.78
1.06
.69
.43
.21
2
4
6
8
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12
14
16
18
20
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34
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38
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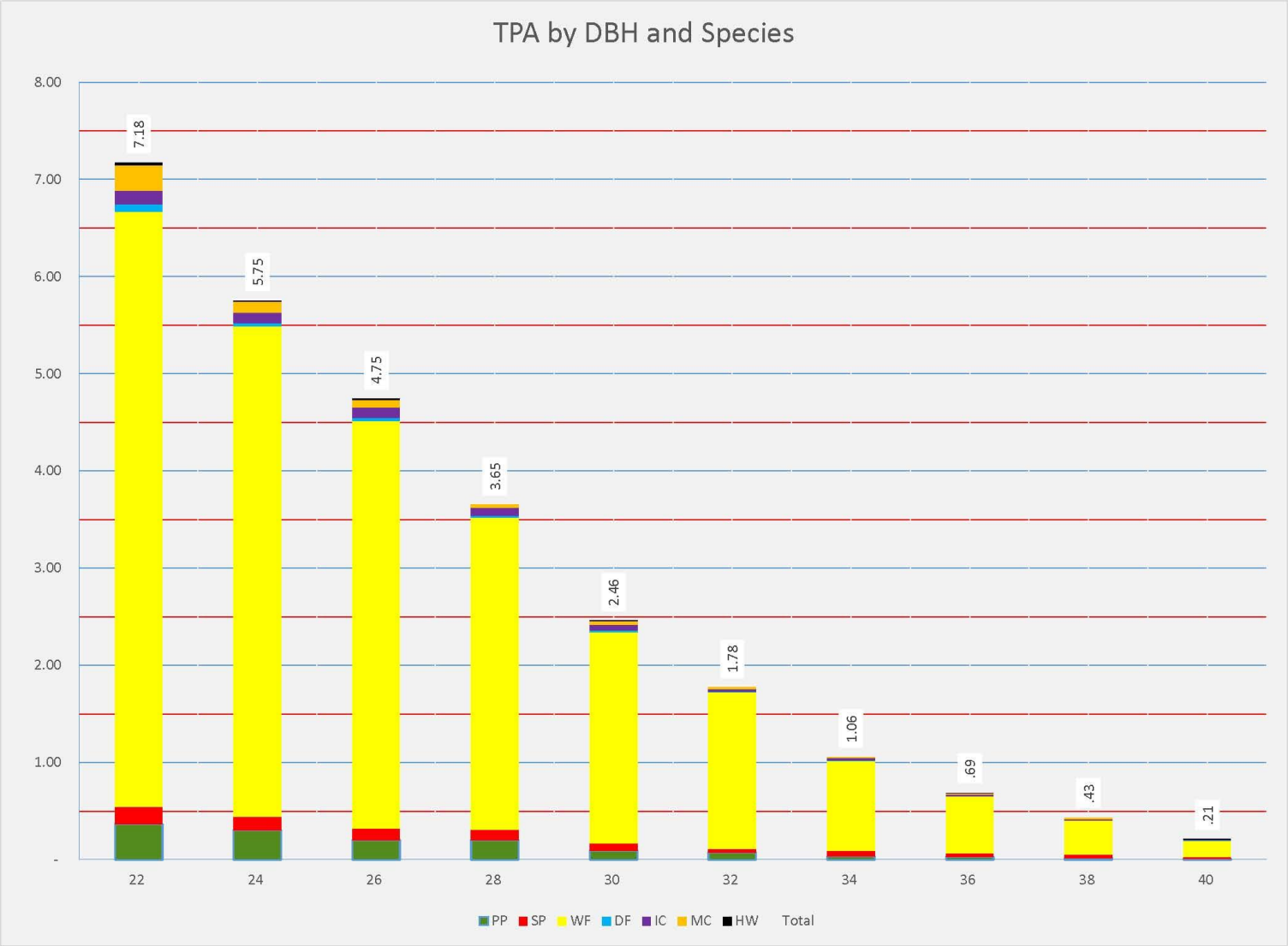
PP
SP
WF
DF
IC
MC
HW
Total


TPA by DBH and Species
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3.00
2.00
1.00
-
7.18
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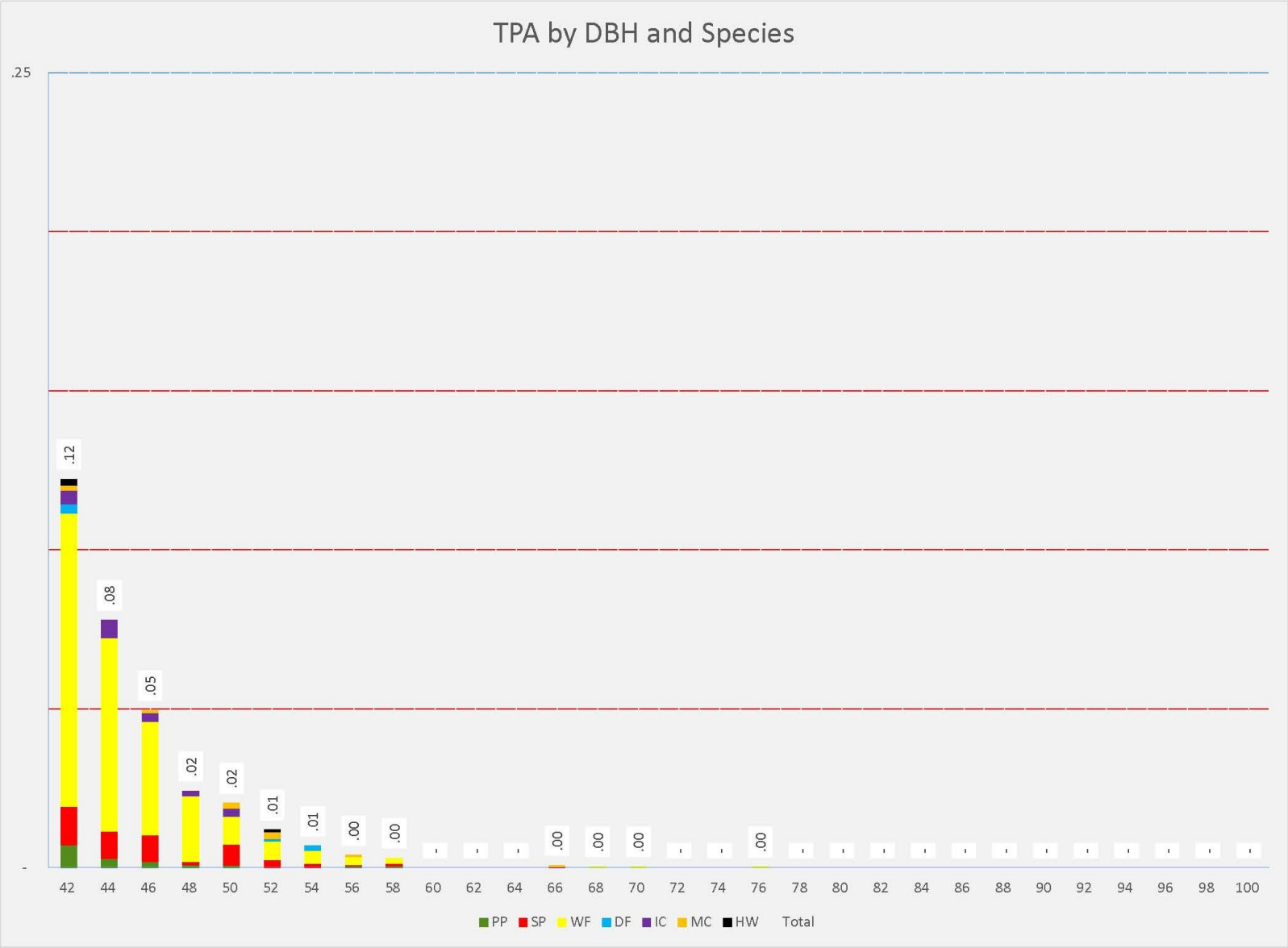
3.65
2.46
1.78
1.06
.69
.43
.21
22
24
26
28
30
32
34
36
38
40
PP
SP
WF
DF
IC
MC
HW
Total

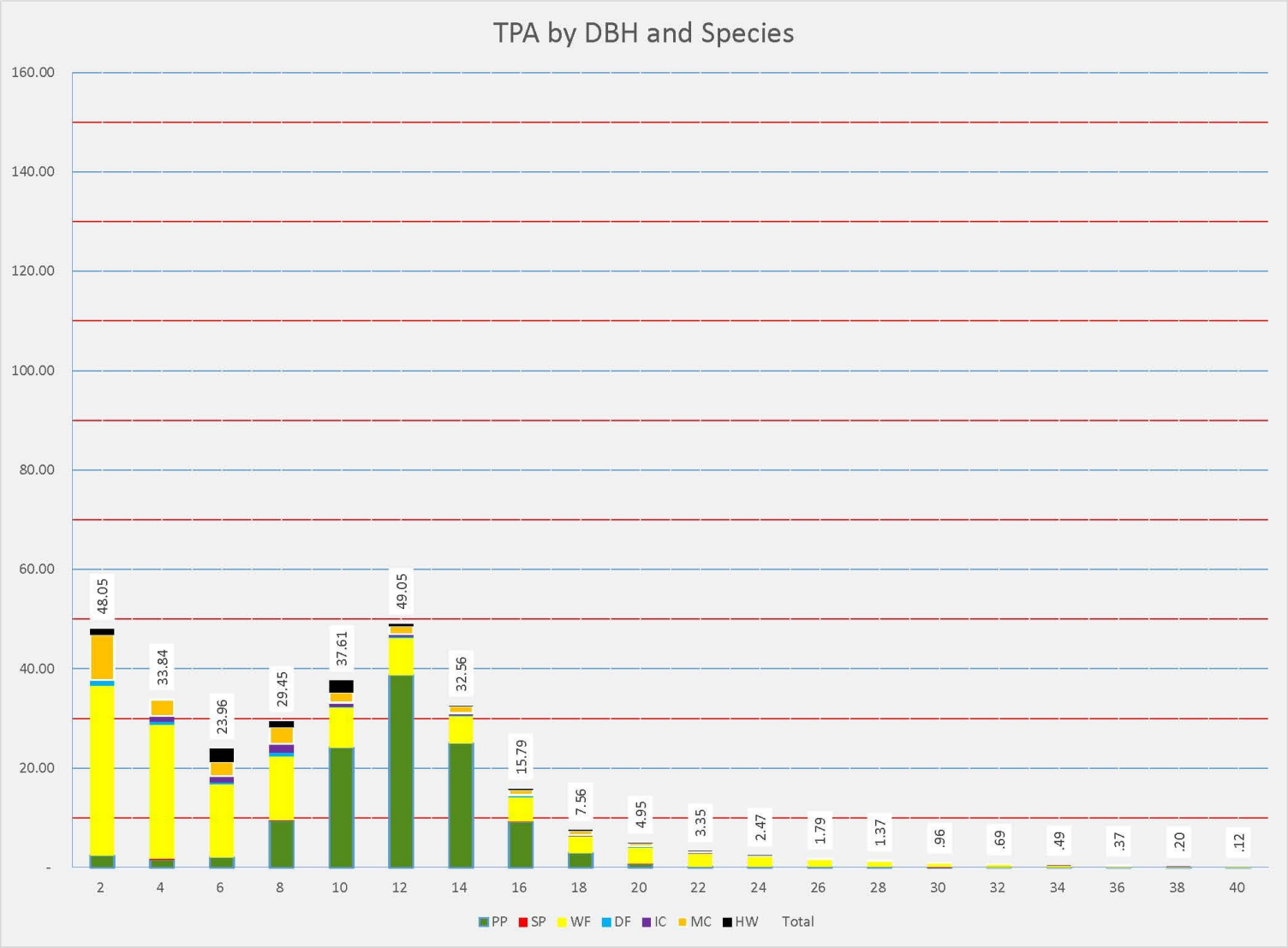



Redding North HF4 DBH 42"+ Page 28

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 11.3 | (+ or -) | 14.0 |
| Processed 02/07/2014 at 13:34:45 | | QMD >=5" | 13.2 | (+ or -) | 13.9 |
| | | Ave Diam All | 9.6 | (+ or -) | 53.3 |
| Tree Frequency | | Ave Diam >=5" | 12.2 | (+ or -) | 51.1 |
| Plot Count | 1,501 | TPA >=12" 121.9 | TPA >=22" | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 2.43 | - | 34.27 | 1.09 | - | 9.06 | 1.20 | 48.05 |
| 4 | 1.60 | .30 | 26.89 | .62 | 1.13 | 3.30 | - | 33.84 |
| 6 | 2.04 | - | 14.80 | .34 | 1.21 | 2.91 | 2.66 | 23.96 |
| 8 | 9.47 | .07 | 12.86 | .73 | 1.78 | 3.34 | 1.20 | 29.45 |
| 10 | 24.12 | .08 | 8.10 | .14 | .77 | 2.03 | 2.37 | 37.61 |
| 12 | 38.74 | .03 | 7.54 | .20 | .48 | 1.59 | .46 | 49.05 |
| 14 | 24.99 | - | 5.53 | .20 | .36 | 1.40 | .08 | 32.56 |
| 16 | 9.26 | .04 | 4.96 | .17 | .20 | 1.11 | .06 | 15.79 |
| 18 | 2.96 | .03 | 3.28 | .12 | .16 | .91 | .10 | 7.56 |
| 20 | .73 | .08 | 3.29 | .14 | .06 | .63 | .02 | 4.95 |
| 22 | .14 | .11 | 2.58 | .06 | .15 | .27 | .04 | 3.35 |
| 24 | .12 | .09 | 1.96 | .08 | .09 | .11 | .01 | 2.47 |
| 26 | .11 | .02 | 1.45 | .07 | .05 | .10 | - | 1.79 |
| 28 | .10 | .05 | 1.13 | .02 | .04 | .02 | - | 1.37 |
| 30 | .06 | .04 | .82 | .01 | .01 | .02 | - | .96 |
| 32 | .02 | .02 | .62 | .01 | .01 | .01 | - | .69 |
| 34 | .02 | .03 | .43 | .00 | .02 | - | - | .49 |
| 36 | .03 | .00 | .32 | .00 | .00 | .01 | - | .37 |
| 38 | .02 | .01 | .17 | .00 | .00 | - | - | .20 |
| 40 | .01 | .00 | .11 | .00 | - | - | - | .12 |
| 42 | .00 | .00 | .06 | - | - | .00 | - | .07 |
| 44 | .00 | .01 | .05 | - | .01 | - | - | .07 |
| 46 | .00 | - | .02 | - | - | - | - | .02 |
| 48 | - | - | .01 | - | - | - | - | .01 |
| 50 | - | - | .01 | - | .00 | - | - | .01 |
| 52 | - | .00 | .00 | - | .00 | - | - | .01 |
| 54 | - | - | .00 | - | - | - | - | .00 |
| 56 | - | - | - | - | - | - | - | - |
| 58 | - | - | - | - | - | - | - | - |
| 60 | - | - | - | - | .00 | - | - | .00 |
| 62 | - | - | - | - | - | - | - | - |
| 64 | - | - | - | - | - | - | - | - |
| 66 | - | - | - | - | - | - | - | - |
| 68 | - | - | - | - | - | - | - | - |
| 70 | - | - | - | - | - | - | - | - |
| 72 | - | - | - | - | - | - | - | - |
| 74 | - | - | - | - | - | - | - | - |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 116.98 | 1.02 | 131.26 | 4.00 | 6.53 | 26.81 | 8.20 | 294.80 |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100.00
80.00
60.00
40.00
20.00
-
48.05
33.84
23.96
29.45
37.61
49.05
32.56
15.79
7.56
4.95
3.35
2.47
1.79
1.37
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PP
SP
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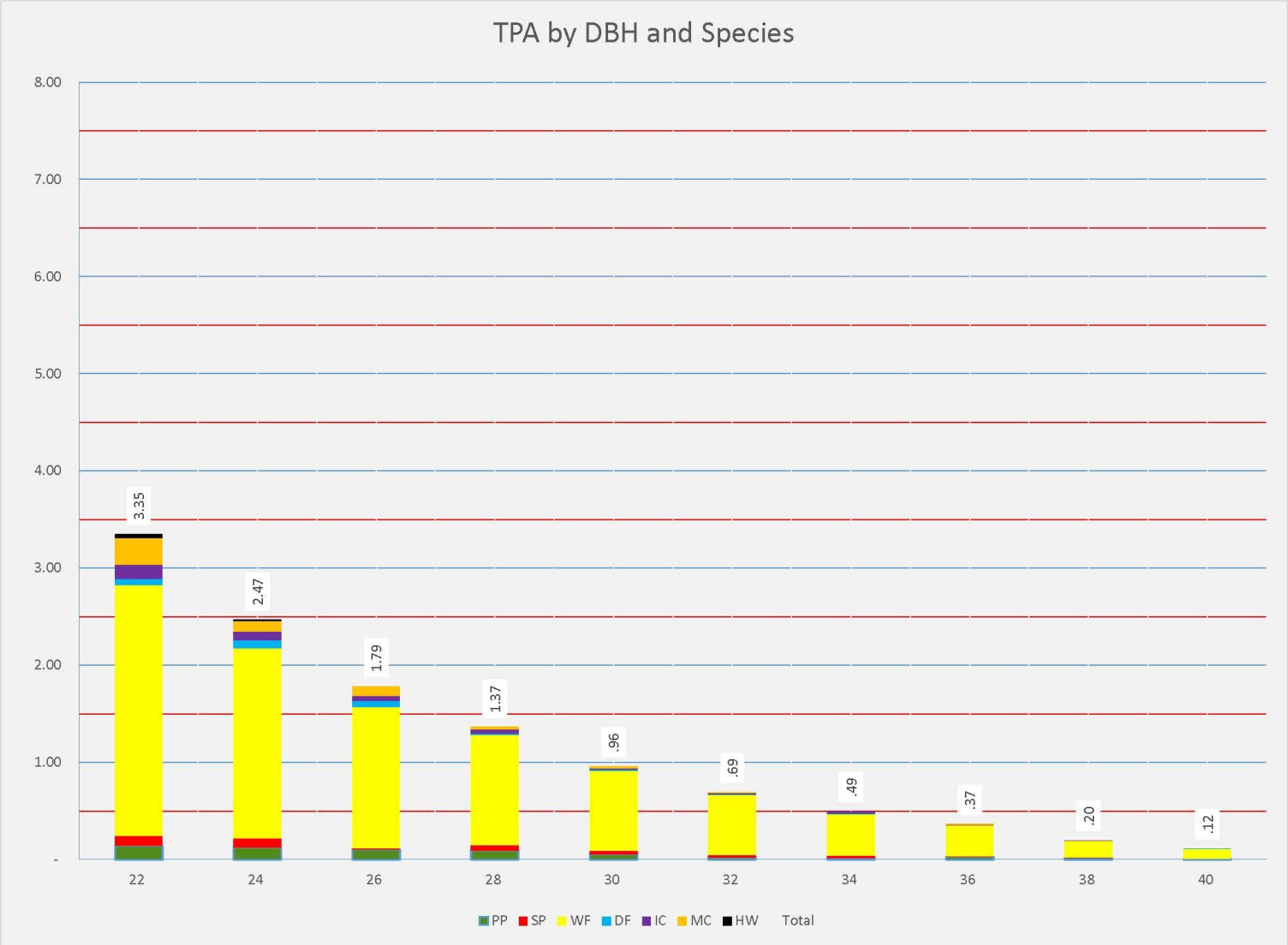
DF
IC
MC
HW
Total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7.00
6.00
5.00
4.00
3.00
2.00
1.00
-
3.35
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1.37
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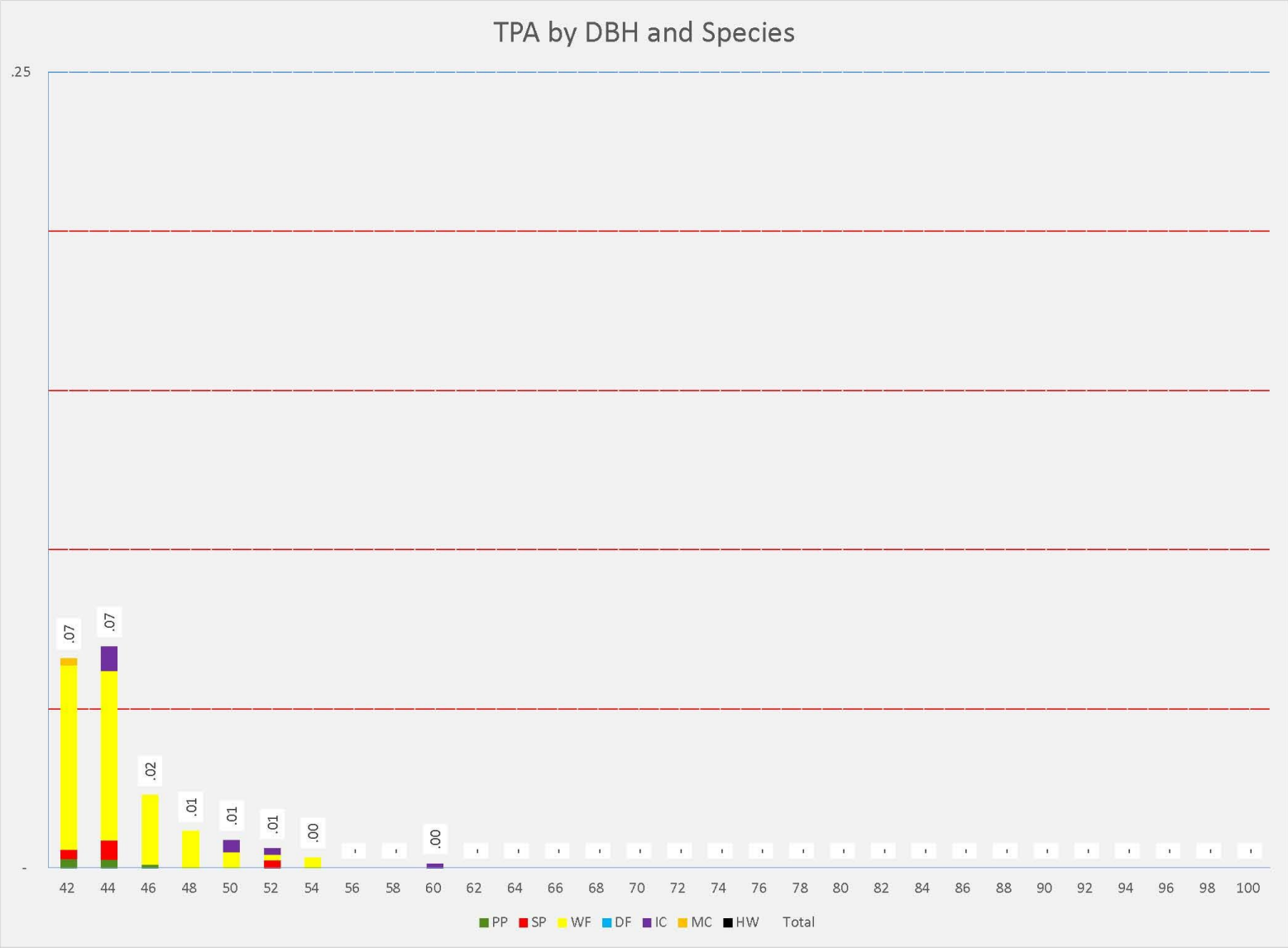
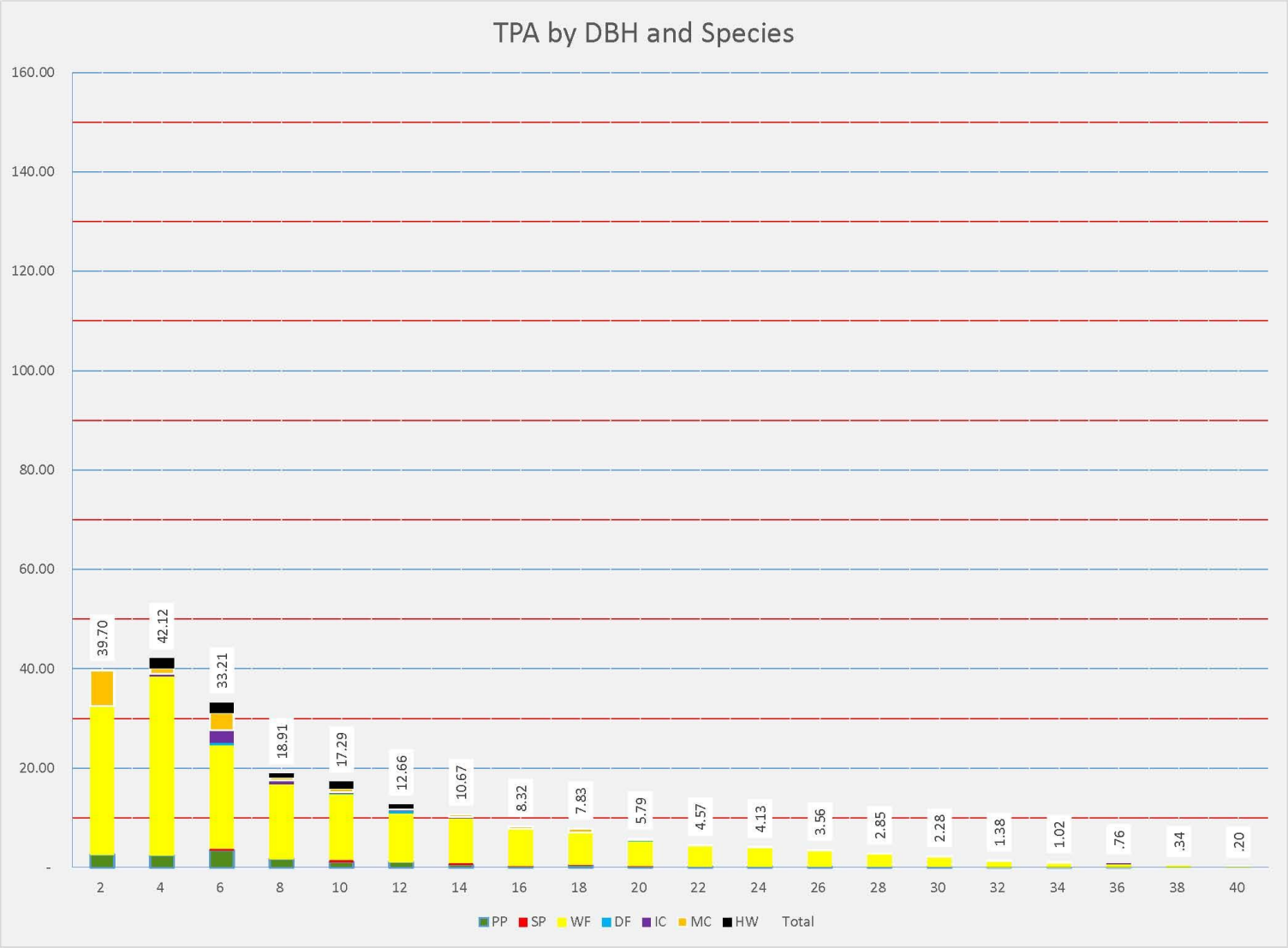
.37
.20
.12
22
24
26
28
30
32
34
36
38
40
PP
SP
WF
DF
IC
MC
HW
Total


TPA by DBH and Species
.25
-
.07
.07
.02
.01
.01
.01
.00
.00
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100
PP SP WF DF IC MC HW Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 12.1 | (+ or -) | 13.4 |
| Processed 02/07/2014 at 13:34:45 | | QMD >=5" | 15.1 | (+ or -) | 13.3 |
| | | Ave Diam All | 9.4 | (+ or -) | 45.1 |
| Tree Frequency | | Ave Diam >=5" | 13.2 | (+ or -) | 42.3 |
| Plot Count | 1,501 | TPA >= 12" 66.5 | TPA >=22" | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 2.65 | - | 29.85 | - | - | 7.20 | - | 39.70 |
| 4 | 2.44 | - | 36.07 | - | .47 | 1.19 | 1.94 | 42.12 |
| 6 | 3.50 | .29 | 20.84 | .58 | 2.45 | 3.54 | 2.02 | 33.21 |
| 8 | 1.77 | - | 15.05 | - | .74 | .57 | .76 | 18.91 |
| 10 | 1.15 | .48 | 13.14 | .14 | .27 | .82 | 1.29 | 17.29 |
| 12 | 1.13 | - | 9.87 | .41 | .31 | .22 | .72 | 12.66 |
| 14 | .59 | .37 | 9.03 | - | .21 | .47 | - | 10.67 |
| 16 | .28 | .11 | 7.35 | .07 | - | .51 | - | 8.32 |
| 18 | .42 | .12 | 6.40 | .08 | .07 | .73 | - | 7.83 |
| 20 | .25 | .03 | 5.10 | .04 | .16 | .21 | - | 5.79 |
| 22 | .14 | .08 | 4.21 | .06 | .03 | .06 | - | 4.57 |
| 24 | .20 | .02 | 3.77 | - | .05 | .08 | - | 4.13 |
| 26 | .15 | .04 | 3.20 | .05 | .02 | .10 | - | 3.56 |
| 28 | .09 | - | 2.66 | - | .05 | .04 | - | 2.85 |
| 30 | .08 | - | 2.13 | .02 | .00 | .04 | - | 2.28 |
| 32 | .03 | - | 1.33 | - | .01 | .01 | - | 1.38 |
| 34 | .02 | - | .98 | .01 | .01 | .00 | - | 1.02 |
| 36 | .03 | .01 | .70 | .00 | .02 | - | - | .76 |
| 38 | - | .01 | .33 | - | - | - | - | .34 |
| 40 | - | - | .19 | - | - | .01 | - | .20 |
| 42 | - | - | .05 | - | - | - | - | .05 |
| 44 | - | - | .05 | - | - | .00 | - | .05 |
| 46 | - | - | .03 | - | - | - | - | .03 |
| 48 | - | - | .02 | - | - | - | - | .02 |
| 50 | - | - | .01 | - | - | - | - | .01 |
| 52 | - | - | .00 | - | - | - | - | .00 |
| 54 | - | - | - | - | - | - | - | - |
| 56 | - | - | .00 | - | - | - | - | .00 |
| 58 | - | - | - | - | - | - | - | - |
| 60 | - | - | - | - | - | - | - | - |
| 62 | - | - | - | - | - | - | - | - |
| 64 | - | - | - | - | - | - | - | - |
| 66 | - | - | - | - | - | - | - | - |
| 68 | - | - | - | - | - | - | - | - |
| 70 | - | - | - | - | - | - | - | - |
| 72 | - | - | - | - | - | - | - | - |
| 74 | - | - | - | - | - | - | - | - |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 14.92 | 1.56 | 172.38 | 1.46 | 4.86 | 15.83 | 6.73 | 217.74 |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120.00
100.00
80.00
60.00
40.00
20.00
-
39.70
42.12
33.21
18.91
17.29
12.66
10.67
8.32
7.83
5.79
4.57
4.13
3.56
2.85
2.28
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1.02
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PP
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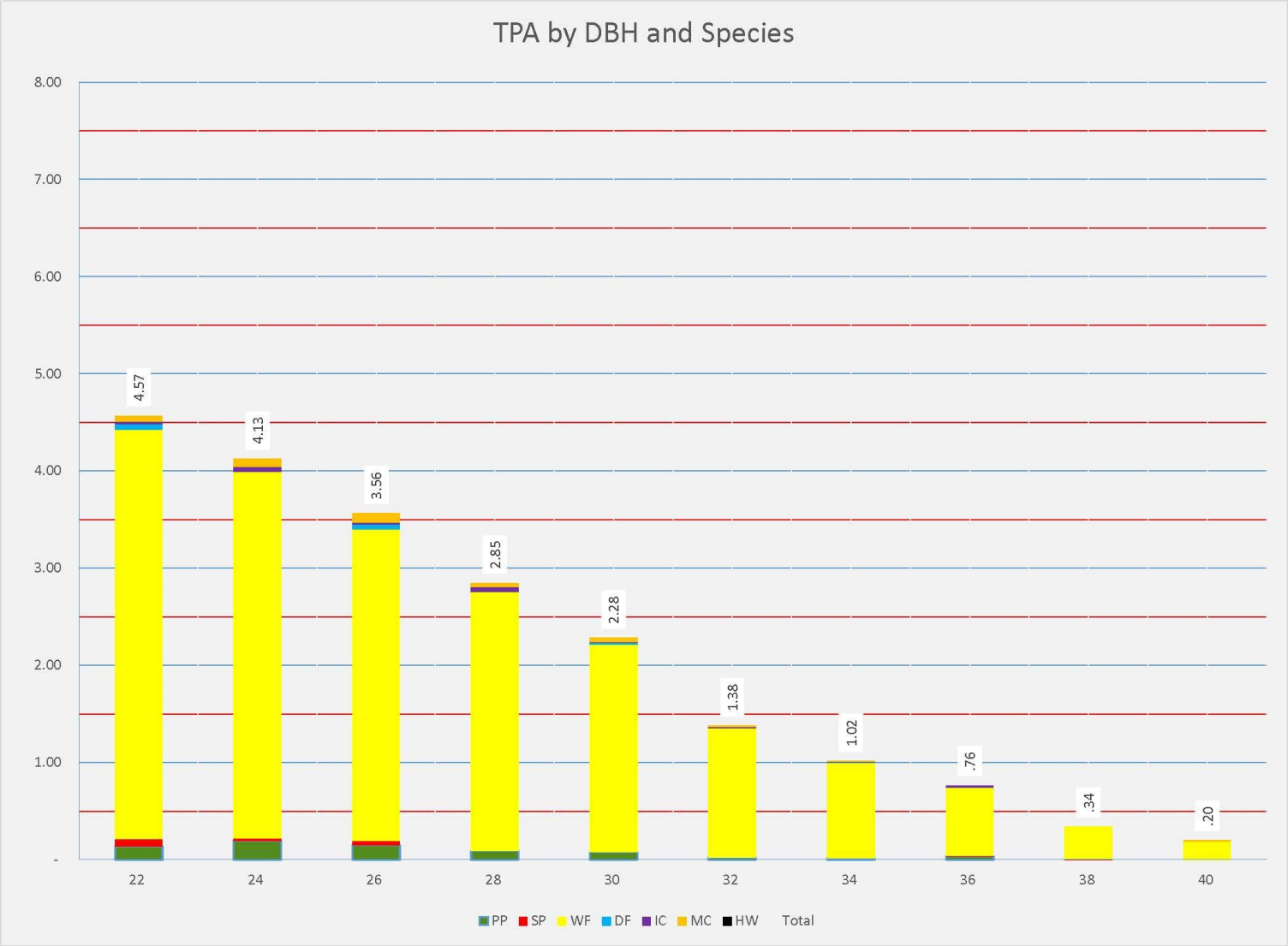
MC
HW
Total


TPA by DBH and Species
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
-
4.57
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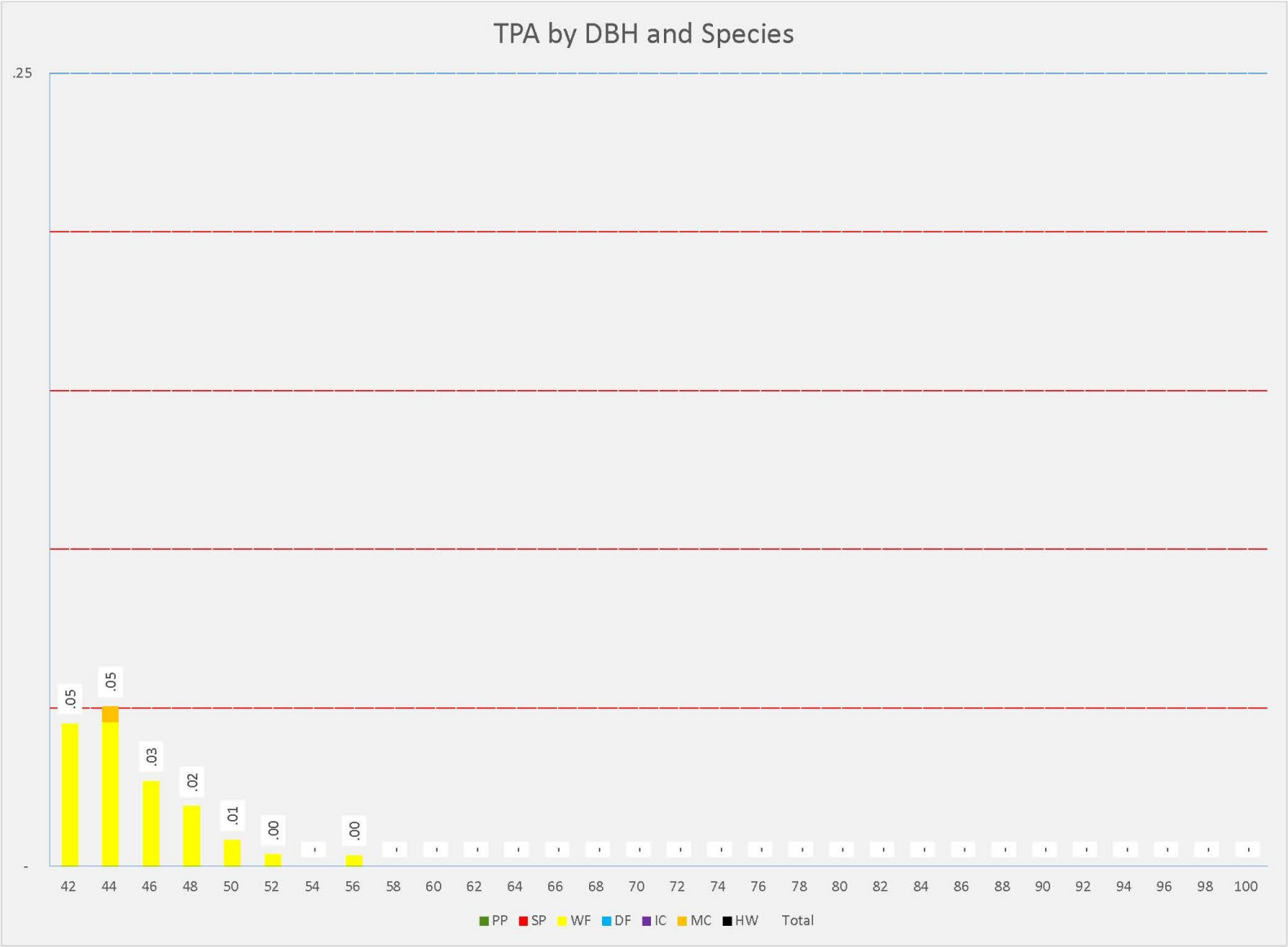
1.38
1.02
.76
.34
.20
22
24
26
28
30
32
34
36
38
40
PP
SP
WF
DF
IC
MC
HW
Total


TPA by DBH and Species
.25
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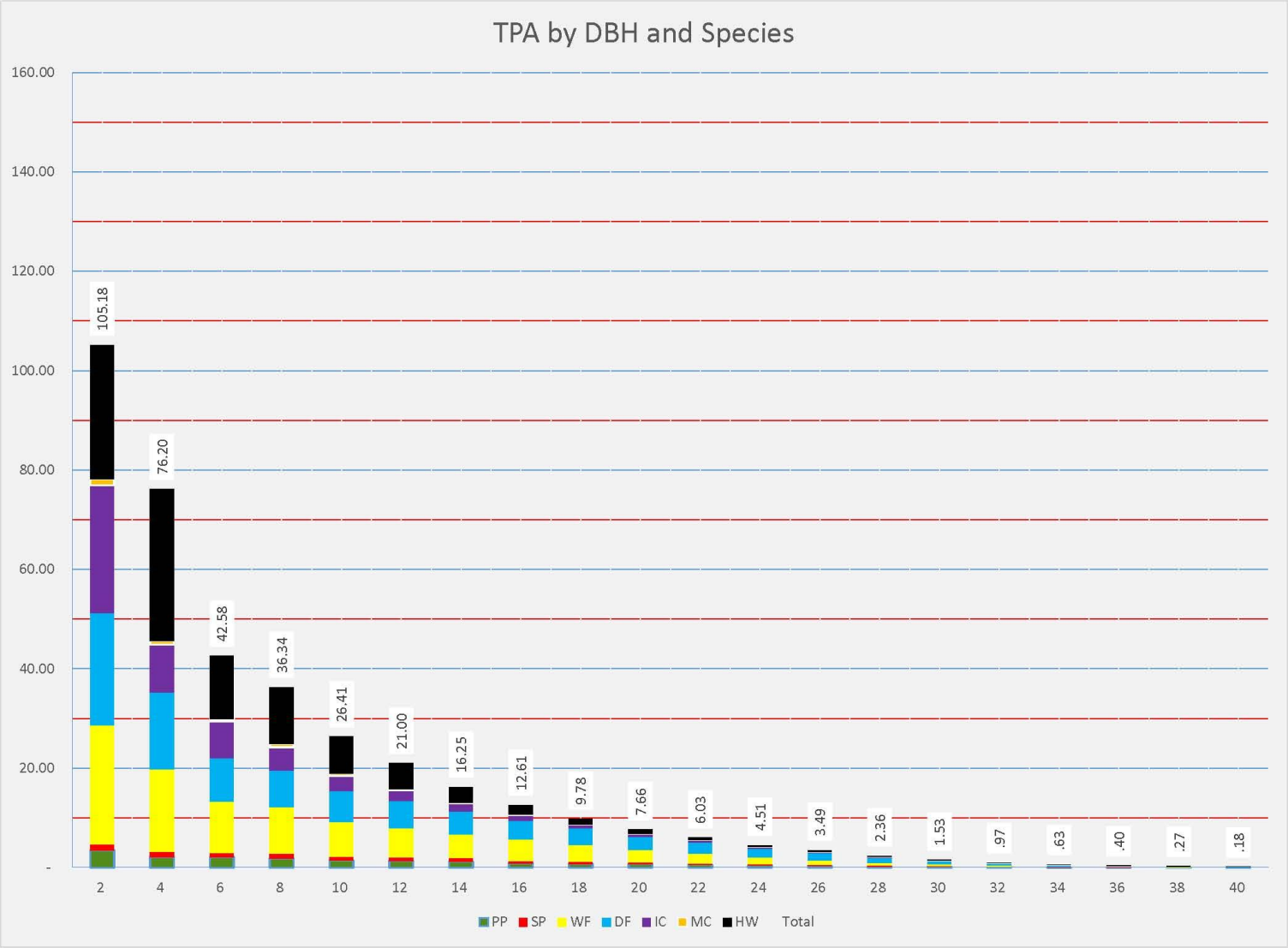
.05
.05
.03
.02
.01
.00
.00
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100
PP SP WF DF IC MC HW Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 10.2 | (+ or -) | 14.0 |
| Processed 02/07/2014 at 11:58:06 | | QMD >=5" | 13.9 | (+ or -) | 13.9 |
| | | Ave Diam All | 7.7 | (+ or -) | 53.7 |
| Tree Frequency | | Ave Diam >=5" | 12.2 | (+ or -) | 48.7 |
| Plot Count | 2,378 | TPA >= 12" 88.1 | TPA >= 22" | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 3.50 | 1.23 | 23.97 | 22.59 | 25.65 | 1.25 | 26.99 | 105.18 |
| 4 | 2.12 | 1.06 | 16.57 | 15.57 | 9.56 | .71 | 30.61 | 76.20 |
| 6 | 2.12 | .80 | 10.36 | 8.71 | 7.46 | .52 | 12.61 | 42.58 |
| 8 | 1.89 | .93 | 9.33 | 7.41 | 4.66 | .70 | 11.42 | 36.34 |
| 10 | 1.48 | .77 | 7.01 | 6.17 | 2.97 | .48 | 7.52 | 26.41 |
| 12 | 1.40 | .73 | 5.86 | 5.41 | 2.13 | .23 | 5.23 | 21.00 |
| 14 | 1.17 | .75 | 4.84 | 4.60 | 1.58 | .17 | 3.14 | 16.25 |
| 16 | .89 | .46 | 4.39 | 3.76 | 1.07 | .09 | 1.96 | 12.61 |
| 18 | .76 | .49 | 3.39 | 3.30 | .73 | .08 | 1.03 | 9.78 |
| 20 | .71 | .41 | 2.50 | 2.63 | .59 | .04 | .78 | 7.66 |
| 22 | .56 | .33 | 1.92 | 2.28 | .45 | .03 | .46 | 6.03 |
| 24 | .46 | .29 | 1.33 | 1.75 | .34 | .01 | .33 | 4.51 |
| 26 | .34 | .26 | .92 | 1.43 | .28 | .01 | .26 | 3.49 |
| 28 | .24 | .18 | .59 | .99 | .21 | .00 | .16 | 2.36 |
| 30 | .18 | .15 | .34 | .62 | .13 | .00 | .11 | 1.53 |
| 32 | .11 | .10 | .20 | .41 | .09 | .00 | .05 | .97 |
| 34 | .07 | .07 | .10 | .29 | .05 | .00 | .04 | .63 |
| 36 | .03 | .05 | .06 | .20 | .04 | .00 | .03 | .40 |
| 38 | .02 | .04 | .03 | .14 | .03 | .00 | .02 | .27 |
| 40 | .01 | .03 | .02 | .09 | .02 | .00 | .01 | .18 |
| 42 | .00 | .02 | .00 | .05 | .01 | .00 | .01 | .09 |
| 44 | .00 | .01 | .00 | .05 | .01 | .00 | .00 | .08 |
| 46 | .00 | .00 | .00 | .04 | .01 | - | .00 | .05 |
| 48 | .00 | .00 | .00 | .03 | .01 | .00 | .00 | .05 |
| 50 | .00 | .00 | .00 | .02 | .01 | .00 | .00 | .03 |
| 52 | .00 | .00 | .00 | .02 | .00 | .00 | .00 | .03 |
| 54 | - | .00 | .00 | .01 | .00 | .00 | .00 | .02 |
| 56 | .00 | .00 | .00 | .01 | .00 | .00 | .00 | .01 |
| 58 | - | .00 | - | .01 | .00 | - | .00 | .01 |
| 60 | .00 | .00 | .00 | .01 | .00 | .00 | .00 | .01 |
| 62 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .01 |
| 64 | - | - | .00 | .00 | .00 | .00 | - | .00 |
| 66 | .00 | .00 | .00 | .00 | .00 | - | - | .00 |
| 68 | - | - | - | .00 | .00 | .00 | - | .00 |
| 70 | .00 | - | - | .00 | - | .00 | - | .00 |
| 72 | - | - | - | .00 | .00 | - | - | .00 |
| 74 | - | - | - | .00 | - | - | - | .00 |
| 76 | - | - | - | .00 | - | - | - | .00 |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | .00 | - | - | - | .00 |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | .00 | - | - | .00 | .00 |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | .00 | - | - | - | - | .00 |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 18.09 | 9.17 | 93.75 | 88.59 | 58.05 | 4.34 | 102.77 | 374.77 |


TPA by DBH and Species
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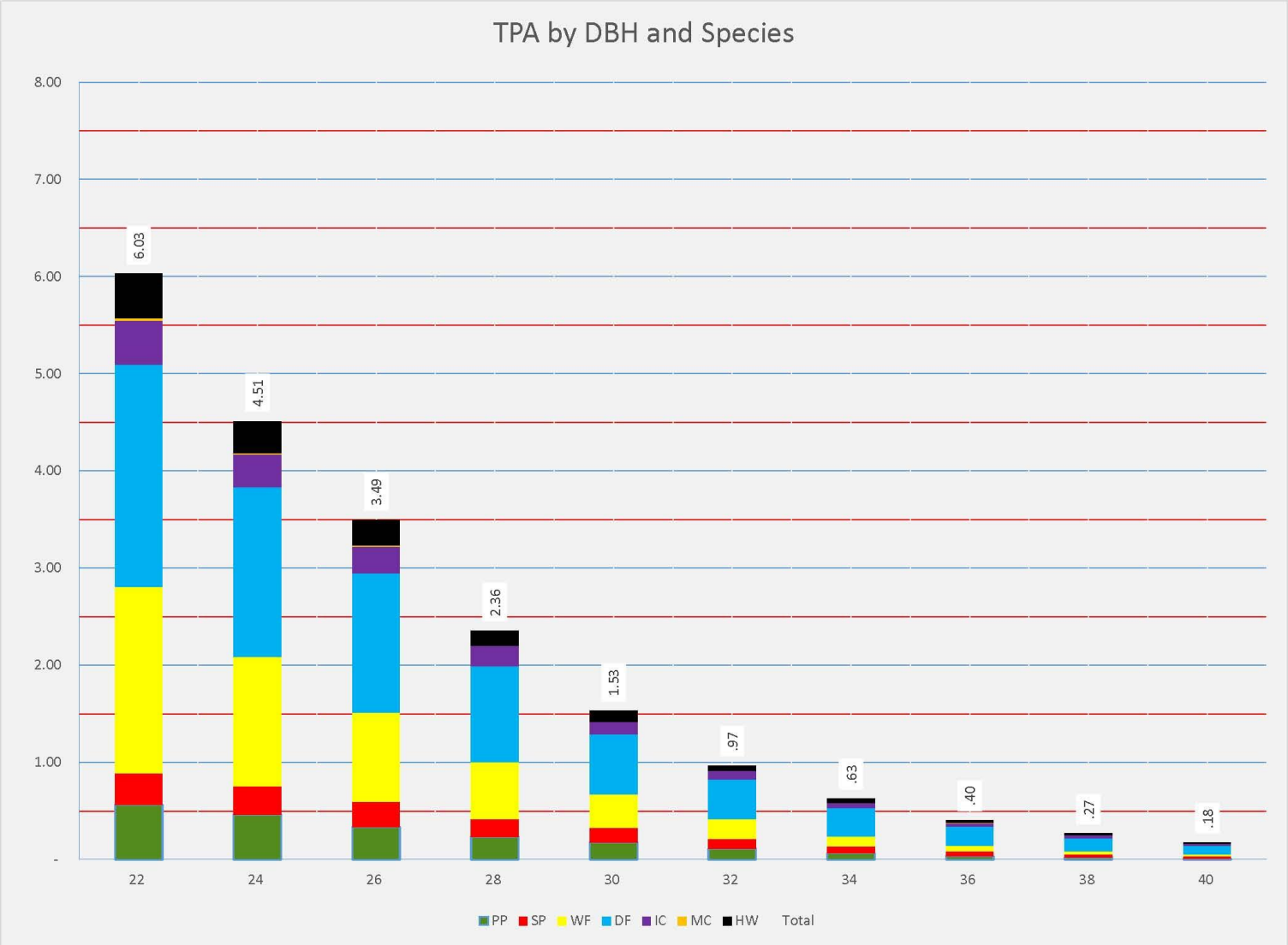
TPA by DBH and Species
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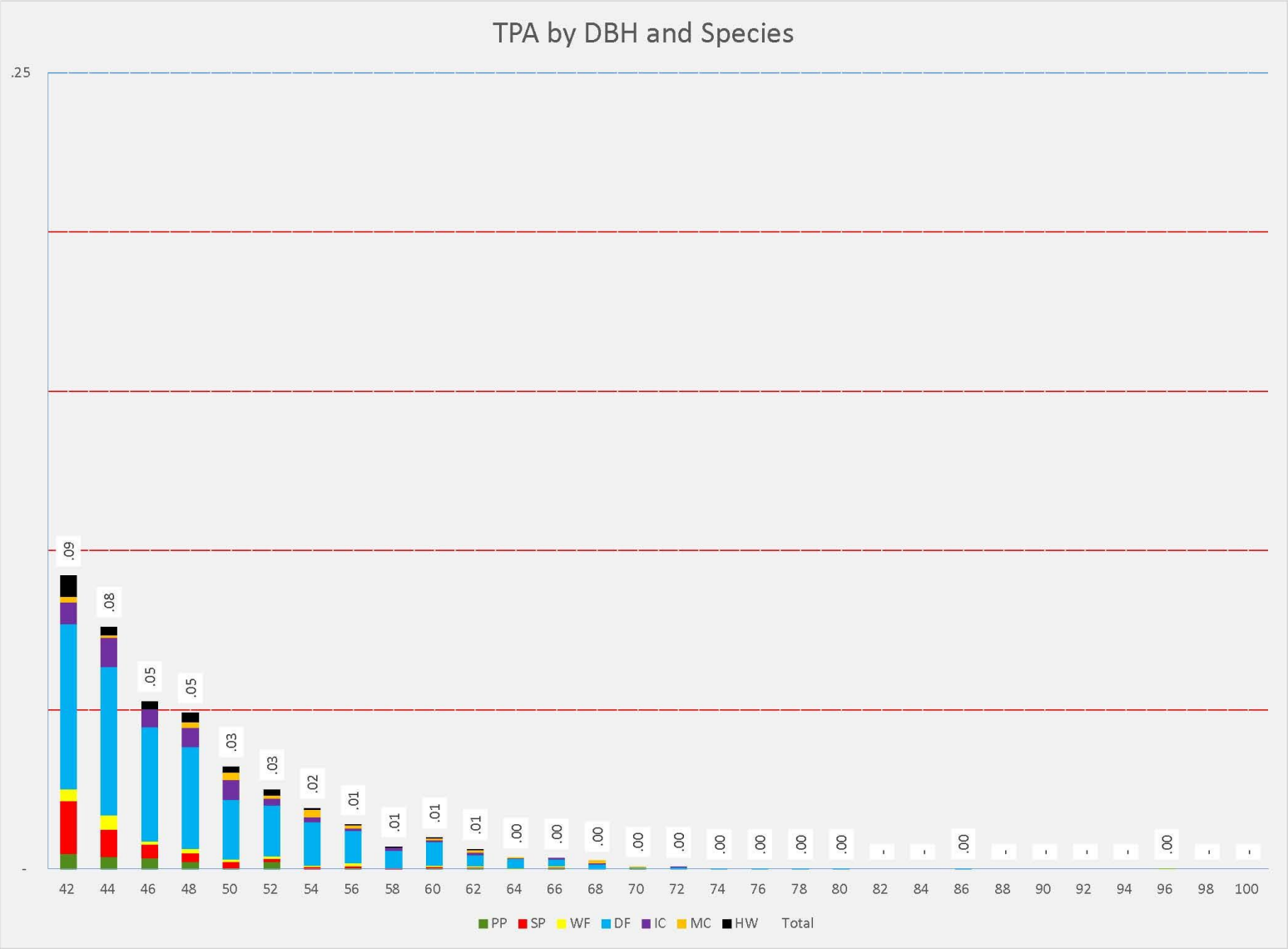
Total


TPA by DBH and Species
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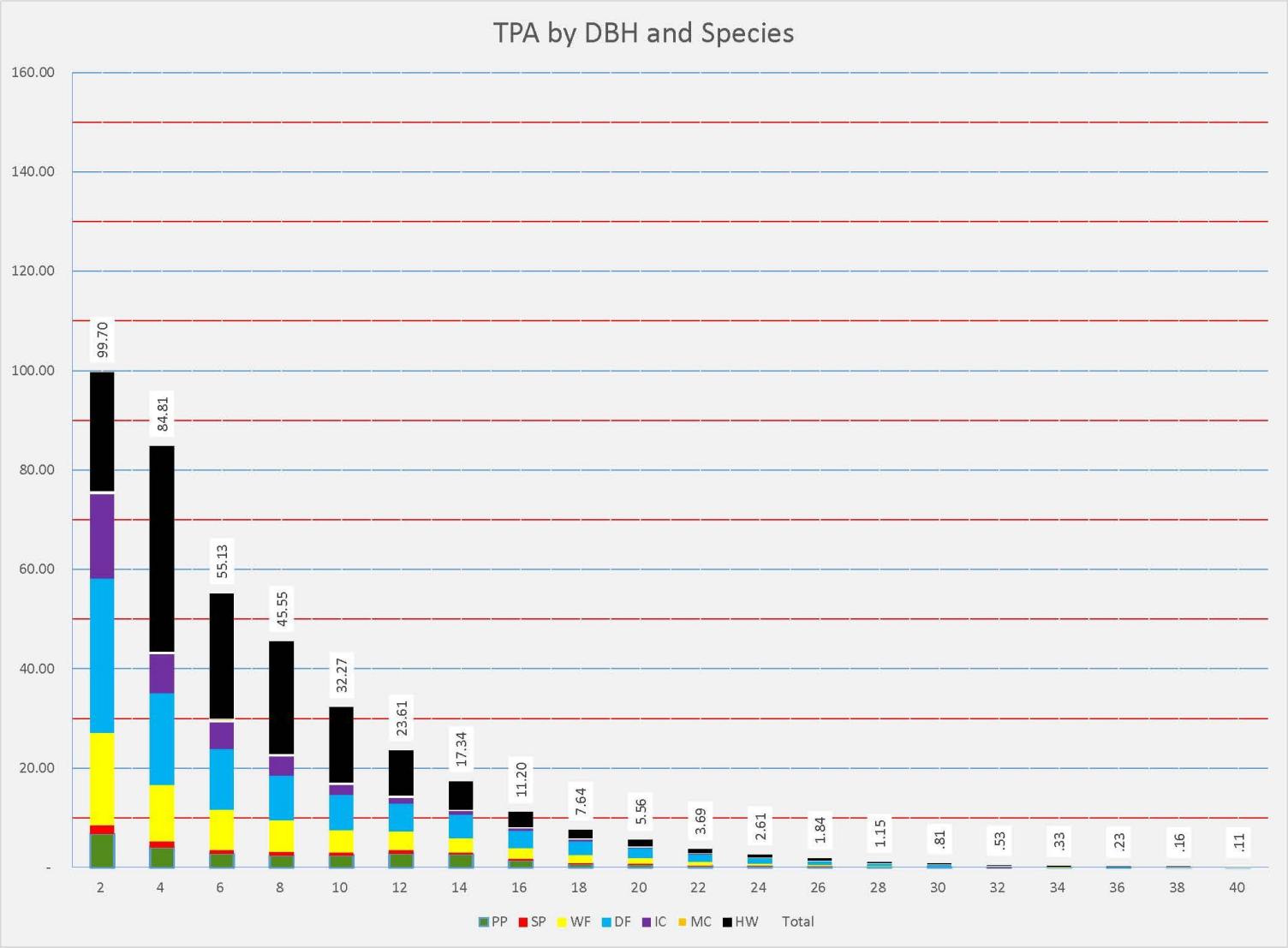
76
78
80
82
84
86
88
90
92
94
96
98
100
PP
SP
WF
DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 9.1 | (+ or -) | 13.4 |
| Processed 02/07/2014 at 13:25:27 | | QMD >=5" | 12.1 | (+ or -) | 13.3 |
| | | Ave Diam All | 7.1 | (+ or -) | 53.1 |
| Tree Frequency | | Ave Diam >=5" | 10.9 | (+ or -) | 47.7 |
| Plot Count | 3,343 | TPA >= 12” 77.1 | TPA >= 22” 11.7 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 6.78 | 1.81 | 18.55 | 31.06 | 17.18 | .46 | 23.86 | 99.70 |
| 4 | 4.13 | 1.25 | 11.31 | 18.43 | 8.07 | .39 | 41.24 | 84.81 |
| 6 | 2.80 | .83 | 8.11 | 12.20 | 5.53 | .59 | 25.07 | 55.13 |
| 8 | 2.46 | .72 | 6.38 | 9.06 | 3.94 | .37 | 22.62 | 45.55 |
| 10 | 2.50 | .59 | 4.47 | 7.10 | 2.15 | .43 | 15.04 | 32.27 |
| 12 | 2.90 | .65 | 3.83 | 5.55 | 1.30 | .35 | 9.03 | 23.61 |
| 14 | 2.72 | .43 | 2.83 | 4.68 | .88 | .18 | 5.63 | 17.34 |
| 16 | 1.46 | .34 | 2.11 | 3.54 | .65 | .12 | 2.99 | 11.20 |
| 18 | .75 | .27 | 1.56 | 2.79 | .48 | .08 | 1.71 | 7.64 |
| 20 | .58 | .23 | 1.11 | 2.00 | .31 | .07 | 1.26 | 5.56 |
| 22 | .37 | .15 | .71 | 1.46 | .23 | .02 | .75 | 3.69 |
| 24 | .29 | .13 | .47 | 1.05 | .15 | .03 | .49 | 2.61 |
| 26 | .19 | .10 | .33 | .73 | .12 | .02 | .35 | 1.84 |
| 28 | .12 | .07 | .18 | .50 | .07 | .01 | .20 | 1.15 |
| 30 | .08 | .07 | .12 | .36 | .05 | .01 | .13 | .81 |
| 32 | .04 | .04 | .06 | .24 | .03 | .00 | .11 | .53 |
| 34 | .03 | .03 | .03 | .15 | .03 | .00 | .07 | .33 |
| 36 | .02 | .02 | .02 | .11 | .02 | .00 | .04 | .23 |
| 38 | .01 | .01 | .01 | .08 | .02 | .00 | .03 | .16 |
| 40 | .01 | .01 | .01 | .06 | .01 | .00 | .02 | .11 |
| 42 | .00 | .01 | .00 | .04 | .01 | .00 | .01 | .07 |
| 44 | .00 | .00 | .00 | .03 | .01 | .00 | .00 | .05 |
| 46 | .00 | .00 | .00 | .02 | .00 | - | .00 | .03 |
| 48 | .00 | .00 | .00 | .02 | .00 | .00 | .00 | .03 |
| 50 | .00 | .00 | .00 | .02 | .00 | - | .00 | .03 |
| 52 | .00 | .00 | .00 | .01 | .00 | .00 | .00 | .02 |
| 54 | .00 | .00 | .00 | .01 | .00 | .00 | .00 | .01 |
| 56 | .00 | .00 | .00 | .01 | .00 | .00 | .00 | .01 |
| 58 | - | .00 | - | .01 | .00 | .00 | .00 | .01 |
| 60 | .00 | .00 | - | .01 | .00 | .00 | - | .01 |
| 62 | - | - | - | .00 | .00 | .00 | .00 | .00 |
| 64 | - | .00 | - | .00 | - | .00 | .00 | .00 |
| 66 | - | .00 | - | .00 | - | .00 | - | .00 |
| 68 | - | - | - | .00 | .00 | - | - | .00 |
| 70 | - | - | - | .00 | - | - | - | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | - | - | - | - | .00 | - | .00 |
| 76 | - | - | - | .00 | - | - | - | .00 |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | .00 | - | - | - | .00 |
| 84 | - | - | - | - | - | - | .00 | .00 |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | .00 | - | - | - | .00 |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 28.23 | 7.76 | 62.19 | 101.32 | 41.22 | 3.15 | 150.65 | 394.52 |


TPA by DBH and Species
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120.00
100.00
80.00
60.00
40.00
20.00
-
99.70
84.81
55.13
45.55
32.27
23.61
17.34
11.20
7.64
5.56
3.69
2.61
1.84
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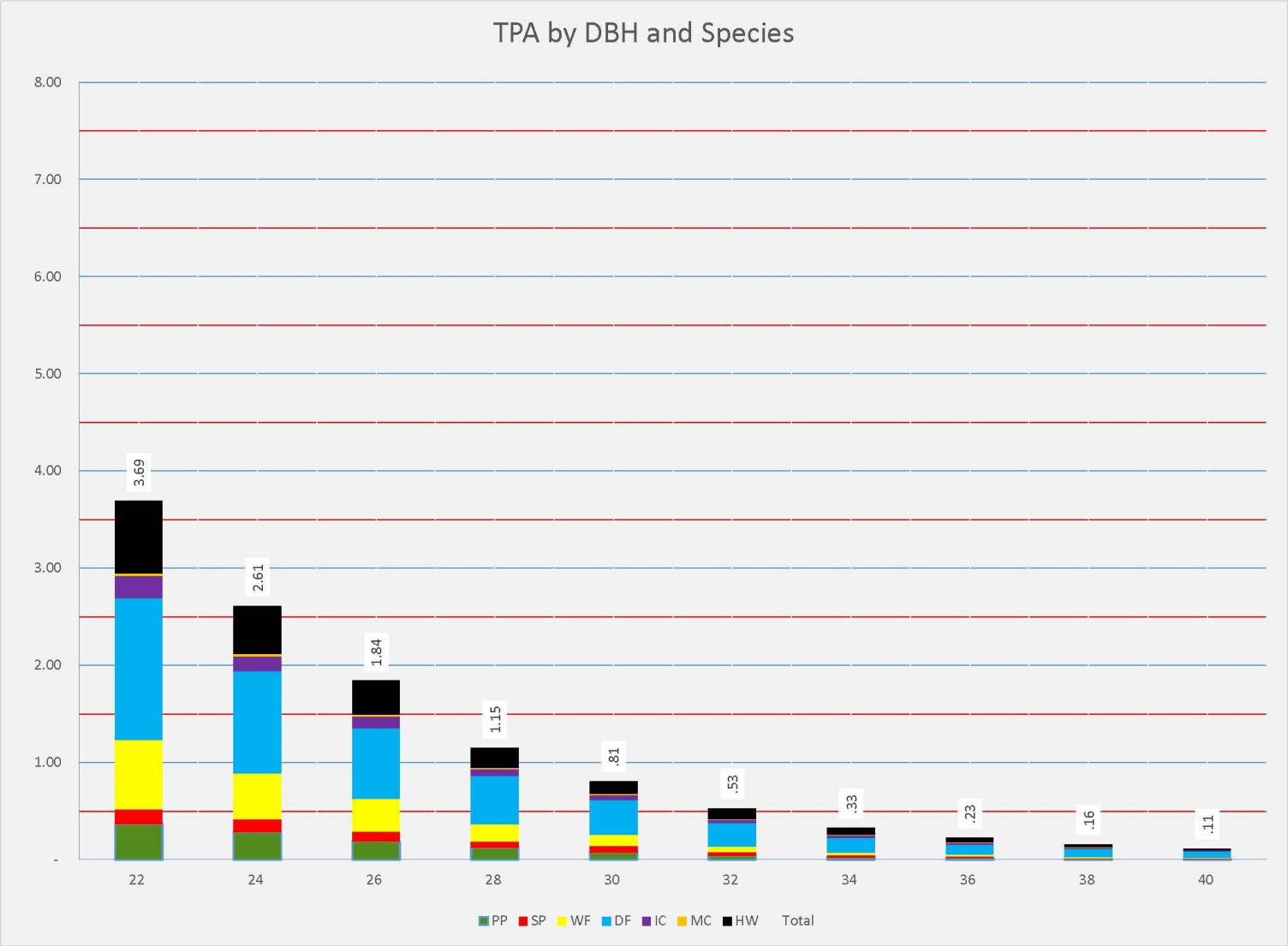
HW
Total


TPA by DBH and Species
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7.00
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5.00
4.00
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1.00
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PP
SP
WF
DF
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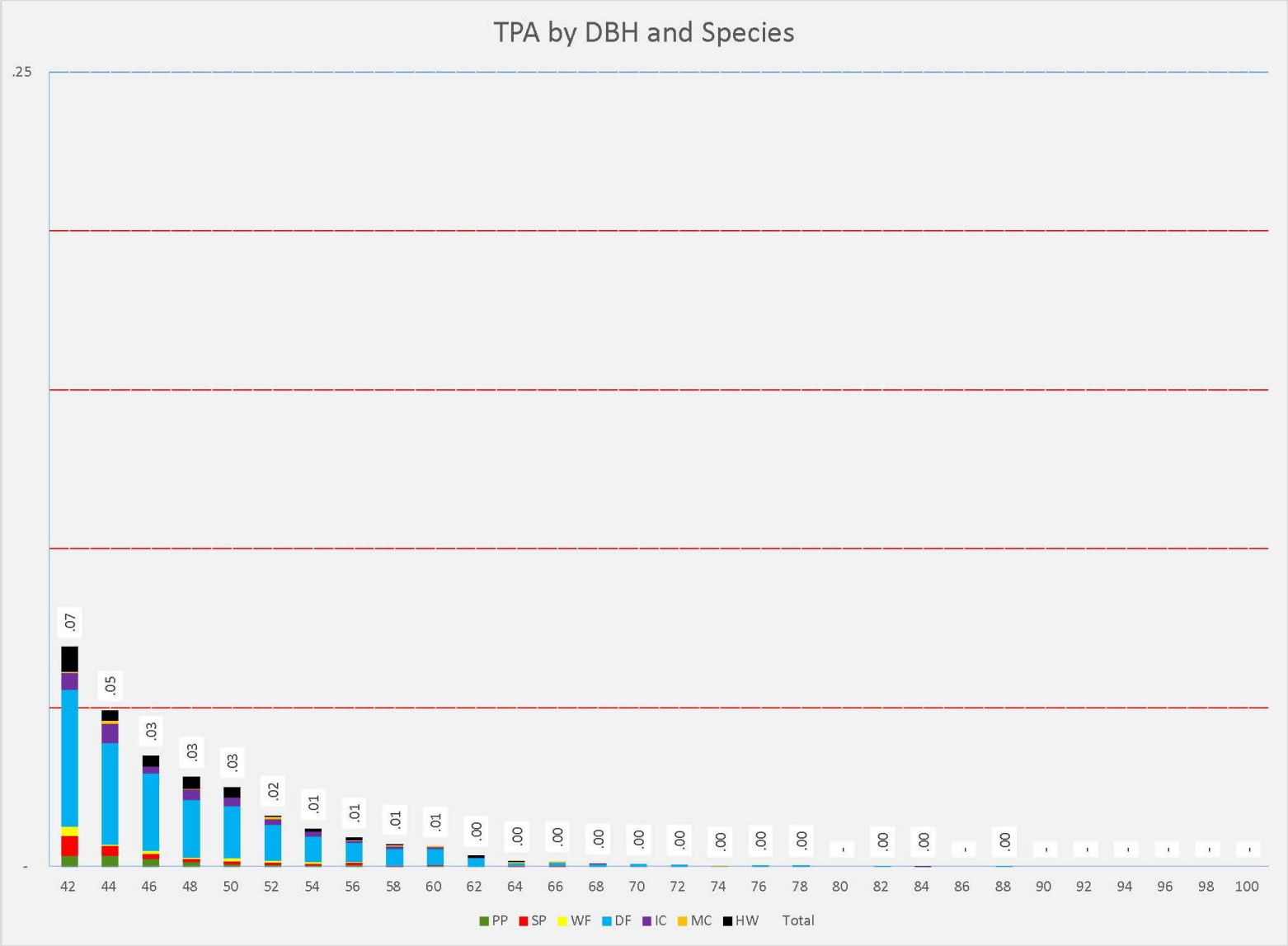
MC
HW
Total


TPA by DBH and Species
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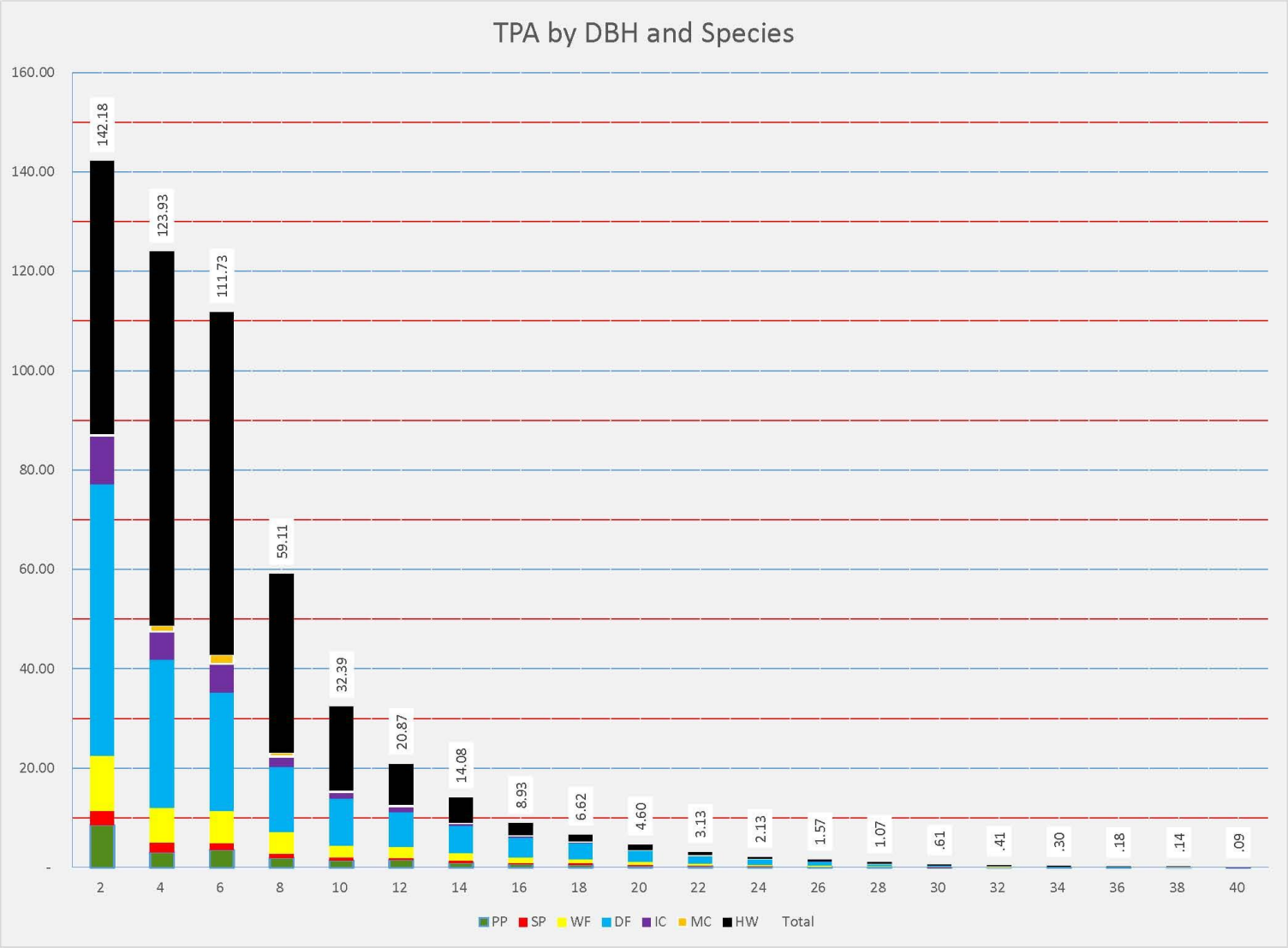
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100
PP SP WF DF IC MC HW Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 7.8 | (+ or -) | 13.4 |
| Processed 02/07/2014 at 13:25:27 | | QMD >=5" | 10.6 | (+ or -) | 13.2 |
| | | Ave Diam All | 6.2 | (+ or -) | 57.5 |
| Tree Frequency | | Ave Diam >=5" | 9.4 | (+ or -) | 50.3 |
| Plot Count | 3,343 | TPA >= 12" 65.0 | TPA >= 22" | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 8.59 | 2.91 | 11.04 | 54.66 | 9.67 | .49 | 54.83 | 142.18 |
| 4 | 3.04 | 2.08 | 6.91 | 29.82 | 5.61 | 1.26 | 75.22 | 123.93 |
| 6 | 3.59 | 1.35 | 6.51 | 23.85 | 5.68 | 1.90 | 68.84 | 111.73 |
| 8 | 1.96 | .86 | 4.39 | 13.13 | 2.02 | .76 | 35.98 | 59.11 |
| 10 | 1.42 | .65 | 2.43 | 9.47 | 1.20 | .38 | 16.84 | 32.39 |
| 12 | 1.55 | .39 | 2.29 | 6.98 | 1.12 | .42 | 8.11 | 20.87 |
| 14 | 1.03 | .42 | 1.55 | 5.42 | .52 | .18 | 4.97 | 14.08 |
| 16 | .71 | .21 | 1.15 | 4.01 | .34 | .12 | 2.39 | 8.93 |
| 18 | .64 | .28 | .85 | 3.18 | .27 | .10 | 1.30 | 6.62 |
| 20 | .38 | .17 | .64 | 2.22 | .20 | .02 | .98 | 4.60 |
| 22 | .29 | .13 | .41 | 1.55 | .15 | .05 | .56 | 3.13 |
| 24 | .20 | .11 | .33 | 1.04 | .13 | .01 | .31 | 2.13 |
| 26 | .14 | .11 | .17 | .83 | .06 | - | .26 | 1.57 |
| 28 | .11 | .07 | .12 | .53 | .06 | .00 | .17 | 1.07 |
| 30 | .06 | .04 | .07 | .29 | .04 | - | .10 | .61 |
| 32 | .05 | .02 | .04 | .22 | .01 | .00 | .07 | .41 |
| 34 | .03 | .02 | .03 | .16 | .02 | - | .05 | .30 |
| 36 | .02 | .01 | .01 | .11 | .02 | .00 | .01 | .18 |
| 38 | .01 | .01 | .01 | .09 | .01 | .00 | .01 | .14 |
| 40 | .01 | .00 | .01 | .06 | .00 | - | .01 | .09 |
| 42 | .00 | .00 | .00 | .04 | - | .00 | .01 | .06 |
| 44 | .00 | .00 | .00 | .03 | .00 | .00 | - | .04 |
| 46 | - | - | .00 | .02 | .00 | .00 | .00 | .03 |
| 48 | .00 | .00 | .00 | .02 | - | - | .00 | .02 |
| 50 | .00 | .00 | .00 | .02 | .00 | - | - | .02 |
| 52 | .00 | .00 | - | .01 | - | .00 | .00 | .01 |
| 54 | - | - | .00 | .01 | - | - | - | .01 |
| 56 | .00 | .00 | - | .01 | - | - | .00 | .01 |
| 58 | - | - | - | .01 | - | - | - | .01 |
| 60 | - | .00 | - | .00 | - | - | .00 | .00 |
| 62 | - | - | - | .00 | - | - | - | .00 |
| 64 | - | - | - | .00 | - | - | - | .00 |
| 66 | - | .00 | - | .00 | .00 | - | - | .00 |
| 68 | - | - | - | - | - | - | - | - |
| 70 | - | - | - | .00 | - | - | - | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | - | - | .00 | - | - | - | .00 |
| 76 | - | - | - | .00 | - | - | - | .00 |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 23.83 | 9.87 | 38.94 | 157.78 | 27.13 | 5.71 | 271.03 | 534.30 |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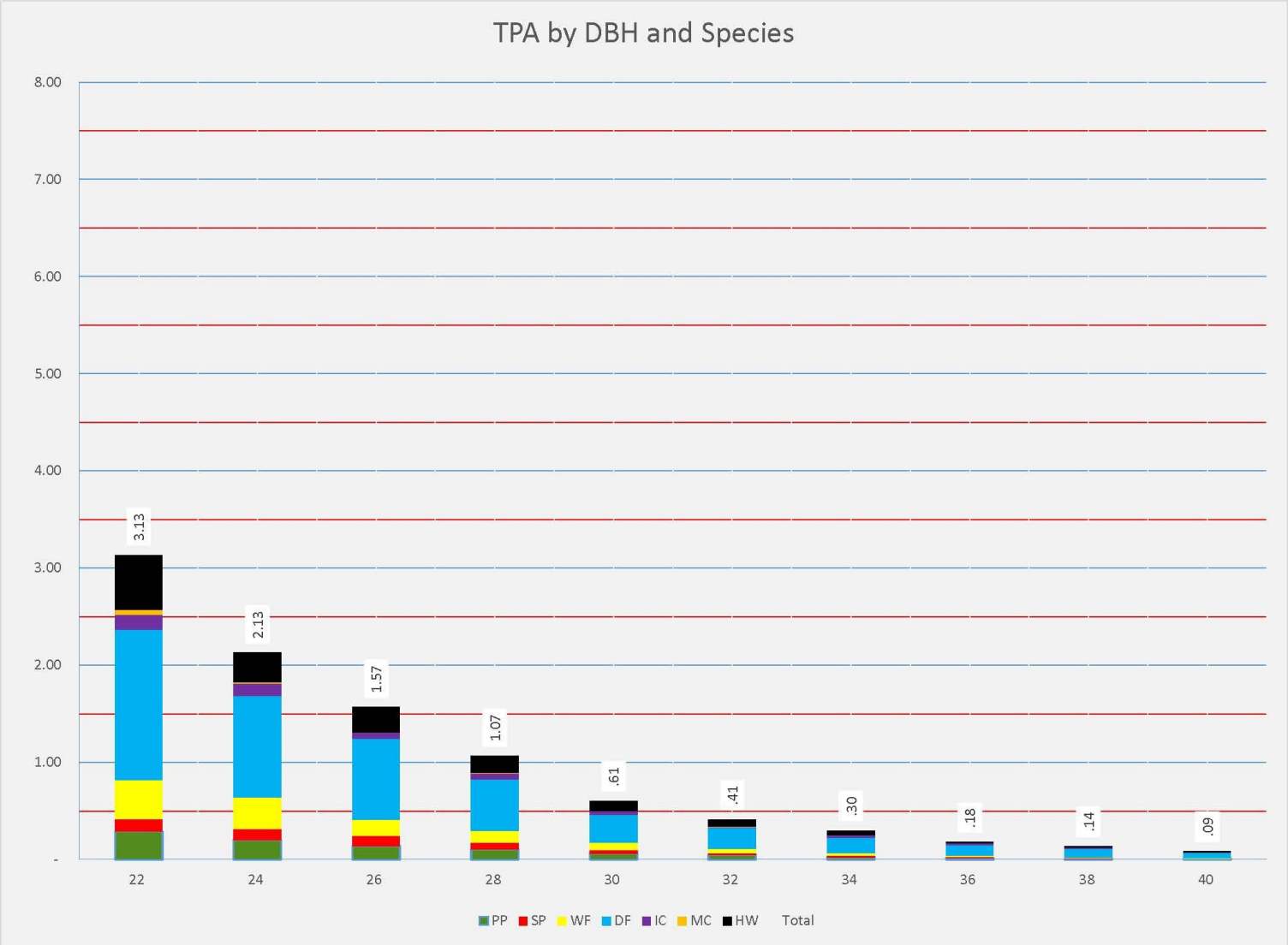
TPA by DBH and Species
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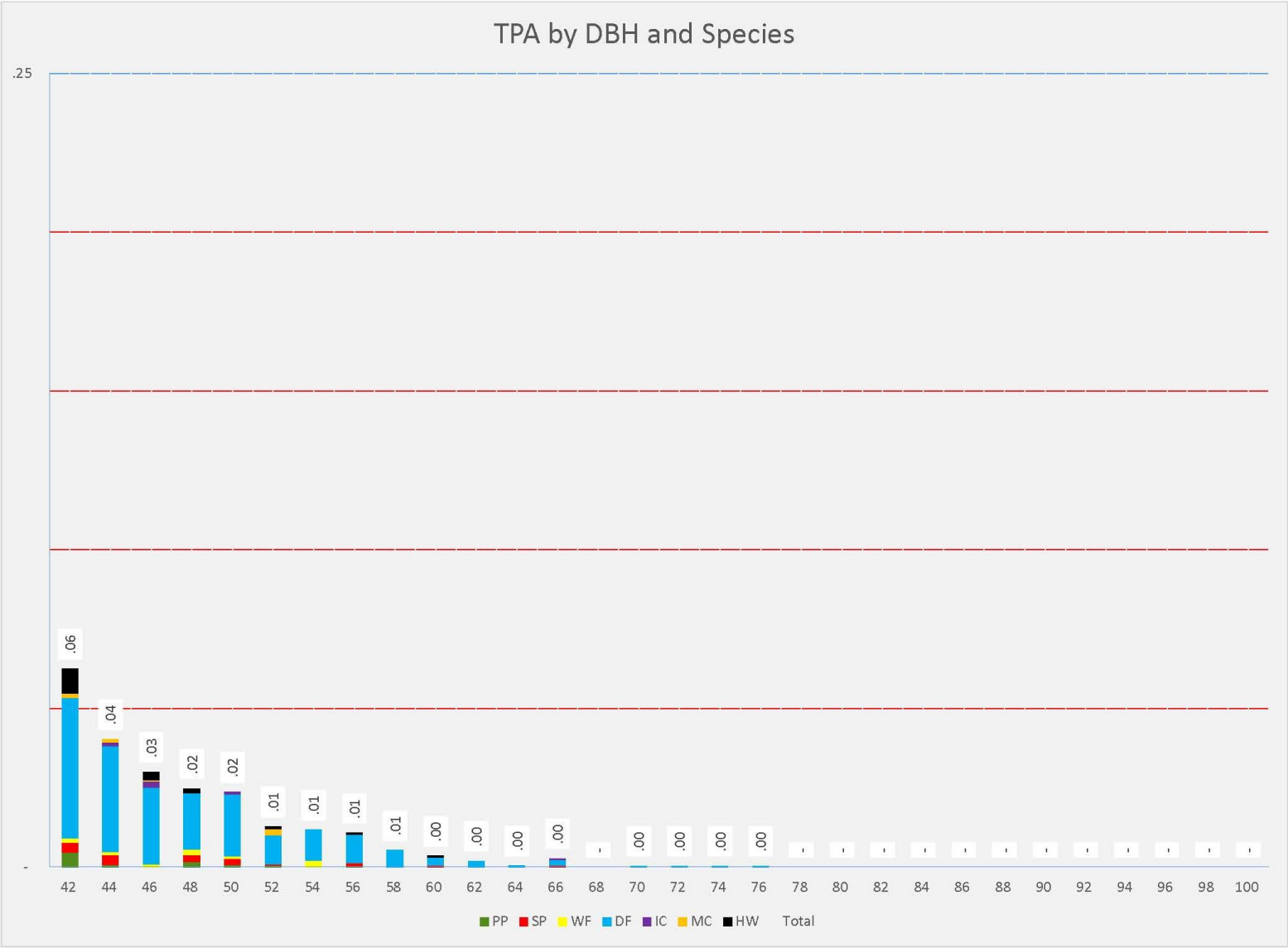
Total


TPA by DBH and Species
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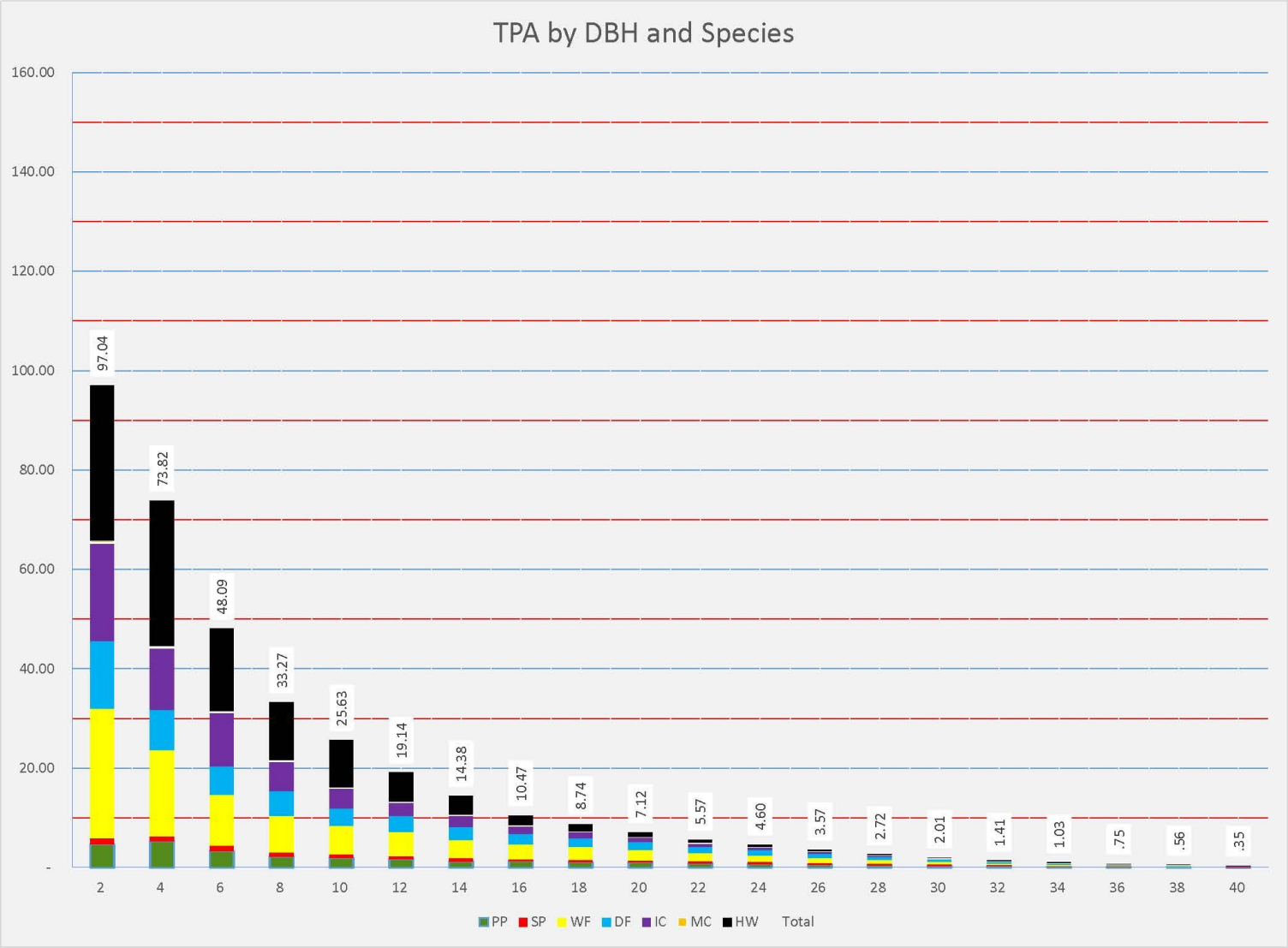
76
78
80
82
84
86
88
90
92
94
96
98
100
PP
SP
WF
DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 10.6 | (+ or -) | 14.2 |
| Processed 02/07/2014 at 16:01:56 | | QMD >=5" | 14.3 | (+ or -) | 14.0 |
| | | Ave Diam All | 7.9 | (+ or -) | 53.3 |
| Tree Frequency | | Ave Diam >=5" | 12.3 | (+ or -) | 48.4 |
| Plot Count | 18,636 | TPA >=12" 83.1 | TPA >=22" 23.3 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 4.70 | 1.23 | 26.08 | 13.57 | 19.74 | .51 | 31.21 | 97.04 |
| 4 | 5.34 | 1.01 | 17.33 | 8.11 | 12.43 | .41 | 29.19 | 73.82 |
| 6 | 3.33 | 1.14 | 10.26 | 5.73 | 10.80 | .28 | 16.55 | 48.09 |
| 8 | 2.24 | .88 | 7.31 | 4.97 | 6.02 | .28 | 11.56 | 33.27 |
| 10 | 1.96 | .70 | 5.77 | 3.56 | 4.02 | .23 | 9.38 | 25.63 |
| 12 | 1.72 | .68 | 4.82 | 3.22 | 2.70 | .18 | 5.82 | 19.14 |
| 14 | 1.28 | .66 | 3.67 | 2.64 | 2.31 | .11 | 3.72 | 14.38 |
| 16 | 1.28 | .47 | 2.96 | 2.15 | 1.64 | .10 | 1.85 | 10.47 |
| 18 | 1.07 | .49 | 2.61 | 1.84 | 1.30 | .07 | 1.35 | 8.74 |
| 20 | 1.04 | .49 | 2.07 | 1.57 | 1.03 | .06 | .86 | 7.12 |
| 22 | .90 | .46 | 1.58 | 1.32 | .75 | .04 | .52 | 5.57 |
| 24 | .76 | .42 | 1.28 | 1.13 | .61 | .03 | .36 | 4.60 |
| 26 | .63 | .39 | .98 | .89 | .46 | .01 | .21 | 3.57 |
| 28 | .53 | .34 | .71 | .67 | .34 | .01 | .12 | 2.72 |
| 30 | .37 | .32 | .49 | .48 | .24 | .01 | .09 | 2.01 |
| 32 | .31 | .25 | .29 | .34 | .18 | .00 | .05 | 1.41 |
| 34 | .21 | .20 | .21 | .25 | .13 | .00 | .03 | 1.03 |
| 36 | .14 | .17 | .14 | .18 | .10 | .00 | .03 | .75 |
| 38 | .10 | .15 | .10 | .12 | .08 | .00 | .01 | .56 |
| 40 | .05 | .09 | .07 | .07 | .06 | - | .01 | .35 |
| 42 | .03 | .06 | .04 | .05 | .04 | - | .01 | .22 |
| 44 | .02 | .04 | .02 | .03 | .03 | - | .00 | .15 |
| 46 | .01 | .04 | .01 | .02 | .02 | - | .00 | .11 |
| 48 | .01 | .02 | .01 | .01 | .02 | .00 | .00 | .07 |
| 50 | .00 | .02 | .01 | .02 | .01 | - | .00 | .05 |
| 52 | .00 | .01 | .01 | .01 | .01 | .00 | .00 | .04 |
| 54 | .00 | .01 | .00 | .01 | .01 | - | .00 | .03 |
| 56 | .00 | .00 | .00 | .01 | .00 | - | .00 | .02 |
| 58 | .00 | .00 | .00 | .00 | .00 | - | - | .01 |
| 60 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 62 | - | .00 | .00 | .00 | .00 | - | - | .01 |
| 64 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 66 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 68 | - | - | .00 | .00 | .00 | - | - | .00 |
| 70 | .00 | .00 | - | .00 | .00 | - | - | .00 |
| 72 | .00 | .00 | - | .00 | .00 | - | - | .00 |
| 74 | - | - | .00 | .00 | .00 | - | - | .00 |
| 76 | - | - | - | - | .00 | - | - | .00 |
| 78 | - | - | - | .00 | .00 | - | - | .00 |
| 80 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | .00 | - | - | - | .00 |
| 86 | - | - | - | .00 | - | - | - | .00 |
| 88 | - | - | - | - | .00 | - | - | .00 |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | .00 | - | - | .00 |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | .00 | - | - | - | - | - | .00 |
| Total | 28.03 | 10.73 | 88.84 | 53.00 | 65.10 | 2.35 | 112.92 | 360.97 |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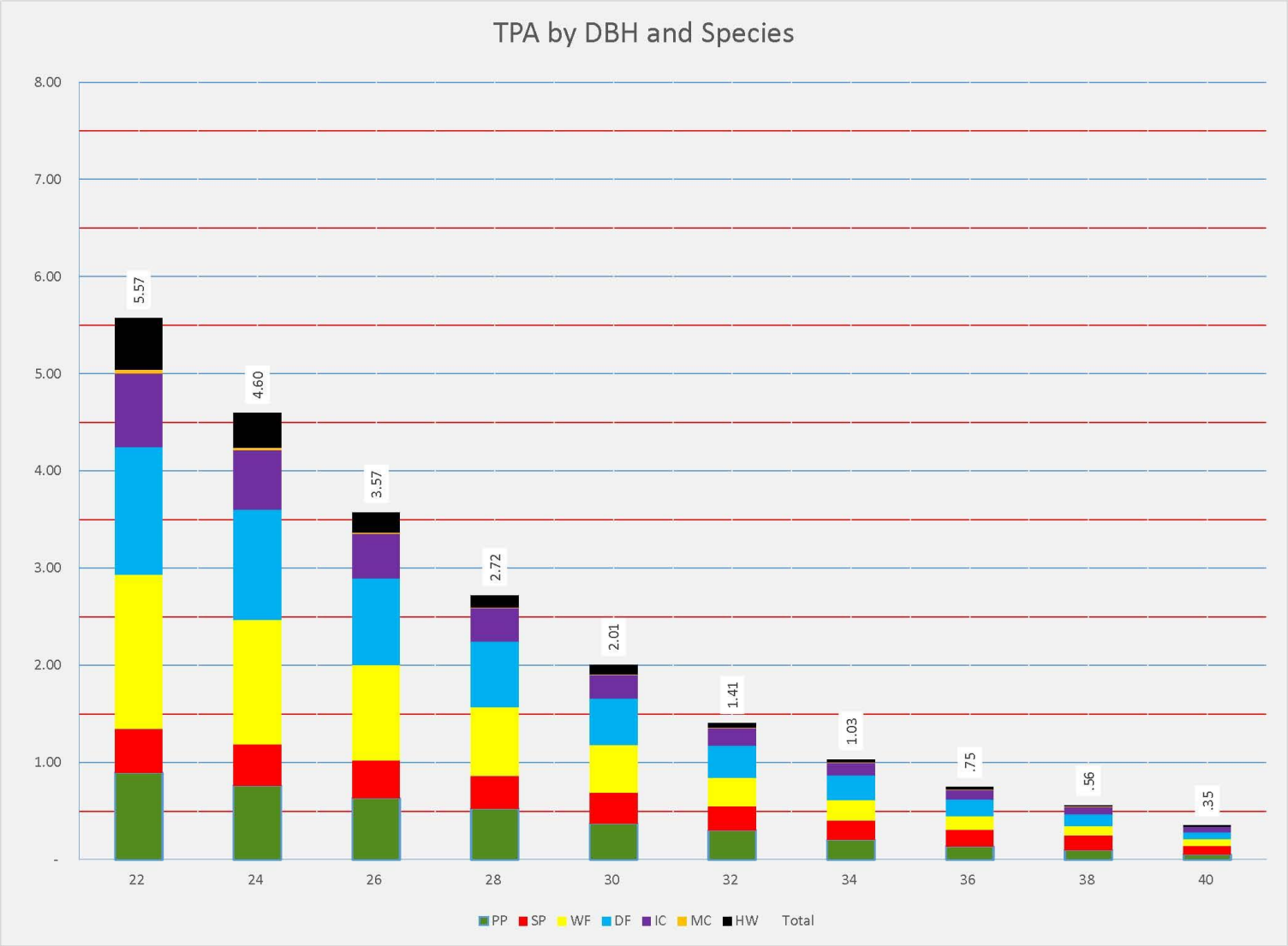
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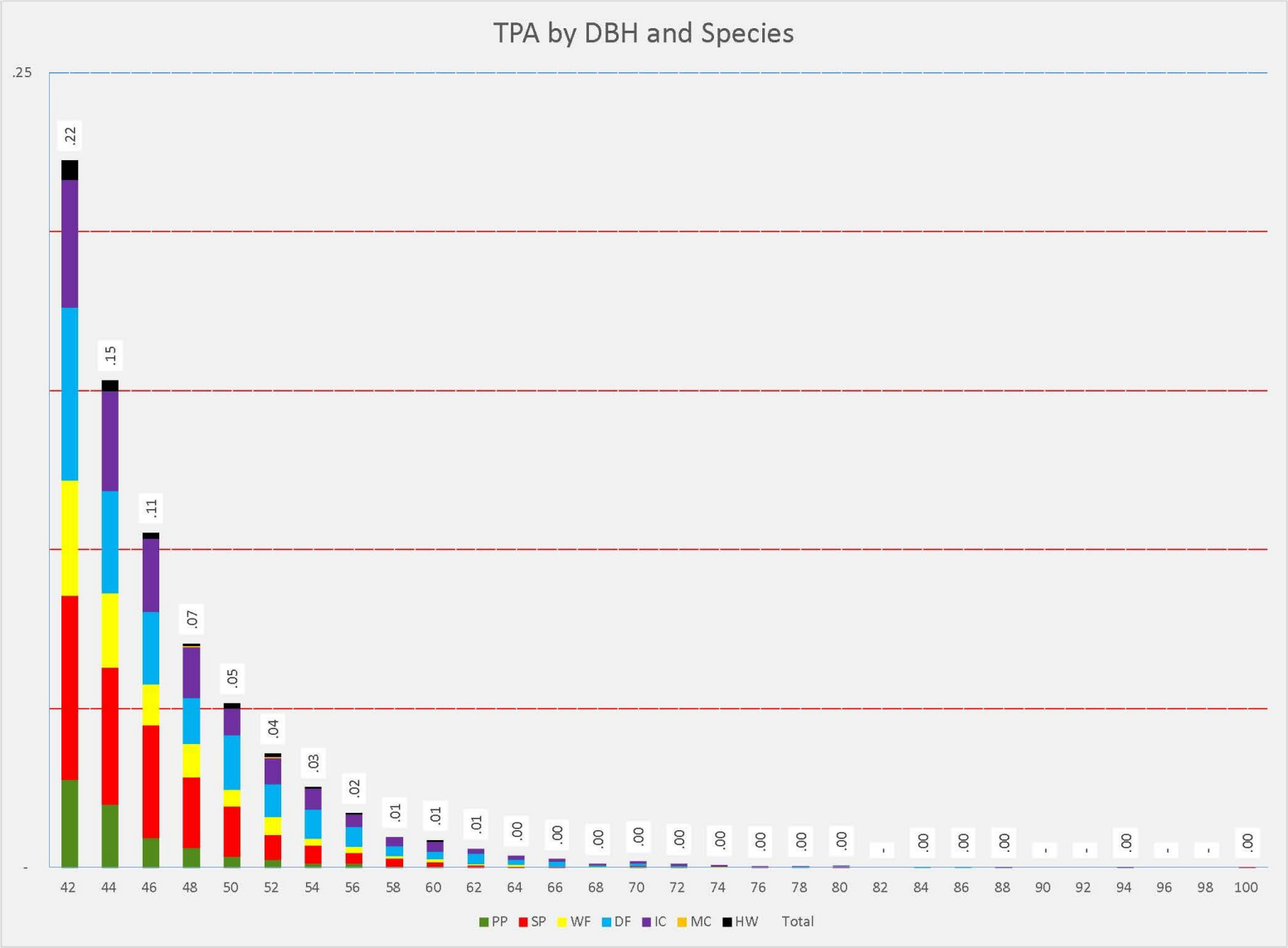
TPA by DBH and Species
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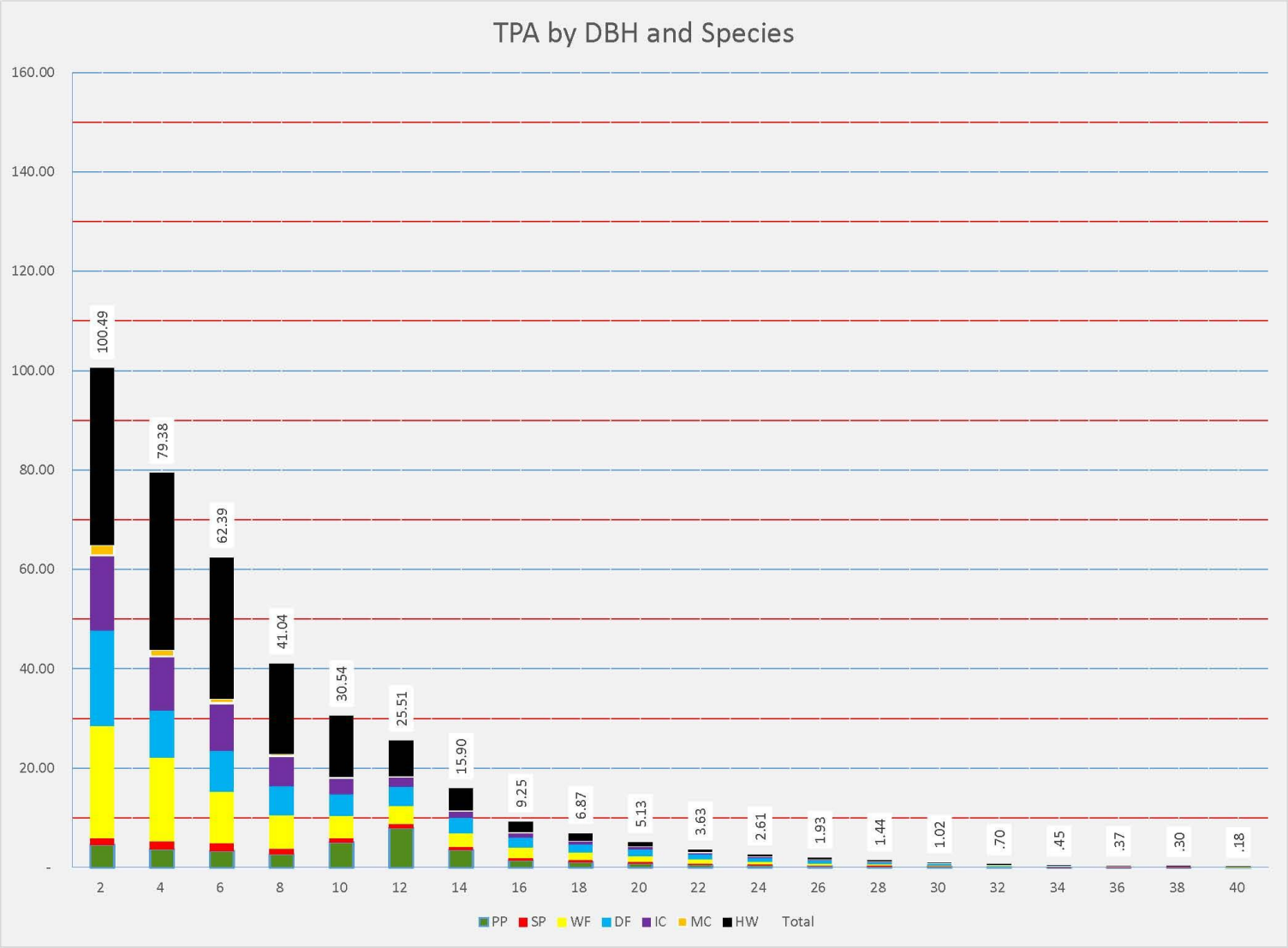
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 9.2 | (+ or -) | 13.5 |
| Processed 02/07/2014 at 13:51:56 | | QMD >=5" | 12.2 | (+ or -) | 13.3 |
| | | Ave Diam All | 7.1 | (+ or -) | 52.7 |
| Tree Frequency | | Ave Diam >=5" | 10.8 | (+ or -) | 47.6 |
| Plot Count | 10,560 | TPA >= 12" 75.7 | TPA >=22" 13.0 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 4.62 | 1.40 | 22.49 | 19.18 | 15.14 | 2.08 | 35.57 | 100.49 |
| 4 | 3.75 | 1.54 | 16.86 | 9.48 | 10.88 | 1.33 | 35.54 | 79.38 |
| 6 | 3.36 | 1.59 | 10.32 | 8.23 | 9.56 | .92 | 28.41 | 62.39 |
| 8 | 2.66 | 1.18 | 6.72 | 5.92 | 5.93 | .48 | 18.14 | 41.04 |
| 10 | 5.12 | .83 | 4.47 | 4.36 | 3.22 | .32 | 12.21 | 30.54 |
| 12 | 7.98 | .84 | 3.61 | 3.93 | 1.90 | .13 | 7.13 | 25.51 |
| 14 | 3.60 | .60 | 2.80 | 3.04 | 1.41 | .10 | 4.36 | 15.90 |
| 16 | 1.47 | .50 | 2.15 | 1.97 | 1.06 | .07 | 2.05 | 9.25 |
| 18 | 1.13 | .41 | 1.57 | 1.60 | .74 | .04 | 1.38 | 6.87 |
| 20 | .81 | .37 | 1.10 | 1.41 | .58 | .04 | .81 | 5.13 |
| 22 | .55 | .35 | .80 | 1.03 | .41 | .02 | .46 | 3.63 |
| 24 | .42 | .24 | .55 | .80 | .31 | .02 | .26 | 2.61 |
| 26 | .29 | .21 | .36 | .56 | .29 | .01 | .20 | 1.93 |
| 28 | .25 | .17 | .26 | .47 | .17 | .01 | .12 | 1.44 |
| 30 | .19 | .14 | .16 | .31 | .15 | .01 | .07 | 1.02 |
| 32 | .12 | .11 | .11 | .22 | .10 | .00 | .04 | .70 |
| 34 | .06 | .10 | .06 | .15 | .06 | .00 | .02 | .45 |
| 36 | .05 | .07 | .04 | .12 | .06 | .00 | .03 | .37 |
| 38 | .04 | .06 | .04 | .09 | .05 | - | .02 | .30 |
| 40 | .02 | .04 | .02 | .06 | .03 | - | .01 | .18 |
| 42 | .01 | .02 | .01 | .04 | .02 | - | .00 | .11 |
| 44 | .01 | .02 | .01 | .02 | .01 | - | .00 | .07 |
| 46 | .00 | .01 | .01 | .01 | .01 | - | .00 | .05 |
| 48 | .00 | .01 | .00 | .01 | .01 | - | .00 | .04 |
| 50 | .00 | .01 | .00 | .01 | .01 | - | .00 | .03 |
| 52 | .00 | .00 | .00 | .01 | .00 | - | - | .02 |
| 54 | .00 | .00 | .00 | .01 | .00 | - | - | .02 |
| 56 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 58 | .00 | .00 | .00 | .00 | .00 | - | - | .01 |
| 60 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 62 | .00 | - | - | .00 | .00 | .00 | - | .00 |
| 64 | .00 | - | .00 | .00 | .00 | - | - | .00 |
| 66 | - | .00 | - | .00 | .00 | - | - | .00 |
| 68 | .00 | .00 | - | .00 | .00 | - | - | .00 |
| 70 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 72 | - | - | - | .00 | - | - | - | .00 |
| 74 | - | - | - | - | .00 | - | - | .00 |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | - | .00 | - | - | .00 |
| 80 | - | .00 | - | - | - | - | - | .00 |
| 82 | - | - | - | - | - | - | - | - |
| 84 | .00 | - | - | - | - | - | - | .00 |
| 86 | - | - | - | .00 | - | - | - | .00 |
| 88 | - | - | - | - | .00 | - | - | .00 |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 36.55 | 10.81 | 74.53 | 63.07 | 52.14 | 5.57 | 146.85 | 389.50 |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-
100.49
79.38
62.39
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30.54
25.51
15.90
9.25
6.87
5.13
3.63
2.61
1.93
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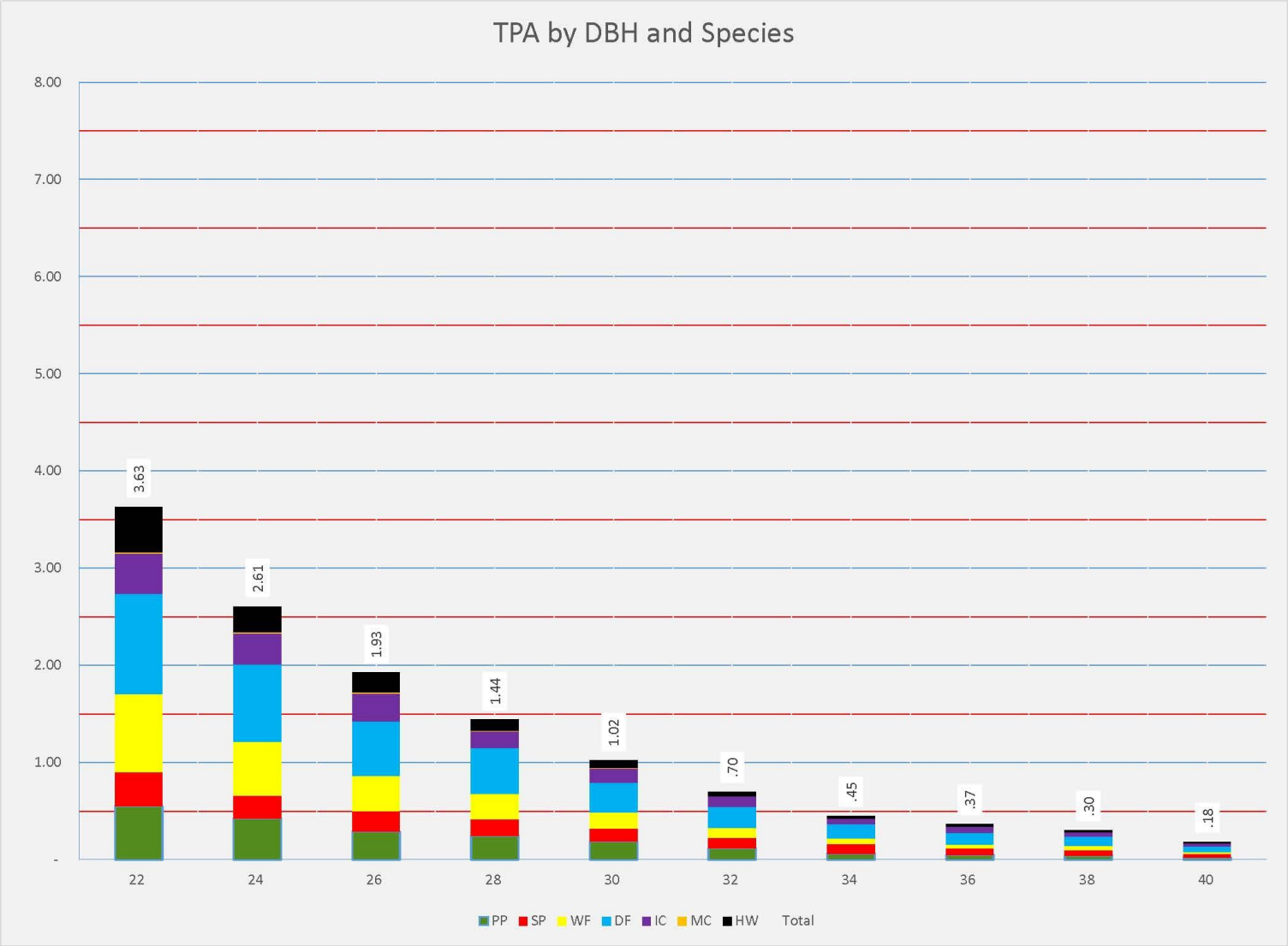
HW
Total


TPA by DBH and Species
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4.00
3.00
2.00
1.00
-
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2.61
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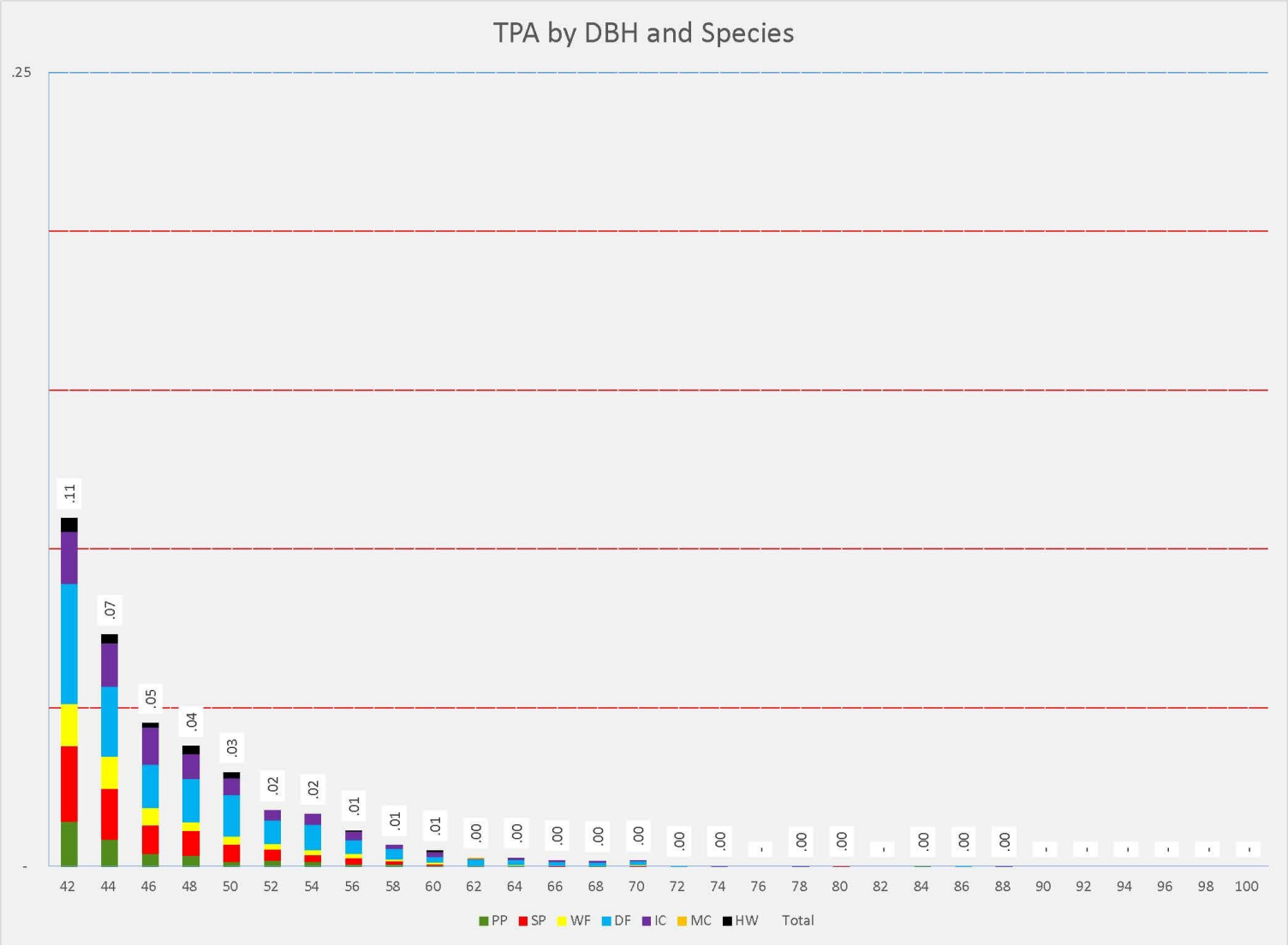
Total


TPA by DBH and Species
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SP
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DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 8.2 | (+ or -) | 13.4 |
| Processed 02/07/2014 at 13:51:56 | | QMD >=5" | 11.0 | (+ or -) | 13.1 |
| | | Ave Diam All | 6.4 | (+ or -) | 54.8 |
| Tree Frequency | | Ave Diam >=5" | 9.6 | (+ or -) | 48.5 |
| Plot Count | 10,560 | TPA >= 12” 59.9 | TPA >= 22” 12.1 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 5.67 | 1.60 | 23.87 | 27.66 | 15.70 | 5.92 | 42.83 | 123.24 |
| 4 | 5.25 | .98 | 16.88 | 10.87 | 7.55 | 2.82 | 55.58 | 99.93 |
| 6 | 5.09 | 2.32 | 11.15 | 14.23 | 8.83 | 2.28 | 59.65 | 103.55 |
| 8 | 2.80 | 1.19 | 5.34 | 7.26 | 4.66 | 1.12 | 27.86 | 50.23 |
| 10 | 2.09 | .71 | 3.30 | 5.53 | 2.18 | .70 | 16.25 | 30.75 |
| 12 | 1.66 | .75 | 2.86 | 3.76 | 1.41 | .24 | 6.92 | 17.61 |
| 14 | 1.11 | .47 | 1.95 | 2.76 | 1.21 | .26 | 3.79 | 11.55 |
| 16 | .97 | .40 | 1.71 | 2.60 | .66 | .07 | 1.14 | 7.55 |
| 18 | .68 | .46 | 1.43 | 2.12 | .70 | .05 | 1.16 | 6.61 |
| 20 | .64 | .27 | .96 | 1.45 | .47 | .02 | .63 | 4.44 |
| 22 | .64 | .25 | .75 | 1.10 | .34 | .03 | .40 | 3.51 |
| 24 | .39 | .20 | .52 | .78 | .27 | - | .27 | 2.43 |
| 26 | .31 | .22 | .43 | .57 | .19 | .01 | .13 | 1.86 |
| 28 | .21 | .17 | .22 | .32 | .16 | - | .08 | 1.16 |
| 30 | .13 | .15 | .24 | .31 | .13 | .01 | .08 | 1.05 |
| 32 | .13 | .11 | .11 | .18 | .07 | - | .04 | .64 |
| 34 | .07 | .09 | .09 | .14 | .06 | - | .02 | .47 |
| 36 | .03 | .08 | .07 | .09 | .05 | - | .02 | .34 |
| 38 | .02 | .05 | .03 | .08 | .03 | - | .01 | .22 |
| 40 | .01 | .04 | .02 | .04 | .02 | - | .01 | .14 |
| 42 | .01 | .02 | .01 | .04 | .02 | .00 | .00 | .10 |
| 44 | .00 | .02 | .01 | .02 | .01 | - | .00 | .06 |
| 46 | .00 | .00 | .00 | .01 | .01 | - | - | .03 |
| 48 | .00 | .00 | .00 | .01 | .01 | - | - | .03 |
| 50 | .00 | .00 | .00 | .01 | .01 | - | .00 | .03 |
| 52 | .00 | .00 | .00 | .00 | .00 | - | - | .01 |
| 54 | - | .00 | .00 | .00 | .00 | - | - | .01 |
| 56 | .00 | .00 | .00 | .00 | .00 | - | - | .01 |
| 58 | - | .00 | - | .00 | .00 | - | - | .01 |
| 60 | - | .00 | - | .00 | - | - | - | .00 |
| 62 | - | - | - | - | - | - | - | - |
| 64 | - | - | - | .00 | .00 | - | - | .00 |
| 66 | - | - | - | .00 | .00 | - | .00 | .00 |
| 68 | - | .00 | - | - | - | - | - | .00 |
| 70 | - | - | - | - | - | - | .00 | .00 |
| 72 | - | - | - | - | - | - | .00 | .00 |
| 74 | - | - | - | - | - | - | - | - |
| 76 | - | - | - | - | .00 | - | - | .00 |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | - | .00 | - | - | .00 |
| 82 | - | - | - | .00 | - | - | - | .00 |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
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| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
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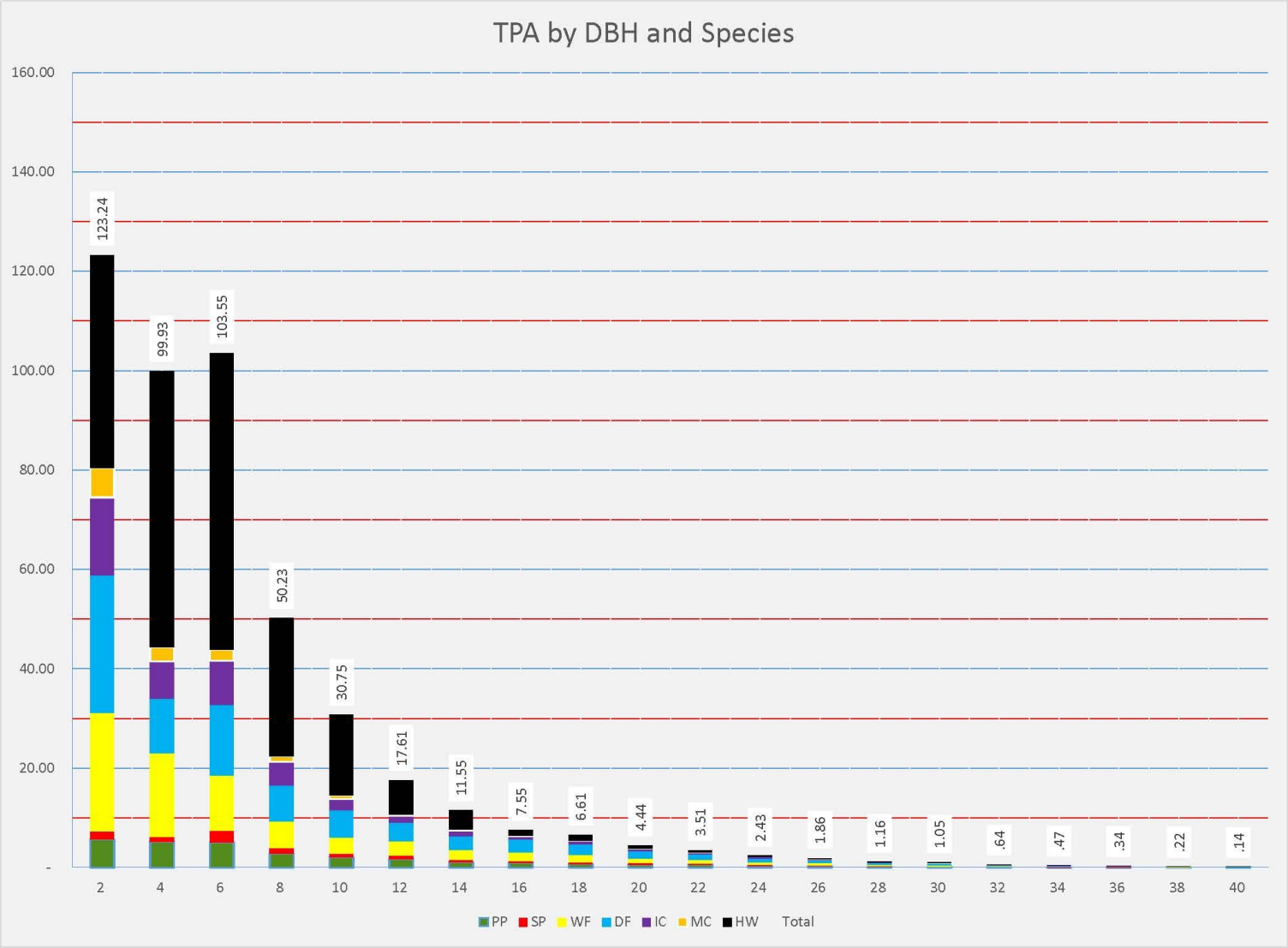
| Total | 27.93 | 10.57 | 71.97 | 81.96 | 44.75 | 13.52 | 216.89 | 467.58 |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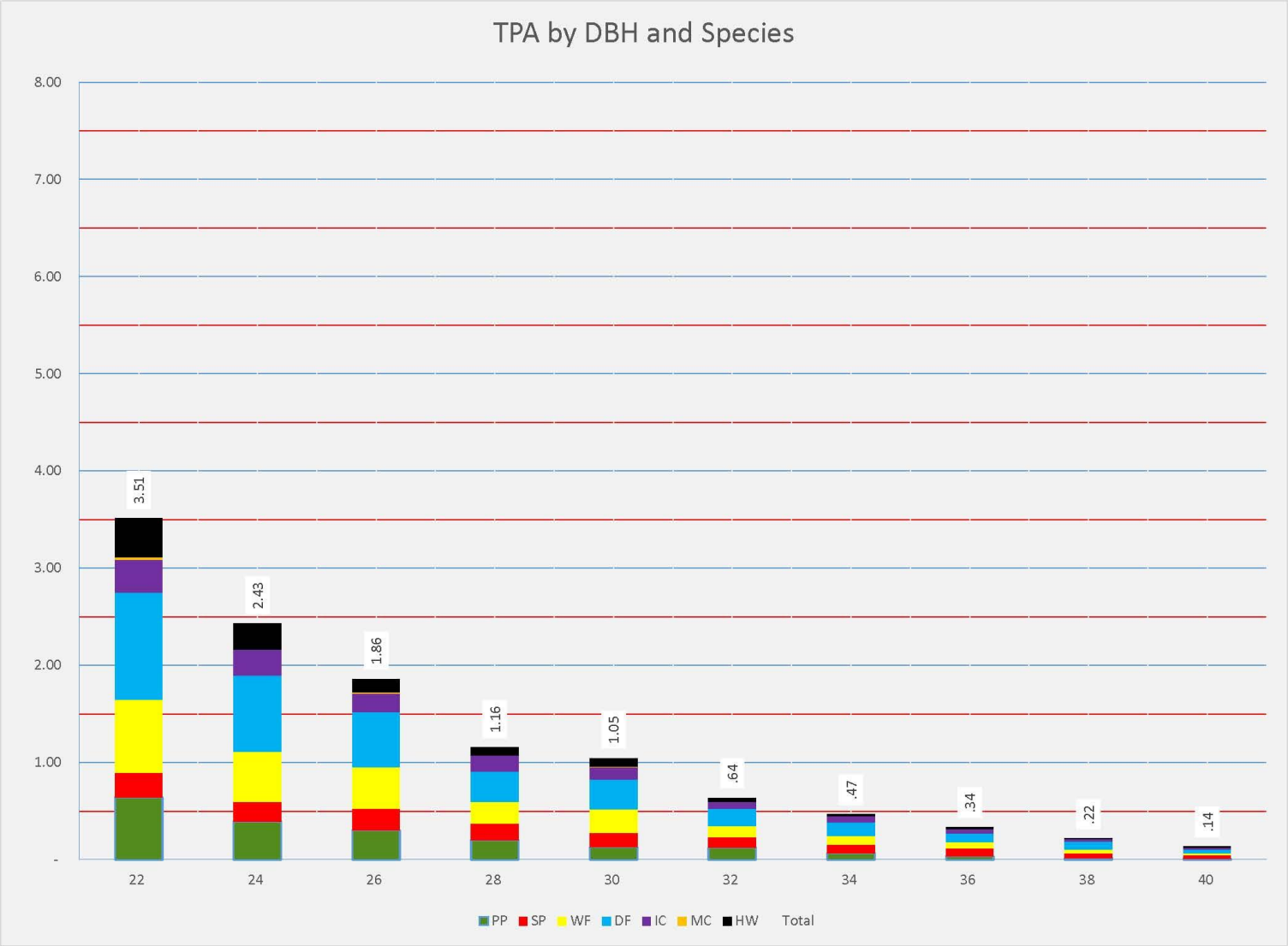
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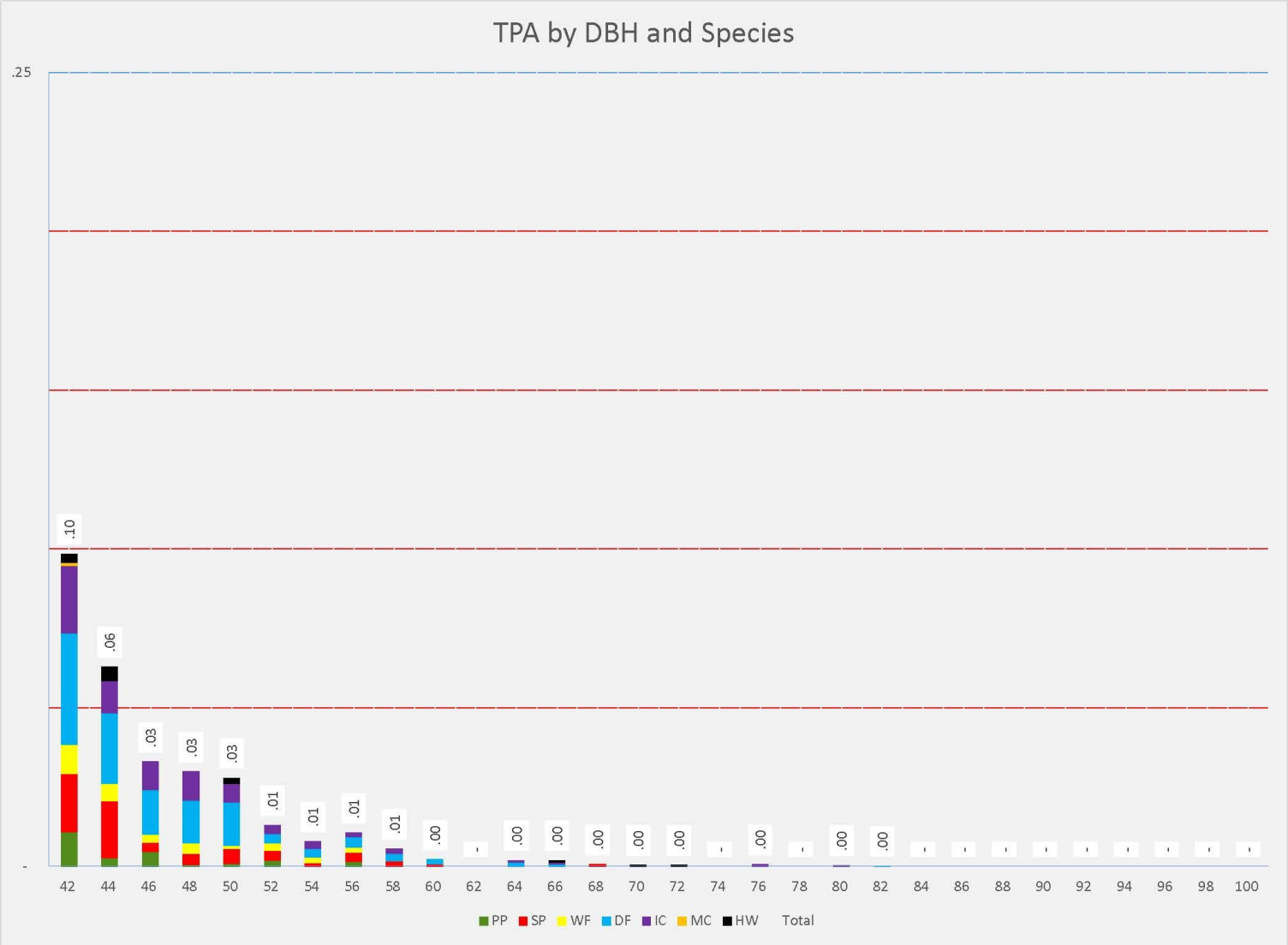
Total


TPA by DBH and Species
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80
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84
86
88
90
92
94
96
98
100
PP
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WF
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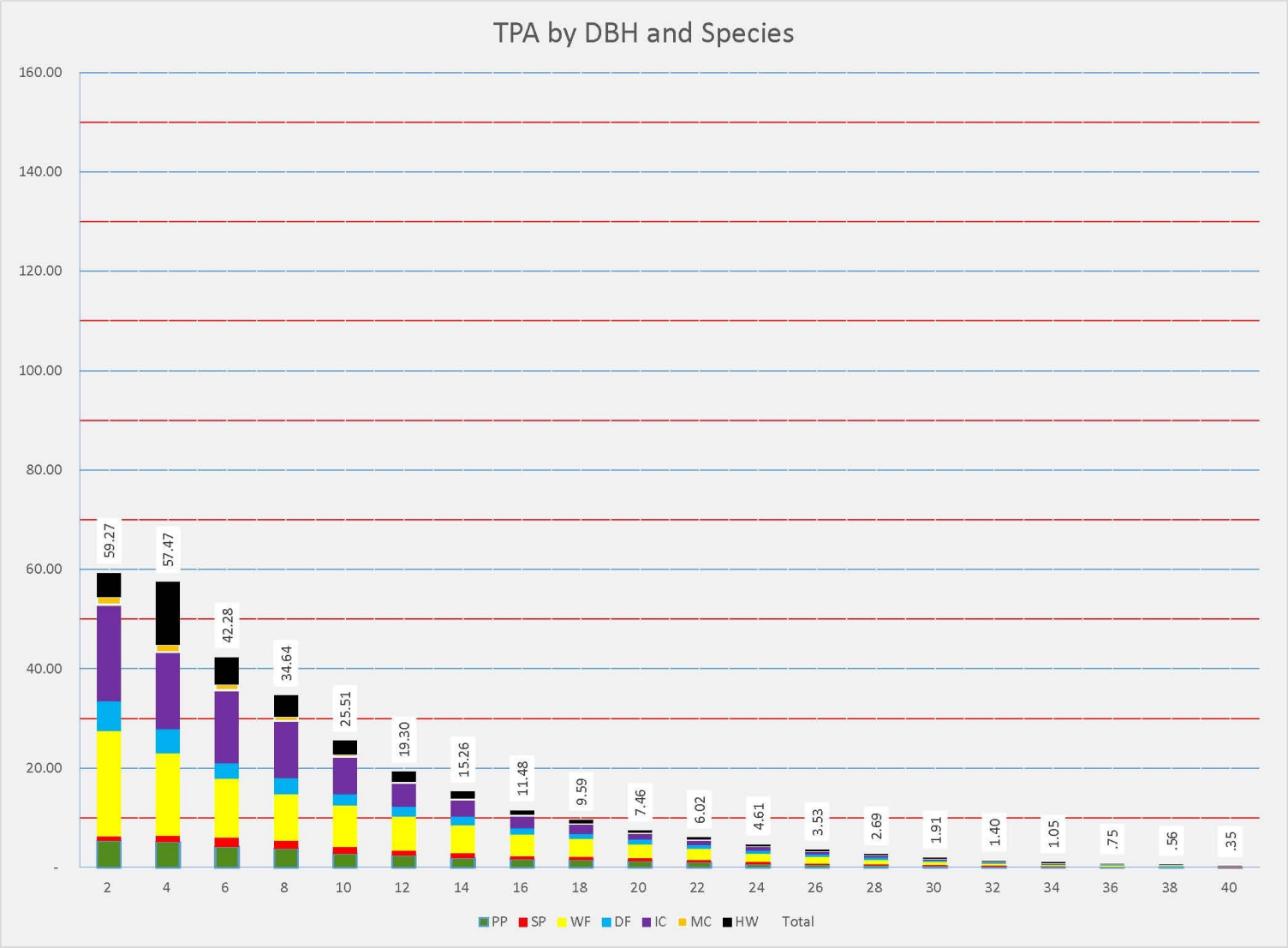
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | |
|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 11.6 (+ or -) | 14.2 |
| Processed 04/29/2014 at 13:44:51 | | QMD >=5" | 14.5 (+ or -) | 14.1 |
| | | Ave Diam All | 8.9 (+ or -) | 52.3 |
| Tree Frequency | | Ave Diam >=5" | 12.6 (+ or -) | 48.9 |
| Plot Count | 9,508 | TPA >= 12" 86.85 | TPA >=22" 23.75 | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 5.43 | .84 | 21.26 | 5.95 | 19.42 | 1.57 | 4.78 | 59.27 |
| 4 | 5.20 | 1.26 | 16.58 | 4.92 | 15.36 | 1.60 | 12.54 | 57.47 |
| 6 | 4.24 | 1.79 | 11.94 | 3.14 | 14.59 | 1.22 | 5.37 | 42.28 |
| 8 | 3.90 | 1.51 | 9.37 | 3.33 | 11.39 | .92 | 4.22 | 34.64 |
| 10 | 2.90 | 1.29 | 8.43 | 2.18 | 7.52 | .50 | 2.69 | 25.51 |
| 12 | 2.42 | .98 | 6.87 | 2.06 | 4.72 | .29 | 1.94 | 19.30 |
| 14 | 1.94 | 1.01 | 5.69 | 1.66 | 3.46 | .13 | 1.38 | 15.26 |
| 16 | 1.67 | .69 | 4.38 | 1.17 | 2.57 | .20 | .80 | 11.48 |
| 18 | 1.56 | .69 | 3.56 | 1.07 | 1.94 | .16 | .61 | 9.59 |
| 20 | 1.39 | .53 | 2.82 | .94 | 1.32 | .10 | .37 | 7.46 |
| 22 | 1.06 | .48 | 2.25 | .81 | 1.03 | .08 | .31 | 6.02 |
| 24 | .77 | .41 | 1.61 | .69 | .79 | .06 | .27 | 4.61 |
| 26 | .56 | .33 | 1.30 | .58 | .55 | .03 | .19 | 3.53 |
| 28 | .47 | .28 | .88 | .46 | .44 | .02 | .14 | 2.69 |
| 30 | .35 | .20 | .62 | .30 | .33 | .01 | .10 | 1.91 |
| 32 | .27 | .19 | .37 | .22 | .26 | .01 | .07 | 1.40 |
| 34 | .20 | .15 | .27 | .15 | .21 | .01 | .05 | 1.05 |
| 36 | .12 | .11 | .19 | .13 | .16 | .00 | .04 | .75 |
| 38 | .08 | .10 | .14 | .11 | .12 | .00 | .02 | .56 |
| 40 | .05 | .07 | .07 | .07 | .08 | .00 | .01 | .35 |
| 42 | .03 | .04 | .03 | .04 | .06 | .00 | .01 | .23 |
| 44 | .02 | .03 | .03 | .03 | .05 | - | .01 | .17 |
| 46 | .01 | .02 | .02 | .02 | .04 | - | .00 | .12 |
| 48 | .01 | .02 | .01 | .02 | .03 | - | .00 | .09 |
| 50 | .00 | .01 | .01 | .02 | .02 | .00 | .00 | .07 |
| 52 | .00 | .01 | .01 | .01 | .02 | - | .00 | .05 |
| 54 | .00 | .01 | .01 | .01 | .02 | - | .00 | .04 |
| 56 | .00 | .01 | .00 | .01 | .01 | - | .00 | .03 |
| 58 | .00 | .00 | .00 | .01 | .01 | - | .00 | .02 |
| 60 | .00 | .00 | .00 | .01 | .01 | - | - | .02 |
| 62 | .00 | .00 | .00 | .00 | .01 | - | .00 | .01 |
| 64 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 66 | - | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 68 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 70 | - | .00 | .00 | .01 | .00 | - | - | .02 |
| 72 | - | .00 | .00 | .01 | .00 | - | - | .01 |
| 74 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 76 | - | - | - | .00 | .00 | - | - | .00 |
| 78 | .00 | .00 | - | .00 | .00 | - | - | .00 |
| 80 | - | .00 | - | .00 | .00 | - | - | .00 |
| 82 | - | .00 | - | .00 | .00 | - | - | .00 |
| 84 | - | - | - | .00 | .00 | - | - | .00 |
| 86 | - | - | - | - | .00 | - | - | .00 |
| 88 | - | - | - | .00 | .00 | - | - | .00 |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | .00 | - | .00 | - | - | - | .00 |
| 96 | - | - | - | - | .00 | - | - | .00 |
| 98 | - | - | - | .00 | .00 | - | - | .00 |
| 100 | - | - | - | - | - | - | - | - |
| Total | 34.66 | 13.10 | 98.72 | 30.14 | 86.55 | 6.91 | 35.95 | 306.02 |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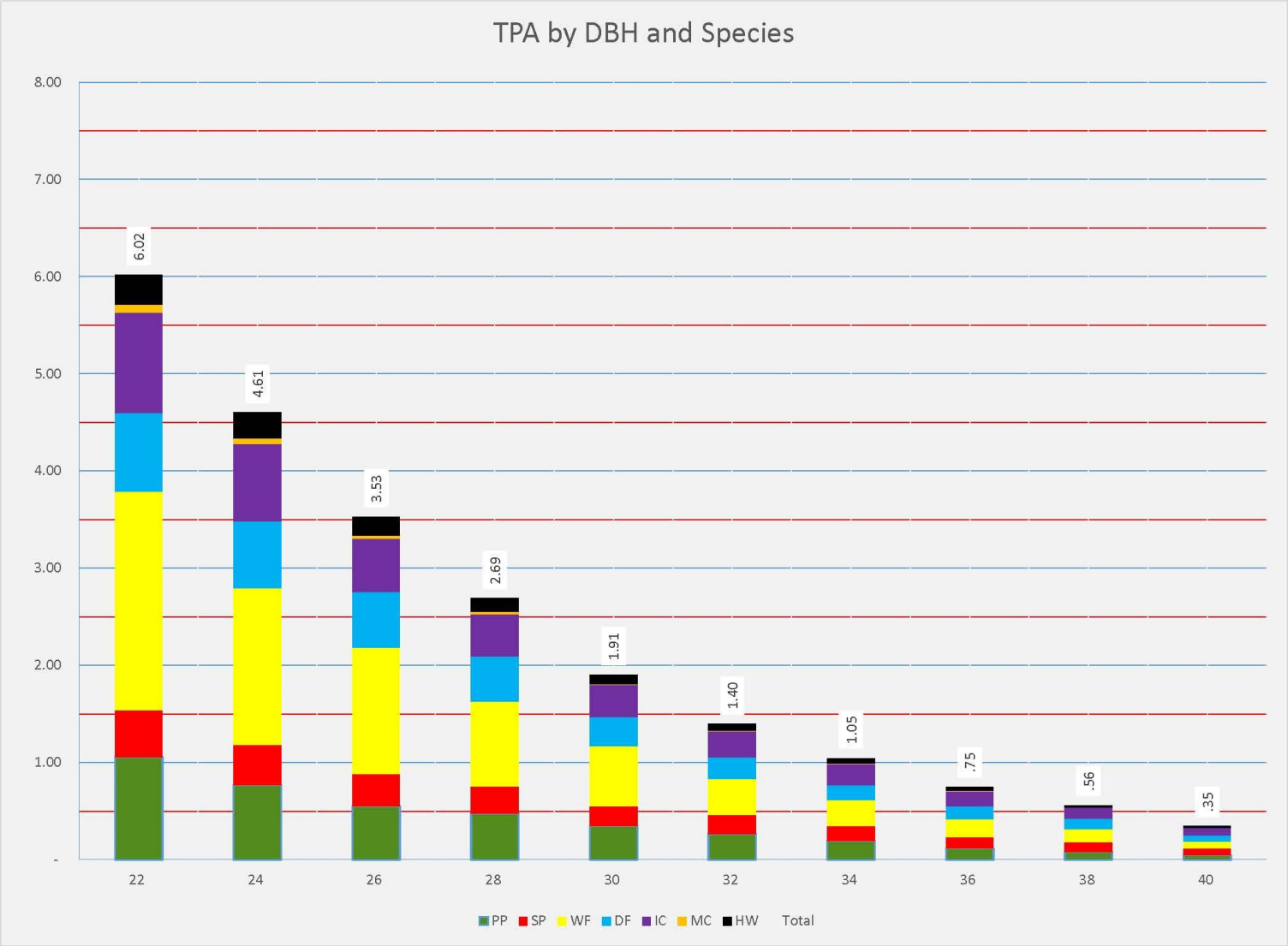
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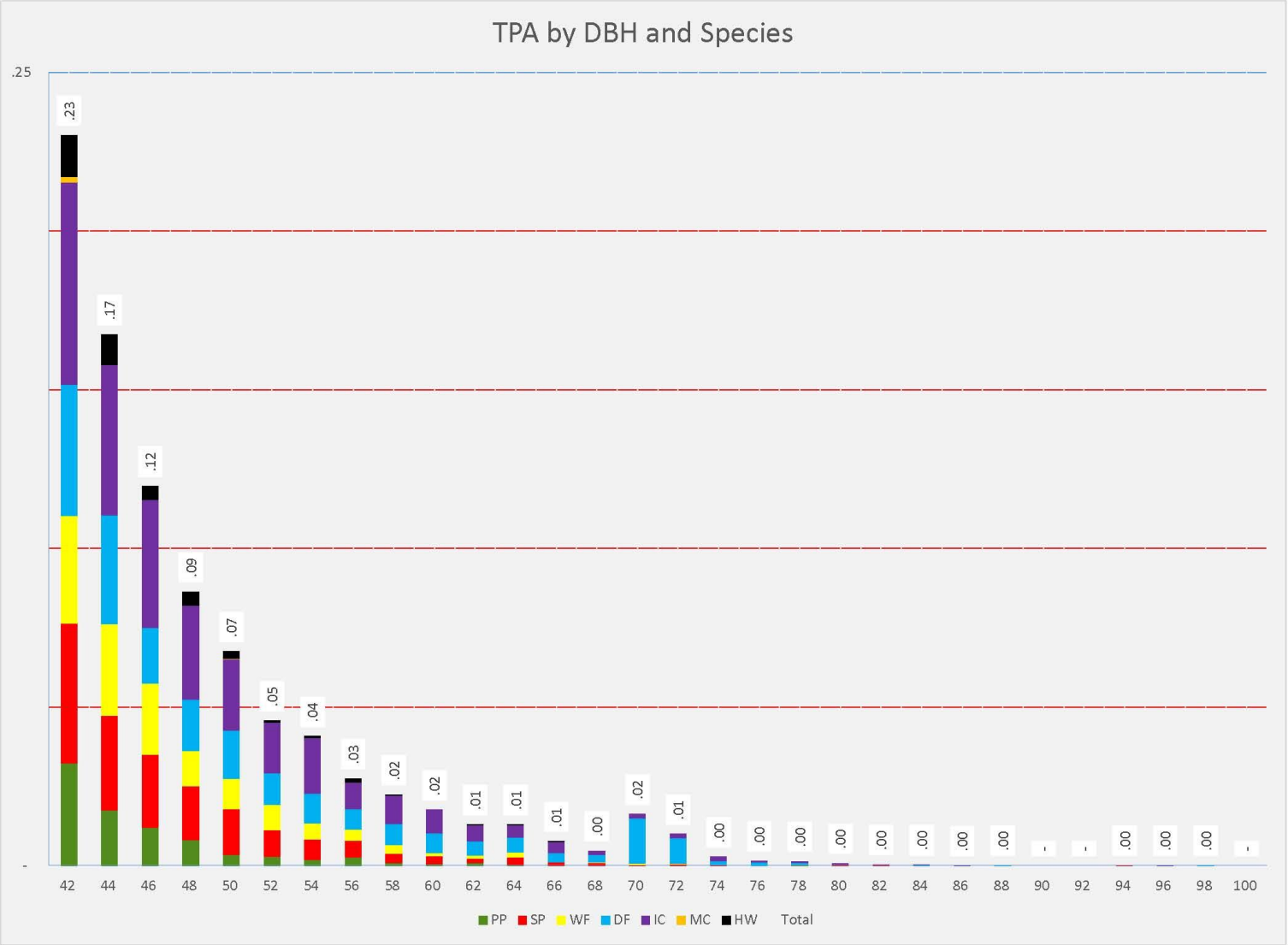
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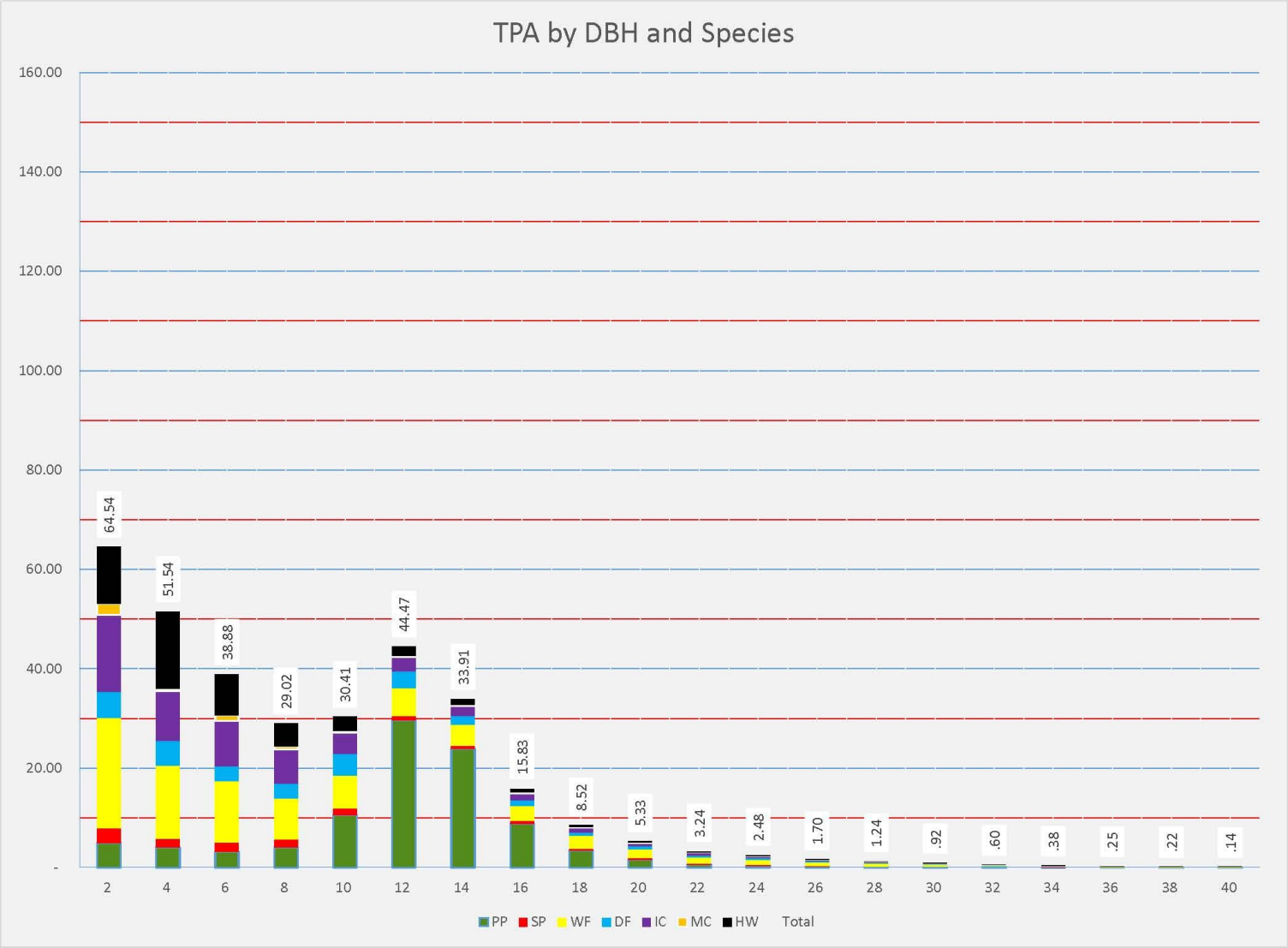
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100
PP SP WF DF IC MC HW Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 10.7 | (+ or -) | 14.0 |
| Processed 04/29/2014 at 13:36:16 | | QMD >=5" | 13.0 | (+ or -) | 13.9 |
| | | Ave Diam All | 8.8 | (+ or -) | 54.2 |
| Tree Frequency | | Ave Diam >=5" | 11.9 | (+ or -) | 51.0 |
| Plot Count | 7,178 | TPA >= 12" 119.59 | TPA >= 22" 11.52 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 4.95 | 3.04 | 22.16 | 5.21 | 15.49 | 2.26 | 11.43 | 64.54 |
| 4 | 4.10 | 1.70 | 14.75 | 5.05 | 9.96 | .44 | 15.54 | 51.54 |
| 6 | 3.21 | 1.83 | 12.41 | 2.95 | 9.15 | 1.06 | 8.27 | 38.88 |
| 8 | 4.06 | 1.65 | 8.17 | 3.10 | 6.82 | .65 | 4.56 | 29.02 |
| 10 | 10.53 | 1.38 | 6.69 | 4.27 | 4.35 | .27 | 2.93 | 30.41 |
| 12 | 29.69 | .82 | 5.67 | 3.35 | 2.87 | .24 | 1.83 | 44.47 |
| 14 | 23.90 | .71 | 4.23 | 1.72 | 2.02 | .22 | 1.12 | 33.91 |
| 16 | 8.82 | .68 | 2.96 | 1.14 | 1.36 | .18 | .68 | 15.83 |
| 18 | 3.42 | .44 | 2.55 | .71 | .92 | .13 | .36 | 8.52 |
| 20 | 1.55 | .38 | 1.82 | .56 | .69 | .09 | .24 | 5.33 |
| 22 | .62 | .23 | 1.29 | .37 | .51 | .05 | .17 | 3.24 |
| 24 | .37 | .28 | .97 | .34 | .35 | .06 | .12 | 2.48 |
| 26 | .18 | .17 | .70 | .26 | .27 | .04 | .08 | 1.70 |
| 28 | .14 | .13 | .52 | .18 | .19 | .02 | .06 | 1.24 |
| 30 | .11 | .10 | .36 | .14 | .15 | .02 | .04 | .92 |
| 32 | .09 | .06 | .23 | .08 | .10 | .01 | .03 | .60 |
| 34 | .05 | .06 | .11 | .05 | .08 | .01 | .01 | .38 |
| 36 | .03 | .04 | .07 | .05 | .05 | .00 | .02 | .25 |
| 38 | .02 | .04 | .06 | .04 | .05 | .00 | .01 | .22 |
| 40 | .02 | .03 | .04 | .02 | .04 | - | .00 | .14 |
| 42 | .01 | .03 | .02 | .02 | .02 | .00 | .00 | .10 |
| 44 | .00 | .02 | .02 | .01 | .02 | .00 | .00 | .07 |
| 46 | .00 | .01 | .01 | .01 | .01 | .00 | .00 | .05 |
| 48 | .00 | .01 | .01 | .01 | .01 | - | .00 | .03 |
| 50 | .00 | .00 | .00 | .01 | .01 | .00 | .00 | .03 |
| 52 | .00 | .01 | .00 | .00 | .01 | .00 | - | .02 |
| 54 | - | .00 | .00 | .00 | .00 | .00 | - | .01 |
| 56 | .00 | .00 | .00 | .00 | .00 | - | - | .01 |
| 58 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 60 | .00 | .00 | .00 | .00 | .00 | .00 | - | .01 |
| 62 | .00 | .00 | .00 | .00 | .00 | - | - | .01 |
| 64 | - | .00 | .00 | .00 | .00 | - | - | .01 |
| 66 | .00 | - | .00 | .00 | .00 | - | - | .00 |
| 68 | - | .00 | - | .00 | .00 | - | - | .00 |
| 70 | - | .00 | - | .00 | - | - | - | .00 |
| 72 | - | - | .00 | .00 | .00 | - | - | .00 |
| 74 | - | .00 | .00 | - | - | - | - | .00 |
| 76 | .00 | - | - | - | .00 | - | - | .00 |
| 78 | - | - | - | .00 | - | - | - | .00 |
| 80 | - | - | - | - | .00 | - | - | .00 |
| 82 | - | - | - | - | .00 | - | - | .00 |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | .00 | - | - | - | .00 |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 95.90 | 13.83 | 85.81 | 29.67 | 55.50 | 5.76 | 47.50 | 333.99 |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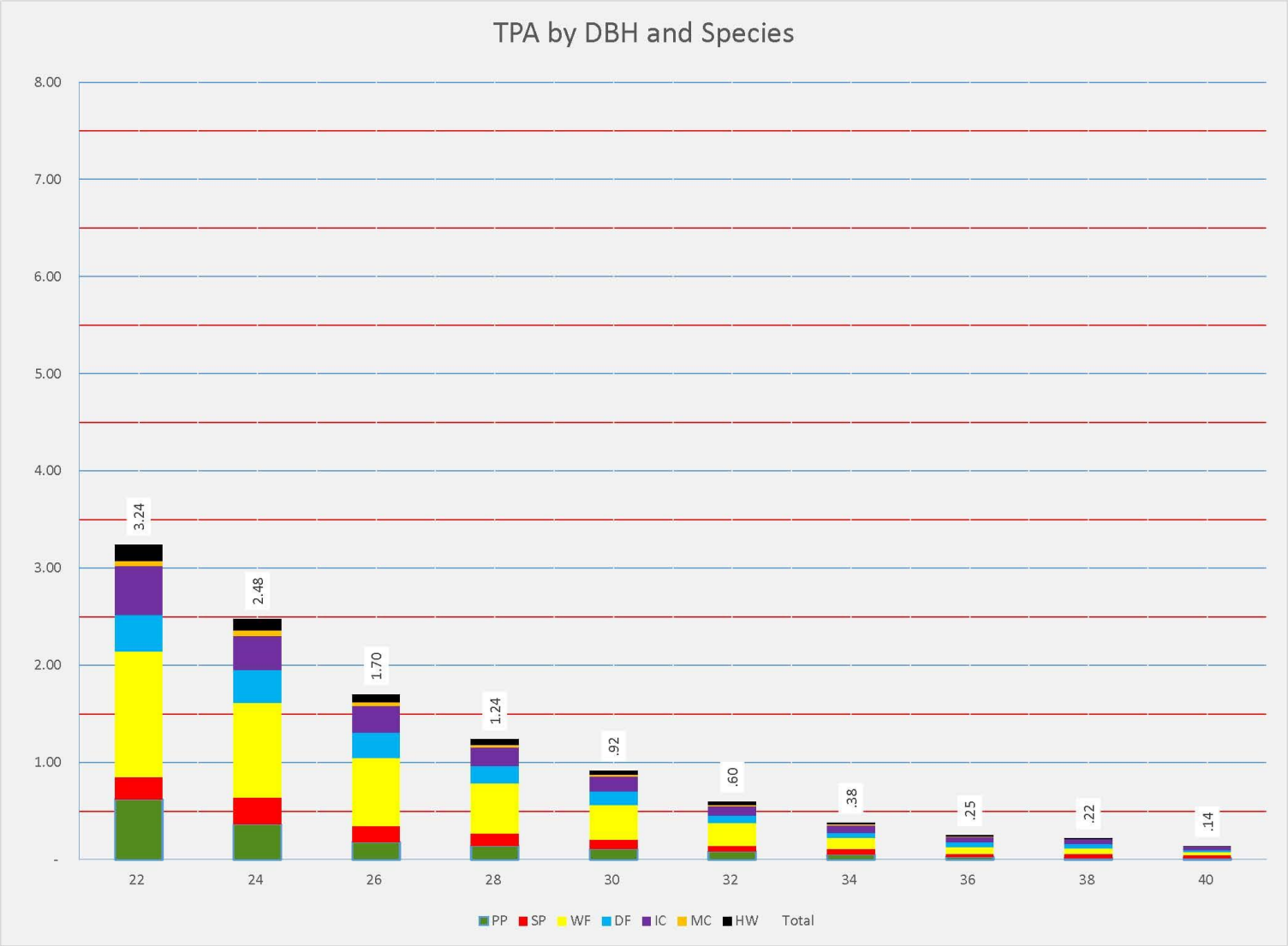
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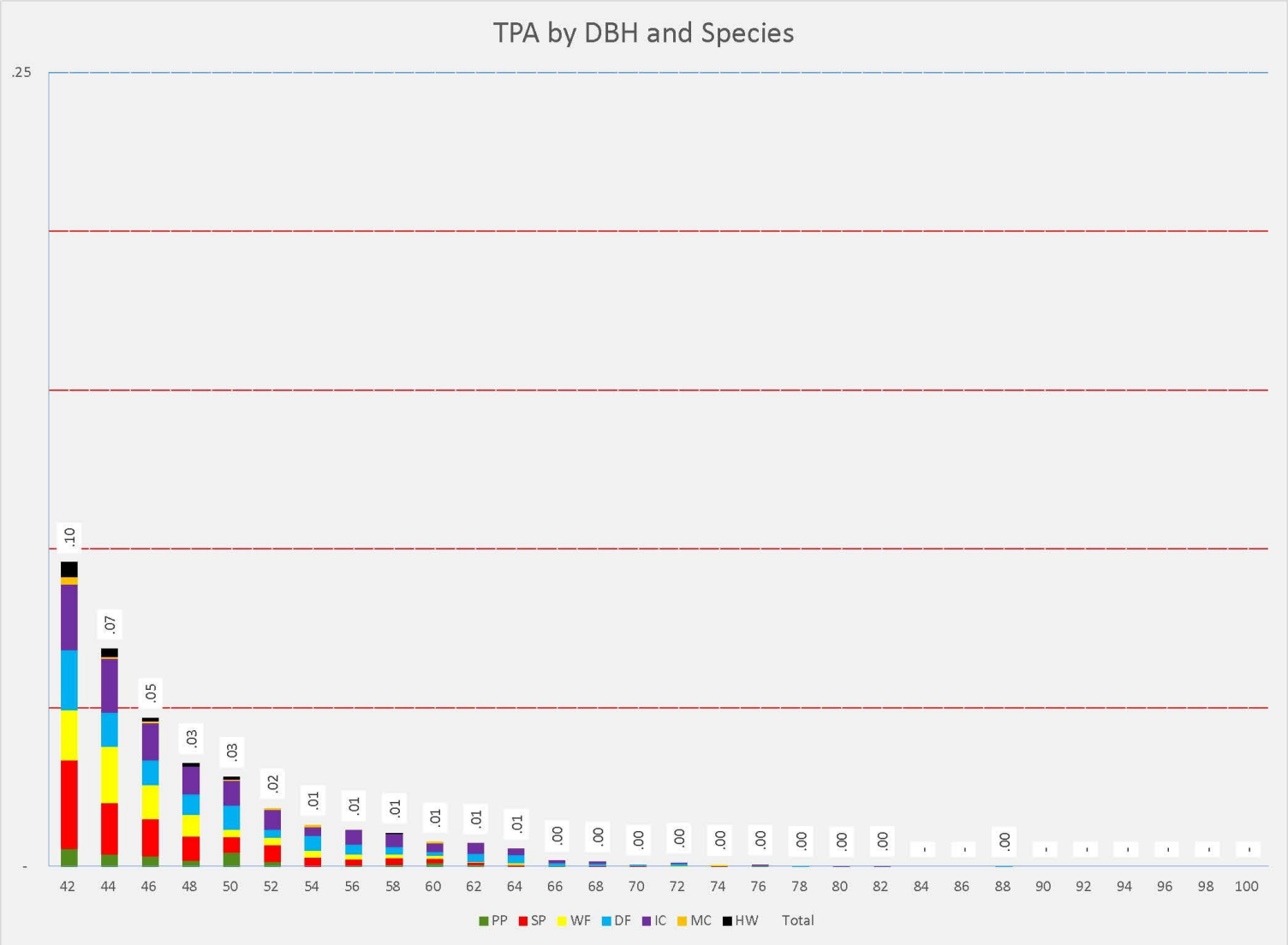
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96
98
100
PP
SP
WF
DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 10.0 | (+ or -) | 13.1 |
| Processed 04/29/2014 at 13:36:16 | | QMD >=5" | 12.9 | (+ or -) | 13.0 |
| | | Ave Diam All | 7.7 | (+ or -) | 47.8 |
| Tree Frequency | | Ave Diam >=5" | 11.2 | (+ or -) | 43.6 |
| Plot Count | 7,178 | TPA >= 12" 61.87 | TPA >= 22" 15.75 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 2.66 | 5.12 | 18.75 | 8.39 | 8.81 | 5.50 | 13.07 | 62.30 |
| 4 | .55 | .20 | 16.71 | 6.95 | 7.41 | 2.40 | 30.19 | 64.41 |
| 6 | 5.22 | 2.28 | 14.07 | 2.46 | 12.43 | 2.45 | 19.23 | 58.14 |
| 8 | 2.46 | 1.83 | 7.28 | 3.29 | 7.40 | 1.61 | 5.42 | 29.28 |
| 10 | 2.14 | 1.32 | 6.68 | 2.09 | 5.39 | .95 | 2.29 | 20.86 |
| 12 | 1.42 | .56 | 6.21 | .88 | 3.48 | .53 | 1.56 | 14.65 |
| 14 | .92 | .39 | 5.06 | .75 | 2.29 | .61 | 1.40 | 11.41 |
| 16 | .81 | .48 | 3.94 | .94 | 1.33 | .46 | .67 | 8.63 |
| 18 | .86 | .36 | 3.36 | .56 | .92 | .30 | .29 | 6.64 |
| 20 | .59 | .19 | 2.36 | .50 | .64 | .27 | .23 | 4.79 |
| 22 | .58 | .31 | 2.36 | .58 | .38 | .23 | .17 | 4.59 |
| 24 | .41 | .18 | 1.59 | .30 | .44 | .14 | .14 | 3.20 |
| 26 | .23 | .14 | 1.18 | .27 | .29 | .10 | .09 | 2.30 |
| 28 | .23 | .10 | .95 | .16 | .25 | .06 | .02 | 1.77 |
| 30 | .17 | .11 | .52 | .19 | .15 | .02 | .06 | 1.21 |
| 32 | .14 | .06 | .38 | .12 | .12 | .03 | .01 | .86 |
| 34 | .06 | .08 | .27 | .05 | .11 | .01 | .02 | .59 |
| 36 | .05 | .05 | .13 | .06 | .08 | .01 | .02 | .39 |
| 38 | .04 | .03 | .11 | .04 | .04 | .00 | .01 | .29 |
| 40 | .01 | .02 | .07 | .02 | .02 | - | - | .14 |
| 42 | .01 | .02 | .05 | .02 | .02 | - | .01 | .11 |
| 44 | .01 | .02 | .02 | .01 | .02 | - | - | .09 |
| 46 | .00 | .02 | .01 | .02 | .02 | - | - | .07 |
| 48 | .00 | .00 | .01 | .01 | .02 | - | - | .05 |
| 50 | .00 | .00 | .01 | .01 | .01 | - | - | .03 |
| 52 | .00 | .00 | .00 | .00 | .01 | - | - | .02 |
| 54 | - | - | - | .00 | .00 | - | - | .01 |
| 56 | - | .00 | .01 | - | .00 | - | - | .02 |
| 58 | - | - | .00 | .00 | .00 | - | - | .01 |
| 60 | .00 | .00 | - | - | .00 | - | - | .01 |
| 62 | - | - | - | .00 | .01 | - | - | .01 |
| 64 | .00 | .00 | .00 | .00 | - | - | - | .00 |
| 66 | - | - | - | .00 | - | - | - | .00 |
| 68 | - | - | - | .00 | - | - | - | .00 |
| 70 | - | - | .00 | - | .00 | - | - | .00 |
| 72 | - | - | - | - | .00 | - | - | .00 |
| 74 | - | .00 | - | - | - | - | - | .00 |
| 76 | - | - | - | - | - | - | - | - |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
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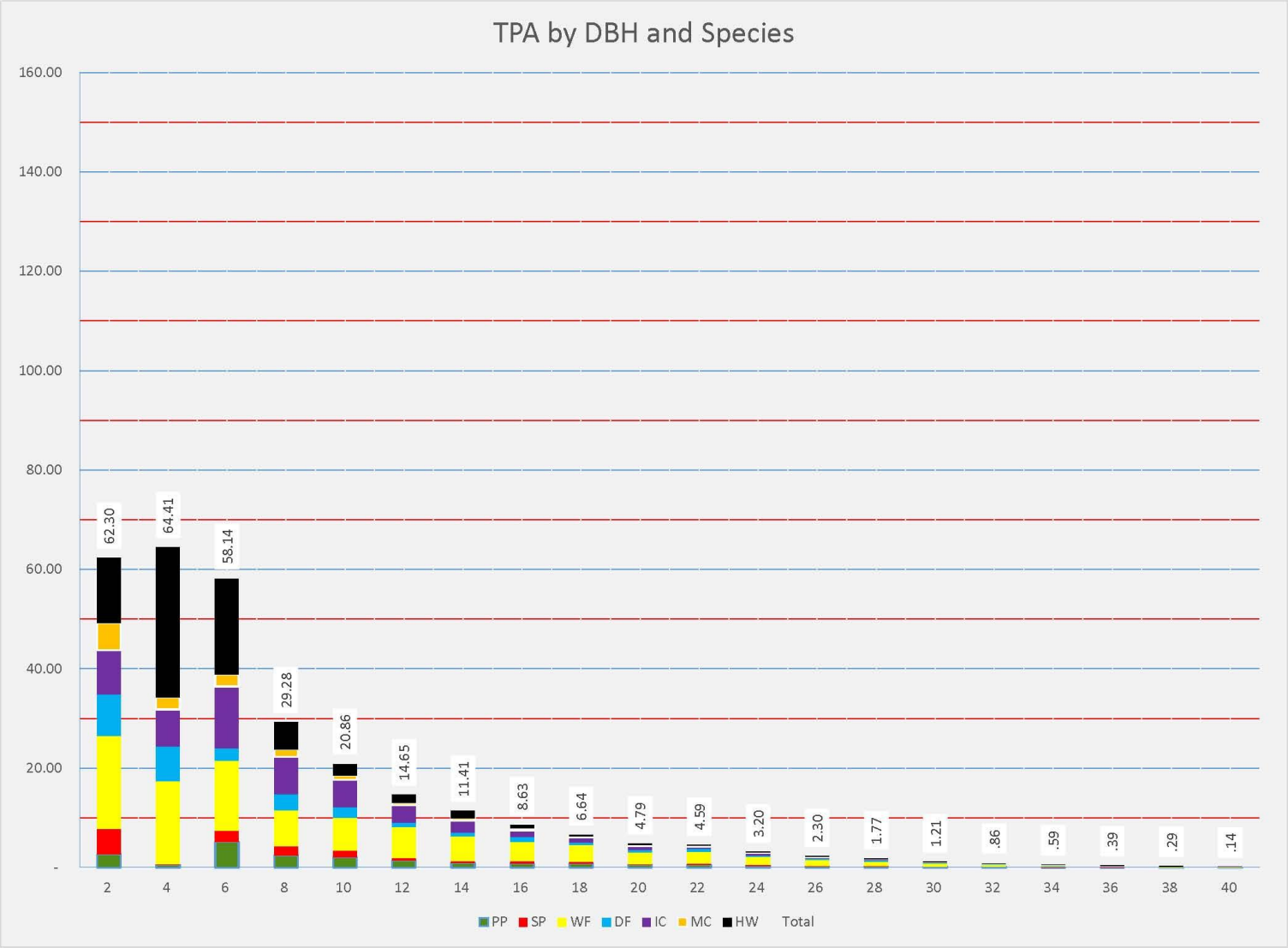
| Total | 19.57 | 13.87 | 92.10 | 28.69 | 52.09 | 15.66 | 74.88 | 296.85 |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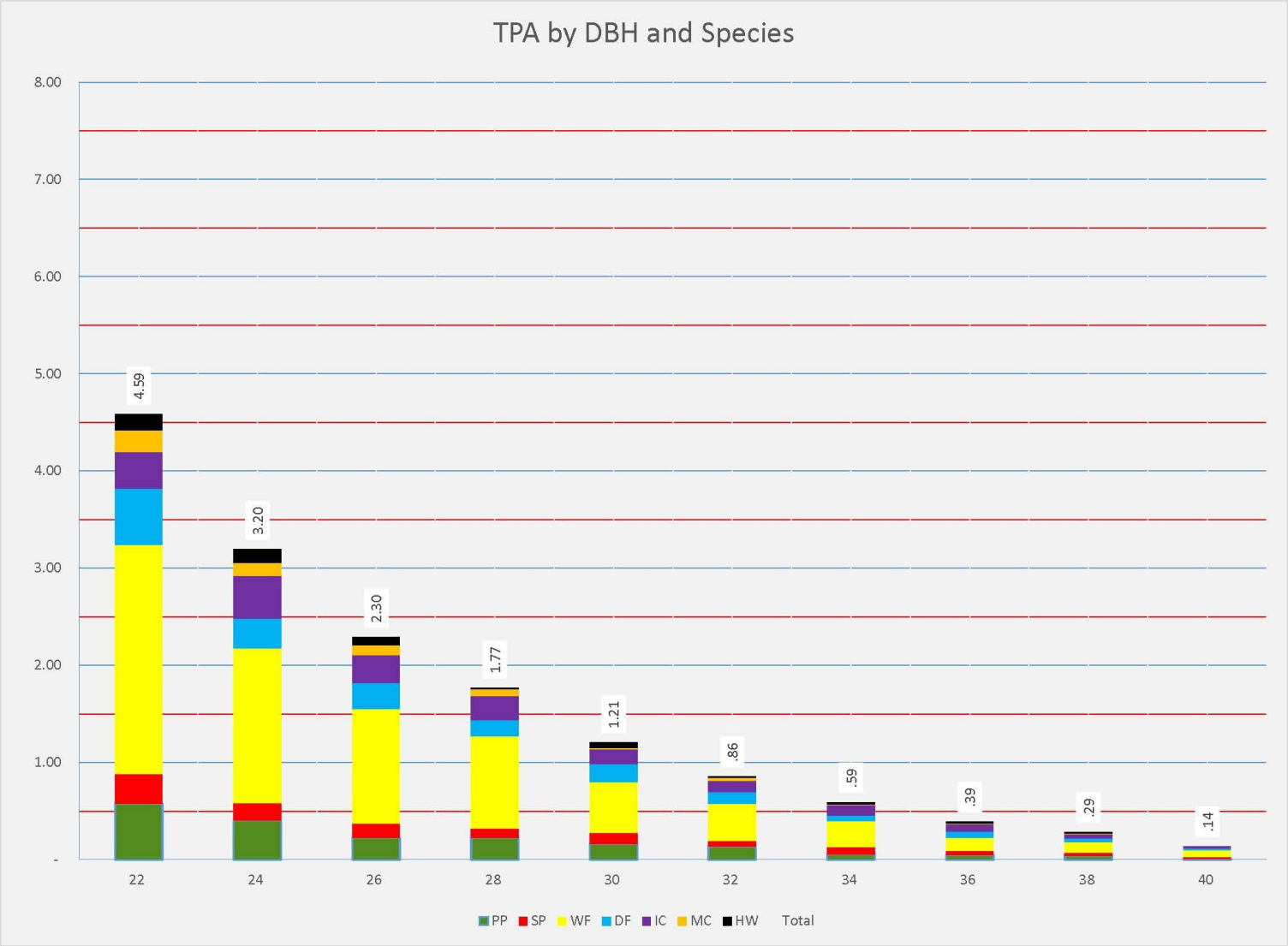
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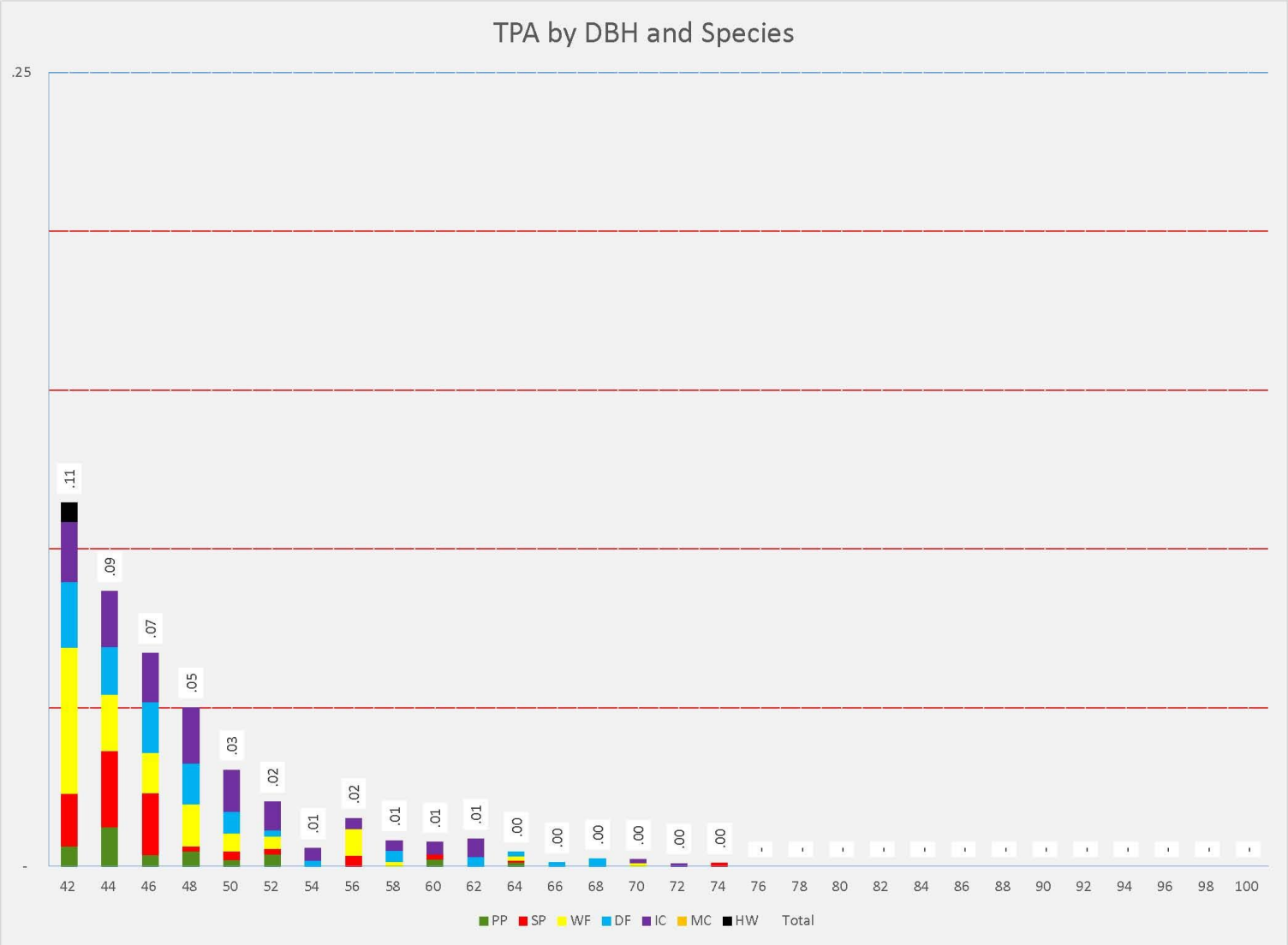
Total


TPA by DBH and Species
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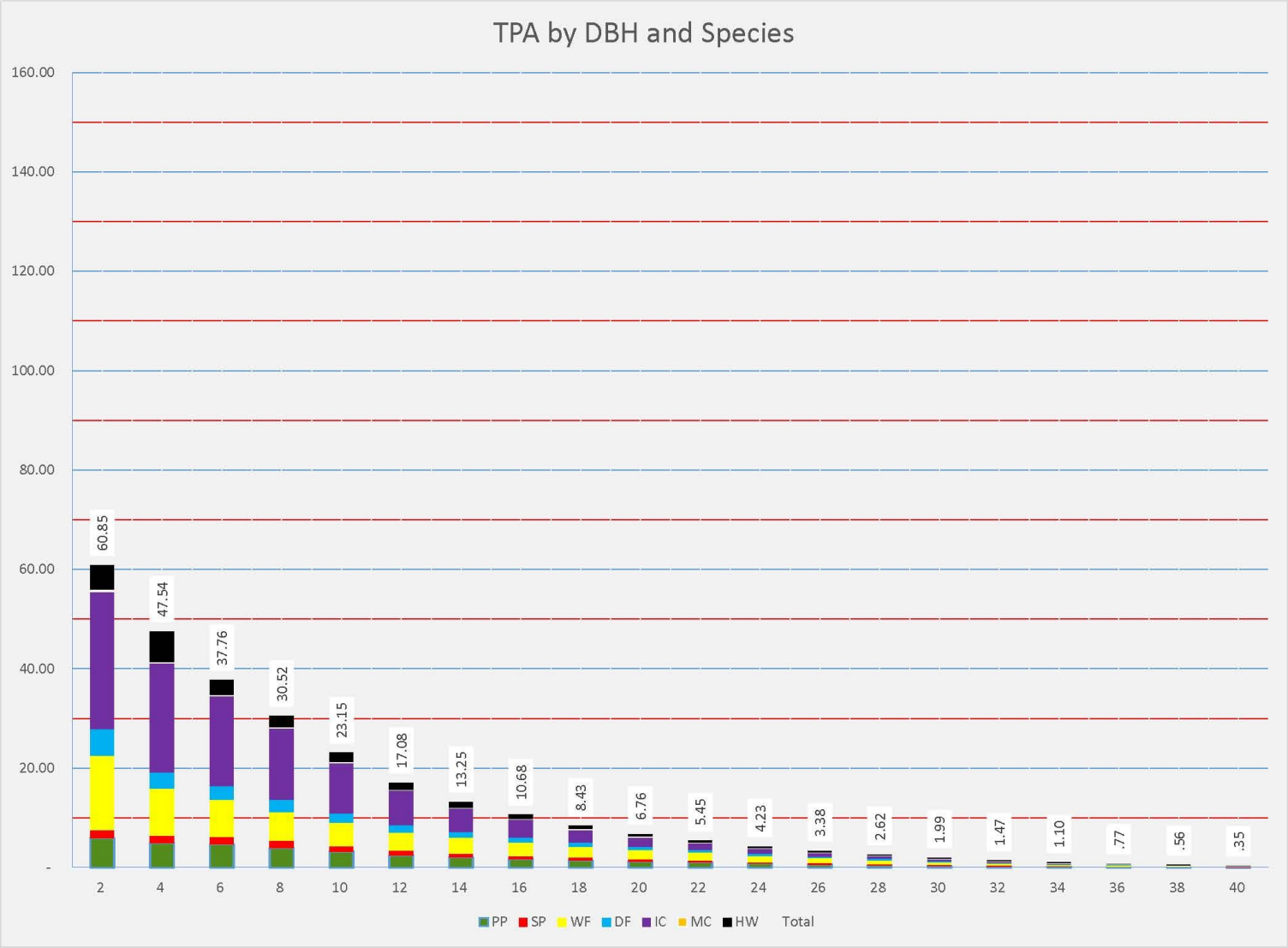
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100
PP SP WF DF IC MC HW Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 11.6 | (+ or -) | 13.9 |
| Processed 02/07/2014 at 14:19:56 | | QMD >=5" | 14.7 | (+ or -) | 13.8 |
| | | Ave Diam All | 8.9 | (+ or -) | 49.8 |
| Tree Frequency | | Ave Diam >=5" | 12.7 | (+ or -) | 46.6 |
| Plot Count | 8,607 | TPA >= 12" 78.8 | TPA >= 22" 22.6 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 5.92 | 1.71 | 14.92 | 5.41 | 27.70 | .33 | 4.86 | 60.85 |
| 4 | 4.91 | 1.59 | 9.38 | 3.27 | 22.07 | .19 | 6.14 | 47.54 |
| 6 | 4.67 | 1.49 | 7.49 | 2.77 | 18.22 | .14 | 2.97 | 37.76 |
| 8 | 3.98 | 1.52 | 5.68 | 2.49 | 14.47 | .13 | 2.26 | 30.52 |
| 10 | 3.25 | 1.08 | 4.74 | 1.84 | 10.32 | .12 | 1.80 | 23.15 |
| 12 | 2.49 | .93 | 3.68 | 1.49 | 7.05 | .06 | 1.38 | 17.08 |
| 14 | 2.10 | .74 | 3.19 | 1.15 | 4.85 | .07 | 1.15 | 13.25 |
| 16 | 1.73 | .67 | 2.66 | 1.02 | 3.77 | .04 | .79 | 10.68 |
| 18 | 1.46 | .59 | 2.18 | .84 | 2.70 | .03 | .64 | 8.43 |
| 20 | 1.23 | .51 | 1.84 | .63 | 2.06 | .02 | .48 | 6.76 |
| 22 | 1.03 | .42 | 1.62 | .56 | 1.45 | .01 | .36 | 5.45 |
| 24 | .82 | .33 | 1.20 | .47 | 1.13 | .01 | .29 | 4.23 |
| 26 | .63 | .30 | .99 | .36 | .86 | .01 | .25 | 3.38 |
| 28 | .46 | .26 | .78 | .29 | .64 | .00 | .20 | 2.62 |
| 30 | .36 | .20 | .56 | .23 | .50 | .00 | .14 | 1.99 |
| 32 | .25 | .18 | .41 | .17 | .35 | .00 | .11 | 1.47 |
| 34 | .17 | .16 | .29 | .12 | .25 | .00 | .10 | 1.10 |
| 36 | .12 | .13 | .20 | .10 | .16 | .00 | .06 | .77 |
| 38 | .08 | .11 | .14 | .07 | .12 | .00 | .04 | .56 |
| 40 | .05 | .08 | .07 | .05 | .07 | .00 | .03 | .35 |
| 42 | .02 | .06 | .03 | .02 | .04 | .00 | .02 | .19 |
| 44 | .01 | .05 | .02 | .01 | .03 | .00 | .02 | .14 |
| 46 | .01 | .03 | .01 | .01 | .02 | .00 | .01 | .08 |
| 48 | .00 | .02 | .00 | .01 | .01 | - | .01 | .06 |
| 50 | .00 | .01 | .00 | .01 | .01 | .00 | .00 | .04 |
| 52 | .00 | .01 | .00 | .00 | .01 | - | .00 | .03 |
| 54 | .00 | .01 | .00 | .00 | .01 | - | .00 | .02 |
| 56 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 58 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .01 |
| 60 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 62 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .01 |
| 64 | .00 | .00 | .00 | .00 | .00 | - | .00 | .00 |
| 66 | - | .00 | .00 | .00 | .00 | - | .00 | .00 |
| 68 | - | .00 | - | .00 | .00 | - | .00 | .00 |
| 70 | - | .00 | .00 | .00 | .00 | - | .00 | .00 |
| 72 | - | .00 | - | .00 | .00 | - | .00 | .00 |
| 74 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 76 | .00 | .00 | - | .00 | .00 | - | - | .00 |
| 78 | - | - | - | .00 | .00 | - | - | .00 |
| 80 | .00 | .00 | - | .00 | .00 | - | - | .00 |
| 82 | - | .00 | - | .00 | .00 | - | - | .00 |
| 84 | - | - | - | .00 | - | - | - | .00 |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | .00 | - | - | - | .00 |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 35.76 | 13.17 | 62.10 | 23.41 | 118.87 | 1.17 | 24.10 | 278.57 |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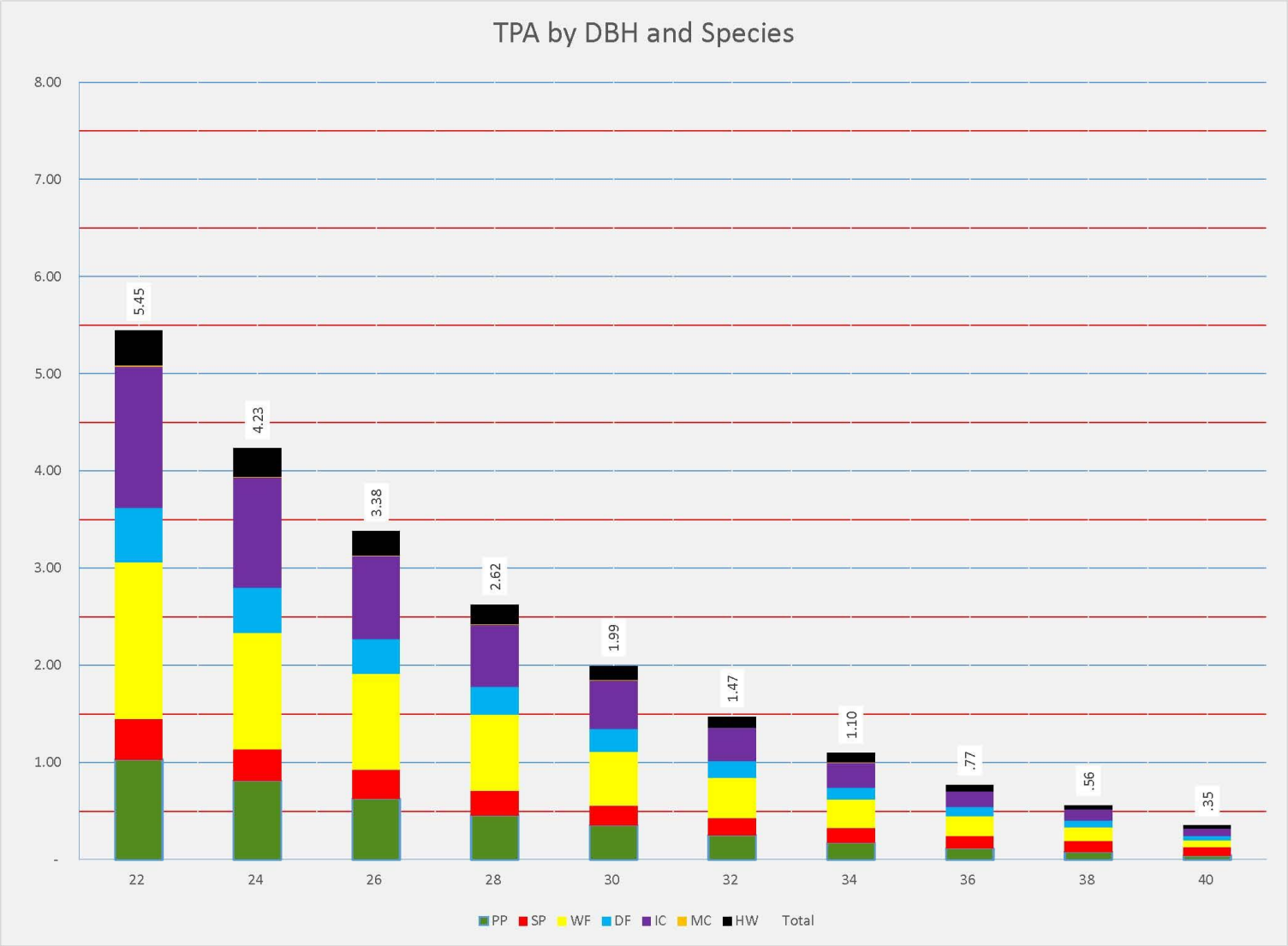
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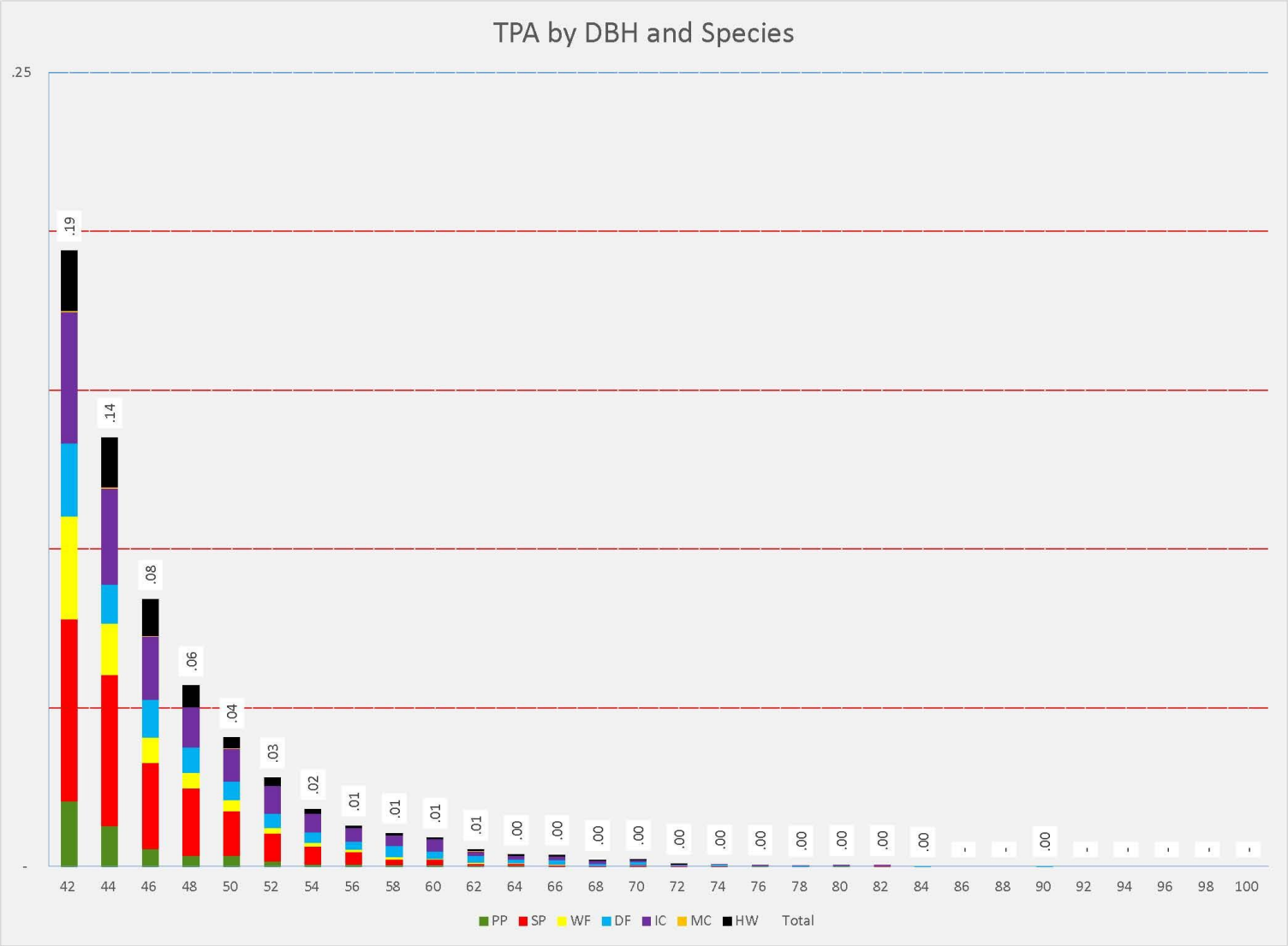
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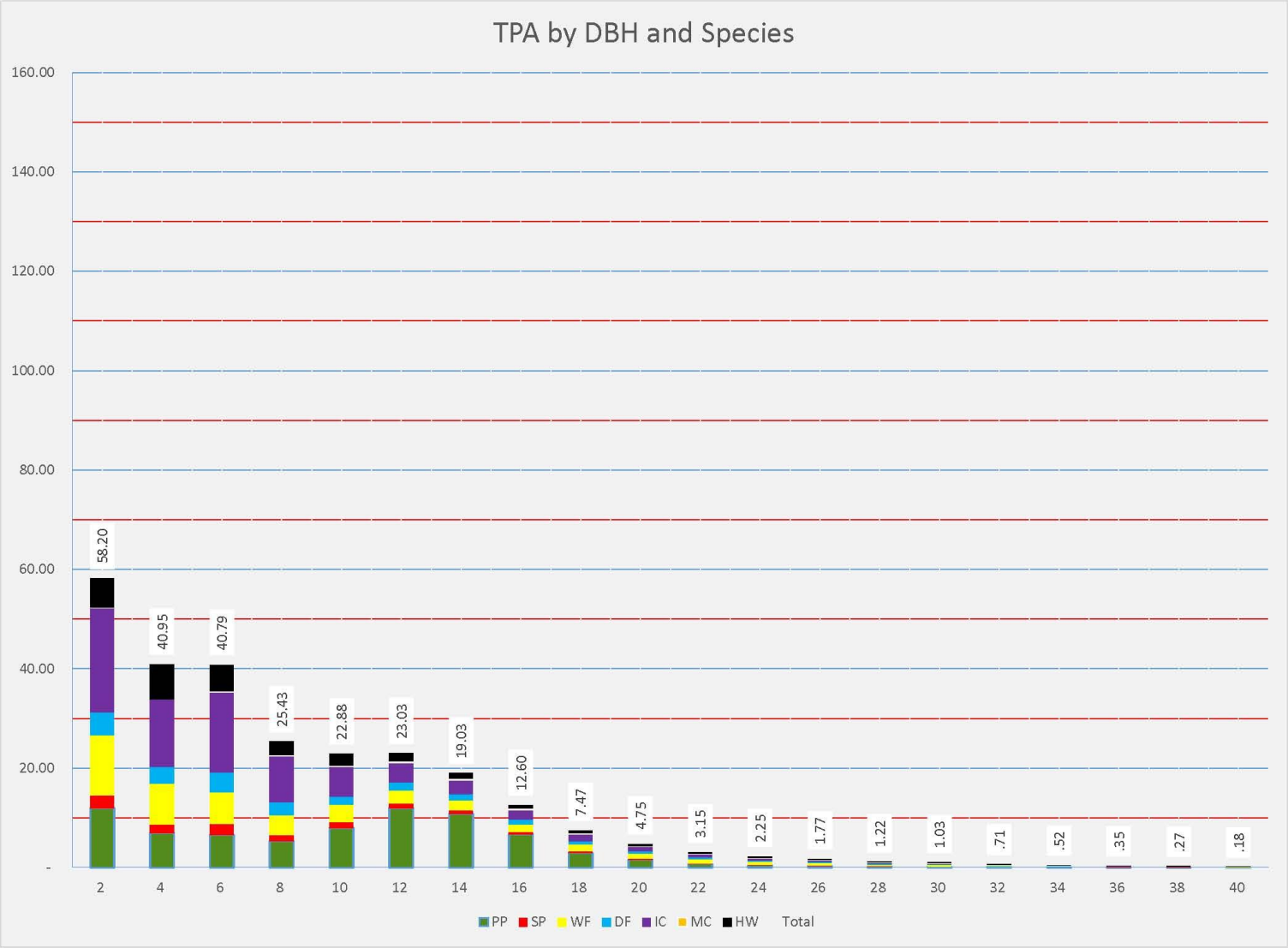
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100
PP SP WF DF IC MC HW Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 10.6 | (+ or -) | 13.1 |
| Processed 02/07/2014 at 14:11:05 | | QMD >=5" | 13.1 | (+ or -) | 13.0 |
| | | Ave Diam All | 8.4 | (+ or -) | 47.4 |
| Tree Frequency | | Ave Diam >=5" | 11.7 | (+ or -) | 44.4 |
| Plot Count | 2,529 | TPA >= 12" 78.6 | TPA >= 22" 11.8 | | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 11.99 | 2.62 | 12.11 | 4.57 | 21.13 | .01 | 5.78 | 58.20 |
| 4 | 6.92 | 1.81 | 8.19 | 3.36 | 13.64 | - | 7.03 | 40.95 |
| 6 | 6.56 | 2.20 | 6.42 | 4.02 | 16.21 | .09 | 5.27 | 40.79 |
| 8 | 5.32 | 1.27 | 4.01 | 2.54 | 9.44 | .07 | 2.77 | 25.43 |
| 10 | 8.01 | 1.23 | 3.43 | 1.67 | 6.04 | .12 | 2.37 | 22.88 |
| 12 | 12.01 | .93 | 2.63 | 1.66 | 4.00 | .22 | 1.59 | 23.03 |
| 14 | 10.83 | .73 | 2.01 | 1.24 | 2.88 | .26 | 1.07 | 19.03 |
| 16 | 6.71 | .48 | 1.56 | .93 | 1.99 | .25 | .68 | 12.60 |
| 18 | 2.97 | .34 | 1.36 | .68 | 1.54 | .09 | .49 | 7.47 |
| 20 | 1.58 | .31 | .99 | .47 | .96 | .02 | .41 | 4.75 |
| 22 | .67 | .23 | .81 | .37 | .77 | .01 | .30 | 3.15 |
| 24 | .43 | .17 | .61 | .27 | .53 | .01 | .24 | 2.25 |
| 26 | .32 | .16 | .48 | .21 | .38 | .00 | .21 | 1.77 |
| 28 | .20 | .11 | .33 | .16 | .27 | .00 | .15 | 1.22 |
| 30 | .18 | .09 | .26 | .14 | .24 | .00 | .12 | 1.03 |
| 32 | .12 | .07 | .19 | .10 | .14 | .00 | .09 | .71 |
| 34 | .08 | .07 | .13 | .07 | .10 | .00 | .08 | .52 |
| 36 | .06 | .05 | .07 | .05 | .08 | - | .04 | .35 |
| 38 | .05 | .05 | .06 | .03 | .06 | - | .03 | .27 |
| 40 | .02 | .05 | .04 | .02 | .03 | - | .02 | .18 |
| 42 | .01 | .03 | .01 | .01 | .02 | - | .01 | .10 |
| 44 | .01 | .01 | .01 | .01 | .01 | .00 | .01 | .06 |
| 46 | .00 | .01 | .01 | .01 | .01 | - | .01 | .04 |
| 48 | .00 | .01 | .00 | .01 | .00 | - | .00 | .03 |
| 50 | .00 | .01 | .00 | .00 | .01 | - | .00 | .02 |
| 52 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 54 | .00 | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 56 | - | .00 | .00 | .00 | .00 | - | .00 | .01 |
| 58 | - | .00 | - | .00 | .00 | - | .00 | .00 |
| 60 | - | .00 | .00 | .00 | .00 | - | .00 | .00 |
| 62 | - | .00 | - | .00 | .00 | - | - | .00 |
| 64 | - | .00 | - | .00 | .00 | - | - | .00 |
| 66 | - | .00 | - | .00 | .00 | - | .00 | .00 |
| 68 | - | - | - | .00 | .00 | - | - | .00 |
| 70 | - | - | .00 | .00 | .00 | - | .00 | .00 |
| 72 | - | - | - | .00 | .00 | - | .00 | .00 |
| 74 | - | .00 | - | .00 | - | - | - | .00 |
| 76 | - | - | .00 | - | .00 | - | .00 | .00 |
| 78 | - | - | - | - | - | - | - | - |
| 80 | - | - | - | .00 | - | - | - | .00 |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | .00 | - | - | .00 |
| 96 | - | - | - | - | .00 | - | - | .00 |
| 98 | - | - | - | - | - | - | .00 | .00 |
| 100 | - | - | - | - | - | - | - | - |
| Total | 75.06 | 13.04 | 45.74 | 22.62 | 80.49 | 1.15 | 28.79 | 266.88 |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4.75
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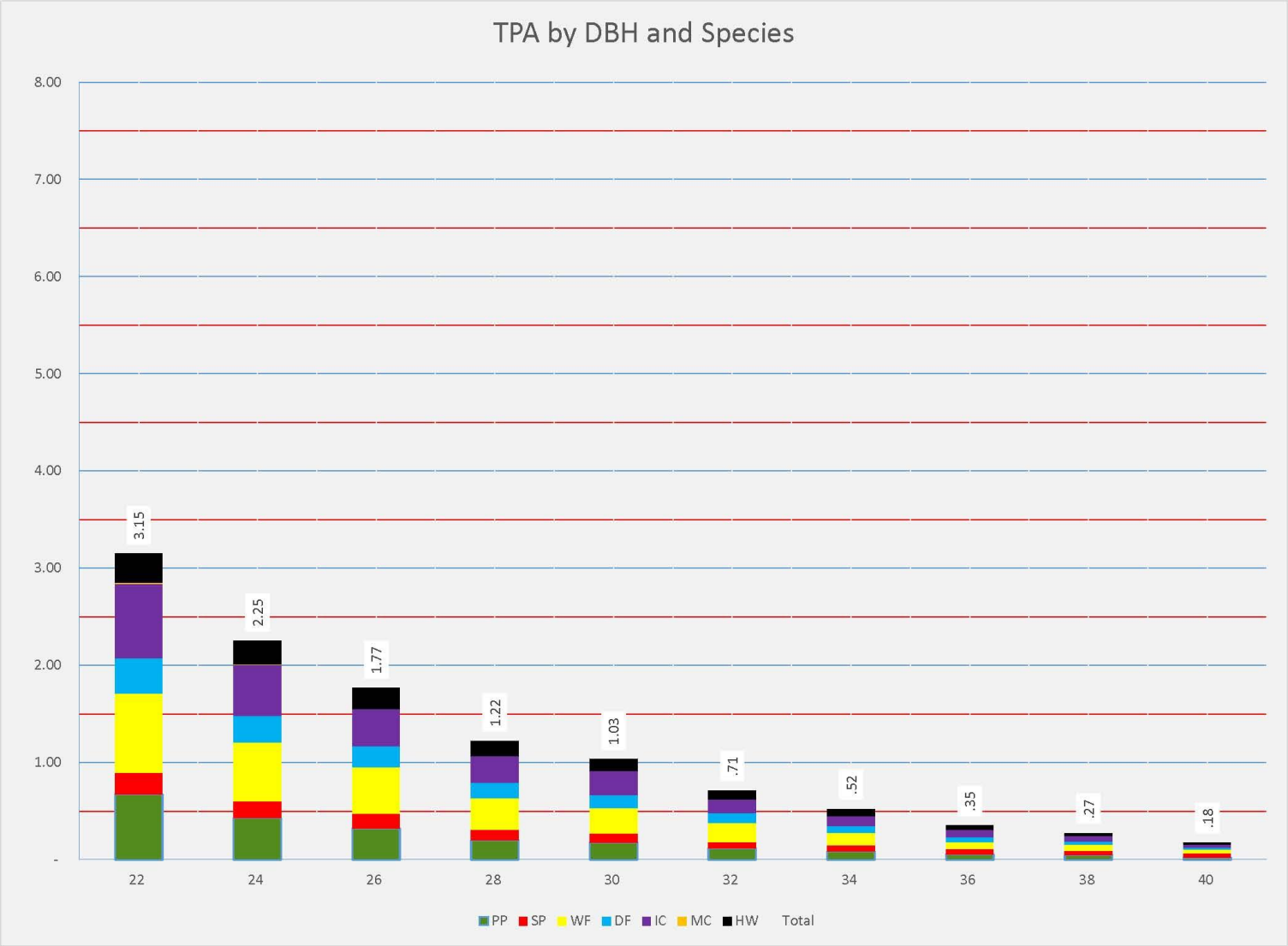
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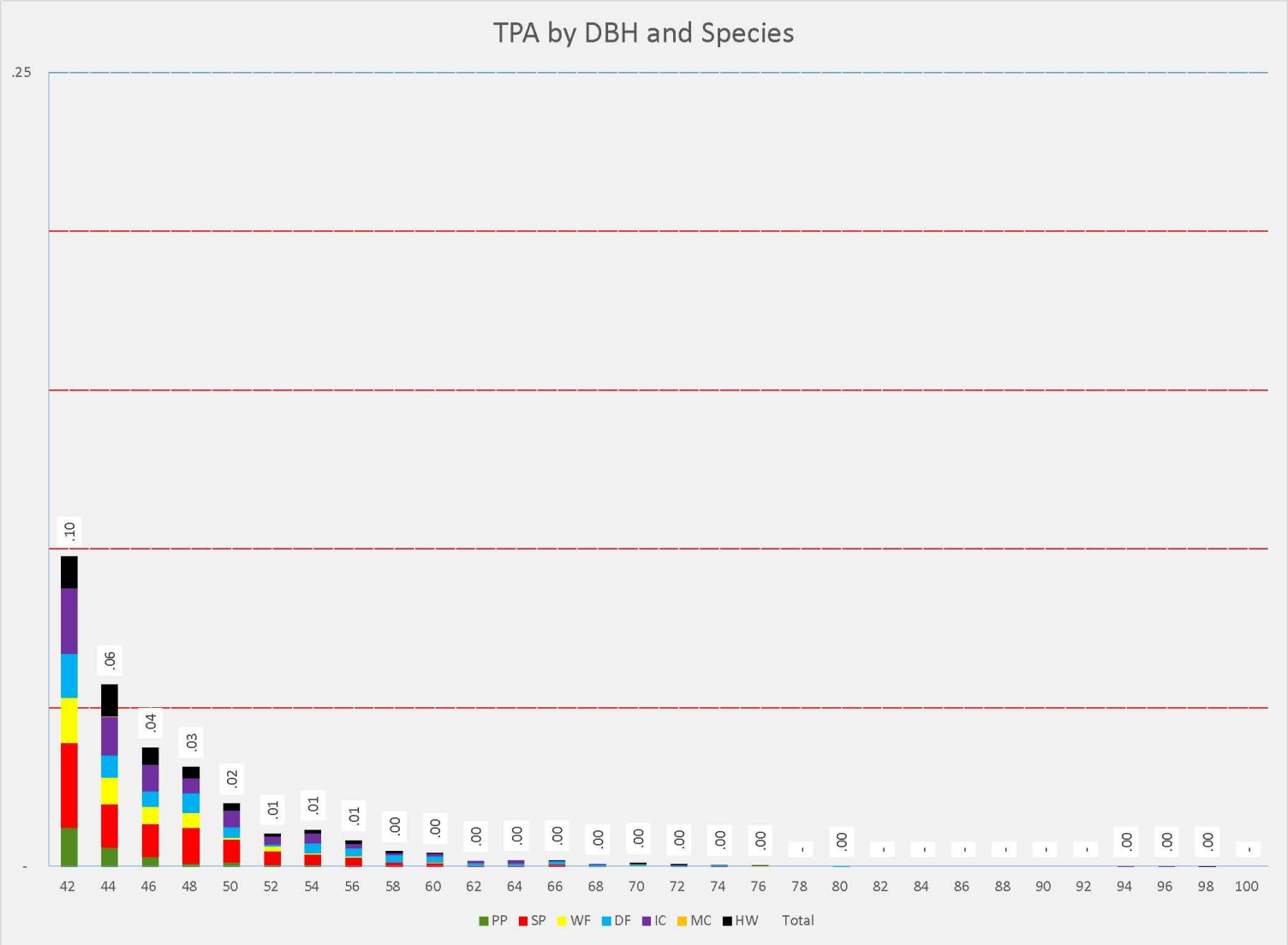
TPA by DBH and Species
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84
86
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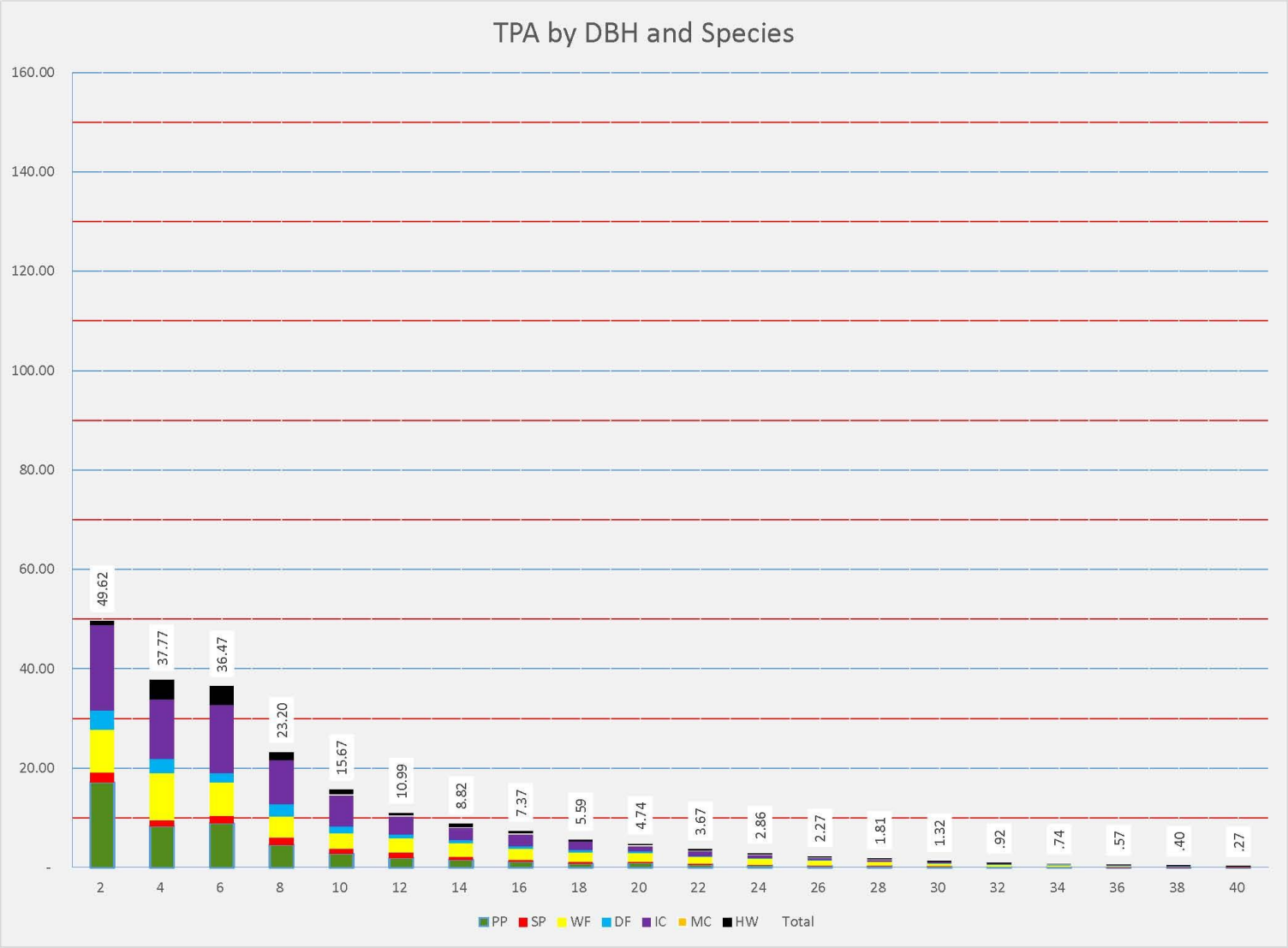
90
92
94
96
98
100
PP
SP
WF
DF
IC
MC
HW
Total

Appendix H: SPI 2013b. Nesting / Denning Structure Presence and Abundance Survey in Covered Species Conservation Areas

| | | | | | |
|---|---|---|---|---|---|
| Interpreter (Fixed Grid) | | QMD ALL | 11.0 | (+ or -) | 12.7 |
| Processed 02/07/2014 at 14:11:05 | | QMD >=5" | 14.0 | (+ or -) | 12.6 |
| | | Ave Diam All | 8.3 | (+ or -) | 42.4 |
| Tree Frequency | | Ave Diam >=5" | 12.1 | (+ or -) | 39.3 |
| Plot Count | 2,529 | TPA >= 12" 52.7 | | TPA >= 22" 15.2 | |

| DBH | PP | SP | WF | DF | IC | MC | HW | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 17.21 | 1.94 | 8.69 | 3.88 | 17.14 | - | .76 | 49.62 |
| 4 | 8.38 | 1.24 | 9.41 | 2.88 | 11.99 | - | 3.87 | 37.77 |
| 6 | 8.91 | 1.55 | 6.69 | 1.90 | 13.73 | - | 3.69 | 36.47 |
| 8 | 4.61 | 1.46 | 4.27 | 2.47 | 8.90 | - | 1.49 | 23.20 |
| 10 | 2.82 | 1.02 | 3.18 | 1.30 | 6.35 | .12 | .88 | 15.67 |
| 12 | 1.97 | 1.10 | 2.85 | .75 | 3.73 | .20 | .39 | 10.99 |
| 14 | 1.57 | .61 | 2.77 | .64 | 2.57 | .07 | .59 | 8.82 |
| 16 | 1.17 | .45 | 2.21 | .52 | 2.54 | .08 | .40 | 7.37 |
| 18 | .80 | .42 | 1.92 | .41 | 1.74 | - | .31 | 5.59 |
| 20 | .92 | .35 | 1.68 | .34 | 1.23 | .01 | .21 | 4.74 |
| 22 | .64 | .22 | 1.34 | .17 | 1.06 | .01 | .23 | 3.67 |
| 24 | .42 | .23 | 1.15 | .17 | .70 | .01 | .18 | 2.86 |
| 26 | .31 | .16 | .97 | .09 | .57 | .00 | .16 | 2.27 |
| 28 | .32 | .16 | .69 | .07 | .45 | .01 | .11 | 1.81 |
| 30 | .19 | .16 | .49 | .09 | .32 | - | .07 | 1.32 |
| 32 | .11 | .14 | .34 | .09 | .19 | - | .06 | .92 |
| 34 | .09 | .10 | .29 | .06 | .15 | .00 | .03 | .74 |
| 36 | .06 | .11 | .21 | .05 | .10 | - | .04 | .57 |
| 38 | .04 | .06 | .16 | .03 | .09 | - | .02 | .40 |
| 40 | .03 | .05 | .09 | .01 | .07 | - | .01 | .27 |
| 42 | .01 | .03 | .02 | .01 | .04 | - | .00 | .12 |
| 44 | .01 | .04 | .02 | .00 | .02 | - | .01 | .08 |
| 46 | .00 | .02 | .01 | .01 | .02 | - | .00 | .05 |
| 48 | .00 | .01 | .01 | .00 | .01 | - | .00 | .03 |
| 50 | .00 | .01 | .01 | .00 | .01 | - | .00 | .03 |
| 52 | .00 | .01 | .00 | - | .00 | - | .00 | .01 |
| 54 | .00 | .01 | .00 | .00 | .00 | - | .00 | .02 |
| 56 | - | .00 | .00 | - | .00 | - | .00 | .01 |
| 58 | - | .00 | - | .00 | .00 | - | .00 | .01 |
| 60 | - | .00 | .00 | .00 | .00 | - | - | .01 |
| 62 | - | .00 | - | .00 | .00 | - | .00 | .01 |
| 64 | .00 | .00 | .00 | .00 | .00 | - | - | .00 |
| 66 | - | .00 | .00 | .00 | .00 | - | - | .00 |
| 68 | - | - | - | - | - | - | - | - |
| 70 | - | - | - | - | - | - | - | - |
| 72 | - | .00 | - | - | - | - | - | .00 |
| 74 | - | .00 | - | - | .00 | - | - | .00 |
| 76 | - | .00 | - | .00 | - | - | - | .00 |
| 78 | - | .00 | - | - | - | - | - | .00 |
| 80 | - | - | - | - | - | - | - | - |
| 82 | - | - | - | - | - | - | - | - |
| 84 | - | - | - | - | - | - | - | - |
| 86 | - | - | - | - | - | - | - | - |
| 88 | - | - | - | - | - | - | - | - |
| 90 | - | - | - | - | - | - | - | - |
| 92 | - | - | - | - | - | - | - | - |
| 94 | - | - | - | - | - | - | - | - |
| 96 | - | - | - | - | - | - | - | - |
| 98 | - | - | - | - | - | - | - | - |
| 100 | - | - | - | - | - | - | - | - |
| Total | 50.60 | 11.66 | 49.47 | 15.96 | 73.73 | .51 | 13.53 | 215.46 |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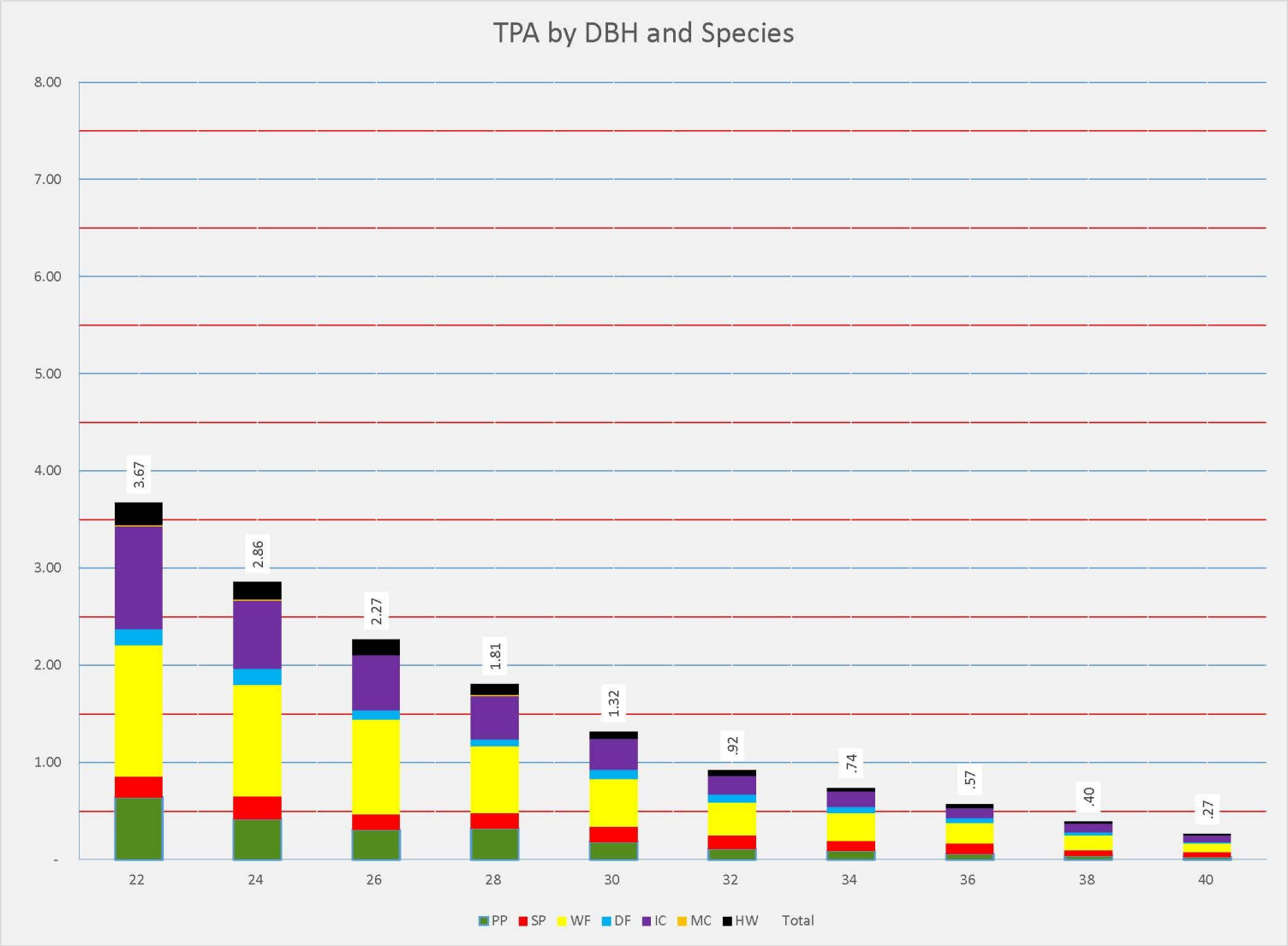
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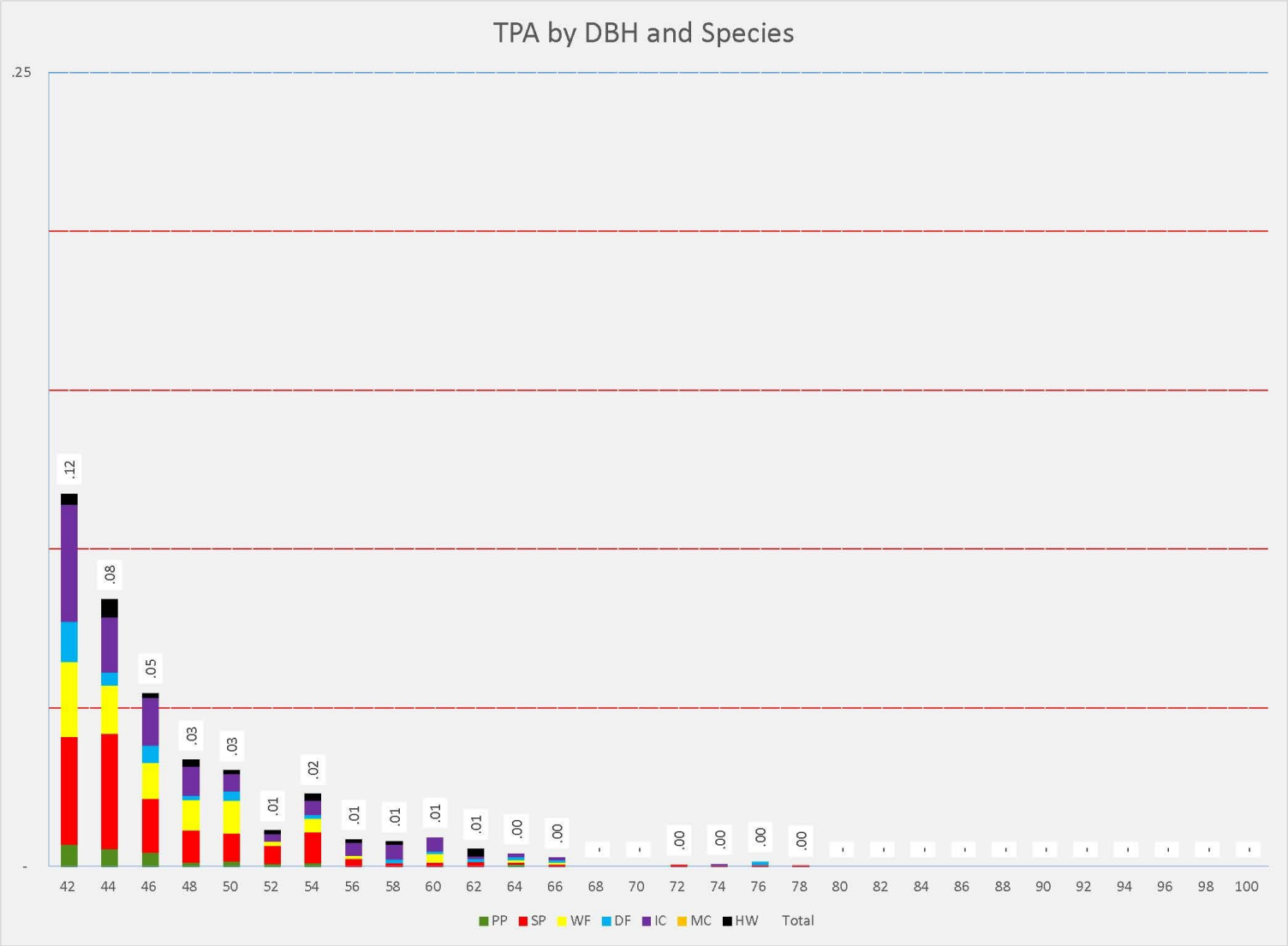
Total


TPA by DBH and Species
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PP
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WF
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MC
HW
Total

Appendix I: SPI 2013c. Habitat Form 2Hv as support for California Spotted owl, Northern Goshawk, and Fisher territories

Habitat Form 2hv as support for Covered Species territories V3.3
8/5/13

Introduction

This is the third in a series of White Papers addressing aspects of quantification of current and projected habitat under SPI's proposed Candidate Conservation Agreement with Assurances (CCAA). The first paper (SPI 2013a) laid out the proposed category of "Habitat Form 4," which represents nesting and denning habitat for the three CCAA Covered Species: the fisher; the California spotted owl (CSO); and the northern goshawk (NOGO). The second paper (SPI 2013b) reported on sampling of SPI lands in Habitat Form 4 and Habitat Form 2 (the successional precursor to Habitat Form 4) for the presence of possible nest/den structures in the Mixed Land Class. This third paper evaluates whether it is appropriate to include a subset of Habitat Form 2 ("HF2hv") with a larger component of Habitat Form 4 in the quantification of potential territories of the Covered Species.

We conclude that HF2hv may provide nesting/denning habitat in limited cases, and that it also may provide foraging habitat, but that these uses are largely dependent on presence of elements such as remnant hardwoods and snags, and thus that HF2hv should only be included in habitat quantification as a minority, supplemental portion of the total.

Background

As described in more detail in the aforementioned papers, the criteria for Habitat Form 4 includes forest stands with attributes of quadratic mean diameter (QMD), canopy cover, presence of large trees, and presence of nest/den structures that make them suitable for nesting/denning use by the Covered Species (see Table 1). Establishment of Habitat Form 4 (HF4) provided a metric for measurement, but the next step, conversion of that metric into an estimate of desirable amounts for the Covered Species, has not yet been accomplished.

**Table 1**. Threshold Criteria Values for Habitat Form 4

| LAND CLASS | CANOPY COVER | TREE SIZE | TREES /ACRE ≥22" dbh | OTHER |
|---|---|---|---|---|
| Mixed | ≥60 % | Stand QMD ≥13" dbh | At least 9 trees | At least one suitable Nest / Den structure per stand. |
| Even | ≥60 % | Stand QMD ≥13" dbh | At least 20 trees | |

It is not presently feasible to conduct thorough field surveys for the three Covered Species on the entire SPI ownership, and thus the present number of territories of these animals is unknown. Similarly, based on present methods and technologies, we do not expect to conduct complete surveys for the Covered Species during the period of the CCAA. To predict the potential benefits of the CCAA to Covered Species over the 50-year life of the plan, and to establish objectives, it is thus necessary to estimate a baseline amount of

habitat and extrapolate to the estimated number of territories that may be present currently and in the future.

As described in SPI (2013a), HF4 is and will be the primary habitat type providing nesting/denning habitat, and the sustained presence of the Covered Species probably depends on the presence of sufficient amounts of HF4. However, SPI's measurements of stands at reproductively successful sites on their ownership, along with scientific literature from elsewhere in the Covered Species' range, include descriptions of the species' use of stands with somewhat smaller QMDs and canopy cover than those established for inclusion in HF4. These stands fall within SPI's Habitat Form 2 (further described below). Because stands with these smaller parameters support a minority of the observed nesting/denning use, SPI believes that it would not be appropriate to use these site descriptions as the threshold criteria for quantification of the primary nesting/denning habitat. However, it may be appropriate to include such stands in overall amounts of habitat contributing to the presence of Covered Species' territories.

Habitat Form 2

Habitat Form 2 (HF2) is the stand condition that is the precursor to HF4. HF2 has moderate to dense canopy cover (40% - 100%) and a QMD of ≥6 in. dbh. While a component of larger trees may be present in a stand designated as HF2, and/or QMD can be 11in. dbh (and in rare instances >13in. dbh), HF2 stands do not satisfy all the criteria of HF4.

At present, most of SPI's HF2 stands are in the Mixed land class (see SPI 2013a for description of land classes), the legacy of various intensities of selection harvest carried out over past decades by various owners. While quite variable in condition, the HF2 stands in the Mixed land class sometimes do contain numbers of large trees, especially hardwoods, and based upon sampling, contain many potential nesting/denning structures for the Covered Species (SPI 2013b). However, HF2 stands usually have QMD lower than stands typically used for nesting/denning by Covered Species, and in some cases may have canopy cover <60%.

HF2 stands currently occupy about 38% percent of the ownership. During the period of the CCAA, about half of today's acreage of HF2 will be clearcut and converted to Regen and Even land classes. The remainder of today's HF2 will continue to grow, and much of it will become HF4 during the plan period. Meantime, many young Even-aged stands will grow into HF2.

Habitat Form HF2hv

As stated above, the broad range of conditions included in HF2 includes some stands that provide nesting/denning habitat for the Covered Species. However, in most cases, use of HF2 stands is in the portion of the class that is made up of the highest QMD. As a result, SPI has subdivided the HF2 category, and designated a portion that includes the larger QMDs and the higher degrees of canopy cover as "HF2 Heavy" or HF2hv. The QMD criteria for inclusion in this category is ≥ 11 in. dbh, and the criteria for canopy cover is ≥50%.

The following section discusses the rationale for selection of these criteria. Because different studies have used different methods and different habitat classifications, the results often are not directly comparable. However, recognizing that suitability of habitat occurs along a spectrum rather than as a discrete condition, common themes can be identified.

Comparison to California Wildlife Habitat Relationships (WHR) System

HF2hv falls within WHR size class 4, which includes QMD of 11-24 in. dbh, and within canopy cover class M or D, which include canopy cover of greater than 40% and 60%, respectively. Thus, while most acreage of existing HF2hv falls within WHR class 4M or 4D, the lower threshold for HF2hv would be among the smaller QMD stands of that WHR class.

Comparison to U.S. Forest Service timber strata system

The lower size threshold of HF2hv falls near the categorical boundary of USFS timber strata system size class 2 (QMD of 6 to 12 in.) and size class 3 (QMD 12 to 24 in.). The canopy cover threshold falls within strata class N (40% to 70% canopy cover) or G ($\geq$ 70% canopy cover). Most HF2hv would fall within strata class 3N or 3G.

HF2hv as denning/resting habitat for Fisher

Numerous studies of fisher habitat have been conducted in southwestern Oregon and northwestern California. Most of these have focused on the structures used for denning and resting. While these studies are of interest, they are not directly applicable to SPI's need for broader habitat descriptions. Those studies that did describe habitat at other scales used various methods and areas of analyses that are not directly comparable to the habitat descriptions produced by SPI.

Our review of the summaries presented in Lofroth et al. (2011) indicate that the lower threshold values for SPI's HF2hv (i.e., QMD $\geq$11 in. dbh, and canopy cover $\geq$50%) fall within the smaller size classes observed at the sites of fisher den structures, and fall within the range of canopy cover observed. ((See Lofroth et al. (2011): Table "Shasta-Trinity 2", p. 62; and Table "Northern California Inventory 4", p. 87)).

Within 1.05-acre sites surrounding 131 fisher maternal or natal den structures measured on SPI land, QMD ranged from 6.2 to 33.3 in., with a mean QMD of 13.4 in., and a SD of $\pm$3.5 in. Thus, the HF2hv lower size threshold of 11in. QMD is lower than the mean of these observations, but falls within one SD of the mean QMD. At the same 131 sites, canopy closure measured by spherical densiometers ranged from 11.5% to 99%, with a mean of 79.9% and a SD of $\pm$18.1%. While the lower HF2hv canopy cover threshold of 50% QMD is lower than the mean and the lower extent of the SE of these observations, they are actually equivalent, because SPI's Habitat Form criteria use a calculated index of canopy cover that typically produces values about 20% lower than field measurements of the same stands using spherical densiometers. Thus, the threshold values for HF2hv fall within the lower bounds of the range of conditions in occupied fisher habitat observed on SPI lands.

Note that the observations summarized above describe conditions within very small areas near den sites. Numerous studies have noted that conditions at denning sites often include tree sizes and canopy cover that are higher than at random locations measured at broader scales (Lofroth et al. 2010, Lofroth et al. 2011). We conclude that HF2hv will provide structural attributes similar to those observed at a minority of fisher denning and resting sites, representing the lower portions of the observed distribution of tree sizes. Thus, HF2hv is appropriate habitat for supplementing larger amounts of HF4.

HF2hv as nesting habitat for CSO

Numerous studies of CSO habitat have been conducted in California. These studies include description of habitat at various scales, including nest sites, nest "cores", and home ranges. Most of these studies used methods not directly comparable to those that produced the SPI observations reported below, particularly with regard to the size of areas where habitat measurements took place.

Within 1.05-acre sites surrounding 35 CSO nest structures measured on SPI land, QMD ranged from 10.5 to 22.3 in., with a mean QMD of 16.5 in., and a SD of ±2.9 in.. Thus the HF2hv lower size threshold of 11in. QMD is lower than one SD below the mean QMD, but falls within the range of the observations. At the same 35 sites, canopy closure measured by spherical densiometers ranged from 61% to 100% with a mean of 88% and a SD of ±8.7%. While the lower HF2hv canopy cover threshold of 50% QMD is lower than the mean and the lower extent of the SD of these observations, there is some overlap with the observed values, because the Habitat Form assignments use a calculated index of canopy cover that typically produces values about 20% lower than field measurements of the same stands using spherical densiometers. Thus, the threshold values for HF2hv fall within the lower bounds of the range of conditions observed at CSO nest sites on SPI lands.

According to Gutiérrez et al. (1992), approximately 30% of 148 nests reported from USFS lands occurred in timber strata classes 3N and 3G, and less than 10 percent in classes with lower tree size and or canopy closure. Many HF2hv stands would meet the criteria for classes 3N and 3G, but might fall within the lower portion of the range of the size class. Moen and Gutiérrez (1997) and Blakesley et al. (2005) noted the high importance of low numbers of large residual trees in providing nest structures within stands of size class 3. Keane et al. (2010) noted that while 37% of 104 nests observed in the Lassen Plumas study area were in stands classed as WHR 4, most of these nests occurred in the larger, upper portion of the class. There is no criterion in HF2 for presence of large trees, and nest sites within the upper range of values in WHR size class 4 would be outside the definition of HF2hv.

We conclude that some CSO nests are found in stands that meet the definition of Hf2hv, but these represent a small minority of the known CSO nests on both SPI and USFS lands, and nesting in these stands is often dependent on presence of residual structures not represented in the criteria. Thus, HF2hv will not be relied upon as the sole nesting habitat for CSO under the CCAA. However, as further discussed below, it will be relied upon to contribute foraging habitat and stand contiguity.

HF2hv as nesting habitat for northern goshawk

Within 1.05-acre sites surrounding 92 NOGO nest structures measured on SPI land, QMD ranged from 10.3 to 40.1 in., with a mean QMD of 17.4 in., and a SD of ±4.4 in.. Thus, the HF2hv lower size threshold of 11in. QMD is lower than one SE below the mean QMD; but the threshold falls within the range of the observations. At the same 92 sites, canopy closure measured by spherical densiometers ranged from 35% to 99% with a mean of 81.1% and a SD of ± 14.3%. While the lower HF2hv canopy cover threshold of 50% QMD is lower than the mean and the lower extent of the SD of these observations, there is some overlap with the observed values, because the Habitat Form assignments use a calculated index of canopy cover that typically produces values about 20% lower than field measurements using spherical densiometers. Thus, the threshold values for HF2hv fall within the lower bounds of the range of conditions observed at NOGO nest sites on SPI lands.

Data for NOGO nest sites on USFS lands in California have apparently not been reported in a similar format. A summary by Hansen et al. (2012a, Table 9.9) indicates that NOGO nest sites on the Lassen National Forest, in the Lake Tahoe region, and in Yosemite National Park generally have larger numbers of trees ≥22 in. dbh and ≥30 in. dbh than sites on timber company lands, and that canopy cover measurements from these sites range from 45% to 97%, with the average above 70%.

We conclude that some NOGO nest sites are found within stands meeting the definition of HF2hv, but these represent a small minority of the known NOGO nests on both SPI and USFS lands. HF2hv will not be relied upon as the sole nesting habitat for NOGO under the CCAA; it may contribute as nesting habitat in a few situations. However, as further discussed below, it will be relied upon to contribute foraging habitat and stand contiguity.

HF2hv stands as cover habitat

Several studies of CSO and northern spotted owls (e.g. Franklin 2000, Seamans 2005, Blakesley et al. 2005) have noted the importance of contiguous stands of mature forest with high degree of canopy cover in providing protection from weather and predation, and thus increasing the survival of adults and young. However, these assessments varied in their use of forest classes for analysis.

Franklin et al. (2000) found that presence of mature forest was associated with increased survival of northern spotted owls, but did not include stands with QMD of 11 to 21 in. (i.e., corresponding to the definition of HF2hv) in their definition of mature forest. Thus, the potential role of these younger mid-seral stands was not assessed. In that study, which was conducted in coastal mixed conifer forests with a substantial hardwood component, woodrats were the most important prey.

Seamans (2005) found that amount of "mature forest"(described as forest ≥70% canopy cover in size classes ≥12 in. and ≥24 in. dbh) was the best predictor of CSO demographic parameters. This study in the central Sierra Nevada extended down to 1200 ft. elevation. Prey was a combination of woodrats, flying squirrels, and mice, and hardwoods were an important component in some areas. It appears that HF2hv is of sufficient size to make a positive contribution to habitat in areas of this description.

Blakesley et al. (2005) found CSO site occupancy in 500-acre nest areas within and near the Lassen National Forest to be positively correlated with amount of forest with >24 in.dbh, but negatively correlated with amount of mid-sized forest 12-24 in. dbh. Apparent adult survival showed a similar relationship. These forests were above 4200 ft. in elevation, had very few hardwoods, and the primary prey was flying squirrels. Thus, the factors of high elevation weather and prey availability may have been different than at lower elevations. This suggests that HF2hv may perform differently at higher elevations where hardwoods are not an important component of stands.

In combination, these studies are unanimous in finding that stands with relatively large QMD and high degree of canopy cover contribute to spotted owl demographic parameters, especially survival. But only one (Seamans 2005) offers direct support for the inclusion of stands 11-24 in. dbh as contributory to this effect, and based on Blakesley (2005), it appears that such stands are not sufficient to confer such advantages at high elevations. Because the study area of Seamans (2005) is the most similar to SPI lands, we conclude that it is appropriate to consider HF2hv as supplementing cover habitat for CSO, but recognize that this habitat may have limits in its application.

Appendix I: SPI 2013c. Habitat Form 2Hv as support for California Spotted owl, Northern Goshawk, and Fisher territories

HF2hv foraging habitat for the Covered Species

As detailed above, habitat meeting the definitions of HF2hv is sometimes used as nesting/denning habitat by all three of the Covered Species, but it is at the smaller end of the range of tree sizes making up stands where such use has been recorded. However, stands of trees of this size class have often been recorded as portions of habitat utilized at various broader scales surrounding nesting/denning sites of all three Covered Species.

For instance, at broader scales, studies throughout the fisher's range consistently show selection for forests with high degrees of canopy cover that are often dominated by mid- to late successional forest stages where mid-successional is described as greater than 11 in. or 12 in. dbh. Active fishers have been observed using a diversity of forest types that include stands of even smaller trees (e.g., see Lofroth et al 2010, sec. 7.2.3)

Similarly, some stands documented as foraging habitat for CSO could be classified as WHR 4M and 4D, and USFS strata 3N and 3G. In some cases, use has been documented in even smaller stands; e.g., Williams et al. (2011) reported non-breeding CSO foraging in stands 6 to 10 in. dbh. But other researchers have generally identified foraging habitat as consisting of somewhat larger average tree size than the HF2hv minimum QMD. For instance, Irwin et al. (2007) found that foraging habitat on private land had an average QMD of nearly 16 in.. Gutiérrez et al. (1992) summarized findings of Laymon (1988) and Call (1990) regarding foraging locations identified through radio-telemetry, reporting use of stands with av. dbh of 11-24 in. as less than or equal to availability, and use of stands $\geq$24 in.dbh at rates higher than availability. (However, see Woodbridge and Hansen (2012, pp. 159-160) regarding limitations of radio telemetry and interpretation of "preference" of foraging habitats.)

Numerous studies of foraging goshawks have noted their tendency to use stands of larger size and higher canopy cover than randomly available (Woodbridge & Hansen 2012, Table 7.1) (with the caveats of the above-mentioned interpretative difficulties.) However, most studies also find that to some degree, goshawks use all vegetation types available, as long as the prey are present and accessible in surrounding vegetative conditions. Goshawks are morphologically adapted to hunting in moderately dense forest, and their most common prey are found in such forest or in forest openings (Woodbridge and Hansen 2012).

HF2hv as habitat for Covered Species prey

Use of stands for foraging by Covered Species is of course dependent on the presence of suitable prey species in sufficient availability to attract consistent foraging use. Availability is influenced by the prey species' numbers and behavior, and by vegetative conditions allowing access by the predator.

Prey for the Covered Species may be divided into diurnal and nocturnal species in terms of behavior. Fishers take prey from both groups, CSO primarily take nocturnal prey (although will capture diurnal prey opportunistically), and northern goshawks take diurnal prey almost exclusively. Each of the Covered Species preys on a wide variety of species, and while there is some overlap in prey taken by the three Covered Species, certain prey species are mostly taken by one or another of the Covered Species. Within the wide variety of prey taken by each of the Covered Species, there are a few certain prey species that provide the majority of energy consumed. These species will be further discussed below.

In general, stands of HF2hv may provide requisite cover for prey species and their predators, including the Covered Species. However, the actual presence of prey in stands of this description has not been well documented, and probably varies greatly depending on the management history and species composition of the stand. Most of SPI's existing HF2hv stands have resulted from repeated entries using selection harvest. As noted by Hansen et al. (2012b), selection harvest may reduce some prey species in the short term, but in the long term, generally allows for higher prey diversity and numbers than even-aged management. The presence of residual hardwoods and structural elements such as large legacy trees, snags and logs are important variables in potential suitability of stands as habitat for prey species.

The following discussion will review the natural history of several of the most important prey species for the Covered Species, and relate their natural history to the potential for occurrence in HF2hv stands.

Douglas Squirrel

The Douglas squirrel is a small diurnal tree squirrel primarily associated with mixed hardwood-conifer and coniferous forest. It is not an acorn-eater, but instead depends on conifer seeds, on terrestrial and arboreal fungi, and to a lesser extent other vegetative and avian food items. This species is perhaps the most important food item for goshawks, except in east-side pine forests. It is not an important prey for CSO. Rodents including squirrels made up almost half of the prey items recorded for fishers in northern California (Lofroth et al 2010, Table 6.9); presumably Douglas squirrels are consumed whenever they can be captured. While the Douglas' squirrel appears flexible in terms of use of managed forests, its numbers are dependent on cone crops, so extensive use of conifer stands below cone-bearing age is not to be expected (summary based on Steele (2012)).

Western Grey Squirrel

The western gray squirrel is found in hardwood forest and mixed-conifer forests with a substantial component of oaks or other mast-bearing hardwoods. Its occurrence in forest habitats is primarily limited to areas with moderate or little snowfall and occurrence of large oaks. It is an important food item for fishers, but because it is diurnal, is not an important food for CSO. It primarily occurs in the lower elevations of the range of the NOGO, and thus provides prey for some of the nesting population and for seasonal down-slope migrants. The grey squirrel's presence depends on trees of sufficient age to produce acorns, cones, or other seeds. In addition, it primarily uses cavities in oaks as natal dens. Thus, occurrence in HF2hv stands may be dependent on the age of the coniferous stand and the presence of large oaks in those stands (summary based on Krause (2012)).

Golden-Mantled Ground Squirrel

The golden-mantled ground squirrel is a diurnal species associated with dry, rocky forest openings in mixed conifer and coniferous forest, generally above 4000 ft. elevation. It is an important food item for NOGO at those elevations, but because of its range and diurnal behavior, is not an important food item for fishers or CSO. This species hibernates for about 2/3 of the year, so is not available as winter prey. It is more likely to be found in young clear-cuts and along forest edges than in closed-canopy stands such as HF2hv (summary based on Wilson (2012)).

Dusky-Footed Woodrat

The dusky-footed woodrat, which is largely nocturnal, is the most important prey species for CSO in the lower elevations of the CSO's range (Williams et al. 1992). It is also a prominent prey species for the northern spotted owl, and relevant research on woodrats has been conducted in the ranges of both spotted owl sub-species. Woodrats are apparently much more important in fisher diets in California coastal areas than in the interior, with remains occurring in less than 2% of fisher scats collected in the Shasta-Trinity area (Golightly et al. 2006). They are probably taken opportunistically by NOGO, but are not noted as a prominent prey item (Hansen et al. 2012, Fig 8.1). Although most abundant in chaparral fields, where they would be inaccessible to CSO, dusky-footed woodrats also inhabit brushy young forest stands with high degrees of canopy cover over the rats' nesting sites (Williams et al. 1992, Sakai and Noon 1993). In both coastal and interior forests, mast-producing hardwoods such as tanoak, black oak, and live oaks are typically important components of forest woodrat nest sites, providing food, cover, and nesting material (Sakai and Noon 1993, Innes et al. 2007, Matell 1997). For instance, in second-growth mixed-conifer stands on the Plumas National Forest, Innes et al. (2007) found numbers of woodrats to be positively related to density of black oaks $\geq$13 in. dbh. As such, SPI's HF2hv may provide sufficient cover for woodrats, but the species' presence would be expected only where sufficient numbers of hardwoods or understory brush species are available.

Chipmunks

About five species of chipmunks occur in the area covered by the CCAA. As diurnal species, they occur as important food items of fishers and NOGO. Although there is some variation in the natural history among the species, they generally inhabit a wide range of forest conditions, especially brushy areas amid open canopy forested and riparian habitat. Chipmunks appear to tolerate a wide degree of variation in canopy cover and logging disturbance, and are abundant in thinned stands because of enhanced understory development, which is an important source of food and cover. They consume a wide variety of plants, fruits, seeds, and fungi. Thus, their presence in HF2hv is probably dependent on the conditions of canopy cover and understory brush within the stand (summary based on Innes (2012)).

Northern Flying Squirrel

The northern flying squirrel is a nocturnal species that is of very little importance as prey for fishers or NOGO, but is the most important prey for CSO in the upper elevation portions of the CSO's range. According to Williams et al. (1992), they are generally found above about 4,000 ft. elevation in the Yosemite region and down to about 3,000 ft. or lower in the northern Sierra Nevada. They are found in a variety of forest communities. Northern flying squirrels consume a wide variety of vegetative and occasionally animal food, but specialize on hypogeous (underground) fungi (truffles) during the snow-free period, and on aboreal lichens during winter. They are largely arboreal but come to the ground especially for fungi. Some studies have found much higher densities in late-seral forests than in other areas, but other studies have found the species in second-growth forests. These differences are perhaps related to presence or absence of hypogeous fungi, and to the presence of logs, snags, and arboreal cavities required for denning (multiple studies summarized in Williams et al. 1992). Effects of forest management on truffles are poorly understood. Waters et al. (2000) found truffle production was reduced in recently harvested stands, and truffle diversity remained reduced in stands ten years after thinning. Correspondingly, flying squirrel abundance was significantly less in shelterwood-logged forests (5-7 years after harvest) than in old-growth and mature forests. Further evaluation is needed regarded presence of truffles and flying squirrels in later seral stages of managed forests.

Conclusions

Carey (2000) found substantial differences among populations of northern flying squirrels, Douglas squirrels, and chipmunks in mid-seral forests that had been managed under different harvest rotations and methods. In general, chipmunks sometimes increased, Douglas squirrels showed little change, and flying squirrels declined. Although these species responded quite differently to management, reportedly none achieved the population densities found in un-managed late seral forest. These and other findings reported above strongly suggest that the presence of important prey species in young managed forests is a function of many interacting factors, especially the degree of retention and recruitment of key denning structures (large hardwoods and snags) and of food-producing species of sufficient age (especially large hardwoods).

As such, it is difficult to generalize regarding the potential contribution of SPI's HF2hv as foraging habitat for the Covered Species. Currently, based on the presence of the Covered Species in and near stands meeting this description, it is reasonable to expect that HF2hv is providing foraging habitat in the Mixed land class, especially at lower elevations where hardwoods are prevalent. However, this relationship has not been rigorously demonstrated. Whether the HF2hv that will be present in the Even land class will perform similarly remains a hypothesis. Based on the above analysis, the presence of desired prey species will depend on the retention of important habitat elements from previous Mixed stands, and recruitment of these elements during management of the Even stands.

Appendix I: SPI 2013c. Habitat Form 2Hv as support for California Spotted owl, Northern Goshawk, and Fisher territories

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**Draftv2 - RRHS as an Indicator of Heterogeneity in Land Classes** 6-16-2014

The SPI Fisher CCAA relies primarily on the Mixed land class to provide existing and increasing amounts of suitable habitat for female fisher. The distribution and juxtaposition of this habitat type is accounted for at three scales: 50 acre den stand, 500 acre den and support cores, and the 2,000 acre Territory Opportunity. Stands in the Mixed land class are the product of numerous partial harvest entries that have created a heterogeneous stand condition. An inventory of HF4 and HF2 (including HF2Hv) stands in the Mixed land class (SPI 2013b) demonstrated that on average there is approximately one apparent den structure tree per acre. Subsequent to the den structure tree inventory, the diameter distributions of the Covered Species Conservation Areas (CSCAs) inventoried (SPI 2013b) were provided to the Service. The diameter distribution statistics show a wide distribution of tree sizes and large standard deviation from the mean diameter, indicative of the heterogeneity of those stands.

The following discussion is intended to assess the heterogeneity of HF4 and HF2Hv stands in the Mixed land class using another metric associated with fisher habitat, specifically the Relative Resting Habitat Suitability (RRHS) index value (Zelinski et al. 2010). The RRHS index value for each plot within all CSCAs sampled for structures (2013b) along with each plot in the Camino and Weaverville Districts was calculated for the HF4 and HF2Hv Mixed land class stands. This was accomplished by using the RRHS Excel Spreadsheet model acquired from Dr. Zielinski.

As described in "HABITAT FORM 4" AS A REPRESENTATIVE OF HABITAT FOR COVERED SPECIES (SPI 2013a), SPI inventoried 131 fisher den sites on SPI lands using a "Cross Plot." The one-acre Cross Plot data from these female fisher den sites was applied to the stand scale to establish the threshold criteria for a stand to qualify as den habitat (HF4). We reasoned that since the one-acre area surrounding a den tree (described by the Cross Plot) is suitable for denning, applying those criteria to the stand scale is reasonable and responsible for describing den habitat conditions at the next larger scale, the stand. To apply the same logic using the RRHS as another indicator of suitability, SPI calculated the RRHS value at each of the 149 den sites currently identified. In addition, because the RRHS is defined as Relative Resting Habitat Suitability, we also calculated the RRHS at the 65 known fisher rest sites in our dataset of Cross Plots. The results are displayed in Table 1 below.

Table 1. Fisher Den and Rest Cross Plot RRHS Statistics

| Fisher Den Cross Plots (n=149) | RRHS Value |
|---|---|
| average | 0.2194 |
| median | 0.1452 |
| stddev | 0.2151 |
| min | 0.0028 |
| max | 0.8704 |

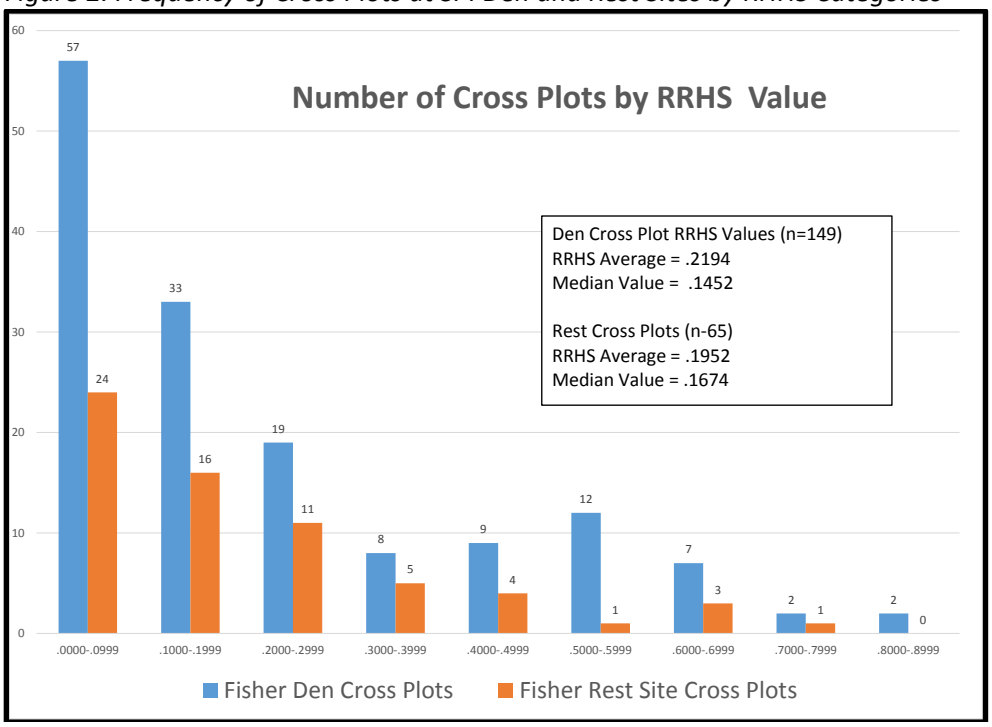
| Fisher Rest Cross Plots (n=65) | RRHS Value |
|---|---|
| average | 0.1952 |
| median | 0.1674 |
| stddev | 0.1828 |
| min | 0.0042 |
| max | 0.7331 |

Table 1 indicates that at the one-acre Cross Plot surrounding the known fisher den sites, the RRHS ranged from 0.0028 to 0.8704. For the establishment of a conservative threshold for a RRHS value for evaluation of suitability of HF4 and HF2Hv stands, we chose a RRHS ≥ 0.22, which is equal to the mean RRHS value of known fisher den sites in SPI forests, but greater than the RRHS value at 61.7% of those sites. Maintaining a conservative approach, we chose not to use the average value for SPI rest sites, which would have supported a 0.20 index.

Zielinski et al. 2012 provided a "strength of selection" index that explained why a RRHS value ≥0.35 could be considered strongly positive for selection, as originally suggested in Zielinski et al. 2010. The range

of correlative RRHS values from Zielinski et al. (2010, Figure 2B, p. 1584) is similar to the broad range of RRHS values found at SPI forests: however, the measurements on SPI land are aggregated lower in the index range (Figure 1). Zielinski et al. 2012 indicated "that below a RRHS value of 0.15, selection is quite strongly negative (selection values ranging from -2.9 to -30) and that selection is neutral when RRHS ranges from 0.15 to 0.35 (Fig. 3). Above 0.35 the selection values steadily increase". Despite the above statement that RRHS values less than 0.015 are strongly negative, 49% of our 149 den sites and 53.8% of our fisher rest sites had RRHS values less than 0.15. However, because the RRHS value of 0.22 is a very conservative estimate of the actual data from SPI fisher den sites, we will use it as our threshold, rather than 0.35. Therefore, the presence of a SPI Forest Inventory plot that has a RRHS value ≥ 0.22 will be the indicator of existing heterogeneity necessary for a female fisher to use SPI's HF4 and HF2Hv stands as suitable habitat.

*Figure 2. Frequency of Cross Plots at SPI Den and Rest Sites by RHHS Categories*




The plot threshold RRHS value of ≥ 0.22 now needs to be put in the context of the next larger scale of analysis, the stand. The stand scale threshold for the density of SPI Forest Inventory plots that meet the plot RRHS value threshold was informed by Niblett et al. (2013 unpublished). Niblett et al. (2013 unpublished, p. 24) reported that high RRHS values indicative of a den stand may be localized occurrences that do not need to occur contiguously at scales smaller than the stand scale. This means that relatively small areas of good denning habitat can cause a stand with relatively low forest density values (except for canopy cover) to be considered suitable habitat.

Niblett et al. (2013 unpublished) calculated the *k*-max value of stand attributes to determine their significance to female fisher territories within a very heterogeneous forest. The *k*-max value utilizes an aggregation of 10 inventory plots around a quadrature point. Niblett referred to this aggregation of plots as a "neighborhood." The *k*-max value is the highest value for an attribute found on any one of the 10 plots in the "neighborhood." The strength of the *k*-max value is that it provides a distributional context to the attribute value, since a "neighborhood" or *k*-max value is associated with a 40-acre area (i.e., 10 plots). For the entire study area, Niblett et al. reported an average inventory plot RRHS value of 0.079, a low RRHS value. However, the *k*-max analysis indicates that even in this landscape of poor RRHS values at least 10

percent of the plots in the den neighborhood have high RRHS values. Therefore, by extension our stand threshold density for inventory plots meeting the plot threshold RRHS value of ≥0.22 is at least 10 percent.

Niblett et al. (2013 unpublished) reported that the average k-max RRHS value in the 75% Kernel Density Estimate (KDE) was 0.333, and in the den "neighborhood" the k-max RRHS value was 0.458. Because the k-max value is a "best of" 10 plots, comparing the k-max values at the 75% KDE and "neighborhood" scale to the plot values reported for the HF4 and HF2Hv stands (Table 2) requires that the plot RRHS values be an aggregation of "best of" plots. At the inventory plots in HF4 that exceed the threshold of 0.22, the RRHS values average 0.4138, which is higher than the k-max RRHS value in the 75% KDE and slightly lower than the den "neighborhood" k-max value of 0.458. At the inventory plots in the HF2Hv type that exceed the threshold of 0.22, the RRHS values average 0.3734. Thus, the average quality of existing habitat in the HF4 and HF2hv plots that exceed the threshold of 0.22 is within the range having a strongly positive selection value as resting habitat by Zielinski et al. (2012).

Because the SPI inventory plot is a point sample within the heterogeneous HF4 and HF2Hv habitat types, the detection of existing sites with high RRHS values is uncertain, even with an inventory plot density of one plot every 4 acres. Thus, the occurrence of points with high RRHS values is likely underestimated.

Next, we evaluated the frequency of occurrence of plots in HF4 and HF2hv that exceed our RRHS index threshold value of 0.22. Table 2 below provides the proportion of plots that exceed the threshold value ≥ 0.22, and the average and standard deviations of the RRHS values for those plots.

Table 2. RRHS Values for Inventory Plots in HF4 and HF2Hv Habitat Forms

**RRHS Stats for 7 CSCAs**

| | RRHS >= .22 | | | | | |
|---|---|---|---|---|---|---|
| CSCA | % of Inventory Points in **HF4** | Average RRHS for plots with **RRHS >=.22** | St- Dev | % of Inventory Points in **HF2Hv** | Average RRHS for plots with **RRHS >=.22** | St- Dev |
| Sonora | 33.8% | 0.4264 | 0.1481 | 21.8% | 0.4038 | 0.1409 |
| Martell | 32.3% | 0.4001 | 0.1398 | 17.9% | 0.3942 | 0.1335 |
| Camino | 36.1% | 0.4252 | 0.1486 | 25.6% | 0.3829 | 0.1398 |
| Stirling | 34.0% | 0.3990 | 0.1384 | 22.7% | 0.3833 | 0.1326 |
| Sac Canyon | 29.3% | 0.3607 | 0.1130 | 17.6% | 0.3575 | 0.1100 |
| Weavervile | 22.6% | 0.3979 | 0.1425 | 15.5% | 0.3839 | 0.1358 |
| McCloud | 32.1% | 0.4872 | 0.1038 | 21.7% | 0.3083 | 0.0887 |
| All Area Averages | 31.4% | 0.4138 | 0.1335 | 20.4% | 0.3734 | 0.1259 |

Among the CSCAs described in Table 2, an average of 31.4% of individual inventory plots in the HF4 habitat type exceeded a RRHS value of 0.22. Thus, almost one in every three plots exceeds the average RRHS value found at the 149 fisher den sites measured in SPI forests. The 31.4% frequency of occurrence is much higher than the occurrence threshold of 10% inferred from the data of Niblett et al. (2013 unpublished). Thus the HF4 in the Mixed land class meets the RRHS measure of heterogeneity established for this CCAA.

The average number of individual inventory plots in the HF2Hv habitat type exceeding a RRHS of 0.22 is 20.4%, indicating that approximately one in every five plots exceeds the average of the RRHS value found at the 149 fisher den sites measured in SPI forests. The 20.4% frequency of a plot having a RRHS value ≥ 0.22 occurring is higher than the occurrence threshold of 10% derived from the data of Niblett et al. (2013 unpublished). Thus, the HF2Hv in the Mixed land class meets the RRHS measure of heterogeneity established for this CCAA. The frequency of RRHS values ≥ 0.22 in the HF2hv land class supports the

contention that HF2Hv is quite close to meeting the HF4 standard fisher denning habitat, as described in SPI (2013c, p. 3-4).

Finally, we evaluated inventory plots in HF4 and HF2hv that exceed a RRHS index threshold value of 0.35. Table 3 below provides the percentage of plots that exceed the threshold value ≥ 0.35, and the average and standard deviations of the RRHS values for those plots.

Table 3. RRHS Values for HF4 and HF2Hv Habitat Forms

| RRHS Stats for 7 CSCA's | | | | | | |
|---|---|---|---|---|---|---|
| | RRHS >= .35 | | | | | |
| CSCA | % of Inventory Points in **HF4** | Average RRHS for plots with **RRHS >=.35** | St- Dev | % of Inventory Points in **HF2Hv** | Average RRHS for plots with **RRHS >=.35** | St- Dev |
| Sonora | 21.2% | 0.5149 | 0.1145 | 12.3% | 0.5015 | 0.1103 |
| Martell | 18.3% | 0.4966 | 0.1095 | 10.1% | 0.4872 | 0.1038 |
| Camino | 22.5% | 0.5143 | 0.1160 | 12.3% | 0.5003 | 0.1133 |
| Stirling | 18.6% | 0.4974 | 0.1112 | 11.2% | 0.4914 | 0.1056 |
| Sac Canyon | 13.3% | 0.4613 | 0.0894 | 7.9% | 0.4560 | 0.0877 |
| Weavervile | 11.9% | 0.5028 | 0.1178 | 7.6% | 0.4961 | 0.1093 |
| McCloud | 12.7% | 0.4575 | 0.0938 | 5.1% | 0.4386 | 0.0867 |
| All Area Averages | 16.9% | 0.4921 | 0.1075 | 9.5% | 0.4816 | 0.1024 |

As shown in Table three the range for the proportion of inventory plots with an RRHS value ≥0.35 is from 11.9% to 22.5% for HF4 stands and 5.1% to 12.3% for HF2Hv stands. At the SWSA Niblett et al. (2013 unpublished) reported that in a den quadrature the frequency of plots with an RRHS value ≥0.35 was 1 in 10 or 10%. In the CSCAs analyzed, the frequency of plots in HF4 that meet or exceed an RRHS value of 0.35 exceeds the rate of occurrence reported by Niblett for Den quadratures.

The average number of individual inventory plots, in the HF2Hv habitat type, with a RRHS value of ≥0.35, averages 9.5% and ranges from 5.1% to 12.3%.

Conclusion

The RRHS value of 0.22 is very conservative estimate describing known denning habitat on SPI lands. The inventory plots in the Mixed land class that qualify as HF4 and have a RRHS value ≥ 0.22 occur at a high frequency (1 in 3) and have an average RRHS value of 0.4138. The inventory plots in the Mixed land class that qualify as HF4 and have a RRHS value ≥ 0.35 occur at a high frequency (1 in 6) and have an average RRHS value of 0.4921.The inventory plots in the Mixed land class that qualify as HF2Hv and have a RRHS value ≥ 0.22 occur at a high frequency (1 in 5) and have an average RRHS value of 0.3734. The inventory plots in the Mixed land class that qualify as HF2Hv and have a RRHS value ≥ 0.35 occur at a high frequency (1 in 10.5) and have an average RRHS value of 0.4816. Thus, the HF4 and HF2Hv in the Mixed land class meets the RRHS measure of heterogeniety established for this CCAA and should indicate that the HF4 and HF2Hv habitat types are likely suitable for fisher den and support habitats.

References:

Zielinski et al. (2010) William J. Zielinski, Jeffrey R. Dunk, J. Scott Yaeger, David W. LaPlante, **"Developing and testing a landscape-scale habitat suitability model for fisher (*Martes pennanti*) in forests of interior northern California"** *Forest Ecology and Management, Volume 260, Issue 9, 30 September 2010, Pages 1579-1591*

Zielinski et al. (2012) William J. Zielinski, Jeffrey R. Dunk, Andrew N. Gray, "**Estimating habitat value using forest inventory data: The fisher (Martes pennanti) in northwestern California**" *Forest Ecology and Management, Volume 275, 1 July 2012, Pages 35-42*

DRAFT Forest Conditions within Hexagons May 30, 2014

1. Introduction

The CCAA has proposed establishes minimum thresholds for fisher denning and denning support habitat. These minimum thresholds are the points at which a forest stands begin to be considered contributing to fisher habitat and/or the minimum configuration on the landscape where combinations of stands begin to function as fisher habitat. However, if the establishment of minimum thresholds is perceived as the intended goal or maximum of such habitat SPI intends to provide, this perception is incorrect. At the stand scale, the habitat threshold is the first point in a stand's life when it can be considered suitable habitat and be counted as such when evaluating the hexagon classification in which it resides. At the hexagon scale, the habitat thresholds are the minimum amounts at which there is enough suitable habitat to begin to function as fisher Support or Den Cores. In order to understand why these thresholds will be regularly exceeded, the dynamics of habitat production must be considered in the context of sustained yield forest management as demonstrated in the SPI's Option A.

2. SPI Option A

The intent of the California Forest Practices Act (CFPA) is to assure the "maximum sustained production of high-quality timber products is achieved while giving consideration to values relating to sequestration of carbon dioxide, recreation, watershed, wildlife, range and forage, fisheries, regional economic vitality, employment, and aesthetic enjoyment." (California Public Resources Code §4513) The CFPRs require timberland owners demonstrate they are meeting their management objectives while achieving "Maximum Sustained Production of High Quality Timber Products" (14 California Code of Regulations §933.11) (MSP).

SPI demonstrates its MSP using §933.11(a). The initial review of the *SPI Option A Demonstration of Maximum Sustained Production* (SPI Option A) was completed and approved by the California Department of Forestry and Fire Protection in 2003. The first decade compliance review for the period 1999 to 2008 of the SPI Option A was completed in 2012 (See attached Cal Fire letter).

Sierra Pacific Industries used the following guiding principles to aid in our land management decisions: 1) SPI's overall management objective of providing for a sustainable, stable to increasing, predictable, and cost-effective supply of raw materials, for a variety of forest products, will primarily determine future landscape conditions, 2) SPI believes that through planning and research the achievement of this overall management objective will result in healthy, fire resilient, and productive forests capable of providing moderate- to high-levels of other forest values, 3) Disturbance is an inherent and required component of California forest stands and landscapes, 4) Forest management activities can be conducted in a manner that takes current forest conditions and trends them toward the stand density conditions of pre-European forest disturbance regimes, 5) Forests prior to European management influences were not subject to modern demands for wood products, 6) Landscapes and stands that are capable of supporting a wide range of vertebrate wildlife species, including both species thought to be "at risk" and species thought "to benefit" from forest management activities, are key elements of what is termed a healthy forest, and 7) A management program that combines research and

monitoring with effective management adaptation can describe and create the stand and landscape conditions of healthy and productive forests, over both the short and long-term.

## 2.1. Duration

The SPI Option A is a long-term plan (100-year term) for managing the balance of timber growth and harvest from its ownership. SPI's minimum harvest rotation age is 80 years. The SPI Option A is considered a key component of its overall business plan which provides a sustainable, stable to increasing, predictable, and cost-effective supply of raw materials for manufacturing a variety of forest products. The SPI Option A is an existing regulatory mechanism under which SPI conducts its operations. SPI is not contractually bound to this plan and thus has the discretion to modify or completely change its Option A plan. However, to exercise a change in the current Option A requires a new planning effort including a process of public disclosure and Cal Fire approval.

## 2.2. Management Constraints

The CFPR demonstration of MSP requires the projected inventory resulting from harvesting over time shall be capable of sustaining the average annual yield achieved during the last decade of the planning horizon. Meeting this definition of sustainability does not require a non-declining yield. The SPI Option A is a volume- and area-regulated model that demonstrates the balance of growth and harvest over time on a decade-by-decade basis. The SPI Option A is a conservative estimate of growth and yield. The SPI Option A recognizes and integrates those timber management constraints limiting the maximization of timber growth opportunities on the SPI ownership. Constraints that limit the SPI Option A include: watercourse buffers, visual aesthetics, botanical and wildlife sites, unit adjacency, and watershed cumulative effects. SPI also imposed three other constraints into its Option A: 1) non-declining yield, 2) Subsequent clearcuts must adjoin a previous decade's clearcut unit, 3) a decadal planning adjacency for clearcut harvest units (harvesting is planned for 10 years but actual harvest timing may be less due to previous planned harvest delays).

SPI has a conservative business philosophy, which is consistent with the non-declining yield and 10-year planning adjacency constraint. SPI operates numerous lumber manufacturing facilities in California. The non-declining yield constraint provides an even-flow "worst case" yield scenario from which to conduct long-term business management planning for those manufacturing facilities. By carefully constraining current harvest levels and investing significant capital in silvicultural systems which increase stand growth rates, our non-declining Option A projects the standing inventory volume will triple, in turn allowing harvest levels to more than double. The planning and investments overtime will also sustain the 4,000 SPI employees and lead to habitat conditions that benefit species like the fisher.

The choice for limiting harvest with a non-declining yield affects the distribution and harvest unit allocation in an interesting way. Annual growth on the timberland will be at a much higher sustainable level after the first rotation on the available portion of the landbase dedicated to evenage management. The non-declining yield constraint causes the area harvested to systematically decline in each decade of the first rotation and evenly across all land classes, so that there are no declines in yield. To reach maximum sustained production with a non-declining yield and adjacency constraints, harvest unit

allocation must be done systematically such that the "average stand" is harvested. In order to harvest the "average stand," harvesting must be distributed across all representative soil site classifications and volume per acre. Essentially, each representative stand condition needs to be harvested proportionally to its abundance across the ownership. Harvesting the soil site classes proportionally to their abundance will also allow for yield from the ownership to plateau at a relatively stable annual volume at the end of the first rotation (i.e., 80 years). Harvesting timber stands with varying volumes per acre is necessary to avoid spikes and rapid declines in the annual harvest volume throughout the term of the plan and is somewhat inevitable with an even initial distribution of regeneration units and adjacency constraints. For example, if the Option A allowed the area allocated for harvest in the first two decades to contain disproportionately higher timber volume per acre than the average, the result would be a spike in harvested volume early in the planning period and then an eventual decline in volume during later decades when additional acres would not be available for harvest because of the area regulation constrained to 80 years. While this would condition may be ameliorated at the end of the planning period it would violate SPI's self-imposed non-declining yield constraint that is central to its Option A. Another example would be if stands having a high soil site classification were harvested at a higher frequency than stands with a low soil site classification. This example would result in a peak in volume when those high soil site classification stands became commercially available to thin and then following that peak, a reduction in available volume would occur as the lower soil site classification land continued to grow towards maturity. Harvesting a disproportionate amount of either high or low soil site classification stands or high or low volume per acre stands will cause an oscillation in the yield volume at the end of the first rotation. Therefore, the objective is to cut the "average stand," which is achieved by harvesting proportionally across the full spectrum of stand conditions during each decade of the plan.

The initial modeling effort for the SPI Option A MSP was performed on 400,000 acres of the ownership, representing a 27% sub-sample of the total SPI ownership. Harvest modeling was conducted on the sub-sample to determine what sustainable harvest level could be achieved while meeting the various timber management constraints that effect the ownership. The modeling demonstrated that due to the variability of the ownership, to meet the non-declining yield constraint and harvest the "average stand," harvest unit location was not as important as the even distribution of harvest units. The modeling also showed that because of the relatively small SPI clearcut size (17-acre average) and the clearcut acreage needed in each decade to balance the maximum available harvest while meeting non-declining constraints, the proposed harvest distribution was shown to be representative of harvesting the "average stand."

The constraint requiring even-aged units in subsequent decades to be placed so they adjoin the previous decade's clearcut unit causes the even distribution of units within a watershed to be repeated. It prevents the targeting of high soil site classification and high volume/acre areas disproportionately to their occurrence across the landscape and thus, perpetuates the harvesting of the "average" stand. The requirement that clearcuts in subsequent decades must adjoin a previous decade's clearcut minimizes the fragmentation of the Mixed land class.

The 10-year adjacency constraint on clearcuts allows the regeneration in clearcuts to double in height, develop a larger canopy and root system, and also allows other vegetation within the clearcut to become fully established in the growing space between trees. The 10-year adjacency constraint is a conservative approach to minimizing the potential peak flow effects in watersheds where clearcut

silviculture is utilized. The SPI Option A harvest activities are generally implemented on a planning watershed basis, once every decade. Limiting SPI Option A harvest activities to approximately once every 10 years within a watershed allows for all planned harvesting to be analyzed comprehensively and provides an accurate assessment of potential watershed effects, since all harvesting planned for that decade has been identified.

2.3. Silviculture

Sierra Pacific Industries manages two types of stand structures, even-aged and mixed-aged. Stands being managed for an uneven-aged structure are generally constrained by site specific conditions that make even-aged management infeasible. Site specific constraints that cause a stand to be managed in an uneven-aged structure include but are not limited to: proximity to water, geologic instability, soil site classification, elevation, important aesthetic values, archeological features, sensitive botanical resources, conservation commitments, and wildlife resources. Constraints are initially identified remotely using GIS information layers including: digital elevation data, watercourse and lake data, digital ortho-photography, geology maps, soil data, wilderness and recreation area boundary information, tax parcel data (e.g., zoning). A project level assessment is conducted by a Registered Professional Forester (RPF) at the time of THP preparation.

The mixed aged stands are generally harvested using the single tree selection and shelterwood preparatory silvicultural systems. Occasionally the group selection method will be utilized. Uneven aged stands generally have a harvest entry once every 20 to 30 years. Uneven aged stands associated with a watercourse and lake protection zone (WLPZ) that are contiguous with an even-aged stand are entered only when the adjacent even aged stand is harvested which is approximately once every forty years or longer. Harvest trees within a WLPZ are marked prior to timber operations by a RPF or a designee. In general uneven-aged stands do not have investments made in regeneration establishment or release, except in areas harvested by group selection or shelterwood prep methods. These areas can be regenerate with trees naturally, however generally SPI plants these units. Group selection harvest areas are up to 2.5 acres in size and cannot constitute more than 20% of the harvest area. Group selection harvest areas will resemble the clearcut method only at a smaller patch size.

The stands being managed for an even-aged structure have an average rotation age of 80 years. Immediately following harvest an even-aged stand area (called a “unit”) may require activities that prepare it for planting. Site preparation activities are designed to reduce fuel loading, reduce compaction, and/or make the soil surface more accessible for planting. Site preparation activities include one or more of the following: broadcast burning, piling and burning, mastication, and ripping. Even aged stands are artificially regenerated by planting conifer seedlings. Seedlings generally come from seed produced within the same seed zone and elevation as the harvest unit. Following planting, the plantation will be evaluated annually for the first three years to determine if weed competition is affecting conifer seedling establishment. If the plantation is thought to require weed control, a California Certified Pest Control Advisor will prescribe the appropriate herbicide treatment. A California Qualified Applicator will supervise the application of the herbicide. Herbicide applications reduce brush species competition, however this is a short lived effect (<3 years), and plant species richness within even-aged units were similar to managed uneven aged stands (James et al. 2012). SPI even-aged units

tended to support more graminoids and forbs while uneven-aged units were richer in trees and brush species (James et al. 2012). Within 10 years following planting, the plantation will be evaluated for conifer tree density. If the density of trees is greater than approximately 150 trees per acre, then pre-commercial thinning will be prescribed to reduce the tree density to approximately 130 trees per acre.

Pre-commercial thinning usually involves men walking through the plantation with chainsaws and cutting down excess trees in a manner that attempts to space the saplings evenly to 18 feet. Where feasible, pre-commercial thinning may be mechanized to recover the biomass material. The wood may be used as fuel for power generation. More importantly, fuel loads are reduced in the plantation. Thinning can greatly increase understory plant density in ponderosa pine forests (Moore and Deiter 1992, Covington et al. 1997). Herbaceous plant growth, both grasses and forbs, typically increases when additional light reaches the forest floor. Following a pre-commercial thinning the stand may be pruned.

Pruning involves the removal of the conifer trees lower branches in order to promote the growth of wood that is free of knots. A secondary benefit from pruning is that it raises the limbs above the forest floor may prevent a ground fire from reaching the tree crowns, making the stand more resilient to wildfire. Pruning has more recently been limited to strategic areas, public-traveled roads and in fuel breaks where fire is the overarching concern.

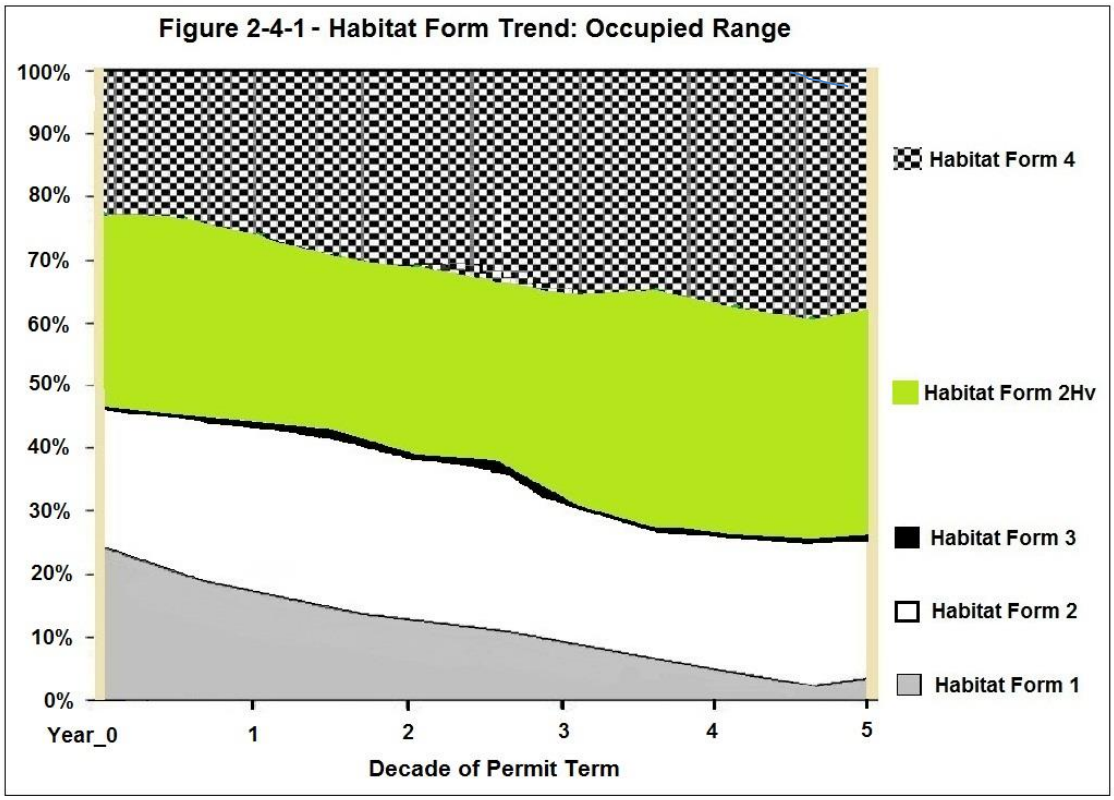
When the even-aged stand is approximately 40 years old it will be commercially thinned to approximately 65-70 trees per acre. In our growth projections we usually schedule commercial thinning in the 5$^{th}$ decade, this is a result of our 20% diameter growth reduction as requested by CalFire in our current Option A. The next entry will be at or near rotation age and it will involve either the final harvest or an additional commercial thinning which would reduce the stocking to 32 trees per acre and allow the extension of the rotation age approximately another 20-40 years. Even-aged stands created through clearcut silviculture will decline through the life of the SPI Option A Plan. The relative proportion of the land, subject to clearcut silviculture will decrease from a maximum of 22%-25% in decade 1 (1999-2009) to 16%-18% in decade 2 (2009-2019), and then to 8%-13% (2019-2029) in decade 3, 3%-5% in decade 4, and then will remain a low percent annually (1%-3%) of the land for the duration of the plan. This means that 32%-45% of the Enrolled Land will not be clearcut during the term of this CCAA. A fully regulated 80-year rotation would lead to an annual harvest of 1.2% of the land available for evenaged management.

## 2.4. Habitat Integration with yield flow and management actions

As discussed earlier, the implementation of the SPI Option A requires that harvest decisions not discriminate for or against a certain site or stand type and units be evenly distributed over the ownership such that the “average stand” is harvested in equal amounts. This harvest allocation process is intended to achieve a volume and acreage regulated forest with a non-declining yield. The even distribution of harvest units while accomplishing the harvest of the “average stand” also fragments the Mixed land class. In order to minimize the fragmentation of the Mixed land class SPI places sequential harvest units (ex. 2$^{nd}$ and 3$^{rd}$ decade harvest units) so that they adjoin the prior decades harvest unit. Grouping units will cause individual 15-20 acre even-aged stands to function as larger (40-60) acres even-aged stands as they mature and minimizes long-term (starting in the fifth and sixth decades) stand fragmentation. Further reduction in stand fragmentation will result from higher average stand

volumes, which, constrained by non-declining flow, will limit the decadal harvest acreage necessary to achieve the sustainable harvest levels.

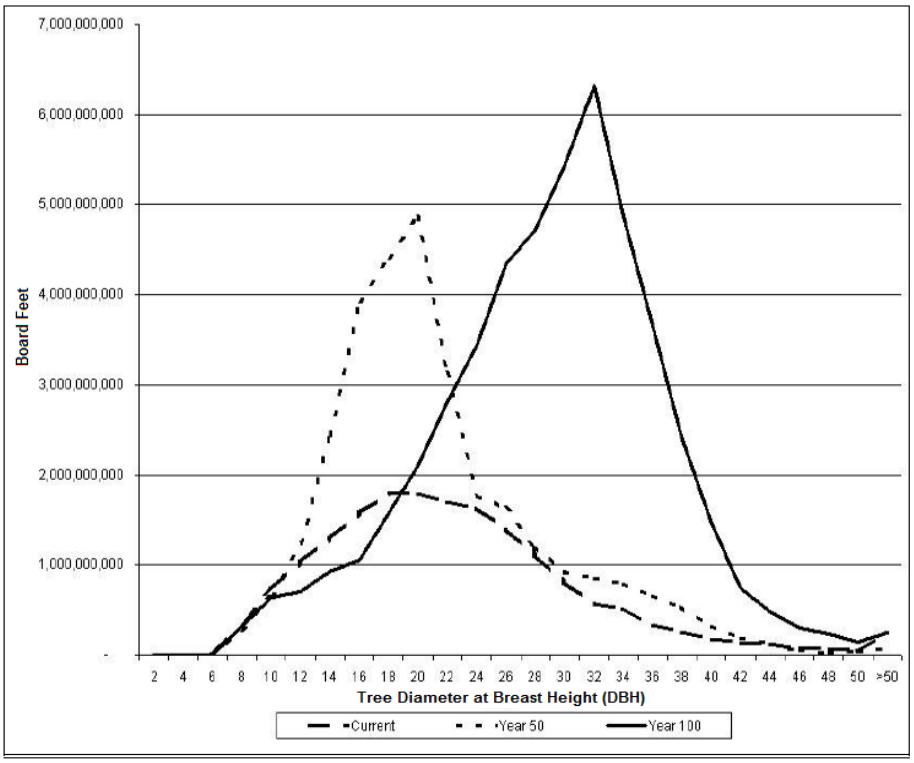
The variability in the current distribution and abundance of Habitat Forms is the result of historic management, current and past wildfire events, and other practices implemented prior to the time the SPI Option A was approved. Figure 2-4-1 shows the approximate change in the proportion of Habitat Forms in the occupied range of the fisher during the term of the permit. Year_0 in Figure 2-4-1 is 2013.




The SPI Option A favors even-aged management because those methods provide increased stand growth over an uneven-aged systems. The monetary investments made in utilizing even-aged silviculture (planting, vegetation management, pre-commercial & commercial thinning) will cause future SPI forests to have a significantly higher annual growth rate and eventually higher biomass volume per acre and also increase the average diameter of the trees growing in those stands. The increases in stand volume, and more importantly average tree diameter, are the result of controlling the density of trees within a stand. Figure 2-4-2 below shows this increase in average tree diameter over time. The initial shift in average tree diameter during the first 50 years of the plan is the result of Mixed land class stands growing larger. During decades 6 through 10 the average size of trees increased due to the increased volume contribution of Even land class stands. Larger tree diameters are achieved in the even-aged stands because fewer trees per acre will provide more growing space (water, nutrients and sunlight) available for individual tree growth. Density control is more easily accomplished in an even-aged stand because the trees are of similar size and silvicultural actions are completed uniformly at only one or two

intervals during the stands 80 year rotation not continually every 7-15 years. Repeated entries into an uneven-aged forest makes achieving the optimum density and distribution of tree sizes difficult since harvesting requires tree removal that necessitates the use of heavy equipment. Heavy equipment, due to its large size, causes damage to the residual trees including those that are intended to be future crop trees. The degree of damage will vary depending on the individual operator, but a degree of stand damage will occur. Stand damage will cause a departure from the appropriate stand density and/or mix of tree sizes thus tree growth rates will decline, regeneration goals are not met, and harvest rates therefore must decline or be set at much lower starting rates to remain sustainable. Due to the lack of sunlight regeneration of the native intolerant species like pines and to some extent Douglas-fir also causes species shifts in stands managed using uneven-aged silvicultural prescriptions. SPI also utilizes whole tree logging where it is feasible in order to remove excess slash from the unit being harvested. In both even and uneven aged harvest areas this practice will reduce the fine fuel loading and make those stands more fire resilient.

**Figure 2-4-2: Diameter Distribution Comparison Over Time**




## 2.5. Riparian Forest

Riparian forests on Sierra Pacific Industries are the forest stands found within the watercourse buffers associated with a perennial water source. Perennial water sources are defined by the CAFPR's as either a class I or class II or IV depending on their characteristics. The CFPR's require minimum buffer

widths and retention standards that are intended to protect the beneficial uses of water[2]. The width of the watercourse buffer varies by harvest method, silviculture, and the steepness of the terrain. The watercourse and lake protection rules require the maintenance of vegetation structure diversity and a total canopy cover of at least 50% retained after harvest, of which the existing overstory canopy shall contribute at least 25%. The canopy covering the ground shall be left in a well distributed multi-storied stand configuration composed of a diversity of species similar to that found before the start of operations. The standard large tree retention requirement calls for the retention of two live trees ≥16" dbh/acre, within 50 feet of the water transition line and that are at least 50 feet tall.

In watersheds that support anadromous salmonids the protection standards vary depending if the channel is confined or has a migration zone (unconfined). For confined and unconfined channels the CAFPR's require a core zone of 30 feet immediately adjacent to and extending from the Watercourse Transition Line (WTL) on either side of the channel. The core zone is essentially a "No operations zone." An "outer zone" extends from the outer edge of the core zone. The outer zone must maintain at least 70% overstory canopy closure and either the 7 or 13 largest trees (live or dead), on every acre, depending on if the channel is confined (7) or unconfined (13).

In recognition of the high non-timber values associated with riparian areas, Sierra Pacific Industries manages riparian forests for their contribution to water quality and wildlife. The riparian forest makes up approximately 8 to 15% of the Sierra Pacific Industries ownership. The proportion of the ownership having riparian forests is higher where steeper terrain occurs than where the terrain is flatter. In areas where the logging method is cable the proportion of land in riparian forest is approximately 15% whereas on lower slope class areas utilizing the tractor yarding method there is approximately 8% riparian forest. The dendritic pattern of these riparian forests serves to provide connectivity between habitats on Sierra Pacific Industries and to adjoining ownerships.

A strategy to improve the functionality of these riparian forests for wildlife habitat connectivity was included in the SPI Option A MSP during the harvest modeling. Due to the long rotation age of SPI's even-aged forest units (minimum 80 years) there is enough harvest scheduling flexibility to use a harvest model constraint that forced planned harvests to occur on one side of a perennial watercourse or the other but not both sides of a watercourse along the same section of stream, in the same decade. In some instances harvest on both sides of a perennial watercourse cannot be feasibly avoided due to topography or access constraints, but these instances are an exception to the rule. Staggering even-aged harvests adjacent to a perennial watercourse minimizes the constriction of the forest canopy cover that occurs when an even-aged timber harvest unit adjoins the riparian forest buffer. This is because during the time (10 years) between watershed harvest entries the canopy cover regrows both in the riparian forest and the clearcut unit. On average the canopy cover at two feet in height is 50% or greater in post pre-commercially thinned even-aged units that are 10 years of age or older[3]. Thus the riparian forest will be connected to a larger forest unit that has at least 50% or greater fisher canopy along one side of the riparian forest or the other, for the length of the watercourse. Maintaining the overall width of the forest corridor may help the riparian forest function more effectively for animal

**2** 14 CCR Article 6 Watercourse and Lake Protection: §§936, 936.2, 936.4, 936.5
**3** Canopy Regrowth in Planted Forests on Sierra Pacific Land, Murphy, 2008.

dispersal as the available travel way is wider than a harvest scenario that does not meet this adjacency rule. The riparian forests on SPI have these average characteristics.

| Range | Trees / Acre >5" | Basal Area / Acre | Conifer Snags / Acre | Hardwoods >16" | Conifers>30" | | Canopy cover |
|---|---|---|---|---|---|---|---|
| Occupied | 157.2 | 142.4 | 17.4 | 5.9 | 3.3 | | 100.00% |
| Unoccupied | 123.8 | 134.5 | 17.9 | 2.7 | 3.9 | | 67.50% |

2.6. Habitat Availability & Distribution

Habitats occurring on Sierra Pacific Industries are the result of intentional management actions and physical acts of nature which occur stochastically. Habitats available to female fisher have been assessed at the scale of a den or support core (500-ac. hexagon) and the trend in Territory Opportunities summarized by Covered Species Conservation Area (CSCA). Habitats that are considered suitable for female fisher use were evaluated at several scales: 1) structure (SPI 2013b), 2) stands (Hexagon analysis), and 3) home ranges (Territory Opportunity). ND structures are those features in the forest that support the Nest / Den activities. The characteristics of the ND structures associated with fisher have been informed by the cross plot inventories performed on structures successfully used by fisher occurring on SPI managed forest habitats. As previously shown in the structure inventory supplemental report, the majority of the den sites are found in black oaks (47%), and a majority of the micro-structures are cavities (52%). The average dbh of den trees in Black oak was 24.8” dbh; however the black oak diameter classes most frequently used were: 16” dbh – 6 trees; 18” dbh – 5 trees; 20” dbh – 11 trees, 22” dbh – 9 trees, and 24” dbh – 5 trees (SPI data unpublished). The SPI forest was inventoried for the presence of potentially suitable den structures (SPI 2013b and fisher supplemental data). The den structure inventory demonstrates that these features occur relatively frequently in Habitat Form 2 and 4 stands at a rate of approximately one potential den structure per acre.

The heterogeneity of the Habitat Form 2Hv and 4 stands in the Mixed land class have been substantiated with a well distributed sample over 40% of the enrolled lands. The inventory sample of the Habitat Form 2Hv and 4 stands reported those stand’s diameter distribution and the Relative Resting Habitat Suitability (RRHS) scores calculated for at each inventory plot. The results of the sample of the Habitat Form 2Hv and 4 stands showed a very broad range of diameters in the Mixed land class (2”- 98” dbh) and a variation around the average quadratic mean diameter of generally 100%. The number of inventory plots with a RRHS value ≥0.2200 was 1 in 3 in Habitat Form 4 and 1 in 5 in Habitat Form 2Hv. The average RRHS value of the inventory plots scoring ≥0.2200 was 0.4138 in Habitat Form 4 and 0.3734 in Habitat Form 2Hv.

The hexagon analysis is a detailed estimation of how the Enrolled Lands will perform at providing female fisher habitat in quantities and in a distribution that is meaningful to the biology of fisher at the territory scale. The hexagon analysis demonstrates that the current Year_0 condition of 74.2% of the Enrolled Lands in the Mixed land class combined with the SPI Option A management constraints together with the growth of retained Mixed land class and regenerated stands the Enrolled lands will maintain and increase the number of Territory Opportunities. (Management constraints include a declining harvest acreage, distributing the even-aged units across the landscape, and placing subsequent

even-aged units adjacent to previous units.) The accounting of Territory Opportunities over the term of the permit is displayed in Figure 2-6-1, which shows that in the occupied range the overall density of Territory Opportunities nearly doubles during the term of the permit. Figure 2-6-2 shows the results from the Territory Opportunity accounting analysis for all of the Enrolled Lands. Both of the Figures 2-6-1 and 2-6-2 show that the number of Territory Opportunities increases at a rate that far exceeds the potential displacement of fisher due to habitat harvest.

*Figure 2-6- 1*

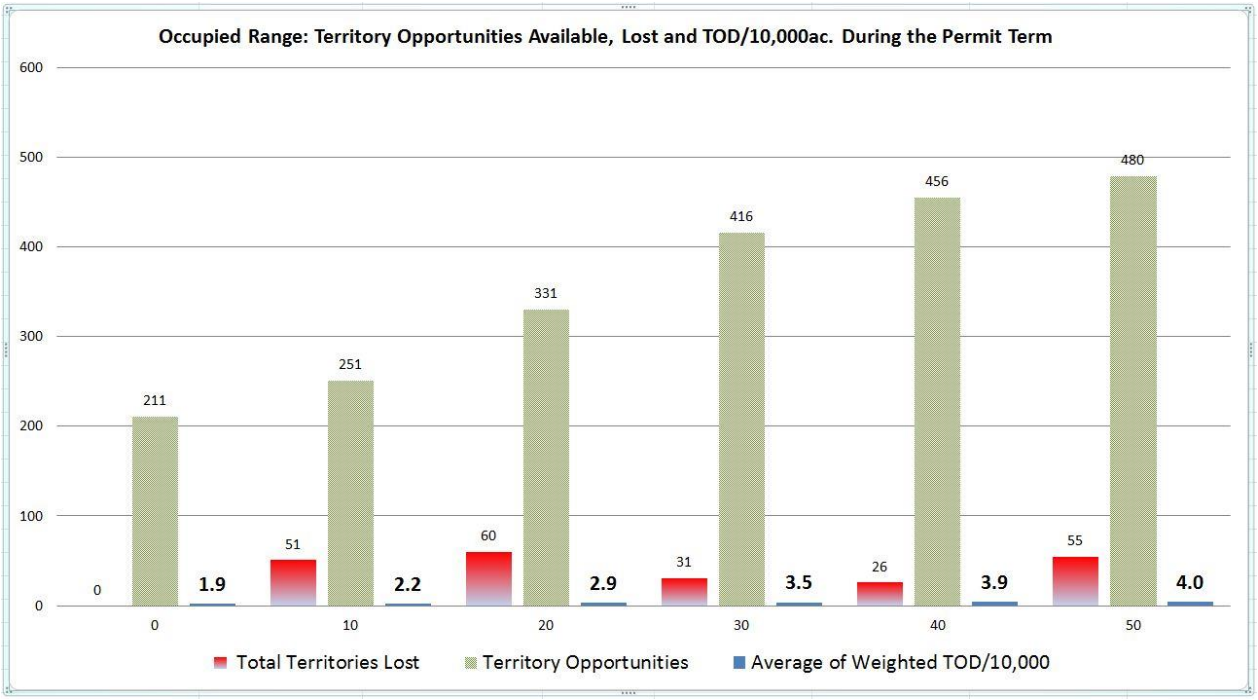
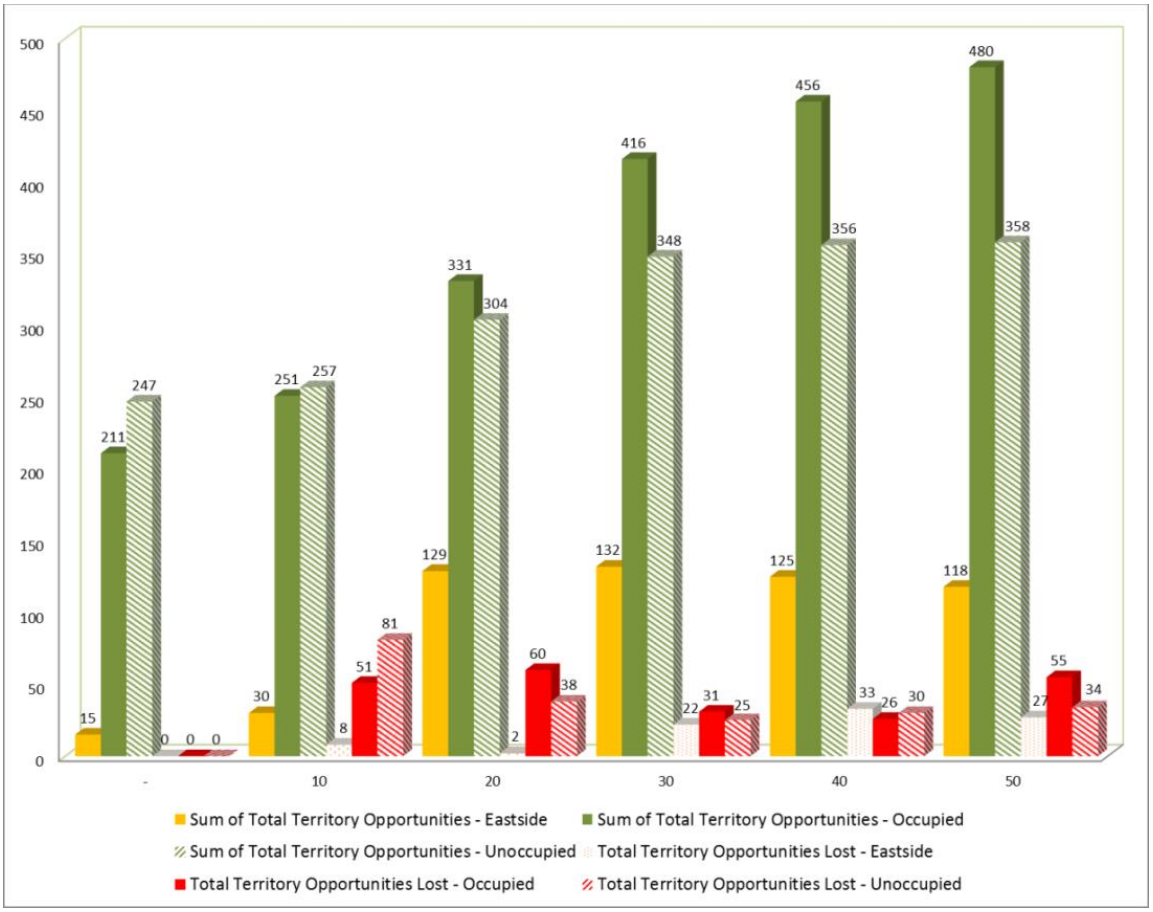


*Figure 2-6- 2*




The SPI Option A management constraints also maintain habitat connectivity across the landscape. This is demonstrated in part by the general trend for increasing Territory Opportunities, but also by the size of the Contiguous Core Stand found in hexagons across the Enrolled Lands. A Contiguous Core Stand is a contiguous den stand ≥50 ac. that consists of a minimum 30 acres of HF4 and 20 acres of HF2Hv present in a hexagon and then all other HF4 or HF2Hv stands that are also contiguous to the den stand. The average Contiguous Core Stand in the 5140 hexagons in Year_0 is 206 acres and in Year 50 the average Contiguous Core Stand is 197 acres. These averages contiguous core stands are found in an average hexagon containing 277 acres of SPI ownership.

The threshold for meeting a Den Core hexagon is at least one Contiguous Core Stand (50 acres as described above), 30% of the hexagon must be HF4, and 50% in total must be HF4 and/or HF2Hv. To qualify as a Support Core hexagon the percent HF4 and HF2Hv must exceed 50%. All other hexagons that have 50 acres of SPI ownership are classified as Currently Not Habitat (CNH) hexagons.

Considering the Den and Support Core thresholds and the CCS analysis, the amount of HF4 and HF2Hv that is contiguous within the average stand (including hexagons that are classified as CNH) is >70% HF4 and HF2Hv. The decadal statistics for the amounts of HF4 and HF2Hv by Occupied and Unoccupied Region are shown in Table 2-6-3 below.

Table 2-6-3

| | Den Core Hexagons | | | | | | Support Core Hexagons | | | | | | Currently Not Support or Den Core Hexagons | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (YYY) | | | | | | NYY, | | | | | | (YNY, YNN, NNY, NNN). | | | | | |
| Year | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | Acres HF4 & 2Hv | % | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | Acres HF4 & 2Hv | % | Average Size (ac.) | n | Acres HF4 | Acres HF2Hv | Acres HF4 & 2Hv | % |
| 0 | 324 | 1476 | 175.1 | 72.0 | 247.2 | 76% | 247.28 | 1414 | 39.75 | 137.43 | 177.2 | 72% | 264.87 | 2280 | 24.02 | 37.87 | 61.9 | 23% |
| 10 | 317 | 1717 | 182.3 | 48.3 | 230.6 | 73% | 244.75 | 1727 | 29.28 | 138.67 | 168.0 | 69% | 269.50 | 1726 | 34.49 | 43.39 | 77.9 | 29% |
| 20 | 317 | 2305 | 167.8 | 57.7 | 225.5 | 71% | 247.19 | 1673 | 49.78 | 130.09 | 179.9 | 73% | 241.10 | 1192 | 37.32 | 40.48 | 77.8 | 32% |
| 30 | 316 | 2721 | 155.6 | 76.9 | 232.5 | 74% | 235.16 | 1642 | 56.49 | 117.23 | 173.7 | 74% | 231.44 | 807 | 45.20 | 37.54 | 82.7 | 36% |
| 40 | 311 | 3014 | 157.1 | 78.8 | 235.9 | 76% | 226.36 | 1486 | 59.30 | 105.70 | 165.0 | 73% | 235.08 | 670 | 38.03 | 45.61 | 83.6 | 36% |
| 50 | 295 | 3016 | 163.1 | 71.1 | 234.2 | 79% | 260.12 | 1573 | 65.57 | 120.13 | 185.7 | 71% | 227.96 | 581 | 33.99 | 40.27 | 74.3 | 33% |

The Habitat Form 4 stands contain a high frequency of large (≥22" dbh) and old (≥80 years) trees found on the Enrolled Lands. Habitat Form 4 stands are and will be distributed in the unregulated portion of the Enrolled Lands (Mixed land class). The Habitat Form 4 stands either exist in that form currently or will grow into that condition from a Habitat Form 2 stand. In the regulated portion of the Enrolled Lands, Habitat Form 4 stands are the result of the establishment and growth of Habitat Form 1 stands (even aged plantations). The newly established Habitat Form 1 stands then grow into Habitat Form 2 in approximately 20 years on more productive soils (site classification I & II) and 30 years on less productive soils (site classification III & IV) . Beginning at approximately 50 years of age, on the more productive soils (site II & III) and 60 years on lower site land (site III & IV) these Habitat Form 2 stands grow into stands that exhibit Habitat Form 4 characteristics. SPI forest inventory of growth projections use the CACTOS for modeling growth in Mixed land class stands (Krumland B. and H. Eng Report 2005) , and G-SPACE tree growth values inserted into CACTOS for Even land class stands (Stone E. C. and J. Cavallaro, 2000).

Once a regulated stand attains a Habitat Form 4 structure, it will generally persist in that condition for approximately 30 or more years before being regenerated into a Habitat Form 1 or possibly a Habitat Form 3/4 stand structure through a commercial thinning. It is important to note that all our modeling that produced the descriptions above is intentionally very conservative because of the CalFire imposed 20% reduction in expected diameter growth rates. So while the Territory Opportunities analysis shows positive results, they likely underestimate the actual or real world results, which means many of the estimated changes from one habitat form to the next will occur in reality 10 years sooner than modeled. SPI has committed to a complete set of permanent growth plots across the range of even-aged units to allow future modeling efforts to be calibrated by actual growth results.

Watercourse buffers will grow into Habitat Form 4 stands in the ASP watersheds and will be maintained is such a condition in perpetuity, where the site is capable of supporting such vegetation. In non-ASP watersheds, watercourse buffers will grow into Habitat Form 4 stands and will likely be maintained in such a condition. In some instances, however for a short period of time they may be reduced to Habitat Form 2Hv during a harvest operation. The change in Habitat Form from 4 to 2Hv will potentially be caused by a reduction in canopy cover which legally can be reduced below 60%, but possibly due to a reduction of 22" dbh trees/acre below 9/acre or a reduction in QMD below 13". The potential change in Habitat Form from 4 to 2Hv will maintain the WLPZ as female fisher Support habitat and likely will grow back into HF4 within a decade.

The benefit to fisher in this CCAA is provided by SPI's decision to constrain our harvest and required under the Cal Fire-approved SPI Option A model. The constraint requiring a reduced rate of even-aged harvesting over the permit term, the aggregation of even-aged units sequentially over time, and the 10-year adjacency constraint combine to increase the amount of suitable fisher habitat that currently exists. The Mixed land class will provide the vast majority of the suitable habitat in the first three to four decades of the permit. In decades 4 and 5 the Even land class will begin to contribute in increasing quantities.

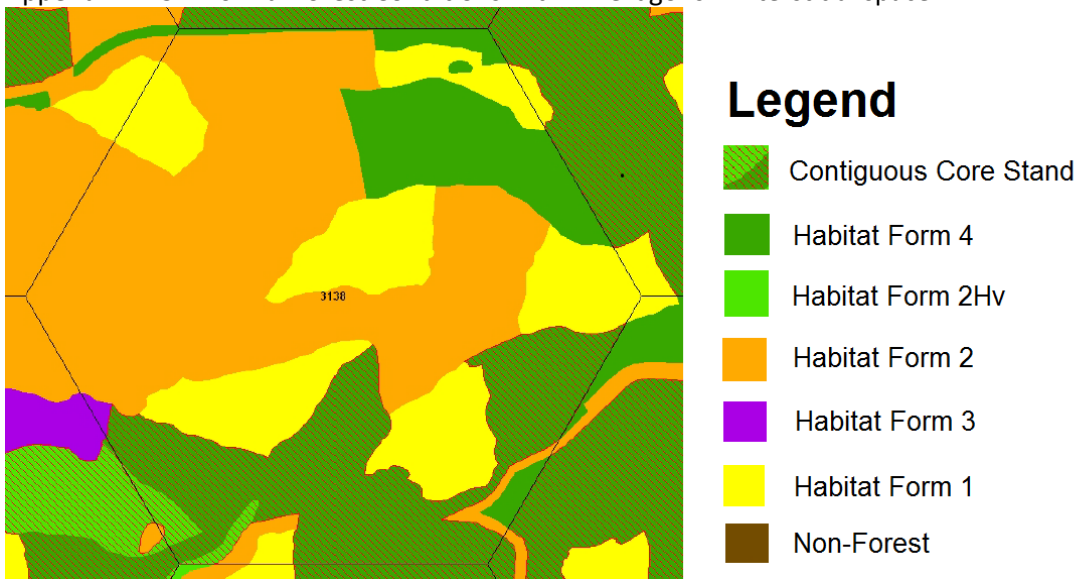
2.7. Habitat Quantities within Hexagons

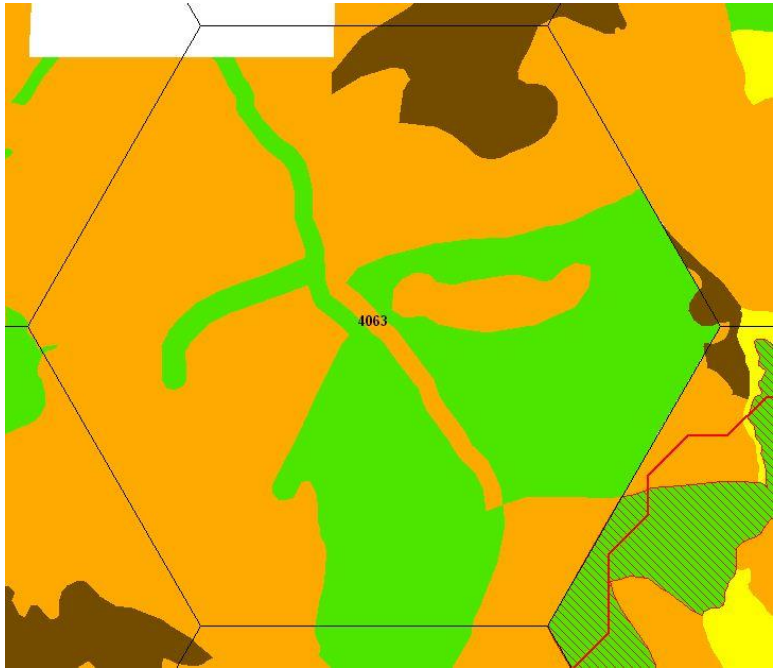
The benefit to fisher that the SPI Fisher CCAA will provide is an increasing quantity of fisher habitat in aggregations that meet the conditions required to support a female fisher home range. For habitat accounting purposes these aggregations of habitat are called Territory Opportunities. The Territory Opportunities are aggregations of 500-acre hexagons. The hexagons have minimum habitat thresholds. This proposal targets 2.0 of Territory Opportunities per 10,000 acres of ownership. Together, the minimum habitat and territory density standards can be perceived as limited quantities of habitat if considered in isolation. However, in the context of a forest landscape that is being managed to achieve a sustainable non-declining yield of timber, fisher will live in stands where there is a doubling of the average tree diameter size and a tripling of the standing biomass inventory.

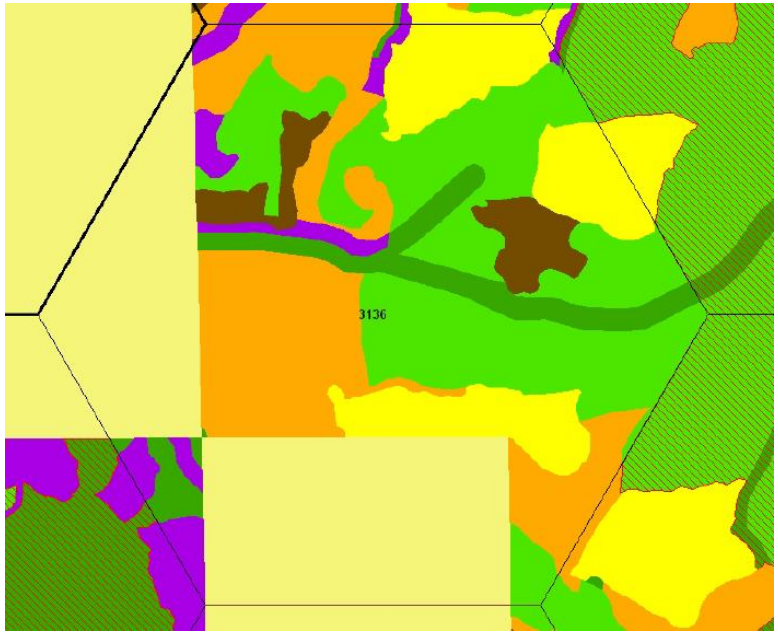
The SPI Fisher CCAA nearly doubles fisher Territory Opportunities during the term of the permit. In order for that to happen, while at the same time allowing harvest to occur, fisher habitat thresholds must be regularly exceeded and there must be a large pool of forest in a smaller and less dense condition must always be present and growing into a larger and denser habitat condition at a rate faster than those amounts of habitat are harvested. Essentially, even though hexagons that are classified "not habitat" for the purposes of Territory Opportunity accounting they still have large quantities of suitable and nearly suitable percentages of habitat, but don't currently meet those minimum thresholds. Likewise, Den and Support core hexagons generally exceed the threshold substantially, otherwise the quantity of "harm" by habitat modification would be much larger.

An example of the habitat threshold being exceeded in a hexagon, but possibly not being counted as habitat, is the average Contiguous Core Stand being 206 acres. Such an "average" hexagon however may be classified as "Currently Not Habitat" (CNH) at the 500-acre hexagon scale since the minimum threshold for a Support core requires at least 50% of the hexagon in HF2Hv. A couple of visual examples of a hexagon being classified as CNH are provided below.

Appendix K: SPI 2014b. Forest Conditions within Hexagons – Interstitial space



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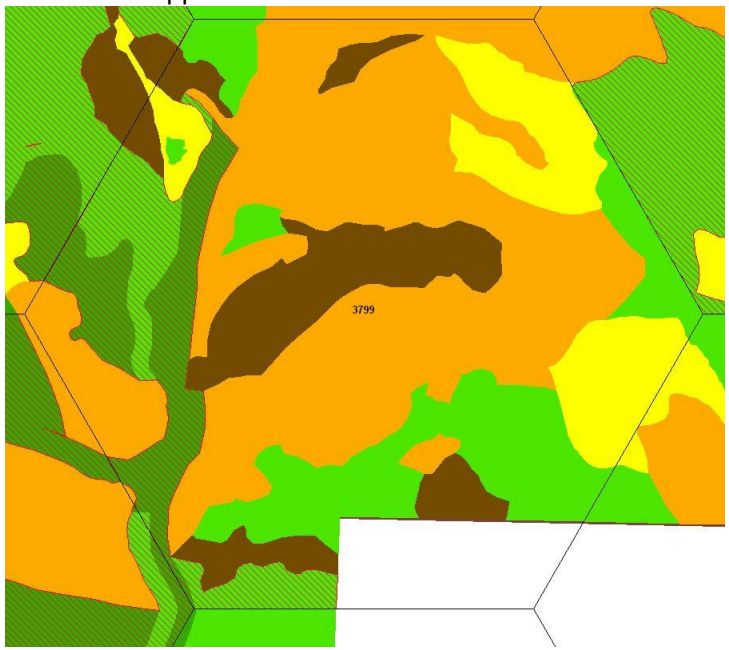


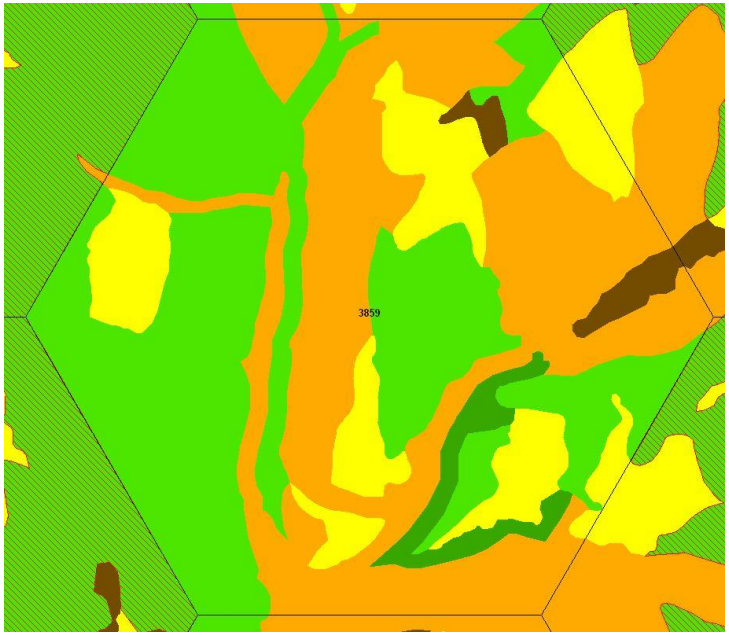


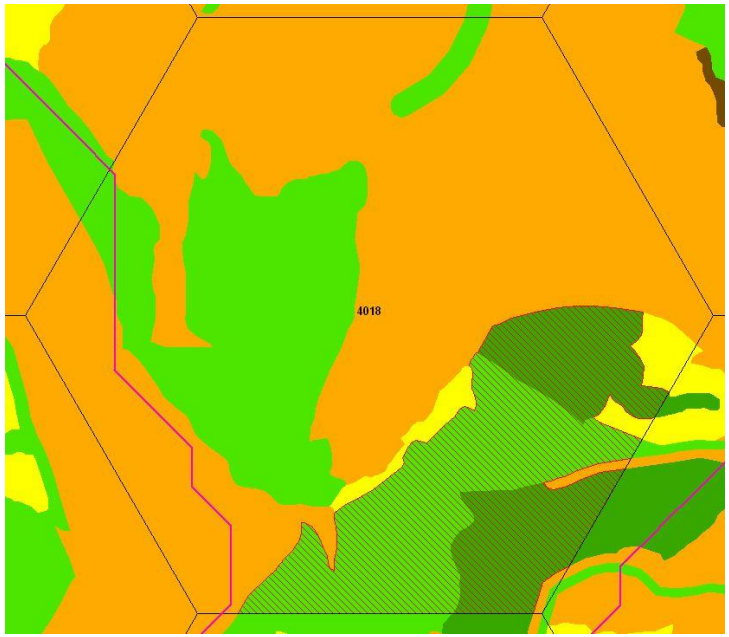


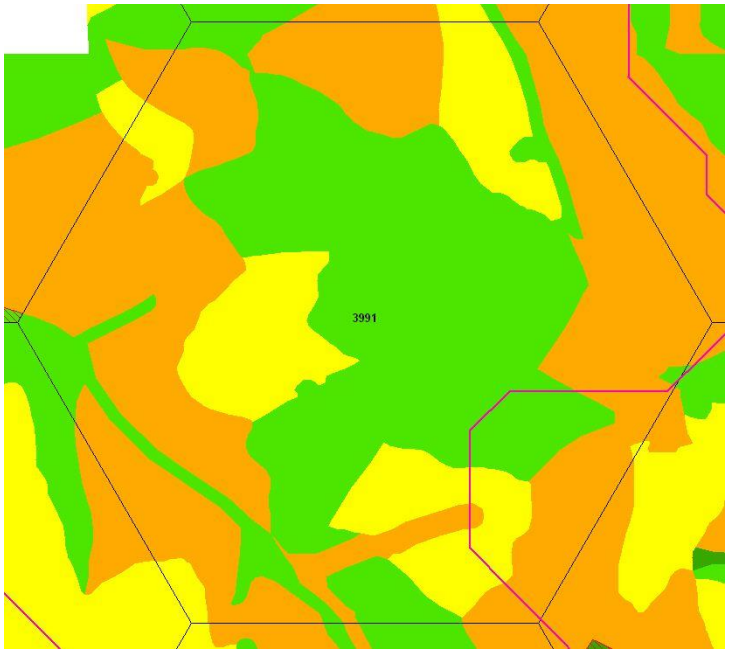

As can be seen in these examples there is abundant habitat available in hexagons classified as "Currently Not Habitat." The additional forest that is not tallied as habitat includes all of the different Habitat Forms. In the case of Habitat Form 2 there is an abundance of potentially suitable fisher den structures available as sampled in the Structure Inventory (SPI 2013b).

## 2.8 Conclusion

The SPI Option A is an existing regulatory mechanism under which SPI conducts its operations. The Enrolled Lands are dominated by the Mixed Land class (74.2%). The SPI Option A plan constrains the harvest rate of the Mixed land class. The SPI Option A requires an even distribution of sequentially adjacent Regen land class harvest units. The Regeneration units will persist for a minimum rotation age of 80 years. The results of these constraints mean that 35% of the Enrolled lands will remain in the Mixed Land class at the end of the permit term. The distribution and persistence of the Mixed Land class, the continuous forest cover required by the SPI Option A, and the length of the minimum rotation age in combination with Conservation Measures 1, 2 and 3 will result in the number of Territory Opportunities doubling during the permit term.

## References

Stone Edward C. and J. Cavallaro., 2000. Cooperative Research, White Fir (GspWF) and Ponderosa Pine (GspPP) Growing Space Project., University of California at Berkeley, Cal Fire, and Sierra Pacific Industries. 2000, (unpublished).

Bruce Krumland and Helge Eng., April 2005. SITE INDEX SYSTEMS FOR MAJOR YOUNG-GROWTHFOREST AND WOODLAND SPECIES IN NORTHERN CALIFORNIA, State of California, The Resources Agency Department of Forestry & Fire Protection, Forestry Report No. 4.

# Monitoring Report

## Covering the period 5/15/2008 to 1/1/2012

## pursuant to the

## Candidate Conservation Agreement with Assurances (CCAA) for Fisher for the Stirling Management Area

**between**

## Sierra Pacific Industries

**and**

## U.S. Fish and Wildlife Service

Permit Number: TE166855-0

Date: 7/1/2012

**Monitoring Report Sections**

**I. Background / Introduction**
- **a. History**
  - **i. Purpose and Need**
  - **ii. Definition of Habitat Form 4 (formerly Life Form 4)**
  - **iii. Threats addressed by the CCAA**
  - **iv. Fisher Reintroduction Effort**
  - **v. Discussion of Annual Report Due Date**

**II. Monitoring Enrolled Lands and Habitat**
- **a. Stirling Management Area (SMA) Acreage Changes**
- **b. Annual Habitat Form 4 (HF4) Changes by Cause 1/1/2008 to 1/1/2012**

**III. Summary of Estimated Take and Minimization Measures**
- **a. Estimated Take – Mortality Report**
- **b. Minimization Measures - Harvesting within .25 mile of active den tree**
- **c. Minimization Measures - Denning Period Harvest Limits**

**IV. Stirling Management Area (SMA) Habitat Retention and other Policies**

**IV. Amendments / Modifications to the CCAA**

## Section I – Background / Introduction

### a. History

On 5/15/2008, Sierra Pacific Industries and the USFWS entered into a Candidate Conservation Agreement with Assurances (CCAA) covering an area of 160,000 acres in Butte, Tehama, and Plumas Counties known as the Stirling Management Area (SMA). The CCAA was developed to incentivize the improvement of fisher habitat within the SMA and provide assurances to SPI (regulatory certainty) for the possible migration or translocation of fisher into the SMA.**4**

#### i. Purpose and Need

The Stirling CCAA has annual and 5-year monitoring and reporting requirements. This report is designed to satisfy the reporting requirements and demonstrate SPIs' achievement of the conservation measure**5**, take minimization and mitigation efforts**6**, and other policies beneficial to fisher**7**.

#### ii. Definition of Habitat Form 4 (formerly Life Form 4)

The primary conservation measure in the Stirling CCAA is an increase in fisher denning and resting habitat. SPI describes fisher denning and resting habitat as Habitat Form 4 (formerly Lifeform 4). In this report and for the future we have changed the name from Lifeform 4 to Habitat Form 4, to avoid confusion with the common scientific uses of the term "life form". The goal of increasing Habitat Form 4 and the definition of fisher denning and resting habitat remains unchanged.**8**

#### iii. Threats Addressed by the CCAA

The Stirling CCAA is primarily designed to address the potential threat of extinction of fishers due to isolation of small populations.**9** This threat is addressed by directly providing for the maintenance of and increases in denning and resting habitat. The Stirling CCAA secondarily addresses the threat of limited denning and resting opportunities due to habitat simplification. This threat is addressed through practices that maintain, grow and recruit structural elements that are suitable for denning and resting. The available habitat is then available to support either the reintroduction of or colonization by fishers.

#### iv. Fisher Reintroduction Effort

The California Department of Fish and Game (DFG), USFWS, and SPI developed a memorandum of understanding for the translocation of fishers to the Stirling Management Area.**10** Under the MOU 40 fishers have been moved to the Stirling Management Area over three annual efforts as outlined in the California Department of Fish and Game Fisher Translocation Plan. The first fishers were released on December the 9th 2009. More info on the translocation project is available at: https://r1.dfg.ca.gov/portal/FisherTranslocation/tabid/832/Default.aspx

#### v. Discussion of Annual Report Due Date

The Stirling CCAA states that the annual implementation report is due by 5/31 of each year.**11** SPI has requested and the Service has concurred that the Monitoring Report due date is changed to 6/30 of each year. This change will allow SPI to efficiently accomplish all the necessary GIS updates of all harvesting, mapping of all known den

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**4** Appendix A, Stirling CCAA, I Authorities and Purpose, pg.2
**5** Appendix A, Stirling CCAA, IV Conservation Measure, pg.5
**6** Appendix A, Stirling CCAA, XI Expected Level of Potential Take, pg.18-20
**7** Appendix A, Stirling CCAA, IX Management Practices and Policies on Enrolled Lands, pgs.15-18
**8** Appendix A, Stirling CCAA, VII Habitat Conditions on the Enrolled Lands, pg.11
**9** Appendix A, Stirling CCAA, VIII Threats Addressed by this CCAA, pg.14
**10** California Department of Fish and Game – SPI; MEMORANDUM OF UNDERSTANDING: California Fisher Translocation, December 9, 2009
**11** Appendix A, Stirling CCAA, XV Reporting, pgs.22-23

sites, and the growth and yield modeling necessary to produce the data sets and maps necessary to meet the annual reporting requirements. The Service has decided that this change is a non-substantive modification to the CCAA.

## Section II – Monitoring Enrolled Lands and Habitat

### a. – Stirling Management Area (SMA) Acreage Changes

The Stirling CCAA states that removals or additions in the Enrolled Lands greater than 5% annually or 10% cumulatively would require written concurrence from the Service.[12] The Enrolled Lands will be accounted for in SPI's geographic information system (GIS) acres. The Enrolled Lands on the Stirling Management Area (SMA), on 5/15/2008 totaled 161,159.7 acres. The following discussion and Table II-1 demonstrates compliance with these limits.

In 2008, there were no changes in ownership.

In 2009 SPI sold its ownership in section 25, T27N R03E MDBM, in Tehama County (599.42 acres) to the Western Rivers Conservancy. This section included a portion of State Highway 32 and the main stem of Deer Creek, which included the only known spawning anadromous fish reach on the SMA. This sale reduced the GIS acreage for the Stirling CCAA to 160,560.28 acres. Since this sale pre-dated the fisher reintroduction in 2009, all reports for the annual summary of habitat changes will start with this new acreage and report changes from there.

In 2009 SPI sold a road right of way to Butte County. This was an eminent domain sale that was the result of Butte County's decision to pave and maintain Forest Highway 171 in the Butte Meadows area. This sale resulted in a 92.6 acre reduction in total acres, most of which was under the existing road prism. This small adjustment has not been made to the GIS yet because the survey of the new right of way is quite complex and since it is a relatively narrow strip of land it is unlikely to appreciably impact habitat form totals. Because the Forest Highway 171 GIS update has not been completed, the habitat totals for this report will not reflect this small reduction in the Enrolled Lands. The effect on available habitat and the exact GIS acreage value will be reported in the next annual report. There were no additional ownership acreage changes in 2010 and 2011.

**Table II-1 - Stirling Management Area Summary Acreage Change**

| Year | Acreage Start | Sale | Acquizition | Acreage End | % Change |
|---|---|---|---|---|---|
| 2008 | 161,159.70 | - | - | 161,159.70 | 0.0% |
| 2009 | 161,159.70 | (599.42) | - | 160,560.28 | -0.4% |
| 2010 | 160,560.28 | - | - | 160,560.28 | 0.0% |
| 2011 | 160,560.28 | - | - | 160,560.28 | 0.0% |
| 2012 | 160,560.28 | | | | |

All Values are in acres except percentages

| Start Acreage | Total Sale | Total Acq. | Net Change | Net % |
|---|---|---|---|---|
| 161159.70 | (599.42) | - | 160560.28 | -0.4% |

Note: In 2009 aproximately 92.6 acres under Forest Highw ay 171 w as sold to Butte County.
This acreage has not yet been removed from the GIS due to the complexity of the survey

### b. - Annual Habitat Form 4 (HF4) Changes by Cause 1/1/2008 to 1/1/2012

The Stirling CCAA requires that the acres of Habitat Form 4 (HF4) are reported annually if fisher are present in the SMA.[13] Table II-2 below provides a annual summary of the change in acres of Habitat Form 4 (HF4) from 1/1/2008 to 1/1/2012. For clarity in this report and for all future reports we have changed the name from Lifeform 4 to Habitat Form 4, to avoid confusion with the common scientific uses of term "life form".

12 Appendix A, Stirling CCAA, XIX Modification of the CCAA, pg.24
13 Appendix A, Stirling CCAA, XV Reporting, pgs.22-23

At the time of developing the Stirling CCAA SPI had in place its forest inventory system, which has a design intensity of one sample plot on every four acres. Using the individual plots from this inventory we estimated the SMA HF4 percentage by calculating the habitat form at the individual plot level scale of analysis. This plot scale estimate of HF4 resulted in a baseline value of 23% HF4 in 2008.. Based upon SPI's commitment to sustainable management and SPI's non-spatially explicit long range sustained yield models estimated that HF4 would increase to 33% during the 20 year term of the Stirling CCAA.**14** Since 2008 SPI has made further investments in its GIS for the SMA and can now calculate annual estimates of change at the stand level rather than plot level scale of analysis. Some of those investments included the development of the necessary processes to map stand boundaries and stand level determination of the HF4 and to track the annual changes in those habitats. The stand level changes in HF4 are calculated by annually harvesting (depleting) and then growing the individual plots. After the plots are depleted and grown they are integrated back into the GIS and annual stand growth determined by summing those plots by the updated stand boundary layer. Using these techniques the HF4 percentage on the SMA has been recalculated based upon stand level estimates. Table II-2 shows the stand level estimate of HF4 on 1/1/2008 of 32.1% and has increased 1.1% to 33.2% by 1/1/2012. Even though this starting point would appear to place SPI near the 20 year goal of the Stirling CCAA, one can see the potential risks over 20 years, including wildfires as shown in Table II -2. SPI intends to manage its harvest rates to increase HF4 overtime. SPI will maintain its commitment to a 10% increase in HF4 measured at the stand level over the 20 year life of the CCAA.

**Table II-2 - Stirling Management Area Summary HF4 Change by Cause**

| Year | HF4 Start | HF4 Harvest | HF4 Growth | HF4 End | HF4 % of Total |
|---|---|---|---|---|---|
| 2008 | 51613.4 | (3823.9) | 3219.4 | 51008.8 | 31.8% |
| 2009 | 51008.8 | (3726.7) | 3171.5 | 50453.6 | 31.4% |
| 2010 | 50453.6 | (784.7) | 3333.8 | 53002.7 | 33.0% |
| 2011 | 53002.7 | (1649.3) | 1952.2 | 53305.5 | 33.2% |
| 2012 | 53305.5 | | | | |

All Values are in acres except percentages — SMA Total Acreage 160,560.3

| Cumulative Totals | Total Harvest | Total Growth | Net HF4 | Net Change % |
|---|---|---|---|---|
| | (9984.6) | 11676.8 | 1692.1 | 1.1% |

Note: In 2008/2009 the following amounts of HF4 change (harvest) were due to wildfire salvage.

| Year | Wildfire Salvage | Green Harvest | HF4 Gowth | Net Change |
|---|---|---|---|---|
| 2008 | (2,815.9) | (1,008.0) | 3219.4 | (604.6) |
| 2009 | (3,336.5) | (390.2) | 3171.5 | (555.2) |

The Stirling CCAA requires that if changed circumstances occur, they are reported and SPI and the Service shall meet to evaluate the change in circumstances.**15** A 2,000 acre cumulative loss of HF4 on the enrolled lands due to wildfire or insects is one of the potential changed circumstances. In 2008, the SMA experienced a wildfire that required emergency salvage harvesting. When salvage harvesting is necessary SPI moves its planned green harvesting operations to fire salvage operations, to the extent practicable. Since emergency salvage harvesting is allowed and planned green harvesting was moved to fire salvage the immediate effect of the wildfire on HF4 was unclear. To understand the wildfire's effects on HF4 over the enrolled lands the wildfire first had to be harvested, then the individual plots for all harvesting needed to be depleted and all of the plots in the SMA grown to determine if there was a cumulative loss of HF4. Following the completion of the wildfire salvage the analysis of the inventory showed that there was no period where fire salvage caused a cumulative loss of HF4 on the enrolled lands that exceeded 2,000 acres and the current 4 year sum of all changes indicates a net increase of 1,692.1 acres of HF4.

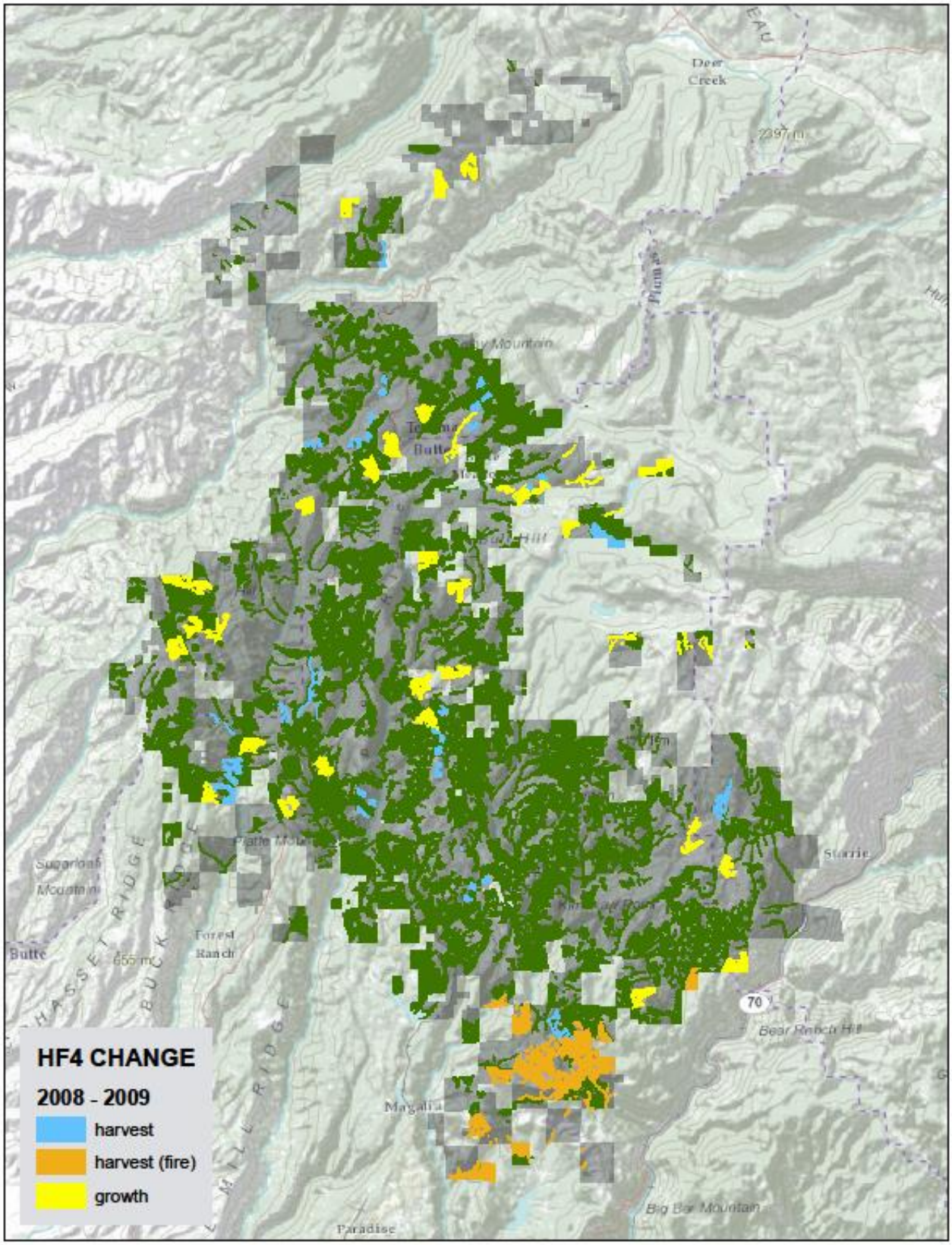
**14** Appendix A, Stirling CCAA, IV Conservation Measure, pg. 5

**15** Appendix A, Stirling CCAA, XIII. Assurances Provided to Property Owner in Case of Changed or Unforeseen Circumstances, pg. 21.

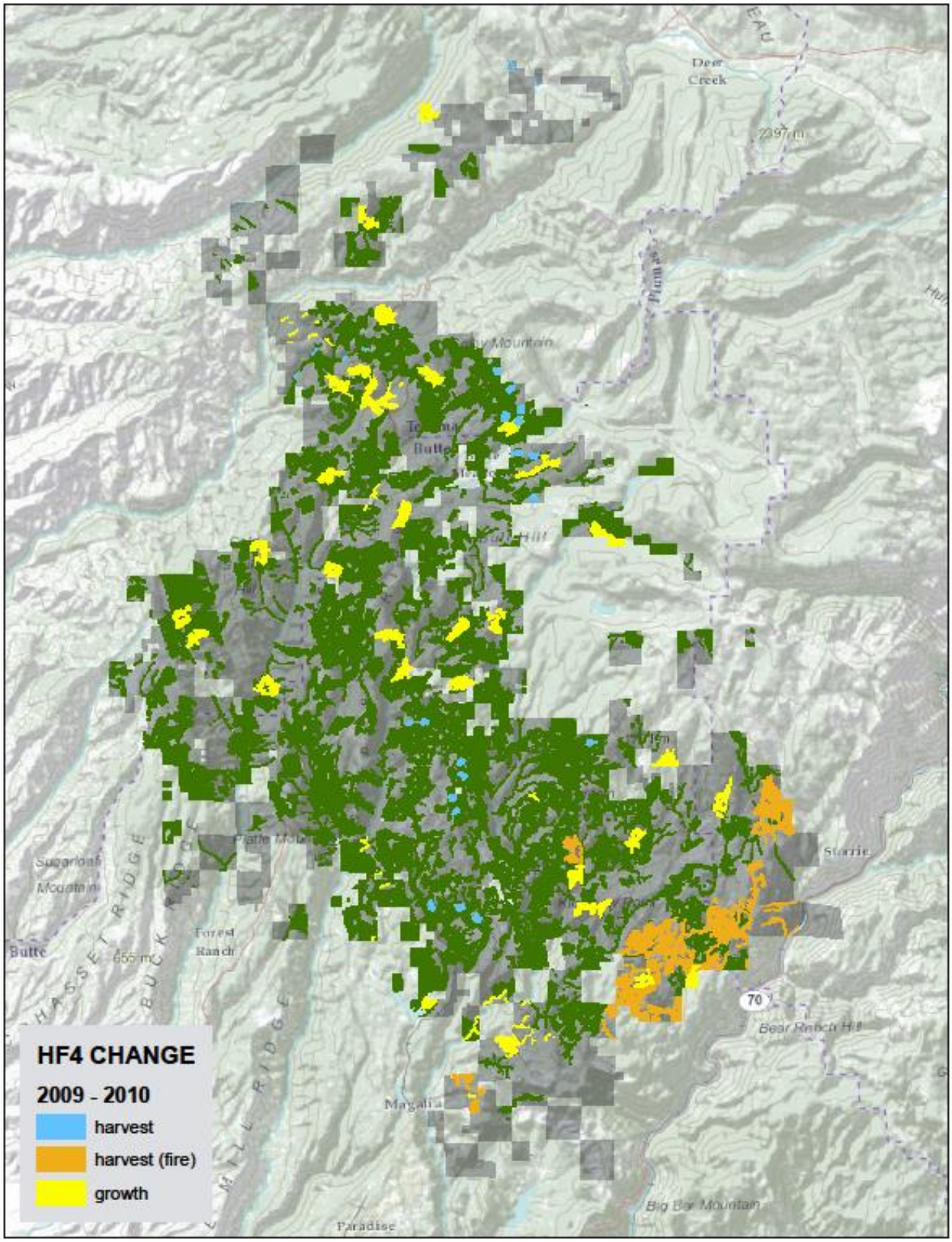
It should be mentioned that there is a very minor technical error shown in Table II-2, in the HF4 growth column of the year 2008. The error is a potential slight overestimate of HF4 growth that is the result of the process of managing a complicated set of plots and stands. It is our practice to remove (deplete) all harvest for that year before we grow the underlying plots. The potential error shown in the HF4 Growth 2008 is caused by growing the plots within the wildfire perimeter that were dead but not yet salvaged. If some of this plot growth caused stands to grow into HF4 there would be a transitory minor increase in HF4. This error was self-correcting when those same plots were correctly depleted after being salvaged during 2009 harvesting operations they would show up as HF4 harvest. There is no net error overtime just a minor overestimate of HF4 in the year end column of year 2008.

As an aide to help understand Table II-2 we provide the following maps for the years 2008 - 2009, 2009 - 2010, 2010 - 2011 and 2011 - 2012, showing the locations where HF4 exists, where it was removed by fire or harvest and where it has grown into HF4. See Maps II-1 through II-4.

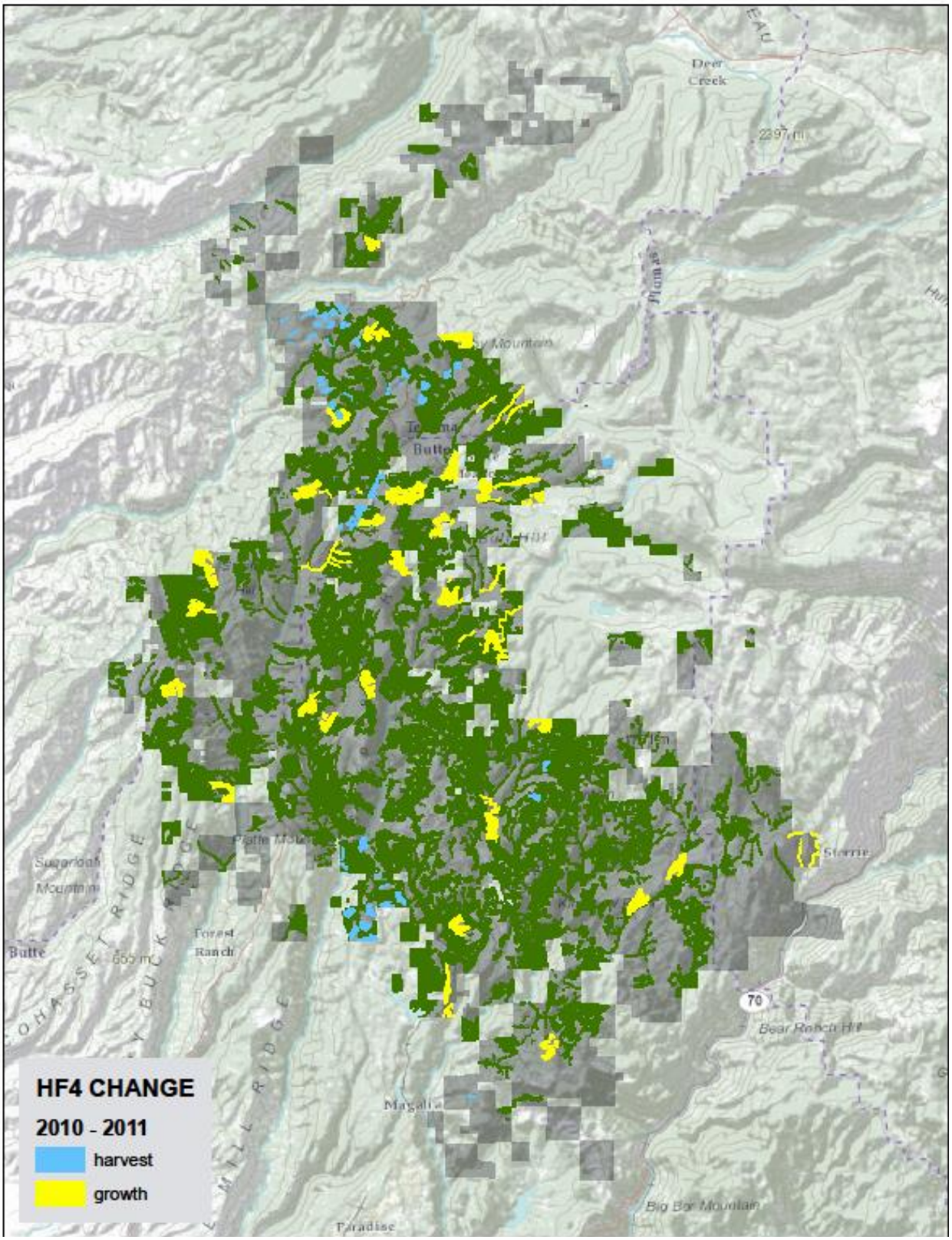
Map II-1 2008-2009 HF4 distribution and change causes shown below



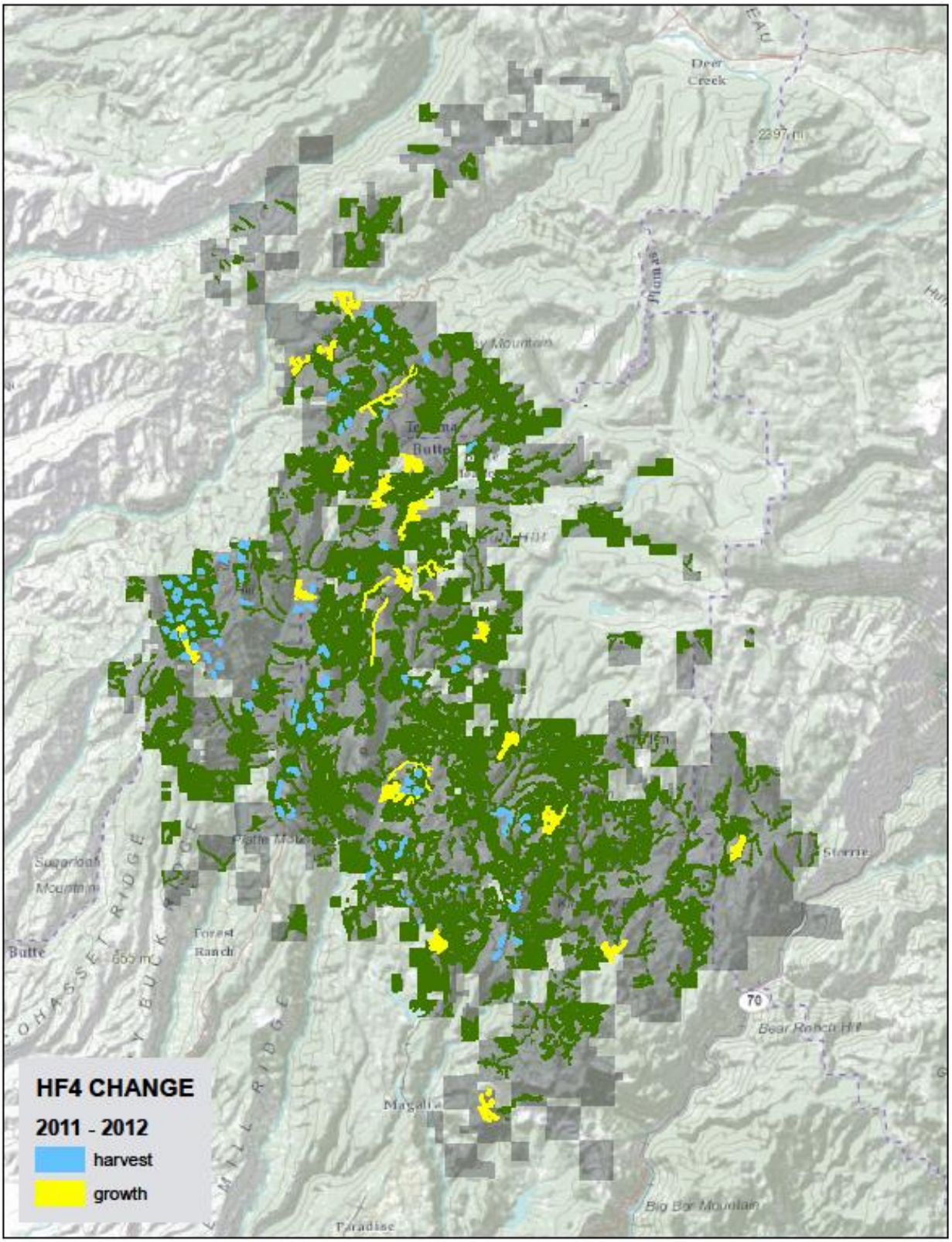
Map II-2 2009-2010 HF4 distribution and change causes shown below



Map II-3 2010-2011 HF4 distribution and change causes shown below



Map II-4 2011-2012 HF4 distribution and change causes shown below



## Section III - Summary of Estimated Take and Minimization Measures

### a. Estimated Take – Mortality Report

Through 6/2/2012 there has been no take documented from covered activities. **16** No known mortalities have arisen from any of the potential causes described in the Stirling CCAA related to covered activities.**17**

**Table III-1 - Known Mortalities and Cause if Known**

| Animal_ID | Year of Release | SEX | DateFound | Cause Known | Cause |
|---|---|---|---|---|---|
| F6280 | Y1 (2009-2010) | F | 6/22/2010 | Yes | bobcat predation |
| F65B6 | Y1 (2009-2010) | F | 6/28/2010 | Yes | bobcat predation |
| D00B0 | Y1 (2009-2010) | F | 7/17/2010 | Yes | drowned in water tank (not SPI land) |
| 18C3E | Y2 (2010-2011) | M | 3/12/2011 | Yes | struck by car on HWY 32 |
| 18FFF | Y2 (2010-2011) | F | 8/27/2011 | No | unknown/unable to determine |
| 252FD | Y3 (2011-2012) | F | 12/10/2011 | Yes | natural death per DFG necropsy |
| IE03E | Y3 (2011-2012) | F | 2/27/2012 | No | unknown/unable to determine |
| 18308 | Y1 (2009-2010) | M | 5/15/2012 | No | pending |
| 1F111 | Y3 (2011-2012) | F | 6/2/2012 | No | pending |

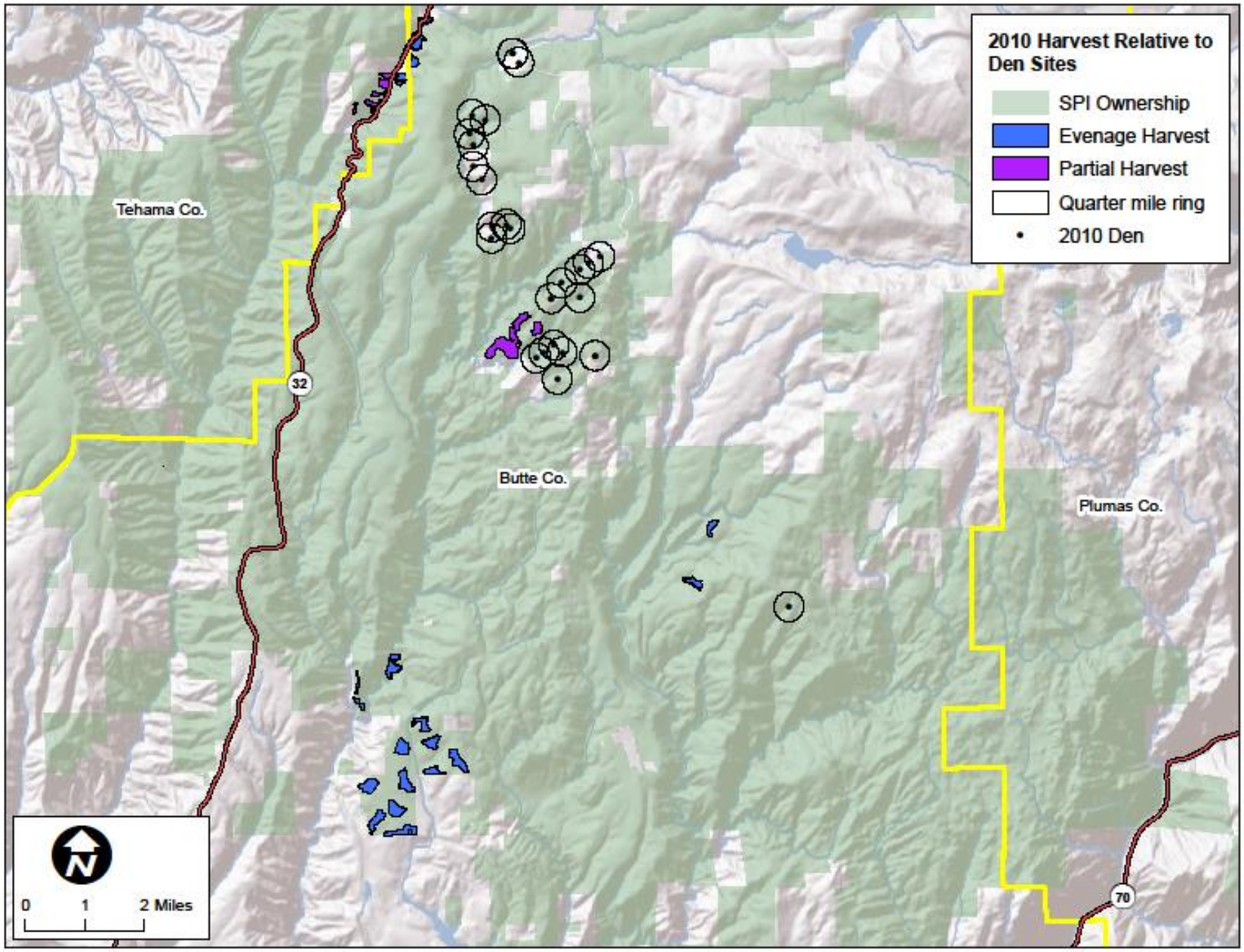
Note: The known vehicle mortality (18C3E) is not considered an incidental take occurrence since a forester working for an adjacent land owner actually observed this fisher being struck by a private vehicle traveling at highway speeds on State Hwy 32 not from the use of roads associated with otherwise legal activities covered under the Stirling CCAA.

### b. Minimization Measures - Harvesting within .25 mile of active den tree

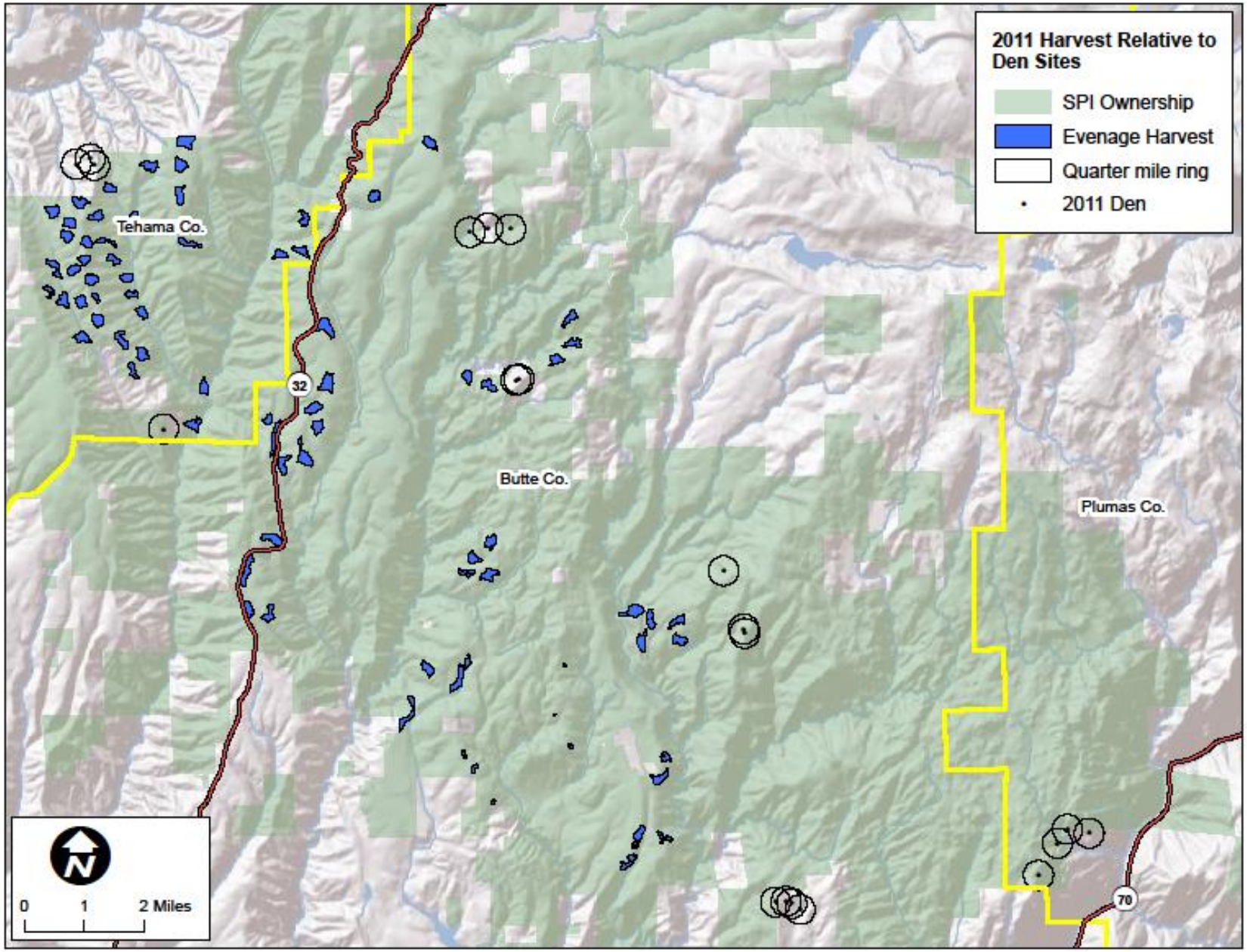
The Stirling CCAA requires SPI to not initiate vegetation disturbing activities within ¼ mile of a known occupied den tree for the period of 3/15 through 7/15.**18** Denning occurred on the SMA during the 2010 and 2011 breeding season. Occupied dens of re-introduced fishers were identified via radio telemetry or other methodologies (e.g. remote cameras), and the fisher researchers are in frequent contact with SPI mangers as the breeding season progresses. As an informative note, to allow study of the interaction, SPI was requested to not stop (to continue) harvesting if a female fisher were to move her den closer than .25 mile from an active harvest site. This would allow the fisher research team to study the fisher's behavior in close proximity to timber harvesting activities. Maps III(b)-1 and III(b)-2 demonstrate SPI's compliance with this take minimization effort. For ease of demonstration the 2010 and 2011 active dens in the entire breeding seasons and the respective entire years harvesting are shown on two separate maps.

**16** Appendix A, Stirling CCAA, X, Incidental Take, Pg. 18
**17** Appendix A, Stirling CCAA, XI. Expected Level of Potential Take, Pgs. 19
**18** Appendix A, Stirling CCAA, XI. Expected Level of Potential Take, Pg. 20

**Map III(b)-1 – 2010 Harvesting within .25 mile of active den trees.** Map shows all 2010 harvested areas and all 2010 dens buffered .25 miles.



**Map III(b)-2 – 2011 Harvesting within .25 mile of active den trees.** Map shows all 2011 harvested areas and all 2011 dens buffered .25 miles.



### c. Minimization Measures – Denning Period Harvest Limits

The Stirling CCAA specifies harvest limits of no more than 25% of annual harvest in any one year and a rolling 3 year average of less than 20% of annual harvest occur between 2/15 and 5/15 – from the SMA.**19** This is a straightforward minimization effort to reduce the overlap between harvest activities and the breeding season when young maybe less mobile.

**Table III (c) 1 - SMA Harvest**
Denning Period Minimization

| | Year | | |
|---|---|---|---|
| **Harvest Volume** | **2009** | **2010** | **2011** |
| Har 2/15 to 5/15 | 11,559 | 236 | 616 |
| Percent of total | 11.0% | 0.6% | 1.5% |
| Total Harvest | 105,257 | 40,720 | 41,999 |
| Three Year Rolling Average | | | 4.3% |

## Section IV – Stirling Management Area (SMA) Habitat Retention and other Policies

While there are many SPI management policies identified in the CCAA, there was no specific requirement to monitor these policies.**20** Any changes to these policies that result in the likely reduction in the expected future capability of the land to support fisher would require a modification to the CCAA. Any proposed modification to the CCAA requires that SPI notify the Service in writing and receive written concurrence that the modification is acceptable.**21** SPI did not modify any of the policies identified in the CCAA and therefore has not notified the Service in writing.

The policies for managing disturbance, the mix of Habitat Forms available and riparian areas extend from our overall land management strategy and are by-products of the implementation of SPI Option (a) Demonstration of MSP. While these policies are considered important to fisher, their localized current conditions are evaluated and mitigated for in the biological and watershed assessment of an individual THP. Because these policy objectives are not known to be critical by themselves to the survival or use of forest habitats by fisher and/or their implementation is provided for at the project level and appear to be within the landscape range that the fisher finds acceptable, these more general policies and watershed attributes will not be included as part of the monitoring report.

Certain habitat elements are essential to the suitability of forest habitats for fisher and their survival. The Stirling CCAA requires that denning resting habitat and habitat elements are monitored and reported every year if fishers are present.**22** The amount of fisher habitat on the Enrolled Lands is found in Section II(b) of this report. The amount of closed canopy forest on the Enrolled Lands that has $\geq$ 50% canopy closure at 2 feet above the ground and the summary of population monitoring will be reported every 5 years and is therefore not included in this year's monitoring report.**23**

The general concept of retention areas has been implemented by SPI since the early 1990's in various forms and with greater flexibility in the earlier years. Prior to signing the Stirling CCAA SPI policy allowed the retention area size and frequency of occurring to vary across the landscape, only expecting 50% of the units to even have retention areas. Prior to the Stirling CCAA these retention areas could have selective harvesting within

**19** Appendix A, Stirling CCAA, XI. Expected Level of Potential Take, Pg. 20
**20** Appendix A, Stirling CCAA, IX Management Practices and Policies on Enrolled Lands, pgs.15-18
**21** Appendix A, Stirling CCAA, XIX Modification of the CCAA, pg. 24
**22** Appendix A, Stirling CCAA, XIV Monitoring, pg. 22
**23** Appendix A, Stirling CCAA, XV Reporting, pg. 23

them. SPI also maintains a working inventory of approved THP's with all the marking and State review completed. The approval date of a THP may precede the year in which a unit is harvested by as much as 5 years, and may include different legally binding requirements than those identified in the Stirling CCAA, therefore regeneration units harvested under THPs approved prior to the signing of the CCAA may or may not reflect the same standards specific to the policy detailed in the Stirling CCAA.

The Stirling CCAA details the new SPI policy for habitat element retention and includes: 2% retention of green trees in tractor units, two regenerating hardwood trees per acre, and two individual hardwood trees ≥ 22 inches dbh hardwoods or two ≥ 30 inches dbh conifer per unit, and all green culls, snags, and down logs that have <25% sound wood volume **24**. SPI will monitor the retention policy on THPs approved after the Stirling CCAA signature date, using the National Agriculture Imagery Program imagery (NAIP imagery). This NAIP imagery program originally planned to acquire the imagery every 5 years, but has in practice acquired the base imagery more often, the latest being completed in July and August of 2010. For example this means that a 2012 report would exclude those units harvested in late 2010 and 2011 and 2012, since that imagery has not yet been produced for those harvest areas. The frequency that NAIP imagery is available may increase in the future but that is uncertain. In years that have NAIP imagery the following monitoring and reporting is proposed: 1) 100% of the regeneration units which have the required 2% retention areas will be analyzed and reported using the GIS/NAIP imagery system as shown in the examples later in this report. 2) From this 100% list, a 10 percent subsample of units will be randomly selected, for walk in surveys. 3) Walk in surveys will include ground pictures of the retention islands and if available pictures of the two retained standing live trees ≥ 22 inch dbh hardwood and or ≥ 30 inch dbh conifer wildlife trees.

The monitoring of the regeneration units for the regeneration of hardwood trees at a rate of two per acre will be reported in our post pre-commercial thinning stand evaluations and will include verification that the wildlife trees are still present. The timing for this reporting is generally 8-12 years after the harvest units are planted. This is the point at which it is unlikely that any further chainsaw or other vegetation control activities are planned, thus subsequent changes would all be by natural processes.

To better understand what such a future report would include the following examples of analysis using NAIP imagery are provided.

Examples of walk in pictures and the reporting form for the verification of hardwood regeneration and wildlife tree retention are not yet available.

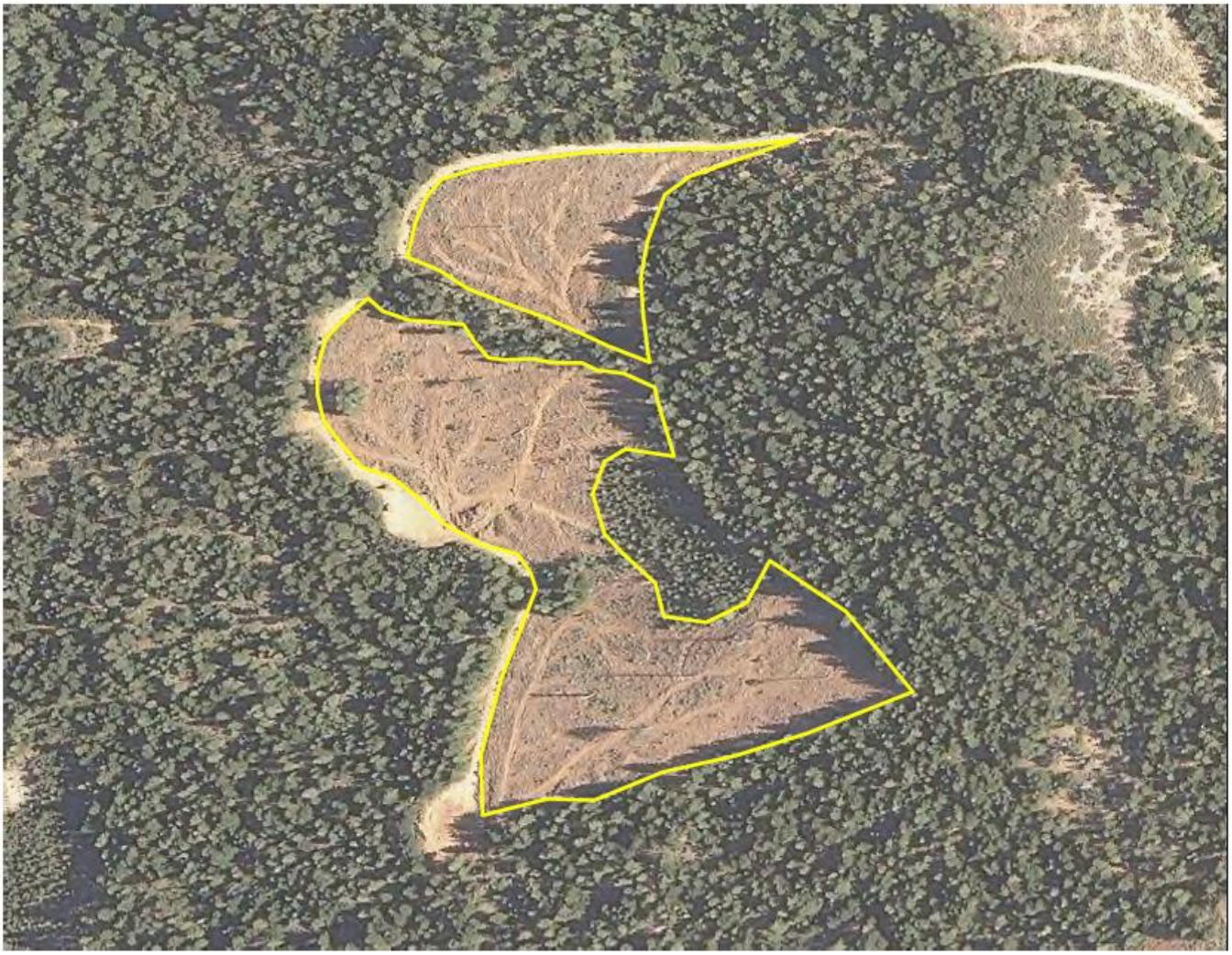
**24** Appendix A, Stirling CCAA, IX Management Practices and Policies on Enrolled Lands, pg. 17

Example of GIS analysis on all applicable units:

THP Number: 2-06-143 Harvested 2010

16.8 acres – retention islands .4 acre approximately 2.3%

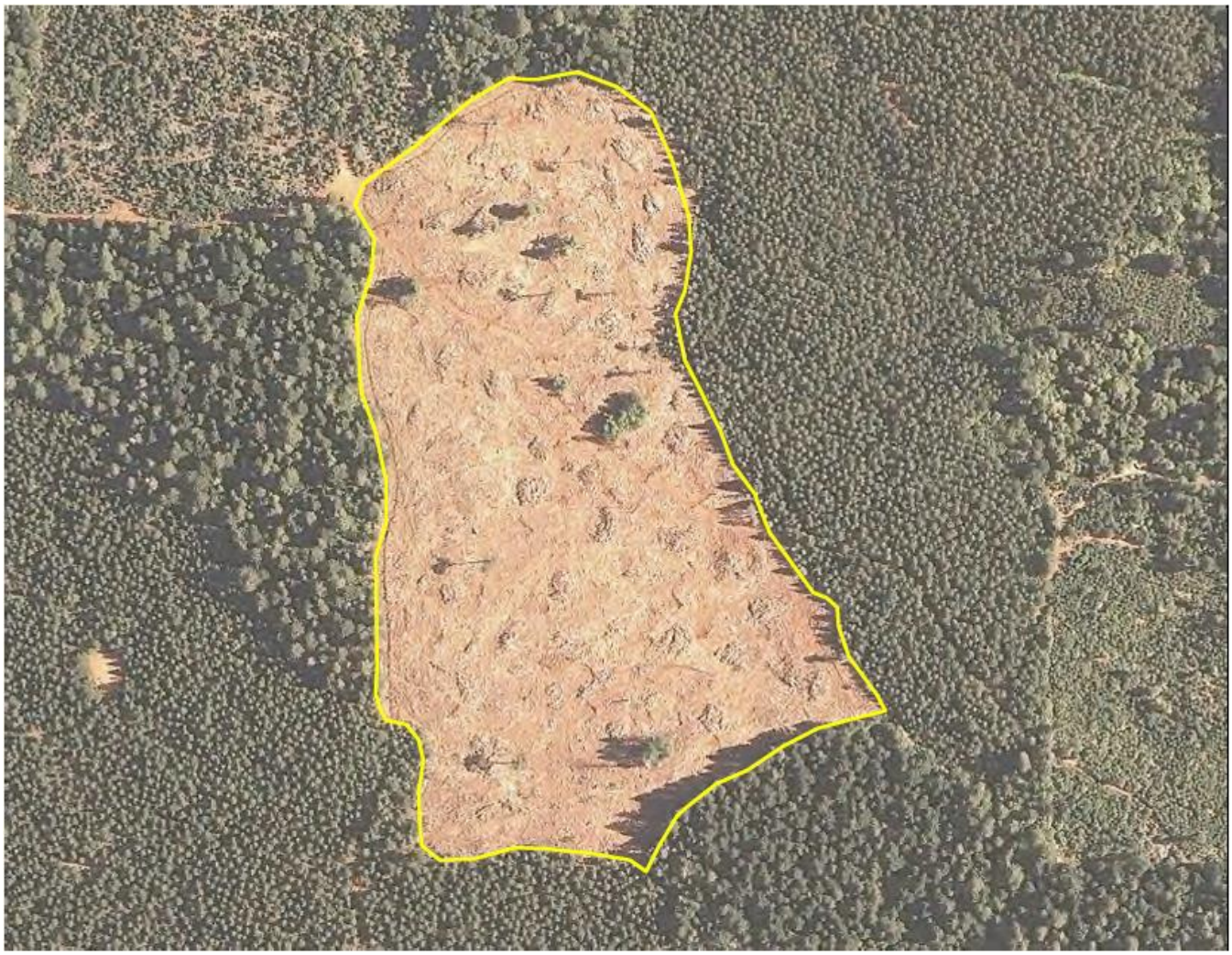
THP Number: 2-06-143 Harvested 2010
18.1 acres – retention islands .4 acre approximately 2.2%



Note: required watercourse protection zones are not counted towards the 2% retention, nor are inclusions of advanced reproduction as seen above.

THP Number: 2-05-092 Harvested 2010

29.9 acres – retention islands .3 acre approximately 1.0%. See discussion about all units with NAP{ imagery currently available are harvested units from THPs that predate signing of the CCAA.



**Section V – Amendments / Modifications to the CCAA**

No substantive amendments / modifications to the Stirling CCAA have been proposed to date. In Section I, v pg. 3 of this report are details to the non-substantive change in the annual report due date from March 31st to June 30th each year.

## Appendix A – CCAA References

Note: All CCAA direct references are shown in italics below.

### Footnote 1 – Section Ia. History

Stirling CCAA, I Authorities and Purpose, pg.2

*The purpose of this CCAA is for SPI to implement a conservation measure for fisher (Martes pennanti) in California. The conservation measure consists of management of fisher denning and resting habitat on SPI lands in the Sierra Nevada. This CCAA will meet the conservation goals of the Service in that it provides incentive for SPI to implement habitat conservation measures for fishers. In addition this CCAA provides incentive to SPI to accept reintroduced fisher onto enrolled lands that historically contained fisher, but currently do not. If the California Department of Fish and Game (CDFG) should implement a reintroduction action with SPI's approval of the plan, this CCAA will provide the opportunity to evaluate future larger scale reintroduction efforts based on monitoring mortality, movement patterns, and habitat use of released fisher. If reintroduction should occur, this CCAA would directly benefit the status of the fisher in currently unoccupied habitat, and provides SPI regulatory certainty concerning land use restrictions that might otherwise apply should fisher become listed under the ESA.*

### Footnotes 2, 3, 4 – Section I(a)i. Purpose and Need
### Footnote 11 – Section II(b) Annual HF4 Change

Stirling CCAA, IV Conservation Measure, pg.5

*Maintaining and increasing the habitat capability of fisher habitat in unoccupied areas is important to allow for future planned reintroduction efforts or colonization by fisher through natural dispersal. Denning and resting habitat has been identified as one of the likely factors limiting fisher populations. Therefore, the conservation measure in this CCAA specifically addresses fisher denning and resting habitat. Currently the enrolled lands contain approximately 23% fisher denning and resting habitat. During the 20-year period of this CCAA, the enrolled lands will maintain a minimum level of 20% of fisher denning and resting habitat at any given time period, and by the end of the permit period fisher denning and resting habitat will increase to approximately 33%.*

Stirling CCAA, XI Expected Level of Potential Take, pg.18-20

*Unless fishers colonize or are reintroduced onto enrolled lands, take is not expected to occur. Should fisher reoccupy the enrolled lands, take may result from (1) disturbance to pregnant or nursing female fishers during the early denning season, (2) cutting down a den tree containing a late term pregnant fisher or fisher kits, (3) reduction in the amount of habitat to a level that significantly impairs a fisher's ability to breed, feed, or shelter, or (4) fisher mortality caused by vehicle traffic associated with otherwise lawful activities. This take will be in the form of harm, harass, wound, and kill, as defined in section 3 of the ESA.*

## Also Footnote 17 – Section IV - SMA Policies

Stirling CCAA, IX Management Practices and Policies on Enrolled Lands, pgs.15-18

*IX. Management Practices and Policies on Enrolled Lands*

*SPI implements a suite of management practices and policies that are not included as conservation measures within this CCAA, but are expected to benefit fisher, should they re-occupy the enrolled lands. These management practices and policies will provide a range of seral stages across the enrolled lands, which will provide an increasing trend in additional support for use by fisher, during but primarily after the 20-year life of this CCAA. Originally instituted under the auspices of the Z'berg-Nejedly Forest Practice Act of 1973, the Forest Practice Rules (FPRs) contain resource protection requirements via two avenues. First, they set prescriptive standards for minimum protection levels for all activities. Additionally, a Registered Professional Forester proposes a harvest accompanied by an associated cumulative effects analysis; then a State multidisciplinary team reviews and must find that a specific Timber Harvest Plan (THP) does not result in a significant adverse impact. In addition to the FPRs, SPI implements a number of company policies which support fisher conservation. SPI policies are described below.*

*Managing Disturbance*

*Whenever possible, SPI uses even-aged management techniques to minimize the number of forest management entries necessary over the life of a stand. In even-aged management stands, SPI limits activities within stands to final harvest; re-establishment, including site preparation, planting, and vegetation control; one pre-commercial thinning and potential pruning; commercial thinning; and a potential second commercial thinning. This represents time intervals from 10 to 40 years between entries, while other silvicultural systems may enter a stand as often as every 7 years.*

*Managing Amount of Habitat*

*Landscape assessment areas, generally planning watersheds averaging about 10,000 acres in size, are managed to remain within a defined set of habitat Lifeforms. SPI uses variable rates of entry, a variety of silvicultural systems, timing of entry, and location of management activities to manage and maintain habitats within a target range, as follows:*

- *Lifeform 1: 5-25% early seral habitat. Early seral habitat on SPI lands is described as stands with a QMD of less than 6 inches with 0-100% canopy closure;*
- *Lifeform 2: 20-40% small tree or moderately dense forest. Small tree or moderately dense forest habitat on SPI lands is described as stands with a QMD of 6-13 inches with 40-100% canopy closure, and stands with a 24 inches QMD or greater, and a canopy closure of 40-60%;*
- *Lifeform 3: 5-15% open forest. Open forest habitat on SPI lands is described as stands with a QMD greater than 6 inches with canopy closures ranging from 0-40%; and*
- *Lifeform 4: 10-60% large tree dense forest habitat. On SPI lands, Lifeform 4 stands may contain either 1) a quadratic mean diameter (QMD) of trees 13 inches or greater among all trees with a diameter breast high (dbh) greater than or equal to 5 inches, a canopy closure of 60% or greater, and a minimum average of 9 trees per acre at least 22 inches dbh or 2) stands with a canopy closure of 60% or greater and a minimum average of 20 trees per acre at least 22 inches dbh. Only those stands meeting the above structure conditions combined with one or more potential fisher denning structures (conifer tree $\geq$30 inches dbh or hardwood tree $\geq$ 22 inches dbh, with the potential of containing a cavity, basal hollow or other suitable defect) are identified as Lifeform 4 stands*

*Regeneration units (exclusive of rehabilitation areas) average no more than 20 acres and will not exceed 40 acres in size. As feasible, regeneration units are "grouped" to create areas 20 to 60 acres in size to eventually provide contiguous larger habitat patches of generally the same age and structure class to benefit wildlife species.*

*Through timely rehabilitation of substantially damaged forest lands, careful and prudent management of plantations, and minimizing the number of harvest entries in any one stand, SPI will maintain at least 80% of the enrolled lands with at least 50% total overhead cover as measured at 2 feet off the ground (over fisher canopy closure).*

*SPI reduces the risk of wildfire by (1) making use of commercial and biomass thinning techniques, (2) using prescribed fire as necessary to treat harvest areas and underburn strategic stands to reduce fuel loading, and (3) pre-commercial thinning and pruning where feasible to reduce fuel ladders so that ground fires do not become crown fires.*

*Managing Habitat Elements within Stands*

*Snags and Green Wildlife Trees*

*Within assessment areas, SPI retains all snags containing less than 25% sound board foot volume (generally decay classes 2), not posing hazards to operators, and not obstructing operations. SPI emphasizes snag retention in Water and Lake Protection Zones (WLPZs) (see definitions in CAFPR 14 CCR 936). Hazardous or obstructive snags ≥ 15 inches dbh (generally decay class 2) that are felled are left on the ground, as often as operationally possible, for the purposes of providing down wood. In assessment areas not meeting or suspected of not meeting snag-retention minimums (SPI Snag Retentions Policy, 2001, Table 5 on pg 6), snag retention is emphasized within regeneration-unit green tree retention areas. Islands of un-harvested trees will be left unmanaged over the life of the stand within which they reside to provide legacy features and ecological processes associated with tree damage and mortality from insects, disease and inter-tree competition.*

*When present, SPI retains an average of two or more green wildlife trees per regeneration harvest unit. Retention is emphasized in WLPZs. Primary candidate trees for retention are large conifer and hardwood species (>30 inches dbh and >22 inches dbh, respectively) that contain cavities, basal hollows, reformed tops, obvious signs of heart rot, or a number of large diameter branches.*

*Within tractor regeneration units, hardwood conversions, or rehabilitation units, SPI retains at least an average of 2% of the unit area in islands of green trees 0.1 acre or larger in size with dominant and co-dominant trees ranging between 8 and 18 inches dbh. Where available, the focus for the green tree retention areas is oaks greater than 22 inches dbh. In other cases, SPI locates green tree retention areas to include important existing stand components such as green wildlife trees, large snags or logs, mast-producing hardwoods (hardwood trees >8 inches dbh), or at the confluence of topographic draws. In the future, at the time of the next harvest entry, these islands will be available candidates for continued retention of forest structural diversity.*

*Mast-Producing Hardwoods*

*SPI will not convert stands dominated by mast producing hardwood trees (e.g. Quercus spp.) to conifer stands unless at least 5% of the capable assessment area is comprised of similar stands with trees capable of producing significant mast crops (hardwood trees >8 inches dbh). In assessment areas, where less than 5% of the capable area is in stands with hardwoods large enough to produce significant mast crops, SPI protects up to two regenerating hardwood trees per acre from herbicide application. In addition, SPI will retain two individual hardwoods in all regeneration and rehabilitation units, which will be greater than 22 inches dbh, when available. In individual marked tree harvest areas, SPI retains at least*

*two hardwoods per acre, which will be greater than 22 inches dbh, when available.*

*Large Down Wood*

*SPI retains existing down wood containing less than 25% sound board foot volume, generally decay classes 2 and 3 (Bull et al. 1997), at least 20 inches diameter at the large end and at least 10 feet in length. Exceptions to this policy may occur as needed to ensure successful regeneration, reduce fire risk, reduce potential drainage-structure damage, or as unavoidably consumed by prescribed burning. Mechanical disturbance to existing down logs is minimized. Down wood will be provided through time due to the recruitment of snags, green culls, and residual material to the forest floor from natural processes and forest management activities.*

*Riparian Inclusions*

*SPI identifies and protects riparian vegetation adjacent to permanent and intermittent water sources within project areas. SPI identifies and uses equipment limitation zones to prevent damage to existing riparian vegetation. Except as approved for specific rehabilitation projects, pesticides will not be used within Class I, II, and IV WLPZs (see definitions in CA FPR 14 CCR 936). If the FPRs are amended to allow, SPI will at its discretion, and with Service concurrence, implement management prescriptions designed to provide for a variety of age classes of hardwood riparian vegetation.*

*Shrub and Grass Layers*

*SPI uses pruning, commercial, and biomass thinning prescriptions, as feasible, to encourage development of shrub and herbaceous layers within forest stands. SPI will minimize the use of herbicides after trees are "released" (growing freely) to allow for the establishment and growth of herbaceous and shrub layers. In accordance with air quality limitations, SPI will use underburning as a method of reducing fire hazard and to stimulate development of shrub and herbaceous layers in strategically located forest stands.*

### Footnote 5 Section Ia.ii. – HF4 Definition

Stirling CCAA, VII Habitat Conditions on the Enrolled Lands, pg.11

*Lifeform 4 stands may contain either 1) a quadratic mean diameter (QMD) of trees 13 inches or greater among all trees with a diameter breast high (dbh) greater than or equal to 5 inches, a canopy closure of 60% or greater, and a minimum average of 9 trees per acre at least 22 inches dbh or 2) stands with a canopy closure of 60% or greater and a minimum average of 20 trees per acre at least 22 inches dbh. Only those stands meeting the above structure conditions combined with one or more potential fisher denning structures (conifer tree ≥30 inches dbh or hardwood tree ≥ 22 inches dbh, with the potential of containing a cavity, basal hollow or other suitable defect) are identified as Lifeform 4 stands.*

### Footnote 6 Section Ia.iii. – Threats

Stirling CCAA, VIII Threats Addressed by this CCAA, pg.14

*Current information indicates that the greatest long-term risk to fishers in the western United States is likely extinction due to isolation of small populations (Heinemeyer and Jones 1994).*

### Footnote 8 Section Ia.v. – Annual Report Due Date

*Stirling CCAA, XV Reporting, pgs.22-23*

Appendix L: 2008-2012 Monitoring Report pursuant to the Candidate Conservation Agreement with Assurances for Fisher for the Stirling Management Area between Sierra Pacific Industries and U.S. Fish and Wildlife Service

*SPI will be responsible for completion of an annual report on Agreement implementation by March 31 each year.*

**Footnote 9 Section IIa. – SMA Acreage Changes**

Stirling CCAA, XIX Modification of the CCAA, pg.24

*Modifications to the CCAA will occur occasionally, through the removals or additions of land to the enrolled lands through sale, purchases, or land exchanges. These changes are not expected to annually comprise more than 5% of the aggregate acreage of the enrolled lands. These changes are considered minor in nature, and at the landowner's discretion, and shall be included or excluded from the CCAA, with written notification to the Service in the annual report. Removals or additions of land in the enrolled lands exceeding 5% annually or 10% cumulatively over the life of the permit will require SPI to provide written notice and obtain written concurrence from the Service and may require the Service to amend the permit in accordance with all applicable legal requirements.*

**Footnote 10 Section IIb. – HF4 Change by Cause**

Stirling CCAA, XV Reporting, pgs.22-23

*SPI will be responsible for completion of an annual report on Agreement implementation by March 31 each year. This report will include, but is not limited to: (1) a summary of acres (and overall percent of the management area) of fisher denning and resting habitat changed over the past year by cause, including cumulative totals after the first year; (2) changes in ownership; (3) a summary of the estimated take from the implementation of conservation measures, monitoring activities, and any other take obviously resulting from land and water use related to the Agreement's covered activities; and (4) any amendments to the CCAA that occurred that year.*

*At years 5, 10, and 15 the annual report will also include, but is not limited to: (1) the projected increase in fisher denning and resting habitat; (2) the amount of closed canopy conditions on the enrolled lands that are $\geq$ 50% at 2 feet above the ground; and (3) a summary of the methods, location, and outcome of population monitoring. Monitoring elements 1 and 2 above will be projected from growth and yield models for years 5 and 15 and year 10 will be validated with updated plot inventory data. If fishers are reintroduced to the enrolled lands, the monitoring report will be agreed upon by CDFG, SPI, and Service prior to reintroduction. If fishers recolonize the enrolled lands, the future contents of the monitoring report will be agreed to by SPI and the Service.*

**Footnote 12 Section IIb. – Reporting Required For Changed Circumstances**

Stirling CCAA, XIII. Assurances Provided to Property Owner in Case of Changed or Unforeseen Circumstances, pg. 21.

*Changed Circumstances Provided for in the CCAA*

*Wildfire or pest infestation that cumulatively removes more than 2000 acres of Lifeform 4 on the enrolled lands will constitute a changed circumstance. If during the 10-year monitoring review, the enrolled lands are found to be outside the expected range for percent fisher denning and resting habitat, this will constitute a changed circumstance. SPI will notify the Service within 30 days of identifying such a changed circumstance. Within 90 days of notification, the parties will meet and evaluate the conservation measure and identify actions that will be employed to address the change in circumstances. If a change in the conservation measure is determined to be necessary and agreed to by both parties, the CCAA and all supporting documents will be modified and/or amended as appropriate.*

**Footnote 13, 14 Section IIIa. – Estimated Take and Expected Level of Potential Take**

Stirling CCAA, X, Incidental Take, Pg. 18

*The permit would authorize incidental take of fisher consistent and associated with this CCAA resulting from the otherwise lawful activities, including forest management activities, on the enrolled lands in Butte, Plumas, and Tehama Counties. Covered forest management activities include felling and bucking timber, yarding timber, loading and landing operations, salvage of timber products, transport of timber and rock, road construction and maintenance, rock pit construction and use, site preparation, tree planting, vegetation control, pre-commercial thinning and pruning, collection of minor forest products, grazing, and fire suppression. Covered activities may be conducted by SPI employees, contractors, agents, or other assigns.*

Stirling CCAA, XI. Expected Level of Potential Take, Pgs. 19

*(1) The potential for take, in the form of harassment, due to disturbance from forest management activities is most likely limited to the situation where a female fisher is disturbed to the degree she abandons her young when she is nursing non-mobile young. However, the probability of such take is low because females have not been observed abandoning their young even after researchers handled young at dens (Higley, pers. comm. 2006). It is unlikely that any forest management activities would be more disruptive than such invasive research activities. It is unknown how a persistent, non-discrete activity such as harvest may affect a den site. Female fishers regularly move young to new den locations.*

*(2) The potential for take, in the form of wounding or killing, of a fisher exists from felling of den trees. In the instance of a late-term pregnancy or non-mobile young, the likelihood of take from cutting down an occupied den tree is quite low. This is the result of the inherent low density of fishers, their primary den tree characteristics (hardwoods, and cull live trees and snags), and the breeding biology of fisher. These natural history attributes in conjunction with the minimal harvest activity that occurs on the enrolled lands during March through May (the most vulnerable period) minimize the potential of this form of take.*

*(3) Fishers use landscapes with a wide variety of stand conditions for foraging, denning and resting activities. Of these habitats, denning and resting habitat is thought to be the most at risk from forest management activities. The loss or reduction in the amount of habitat to a level that significantly impairs a fisher's ability to breed, feed, or shelter is a potential form of take. Thus the loss of, or a significant reduction in, the amount of denning and resting habitat or structural elements in an individual fisher home range may cause individual fishers to discontinue use of the area, which would result in take in the form of harm. The provisions within this CCAA providing for a net increase in the amount of fisher denning and resting habitat improve the ability of the enrolled lands to provide for individual fisher home ranges should fisher be reintroduced or re-occupy the area.*

*(4) Fishers have been killed attempting to cross both paved and unpaved roads. Fisher road kills have occurred on forest dirt roads as well as high use roads such as state and interstate highways (Truex et al. 1998; Klug pers. comm.; Yaeger pers. comm.). Thus, as fishers will attempt to cross roads, it seems that the size and type of road are less important than the traffic on the road (Dark 1997). Various levels of vehicle traffic occur on the enrolled lands, are intermittent in nature, and are likely to continue at current levels. However, the levels of traffic that do and will occur on the enrolled lands are much less than occur on public roads and other public use areas, including National Forest lands. Mortality of fisher related to vehicle collision from use of roads associated with otherwise legal activities is a potential source of take, in the form of harm, wound, and kill, within this CCAA. However, the potential for take from vehicle traffic is believed to be very low due to the ability of vehicle traffic to be regulated on the enrolled lands. Forest roads on SPI's private lands are regulated by gates and seasonal restrictions.*

**Footnote 15, 16 Section IIIb. and IIIc. – Minimization Measures**

Stirling CCAA, XI. Expected Level of Potential Take, Pg. 20

*Mitigation Measures Designed to Minimize and Mitigate any Potential for Take*

*In order to minimize the potential of disturbance potentially causing the loss of a breeding female or one or more of her young, harvest activities within the breeding season (late February to mid-May) will be minimized, for the duration of the CCAA. No more than 25% of SPI's yearly volume harvested from the enrolled lands will come from this time period in any one year and a rolling 3-year average will not exceed 20%. The normal logging season for SPI can be year-round, but over 95% of harvest activities occur from mid-February through mid-November.*

*If SPI agrees to accept reintroduced fisher, release sites will not be located within ¼ mile of active logging, to minimize take of newly introduced animals. SPI agrees to modify its harvest scheduling and will not initiate vegetation disturbing activities within ¼ mile of a known occupied den tree for the period of March 15th through July 15th.*

**Footnote 18, 19, 20 Section IV – Habitat Retention and other Policies**

Stirling CCAA, XIX Modification of the CCAA, pg. 24

*If the policies regarding managing wildlife habitat described in Section IX "Management Practices and Policies on Enrolled Lands" are modified, resulting in the likely reduction in the expected future capability of the land to support fisher, this would require a modification of this CCAA. Such a modification will require SPI to provide written notice and obtain written concurrence from the Service, and may require the Service to amend the permit in accordance with all applicable legal requirements.*

Stirling CCAA, XIV Monitoring, pg. 22

*Generally there will be two foci of monitoring: (1) monitoring of the habitat to ensure that the conservation measure is being met; and (2) monitoring for fisher in currently unoccupied areas to determine if the otherwise suitable habitat becomes occupied. Monitoring of the habitat conservation measure (increases in fisher denning and resting habitat) will be reported every 5 years. Monitoring for colonizing fisher will occur at least every 5 years. Additionally, if fishers colonize the enrolled lands, or if fishers are reintroduced onto enrolled lands, changes to habitat will be reported on an annual basis. Monitoring of habitat and habitat elements and reintroduced fisher will be agreed upon by CDFG, SPI, and Service prior to reintroduction.*

Stirling CCAA, XV Reporting, pg. 23

*At years 5, 10, and 15 the annual report will also include, but is not limited to: (1) the projected increase in fisher denning and resting habitat; (2) the amount of closed canopy conditions on the enrolled lands that are ≥ 50% at 2 feet above the ground; and (3) a summary of the methods, location, and outcome of population monitoring. Monitoring elements 1 and 2 above will be projected from growth and yield models for years 5 and 15 and year 10 will be validated with updated plot inventory data. If fishers are reintroduced to the enrolled lands, the monitoring report will be agreed upon by CDFG, SPI, and Service prior to reintroduction. If fishers recolonize the enrolled lands, the future contents of the monitoring report will be agreed to by SPI and the Service.*

**Footnote 21 Section IV – Habitat Retention and other Policies**

Stirling CCAA, IX Management Practices and Policies on Enrolled Lands, pg. 17

*When present, SPI retains an average of two or more green wildlife trees per regeneration harvest unit. Retention is emphasized in WLPZs. Primary candidate trees for retention are large conifer and hardwood species (>30 inches dbh and >22 inches dbh, respectively) that contain cavities, basal hollows, reformed tops, obvious signs of heart rot, or a number of large diameter branches.*

*Within tractor regeneration units, hardwood conversions, or rehabilitation units, SPI retains at least an average of 2% of the unit area in islands of green trees 0.1 acre or larger in size with dominant and co-dominant trees ranging between 8 and 18 inches dbh. Where available, the focus for the green tree retention areas is oaks greater than 22 inches dbh. In other cases, SPI locates green tree retention areas to include important existing stand components such as green wildlife trees, large snags or logs, mast-producing hardwoods (hardwood trees >8 inches dbh), or at the confluence of topographic draws. In the future, at the time of the next harvest entry, these islands will be available candidates for continued retention of forest structural diversity.*

*Mast-Producing Hardwoods*

*SPI will not convert stands dominated by mast producing hardwood trees (e.g. Quercus spp.) to conifer stands unless at least 5% of the capable assessment area is comprised of similar stands with trees capable of producing significant mast crops (hardwood trees >8 inches dbh). In assessment areas, where less than 5% of the capable area is in stands with hardwoods large enough to produce significant mast crops, SPI protects up to two regenerating hardwood trees per acre from herbicide application. In addition, SPI will retain two individual hardwoods in all regeneration and rehabilitation units, which will be greater than 22 inches dbh, when available. In individual marked tree harvest areas, SPI retains at least two hardwoods per acre, which will be greater than 22 inches dbh, when available.*

*Large Down Wood*

*SPI retains existing down wood containing less than 25% sound board foot volume, generally decay classes 2 and 3 (Bull et al. 1997), at least 20 inches diameter at the large end and at least 10 feet in length. Exceptions to this policy may occur as needed to ensure successful regeneration, reduce fire risk, reduce potential drainage-structure damage, or as unavoidably consumed by prescribed burning. Mechanical disturbance to existing down logs is minimized. Down wood will be provided through time due to the recruitment of snags, green culls, and residual material to the forest floor from natural processes and forest management activities.*

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forest ecology

# Structure of Fisher (*Pekania pennanti*) Habitat in a Managed Forest in an Interior Northern California Coast Range

Matthew R. Niblett, Stuart H. Sweeney, Richard L. Church, and Klaus H. Barber

Forest management planning across the Sierra Nevada and Northern California includes several focal wildlife species, one of which is the fisher, recently reclassified as *Pekania pennanti* (Sato et al. 2012) from *Martes pennanti*. This article presents an analysis of fisher habitat associated with privately owned forestland in Northern California. We take advantage of a high-resolution inventory database to show selective use of female fishers within this landscape. This landscape can be thought of as a matrix containing scattered mature stands of conifers and hardwoods (age 100 years) within a landscape of younger mixed conifer stands and numerous openings (24% of the area). Although stand and forest averages for habitat elements appear to score poorly using a widely used metric, we demonstrate through a new form of spatial sampling using a Kolmogorov-Smirnov (K-S) statistical test, which we call *k*-max, selective habitat use by female fishers at a relatively fine scale. This approach is novel in terms of generating population-level inferential results that are sensitive to smaller scale selection behavior, demonstrating that existing large structures, even though limited in areal extent, are critical elements in female fisher habitat.

Keywords: habitat characterization, spatial analysis, industrial forest management, habitat analysis

To achieve sustainable timber harvest levels, which may in-clude managing forest fuel loads, forest managers rely on planning models, from vegetation simulators to optimiza-tion models focused on activities scheduled over decades. Accurate planning models are especially useful for managing habitat for wild-life species that are listed as threatened or endangered or are candi-dates for listing under the Endangered Species Act. On public lands in the Western United States, forest management has concentrated on fuels removal activities (mechanical removal of ladder fuels, thin-ning, prescribed burns, and others) to reduce the severity and size of large-scale catastrophic fires (Agee et al. 2000, Bahro et al. 2007) as a means of protecting valuable habitat, which has shifted more re-cently toward "ecosystem services" planning. On private holdings, a wider range of management occurs, including harvesting, thinning, and fuel breaks. In either case, special attention is placed on "key" species protection. One candidate species is the fisher (*Pekania pen-nanti*; see Sato et al. [2012]), the main subject of this article.

The objective of this article is to demonstrate that a new spatial sampling technique, when paired with well-established statistical testing methods, is useful for identifying important forest habitat components that do not exist as an average forest condition for a species of concern. We use this technique to characterize significant fisher habitat structure within an industrial forest, which historically has been managed for timber yields and not for wildlife protection. This forest has been subjected to high-intensity storm events, fire, fire salvage logging, and intense logging activity in previous decades. Thus, it is a varied forest consisting primarily of younger aged stands interspersed with older trees and many forest openings, a forest not typically associated with fishers, especially within the context of the amount of open space and the lack of larger tracts of mature forest. Our study is based on a small population of fishers, known den sites, and resting locations and a very high density of stand inventory plots. To assess significance, we introduce a new method of charac-terizing habitat selection and incorporate randomization tests, rooted in the K-S distributional significance test, to identify key structural elements in this forest.

The fisher is a North American member of the Mustelidae (wea-sel) family. The fisher's historic range encompassed boreal forests of Canada, the Cascade Range of the Pacific Northwest, the northern California Coast Range, the Sierra Nevada, and the Rocky



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Mountains of the western United States, as well as large portions of the upper-Midwest extending as far south as Tennessee, and the eastern United States (Lewis et al. 2012). In the western United States, fishers currently occupy areas of the Northern Rockies, the Cascade Range, the northern California Coast Range, and parts of the southern Sierra Nevada and are being monitored after a recent reintroduction program in the northern Sierra Nevada. The fisher has historically been associated with mature to old-growth conifer and mixed hardwood forests in the western United States (Buskirk and Powell 1994, Zielinski et al. 2004b, Lofroth et al. 2010).

Forest elements associated with fishers include the following: trees with cavities suitable as dens for the birth and rearing of kits; trees with limbs and deformities used as rest sites; holes in the ground, rock piles, and fallen trees for resting and sleeping; areas that contain prey such as rodents and birds; and canopy cover (Pow-ell and Zielinski 1994, Zielinski et al. 2004a, 2004b). The impor-tance of canopy cover, particularly moderate to dense cover, has been regularly associated as an important predictor of fisher habitat. In addition, dense canopy cover (vertical structure) is believed to provide refuge from predators and thermoregulatory benefits (Raley et al. 2012). However, Raley et al. (2012) note that studies using canopy cover are hard to compare because of the varying ways it has been measured and defined. It is believed that the reduction in the range of the fisher is due to increased anthropogenic activity includ-ing commercial trapping, logging, fire treatment policy, and habitat loss due to development (Powell and Zielinski 1994). Fishers are also threatened by the increased use of anticoagulant-based roden-ticides within their range. These detected anticoagulants are thought to originate principally from illegal marijuana cultivation sites located on public and community lands (Gabriel et al. 2012).

Previous research has indicated that fishers in the western United States are associated with large woody elements within mature, late-successional forests (Zielinski et al. 2004b). Buck et al. (1994) indi-cate that fishers appear to use some form of selection or avoidance of forest types. Similarly, Jones and Garton (1994) found that fishers in Idaho use different stand classes seasonally, that nonforested areas were not used in any season, and that old-growth forest appeared to be used more during the summer. Jones and Garton (1994) also note that the tracked fishers in the young forested stands of their study area were often associated with a large forest element, such as a large tree, snag, or log that had survived a stand-replacing fire. Although the previously cited works focused on resting sites and use of habitat within a home range, the findings of Weir et al. (2012) and Lofroth et al. (2010) highlight and report on the importance of structure for denning for fishers in British Columbia and western North America, respectively. In addition, these fisher den sites were often associated with a large hardwood tree or snag, although Lo-froth et al. (2010) only reported the average dbh for both conifer and hardwood den trees, rather than reporting them separately. Mature, late-successional forests contain all of the elements typically associ-ated with fisher habitat, but more varied landscapes may contain suitable features and structures for their existence. This means that large structures distributed across a landscape of varying aged stands and sizable forest openings, a somewhat heterogeneous forest, may sustain a population of fishers, even when the forest as a whole is not classified as mature stands of mid- to late-seral forest.

This article consists of two approaches: the first approach char-acterizes the predicted suitability of fisher habitat using highly de-tailed plot-level data. This is done with the predictive habitat model of Zielinski et al. (2012), which was developed for a region of California that includes our study site. Using den and resting sites, we implemented commonly used kernel density estimation techniques to estimate female fisher home ranges. The second approach in-volves testing the significance of "neighborhoods" containing large structures found within the home ranges compared with the neigh-borhoods of the forest as a whole. We also tested the significance of structures found in small neighborhoods defined about the den sites compared with the forest neighborhoods as well as the neighbor-hoods within the home ranges. Although the forest contains large mature trees, they are scattered and principally surrounded by larger blocks of younger trees and include many open areas. To test the significance of structures and their location of use, we developed a method called *k*-max. This method involves testing the significance of the presence of large structures found among this landscape mix-ture of younger trees, vegetation, fire scars, and open areas. The structure of the article is as follows. First, a description of the study area is given, including information on the telemetry of tracked fishers. This is followed by a characterization of the habitat using the model of Zielinski et al. (2012). We then present the *k*-max meth-odology and our approach to inferential testing. This is followed by a presentation of results using the *k*-max method and discussion.

## Study Area

### Vegetation

The study area of this article lies in eastern Trinity County, California (Figure 1) and includes approximately 182 $km^2$ (45,000 acres) of which roughly 78% is private industrial timberland, 15% is within the boundaries of Shasta Trinity National Forest, and 7% is held by private nonindustrial landowners. The size of this area is comparable to that of Buck et al. (1994); however, the public-pri-vate ownership mix is reversed. The bulk of the area has undergone major landscape changes including fire, logging, and salvage logging after severe weather events that denuded trees or to recover salvage-able timber after fires. Early logging activities left trees that were uneconomical to harvest. This has resulted in the larger "legacy" trees currently located within the study area.

In the 1950s and 1970s, three series of selective cuts removed larger trees based on diameter. In 1964, 3,000 acres in the center of the study area burned, and 5,000 acres in the eastern portion burned in 1996. The 1964 fire area was salvage logged and reseeded aerially; conifer regeneration establishment from the aerial seeding efforts was generally poor or patchy, and most of the area became domi-nated by hardwoods with a few remnant older conifer trees. The area burned in 1996 was salvage logged and mostly replanted with pon-derosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga men-ziesii*) seedlings. Overall, the study area now consists of conifer and mixed conifer-hardwood forest. The conifers primarily consist of Douglas-fir (*P. menziesii*), ponderosa pine (*P. ponderosa*), incense cedar (*Calocedrus decurrens*), and white fir (*Abies concolor*). Domi-nant hardwood species are black oak (*Quercus kelloggii*) and canyon live oak (*Quercus chrysolepis*).

The study area forest is relatively young, with an average forest age of 67 years (with SD of 28 years) and low biomass volume per acre. The average basal area for conifer and hardwood trees is 22.83 $m^2$ $ha^{1}$ (99.43 $ft^2$ $acre^{1}$) in the study area. Many of the hardwood trees tend to be 40.64 cm ( 16 in.) dbh and have grown and persisted in areas where conifers were logged. Overall, the forest landscape is a somewhat connected set of stands of various ages interspersed with legacy trees and many openings. Approxi-mately 24% of the study area consists of open area (no tree canopy).

Figure 1. Southwest Weaverville study area in California.

If one uses the California Wildlife Habitat Relationship system classification of Mayer and Laudenslayer (1988) for open to sparse tree canopy cover (areas of 40% canopy cover), 49% of the study area is in this classification range. Areas that are open and have low canopy cover are evenly distributed throughout the forest. Thus, the landscape is somewhat heterogeneous because of the scattering of open areas and the wide variation in forest composition of forested areas. Given the high heterogeneity of the forest stands, Sierra Pa-cific Industries, the current owner of the industrial private lands, wished to inventory the area. They commissioned registered profes-sional foresters to oversee the sampling design and surveying of their holdings and some of the holdings of the US Department of Agri-culture (USDA) Forest Service within Trinity National Forest to generate the inventory.

The resultant inventory plot data set was generated using an angle gauge and variable plot cruising in 2006. The data set is a systematic sample with a random starting point consisting of 10,615 unique plot points containing several attributes (see Table 1 for a sample of measured attributes). Plot points are generally established every 80.4672 m (264 ft) along transects running in a north-south cardinal direction, which are systematically spaced every 201.1680 m (660 ft) across in an east-west cardinal direction. The plot sam-pling design was established such that there is a plot sample for approximately every 1.61874 ha (4 acres) (80.4672 m by 201.1680 m rectangle), while also accounting for topography and ownership. We will subsequently refer to the 1.62-ha area plots in the article as high-resolution plots. The high density of the sample points provides a much greater level of spatial detail than most forest in-ventory data sets, such as the USDA Forest Service Forest Inventory Analysis (FIA) plots. For example, there is approximately one FIA plot for every 2,428.114 ha (6,000 acres). FIA plots are sampled using four detailed subplots (USDA 2005). Figure 1 shows the location of the study area in California. The area in the figure that is shaded darker gray represents areas covered by a forest inventory grid.

Table 1. Table of tested attributes measured at each 4-acre inventory plot along with their description.

| Attribute | Description |
|---|---|
| QUADMEAN | Quadratic mean diameter of all trees (cm) |
| BASAL_PP | Total basal area of ponderosa pine (m$^{2}$ ha$^{-1}$) |
| BASAL_DF | Total basal area of Douglas-fir (m$^{2}$ ha$^{-1}$) |
| BASAL_HW | Total basal area of hardwood trees (m$^{2}$ ha$^{-1}$) |
| BASAL_HW8 | Total basal area of hardwood trees 8 in diameter (m$^{2}$ ha$^{-1}$) |
| BASAL_TOT | Total basal area of live trees (m$^{2}$ ha$^{-1}$) |
| BASAL_SNAG | Basal area of snag trees (m$^{2}$ ha$^{-1}$) |
| SCRIB_DF | Scribner's volume of Douglas-fir (board-feet acre$^{-1}$) |
| SCRIB_TOT | Scribner's volume of total live trees (board-feet acre$^{-1}$) |
| TREES_DF | Total number of Douglas-fir trees per ha |
| TREES_HW | Total number of hardwood trees per ha |
| TREES_HW8 | Total number of hardwood trees 20.32 cm diameter per ha |
| TREES_TOT | Total number of trees per ha |
| TREES_SNAG | Total number of snag trees per ha |
| CANOPY | Percent canopy (100% complete canopy cover) |
| BIOMASS_AG | Aboveground biomass (metric-tons per ha) |
| RRHS | Relative resting habitat suitability score (scored from 0 to 1), computed using the model of Zielinski et al. (2012) |

## Fishers

Fishers were trapped for a collaborative tracking effort between Sierra Pacific Industries (SPI) and the California Department of Fish and Wildlife (CDFW). The three goals of their trapping effort were to document the presence of male and female fishers, to iden-tify and describe the home ranges of female fishers, and to identify their natal dens, where parturition occurred, and maternal dens, where kits were reared (Reno et al. 2008). Fishers were trapped from

Feb. 21 to Mar. 14, 2006, Feb. 5 to Mar. 2, 2007, and Feb. 25 to Mar. 14, 2008 with a total of 1,112 trap nights. During each trap effort, an average of 30 traps were set approximately 50 m from a road and 1.5 km apart. Traps were placed based on fisher observa-tions recorded in the CDFW National Diversity Data Base and by suggestions of local foresters. Gusto, a commercial scent lure, was used to attract fishers to the traps. Female fishers were collared with VHF transmitters from Advanced Telemetry Systems (model M1930). Male fishers were uniquely identified at trap locations; no further attempt at tracking males was made. Telemetry data was collected over a span of 2 weeks every month from Feb. 22, 2006 through Dec. 14, 2007, on the ground and aerially from helicopter by SPI and fixed wing aircraft by CDFW. Relocations were recorded using Telonics model TR-2 receivers with 14K and 2AK "H" style antennas. Resting locations measured from the ground and by heli-copter were used in this study because the location accuracy is con-siderably better than that measured by fixed-wing aircraft; a fisher was determined to be at rest if the signal remained strong and con-stant for longer than 15 minutes. This ensured that the fisher activ-ity could be determined (e.g., moving or at rest) and that an accurate triangulation could be obtained. Triangulation readings helped SPI and the CDFW locate den sites for the females. Removal of radio collars occurred during the last period of trapping in 2008.

Traps captured 33 unique fishers: 9 female and 24 male. The body mass of the trapped male fishers averaged 3.65 kg and ranged from 2.90 to 5.00 kg; female body mass averaged 2.13 kg and ranged from 1.80 to 2.40 kg. Of the fishers trapped in the collaborative effort, 13 of the 24 males and 7 of the 9 female fishers were within the region for which detailed plot data are available, the study area of this article. Of those 7 females, 5 retained their radio collars over the 2-year tracking period. The other 2 fishers provided a limited num-ber of telemetry coordinates, enabling natal and maternal den sites to be located, but not enough points to generate kernel density estimates of their home ranges.

For the 5 females with complete tracking data, 243 unique telemetry points were obtained, an average of 48 locations per indi-vidual during the 2-year tracking period. One of the 7 adult females died during the tracking effort at the end of June 2007; it is thought to have been preyed on by a mountain lion based on the pattern of tooth marks on the skull. In addition to the telemetry points, 46 den sites were located comprising 7 natal dens and 39 maternal dens. Furthermore, natal and maternal dens were identified and con-firmed to contain kits through the use of remote cameras, audio, and visual cues. Data on the den site itself, tree type, height, and dbh were collected. In addition, data measuring the quadratic mean diameter of the surrounding forest was collected using a fixed-radius plot design centered at the den site, but excluding the structure tree.

The fixed-area plot resembled a cross; each arm of the cross was 35 m long and 10 m wide and oriented in a cardinal direction. Of the 7 natal dens, 5 were in black oaks and 1 each was in a live oak and a Douglas-fir tree. Of the 39 maternal dens, 20 were in black oaks, 7 were in live oaks, 6 were in Douglas-fir snags, 2 were in Douglas-fir trees, and 1 each was in a black oak and a live oak snag, a live oak limb fall, and a big leaf maple (*Acer macrophyllum*). Two fishers had kits in 2006 and five had kits in 2007. The average dbh for den hardwoods and conifers is 65.16 and 129.79 cm, respectively. Table 2 lists the number of dens, average dbh, and average height for each species of tree in which a den was located. Although only one conifer type, Douglas-fir, was used for denning by fishers in our study area, the average dbh for living and snag den trees is 129.79 and 119.43

Table 2. Mean dbh and height of fisher den trees and snags in the study area.

| Tree species | Total no. of dens | Dbh (cm) | Height (m) |
|---|---|---|---|
| Black oak | 25 | 53.34 | 15.14 |
| Live oak | 8 | 102.10 | 15.27 |
| Big leaf maple | 1 | 30.98 | 13.71 |
| Douglas-fir | 3 | 129.79 | 36.78 |
| Black oak snag | 1 | 37.33 | 9.44 |
| Live oak snag | 1 | 43.94 | 4.87 |
| Douglas-fir snag | 6 | 119.43 | 20.82 |

cm, respectively. However, 80.4% of den trees in our study area were hardwoods, of which 70.3% were black oaks. We include a live oak limb fall in the above den tree percentage as being a type of hardwood snag because it fell from a large hardwood tree, although we do not include the limb fall in the reported measures of dbh. Black oaks used for denning have lower average dbh (53.34 cm) than the average hardwood dbh used for denning (65.16 cm).

## Method of Analysis

Several predictive models have been developed for fisher habitat suitability (Carroll et al. 1999, Zielinski et al. 2006, 2010a, 2010b, 2012), conservation planning (Carroll et al. 2010, Spencer et al. 2011), and the potential effects of fire and fire fuels management strategies on fisher habitat (Scheller et al. 2011, Thompson et al. 2011). One of the most recently developed habitat suitability mod-els is that of Zielinski et al. (2012). This is a predictive model of relative resting habitat suitability, a major element in fisher habitat. We applied the model of Zielinski et al. (2012) because our study area lies within that used to develop their model, and our plot data set contains attributes that are similar to those employed in their model. The Zielinski et al. (2012) approach uses a set of forest attributes to determine a relative resting habitat suitability (RRHS) score. A series of attribute entries are required to obtain the score: canopy cover, average age of conifer trees, total basal area of live trees, volume of large downed wood, and hardwood basal area. The RRHS score was determined for each of the FIA plots and 4-acre plots using a spreadsheet model (see Zielinski et al. 2012). Comput-ing the FIA-based RRHS scores of Zielinski et al. (2012) may help to predict the likelihood of a fisher considering the study area as a whole, whereas the higher resolution 1.62-ha (4-acre) plot scores can be useful in predicting suitable resting habitat locations within the study area, i.e., places of refugia within the matrix of forest stands.

The high-resolution plot ( 1.62 ha) RRHS scores were com-puted using nearly the same attributes found within the FIA plot data, except that the volume of large downed wood was measured using logs with a diameter of 60.96 cm (24 in.) on the large end, whereas Zielinski et al. (2012) based their analysis on logs that were 25.40 cm (10 in.) in diameter. We believe, however, that this will not have a significant effect on our analysis, as a sensitivity test for this attribute within the RRHS function revealed that downed wood was not a dominant determinant for the model (see the Appendix for a description of sensitivity testing of FIA and high-resolution plot data using the Zielinski et al. [2012] model). All attributes of the high-resolution plots were measured in imperial units and were converted to metric measurements for use in the RRHS model. Zielinski et al. (2012) state that their model indicates strong nega-tive selection for RRHS values of 0.15, and for RRHS scores of

0.35, selection steadily increases. Because our data set contains similar measures of the FIA plot data and the data are in terms of rates/proportions (e.g., $m^2$ $ha^{-1}$, percentage of an area), issues re-lated to the modifiable areal unit problem, which is of scale and aggregation, should be minimal (Jelinski and Wu 1996). Given that our study area lies within that used to calibrate the Zielinski et al. (2012) model and the model testing outlined in the Appendix, we have retained the classification system suggested in their article. Herein, we characterize the plots as being "poor" when RRHS is 0.15 and "good" when RRHS is 0.35.

To be sure, one can expect that a large swath of mature forest will have a high resting habitat suitability score. Expert opinion would also grade this as good, supportive habitat. But, how should one view a forest with scattered sites of high resting suitability, among a larger swath of dense young forest and many scattered open areas? Virtually all FIA plot RRHS scores within and adjacent to the study area are poor, which would suggest, at the resolution of the FIA plots using their metric, that viable habitat is not likely to exist. However, several fishers (7 females and 13 males) were trapped in this area and a number of den sites were located. With use of high-resolution plot data, our goal is to identify whether there is statistically significant selection/use of this industrial forest.

Our approach to testing habitat selectivity attempts to determine the small-scale nature of behaviors such as denning and resting by focusing on "best of the best in neighborhood." Technically, this is implemented by computing the distribution of the maximum values among a set of *k*-nearest neighbors (*k*-max), i.e., the distribution set of maximums of each group of *k*-nearest neighbors. The fundamen-tal question is: Do fishers select habitat based on the availability of critical landscape attributes (e.g., large trees, dense canopy, large amounts of basal area per ha, and density of trees per ha) being minimally present in small patches (neighborhoods of these ele-ments) that are defined by the ability of fishers to find and use them? Implementation of this idea could be the presence of at least one high-scoring RRHS plot or some other feature of the landscape within a neighborhood defined on the set of inventory plots. Testing for the existence of such preferences amounts to inference about the nonequivalence of two distributions of *k*-max measures where one distribution is defined based on where fishers are observed and the other is a reference distribution. The *k*-max measure and our infer-ential tests were developed to detect this preference for the type of scattered forest plots that have high RRHS scores; however, we can also use it for any scattered element of interest. This approach is based in part on the observation that fisher resting and den sites are found among the best structural elements: i.e., areas containing dense canopy cover with few forest openings, large amounts of basal area, and large proportions of mid- to late-seral stands, including larger oak and coniferous trees (Zielinski et al. 2004a, 2004b, Pur-cell et al. 2009, Raley et al. 2012, Zhao et al. 2012, Aubry et al. 2013). We suspect that this observation is true for den sites (natal and maternal) as well (Weir et al. 2012, Zhao et al. 2012). The remainder of this section describes the *k*-max approach in further detail.

Partitioning an area into two distributions to be compared is a classic way to determine habitat selection preference by animals (Alldredge and Ratti 1992, Manly et al. 1993, Alldredge and Gris-wold 2006). The *k*-max approach follows this tactic to compare distributions of a structural element, *Z*, within a landscape, *W*. More formally, suppose the total study domain *W* is partitioned into two sets *V* and *W* {*V*,[1] where *V* could be compact or could be composed of a set of regions (islands) within *W*. The definition of *V* is dependent on the type of comparison to be made. In this article, *V* is either the set of den sites (compared against reference distributions for either the forest or to the domain within the kernel density estimates) or the domain defined by kernel density estimates (com-pared with the reference distribution of forest not including the kernel domains). We want to test a hypothesis of distributional

equivalence, $H_0 : F_{Z_{\{V\}}} \quad F_{Z_{\{W\{V\}}}}$, against $H_A : F_{Z_{\{V\}}} \quad F_{Z_{\{W\{V\}}}}$, where $F$ is some characterization of the distribution of *Z*.

The following describes how the *k*-max distributions were developed and how a permutation approach using a K-S distributional equivalence test was implemented.

To compare and determine the significance of an area, we needed to partition the landscape into unique neighborhoods with a mean-ingful spatial grouping composed of the underlying high-resolution plot data. In this case, the forest neighborhoods represent the area that uniquely surrounds a den site. The area unique to a den site can be thought of as those areas within half of the average move distance between den sites. In a certain way, the unique areas can be viewed as a series of tessellated squares over a landscape; each "square" would contain the *k*-plots representative of the area within it. The area uniquely represented as a set of *k*-neighbors can be defined as a quadrature set. The entire forest is represented as a set of unique quadratures.

Rather than using *Z* measured at every observed plot in *V* and *W* {*V*, we instead focus on the "best of the best in each neighbor-hood or quadrature" or in mathematical terms the set of greatest elements of subsets defined over *k*-nearest neighbors. In spatial terms, we can compare the set of the best plot of quadratures for distribution *V* to the set of the best plot of quadratures in the re-maining distribution *W* {*V*. For example, several quadratures could represent the area unique to a home range (*V*) compared with the quadratures representing the remaining forest (*W* {*V*). By comparing the preeminent high-resolution plots unique to a larger area, we can examine the best structural components of a forest and avoid issues related to the modifiable area unit problem and gain a better understanding of the best elements that are lost when in-cluded in an areal average. Groups of quadratures can be thought of as those uniquely representing den locations, home ranges, or the rest of the forest. We term the set of the best plots, the best from each quadrature, the *k*-max set. To make this more precise mathemati-cally, we introduce three sets of spatial location indices all contained within *W*. These are the following: *s*, the location of plot centers; *t*, the location of den sites (natal and maternal); and *u*, the location of a set of regularly spaced quadrature points. A quadrature point can be thought of as the centroid of a tessellated polygon defined by the set of points contained within it (the *k*-neighborhood).

There are several ways to conduct hypothesis tests of habitat preference (Alldredge and Ratti 1992, Manly et al. 1993, Alldredge and Griswold 2006). The most basic approach to habitat selection testing is based on monitoring animals' choices (moves) among a set of habitats that are exhaustive and have a one-to-one mapping into the study domain; each location on the map has only one habitat among the set of habitats found in the study region. Within that framework, the $^2$ test is the simplest and has been one of the most popular, despite many of the assumptions (minimum cell counts, independence of observations, etc.) not being satisfied (Alldredge and Ratti 1992, Alldredge and Griswold 2006). In our case, we have

very rich and high-resolution inventory and detailed tracking records for a small number of fishers. We therefore focus on compar-ing complete distributions of single landscape attributes between selected (areas where fishers are known to have been proximally) and nonselected (areas where fishers are not known to have been proximally) areas, and we use robust resampling-based methods for inferential testing. As explained in detail below, our measure of distance between the two distributions is defined on empirical cumulative distribution functions as in the K-S test. Whereas we report results for $^2$ tests and standard K-S tests, the permutation (randomization-based) tests provide a more robust nonparametric alternative, given that we know certain assumptions of the other tests are not satisfied (Manly 2007).

In this case, we observe plot characteristics $Z_s$ measured at locations $s$. Next, we define two types of neighborhood sets: $b_t$ consists of the $k$ closest points in $s$ to a point in $t$, and $b_u$ consists of the $k$ closest points in $s$ to a point in $u$. The landscape variables we work with are then defined on locations $t$ or $u$ as

$$Z_t \quad \max_{s \ W_t} Z_s \qquad \text{and} \qquad Z_u \quad \max_{s \ W_u} Z_s. \qquad (1)$$

We focus on the $k$-max sets, $Z_t$ or $Z_u$, because we assert that fishers are selecting domains of the landscape based on satisfying structural requirements within a general neighborhood. That is, they tend to choose locations within the forest that have qualities closer to mature to late-seral forest characteristics (e.g., large trees, dense canopy, high levels of basal area, and others). Specifically, in this study we set $k$ 10. The reason for choosing the 10 closest plots is that this approximates the area within a 201.168-m (660 ft) radius of the den. Because the average den site move, the distance between natal to maternal and maternal to maternal sites, for a female fisher in our study area was approximately 402.336 m (1,320 ft), we assert that the area about a den at half that distance is likely to uniquely represent an area for a potential den. Thus, a 201.168 m (660 ft) neighborhood radius around a den can therefore be reasonably ex-pected to contain the unique structures surrounding a given den site. The quadrature points, $u$, are introduced to provide an approximate partitioning of the plot centers into nonoverlapping sets of 10 plots. Because of some irregularities in the shape and orientation of inven-tory plots, the resulting $k$-max sets include a small amount of overlap among the 10 nearest neighbors.[2]

We want to conduct three different tests of distributional equivalence for each landscape feature, $Z$. These are the following

1. $k$-max about the den sites compared to the complete forest ($W$) or $k$-max about all quadratures, $H_0$: $F_{Z_t \{W\}}$ $F_{Z_u \{W\}}$,
2. $k$-max about the den sites compared to the $k$-max quadratures representing the home range domain ($V$), $H_0$: $F_{Z_t \{V\}}$ $F_{Z_u \{V\}}$, and
3. $k$-max about all quadratures within the home range domain ($V$) compared with the rest of the forest $k$-max quadratures,

$$H_0 : F_{Z_u \{V\}} \qquad F_{Z_u \{W\{V\}}}.$$

We defined the home ranges, $V$, using kernel density estimation with the bandwidth selection chosen using cross-validation and incorporating edge correction following Diggle (1985, 2003).[3] The results reported in the next section for tests 2 and 3 above involved using the 75th quantile of the kernel density to define the domain of $V$. The 75th quantile of the kernel density estimates was used be-cause this is likely to provide the best approximation for areas known to be used by fisher. For tests of type 2, the plot centers in $V$ were

divided into disjoint sets that are either among the 10 nearest neigh-bors of a den site or not. Those that are not are available to be associated with a quadrature point $u$ in $V$. The full forest domain, $W$, was also reduced to exclude nonforest elements before any tests were conducted. Areas consisting of 40 acres or more of nonforested land (mostly areas of recent severe wildfire) were excluded from the study to reduce the number of low $k$-max values. This reduces the likelihood that an element will be identified as statistically signifi-cant as we have compared only quadratures containing some for-ested areas; if these quadratures are included, statistical significance is even stronger.

For each of the pairwise comparisons between distributions "A" and "B" (den/forest, den/kernel, and kernel/forest), we present three related inferential tests of distributional equivalence: $^2$, K-S, and a permutation test that uses K-S as a distance measure. The first two tests, $^2$ and K-S, are well-known tests with inference based on comparison of the test statistics to a known reference distribution. The drawback of the $^2$ test is that the continuous data are aggre-gated into a set of threshold bins; the binned counts in A are then compared with the expected bin counts under the distribution of bin counts in B. Information is lost in the binning process and for most of the attributes tested. We do not satisfy the requirements for the $^2$ distribution to hold and thus the resulting $P$ values may be misleading. This is probably the most well-known test but is also the least robust. We include it primarily for comparison to the other two test results.

The K-S test is useful because it is a nonparametric test for comparing a set of observations with an underlying continuous distribution. The test essentially measures the distance between the empir-ical cumulative distribution function of A and the empirical cumulative distribution function of B. The drawback of the K-S test is that valid inference requires that the distributions compared are truly continuous; as the number of ties increases, the basis for infer-ence erodes. Because of this, we suppress the test results when the distributions compared have 70% of the values being unique. However, it is still useful as a reference to compare $P$ values from the K-S test with those from the permutation test.

The permutation test uses the variation in our observations to numerically derive a $P$ value. Assume that distribution A has $n_a$ values, distribution B has $n_b$ values, and we have a function $M(A, B)$ that yields a measure of distance between distributions A and B. The function $M(\ )$ in this case is the K-S test used to derive the test statistic as a measure of distance between distributions. Take $M(A, B)$ as the observed test statistic, and then generate $R$ replications of $M(\ )$ where the input distributions $A_r$ with $n_a$ values and $B_r$ with $n_b$ values are random samples without replacement from the vector ‹$A$, $B$›. The permutation $P$ value reported below is calculated as

$$\frac{1}{R} \ {}_{r} I \ M A_r, B_r \quad M A, B \qquad (2)$$

where $I(,\ )$ is an indicator function that takes the value 1 if true and 0 otherwise. The permutation test simply yields the probability of the observed distance between distributions A and B occurring due to "chance" as defined under the null hypothesis. Permutation test-ing was conducted using 999 replications. The permutation test should yield valid results even in the presence of ties. Of the three tests, this is the test in which statistical significance is the most robust

Figure 2. RRHS map characterizing poor (<0.15) and good (>0.35) habitat with 75% kernel density contours of 5 female fishers.

to the peculiarities of the distributions we are analyzing. The attri-butes tested using the *k*-max approach are listed in Table 1. Several of these attributes have been suggested as being useful for character-izing fisher habitat and therefore were chosen for use in the analysis (Zielinski et al. 2006, 2010a, 2010b, 2012, Thompson et al. 2011, Aubry et al. 2013).

## Results

The results of the characterization of the study area using the model developed by Zielinski et al. (2012) are shown in Figure 2.

This figure shows both the FIA and 1.62-ha (4-acre) plot RRHS scores as characterized by the method of Zielinski et al. (2012) as being poor (RRHS of 0.15), neutral (0.15 RRHS 0.35) or good (RRHS of 0.35); see the Appendix for a discussion related to scoring and thresholds. In addition, isolines representing the 75% quartile of fisher use density within each individual home range were plotted. Sixteen of 18 FIA plots within 2 km of the study area were characterized as being poor fisher habitat (RRHS of 0.15); 2 of the 18 plots, located in the eastern edge of the study area, were charac-terized as neutral. The average FIA plot score of the study area was

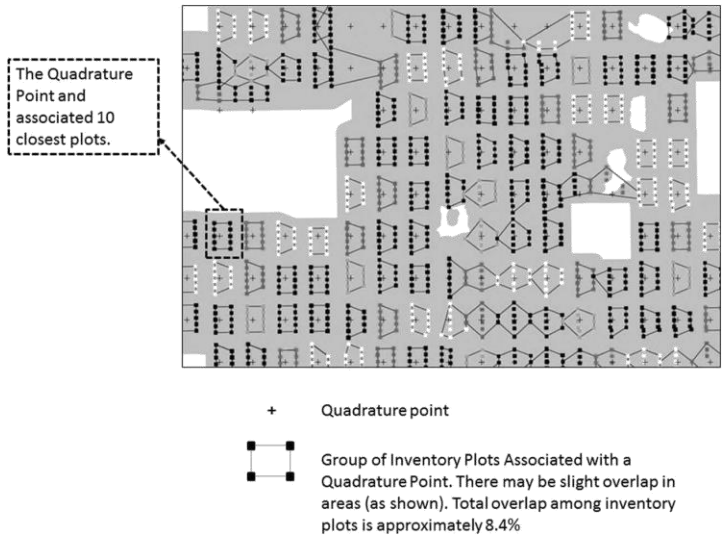


Figure 3. A portion of the region depicting quadrature points with the closest 10 plots: there is a total overlap of 8.4% across the entire forest.

Table 3. *k*-max *P* values for distributional comparison: dens versus forest, 75% kernels versus forest, and dens versus 75% kernels.

| | | Dens versus forest | | | 75% kernels versus forest | | | Dens versus 75% kernels | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Variable: *A* | $^2$ test: *B* | K-S test: *C* | Permutation: *D* | $^2$ test: *E* | K-S test: *F* | Permutation: *G* | $^2$ test: *H* | KS test: *I* | Permutation: *J* |
| 1 | QUADMEAN | 0.211 | 0.294 | 0.260 | 0.000 | 0.000 | 0.001 | 0.146 | 0.619 | 0.534 |
| 2 | BASAL_PP | 0.177 | | 0.044 | 0.258 | | 0.200 | 0.001 | | 0.024 |
| 3 | BASAL_DF | 0.002 | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.323 | 0.207 | 0.161 |
| 4 | BASAL_HW | 0.028 | 0.003 | 0.008 | 0.000 | 0.005 | 0.005 | 0.073 | 0.124 | 0.103 |
| 5 | BASAL_HW8 | 0.000 | 0.009 | 0.007 | 0.001 | 0.008 | 0.010 | 0.000 | 0.189 | 0.156 |
| 6 | BASAL_TOT | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.269 | 0.018 | 0.016 |
| 7 | SCRIB_DF | 0.004 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.117 | 0.137 | 0.116 |
| 8 | SCRIB_TOT | 0.003 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.018 | 0.058 | 0.054 |
| 9 | TREES_DF | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.292 | 0.224 |
| 10 | TREES_HW | 0.018 | | 0.006 | 0.004 | | 0.003 | 0.142 | | 0.191 |
| 11 | TREES_HW8 | 0.026 | | 0.319 | 0.005 | | 0.005 | 0.591 | | 0.970 |
| 12 | TREES_TOT | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.036 | 0.360 | 0.333 |
| 13 | CANOPY | 0.401 | | 0.040 | 0.021 | | 0.056 | 0.346 | | 0.182 |
| 14 | BASAL_SNAG | 0.000 | | 0.001 | 0.000 | | 0.001 | 0.003 | | 0.120 |
| 15 | TREES_SNAG | 0.000 | | 0.001 | 0.000 | | 0.001 | 0.006 | | 0.057 |
| 16 | BIOMASS_AG | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.163 | 0.007 | 0.012 |
| 17 | RRHS | 0.000 | 0.004 | 0.003 | 0.000 | 0.000 | 0.001 | 0.000 | 0.216 | 0.187 |

0.074. Of the high-resolution plots, a majority of them, 8,699 of 10,615, were classified as being poor (RRHS of 0.15), 683 were characterized as being good (RRHS of 0.35), and 1,233 were characterized as being selectively neutral (Figure 2). The average RRHS score of the high-resolution plots is 0.081. This indicates that the high-resolution study area average is in near agreement with the lower resolution FIA plot average. This result is not surprising, because the large-scale aggregate measure of the FIA plots should be approximately the value of the detailed fine-scale plots.

Figure 3 shows a subset of the quadrature point locations within the study area, and the 1.62-ha (4-acre) plots that have been allocated to them. The area shown in Figure 3 is where several of the plots have been associated with more than one quadrature point due to the sampling structure of the inventory plots. Quadrature points were placed such that the number of overlaps was minimized when inventory plots were grouped into neighborhoods of 10. The placement of the quadrature points minimized the number of inventory plot overlaps to 8.4%. As noted above, openings of 40 acres with no forest cover were excluded, so as not to include low *k*-max values that could bias the results of significance testing.

The test results based on the *k*-max measure are summarized in Table 3. It is important to stress here that rather than comparing quadratures based on variable averages found among the *k*-plots of a quadrature, the *k*-max test is associated with comparing the best of the *k*-values of that variable found in each quadrature. For the *k*-max test, most variables have statistically significant differences at the 0.05 level for the den/forest and kernel/forest comparisons and a few more at the 0.10 level. Three sets of inferential tests are reported: the first set presents the dens versus forest *k*-max comparisons (columns *B*, *C*, and *D*), the second set gives the 75% kernel versus forest *k*-max comparisons (columns *E*, *F*, and *G*), and the third set reports the dens versus 75% kernel *k*-max comparisons (columns *H*, *I*, and *J*).

Table 4. Average values and average *k*-max values for selected variables of the 1.62-ha (4-acre) plots.

| | | Plots | | *k*-max | | | | |
|---|---|---|---|---|---|---|---|---|
| | Variable: *A* | 75% KDE: *B* | Study area: *C* | 75% KDE: *D* | 75% KDE ND: *E* | Study area NKDE: *F* | Study area: *G* | Den: *H* |
| 1 | QUADMEAN | 29.276 | 26.566 | 68.321 | 67.793 | 64.864 | 65.138 | 65.306 |
| 2 | BASAL_PP | 2.039 | 2.589 | 10.547 | 10.432 | 12.182 | 11.988 | 13.784 |
| 3 | BASAL_DF | 10.495 | 7.201 | 36.636 | 33.830 | 26.911 | 28.154 | 42.221 |
| 4 | BASAL_HW | 15.467 | 12.285 | 60.309 | 59.001 | 48.400 | 49.952 | 64.696 |
| 5 | BASAL_HW8 | 10.931 | 8.518 | 39.603 | 37.854 | 32.497 | 33.473 | 43.442 |
| 6 | BASAL_TOT | 28.701 | 22.826 | 78.188 | 75.406 | 64.209 | 66.022 | 83.158 |
| 7 | SCRIB_DF | 6,655.59 | 4,425.83 | 25,139.16 | 21,891.88 | 17,733.41 | 18,757.94 | 27,078.72 |
| 8 | SCRIB_TOT | 8,115.75 | 5,842.46 | 27,746.70 | 24,639.71 | 21,086.85 | 22,000.30 | 29,614.04 |
| 9 | TREES_DF | 399.819 | 262.354 | 2,666.260 | 2,737.391 | 1,667.952 | 1,789.113 | 6,057.247 |
| 10 | TREES_HW | 529.996 | 427.489 | 3,241.135 | 3,148.780 | 2,462.000 | 2,577.883 | 8,922.826 |
| 11 | TREES_HW8 | 152.115 | 131.566 | 722.348 | 689.129 | 627.946 | 641.112 | 1,757.664 |
| 12 | TREES_TOT | 1,144.734 | 929.684 | 5,706.197 | 6,121.917 | 4,289.452 | 4,493.088 | 1,3013.349 |
| 13 | CANOPY | 57.872 | 49.063 | 98.522 | 97.855 | 95.104 | 95.534 | 100.000 |
| 14 | BASAL_SNAG | 2.303 | 1.611 | 13.211 | 12.370 | 9.080 | 9.669 | 3.543 |
| 15 | TREES_SNAG | 3.923 | 2.639 | 33.930 | 36.111 | 21.138 | 22.623 | 7.507 |
| 16 | BIOMASS_AG | 176.604 | 132.836 | 451.758 | 434.250 | 357.890 | 370.626 | 1,193.931 |
| 17 | RRHS | 0.112 | 0.081 | 0.413 | 0.388 | 0.320 | 0.333 | 0.458 |

The FIA RRHS average is 0.074.

The classic K-S test results are not provided in cases where the assumption of no ties is strongly violated; operationally, we only report results for the K-S test when 70% or more of the values in the distribution are unique.

For example, consider the aboveground biomass attribute found on line 16 of Table 3. Overall, given a significance threshold of 0.05, one can see that the distribution of *k*-max values (i.e., the highest amount of aboveground biomass found in the 10-plot neighbor-hood) for all three comparisons is significantly different from the distribution of *k*-max values for the comparison set under the null hypothesis. Comparing the *k*-max distributions in the neighbor-hood of dens to the distribution of *k*-max values for neighborhoods centered on quadrature points in the forest (first set of columns), the best of the *k*-neighborhood about a den is significant compared with the best of the *k*-neighborhoods across the rest of the forest. As another example, the number of hardwoods 20.32 cm (8 in.) in diameter (Table 3, line 11) is not significantly different when dens are compared with the rest of the forest. Table 4 lists the average *k*-max values for the three levels of comparison: the 75% kernel density estimate (75% KDE), 75% KDE without the den sites (75% KDE ND), the study area excluding the 75% KDE (study area NKDE), the study area, and the den sites. The following subhead-ings break down the results of the *k*-max tests for each of the three levels of comparison: dens versus forest, dens versus 75% kernels, and 75% kernels versus forest.

### Dens versus Forest

Table 3 shows that all but two of the attributes tested were significant at the 0.05 confidence level when the set of the best plots found in den quadratures are compared with the set of the best plots found in forest quadratures; quadratic mean diameter and the num-ber of hardwood trees 20.32 cm (8 in.) in diameter were not significant. Table 4 shows that the average den site *k*-max attribute values are 2–7 times higher than the average forest value. When the quadratures containing dens are compared with the forest quadra-tures, all of the tested den *k*-max attributes are higher. The average den site RRHS *k*-max is 0.458 compared with the average study area *k*-max score of 0.333.

### 75% Kernels versus Forest

All but two forest attributes (canopy cover and ponderosa pine basal area) were significant at the 0.05 confidence threshold when the 75% KDE *k*-max values were compared with the forest *k*-max values (Table 3). At the 0.10 confidence threshold, canopy cover is significant. Of the average *k*-max attributes, all but the basal area of ponderosa pine are greater in the *k*-max of the 75% KDE than those of the remaining forest (Table 4). The average RRHS 75% KDE *k*-max is 0.413, whereas the average study area *k*-max score without the kernels (study area NKDE) is 0.320.

### Dens versus 75% Kernels

In a comparison of den with 75% KDE *k*-max, only ponderosa pine basal area, total basal area, and aboveground biomass were found to be significant at the 0.05 confidence threshold (Table 3). Total Scribner's volume and the number of snags per ha are signif-icant at the 0.10 confidence threshold. Average attribute *k*-max values for quadratic mean diameter, the number of Douglas-fir trees, the number of total trees, and the number of snags were lower in den quadratures than in the remaining 75% KDE quadratures, but not significantly (Table 4). All of the other average *k*-max attributes of the den quadratures are greater than those of the remaining 75% KDE. The average RRHS dens *k*-max is 0.458 compared with the 0.388 for the 75% KDE excluding dens, although this difference is not significant.

## Discussion

One can think of this forest as a matrix containing a somewhat consistent scattering of prized habitat. Much of the landscape is classified as being considered poor for resting tree selection, al-though there are areas in which "good" RRHS classifications are spatially distributed. That is, the average forest is scored quite low, whereas there are plots that score well. This is evidenced by the fact that only 683 plots or 6.4% of the study area was predicted to provide "good" resting site habitat, although 26.5% of these lie within the estimated 5 female home ranges. However, the distribu-tion of the best within each 16.2-ha (40-acre) neighborhood

within the kernels is statistically significant for large structural elements compared with the distribution of the best in each neighborhood for the rest of the forest. For example, although only one conifer type, Douglas-fir, was identified for denning fisher in our study area, the average dbh for live (129.79 cm) and snag (119.43 cm) Douglas-fir denning trees is similar to the dbh of live conifer (117.3 cm) and snag conifer (119.8 cm) resting trees reported by Zielinski et al. (2004b). These are also greater than the average dbh Purcell et al. (2009) described for live conifer (97.40 cm), and snag (98.83 cm) resting trees used by female fishers in the southern Sierra. In addition, it is notable that the black oaks, the trees used most often for den sites, have a much lower average dbh than the average hardwood dbh in the study area. Furthermore, black oaks used for denning (average dbh of 53.34 cm) are smaller than the other hardwoods used for denning (average dbh of 65.16 cm), both of which are less than the average resting hardwood (dbh of 69.0 cm) reported by Zielinski et al. (2004b). However, the hardwoods are still large trees that contained cavities where kits were reared. Thus, fisher locations appear to be selective for these larger elements. This observation is consistent with what the existing literature characterizes as important structural components of fisher resting habitat (Zielinski et al. 2004a, 2004b, Purcell et al. 2009, Lofroth et al. 2010, Aubry et al. 2013). However, what is not consistent is the fact that these larger elements comprise only a small portion of the total area. For example, plots with a RRHS score of 0.35 comprise 6.5% of the study area.

Lofroth et al. (2010) have presented a data summary of known den sites for fishers in Northern California. This summary is based on 170 den sites (natal and maternal), which include the 45 den sites in our study area (26% of their data). Of the 125 unique den trees that are not part of our study area, 66.4% of dens were within hardwoods (living or snags) and 33.6% were in conifers (living or snags). In comparison, of the 45 den sites reported in Lofroth et al. (2010) that fall within our study area, 80.0% are hardwood and 20.0% conifers. Thus, our study area has a higher percentage of hardwood trees used as den sites than found in other studies.

The number of hardwoods used as dens in our study area could be due to the fact that usable cavities form within hardwoods at a younger age than those of conifers and at a dbh that is much smaller than that of a comparable conifer tree. These oak trees could also provide food and cover in a manner similar to the southern Sierra fisher (Zielinski et al. 2004a). As Zielinski et al. (2004a) note, female fisher home ranges included a greater proportion of forest types in the densest canopy class than did male home ranges and they could not distinguish whether this relationship was proportional or absolute. Even though the proportion of mature stands and large trees within our study area is low, female fishers selectively use such areas and such selection is statistically significant. What we do not address here is estimating the absolute minimum in terms of large trees and their spatial distribution that underpins whether a female fisher is able to maintain a viable home range in a particular location over time. The use of den trees similar in size to those found used as resting sites in previous studies (Zielinski et al. 2004b, Purcell et al. 2009) suggests that although these large trees may be somewhat scarce within this landscape, they are critical components.

Weir et al. (2012) point out that den site selection appears to occur within a forest at a fine scale and that this selection may be harder to identify at larger aggregate scales. Our study supports that claim, as at the aggregate scale (lower resolution), the study area appears to be less than desirable when a published metric is used, but at a higher-resolution elements do exist that are differentially selected. Fine-scale selection may also be teased out using LiDAR (light detection and ranging) data instead of a high number of in-ventory plots. For example, Zhao et al. (2012) have used LiDAR data to determine locations potentially suitable for fisher den sites in the southern Sierra.

The findings of this article suggest that preference is given to areas containing large structural components as others have found. However, the density of apparent suitable structures is quite low (6.5% of the landscape), as these structures occur very infrequently across the study area and in stands composed of primarily young trees, whose average age is 67 years, rather than mature (100- to 200-year) or late-seral ( 200-year) stands. Whereas old, mature forests contain numerous large elements for potential resting and denning, this study demonstrates that elements of mature to late-seral stands appear to be significant components of fisher habitat even if not very prevalent.

It is important to note that our study is somewhat limited by the small number of female fishers tracked for an extended period. It would have been nice to have had data tracking individuals and their progeny for longer periods to determine long-term use patterns. However, the average weight of fishers in our study area (3.65 kg for males and 2.13 kg for females) is similar to that of two other studies in California, one located near our study area and the other in the southern Sierra Nevada range. Although both studies contain few females (3 each), Buck et al. (1979) reported an average body weight of 3.5 kg for males and 1.8 kg for females. Similarly, Boroski et al. (2002) report a median weight of 3.6 kg for males and a mean weight of 2.1 kg for females. Thus, it appears as though the fishers in this study are not terribly different in terms of weight from fishers in other areas of California, particularly those from a study conducted nearly 40 years ago very close to the current study area.

In addition, females had kits during the 2 years of tracking, although what happened to the kits after their rearing is not known. It is unfortunate that no information was collected on male fishers other than the number of males trapped and their trap location. Because of this, we are not able to determine home ranges main-tained by males and any similar or dissimilar landscape use for them. Even though averages across scales of hundreds of acres tend to be low in terms of basal area, large structural elements, and average tree age as well as RRHS scores, at a finer scale fisher selectivity toward larger structural elements is statistically significant. Without this new spatial sampling approach, this selectivity cannot be identified and without it one might conclude that the area is not suitable habitat. Simply put, female fisher home ranges are statistically dif-ferent from the background forest in terms of the largest structures and scattered mature stands that are present. The spatial sampling and testing approach developed in this article is useful for charac-terizing critical habitat components, even when they may be scat-tered and lost in average measures over larger areas. It also shows that high-resolution forest inventory plots are useful for describing the critical components of habitat where forest variation is great.

Thus, a metric applied across a large area (represented by FIA plot data) may undervalue important features such as scattered ma-ture stands and scattered groups of large trees when they exist. Al-though a large area covered with mature stands contains such ele-ments in abundance and average values will reflect this fact, a different approach is necessary to measure suitability when needed elements are scattered and are not abundant. The *k*-max test was developed to detect whether scattered elements are significant in

selected use. One issue that remains is, when scattered elements exist, at what level and numbers are such elements supportive of a species, like the fisher, and at what threshold below which are they not supportive for a local population? This question may be an-swered by expanding the *k*-max test to search for a significant thresh-old of need, e.g., the best three plots of a quadrature must contain large trees suitable for denning, and, thus, is part of ongoing research.

## Summary and Conclusions

We have studied an area of approximately 180 km$^2$ that existing models predictively characterized as poor or nonexistent fisher hab-itat. Previous field surveys in 2006 and 2007 trapped 33 fishers (9 female and 24 male). Of these, 5 female fishers were tracked over several seasons, which resulted in the identification of 7 natal dens, 39 maternal dens, 19 observed resting sites, and 253 additional telemetry locations. In addition, the study region has been invento-ried at a very high density of field plots, averaging one plot per 1.62 ha (4 acres). This has allowed us to statistically characterize structural use and habitat elements at a finer scale than existing work, with the exception of that of Zhao et al. (2012). Although the number of home ranges is somewhat small, this falls within a range of data set sizes that have been used in many other studies of the fisher. However, it is still important to state that this sample size may limit the extent to which the conclusions reached here are fully applicable elsewhere.

FIA plots (one per 6,000 acres) have been used to characterize the landscape at a broader scale. Of the 18 FIA plots within a region bounded by a 2-km buffer of the study area, two are classified as neutral with respect to the Zielinski et al. (2012) RRHS scores and 16 are classified as poor. The two that were scored as neutral fell on the eastern edge of the study area, where no traps had been deployed. The validity of the RRHS score applied to a forest area that is more varied and containing many less-than-mature stands appears to hold only when applied at a finer scale compared with areawide averages. Habitat use by females tends to occur in and around those stands that score highly even though they are often surrounded by stands of younger trees, larger openings, and areas with low levels of canopy cover. This means that the RRHS scoring system can be used to characterize habitat elements when higher spatial resolution data are available for forests that are not large homogeneous swaths of ma-ture stands, which should not be a major surprise, as the RRHS scores were developed to identify those features that had high cor-relation with use. What is a bit of a surprise is that these elements do not need to be as abundant as what would be found in a large mature forest.

Even though fisher dens tend to be found on the plots with the highest RRHS scores, these valuable plots tend to be scattered among a matrix of younger trees. To demonstrate this observation, as well as test other possibly important attributes, we have developed the *k*-max approach and imbedded it into an inferential framework based on permutations. One can think of this as a test of the best of the attributes found among a point and its *k*-nearest plots (called the *k*-neighborhood). When we compared the den site neighborhoods to the forest in general, virtually all of the measured attributes were statistically significant at the $P$ 0.05 level. Further, the *k*-max tests of the RRHS scores of Zielinski et al. (2012) are also statistically significant at the neighborhood level but not at the landscape level. What this work shows is that the scale of analysis is tantamount to

classifying fisher habitat in varied landscapes (including many open-ings), a scale that is finer than that used in most previous work.

We believe that the methodology proposed in this article can be useful in characterizing the habitat of fishers and other animals in a varied landscape. What is needed in this approach is high-resolution landscape data, whether generated from a land-based survey or aer-ial-based survey (e.g., LiDAR). What remains to be determined for fisher management is the needed amount and distribution of habitat elements, e.g., the minimum density of denning and resting trees, which would not be necessary if the habitat consisted principally of mature to old-growth stands. Estimating such thresholds may be done by expanding the *k*-max approach and comparing the overall distributions of ranked quadrature elements. That is, it is possible to compare the sets of second best plots to second best plots, third best plots to third best plots, and so on until the "worst of the worst" are compared among quadratures. This may provide valuable insight as to the needed distribution of elements in the classification of poten-tial female habitat.

### Endnotes

1. $W \{V$ is read as $W$ excluding elements in $V$. This is standard set notation used in mathematics and statistics.
2. The reason for plot overlap is that the plot samples are not all equally spaced within the forest due to odd parcel shapes. The odd parcel shapes required adjust-ments to the inventory grid such that each parcel is inventoried at the prescribed frequency where differing topographic features are evenly sampled.
3. This was implemented in the Spatstat package found in R (version 2.15).

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## Appendix

The Zielinski et al. (2012) model requires five attribute measures to compute a RRHS score. These variables are average age of dominant conifer trees (in years), total basal area ($m^2$ $ha^{1}$), canopy cover (% of cover), hardwood basal area ($m^2$ $ha^{1}$), and volume of large downed wood ($m^3$ $ha^{1}$). Each of the five required variables to compute the RRHS score were used in the FIA and 1.61874-ha (4-acre) fine-scale plot data. Stand age in the FIA and fine-scale plot data set used in this article are computed in a similar manner. Conifer age is estimated by the field crew or analyst based on the trees that were cored and any other information they might have about the plot. Age tends to correspond to the age of the canopy domi-nants in forests with severe disturbance regimes but is more of a weighted average in stands with multiple partial disturbances (nat-ural or management). Canopy cover is measured through the use of an

algorithm, as is the FIA plot; both assure that canopy cover of 100% does not occur. Total basal area and hardwood basal area are computed using the same methodology. The volume of large downed wood is the only variable that is not computed in the same manner as whereas Zielinski et al. (2012) based their analysis on logs that were 25.40 cm (10 in) in diameter.

The Zielinski et al. (2012) model was tested for sensitivity in regard to variable inputs. This was done using the FIA and fine-scale plot data; in this case, the average attributes of the included 99 FIA plots in the Zielinski et al. (2012) Excel workbook and the best plot in each forest *k*-max neighborhood. The data were tested using two methods. The first method incremented through each variable, one at a time. The first variable, say age, was zeroed out and the RRHS was recalculated to obtain a score. Once this was done, the original variable value was replaced, and the process was repeated with the next variable. The attribute most sensitive to a zero value is the basal area variable; this produced a 98% reduction in the RRHS score. A zero for the volume of large downed wood entry reduced the RRHS score by 41%. A zero for hardwood basal area reduced the score by 24%. A zero for canopy cover increased the RRHS score by 23%. However, most of these attributes are likely to be correlated; a test for subtle variation among all variables is likely to be more informa-tive of changes to an RRHS score. This is why a second test was used.

The second method followed the previous one, except that in-stead of setting a variable value to zero, the variable was tested for a 10% increase and decrease of the mean attribute value. Basal area was again the most sensitive to this variation; a range of 0.08958 occurs for a 10% change. The volume of large downed wood was that used in Zielinski et al. (2012). In this case, the fine-scale plots, the volume of large downed wood was measured using logs with a diameter of 60.96 cm (24 in.) on the large end,

the fourth most sensitive variable of the five input variables, having an RRHS range of change of 0.01778 between the 10% decrease and increase. Given these two tests, as applied to both data sets, it appears that basal area is the most important variable in the computation of the RRHS score and that the large downed wood is not a dominant determinant when there is a 10% change in value. Given that the 4-acre plot data are computed in a manner similar to that for the FIA plot data, the slight variation in the measurement of large downed wood should not greatly affect the RRHS score.

We believe that the application of this model, using proportional measures similar to those found in the FIA plot data, helps to iden-tify those areas in the forest matrix that are likely to have greater potential resting habitat. This is supported by an analysis using the *k*-max "bests" found within the 75% KDEs compared with 499 randomly rotated and placed KDE *k*-max "bests" within the study area. An empirical cumulative density function can then be used to determine significant dissociation, neutrality, or significant associa-tion. Significant association/dissociation was determined using a 0.05 confidence interval. This test suggested that selection was sig-nificantly associated with RRHS values of 0.35 and neutral for values of 0.35, results that are in line with the findings of Zielinski et al. (2012) related to FIA plot RRHS scoring.

# Fisher Natal Den Use On Managed Timberland In California

*Fisher Data Compiled from Cooperative Studies*

*Study Cooperators:*

*California Department of Fish and Wildlife*

*Sierra Pacific Industries*

*US Fish and Wildlife Service*

*North Carolina State University*

Sierra Pacific Industries
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# Report on Fisher Natal Den Use

## Introduction

Starting in 2006 Sierra Pacific Industries (SPI) has been a cooperator in two different fisher wildlife studies, the first being a habitat use and home range study via radio telemetry on Pacific fisher in a portion of SPI lands south of Weaverville, and in the Sacramento Canyon north of Redding, the second being the much larger effort to translocate fishers from the Northern California population to SPI's Stirling Management Area. In these three areas radio collars were placed on female fishers and those fishers were followed to determine denning and reproductive success. The California Department of Fish and Wildlife (CDFW) was a cooperator in both of these studies. The translocation effort included the US Fish and Wildlife Service and North Carolina State University as cooperators. From those efforts we located 30 natal den sites from which the following analysis has been conducted. Prior to these efforts published literature indicates that as of 2006 fewer than 10 natal sites were known in California (Zielinski, 2006). Natal dens are usually the first den used each season, where parturition (birth) occurs. Female fishers move their kits to subsequent dens and those are referred to as maternal dens. These data are presented here with the permission of the cooperators to help inform fisher management. The cooperators reserve the right to formally publish these data in the scientific literature and academic papers.

## Earliest Date of Natal Den Use

The data presented here is based on cooperative efforts to monitor 30 natal dens from Weaverville, Sacramento Canyon and Stirling City study sites. Natal den data will continue to be collected on the translocation effort. At these study sites we did not document fisher denning earlier than March 17, with the latest natal den found on April 19$^{th}$. The average date of natal den establishment was March 29$^{th}$. These findings are similar to other denning studies in western North America where the earliest and latest parturition dates were March 9$^{th}$ (Higley and Matthews 2006) and April 12$^{th}$ (Weir and Corbould 2008). The average start date for denning in Hoopa was March 22 (range 9 March-7 April) (Matthews et al. in press). Realizing that fishers may have begun using a den before researchers detected the natal den location, March 1 would be a reasonable estimate for the earliest date of natal den selection and use.

## Ability to Move Kits to Maternal Dens

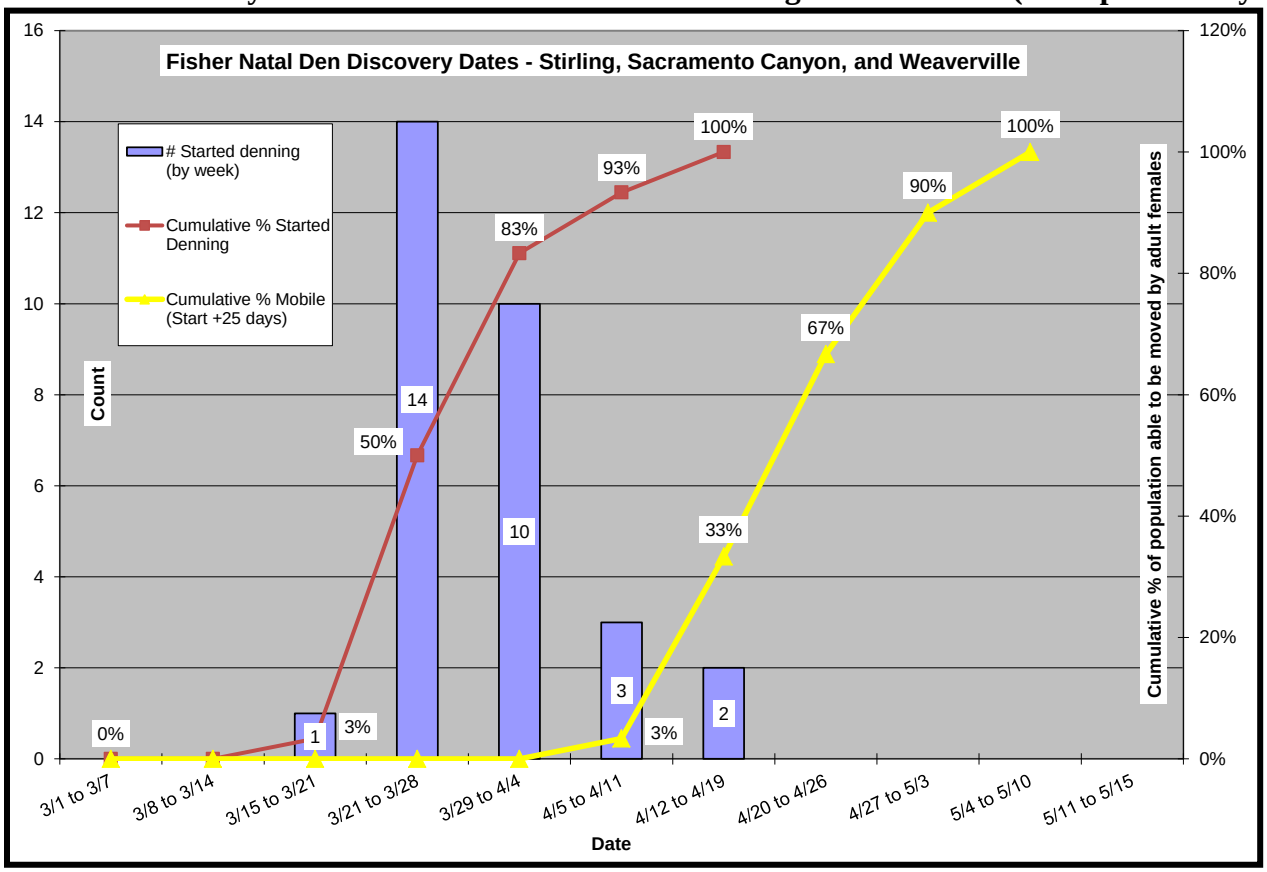
As kits grow, the female moves them from natal dens to maternal dens. Data from 29 of 30 natal dens indicates the average stay is 25 days (95% CI ranges from 19.7 to 30.9 days). One fisher was able to slip her collar after denning started. The total data set for natal den stay ranges from a minimum 5 days to the longest 68 days with a standard deviation of $\pm$16 days. We can safely assume the kits are sufficiently developed for the mother to move them with the average move occurring 25 days following parturition.

## Days Spent in Natal Dens

Using the average natal den stay (25 days) and adding 1 standard deviation (16 days) we get what we term a Max Average Stay of 41 days. Using our average start of natal den as March 29 and adding 41 days for the Max Average Stay we extend until May 9. Using our data we can describe the natal den period beginning March 1 (9 days earlier than any reported start of denning in California) to May 15 (1 week longer than the average stay in a natal den plus one standard deviation from our data set).

In these studies, 29 (one slipped her collar) out of the 30 fishers in this data set successfully moved from their natal den trees to at least one additional maternal den, and most had many (ranging from 1 to 9) maternal dens. The accuracy of these denning period dates has been confirmed by frequent walk-ins and digital images from cameras positioned around den trees with date and time stamps. Our researchers reported fishers making multiple trips carrying kits to subsequent maternal dens, showing they can make these moves very quickly as recorded by camera time stamps.

**Figure 3 - # of Dens by Date – Cumulative % Started Denning and % Mobile (Start plus 25 days)**




## Date Ranges for Natal Den Tree Protection

Using our earliest March 17 start date adding 41 days gives us an end date of April 27. Using our mean start date of March 29 adding 41 days gives us a May 9 end date. So we have decided to extend the protection period to May 15. After this period based on our study sites fishers have the ability to move away from any potential harvest activities, since they already make such moves without any harvest associated disturbance. Assuming the fisher is able to move young safely after 25 days, using the start of denning date for each of the 30 studied fishers, and allowing for 25 days in the den, 100% of these fishers would be able to move their kits on or before May 10. See Figure 1.

Since these radio collared research fishers have demonstrated they are capable of moving their kits on their own from a natal den to the first maternal den and if we avoid harvesting a natal den structure, we would significantly reduce one of the harvest associated risks, while already a very low risk, that our harvesting would kill a fisher adult female or her kits. To understand how low a probability of harvesting

an actual natal den tree is, in two full years of harvesting on each research project, the Stirling Management Unit and Weaverville Study Area with radio collared fishers, with no prohibition or limitation on where they harvest, SPI has not commenced harvesting within a quarter of a mile of any active natal or maternal den tree. By not cutting a natal den structure down between March 1 and May 15 we would significantly minimize to the extent practical direct take (i.e. killing per CESA's definition of take) of fisher associated with harvesting trees on a THP.

## Trees Typically Containing Natal or Maternal Dens

Based on our measured den data set, the minimum diameters of den structures in the inland Forest Districts in California is any hardwood (dead or alive) ≥15" DBH or snag or cull conifer ≥22" DBH. Such a tree must contain a suitable cavity for a den. Conservatively, natal den tree protection can be accomplished by mitigation to not fall any tree that meets these definitions regardless of cavity presence between March 1 and May 15. To provide even greater protection during the remainder of the denning season (after May 15$^{th}$) suitable trees with potential den structures can be provided protection by avoiding harvest until at least one additional day after other trees have been harvested. This will provide fishers time to leave their den trees during the night.

## References

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# DRAFT Appendix O – 7-11-2014

Hexagon Referencing for Future Habitat Analysis

The proposed fisher CCAA is designed to provide benefit for fisher by maintaining and improving habitat in the form of female fisher Territory Opportunities (CCAA Section 7.2). Habitat is accounted for at the stand scale using a fixed network of 500 acre hexagons. The aggregated stands within each hexagon, which depending on their value as habitat; can be aggregated into a Territory Opportunity. In order to account for Territory Opportunities a method of modeling stand conditions that is reflective of the implementation of the SPI Option A management plan for the next 50 years is necessary in order to express the projection of habitat over the term of the permit.

The area for this analysis is the proposed CCAA Enrolled Lands (CCAA Figure 7.3.5.1).
The data available for this analysis includes two hexagon populations, the Parent HEX and Child HEX. The Parent HEX population has detailed spatially explicit stands modeled for harvest and growth from Year_0 (2013) through the term of the CCAA (2065). The Parent HEX population contains 802 hexagons of which 241,783 acres are SPI ownership. The Child HEX population has detailed spatially explicit stands available for Year_0 and contains 4,368 hexagons. For both the hexagon populations stand parameters such as cover type, tree species, basal area, quadratic mean diameter (QMD), trees per acre, canopy cover, tree volume, tree height, snags, and down logs are derived from the SPI Forest Inventory plots.

Considering that the Parent Hex population and Child Hex population of hexagons both have spatially explicit stand strata for Year_0, it was hypothesized that the individual hexagons from the Parent Hex population could be used as surrogates to approximate the response to management over time for the individual hexagons in the Child Hex population through a process of “adoption”. This hypothesis was contingent on three factors. First, the Parent Hex populations needed enough breadth to capture all of the Year_0 strata conditions occurring across the SPI ownership such that all the individual hexagons in the Child Hex population could be matched or “adopted” by an individual hexagon from the Parent Hex population. Second, a set of diagnostic parameters needed to be identified that were deterministic of an individual Parent Hex hexagons stand strata’s response to harvesting, growth performance, and resistance to fragmentation over time. Third, a method of assessing the overall accuracy of the “adoption” process needed to be developed to ensure the performance of the Enrolled Lands relative to habitat characteristics were not over stated.

The Parent Hex population is made up of two categories that contain all the various forest conditions found on SPI. The first and most abundant category in terms of acres is the Prime category. The Prime category is areas that are composed of productive timberland, are generally unconstrained relative to intensive management activities, and have not been substantially damaged or recently rehabilitated. The Prime category has a Parent hexagon population that is composed of seven separate carbon assessment analysis areas (CAA Parent Hex). The CAA Parent Hex population is distributed from the South Redding CSCA (Buck Mtn) to the Sonora CSCA (Cherry Lake). The CAA Parent Hex population is comprised of 448 hexagons totaling 140,567 acres of SPI ownership. The CAA Parent Hex population was completed in conjunction with SPI’s on-going Carbon Offset Analysis program. The second category (Isolated area of Interest (ISO)) is an area which has a unique condition not represented in the Prime category. ISO’s were classified by common condition or management theme. ISO Parent hexagon population classes include: 1) Fire/Rehab (F/R Parent Hex), developed for each common fire event. 2) Local vicinity / watershed conditions (LV/W Parent Hex), developed and named for the local vicinity/watershed condition being addressed. 3) Professional judgment (PRO Parent Hex), developed to address known management anomalies. The anomalies most commonly considered

for the PRO Parent Hex population were soil, site productivity, or limitations relating to special administrative considerations. All ISO Parent Hex populations were developed and contained completely within one of the four SPI regions covering the Enrolled Lands (Eastside, Sierra/Cascade Occupied, Sierra/Cascade Unoccupied and Westside), the single exception being the PRO Parent Hex population of hexagons. In total the ISO category is composed of 24 Parent Hex populations containing 354 hexagons and 101,216 acres of SPI ownership. The ISO Parent Hex populations together with the CAA Parent Hex populations result in a total of 31 Parent Hex populations.

The Parent HEX populations (both Prime and ISO) were modeled for harvest and growth using the SPI Option A for a 50 year planning horizon. The impact of the detailed spatial application of the SPI Option A management regime (periodic harvest and growth) on habitat was recorded on a 5 year periodic basis. Stand strata were evaluated for habitat parameters at the end of each period.

The diagnostic parameters (by which to compare and match children) for individual hexagons in the Parent Hex populations which were deterministic of their stand strata's response to harvesting, growth performance, and resistance to fragmentation are below in order of evaluation precedence:

1. The net SPI acres located with an analysis hexagon.
2. The average elevation of the SPI acres within each hexagon.
3. The percentage of Mixed land class (M) to be converted to even-age within each hexagon.
4. The percentage of Regen (R) and or Even (E) land class within each Hexagon.
5. The area weighted average age of Regen and Even stands in each Hexagon.
6. The percentage of area within the HEX to be managed in consideration of non-timber values. Examples include but are not limited to: Watercourse and Lakeside Protection Zones (WLPZs), wildlife/botanical protection zones, sensitive treatment areas (soils, geology, visual).
7. Year_0 quantity of Habitat form 4. Does the Hexagon contain 30% or more HF4. (Yes or No).
8. Year_0 quantity of Habitat Form 4 and Habitat Form2Hv. Does the Hexagon contain 50% or more of HF4 and/or HF2Hv combined. (Yes or No).
9. Year_0 Den Stand Core Area. Is there at least one contiguous area, 50 acres or more in size that is comprised of at least 30% HF4 and 20% HF2Hv. (Yes or No).

Tests 7, 8 and 9 were designed to assure that the children and parents had similar starting conditions relative to contributing to a Territory Opportunity in Year_0.

The method for matching the individual Child Hex hexagons to an individual Parent Hex hexagon was done through a process referred to as "adoption". An "adoption" run takes one of the 25 Parent Hex populations and using the nine diagnostic parameters each individual Child Hex hexagon is tested programmatically in an iterative and stepwise fashion, in order to make the best match or "adoption".

The tolerance limits for each diagnostic parameter were varied for each "adoption" run beginning with the most restrictive limit and iteratively relaxed a specific amount before each sequential "adoption" run. The number of sequential "adoption" runs through the Child Hex population was specified. The nine diagnostic parameters were controlled by a pre-programmed set of tolerance limits that specified the starting and end limit value for the diagnostic parameter and the incremental step value change for each iterative "adoption" run. An "adoption" run continues until all nine diagnostic parameters reach their end limit or the number of specified "adoption" runs has been reached. Successful individual Child Hex adoptions of an individual Parent HEX results in

the individual Child HEX being removed from consideration in any subsequent “adoption” runs. All Parent HEX populations are retained intact for future “adoption” runs.

In order to achieve the highest number of very well matched “adoptions” the first several “adoption” runs through the Child Hex population were conducted using the most stringent tolerance limits. Successive “adoption” runs using the same or slightly modified tolerance limits for one or more of the nine diagnostic parameters incrementally led to the “adoption” of each Child Hex hexagon. This iterative and systematic approach was applied to an ever diminishing Child Hex population until all hexagons were matched.

During an “adoption” run there were instances when an individual Child Hex would qualify for adoption to multiple individual Parent Hex hexagons. The ultimate assignment in these instances was a review of the management tags, which are assigned to both Parent Hex and Child HEX populations prior to any “adoption” runs. The management tags reference the historical management intensity that has occurred within each individual hexagon. Allowing the match to occur using that parameter seemed a logical step for aligning the hexagon match, all other things being equal.

A detailed summary log as well as all relevant details for each “adoption” run was archived for review. It is available as a chart attached at the end of this document. The Child Hex population was tested against the CAA Parent Hex and ISO Parent Hex populations in order of perceived importance for providing current and future fisher habitat, using the nine diagnostic parameters. After each subsequent “adoption” run, the remaining unmatched Child HEX population became increasingly problematic to match without further relaxing the tolerance limits for the diagnostic parameters. A successful strategy matches the greatest number of individual Child Hex hexagons with a Parent Hex hexagon, while keeping the diagnostic parameter limits professionally reasonable and practicable.

Several procedural strategies for implementing the “adoption” run process were tested before arriving at the one chosen. It is important to note that the diagnostic parameters 7, 8, and 9 for all “adoption” runs required an absolute match. This means that the Year_0 quantity of HF4, the Year_0 quantity of HF4 and HF2Hv and the Year_0 Den stand core area for each individual Parent Hex must match the Child Hex hexagon it “adopted”.

It is important to disclose that 55 individual hexagons from the Child HEX population out of the total of 4,384 required manual “adoption”. These Child HEX hexagons failed to find an adequate parent using the programmatic approach.

Finally, a method of assessing the overall accuracy of the “adoption” was tested to determine if the adoption process changed the performance of the Enrolled Lands relative to habitat characteristics. The performance characteristic that was identified as a good diagnostic test for the performance of the adoption process was total basal area. The metrics that describe suitable fisher habitat are stand QMD, canopy cover, and large trees. These habitat parameters all correlate positively with basal area. Also because basal area was not a diagnostic parameter for matching the Child Hex population to the Parent Hex population such a test should not auto correlate.

The basal area test took the average Year_0 basal area for all stands in each Child Hex prior to adoption and compared that with the average Year_0 basal area values derived from the stands in their assigned parents. The Year_0 basal area values were within3.29% of values at Year_0 for the assigned future stands. This indicates that the “adoption” process did not inflate the overall productivity or suitability of the Enrolled Lands by virtue of replacing low volume or low productivity Child Hex hexagons with higher volume and productivity Parent Hex hexagons.

| | Constraints <> Constraints <> Constraints | | | | | | | | | Limits <> Limits <> Limits | | | | | | | | | Escalation <> Escalation <> Escalation | | | | | | | | | ll_Children-Data Results | | | ing Current ISO - Data Re | | | Adoptions | Required |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hex Acres | Avg. Elev | % M | % R-E | R-E Age | % Prot | HF4 | HF4 - HF2 | Core | Hex Acres | Avg. Elev | % M | % R-E | R-E Age | % Prot | HF4 | HF4 - HF2 | Core | Hex Acres | Avg. Elev | % M | % R-E | R-E Age | % Prot | HF4 | HF4 - HF2 | Core | All | Parent | Children | All | Parent | Children | Results | Iterations |
| RUN1_ISO_MIN | 50 | 200 | 3.0% | 3.0% | 3 | 10.0% | 1 | 1 | 1 | 100 | 500 | 6.0% | 6.0% | 5 | 25.0% | 1 | 1 | 1 | 1.05 | 1.07 | 1.05 | 1.05 | 1.04 | 1.07 | 1 | 1 | 1 | 5170 | 786 | 4384 | 628 | 61 | 567 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 642 | 225 |
| RUN2_ISO_MID | 100 | 500 | 6.0% | 6.0% | 5 | 20.0% | 1 | 1 | 1 | 125 | 750 | 9.0% | 9.0% | 7 | 30.0% | 1 | 1 | 1 | 1.02 | 1.03 | 1.03 | 1.03 | 1.02 | 1.03 | 1 | 1 | 1 | 4528 | 786 | 3742 | 529 | 61 | 468 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 832 | 240 |
| RUN3_ISO_MAX | 125 | 750 | 9.0% | 9.0% | 7 | 25.0% | 1 | 1 | 1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 1.01 | 1.02 | 1.01 | 1.01 | 1.03 | 1.03 | 1 | 1 | 1 | 3696 | 786 | 2910 | 372 | 61 | 311 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 470 | 225 |
| RUN4_REGEN_ISO_MIN | 50 | 200 | 3.0% | 3.0% | 3 | 10.0% | 1 | 1 | 1 | 100 | 500 | 6.0% | 6.0% | 5 | 25.0% | 1 | 1 | 1 | 1.05 | 1.07 | 1.05 | 1.05 | 1.04 | 1.07 | 1 | 1 | 1 | 3226 | 786 | 2440 | 512 | 161 | 351 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 69 | 15 |
| RUN5_REGEN_ISO_MID | 100 | 500 | 6.0% | 6.0% | 5 | 20.0% | 1 | 1 | 1 | 125 | 750 | 9.0% | 9.0% | 7 | 30.0% | 1 | 1 | 1 | 1.02 | 1.03 | 1.03 | 1.03 | 1.02 | 1.03 | 1 | 1 | 1 | 3157 | 786 | 2371 | 443 | 161 | 282 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 80 | 15 |
| RUN6_REGEN_ISO_MAX | 125 | 750 | 9.0% | 9.0% | 7 | 25.0% | 1 | 1 | 1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 1.01 | 1.02 | 1.01 | 1.01 | 1.03 | 1.03 | 1 | 1 | 1 | 3077 | 786 | 2291 | 363 | 161 | 202 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 59 | 15 |
| RUN7_ISO_EXTREME1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 1.01 | 1.03 | 1.03 | 1.03 | 1.01 | 1.02 | 1 | 1 | 1 | 3018 | 786 | 2232 | 340 | 61 | 279 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 660 | 225 |
| RUN8_AD_MIN | 50 | 200 | 3.0% | 3.0% | 3 | 10.0% | 1 | 1 | 1 | 100 | 500 | 6.0% | 6.0% | 5 | 25.0% | 1 | 1 | 1 | 1.05 | 1.07 | 1.05 | 1.05 | 1.04 | 1.07 | 1 | 1 | 1 | 2358 | 786 | 1572 | 532 | 81 | 451 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 182 | 45 |
| RUN9_AD_MID | 100 | 500 | 6.0% | 6.0% | 5 | 20.0% | 1 | 1 | 1 | 125 | 750 | 9.0% | 9.0% | 7 | 30.0% | 1 | 1 | 1 | 1.02 | 1.03 | 1.03 | 1.03 | 1.02 | 1.03 | 1 | 1 | 1 | 2176 | 787 | 1389 | 490 | 81 | 409 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 344 | 48 |
| RUN10_AD_MAX | 125 | 750 | 9.0% | 9.0% | 7 | 25.0% | 1 | 1 | 1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 1.01 | 1.02 | 1.01 | 1.01 | 1.03 | 1.03 | 1 | 1 | 1 | 1832 | 788 | 1044 | 382 | 81 | 301 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 251 | 45 |
| RUN11_AD_EXTREME1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 1.01 | 1.03 | 1.03 | 1.03 | 1.01 | 1.02 | 1 | 1 | 1 | 1581 | 789 | 792 | 330 | 81 | 249 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 322 | 45 |
| RUN12_REGEN_ISO_EXTREME1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 1.01 | 1.03 | 1.03 | 1.03 | 1.01 | 1.02 | 1 | 1 | 1 | 1259 | 790 | 469 | 196 | 161 | 35 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 15 |
| RUN13_ISO_EXTREME2 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 225 | 2500 | 25.0% | 25.0% | 16 | 80.0% | 1 | 1 | 1 | 1.02 | 1.03 | 1.04 | 1.04 | 1.02 | 1.03 | 1 | 1 | 1 | 1254 | 790 | 464 | 98 | 61 | 37 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 106 | 240 |
| RUN14_REGEN_ISO_EXTREME2 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 225 | 2500 | 25.0% | 25.0% | 16 | 80.0% | 1 | 1 | 1 | 1.02 | 1.03 | 1.04 | 1.04 | 1.02 | 1.03 | 1 | 1 | 1 | 1148 | 790 | 358 | 191 | 161 | 30 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 12 | 16 |
| RUN15_AD_EXTREME2 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 225 | 2500 | 25.0% | 25.0% | 16 | 80.0% | 1 | 1 | 1 | 1.04 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1 | 1 | 1 | 1136 | 790 | 346 | 179 | 81 | 98 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 156 | 30 |
| RUN16_ISO_MIN | 50 | 200 | 3.0% | 3.0% | 3 | 10.0% | 1 | 1 | 1 | 100 | 500 | 6.0% | 6.0% | 5 | 25.0% | 1 | 1 | 1 | 1.05 | 1.07 | 1.05 | 1.05 | 1.04 | 1.07 | 1 | 1 | 1 | 978 | 791 | 187 | 977 | 791 | 186 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 60 | 15 |
| RUN17_ISO_MID | 100 | 500 | 6.0% | 6.0% | 5 | 20.0% | 1 | 1 | 1 | 125 | 750 | 9.0% | 9.0% | 7 | 30.0% | 1 | 1 | 1 | 1.02 | 1.03 | 1.03 | 1.03 | 1.02 | 1.03 | 1 | 1 | 1 | 918 | 792 | 126 | 917 | 791 | 126 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 33 | 16 |
| RUN18_ISO_MAX | 125 | 750 | 9.0% | 9.0% | 7 | 25.0% | 1 | 1 | 1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 1.01 | 1.02 | 1.01 | 1.01 | 1.03 | 1.03 | 1 | 1 | 1 | 885 | 792 | 93 | 884 | 791 | 93 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 14 | 15 |
| RUN19_ISO_EXTREME1 | 150 | 1000 | 10.0% | 10.0% | 10 | 40.0% | 1 | 1 | 1 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 1.01 | 1.03 | 1.03 | 1.03 | 1.01 | 1.02 | 1 | 1 | 1 | 871 | 792 | 79 | 870 | 791 | 79 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 15 | 15 |
| RUN20_ISO_EXTREME2 | 175 | 1500 | 14.0% | 14.0% | 12 | 50.0% | 1 | 1 | 1 | 225 | 2500 | 25.0% | 25.0% | 16 | 80.0% | 1 | 1 | 1 | 1.02 | 1.03 | 1.04 | 1.04 | 1.02 | 1.03 | 1 | 1 | 1 | 856 | 792 | 64 | 855 | 791 | 64 | - | 0 |
| CURRENT RUN ADOPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 47 | | | | 17 | 16 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4,329 | 1,521 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 55 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4384 | |

**SPI MESOCARNIVORE CAMERA PROTOCOL** Draft 2011

These forest carnivore surveys are conducted generally following the survey guidelines found in **American Marten, Fisher, Lynx, and Wolverine: Survey Methods for Their Detection, August 1995** (Zielinski and Kucera 1995). The photographic bait station technique is used to conduct these surveys.

The area is divided into 4-mile$^2$ survey units determined prior to field visits using Township, Range and Section lines. For every survey unit established, two camera stations are placed. The stations are set to be at least 1 mile apart from each other.

The camera stations should be set up in a north-south alignment. The camera is set up facing north so to minimize direct sun exposure. The camera tree and the bait tree should be 15-25 feet apart. An axe and/or a hand saw may be needed to cut down all branches, saplings and limbs in the camera's "trigger zone".

On the bait tree, 4-8 pounds of raw chicken, turkey or deer is attached to the tree. It is recommended to find a local butcher and see what is available. During hunting season, deer parts may be free. Otherwise chicken backs and spare parts can be purchased in 40 lb. boxes. A galvanized aviary wire is cut (2' x 3') and used to create a bait basket to hold the bait securely to the tree with fencing staples, approximately 4 feet of the ground. Aviary wire can be purchased in 100' rolls from a local farm supply store. When animals tear a hole in the aviary wire, repairs can be made quickly with "zip ties". Aviary wire basket is nailed to tree with fencing nails. Glove should be worn to handle meat, then removed before touching camera.

Though cameras come with material to strap to tree, bailing wire will allow for more adjustments. Use sticks and additional wire to position camera on tree.

Additionally, a 5.5 oz can of cat food (any flavor is fine but get the pate) is nailed to the baited tree above the bait and approximately ½ ounce (<1 tbsp) of "Gusto" (Caven's Lures, Minnesota Trapline Products, Pennock, MN) is placed on and around the survey station and bait to serve as an added attractant. A tablespoon (or more) of peanut butter is also spread on the tree to attract possible omni/herbivores.

The baited camera stations are "run" for at least 28 days. Stations should be baited with meat or cat food for at least 80% of the time (22 days). Each station is checked approximately every seven days. Stations are checked for bait, (rebait or add to if necessary), battery level, exchange SD cards if necessary and re-Gusto area.

DRAFT

**SPI MESOCARNIVORE CAMERA PROTOCOL** Draft 2011

**Supplies**

- Trail cameras
- SD memory cards
- Hammer
- Aviary wire
- Cat food
- Bait meat
- Peanut butter
- Gusto
- Bailing wire
- Batteries
- Axe or machete
- Hand saw
- Tin snips for cutting aviary wire
- Wire cutters
- Zip ties for repairing aviary wire
- Fencing nails for aviary wire
- Straight nails (6 penny) to attach cat food
- Latex gloves for handling meat and protecting cameras from scent
- Backpack to carry gear

DRAFT

# Snag Management Objectives for Cavity-Using Species on Sierra Pacific Industries' Lands

by Steven Self
Staff Wildlife Biologist

October 1, 2000
(Revised November, 2001)

Wildlife Research
Paper No. 2

Sierra Pacific Research & Monitoring

Sierra Pacific Industries

# Snag Management Objectives for Cavity-Using Species on Sierra Pacific Industries' Lands

*By Steven Self, Staff Wildlife Biologist*

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October 1, 2000
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## Introduction

Snags, or dead trees, are an important resource for many wildlife species (USDA 1979, CDFG 1999). In order to retain an adequate number of snags on its lands to maintain healthy populations of wildlife species that rely on snags for shelter and foraging, SPI has developed snag management objectives to be incorporated in its forest management activities. In developing these objectives, it was necessary to understand that how a snag is used by wildlife depends on the animal, the snag's size and state of decay, and the location on the landscape. In addition, it was important to understand that the distribution of snags across the landscape is never uniform. Snags spread uniformly across a landscape would be an anomaly unlikely to best serve resident wildlife populations.

Snags are often described in terms of their state of decay (USDA 1979). Recently dead snags, or *hard snags*, have some or most branches still in place and often have most of their bark. *Soft snags,* in contrast, are standing trees that have been dead for a number of years. They have decayed to the point where they have few to no branches, and little or no bark. Their wood has been softened by weather, insects, and fungal rot.

Snag distribution in forests is usually non-random and non-homogenous. Raphael and White (1984) found that snags occurred in a pattern of "patches" rather than in an even distribution. Their study area had four times as many snags in areas surrounding nests of cavity-using species as they found in random plots. Inventory information gathered by Sierra Pacific Industries confirms this observation, consistently finding that snags of any size occur on less than 30% of inventory plots. This patchy distribution pattern apparently results from the way in which the primary vectors of snag formation (root diseases, insect infestations, and mechanical damage such as wind and snow breakage) occur and/or spread. As a result, researchers recommend that snag retention guidelines call for a "clumpy," non-uniform distribution of snags across the larger landscape instead of snags distributed evenly based on a smaller per-unit-area (USDA 1979; Raphael and White 1984; Ohmann et al. 1994).

## Snag Preferences of Cavity-Using Species

Species that use snags can be divided into two distinct categories: primary cavity users, which excavate their own cavities, and secondary cavity users, which use holes abandoned by primary cavity users, natural cavities, cracks, and spaces between bark (USDA 1979; Raphael and White 1984; CDFG 1999).

Primary cavity users use both hard and soft snags. Some species will excavate cavities in hard snags, some in soft snags, and some will use either type of snag. In general, cavity

excavators tend to use those portions of snags—whether hard or soft—that have some sort of decay (USDA 1979; Cunningham et al. 1980; Bull et al. 1997). In addition, both primary and secondary cavity users create and/or use cavities in live trees as well as in snags (Raphael and White 1984; Bull et al. 1997; CDFG 1999).

## Known Habits of Primary and Secondary Cavity Users

### Overall Observations Based on Research Data

Two studies conducted over several years in the Sierra Nevada found that 24% to 37% of primary cavity users created cavities and nested in live trees instead of snags (Raphael and White 1984; SPI 2000). Studies in other areas confirm similar relationships (Balda 1975; Miller and Miller 1976; Cunningham et al. 1980).

Primary and secondary cavity users are selective about the stand conditions they'll use for nesting. Some species choose open forest stand conditions; others prefer closed forest stands composed of either large or small trees. Some prefer riparian stands—stands adjacent to sources of water (Raphael and White 1984; Zarnowitz and Manuwal 1985; Ohmann et al. 1994; Bull et al. 1997; CDFG 1999). This indicates that not all primary or secondary cavity users can be found in any one stand or area, unless the area is big enough to support all of these conditions, and that it is not realistic to attempt to provide snags to support all primary and secondary cavity users in any one stand (Raphael and White 1984). Rather, when developing management objectives for primary and secondary cavity users, managers should account for the fact that species have preferences for certain stand conditions (open, riparian, closed small trees, and closed large trees) and thus won't be found everywhere in the landscape, and also for the fact that most species will also use live trees for some of their needs (Raphael and White 1984; Ohmann et al. 1994).

### Cavity-Using Species on SPI Lands

There are over 40 species of vertebrate wildlife that use snags for foraging or nesting on SPI lands.[1] Thirteen of these species are primary cavity users, and about 30 others are secondary cavity users. Table 1 lists the primary cavity-using species and their known snag preferences.

[1] Sources: CRA 1999; CDFG 1999; SPI sighting records

**Table 1. Nest Tree and Nest Stand Conditions for Primary Cavity Species Expected to Use SPI Land [2]**

| Common Name | Hard or Soft Snag | Live or Dead Tree | Stand Condition |
|---|---|---|---|
| Lewis woodpecker | Soft | Both | Open |
| Acorn woodpecker | Hard | Both | Open |
| Red-breasted sapsucker | Hard | Both | Riparian |
| Williamson's sapsucker | Hard | Both | Riparian |
| Downy woodpecker | Both | Both | Riparian |
| Hairy woodpecker | Hard | Both | Open |
| White-headed woodpecker | Soft | Both | Open |
| Black-backed woodpecker | Hard | Both | Large Tree Closed |
| Northern flicker | Both | Both | Open |
| Pileated woodpecker | Hard | Both | Large Tree Closed |
| Red-breasted nuthatch | Hard | Both | Small Tree Closed |
| White-breasted nuthatch | Hard | Both | Large Tree Closed |
| Pygmy nuthatch | Hard | Dead | Small Tree Closed |
| Brown creeper [3] | Both | Both | Large Tree Closed |

## Determining Snag Management Objectives

SPI used a systematic approach based on the best data available for setting snag- management objectives for forestry operations on its lands. This approach involves several steps that include identifying cavity-using species on its lands (presented in Table 1 above); determining exactly how many pairs or individuals of these species could be supported under the most optimal circumstances (i.e., calculating the number of snags needed to provide maximum habitat capacity for these species); stratifying this data for four common stand conditions (since different species tend to prefer different types of habitat); consolidating the snag requirements for these four stand conditions into a single set of requirements that accounts for the needs of all the species (because it is not reasonable to manage for snags at a stand level given their uneven patterns of distribution); and finally to adjust the number of snags to account for the use of live trees by many snag-using species. The result is a set of snag-management objectives that SPI believes will provide moderate to high habitat capability for snag-using wildlife species on its lands.

### Calculating Habitat Capability for Primary Cavity-Using Species

After identifying primary cavity using species on SPI lands (those listed in Table 1) and their habitat preferences, it is necessary to calculate the number of snags in each dbh (diameter at breast height) class needed to provide the maximum (100%) habitat capacity for each species. The calculation uses data from available scientific literature about the

[2] Sources: USDA 1979; Raphael and White 1984; Marcot 1992, Ohmann et al. 1994; CDFG 1999; SPI 2000.

[3] Although technically not a primary cavity user, the brown creeper's nesting requirements are so different that Raphael and White (1984) recommend treating it as such.

species, including home range size, number of cavities excavated per year, and number of snags available per excavated snag (USDA 1979; Raphael and White 1984; Marcot 1992; Ohmann et al. 1994). Table 2 presents the numbers of snags, averaged on a per-acre basis, needed to provide maximum habitat capability for the fourteen primary cavity nesting species on SPI lands (including the brown creeper).

**Table 2. Snag Numbers Predicted to Provide Maximum (100%) Habitat Capability** [4]

| Species | No. of Hard Snags per Acre | No. of Soft Snags per Acre |
|---|---|---|
| Lewis woodpecker | — | 0.48 (15+ inches dbh) |
| Acorn woodpecker | 0.70 (15+ inches dbh) | — |
| Red-breasted sapsucker | 0.45 (15+ inches dbh) | |
| Williamson's sapsucker | 0.33 (15+ inches dbh) | — |
| Downy woodpecker | 0.08 (11+ inches dbh) | 0.08 (11+ inches dbh) |
| Hairy woodpecker | 1.92 (15+ inches dbh) | — |
| White-headed woodpecker | — | 0.60 (15+ inches dbh) |
| Black-backed woodpecker | 0.12 (15+ inches dbh) | — |
| Northern flicker | 0.24 (15+ inches dbh) | 0.24 (15+ inches dbh) |
| Pileated woodpecker | 0.06 (24+ inches dbh) | — |
| Red-breasted nuthatch | 0.76 (15+ inches dbh) | — |
| White-breasted nuthatch | 0.76 (15+ inches dbh) | — |
| Pygmy nuthatch | 1.08 (15+ inches dbh) | — |
| Brown creeper | 0.40 (15+ inches dbh) | 0.40 (15+ inches dbh) |

Once the maximum habitat capability for each species has been determined, the information from tables 1 and 2 can be used to prepare a habitat capability chart that lists (stratifies) for each of four stand conditions (open, riparian, small tree closed canopy, and large tree closed canopy) the numbers of snags per acre for each of three size classes needed to satisfy the requirements of all primary cavity-using species on SPI lands (Table 3). A linear relationship is used to calculate the percentages of habitat capacity below 100%. (Using a linear relationship for calculating these levels is believed to be conservative, meaning that it overestimates the number of snags necessary for a given capability level [Raphael and White 1984].) Past approaches did not stratify by stand condition or take into account the use of live trees by cavity users.

4 Sources: USDA 1979; Raphael and White 1984; Marcot 1992; CDFG 1999.

**Table 3. The number of snags per acre required to achieve increasing levels of habitat capacity for primary cavity-using species on SPI lands for a variety of snag sizes and stand conditions**

| Open Forest Stand Condition Percentage of Maximum Habitat Capability (snags/acre) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Snag Size Class (dbh) | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Total > 11" | 1.67 | 2.09 | 2.51 | 2.92 | 3.35 | 3.76 | 4.18 |
| Total >15" | 1.67 | 2.09 | 2.51 | 2.92 | 3.35 | 3.76 | 4.18 |
| Total >24" | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Riparian Forest Stand Condition Percentage of Maximum Habitat Capability (snags/acre)** | | | | | | | |
| Snag Size Class (dbh) | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Total > 11" | 0.38 | 0.47 | 0.56 | 0.66 | 0.75 | 0.85 | 0.94 |
| Total >15" | 0.31 | 0.39 | 0.47 | 0.55 | 0.62 | 0.70 | 0.78 |
| Total >24" | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Small Tree Closed Forest Stand Condition Percentage of Maximum Habitat Capability (snags/acre)** | | | | | | | |
| Snag Size Class (dbh)) | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Total > 11" | 0.74 | 0.92 | 1.10 | 1.29 | 1.47 | 1.66 | 1.84 |
| Total >15" | 0.74 | 0.92 | 1.10 | 1.29 | 1.47 | 1.66 | 1.84 |
| Total >24" | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Large Tree Closed Forest Stand Condition Percentage of Maximum Habitat Capability (snags/acre)** | | | | | | | |
| Snag Size Class (dbh) | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Total > 11" | 0.70 | 0.87 | 1.04 | 1.22 | 1.39 | 1.57 | 1.74 |
| Total >15" | 0.70 | 0.87 | 1.04 | 1.22 | 1.39 | 1.57 | 1.74 |
| Total >24" | 0.02 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 |

## Managing for Combined Stand Levels

Setting management objectives and attempting to track implementation and monitor effectiveness would be extremely difficult if it were attempted by stand condition or some other small unit area. In order to minimize the complexities associated with implementation and monitoring, and to be conservative in providing the necessary numbers of snags, a single table can be developed and applied to all stand conditions by combining the highest level of snags necessary by stand condition and snag size from Table 3. In choosing a level of snag habitat capability for which to manage, it is important to note researchers have stated that providing less than about 40% of total habitat capability could present an unacceptable risk to cavity-using wildlife species (USDA 1979; Raphael and White 1984). Table 4 depicts the result of this combination. The results presented in Table 4 are designed to allow snag management objectives to be efficiently and effectively accomplished at the scale of a Management Inventory Unit[5] (MIU), giving managers the

5 A Management Inventory Unit (MIU) is an area defined for assessing the potential effects of a particular project or set of projects. A MIU is by definition larger than the project area and is defined by logical groupings of ownership boundaries.

flexibility to provide for the clumpy distribution of snags found in the field and recommended in the literature.

**Table 4. Number of Snags Required to Achieve Maximum Habitat Capability**

| Percent of Maximum Habitat Capability (snags/acre) | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
|---|---|---|---|---|---|---|---|
| Total number of snags > 11" dbh | 1.67 | 2.09 | 2.51 | 2.92 | 3.35 | 3.76 | 4.18 |
| Total number of snags > 15" dbh | 1.67 | 2.09 | 2.51 | 2.92 | 3.35 | 3.76 | 4.18 |
| Total number of snags > 24" dbh | 0.02 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 |

## Accounting for the Use of Live Trees by Cavity-Using Species

The final step in developing snag management objectives is to account for use of live trees by cavity-using species. The available data suggest that primary cavity users nest in live trees from 24 to 37% of the time. By reducing the levels presented in Table 4 by 24% (a conservative estimate), a final set of snag management objectives can be arrived at. These are presented in Table 5.

**Table 5. SPI Snag Management Objectives**

| Percent of Maximum Habitat Capability (snags/acre) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 40 | | 50 | 60 | 70 | 80 | 90 | 100 |
| Total number of snags >=11" dbh | 1.27 | 1.59 | 1.91 | 2.22 | 2.55 | 2.86 | 3.18 |
| Total number of snags >= 15" dbh | 1.27 | 1.59 | 1.91 | 2.22 | 2.55 | 2.86 | 3.18 |
| Total number of snags >= 24" dbh | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 |

The capability for the levels of snags included in Table 5 to support cavity using wildlife species is further supported by two analyses conducted by Raphael and White (1984). In the 1st analysis, they found that the density of cavity nesters within their overall study area increased up to about 3.0 snags/acre $\geq$15" in dbh. After this density of snags was reached, further increases in snag density did not lead to a corresponding increase in density of cavity nesting birds.

In their second analysis, considering only unburned areas of the study, Raphael and White (1984) found equal densities of excavators and creepers in 2 areas with quite different snag densities. While Area 1 (Unburned Plot) had 3.44 snags/acre $\geq$15" dbh and Area 2

(Goshawk Plot) had 1.40 snags/acre ≥15" dbh, both Areas supported identical combined densities of excavators and creepers.

These two analyses indicate that management for the snag levels proposed by SPI has a high probability of maintaining moderate to high population levels of excavator bird species.

**Other Management Concerns to Address**

- Snags and their residual forms are known to significantly contribute to increased difficulty in controlling the spread and intensity of forest fires (Weatherspoon 1996). Managers must consider the increased risks associated with forest fire management when considering what level of snags to provide within forest ecosystems.
- **Meeting the needs of the secondary cavity nesting species.**

Another concern that must be addressed is whether providing for the snag needs of primary cavity nesting species will also meet the needs of secondary cavity nesting species. Past snag management recommendations usually assumed that providing adequate habitat for primary cavity users will meet the needs of secondary cavity users. While this seems logical, it is usually considered a relatively untested assumption. The Thomas et al. model (USDA 1979) specifically assumes that if primary cavity users are sufficiently provided for, secondary cavity users will also be provided for. The Marcot model does not address the issue of primary vs. secondary cavity users (Marcot 1992).

Raphael and White (1984) addressed this issue for secondary cavity nesting birds. They found that, based on measurements of excavator (primary cavity user) and non- excavator (secondary cavity user) nest sites, there was at least one excavator species whose nest and nest-tree characteristics were statistically matched for each non- excavator species. They concluded that excavator management could meet non- excavator needs for nest trees and nest stands. This conclusion is supported by the fact that secondary cavity-using species are known to discriminate less than primary cavity users as to whether a tree is dead or alive (Species Notes, CDFG 1999). This suggests that these species are more flexible in their use of nesting substrates than primary cavity users are. A possible exception to this is the brown creeper. Brown creepers use the widest variety of nesting substrates of any of the cavity-using bird species. They usually nest behind loose bark but are also known to use cracks in trees, natural cavities, and, rarely, abandoned cavities of other species (CDFG 1999). Raphael and White (1984) found that cavities used by this species were not well matched by cavities excavated by the primary cavity-using species in their study area. As recommended by Raphael and White, this species is treated here as a primary cavity nester to ensure meeting its needs.

- **Providing habitat for species other than birds that use cavities.**

A variety of species other than birds, including mammals, amphibians, and reptiles, are known to use cavities. Although cavities are not believed to be required by these species, they are known to make use of them when available (CDFG 1999). Sierra Pacific Industries has collected data on snag densities in landscapes known to support year-round occupancy and successful reproduction by a number of large-bodied and small-bodied secondary cavity using species (CRA 1999; SPI sighting records). The species specifically known to live and reproduce in these inventoried landscapes are the northern and California spotted owls, pine marten, fisher, and silver-haired bat. These landscapes range in size from 5,000 to over 30,000 acres in size and total over 200,000 acres. They are located on the Northern California coast and in the Klamath Mountains, the southern Cascades, and the Sierra Nevada sections of the Humid Temperate Domain of California (USDA 1997). All of these landscapes have average snag densities greater than or equal to the 50% habitat capability level. Because these non-bird secondary cavity-using species are living and reproducing on these lands, this is additional evidence supporting the assumption that providing for primary cavity users may be adequate to provide for secondary cavity users.

- **Providing for the foraging needs of cavity-using species.**

Another assumption in past snag management guidelines is that providing sufficient snags for nesting will also provide sufficient snags for foraging needs. This issue was addressed by Raphael and White (1984). They included observations in their study about the foraging habits of the cavity-using species. They found that, in general, snags were used for foraging more than would be expected based upon availability. This finding varied by species, with some species foraging on snags less than would be expected based upon availability. Of the total foraging observations, 30% occurred on snags, over 60% occurred on live trees, with the rest occurring on logs, on the ground, and by hawking insects from the air. These data strongly suggest that, while snags are an important foraging substrate, the overwhelming majority of foraging occurs on substrates other than snags.

## SPI Snag Management Implementation

- **In each Management Inventory Unit, SPI will retain enough snags to maintain moderate to high population levels of cavity-dwelling species expected to use the area.**

For instance, each MIU would contain no less than 1.27 snags per acre that are 15 inches or more in diameter (about 130 snags for every 100 acres). At least 0.02 snags per acre (2 snags for every 100 acres) would be at least 24 inches in diameter.
Depending on other management considerations, the actual number of snags on the landscape is usually well above the minimum level, especially of the larger size classes.

The numbers of snags to be retained per acre for habitat capabilities between 40% and 100% (SPI's objectives) are presented in Table 5. SPI will never manage for less than 40% of the maximum habitat capability.

- **Uniform distribution of snags is not required or desirable. Instead, SPI will average the total number of snags over the entire Management Inventory Unit, always retaining enough snags to provide more than 40 percent of maximum habitat capability levels for cavity-using species.**
- **Because different species prefer different types of forest stands, SPI will not attempt to manage for every cavity-using species in every stand. Rather, SPI will manage snags in each stand type to encourage the species that prefer those specific stand conditions, and ensure that across its ownership all species are provided for.**

By adhering to these objectives, Sierra Pacific Industries strives to manage for a level of habitat capability that provides moderate to high habitat capability for snag-using wildlife species while providing the management flexibility to meet other objectives.

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# Canopy Regrowth in Planted Forests

# on

# Sierra Pacific Industries Land

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## Abstract

Many perceptions exist as to the rate that canopy closure recovers after disturbance, followed by replanting and stand maintenance activities. We quantified the change in canopy closure by randomly placing one hundred-foot transects in ninety regenerated forest areas across Sierra Pacific Industries' (SPI) land base. These planted areas ranged from 10 years to 24 years old. They spanned SPI land from the central Sierra Nevada north to the Cascade Range and west to the interior Coast Range. We only included randomly chosen planted forest areas, which had been pre-commercially thinned. The results indicate on average ~50% canopy closure at 2 feet above the ground is re-established under management within 10 years after planting and increases rapidly after that time.

## Introduction

Openings in forested areas are an important requirement for many early seral species, but can also be a potential hindrance for species that are perceived to avoid areas with sparse canopy cover. As a note about canopy closure the values measured in this study, we followed the conventional definition of canopy closure as vertical projected canopy. However, the reader is reminded that outside of the tropics, the sun is always at an angle to vertical organisms and they cast shadows that significantly increase the total shade on a particular site.

SPI has been researching Pacific fisher's (*Martes pennanti*) use of managed forests and developing a Candidate Conservation Agreement with Assurances with the United States Fish and Wildlife Service. In this context, questions arose as to when a forest stand, established after regeneration harvest, has sufficient overhead cover to allow fisher to travel and forage. While it is generally agreed that fishers avoid large open areas, there are a number of studies that have documented fisher using early seral and open areas, primarily for traveling and foraging (Buck et al. 1983, Jones and Garton 1994, Self and Kerns 2001, Weir and Harestad 2003). These openings were usually created by fires or forest management activities, including relatively recent clear-cut harvest areas (Buck et al. 1983, Thomasma et al. 1991, Self and Kerns 2001). A few authors have suggested that cover low to the ground may be adequate to allow use of an area by fisher (Buskirk and Powell 1994, Kelly 1977). During foraging bouts, overhead cover is believed to be important to fishers for protection from predators and complexity near the forest floor is important for prey diversity (Buskirk and Powell 1994). Jones and Garton (1994) suggested fishers may make forays into non-forested (no canopy cover) habitats for prey. The use of these open areas has been consistent enough to be incorporated into models of fisher habitat use. Specifically, within existing models of fisher habitat use, 30-40% overhead cover is defined as the beginning point at which fisher will use a stand (Thomasma et al 1991, Freel 1991).

Thus, while there is a diversity of opinion within the fisher literature, there is general consensus that overhead cover, whether provided by brush or trees, can provide sufficient cover for fisher to use small openings, of the sizes created through even-age management in California, for travel and foraging activities. However, data are limited regarding when such overhead cover might be achieved through normal forest management activities. Here, we attempt to determine the time frame within which overhead cover sufficient to allow use by fishers is achieved on industrial forest lands in non-coastal areas of California.

## Methods

SPI utilized its regeneration database to select candidates for this study. The selection criteria were that the planted area was: (1) at least 10 acres in size; (2) had been harvested and planted at least 10 years ago, and (3) had been pre-commercially thinned. Pre-commercial thinning involves cutting approximately half the existing stems to space the remaining trees. The cut stems are left on the ground rather than removing them from the site and utilizing the material commercially. As a result substantial canopy cover is removed from these planted forests. Since this usually occurs at or near ten years following planting, some of the 10 and 11 year old sampled stands were indeed just recently pre-commercially thinned.

A random number selection process was run to choose 10% of all candidates from each township and range from all available candidates. This resulted in a well-distributed sample across SPIs' land base. There were also a minimum of 10 sample areas in each age classes from 10 to 17 years, and we combined all 18 year and older samples into one class. We produced a set of field data collection sheets with an aerial photo of the planted area on one side and the field data collection sheet on the other side.

**Field Measurement Procedures**

1. First transect starting point is 5 chains on a direction into the center of the planted area from an identifiable point on the edge. (Usually a prominent road intersection or other photo identifiable point.)
2. Layout two 100-foot transects, 2 chains apart running north/south.
3. The second transect is placed 2-chains east of transect 1.
4. Tally cover/no cover every 0.5-foot along each transect accounting for full leafing of spring vegetation. (Tallied cover must be at least 2-foot height minimum.)
5. A concave spherical densiometer reading was taken 2 feet above ground at 25-, 50-, 75-, and 100-foot distances from the start point.
6. A field estimate of plantation age was recorded by counting whorls on representative trees.

## Results

A total of 118 regenerated areas were sampled. Of these, 90 were used in this study; the 28 areas excluded were from the northeast ownership area. These were outside the historic and current range of the fisher in California and represent a uniquely different landscape: the much more xeric Modoc Plateau. These 90 units produced 180 age-canopy sample values. Data was collected during the 2007 summer field season.

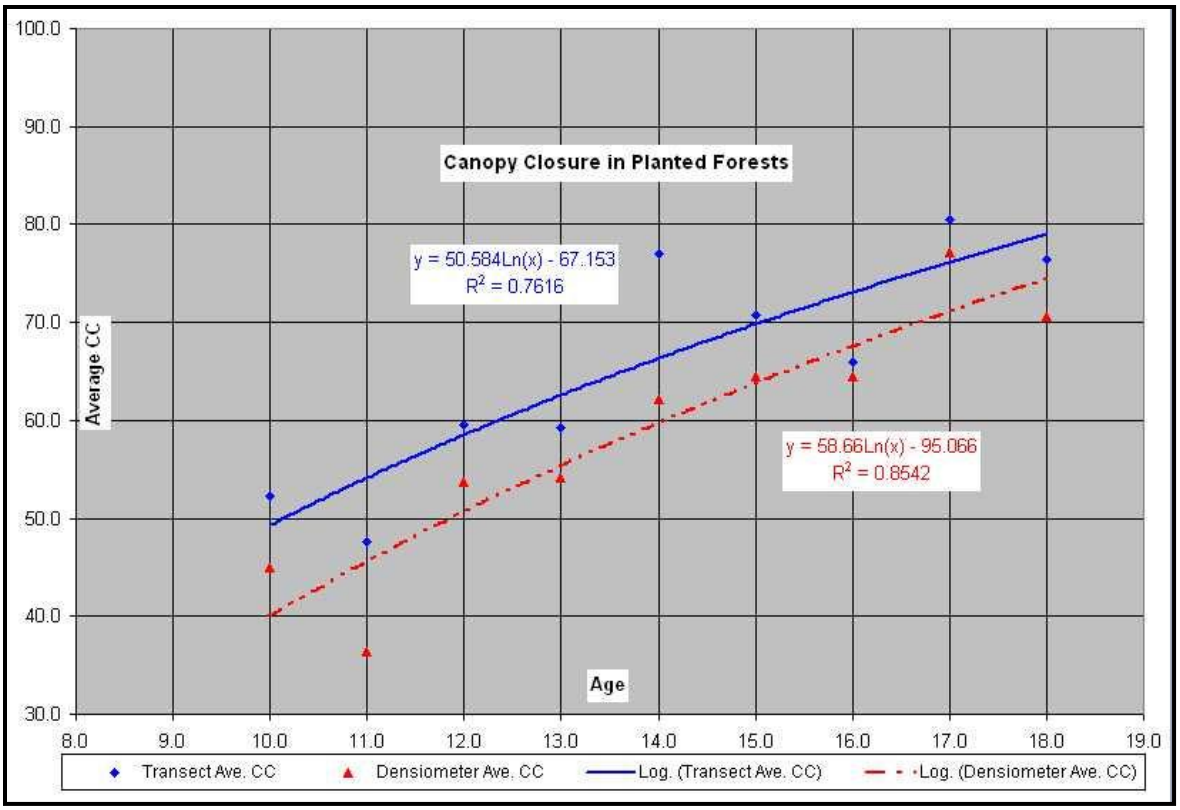
The 180 sample pairs of age and canopy were averaged for each age class. These values were plotted against age and the following trendline was fitted to the data. The equation that best fit the data is expressed as follows:

$$\text{Canopy Closure} = 50.584 * \text{Ln(age)} - 67.153$$

$$R^2 = .7616$$

The resulting data from the transects shows these planted, pre-commercially thinned forests reach 50% canopy closure at 2 feet above the ground at 10 years after planting, and continue to increase in canopy closure reaching 70% at 15 years. See Figure 1. As a comparison, to actual transect data, we also tested the use of concave spherical densiometers at 4 locations on each transect. These estimates were compared to the transect values. See Figure 1. The densiometer estimates were lower than actual canopy closure measured at 2 feet above the ground and ranged from 9.3% low at age 10 to 4.6% low at age 18+. The densiometer estimates followed the same trend as the measured transects.

Figure 1 - Average percent canopy closure plotted against age. Densiometer estimates compared to transect values shown in red (dashed) lines.




## Discussion

Overhead cover or canopy closure measured 2 feet above the ground returns rapidly after harvest and planting. Since approximately half of the trees are removed in pre-commercial thinning and the measured values post pre-commercial thinning were 50%, canopy closures prior to the thinning were higher than 50%. We did not sample areas that had not been pre-commercially thinned because we wanted to allow all stand management treatments that could affect canopy closure to be completed. These data indicate that overhead cover for fishers sufficient to allow travel and foraging activities is achieved at 10 years post-planting on SPIs' interior industrial lands within the range of the fisher. In addition, this information will allow projection of average canopy closure of future landscapes so that potential impacts to species that may be sensitive to openings in the landscape can be estimated.

Most reports of actual measurements versus estimates from densiometers have indicated that densiometers tend to over estimate actual transect point intercept methods by ~5%.(Cook etal 1995) In this case probably due to the shorter height of the measured vegetation canopy, it appears that densiometers underestimate canopy closure from 9.3% at age 10 to 4.6% at age 18.

It is important to note, that for California Wildlife Habitat Relationship (CWHR) canopy classes, while there is some difference from actual, that densiometers would still have placed these sites into

the same classes and would certainly be more efficient. Either method would have indicated that by 10 years from planting that these forests are in the moderate canopy closure class of the CWHR.

## Acknowledgements

This study could not have been completed without the support and cooperation of several individuals. I wish to thank Sierra Pacific Industries for supporting this study. I especially thank Dan Ball, Glen Rouse, Dan Maw, and Joe Puentes for the professional effort to collect the data so the study could be completed in a timely manner.

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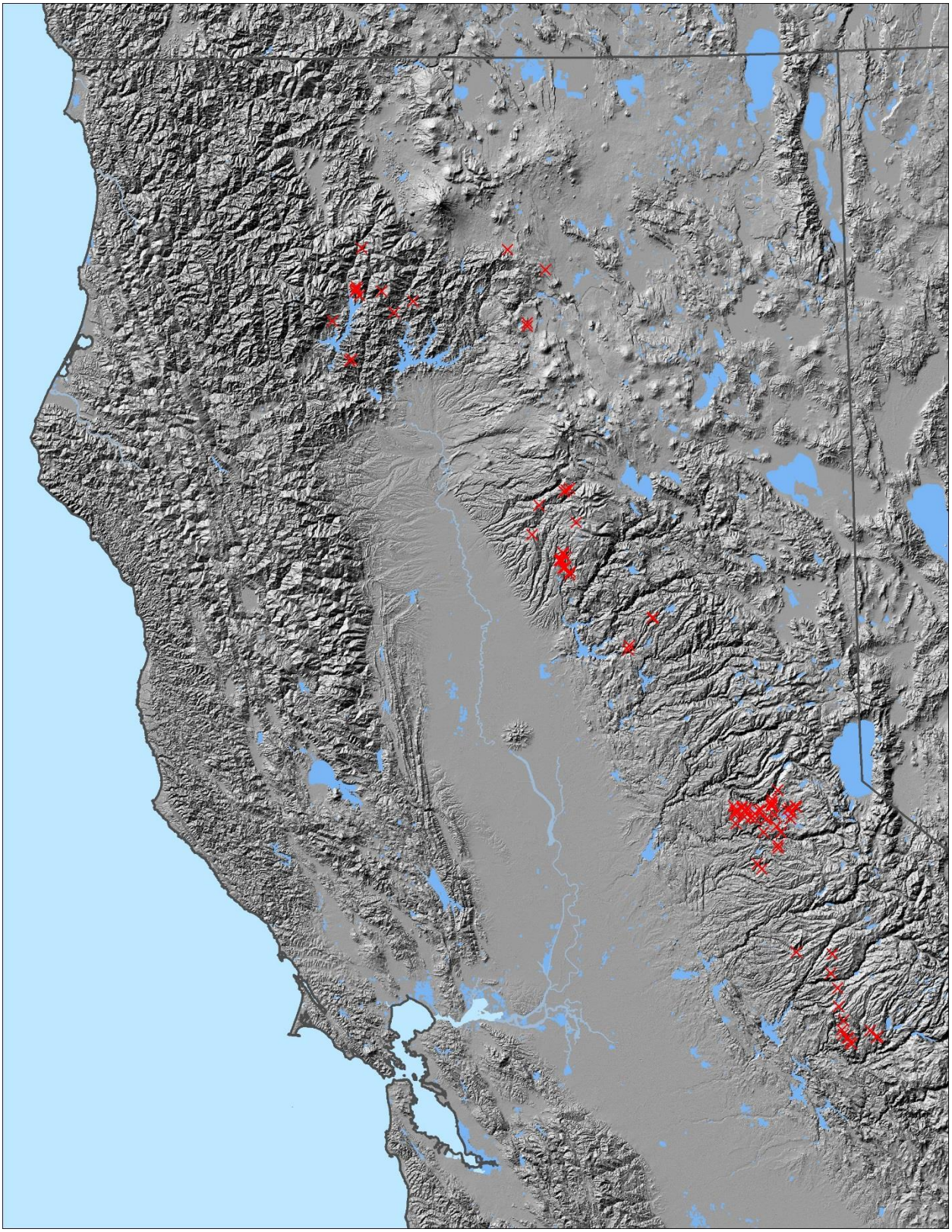
**Figure 2. Distribution of Planted Forests Sampled for this Study.**



Appendix S: Legal Descriptions of the Enrolled Lands

| County | APN Bk-Pg-Parcel# | LEGAL (M=Mount Diablo Base Meridian) Section Township Range | Acres |
|---|---|---|---|
| **Amador** | 021-030-001- | 28 08N 12E (M) | 154.37 |
| **Amador** | 021-030-001- | 29 08N 12E (M) | 80 |
| **Amador** | 021-030-003- | 28 08N 12E (M) | 61.12 |
| **Amador** | 021-050-007- | 27 08N 12E (M) | 8 |
| **Amador** | 021-050-007- | 34 08N 12E (M) | 65.17 |
| **Amador** | 021-050-040- | 33 08N 12E (M) | 80 |
| **Amador** | 021-050-040- | 34 08N 12E (M) | 180 |
| **Amador** | 021-050-041- | 34 08N 12E (M) | 160 |
| **Amador** | 021-060-005- | 35 08N 12E (M) | 75 |
| **Amador** | 021-060-007- | 35 08N 12E (M) | 50.16 |
| **Amador** | 021-060-010- | 36 08N 12E (M) | 104.09 |
| **Amador** | 021-060-011- | 36 08N 12E (M) | 80 |
| **Amador** | 021-060-012- | 35 08N 12E (M) | 57.43 |
| **Amador** | 021-060-013- | 35 08N 12E (M) | 69.84 |
| **Amador** | 021-060-017- | 35 08N 12E (M) | 15.65 |
| **Amador** | 021-100-029- | 02 07N 12E (M) | 40 |
| **Amador** | 021-300-012- | 36 08N 12E (M) | 1.09 |
| **Amador** | 023-010-008- | 33 08N 13E (M) | 40 |
| **Amador** | 023-010-009- | 33 08N 13E (M) | 40 |
| **Amador** | 023-010-010- | 33 08N 13E (M) | 200 |
| **Amador** | 023-010-013-3 | 33 08N 13E (M) | 15 |
| **Amador** | 023-010-024- | 31 08N 13E (M) | 293.18 |
| **Amador** | 023-010-024- | 32 08N 13E (M) | 140 |
| **Amador** | 023-010-025- | 31 08N 13E (M) | 30 |
| **Amador** | 023-010-030- | 29 08N 13E (M) | 1 |
| **Amador** | 023-010-031- | 28 08N 13E (M) | 23 |
| **Amador** | 023-010-031- | 32 08N 13E (M) | 225.99 |
| **Amador** | 023-010-031- | 33 08N 13E (M) | 120 |
| **Amador** | 024-010-002- | 20 08N 14E (M) | 25.23 |
| **Amador** | 024-010-003-3 | 20 08N 14E (M) | 1.1 |
| **Amador** | 024-010-004- | 20 08N 14E (M) | 38.34 |
| **Amador** | 024-010-005- | 21 08N 14E (M) | 5.74 |
| **Amador** | 024-010-008- | 21 08N 14E (M) | 116.84 |
| **Amador** | 024-020-004- | 22 08N 14E (M) | 267.86 |
| **Amador** | 024-020-006- | 23 08N 14E (M) | 558.62 |
| **Amador** | 024-020-007- | 24 08N 14E (M) | 311.2 |
| **Amador** | 024-020-009- | 24 08N 14E (M) | 160 |
| **Amador** | 024-020-010- | 13 08N 14E (M) | 79 |
| **Amador** | 024-020-011- | 13 08N 14E (M) | 4.17 |
| **Amador** | 024-020-011- | 14 08N 14E (M) | 0.5 |
| **Amador** | 024-030-001- | 30 08N 14E (M) | 45.86 |

| | | | |
|---|---|---|---|
| **Amador** | 024-030-002- | 30 08N 14E (M) | 123.09 |
| **Amador** | 024-030-008- | 29 08N 14E (M) | 65 |
| **Amador** | 024-030-009- | 29 08N 14E (M) | 114.05 |
| **Amador** | 024-030-010- | 29 08N 14E (M) | 13.28 |
| **Amador** | 024-030-013- | 29 08N 14E (M) | 45.38 |
| **Amador** | 024-030-014- | 29 08N 14E (M) | 8.79 |
| **Amador** | 024-030-016- | 29 08N 14E (M) | 328.47 |
| **Amador** | 024-030-017- | 28 08N 14E (M) | 638.72 |
| **Amador** | 024-030-018- | 30 08N 14E (M) | 154.16 |
| **Amador** | 024-030-019- | 31 08N 14E (M) | 703.6 |
| **Amador** | 024-030-020- | 32 08N 14E (M) | 640 |
| **Amador** | 024-030-021- | 33 08N 14E (M) | 640 |
| **Amador** | 024-030-022- | 30 08N 14E (M) | 145.36 |
| **Amador** | 024-040-001- | 27 08N 14E (M) | 640 |
| **Amador** | 024-040-002- | 26 08N 14E (M) | 600 |
| **Amador** | 024-040-003- | 25 08N 14E (M) | 80 |
| **Amador** | 024-040-003- | 26 08N 14E (M) | 40 |
| **Amador** | 024-040-003- | 35 08N 14E (M) | 40 |
| **Amador** | 024-040-004- | 25 08N 14E (M) | 560 |
| **Amador** | 024-040-005- | 34 08N 14E (M) | 640 |
| **Amador** | 024-040-006- | 35 08N 14E (M) | 600 |
| **Amador** | 024-040-007- | 36 08N 14E (M) | 640 |
| **Amador** | 024-050-001- | 06 07N 14E (M) | 707.86 |
| **Amador** | 024-050-002- | 05 07N 14E (M) | 555.48 |
| **Amador** | 024-050-003- | 04 07N 14E (M) | 641.83 |
| **Amador** | 024-050-004- | 07 07N 14E (M) | 697.92 |
| **Amador** | 024-050-005- | 08 07N 14E (M) | 80 |
| **Amador** | 024-050-007- | 08 07N 14E (M) | 80 |
| **Amador** | 024-050-008- | 09 07N 14E (M) | 320 |
| **Amador** | 024-060-001- | 03 07N 14E (M) | 595.82 |
| **Amador** | 024-060-004- | 01 07N 14E (M) | 634.1 |
| **Amador** | 024-060-005- | 10 07N 14E (M) | 40 |
| **Amador** | 024-060-009- | 11 07N 14E (M) | 400 |
| **Amador** | 024-060-010- | 12 07N 14E (M) | 440 |
| **Amador** | 024-060-012- | 02 07N 14E (M) | 306 |
| **Amador** | 024-060-014- | 02 07N 14E (M) | 171.5 |
| **Amador** | 024-070-002- | 18 07N 14E (M) | 162 |
| **Amador** | 024-070-007- | 16 07N 14E (M) | 124.8 |
| **Amador** | 025-010-004- | 12 08N 15E (M) | 114.84 |
| **Amador** | 025-020-003- | 17 08N 15E (M) | 46.71 |
| **Amador** | 025-020-006- | 16 08N 15E (M) | 193 |
| **Amador** | 025-020-011- | 19 08N 15E (M) | 47.9 |
| **Amador** | 025-020-014- | 21 08N 15E (M) | 80 |
| **Amador** | 025-020-025- | 18 08N 15E (M) | 40 |

| | | | |
|---|---|---|---|
| **Amador** | 025-020-025- | 19 08N 15E (M) | 80 |
| **Amador** | 025-030-003- | 14 08N 15E (M) | 360 |
| **Amador** | 025-030-004- | 13 08N 15E (M) | 240 |
| **Amador** | 025-030-006- | 13 08N 15E (M) | 40 |
| **Amador** | 025-030-008- | 23 08N 15E (M) | 560 |
| **Amador** | 025-030-009- | 23 08N 15E (M) | 80 |
| **Amador** | 025-030-010- | 24 08N 15E (M) | 360 |
| **Amador** | 025-040-001- | 30 08N 15E (M) | 128.06 |
| **Amador** | 025-040-003- | 30 08N 15E (M) | 176.9 |
| **Amador** | 025-040-006- | 28 08N 15E (M) | 400 |
| **Amador** | 025-040-009- | 32 08N 15E (M) | 80 |
| **Amador** | 025-040-011- | 33 08N 15E (M) | 280 |
| **Amador** | 025-040-012- | 33 08N 15E (M) | 40 |
| **Amador** | 025-040-013- | 33 08N 15E (M) | 40 |
| **Amador** | 025-040-015- | 32 08N 15E (M) | 120 |
| **Amador** | 025-050-002- | 27 08N 15E (M) | 40 |
| **Amador** | 025-050-003- | 26 08N 15E (M) | 120 |
| **Amador** | 025-050-003- | 27 08N 15E (M) | 160 |
| **Amador** | 025-050-004- | 27 08N 15E (M) | 360 |
| **Amador** | 025-050-005- | 26 08N 15E (M) | 440 |
| **Amador** | 025-050-008- | 25 08N 15E (M) | 80 |
| **Amador** | 025-050-010- | 25 08N 15E (M) | 240 |
| **Amador** | 025-050-011- | 34 08N 15E (M) | 160 |
| **Amador** | 025-050-014- | 36 08N 15E (M) | 256 |
| **Amador** | 025-050-017- | 34 08N 15E (M) | 40 |
| **Amador** | 025-060-001- | 06 07N 15E (M) | 51.09 |
| **Amador** | 025-060-004- | 05 07N 15E (M) | 83.8 |
| **Amador** | 025-060-006- | 05 07N 15E (M) | 40 |
| **Amador** | 025-060-008- | 04 07N 15E (M) | 87.53 |
| **Amador** | 025-060-010- | 04 07N 15E (M) | 82.98 |
| **Amador** | 025-070-001- | 03 07N 15E (M) | 42.79 |
| **Amador** | 026-110-005- | 36 09N 16E (M) | 640 |
| **Amador** | 028-090-002- | 30 08N 16E (M) | 437.66 |
| **Amador** | 028-090-008- | 31 08N 16E (M) | 39.79 |
| **Amador** | 028-090-013- | 31 08N 16E (M) | 40 |
| **Amador** | 028-090-014- | 29 08N 16E (M) | 160 |
| **Amador** | 032-010-001- | 27 08N 13E (M) | 9 |
| **Amador** | 032-010-001- | 34 08N 13E (M) | 273 |
| **Amador** | 032-010-006- | 26 08N 13E (M) | 80 |
| **Amador** | 032-010-006- | 35 08N 13E (M) | 160.6 |
| **Amador** | 032-010-011- | 35 08N 13E (M) | 4 |
| **Amador** | 032-010-013- | 25 08N 13E (M) | 309 |
| **Amador** | 032-010-013- | 36 08N 13E (M) | 80 |
| **Amador** | 032-010-014- | 36 08N 13E (M) | 349 |

| | | | |
|---|---|---|---|
| **Amador** | 032-010-021-1 | 34 08N 13E (M) | 16.6 |
| **Amador** | 032-100-001- | 02 07N 13E (M) | 156 |
| **Amador** | 032-100-002- | 01 07N 13E (M) | 378.24 |
| **Amador** | 032-100-010- | 11 07N 13E (M) | 456 |
| **Amador** | 032-100-012- | 12 07N 13E (M) | 560 |
| **Amador** | 032-100-013- | 11 07N 13E (M) | 80 |
| **Amador** | 032-100-013- | 12 07N 13E (M) | 80 |
| **Amador** | 033-010-009- | 13 07N 13E (M) | 360 |
| **Amador** | 033-010-052- | 14 07N 13E (M) | 314 |
| **Amador** | 033-010-053- | 23 07N 13E (M) | 80 |
| **Amador** | 033-010-061- | 14 07N 13E (M) | 100 |
| **Amador** | 033-010-061- | 15 07N 13E (M) | 18.63 |
| **Butte** | 056-070-002- | 01 24N 02E (M) | 124.47 |
| **Butte** | 056-070-004- | 02 24N 02E (M) | 21.7 |
| **Butte** | 056-070-015- | 12 24N 02E (M) | 240 |
| **Butte** | 056-070-016- | 12 24N 02E (M) | 20 |
| **Butte** | 056-070-018- | 12 24N 02E (M) | 40 |
| **Butte** | 056-070-019- | 12 24N 02E (M) | 40 |
| **Butte** | 056-070-050- | 36 25N 02E (M) | 140.42 |
| **Butte** | 056-070-065- | 01 24N 02E (M) | 240.37 |
| **Butte** | 056-070-066- | 01 24N 02E (M) | 240.01 |
| **Butte** | 056-130-007- | 25 24N 02E (M) | 520 |
| **Butte** | 056-190-003- | 02 24N 03E (M) | 657 |
| **Butte** | 056-190-004- | 01 24N 03E (M) | 640.65 |
| **Butte** | 056-190-005- | 10 24N 03E (M) | 81.68 |
| **Butte** | 056-190-006- | 10 24N 03E (M) | 574.39 |
| **Butte** | 056-190-008- | 12 24N 03E (M) | 631.5 |
| **Butte** | 056-190-009- | 12 24N 03E (M) | 20.82 |
| **Butte** | 056-190-011- | 03 24N 03E (M) | 642.37 |
| **Butte** | 056-190-012- | 11 24N 03E (M) | 662.63 |
| **Butte** | 056-200-002- | 06 24N 03E (M) | 53.93 |
| **Butte** | 056-200-003- | 06 24N 03E (M) | 481.17 |
| **Butte** | 056-200-004- | 05 24N 03E (M) | 640 |
| **Butte** | 056-200-009- | 07 24N 03E (M) | 695.56 |
| **Butte** | 056-200-010- | 08 24N 03E (M) | 160 |
| **Butte** | 056-200-032- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-033- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-036- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-038- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-039- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-047- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-048- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-050- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-055- | 06 24N 03E (M) | 5 |

| | | | |
|---|---|---|---|
| **Butte** | 056-200-056- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-057- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-058- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-060- | 06 24N 03E (M) | 5 |
| **Butte** | 056-200-061- | 09 24N 03E (M) | 592.67 |
| **Butte** | 056-200-067- | 04 24N 03E (M) | 446.06 |
| **Butte** | 056-210-012- | 17 24N 03E (M) | 520 |
| **Butte** | 056-210-013- | 17 24N 03E (M) | 40 |
| **Butte** | 056-210-014- | 17 24N 03E (M) | 80 |
| **Butte** | 056-210-016- | 19 24N 03E (M) | 535 |
| **Butte** | 056-210-017- | 19 24N 03E (M) | 160 |
| **Butte** | 056-210-019- | 20 24N 03E (M) | 320 |
| **Butte** | 056-210-043- | 16 24N 03E (M) | 615.73 |
| **Butte** | 056-220-001- | 15 24N 03E (M) | 640 |
| **Butte** | 056-220-004- | 14 24N 03E (M) | 80 |
| **Butte** | 056-220-013- | 23 24N 03E (M) | 80 |
| **Butte** | 056-220-018- | 24 24N 03E (M) | 95.1 |
| **Butte** | 056-220-019- | 24 24N 03E (M) | 20.66 |
| **Butte** | 056-220-023- | 14 24N 03E (M) | 556.71 |
| **Butte** | 056-220-024- | 13 24N 03E (M) | 639.9 |
| **Butte** | 056-220-026- | 23 24N 03E (M) | 551.73 |
| **Butte** | 056-220-027- | 22 24N 03E (M) | 539.27 |
| **Butte** | 056-220-028- | 24 24N 03E (M) | 507.1 |
| **Butte** | 056-230-007- | 26 24N 03E (M) | 7.34 |
| **Butte** | 056-230-010- | 26 24N 03E (M) | 286.72 |
| **Butte** | 056-230-011- | 25 24N 03E (M) | 560 |
| **Butte** | 056-230-018- | 35 24N 03E (M) | 564.88 |
| **Butte** | 056-240-028- | 33 24N 03E (M) | 480 |
| **Butte** | 056-240-039- | 29 24N 03E (M) | 557.17 |
| **Butte** | 056-250-001- | 32 24N 03E (M) | 20 |
| **Butte** | 056-270-015- | 36 24N 03E (M) | 74 |
| **Butte** | 056-410-009- | 21 24N 03E (M) | 35 |
| **Butte** | 056-440-012- | 13 24N 02E (M) | 107 |
| **Butte** | 056-440-012- | 24 24N 02E (M) | 26.5 |
| **Butte** | 058-020-002- | 06 23N 05E (M) | 547 |
| **Butte** | 058-020-003- | 05 23N 05E (M) | 643 |
| **Butte** | 058-020-006- | 07 23N 05E (M) | 627 |
| **Butte** | 058-020-010- | 09 23N 05E (M) | 160 |
| **Butte** | 058-020-011- | 04 23N 05E (M) | 642 |
| **Butte** | 058-020-012- | 08 23N 05E (M) | 640 |
| **Butte** | 058-030-011- | 18 23N 05E (M) | 131.63 |
| **Butte** | 058-030-013- | 17 23N 05E (M) | 320 |
| **Butte** | 058-080-002- | 03 23N 04E (M) | 40 |
| **Butte** | 058-080-005- | 02 23N 04E (M) | 320 |

| | | | |
|---|---|---|---|
| **Butte** | 058-080-012- | 11 23N 04E (M) | 640 |
| **Butte** | 058-080-014- | 01 23N 04E (M) | 563 |
| **Butte** | 058-080-015- | 03 23N 04E (M) | 225.62 |
| **Butte** | 058-080-016- | 03 23N 04E (M) | 379.22 |
| **Butte** | 058-090-004- | 06 23N 04E (M) | 510 |
| **Butte** | 058-090-008- | 04 23N 04E (M) | 636 |
| **Butte** | 058-090-020- | 08 23N 04E (M) | 20 |
| **Butte** | 058-090-021- | 05 23N 04E (M) | 30 |
| **Butte** | 058-090-021- | 08 23N 04E (M) | 150 |
| **Butte** | 058-090-022- | 08 23N 04E (M) | 54 |
| **Butte** | 058-090-025- | 09 23N 04E (M) | 636.75 |
| **Butte** | 058-090-026- | 09 23N 04E (M) | 40.89 |
| **Butte** | 058-090-056- | 05 23N 04E (M) | 589.19 |
| **Butte** | 058-090-095- | 08 23N 04E (M) | 40 |
| **Butte** | 058-090-110- | 08 23N 04E (M) | 10 |
| **Butte** | 058-100-004- | 17 23N 04E (M) | 40 |
| **Butte** | 058-100-009- | 17 23N 04E (M) | 160 |
| **Butte** | 058-100-019- | 21 23N 04E (M) | 640 |
| **Butte** | 058-100-082- | 17 23N 04E (M) | 160 |
| **Butte** | 058-100-116- | 18 23N 04E (M) | 80.47 |
| **Butte** | 058-110-001- | 15 23N 04E (M) | 640 |
| **Butte** | 058-110-002- | 14 23N 04E (M) | 640 |
| **Butte** | 058-110-003- | 13 23N 04E (M) | 560 |
| **Butte** | 058-110-006- | 22 23N 04E (M) | 640 |
| **Butte** | 058-110-007- | 23 23N 04E (M) | 640 |
| **Butte** | 058-110-018- | 24 23N 04E (M) | 398.9 |
| **Butte** | 058-120-001- | 27 23N 04E (M) | 640 |
| **Butte** | 058-120-009- | 35 23N 04E (M) | 640 |
| **Butte** | 058-120-011- | 25 23N 04E (M) | 598.9 |
| **Butte** | 058-120-013- | 25 23N 04E (M) | 40 |
| **Butte** | 058-120-013- | 26 23N 04E (M) | 480 |
| **Butte** | 058-130-016- | 28 23N 04E (M) | 160 |
| **Butte** | 058-130-018- | 28 23N 04E (M) | 160 |
| **Butte** | 058-130-021- | 31 23N 04E (M) | 240 |
| **Butte** | 058-130-024- | 32 23N 04E (M) | 120 |
| **Butte** | 058-130-025- | 33 23N 04E (M) | 600 |
| **Butte** | 058-130-038- | 29 23N 04E (M) | 600 |
| **Butte** | 058-150-001- | 05 22N 04E (M) | 609.56 |
| **Butte** | 058-150-005- | 04 22N 04E (M) | 160 |
| **Butte** | 058-150-005- | 05 22N 04E (M) | 40 |
| **Butte** | 058-250-001- | 03 22N 04E (M) | 211.21 |
| **Butte** | 058-360-003- | 01 22N 04E (M) | 656.14 |
| **Butte** | 058-700-006- | 05 21N 05E (M) | 218.3 |
| **Butte** | 058-700-008- | 05 21N 05E (M) | 149.28 |

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| **Butte** | 058-700-009- | 05 21N 05E (M) | 149.28 |
| **Butte** | 058-710-003- | 33 22N 05E (M) | 137.05 |
| **Butte** | 058-710-006- | 03 21N 05E (M) | 97.3 |
| **Butte** | 058-710-008- | 04 21N 05E (M) | 40 |
| **Butte** | 058-710-009- | 04 21N 05E (M) | 120 |
| **Butte** | 058-790-XXX- | 15 23N 05E (M) | 110 |
| **Butte** | 058-800-007- | 03 22N 04E (M) | 1.85 |
| **Butte** | 059-010-001- | 03 24N 04E (M) | 636.4 |
| **Butte** | 059-010-002- | 02 24N 04E (M) | 633 |
| **Butte** | 059-010-003- | 01 24N 04E (M) | 638.56 |
| **Butte** | 059-010-004- | 10 24N 04E (M) | 640 |
| **Butte** | 059-010-005- | 11 24N 04E (M) | 640 |
| **Butte** | 059-010-006- | 12 24N 04E (M) | 320 |
| **Butte** | 059-010-007- | 12 24N 04E (M) | 320 |
| **Butte** | 059-020-001- | 06 24N 04E (M) | 631 |
| **Butte** | 059-020-003- | 04 24N 04E (M) | 638 |
| **Butte** | 059-020-004- | 07 24N 04E (M) | 480 |
| **Butte** | 059-020-009- | 09 24N 04E (M) | 640 |
| **Butte** | 059-020-011- | 05 24N 04E (M) | 437.24 |
| **Butte** | 059-020-012- | 08 24N 04E (M) | 510 |
| **Butte** | 059-020-013- | 05 24N 04E (M) | 200 |
| **Butte** | 059-020-013- | 07 24N 04E (M) | 140 |
| **Butte** | 059-020-013- | 08 24N 04E (M) | 90 |
| **Butte** | 059-020-014- | 07 24N 04E (M) | 20 |
| **Butte** | 059-030-004- | 16 24N 04E (M) | 320 |
| **Butte** | 059-030-005- | 16 24N 04E (M) | 320 |
| **Butte** | 059-030-008- | 20 24N 04E (M) | 640 |
| **Butte** | 059-030-011- | 18 24N 04E (M) | 507 |
| **Butte** | 059-030-013- | 17 24N 04E (M) | 640 |
| **Butte** | 059-030-014- | 19 24N 04E (M) | 622 |
| **Butte** | 059-030-015- | 21 24N 04E (M) | 640 |
| **Butte** | 059-040-004- | 14 24N 04E (M) | 640 |
| **Butte** | 059-040-005- | 13 24N 04E (M) | 640 |
| **Butte** | 059-040-006- | 22 24N 04E (M) | 640 |
| **Butte** | 059-040-007- | 23 24N 04E (M) | 640 |
| **Butte** | 059-040-008- | 24 24N 04E (M) | 640 |
| **Butte** | 059-040-009- | 15 24N 04E (M) | 640 |
| **Butte** | 059-050-005- | 26 24N 04E (M) | 640 |
| **Butte** | 059-050-006- | 25 24N 04E (M) | 640 |
| **Butte** | 059-050-008- | 34 24N 04E (M) | 40 |
| **Butte** | 059-050-011- | 34 24N 04E (M) | 80 |
| **Butte** | 059-050-013- | 35 24N 04E (M) | 640 |
| **Butte** | 059-050-014- | 36 24N 04E (M) | 638.49 |
| **Butte** | 059-050-016- | 27 24N 04E (M) | 300 |

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| **Butte** | 059-050-019- | 34 24N 04E (M) | 270 |
| **Butte** | 059-050-020- | 34 24N 04E (M) | 250 |
| **Butte** | 059-050-021- | 27 24N 04E (M) | 332 |
| **Butte** | 059-060-001- | 30 24N 04E (M) | 621.4 |
| **Butte** | 059-060-002- | 29 24N 04E (M) | 640 |
| **Butte** | 059-060-011- | 32 24N 04E (M) | 602.72 |
| **Butte** | 059-060-034- | 31 24N 04E (M) | 474.79 |
| **Butte** | 059-060-047- | 28 24N 04E (M) | 28.14 |
| **Butte** | 059-060-053- | 28 24N 04E (M) | 305.59 |
| **Butte** | 059-060-054- | 33 24N 04E (M) | 607.46 |
| **Butte** | 059-060-055- | 28 24N 04E (M) | 3.9 |
| **Butte** | 059-060-056- | 28 24N 04E (M) | 185.2 |
| **Butte** | 059-100-001- | 06 24N 05E (M) | 560 |
| **Butte** | 059-100-010- | 08 24N 05E (M) | 140 |
| **Butte** | 059-100-015- | 07 24N 05E (M) | 160 |
| **Butte** | 059-100-017- | 05 24N 05E (M) | 553.12 |
| **Butte** | 059-100-018- | 09 24N 05E (M) | 320 |
| **Butte** | 059-110-001- | 18 24N 05E (M) | 640 |
| **Butte** | 059-110-005- | 17 24N 05E (M) | 82.29 |
| **Butte** | 059-110-007- | 16 24N 05E (M) | 320 |
| **Butte** | 059-110-010- | 20 24N 05E (M) | 556 |
| **Butte** | 059-110-013- | 17 24N 05E (M) | 500 |
| **Butte** | 059-110-014- | 19 24N 05E (M) | 588 |
| **Butte** | 059-110-015- | 21 24N 05E (M) | 558 |
| **Butte** | 059-120-001- | 30 24N 05E (M) | 645.56 |
| **Butte** | 059-120-002- | 29 24N 05E (M) | 640 |
| **Butte** | 059-120-003- | 31 24N 05E (M) | 643 |
| **Butte** | 059-120-004- | 32 24N 05E (M) | 640 |
| **Butte** | 059-120-005- | 33 24N 05E (M) | 640 |
| **Butte** | 059-130-001- | 03 25N 04E (M) | 93.65 |
| **Butte** | 059-130-006- | 10 25N 04E (M) | 81.83 |
| **Butte** | 059-140-001- | 06 25N 04E (M) | 344 |
| **Butte** | 059-140-002- | 05 25N 04E (M) | 391 |
| **Butte** | 059-140-004- | 04 25N 04E (M) | 9 |
| **Butte** | 059-140-006- | 04 25N 04E (M) | 80 |
| **Butte** | 059-140-008- | 07 25N 04E (M) | 135 |
| **Butte** | 059-140-010- | 07 25N 04E (M) | 320 |
| **Butte** | 059-140-013- | 08 25N 04E (M) | 360 |
| **Butte** | 059-140-019- | 05 25N 04E (M) | 20 |
| **Butte** | 059-140-035- | 04 25N 04E (M) | 123.19 |
| **Butte** | 059-140-036- | 09 25N 04E (M) | 628.58 |
| **Butte** | 059-150-003- | 17 25N 04E (M) | 609.23 |
| **Butte** | 059-150-006- | 19 25N 04E (M) | 673.5 |
| **Butte** | 059-150-007- | 20 25N 04E (M) | 625.56 |

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| **Butte** | 059-150-010- | 18 25N 04E (M) | 616.5 |
| **Butte** | 059-150-011- | 16 25N 04E (M) | 432.41 |
| **Butte** | 059-150-012- | 21 25N 04E (M) | 588.26 |
| **Butte** | 059-160-001- | 15 25N 04E (M) | 320 |
| **Butte** | 059-170-008- | 34 25N 04E (M) | 320 |
| **Butte** | 059-170-010- | 35 25N 04E (M) | 320 |
| **Butte** | 059-170-012- | 27 25N 04E (M) | 20.3 |
| **Butte** | 059-170-019- | 27 25N 04E (M) | 240 |
| **Butte** | 059-180-002- | 30 25N 04E (M) | 40 |
| **Butte** | 059-180-003- | 30 25N 04E (M) | 20.47 |
| **Butte** | 059-180-005- | 30 25N 04E (M) | 303 |
| **Butte** | 059-180-009- | 29 25N 04E (M) | 400 |
| **Butte** | 059-180-015- | 31 25N 04E (M) | 543 |
| **Butte** | 059-180-016- | 31 25N 04E (M) | 75 |
| **Butte** | 059-180-017- | 32 25N 04E (M) | 550 |
| **Butte** | 059-180-019- | 33 25N 04E (M) | 40 |
| **Butte** | 059-180-020- | 33 25N 04E (M) | 280 |
| **Butte** | 059-180-037- | 29 25N 04E (M) | 79.98 |
| **Butte** | 059-180-038- | 28 25N 04E (M) | 477.48 |
| **Butte** | 059-180-039- | 28 25N 04E (M) | 19.68 |
| **Butte** | 059-180-040- | 28 25N 04E (M) | 22.68 |
| **Butte** | 059-200-001- | 06 25N 05E (M) | 99.68 |
| **Butte** | 059-200-003- | 06 25N 05E (M) | 47.52 |
| **Butte** | 059-210-008- | 19 25N 05E (M) | 638.84 |
| **Butte** | 059-210-014- | 21 25N 05E (M) | 320 |
| **Butte** | 059-220-006- | 28 25N 05E (M) | 240 |
| **Butte** | 059-220-008- | 31 25N 05E (M) | 478.72 |
| **Butte** | 059-240-016- | 31 25N 05E (M) | 18.39 |
| **Butte** | 060-010-001- | 02 25N 03E (M) | 160 |
| **Butte** | 060-010-007- | 11 25N 03E (M) | 600 |
| **Butte** | 060-010-008- | 12 25N 03E (M) | 640 |
| **Butte** | 060-010-009- | 10 25N 03E (M) | 114.39 |
| **Butte** | 060-010-010- | 01 25N 03E (M) | 492.7 |
| **Butte** | 060-020-002- | 14 25N 03E (M) | 640 |
| **Butte** | 060-020-003- | 13 25N 03E (M) | 640 |
| **Butte** | 060-020-005- | 23 25N 03E (M) | 640 |
| **Butte** | 060-020-006- | 24 25N 03E (M) | 640 |
| **Butte** | 060-020-007- | 15 25N 03E (M) | 456.79 |
| **Butte** | 060-020-008- | 22 25N 03E (M) | 616.17 |
| **Butte** | 060-030-002- | 26 25N 03E (M) | 640 |
| **Butte** | 060-030-006- | 35 25N 03E (M) | 640 |
| **Butte** | 060-030-007- | 36 25N 03E (M) | 640 |
| **Butte** | 060-030-008- | 27 25N 03E (M) | 612.75 |
| **Butte** | 060-030-009- | 34 25N 03E (M) | 631.69 |

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| **Butte** | 060-030-010- | 25 25N 03E (M) | 640 |
| **Butte** | 060-040-001- | 28 25N 03E (M) | 160 |
| **Butte** | 060-040-002- | 31 25N 03E (M) | 347 |
| **Butte** | 060-040-003- | 32 25N 03E (M) | 320 |
| **Butte** | 060-040-007- | 33 25N 03E (M) | 401.23 |
| **Butte** | 060-040-008- | 33 25N 03E (M) | 59.75 |
| **Butte** | 060-050-001- | 14 26N 04E (M) | 80 |
| **Butte** | 060-050-001- | 15 26N 04E (M) | 160 |
| **Butte** | 060-050-006- | 22 26N 04E (M) | 560 |
| **Butte** | 060-050-007- | 23 26N 04E (M) | 480 |
| **Butte** | 060-050-013- | 21 26N 04E (M) | 360 |
| **Butte** | 060-060-002- | 24 26N 03E (M) | 150 |
| **Butte** | 060-060-004- | 19 26N 04E (M) | 668 |
| **Butte** | 060-060-009- | 20 26N 04E (M) | 40 |
| **Butte** | 060-060-010- | 24 26N 03E (M) | 135 |
| **Butte** | 060-060-012- | 20 26N 04E (M) | 440 |
| **Butte** | 060-070-004- | 27 26N 04E (M) | 640 |
| **Butte** | 060-070-005- | 26 26N 04E (M) | 320 |
| **Butte** | 060-070-007- | 33 26N 04E (M) | 640 |
| **Butte** | 060-070-028- | 28 26N 04E (M) | 538.3 |
| **Butte** | 060-080-010- | 36 26N 03E (M) | 640 |
| **Butte** | 060-080-018- | 25 26N 03E (M) | 627.5 |
| **Butte** | 060-080-020- | 30 26N 04E (M) | 507.65 |
| **Butte** | 060-080-027- | 32 26N 04E (M) | 309.09 |
| **Butte** | 060-080-028- | 31 26N 04E (M) | 636.42 |
| **Butte** | 060-080-029- | 29 26N 04E (M) | 404.55 |
| **Butte** | 060-100-001- | 29 26N 04E (M) | 17.76 |
| **Butte** | 060-100-002- | 29 26N 04E (M) | 10.22 |
| **Butte** | 060-150-009- | 24 26N 04E (M) | 320 |
| **Butte** | 060-160-001- | 25 26N 04E (M) | 160 |
| **Butte** | 060-160-007- | 36 26N 04E (M) | 360 |
| **Butte** | 060-160-009- | 31 26N 05E (M) | 40 |
| **Butte** | 060-160-015- | 31 26N 05E (M) | 120 |
| **Butte** | 061-030-026- | 07 21N 06E (M) | 35 |
| **Butte** | 061-050-003- | 18 21N 06E (M) | 158 |
| **Butte** | 061-050-006- | 17 21N 06E (M) | 100 |
| **Butte** | 061-050-017- | 17 21N 06E (M) | 211.76 |
| **Butte** | 061-050-025- | 17 21N 06E (M) | 250 |
| **Butte** | 061-050-025- | 20 21N 06E (M) | 160 |
| **Butte** | 061-070-007- | 36 21N 06E (M) | 640 |
| **Butte** | 061-090-005- | 08 21N 07E (M) | 160 |
| **Butte** | 061-090-006- | 09 21N 07E (M) | 520 |
| **Butte** | 061-100-002- | 17 21N 07E (M) | 445 |
| **Butte** | 061-100-004- | 16 21N 07E (M) | 602.4 |

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| **Butte** | 061-100-008- | 20 21N 07E (M) | 239.45 |
| **Butte** | 061-100-009- | 20 21N 07E (M) | 122.7 |
| **Butte** | 061-100-010- | 21 21N 07E (M) | 532.91 |
| **Butte** | 061-110-001- | 15 21N 07E (M) | 655.93 |
| **Butte** | 061-110-002- | 22 21N 07E (M) | 662 |
| **Butte** | 061-110-004- | 23 21N 07E (M) | 125.16 |
| **Butte** | 061-120-008- | 26 21N 07E (M) | 27.6 |
| **Butte** | 061-120-010- | 27 21N 07E (M) | 499.5 |
| **Butte** | 061-120-012- | 34 21N 07E (M) | 519.92 |
| **Butte** | 061-130-004- | 30 21N 07E (M) | 158 |
| **Butte** | 061-130-006- | 29 21N 07E (M) | 594.34 |
| **Butte** | 061-130-007- | 28 21N 07E (M) | 641.42 |
| **Butte** | 061-130-008- | 31 21N 07E (M) | 176.08 |
| **Butte** | 061-130-009- | 31 21N 07E (M) | 311.24 |
| **Butte** | 061-130-010- | 32 21N 07E (M) | 633.87 |
| **Butte** | 061-130-011- | 33 21N 07E (M) | 631.72 |
| **Butte** | 061-190-010- | 25 22N 05E (M) | 52.54 |
| **Butte** | 061-190-011- | 25 22N 05E (M) | 103.48 |
| **Butte** | 061-190-017- | 34 22N 05E (M) | 80 |
| **Butte** | 061-190-017- | 35 22N 05E (M) | 415.58 |
| **Butte** | 061-190-019- | 25 22N 05E (M) | 86.52 |
| **Butte** | 061-190-019- | 36 22N 05E (M) | 400 |
| **Butte** | 061-220-012- | 33 22N 05E (M) | 158.55 |
| **Butte** | 061-230-006- | 10 22N 06E (M) | 40 |
| **Butte** | 061-230-008- | 10 22N 06E (M) | 160.36 |
| **Butte** | 061-230-010- | 10 22N 06E (M) | 40 |
| **Butte** | 061-230-011- | 10 22N 06E (M) | 40 |
| **Butte** | 061-230-012- | 10 22N 06E (M) | 40 |
| **Butte** | 061-230-013- | 10 22N 06E (M) | 40 |
| **Butte** | 061-230-015- | 04 22N 06E (M) | 38.93 |
| **Butte** | 061-230-019- | 10 22N 06E (M) | 40 |
| **Butte** | 061-230-020- | 10 22N 06E (M) | 20 |
| **Butte** | 061-230-023- | 03 22N 06E (M) | 52.04 |
| **Butte** | 061-230-024- | 03 22N 06E (M) | 100.9 |
| **Butte** | 061-230-027- | 09 22N 06E (M) | 19.28 |
| **Butte** | 061-230-028- | 09 22N 06E (M) | 67.44 |
| **Butte** | 061-250-022- | 16 22N 06E (M) | 9.69 |
| **Butte** | 061-260-003- | 14 22N 06E (M) | 161.72 |
| **Butte** | 061-260-006- | 23 22N 06E (M) | 628.2 |
| **Butte** | 061-260-011- | 15 22N 06E (M) | 432.15 |
| **Butte** | 061-260-012- | 15 22N 06E (M) | 100.39 |
| **Butte** | 061-280-002- | 30 22N 06E (M) | 102.42 |
| **Butte** | 061-280-008- | 31 22N 06E (M) | 20.06 |
| **Butte** | 061-360-001- | 19 23N 06E (M) | 123.89 |

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| **Butte** | 061-380-001- | 15 23N 05E (M) | 38.92 |
| **Butte** | 061-380-006- | 33 23N 05E (M) | 320 |
| **Butte** | 061-390-001- | 13 23N 05E (M) | 75 |
| **Butte** | 061-390-003- | 13 23N 05E (M) | 520 |
| **Butte** | 061-390-008- | 23 23N 05E (M) | 647 |
| **Butte** | 061-420-002- | 03 21N 05E (M) | 257 |
| **Butte** | 061-420-007- | 11 21N 05E (M) | 602.72 |
| **Butte** | 065-010-053- | 12 23N 03E (M) | 69.83 |
| **Butte** | 065-520-014- | 07 23N 04E (M) | 240.44 |
| **Butte** | 065-530-039- | 07 23N 04E (M) | 151.99 |
| **Butte** | 065-530-039- | 18 23N 04E (M) | 1 |
| **Butte** | 071-040-010- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-011- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-013- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-014- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-015- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-016- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-017- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-018- | 12 20N 06E (M) | 20 |
| **Butte** | 071-040-019- | 12 20N 06E (M) | 160 |
| **Butte** | 071-040-045- | 01 20N 06E (M) | 490.91 |
| **Butte** | 071-040-047- | 12 20N 06E (M) | 231.24 |
| **Butte** | 071-050-006- | 13 20N 06E (M) | 5 |
| **Butte** | 071-050-007- | 13 20N 06E (M) | 1.33 |
| **Butte** | 071-050-052- | 24 20N 06E (M) | 107.14 |
| **Butte** | 071-050-053- | 24 20N 06E (M) | 280 |
| **Butte** | 071-050-056- | 24 20N 06E (M) | 11.54 |
| **Butte** | 071-050-072- | 14 20N 06E (M) | 390.2 |
| **Butte** | 071-050-079- | 13 20N 06E (M) | 49.97 |
| **Butte** | 071-050-080- | 13 20N 06E (M) | 40 |
| **Butte** | 071-050-081- | 13 20N 06E (M) | 55.28 |
| **Butte** | 071-050-092- | 13 20N 06E (M) | 372.34 |
| **Butte** | 071-060-002- | 17 20N 06E (M) | 465.65 |
| **Butte** | 071-060-014- | 19 20N 06E (M) | 656.5 |
| **Butte** | 071-090-006- | 33 20N 05E (M) | 48 |
| **Butte** | 071-230-005- | 25 20N 06E (M) | 243.88 |
| **Butte** | 071-490-005- | 14 20N 06E (M) | 240 |
| **Butte** | 071-500-001- | 23 20N 06E (M) | 240 |
| **Butte** | 073-020-001- | 03 20N 07E (M) | 549.59 |
| **Butte** | 073-020-002- | 02 20N 07E (M) | 174.09 |
| **Butte** | 073-020-006- | 03 20N 07E (M) | 23.29 |
| **Butte** | 073-020-007- | 34 21N 07E (M) | 70.33 |
| **Butte** | 073-020-008- | 34 21N 07E (M) | 49.75 |
| **Butte** | 073-020-009- | 35 21N 07E (M) | 640 |

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| **Butte** | 073-020-010- | 36 21N 07E (M) | 600 |
| **Butte** | 073-030-004- | 06 20N 07E (M) | 221.49 |
| **Butte** | 073-030-005- | 06 20N 07E (M) | 349.98 |
| **Butte** | 073-030-006- | 05 20N 07E (M) | 165.29 |
| **Butte** | 073-030-007- | 05 20N 07E (M) | 406.81 |
| **Butte** | 073-030-008- | 04 20N 07E (M) | 65.46 |
| **Butte** | 073-030-009- | 04 20N 07E (M) | 505.82 |
| **Butte** | 073-030-010- | 01 20N 06E (M) | 90.57 |
| **Butte** | 073-030-011- | 12 20N 06E (M) | 88.76 |
| **Butte** | 073-040-001- | 07 20N 07E (M) | 630.38 |
| **Butte** | 073-040-002- | 08 20N 07E (M) | 640 |
| **Butte** | 073-040-004- | 09 20N 07E (M) | 560 |
| **Butte** | 073-040-006- | 18 20N 07E (M) | 116 |
| **Butte** | 073-040-007- | 18 20N 07E (M) | 80 |
| **Butte** | 073-040-010- | 18 20N 07E (M) | 240 |
| **Butte** | 073-040-012- | 17 20N 07E (M) | 80 |
| **Butte** | 073-040-013- | 16 20N 07E (M) | 640 |
| **Butte** | 073-040-014- | 17 20N 07E (M) | 20 |
| **Butte** | 073-040-016- | 17 20N 07E (M) | 10 |
| **Butte** | 073-040-017- | 17 20N 07E (M) | 10 |
| **Butte** | 073-040-018- | 17 20N 07E (M) | 20 |
| **Butte** | 073-040-019- | 17 20N 07E (M) | 40 |
| **Butte** | 073-040-020- | 17 20N 07E (M) | 25 |
| **Butte** | 073-040-021- | 17 20N 07E (M) | 5 |
| **Butte** | 073-040-023- | 17 20N 07E (M) | 40 |
| **Butte** | 073-040-026- | 17 20N 07E (M) | 10 |
| **Butte** | 073-040-027- | 17 20N 07E (M) | 80 |
| **Butte** | 073-040-028- | 17 20N 07E (M) | 110 |
| **Butte** | 073-040-032- | 18 20N 07E (M) | 38.75 |
| **Butte** | 073-040-033- | 18 20N 07E (M) | 118.29 |
| **Butte** | 073-050-001- | 10 20N 07E (M) | 560 |
| **Butte** | 073-050-001- | 11 20N 07E (M) | 40 |
| **Butte** | 073-050-013- | 15 20N 07E (M) | 449.55 |
| **Butte** | 073-050-014- | 15 20N 07E (M) | 38 |
| **Butte** | 073-050-015- | 15 20N 07E (M) | 26 |
| **Butte** | 073-070-001- | 19 20N 07E (M) | 637 |
| **Butte** | 073-070-003- | 20 20N 07E (M) | 711 |
| **Butte** | 073-070-005- | 21 20N 07E (M) | 40.49 |
| **Butte** | 073-070-006- | 21 20N 07E (M) | 140 |
| **Butte** | 073-070-009- | 30 20N 07E (M) | 430 |
| **Butte** | 073-070-011- | 29 20N 07E (M) | 672 |
| **Butte** | 073-080-001- | 22 20N 07E (M) | 143 |
| **Butte** | 073-160-054- | 10 19N 06E (M) | 69.55 |
| **Butte** | 073-170-062- | 10 19N 06E (M) | 115.7 |

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| **Butte** | 073-200-001- | 31 20N 07E (M) | 165.82 |
| **Butte** | 073-200-002- | 31 20N 07E (M) | 162.72 |
| **Butte** | 073-200-022- | 31 20N 07E (M) | 319.85 |
| **Butte** | 073-330-001- | 23 21N 07E (M) | 282.84 |
| **Butte** | 073-330-002- | 27 21N 07E (M) | 140.5 |
| **Butte** | 073-330-003- | 26 21N 07E (M) | 612.4 |
| **Butte** | 073-330-004- | 25 21N 07E (M) | 640 |
| **Butte** | 904-000-005- | 04 24N 03E (M) | 128.6 |
| **Butte** | 904-000-006- | 24 24N 03E (M) | 12.9 |
| **Butte** | 904-000-007- | 27 24N 03E (M) | 45.23 |
| **Butte** | 904-000-007- | 34 24N 03E (M) | 1 |
| **Butte** | 904-000-011- | 30 23N 05E (M) | 38.56 |
| **Butte** | 904-000-013- | 13 23N 04E (M) | 40 |
| **Butte** | 904-000-014- | 13 23N 04E (M) | 40 |
| **Butte** | 904-000-015- | 24 23N 04E (M) | 10 |
| **Butte** | 904-000-016- | 24 23N 04E (M) | 30 |
| **Butte** | 904-000-020- | 29 23N 04E (M) | 40 |
| **Butte** | 904-000-020- | 32 23N 04E (M) | 40 |
| **Butte** | 904-000-020- | 33 23N 04E (M) | 40 |
| **Butte** | 904-000-022- | 18 24N 04E (M) | 120 |
| **Butte** | 904-000-023- | 08 24N 05E (M) | 130 |
| **Butte** | 904-000-024- | 17 24N 05E (M) | 60 |
| **Butte** | 904-000-025- | 04 25N 04E (M) | 117 |
| **Butte** | 904-000-027- | 05 25N 05E (M) | 169 |
| **Butte** | 904-000-028- | 04 25N 05E (M) | 40 |
| **Butte** | 904-000-028- | 09 25N 05E (M) | 120 |
| **Butte** | 904-000-029- | 35 26N 04E (M) | 160 |
| **Butte** | 904-000-031- | 20 26N 05E (M) | 80 |
| **Butte** | 904-000-032- | 13 26N 04E (M) | 0.7 |
| **Butte** | 904-000-033- | 29 26N 05E (M) | 120 |
| **Butte** | 904-000-033- | 30 26N 05E (M) | 40 |
| **Butte** | 904-000-034- | 36 26N 04E (M) | 280 |
| **Calaveras** | 002-009-002- | 14 07N 16E (M) | 80 |
| **Calaveras** | 002-009-002- | 22 07N 16E (M) | 120 |
| **Calaveras** | 002-009-002- | 23 07N 16E (M) | 255 |
| **Calaveras** | 002-009-003- | 22 07N 16E (M) | 80 |
| **Calaveras** | 002-009-005- | 23 07N 16E (M) | 14 |
| **Calaveras** | 002-009-005- | 24 07N 16E (M) | 14 |
| **Calaveras** | 002-010-001- | 16 07N 16E (M) | 619.24 |
| **Calaveras** | 002-010-002- | 19 07N 16E (M) | 80 |
| **Calaveras** | 002-010-003- | 19 07N 16E (M) | 80 |
| **Calaveras** | 002-010-004- | 21 07N 16E (M) | 320 |
| **Calaveras** | 002-011-001- | 30 07N 16E (M) | 41.65 |
| **Calaveras** | 002-011-002- | 28 07N 16E (M) | 640 |

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| **Calaveras** | 002-011-003- | 29 07N 16E (M) | 120 |
| **Calaveras** | 002-011-003- | 30 07N 16E (M) | 200 |
| **Calaveras** | 002-011-003- | 32 07N 16E (M) | 80 |
| **Calaveras** | 002-011-004- | 31 07N 16E (M) | 483.03 |
| **Calaveras** | 002-011-005- | 33 07N 16E (M) | 160 |
| **Calaveras** | 002-011-006- | 32 07N 16E (M) | 160 |
| **Calaveras** | 002-011-006- | 33 07N 16E (M) | 80 |
| **Calaveras** | 002-012-001- | 27 07N 16E (M) | 360 |
| **Calaveras** | 002-012-003- | 25 07N 16E (M) | 37 |
| **Calaveras** | 002-012-003- | 26 07N 16E (M) | 600 |
| **Calaveras** | 002-012-004- | 34 07N 16E (M) | 40 |
| **Calaveras** | 002-012-007- | 27 07N 16E (M) | 80 |
| **Calaveras** | 004-002-001- | 15 07N 15E (M) | 480 |
| **Calaveras** | 004-002-001- | 22 07N 15E (M) | 40 |
| **Calaveras** | 004-002-002- | 14 07N 15E (M) | 440 |
| **Calaveras** | 004-002-004- | 13 07N 15E (M) | 40 |
| **Calaveras** | 004-002-004- | 24 07N 15E (M) | 120 |
| **Calaveras** | 004-002-005- | 24 07N 15E (M) | 440 |
| **Calaveras** | 004-002-006- | 23 07N 15E (M) | 560 |
| **Calaveras** | 004-002-011- | 23 07N 15E (M) | 80 |
| **Calaveras** | 004-002-012- | 22 07N 15E (M) | 120 |
| **Calaveras** | 004-002-013- | 22 07N 15E (M) | 40 |
| **Calaveras** | 004-002-014- | 22 07N 15E (M) | 279.8 |
| **Calaveras** | 004-003-002- | 17 07N 15E (M) | 320 |
| **Calaveras** | 004-003-004- | 20 07N 15E (M) | 80 |
| **Calaveras** | 004-003-004- | 21 07N 15E (M) | 240 |
| **Calaveras** | 004-003-005- | 19 07N 15E (M) | 64.74 |
| **Calaveras** | 004-003-006- | 19 07N 15E (M) | 21.75 |
| **Calaveras** | 004-003-007- | 19 07N 15E (M) | 10.61 |
| **Calaveras** | 004-003-008- | 16 07N 15E (M) | 560 |
| **Calaveras** | 004-004-001- | 15 07N 14E (M) | 480 |
| **Calaveras** | 004-004-002- | 14 07N 14E (M) | 480 |
| **Calaveras** | 004-004-003- | 13 07N 14E (M) | 200 |
| **Calaveras** | 004-004-004- | 24 07N 14E (M) | 320 |
| **Calaveras** | 004-004-006- | 23 07N 14E (M) | 600 |
| **Calaveras** | 004-004-007- | 22 07N 14E (M) | 560 |
| **Calaveras** | 004-004-010- | 23 07N 14E (M) | 40 |
| **Calaveras** | 004-005-001- | 19 07N 14E (M) | 152.48 |
| **Calaveras** | 004-005-001- | 20 07N 14E (M) | 320.98 |
| **Calaveras** | 004-005-002- | 16 07N 14E (M) | 155.2 |
| **Calaveras** | 004-005-003- | 16 07N 14E (M) | 360 |
| **Calaveras** | 004-005-004- | 21 07N 14E (M) | 560 |
| **Calaveras** | 004-006-003- | 30 07N 14E (M) | 556.25 |
| **Calaveras** | 004-006-004- | 29 07N 14E (M) | 634.4 |

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| **Calaveras** | 004-006-005- | 28 07N 14E (M) | 280 |
| **Calaveras** | 004-006-006- | 28 07N 14E (M) | 80 |
| **Calaveras** | 004-006-015- | 33 07N 14E (M) | 80 |
| **Calaveras** | 004-006-016- | 33 07N 14E (M) | 160 |
| **Calaveras** | 004-006-053- | 31 07N 14E (M) | 80 |
| **Calaveras** | 004-006-053- | 32 07N 14E (M) | 80 |
| **Calaveras** | 004-006-056- | 36 07N 13E (M) | 34 |
| **Calaveras** | 004-006-056- | 31 07N 14E (M) | 70.85 |
| **Calaveras** | 004-006-057- | 31 07N 14E (M) | 121.4 |
| **Calaveras** | 004-006-058- | 31 07N 14E (M) | 284.26 |
| **Calaveras** | 004-006-058- | 32 07N 14E (M) | 520 |
| **Calaveras** | 004-006-058- | 33 07N 14E (M) | 80 |
| **Calaveras** | 004-007-001- | 27 07N 14E (M) | 120 |
| **Calaveras** | 004-007-002- | 26 07N 14E (M) | 440 |
| **Calaveras** | 004-007-004- | 25 07N 14E (M) | 120 |
| **Calaveras** | 004-007-005- | 36 07N 14E (M) | 640 |
| **Calaveras** | 004-007-007- | 34 07N 14E (M) | 280 |
| **Calaveras** | 004-007-009- | 35 07N 14E (M) | 480 |
| **Calaveras** | 004-007-010- | 25 07N 14E (M) | 280 |
| **Calaveras** | 004-007-011- | 34 07N 14E (M) | 80 |
| **Calaveras** | 004-007-015- | 25 07N 14E (M) | 40 |
| **Calaveras** | 004-008-001- | 30 07N 15E (M) | 48.35 |
| **Calaveras** | 004-008-002- | 30 07N 15E (M) | 48.05 |
| **Calaveras** | 004-008-004- | 29 07N 15E (M) | 320 |
| **Calaveras** | 004-008-005- | 28 07N 15E (M) | 480 |
| **Calaveras** | 004-008-005- | 29 07N 15E (M) | 40 |
| **Calaveras** | 004-008-007- | 33 07N 15E (M) | 640 |
| **Calaveras** | 004-008-008- | 32 07N 15E (M) | 520 |
| **Calaveras** | 004-008-009- | 30 07N 15E (M) | 80 |
| **Calaveras** | 004-008-009- | 31 07N 15E (M) | 247.55 |
| **Calaveras** | 004-008-011- | 31 07N 15E (M) | 294.2 |
| **Calaveras** | 004-008-011- | 32 07N 15E (M) | 80 |
| **Calaveras** | 004-008-012- | 32 07N 15E (M) | 40 |
| **Calaveras** | 004-009-001- | 27 07N 15E (M) | 480 |
| **Calaveras** | 004-009-002- | 25 07N 15E (M) | 40 |
| **Calaveras** | 004-009-002- | 26 07N 15E (M) | 560 |
| **Calaveras** | 004-009-003- | 25 07N 15E (M) | 240 |
| **Calaveras** | 004-009-004- | 25 07N 15E (M) | 160 |
| **Calaveras** | 004-009-005- | 36 07N 15E (M) | 640 |
| **Calaveras** | 004-009-006- | 35 07N 15E (M) | 640 |
| **Calaveras** | 004-009-007- | 34 07N 15E (M) | 640 |
| **Calaveras** | 004-009-008- | 27 07N 15E (M) | 160 |
| **Calaveras** | 004-009-009- | 26 07N 15E (M) | 80 |
| **Calaveras** | 004-009-010- | 25 07N 15E (M) | 120 |

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| **Calaveras** | 004-009-011- | 25 07N 15E (M) | 80 |
| **Calaveras** | 004-011-013- | 22 07N 15E (M) | 0.31 |
| **Calaveras** | 004-017-013- | 25 07N 13E (M) | 40 |
| **Calaveras** | 004-023-003- | 36 07N 13E (M) | 21.98 |
| **Calaveras** | 004-023-034- | 36 07N 13E (M) | 3.19 |
| **Calaveras** | 004-207-001- | 35 07N 14E (M) | 160 |
| **Calaveras** | 006-002-001- | 03 06N 14E (M) | 197.43 |
| **Calaveras** | 006-002-002- | 03 06N 14E (M) | 39.87 |
| **Calaveras** | 006-002-003- | 03 06N 14E (M) | 319.82 |
| **Calaveras** | 006-002-003- | 10 06N 14E (M) | 80 |
| **Calaveras** | 006-002-003- | 11 06N 14E (M) | 40 |
| **Calaveras** | 006-002-004- | 02 06N 14E (M) | 639.82 |
| **Calaveras** | 006-002-005- | 01 06N 14E (M) | 479.94 |
| **Calaveras** | 006-002-006- | 01 06N 14E (M) | 40 |
| **Calaveras** | 006-002-006- | 12 06N 14E (M) | 600 |
| **Calaveras** | 006-002-008- | 11 06N 14E (M) | 320 |
| **Calaveras** | 006-002-010- | 10 06N 14E (M) | 80 |
| **Calaveras** | 006-002-011- | 10 06N 14E (M) | 77.48 |
| **Calaveras** | 006-002-013- | 10 06N 14E (M) | 1 |
| **Calaveras** | 006-002-015- | 10 06N 14E (M) | 112.42 |
| **Calaveras** | 006-002-017- | 01 06N 14E (M) | 80 |
| **Calaveras** | 006-002-018- | 01 06N 14E (M) | 40 |
| **Calaveras** | 006-003-001- | 06 06N 15E (M) | 298.69 |
| **Calaveras** | 006-003-002- | 06 06N 15E (M) | 160 |
| **Calaveras** | 006-003-003- | 05 06N 15E (M) | 600.08 |
| **Calaveras** | 006-003-004- | 04 06N 15E (M) | 640.02 |
| **Calaveras** | 006-003-005- | 08 06N 15E (M) | 80 |
| **Calaveras** | 006-003-005- | 09 06N 15E (M) | 480 |
| **Calaveras** | 006-003-006- | 08 06N 15E (M) | 160 |
| **Calaveras** | 006-003-007- | 08 06N 15E (M) | 400 |
| **Calaveras** | 006-003-009- | 07 06N 15E (M) | 410 |
| **Calaveras** | 006-003-010- | 06 06N 15E (M) | 46.58 |
| **Calaveras** | 006-003-011- | 06 06N 15E (M) | 74.27 |
| **Calaveras** | 006-003-012- | 05 06N 15E (M) | 36.14 |
| **Calaveras** | 006-003-013- | 06 06N 15E (M) | 40 |
| **Calaveras** | 006-003-013- | 07 06N 15E (M) | 120 |
| **Calaveras** | 006-003-014- | 09 06N 15E (M) | 160 |
| **Calaveras** | 006-004-001- | 03 06N 15E (M) | 639.7 |
| **Calaveras** | 006-004-002- | 02 06N 15E (M) | 239.18 |
| **Calaveras** | 006-004-003- | 12 06N 15E (M) | 440 |
| **Calaveras** | 006-004-004- | 11 06N 15E (M) | 200 |
| **Calaveras** | 006-004-005- | 10 06N 15E (M) | 40 |
| **Calaveras** | 006-004-006- | 10 06N 15E (M) | 160 |
| **Calaveras** | 006-004-007- | 10 06N 15E (M) | 360 |

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| **Calaveras** | 006-004-009- | 11 06N 15E (M) | 40 |
| **Calaveras** | 006-004-010- | 10 06N 15E (M) | 40 |
| **Calaveras** | 006-004-011- | 10 06N 15E (M) | 40 |
| **Calaveras** | 006-005-001- | 06 06N 16E (M) | 52.9 |
| **Calaveras** | 006-005-002- | 05 06N 16E (M) | 35.23 |
| **Calaveras** | 006-005-005- | 09 06N 16E (M) | 160 |
| **Calaveras** | 006-005-006- | 09 06N 16E (M) | 40 |
| **Calaveras** | 006-005-007- | 08 06N 16E (M) | 600 |
| **Calaveras** | 006-005-008- | 07 06N 16E (M) | 321.85 |
| **Calaveras** | 006-005-011- | 07 06N 16E (M) | 322.21 |
| **Calaveras** | 006-005-011- | 08 06N 16E (M) | 40 |
| **Calaveras** | 006-006-002- | 10 06N 16E (M) | 160 |
| **Calaveras** | 006-006-003- | 10 06N 16E (M) | 75 |
| **Calaveras** | 006-006-003- | 11 06N 16E (M) | 19.07 |
| **Calaveras** | 006-006-006- | 11 06N 16E (M) | 164.89 |
| **Calaveras** | 006-009-004- | 15 06N 16E (M) | 7 |
| **Calaveras** | 006-009-004- | 22 06N 16E (M) | 198.6 |
| **Calaveras** | 006-010-001- | 18 06N 16E (M) | 322.7 |
| **Calaveras** | 006-010-002- | 17 06N 16E (M) | 360 |
| **Calaveras** | 006-010-002- | 19 06N 16E (M) | 120 |
| **Calaveras** | 006-010-002- | 20 06N 16E (M) | 160 |
| **Calaveras** | 006-010-003- | 17 06N 16E (M) | 80 |
| **Calaveras** | 006-010-003- | 20 06N 16E (M) | 80 |
| **Calaveras** | 006-010-003- | 21 06N 16E (M) | 40 |
| **Calaveras** | 006-010-004- | 16 06N 16E (M) | 640 |
| **Calaveras** | 006-010-008- | 20 06N 16E (M) | 80 |
| **Calaveras** | 006-010-008- | 21 06N 16E (M) | 160 |
| **Calaveras** | 006-010-010- | 18 06N 16E (M) | 161.24 |
| **Calaveras** | 006-010-011- | 17 06N 16E (M) | 200 |
| **Calaveras** | 006-010-012- | 20 06N 16E (M) | 40 |
| **Calaveras** | 006-011-001- | 15 06N 15E (M) | 480 |
| **Calaveras** | 006-011-002- | 14 06N 15E (M) | 600 |
| **Calaveras** | 006-011-003- | 13 06N 15E (M) | 600 |
| **Calaveras** | 006-011-004- | 24 06N 15E (M) | 560 |
| **Calaveras** | 006-011-005- | 23 06N 15E (M) | 475 |
| **Calaveras** | 006-011-006- | 22 06N 15E (M) | 640 |
| **Calaveras** | 006-011-007- | 15 06N 15E (M) | 80 |
| **Calaveras** | 006-011-008- | 15 06N 15E (M) | 40 |
| **Calaveras** | 006-011-009- | 15 06N 15E (M) | 40 |
| **Calaveras** | 006-011-010- | 14 06N 15E (M) | 40 |
| **Calaveras** | 006-011-011- | 13 06N 15E (M) | 37.86 |
| **Calaveras** | 006-011-013- | 23 06N 15E (M) | 5 |
| **Calaveras** | 006-011-014- | 23 06N 15E (M) | 160 |
| **Calaveras** | 006-011-014- | 24 06N 15E (M) | 40 |

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| **Calaveras** | 006-012-001- | 18 06N 15E (M) | 636.19 |
| **Calaveras** | 006-012-002- | 18 06N 15E (M) | 20.64 |
| **Calaveras** | 006-012-003- | 17 06N 15E (M) | 560 |
| **Calaveras** | 006-012-004- | 16 06N 15E (M) | 640 |
| **Calaveras** | 006-012-005- | 21 06N 15E (M) | 600 |
| **Calaveras** | 006-012-006- | 20 06N 15E (M) | 600 |
| **Calaveras** | 006-012-007- | 19 06N 15E (M) | 610.54 |
| **Calaveras** | 006-012-008- | 17 06N 15E (M) | 80 |
| **Calaveras** | 006-012-008- | 20 06N 15E (M) | 40 |
| **Calaveras** | 006-012-008- | 21 06N 15E (M) | 40 |
| **Calaveras** | 006-012-009- | 19 06N 15E (M) | 32.88 |
| **Calaveras** | 006-013-001- | 15 06N 14E (M) | 160 |
| **Calaveras** | 006-013-002- | 15 06N 14E (M) | 80 |
| **Calaveras** | 006-013-006- | 13 06N 14E (M) | 240 |
| **Calaveras** | 006-013-007- | 24 06N 14E (M) | 600 |
| **Calaveras** | 006-013-041- | 13 06N 14E (M) | 120 |
| **Calaveras** | 006-013-041- | 14 06N 14E (M) | 320 |
| **Calaveras** | 006-013-042- | 23 06N 14E (M) | 560 |
| **Calaveras** | 006-014-003- | 26 06N 14E (M) | 80 |
| **Calaveras** | 006-014-004- | 25 06N 14E (M) | 80 |
| **Calaveras** | 006-014-004- | 26 06N 14E (M) | 80 |
| **Calaveras** | 006-014-006- | 27 06N 14E (M) | 310 |
| **Calaveras** | 006-014-007- | 27 06N 14E (M) | 10 |
| **Calaveras** | 006-014-008- | 26 06N 14E (M) | 160 |
| **Calaveras** | 006-014-008- | 35 06N 14E (M) | 320 |
| **Calaveras** | 006-014-010- | 25 06N 14E (M) | 400 |
| **Calaveras** | 006-014-011- | 36 06N 14E (M) | 640 |
| **Calaveras** | 006-014-012- | 27 06N 14E (M) | 40 |
| **Calaveras** | 006-014-012- | 34 06N 14E (M) | 40 |
| **Calaveras** | 006-015-001- | 30 06N 15E (M) | 522.15 |
| **Calaveras** | 006-015-001- | 31 06N 15E (M) | 120.99 |
| **Calaveras** | 006-015-002- | 29 06N 15E (M) | 560 |
| **Calaveras** | 006-015-003- | 28 06N 15E (M) | 640 |
| **Calaveras** | 006-015-004- | 32 06N 15E (M) | 160 |
| **Calaveras** | 006-015-004- | 33 06N 15E (M) | 440 |
| **Calaveras** | 006-015-005- | 33 06N 15E (M) | 40 |
| **Calaveras** | 006-015-010- | 33 06N 15E (M) | 160 |
| **Calaveras** | 006-016-001- | 27 06N 15E (M) | 160 |
| **Calaveras** | 006-016-002- | 27 06N 15E (M) | 440 |
| **Calaveras** | 006-016-003- | 26 06N 15E (M) | 480 |
| **Calaveras** | 006-016-004- | 25 06N 15E (M) | 480 |
| **Calaveras** | 006-016-005- | 25 06N 15E (M) | 40 |
| **Calaveras** | 006-016-006- | 34 06N 15E (M) | 520 |
| **Calaveras** | 006-016-007- | 35 06N 15E (M) | 480 |

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| **Calaveras** | 006-016-008- | 36 06N 15E (M) | 640 |
| **Calaveras** | 006-016-009- | 26 06N 15E (M) | 160 |
| **Calaveras** | 006-016-010- | 25 06N 15E (M) | 85.94 |
| **Calaveras** | 006-016-011- | 25 06N 15E (M) | 42.03 |
| **Calaveras** | 006-016-012- | 27 06N 15E (M) | 43.07 |
| **Calaveras** | 006-016-012- | 34 06N 15E (M) | 120 |
| **Calaveras** | 006-016-013- | 35 06N 15E (M) | 120 |
| **Calaveras** | 006-016-014- | 35 06N 15E (M) | 40 |
| **Calaveras** | 006-017-002- | 30 06N 16E (M) | 345.66 |
| **Calaveras** | 006-017-003- | 28 06N 16E (M) | 289.2 |
| **Calaveras** | 006-017-003- | 29 06N 16E (M) | 232 |
| **Calaveras** | 006-017-004- | 31 06N 16E (M) | 494.49 |
| **Calaveras** | 006-017-005- | 32 06N 16E (M) | 205.19 |
| **Calaveras** | 006-017-006- | 28 06N 16E (M) | 120 |
| **Calaveras** | 006-017-006- | 32 06N 16E (M) | 200 |
| **Calaveras** | 006-017-006- | 33 06N 16E (M) | 147.89 |
| **Calaveras** | 006-017-007- | 30 06N 16E (M) | 58.74 |
| **Calaveras** | 006-023-001- | 27 06N 16E (M) | 40 |
| **Calaveras** | 006-202-001- | 11 06N 14E (M) | 120 |
| **Calaveras** | 010-021-003- | 06 06N 14E (M) | 39.02 |
| **Calaveras** | 010-021-029- | 09 06N 14E (M) | 93 |
| **Calaveras** | 010-021-040- | 09 06N 14E (M) | 17 |
| **Calaveras** | 010-021-094- | 09 06N 14E (M) | 1.69 |
| **Calaveras** | 010-021-100- | 04 06N 14E (M) | 338.8 |
| **Calaveras** | 010-021-100- | 09 06N 14E (M) | 300 |
| **Calaveras** | 012-013-009- | 16 06N 14E (M) | 600 |
| **Calaveras** | 012-013-015- | 21 06N 14E (M) | 40 |
| **Calaveras** | 012-013-038- | 17 06N 14E (M) | 30 |
| **Calaveras** | 012-013-038- | 20 06N 14E (M) | 160 |
| **Calaveras** | 012-013-038- | 21 06N 14E (M) | 104.2 |
| **Calaveras** | 014-020-010- | 28 06N 14E (M) | 40 |
| **Calaveras** | 020-033-064- | 02 05N 14E (M) | 36.06 |
| **Calaveras** | 020-033-075- | 02 05N 14E (M) | 36.05 |
| **Calaveras** | 020-033-075- | 03 05N 14E (M) | 316.11 |
| **Calaveras** | 020-033-075- | 10 05N 14E (M) | 83.45 |
| **Calaveras** | 020-033-075- | 11 05N 14E (M) | 39.99 |
| **Calaveras** | 020-033-076- | 11 05N 14E (M) | 82.9 |
| **Calaveras** | 020-033-076- | 12 05N 14E (M) | 482.69 |
| **Calaveras** | 020-034-009- | 15 05N 14E (M) | 80 |
| **Calaveras** | 020-034-039- | 23 05N 14E (M) | 80 |
| **Calaveras** | 020-034-040- | 13 05N 14E (M) | 36.23 |
| **Calaveras** | 020-034-041- | 13 05N 14E (M) | 72.88 |
| **Calaveras** | 020-034-042- | 13 05N 14E (M) | 80 |
| **Calaveras** | 020-034-042- | 24 05N 14E (M) | 360 |

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| **Calaveras** | 020-034-049- | 14 05N 14E (M) | 80 |
| **Calaveras** | 023-026-024- | 13 05N 15E (M) | 5.9 |
| **Calaveras** | 023-026-024- | 14 05N 15E (M) | 1.3 |
| **Calaveras** | 023-077-008- | 13 05N 15E (M) | 0.56 |
| **Calaveras** | 024-001-019- | 34 05N 15E (M) | 80 |
| **Calaveras** | 024-003-034- | 33 05N 15E (M) | 279.43 |
| **Calaveras** | 025-001-001- | 07 05N 15E (M) | 80.04 |
| **Calaveras** | 025-001-003- | 07 05N 15E (M) | 280 |
| **Calaveras** | 025-001-005- | 05 05N 15E (M) | 358.64 |
| **Calaveras** | 025-001-006- | 04 05N 15E (M) | 634.64 |
| **Calaveras** | 025-001-008- | 08 05N 15E (M) | 520 |
| **Calaveras** | 025-001-009- | 09 05N 15E (M) | 280 |
| **Calaveras** | 025-001-010- | 09 05N 15E (M) | 360 |
| **Calaveras** | 025-002-001- | 03 05N 15E (M) | 157.48 |
| **Calaveras** | 025-002-004- | 03 05N 15E (M) | 120 |
| **Calaveras** | 025-002-005- | 02 05N 15E (M) | 78.88 |
| **Calaveras** | 025-002-012- | 10 05N 15E (M) | 600 |
| **Calaveras** | 025-002-013- | 10 05N 15E (M) | 40 |
| **Calaveras** | 025-002-015- | 02 05N 15E (M) | 78.78 |
| **Calaveras** | 025-002-016- | 01 05N 15E (M) | 275.14 |
| **Calaveras** | 025-002-017- | 01 05N 15E (M) | 47.35 |
| **Calaveras** | 025-002-041- | 12 05N 15E (M) | 34 |
| **Calaveras** | 025-002-044- | 02 05N 15E (M) | 102.32 |
| **Calaveras** | 025-002-047- | 02 05N 15E (M) | 157.66 |
| **Calaveras** | 025-002-048- | 03 05N 15E (M) | 157.68 |
| **Calaveras** | 025-002-049- | 02 05N 15E (M) | 80 |
| **Calaveras** | 025-002-049- | 03 05N 15E (M) | 40 |
| **Calaveras** | 025-002-049- | 11 05N 15E (M) | 40 |
| **Calaveras** | 025-002-050- | 02 05N 15E (M) | 137.68 |
| **Calaveras** | 025-002-050- | 11 05N 15E (M) | 45.6 |
| **Calaveras** | 025-002-055- | 02 05N 15E (M) | 5 |
| **Calaveras** | 025-002-055- | 11 05N 15E (M) | 384.79 |
| **Calaveras** | 025-003-004- | 05 05N 16E (M) | 272.29 |
| **Calaveras** | 025-003-005- | 08 05N 16E (M) | 10 |
| **Calaveras** | 025-003-022- | 06 05N 16E (M) | 289.64 |
| **Calaveras** | 025-003-023- | 07 05N 16E (M) | 292.21 |
| **Calaveras** | 025-003-024- | 07 05N 16E (M) | 14.86 |
| **Calaveras** | 025-003-026- | 07 05N 16E (M) | 30.38 |
| **Calaveras** | 025-003-029- | 07 05N 16E (M) | 59.06 |
| **Calaveras** | 025-003-037- | 06 05N 16E (M) | 60.77 |
| **Calaveras** | 025-003-039- | 05 05N 16E (M) | 40 |
| **Calaveras** | 025-003-039- | 08 05N 16E (M) | 3.5 |
| **Calaveras** | 025-004-001- | 18 05N 15E (M) | 40.03 |
| **Calaveras** | 025-004-002- | 17 05N 15E (M) | 80 |

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| **Calaveras** | 025-004-003- | 16 05N 15E (M) | 640 |
| **Calaveras** | 025-004-037- | 20 05N 15E (M) | 172.38 |
| **Calaveras** | 025-004-037- | 21 05N 15E (M) | 119.31 |
| **Calaveras** | 025-004-040- | 21 05N 15E (M) | 239.45 |
| **Calaveras** | 025-005-001- | 14 05N 15E (M) | 25 |
| **Calaveras** | 025-005-001- | 15 05N 15E (M) | 305.37 |
| **Calaveras** | 025-005-007- | 23 05N 15E (M) | 76.59 |
| **Calaveras** | 025-005-007- | 24 05N 15E (M) | 160 |
| **Calaveras** | 025-005-022- | 13 05N 15E (M) | 33 |
| **Calaveras** | 025-005-024- | 13 05N 15E (M) | 192.23 |
| **Calaveras** | 025-005-025- | 13 05N 15E (M) | 40.63 |
| **Calaveras** | 025-022-001- | 05 05N 16E (M) | 33.4 |
| **Calaveras** | 025-022-004- | 08 05N 16E (M) | 28.8 |
| **Calaveras** | 025-022-008- | 08 05N 16E (M) | 3 |
| **Calaveras** | 025-224-001- | 11 05N 15E (M) | 6.29 |
| **Calaveras** | 030-001-011- | 08 04N 15E (M) | 158.25 |
| **Calaveras** | 030-001-036- | 04 04N 15E (M) | 226.99 |
| **Calaveras** | 030-001-036- | 05 04N 15E (M) | 240 |
| **Calaveras** | 030-001-036- | 08 04N 15E (M) | 280 |
| **Calaveras** | 030-001-036- | 09 04N 15E (M) | 80 |
| **Calaveras** | 030-015-004- | 18 04N 15E (M) | 13.35 |
| **Calaveras** | 030-015-023- | 18 04N 15E (M) | 143.9 |
| **Calaveras** | 030-020-001- | 18 04N 15E (M) | 0.25 |
| **Calaveras** | 030-020-002- | 18 04N 15E (M) | 0.28 |
| **Calaveras** | 032-003-014- | 06 04N 15E (M) | 80 |
| **Calaveras** | 034-001-015- | 22 04N 14E (M) | 78.42 |
| **Calaveras** | 034-004-002- | 27 04N 14E (M) | 226.77 |
| **El Dorado** | 009-010-02- | 08 11N 13E (M) | 480 |
| **El Dorado** | 009-010-03- | 09 11N 13E (M) | 640 |
| **El Dorado** | 009-020-01- | 10 11N 13E (M) | 121.65 |
| **El Dorado** | 009-030-01- | 16 11N 13E (M) | 520 |
| **El Dorado** | 009-030-05- | 21 11N 13E (M) | 160 |
| **El Dorado** | 009-030-19- | 16 11N 13E (M) | 122.81 |
| **El Dorado** | 009-040-01- | 15 11N 13E (M) | 40.96 |
| **El Dorado** | 009-040-05- | 22 11N 13E (M) | 40 |
| **El Dorado** | 009-040-05- | 23 11N 13E (M) | 120 |
| **El Dorado** | 009-040-07- | 24 11N 13E (M) | 200 |
| **El Dorado** | 009-051-14- | 32 11N 13E (M) | 125.21 |
| **El Dorado** | 009-051-20- | 33 11N 13E (M) | 73.22 |
| **El Dorado** | 009-051-22- | 33 11N 13E (M) | 118.26 |
| **El Dorado** | 009-060-08- | 34 11N 13E (M) | 34.42 |
| **El Dorado** | 009-060-09- | 33 11N 13E (M) | 2 |
| **El Dorado** | 009-060-09- | 34 11N 13E (M) | 5.32 |
| **El Dorado** | 009-060-21- | 36 11N 13E (M) | 589.64 |

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| **El Dorado** | 010-010-03- | 33 14N 14E (M) | 121.97 |
| **El Dorado** | 010-020-08- | 35 14N 14E (M) | 133.88 |
| **El Dorado** | 010-020-09- | 35 14N 14E (M) | 182.17 |
| **El Dorado** | 010-030-01- | 04 13N 14E (M) | 40 |
| **El Dorado** | 010-030-02- | 04 13N 14E (M) | 125.04 |
| **El Dorado** | 010-030-02- | 08 13N 14E (M) | 42.48 |
| **El Dorado** | 010-030-02- | 09 13N 14E (M) | 152.48 |
| **El Dorado** | 010-030-03- | 09 13N 14E (M) | 40 |
| **El Dorado** | 010-030-04- | 09 13N 14E (M) | 40 |
| **El Dorado** | 010-030-05- | 08 13N 14E (M) | 120 |
| **El Dorado** | 010-040-02- | 03 13N 14E (M) | 40 |
| **El Dorado** | 010-040-03- | 10 13N 14E (M) | 40 |
| **El Dorado** | 010-040-04- | 10 13N 14E (M) | 80 |
| **El Dorado** | 010-040-08- | 02 13N 14E (M) | 35.55 |
| **El Dorado** | 010-040-08- | 03 13N 14E (M) | 84.81 |
| **El Dorado** | 010-040-09- | 02 13N 14E (M) | 48.37 |
| **El Dorado** | 010-050-01- | 17 13N 14E (M) | 126.49 |
| **El Dorado** | 010-050-01- | 18 13N 14E (M) | 87.69 |
| **El Dorado** | 010-050-01- | 20 13N 14E (M) | 82.69 |
| **El Dorado** | 010-050-02- | 17 13N 14E (M) | 42.61 |
| **El Dorado** | 010-050-03- | 16 13N 14E (M) | 634 |
| **El Dorado** | 010-050-04- | 21 13N 14E (M) | 78.94 |
| **El Dorado** | 010-060-05- | 14 13N 14E (M) | 40.12 |
| **El Dorado** | 010-060-10- | 24 13N 14E (M) | 115.24 |
| **El Dorado** | 010-060-15- | 13 13N 14E (M) | 118.69 |
| **El Dorado** | 010-060-17- | 24 13N 14E (M) | 37.47 |
| **El Dorado** | 010-060-24- | 22 13N 14E (M) | 15 |
| **El Dorado** | 010-060-24- | 23 13N 14E (M) | 235 |
| **El Dorado** | 010-060-25- | 22 13N 14E (M) | 110 |
| **El Dorado** | 010-060-26- | 22 13N 14E (M) | 20.69 |
| **El Dorado** | 010-060-27- | 22 13N 14E (M) | 60.9 |
| **El Dorado** | 010-060-28- | 14 13N 14E (M) | 159.75 |
| **El Dorado** | 010-060-29- | 14 13N 14E (M) | 3 |
| **El Dorado** | 010-060-34- | 14 13N 14E (M) | 40.91 |
| **El Dorado** | 010-070-01- | 30 13N 14E (M) | 410.29 |
| **El Dorado** | 010-070-02- | 29 13N 14E (M) | 429.03 |
| **El Dorado** | 010-070-03- | 28 13N 14E (M) | 280 |
| **El Dorado** | 010-070-04- | 31 13N 14E (M) | 398.3 |
| **El Dorado** | 010-070-05- | 32 13N 14E (M) | 640 |
| **El Dorado** | 010-070-06- | 33 13N 14E (M) | 209.52 |
| **El Dorado** | 010-070-07- | 28 13N 14E (M) | 40 |
| **El Dorado** | 010-070-13- | 29 13N 14E (M) | 79.58 |
| **El Dorado** | 010-070-16- | 31 13N 14E (M) | 240 |
| **El Dorado** | 010-080-11- | 25 13N 14E (M) | 400 |

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| **El Dorado** | 010-080-13- | 36 13N 14E (M) | 640 |
| **El Dorado** | 010-080-14- | 35 13N 14E (M) | 400 |
| **El Dorado** | 010-080-26- | 35 13N 14E (M) | 150 |
| **El Dorado** | 010-080-28- | 35 13N 14E (M) | 10 |
| **El Dorado** | 010-080-29- | 26 13N 14E (M) | 160 |
| **El Dorado** | 010-080-29- | 27 13N 14E (M) | 237.73 |
| **El Dorado** | 010-080-29- | 34 13N 14E (M) | 20 |
| **El Dorado** | 010-080-30- | 27 13N 14E (M) | 119 |
| **El Dorado** | 010-080-30- | 34 13N 14E (M) | 100 |
| **El Dorado** | 010-080-36- | 27 13N 14E (M) | 30 |
| **El Dorado** | 010-080-36- | 28 13N 14E (M) | 40 |
| **El Dorado** | 010-080-37- | 27 13N 14E (M) | 146 |
| **El Dorado** | 010-080-37- | 28 13N 14E (M) | 1 |
| **El Dorado** | 010-080-39- | 27 13N 14E (M) | 3 |
| **El Dorado** | 010-080-46- | 35 13N 14E (M) | 40 |
| **El Dorado** | 011-010-01- | 06 12N 14E (M) | 507.72 |
| **El Dorado** | 011-010-02- | 05 12N 14E (M) | 689.38 |
| **El Dorado** | 011-010-03- | 07 12N 14E (M) | 645.88 |
| **El Dorado** | 011-010-05- | 08 12N 14E (M) | 320 |
| **El Dorado** | 011-010-06- | 09 12N 14E (M) | 560 |
| **El Dorado** | 011-010-16- | 06 12N 14E (M) | 185.65 |
| **El Dorado** | 011-020-05- | 10 12N 14E (M) | 236.57 |
| **El Dorado** | 011-020-06- | 10 12N 14E (M) | 120 |
| **El Dorado** | 011-020-07- | 10 12N 14E (M) | 40 |
| **El Dorado** | 011-020-09- | 12 12N 14E (M) | 40 |
| **El Dorado** | 011-020-10- | 12 12N 14E (M) | 80 |
| **El Dorado** | 011-020-11- | 01 12N 14E (M) | 471.46 |
| **El Dorado** | 011-020-11- | 12 12N 14E (M) | 40 |
| **El Dorado** | 011-020-20- | 11 12N 14E (M) | 101.56 |
| **El Dorado** | 011-020-24- | 02 12N 14E (M) | 239.53 |
| **El Dorado** | 011-020-25- | 02 12N 14E (M) | 7.27 |
| **El Dorado** | 011-030-01- | 18 12N 14E (M) | 322.15 |
| **El Dorado** | 011-030-04- | 16 12N 14E (M) | 120 |
| **El Dorado** | 011-030-05- | 19 12N 14E (M) | 177.69 |
| **El Dorado** | 011-030-10- | 18 12N 14E (M) | 289.89 |
| **El Dorado** | 011-040-16- | 22 12N 14E (M) | 21.7 |
| **El Dorado** | 011-040-22- | 15 12N 14E (M) | 36.88 |
| **El Dorado** | 011-040-36- | 15 12N 14E (M) | 141.23 |
| **El Dorado** | 011-040-37- | 13 12N 14E (M) | 6.28 |
| **El Dorado** | 011-040-37- | 14 12N 14E (M) | 92.7 |
| **El Dorado** | 011-040-38- | 13 12N 14E (M) | 73.72 |
| **El Dorado** | 011-040-45- | 23 12N 14E (M) | 477.48 |
| **El Dorado** | 011-040-47- | 24 12N 14E (M) | 144.14 |
| **El Dorado** | 011-050-06- | 32 12N 14E (M) | 440 |

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| **El Dorado** | 011-050-07- | 33 12N 14E (M) | 280 |
| **El Dorado** | 011-050-11- | 31 12N 14E (M) | 153.73 |
| **El Dorado** | 011-050-12- | 30 12N 14E (M) | 169.96 |
| **El Dorado** | 011-050-14- | 29 12N 14E (M) | 422.7 |
| **El Dorado** | 011-050-18- | 31 12N 14E (M) | 116.21 |
| **El Dorado** | 011-050-22- | 28 12N 14E (M) | 49.6 |
| **El Dorado** | 011-060-03- | 25 12N 14E (M) | 40 |
| **El Dorado** | 011-060-04- | 25 12N 14E (M) | 160 |
| **El Dorado** | 011-060-04- | 26 12N 14E (M) | 200 |
| **El Dorado** | 011-060-09- | 27 12N 14E (M) | 56 |
| **El Dorado** | 011-060-11- | 26 12N 14E (M) | 254.9 |
| **El Dorado** | 011-060-36- | 35 12N 14E (M) | 157.94 |
| **El Dorado** | 011-060-38- | 36 12N 14E (M) | 315.96 |
| **El Dorado** | 011-060-40- | 26 12N 14E (M) | 29.21 |
| **El Dorado** | 011-060-42- | 35 12N 14E (M) | 347.89 |
| **El Dorado** | 011-070-04- | 04 11N 14E (M) | 632 |
| **El Dorado** | 011-070-05- | 07 11N 14E (M) | 97.33 |
| **El Dorado** | 011-070-06- | 07 11N 14E (M) | 120 |
| **El Dorado** | 011-070-07- | 08 11N 14E (M) | 360 |
| **El Dorado** | 011-070-08- | 09 11N 14E (M) | 640 |
| **El Dorado** | 011-070-09- | 05 11N 14E (M) | 675.2 |
| **El Dorado** | 011-070-10- | 06 11N 14E (M) | 393.66 |
| **El Dorado** | 011-070-11- | 04 11N 14E (M) | 32.91 |
| **El Dorado** | 011-080-02- | 02 11N 14E (M) | 69.73 |
| **El Dorado** | 011-080-03- | 02 11N 14E (M) | 62.94 |
| **El Dorado** | 011-080-07- | 10 11N 14E (M) | 610.95 |
| **El Dorado** | 011-080-08- | 11 11N 14E (M) | 125.33 |
| **El Dorado** | 011-080-09- | 11 11N 14E (M) | 65.62 |
| **El Dorado** | 011-080-10- | 12 11N 14E (M) | 640 |
| **El Dorado** | 011-080-13- | 11 11N 14E (M) | 282.5 |
| **El Dorado** | 011-080-14- | 03 11N 14E (M) | 47.5 |
| **El Dorado** | 011-080-15- | 03 11N 14E (M) | 528.25 |
| **El Dorado** | 011-080-16- | 01 11N 14E (M) | 72.61 |
| **El Dorado** | 011-080-19- | 01 11N 14E (M) | 25.92 |
| **El Dorado** | 011-080-26- | 11 11N 14E (M) | 77.5 |
| **El Dorado** | 011-090-03- | 17 11N 14E (M) | 403.75 |
| **El Dorado** | 011-090-04- | 16 11N 14E (M) | 640 |
| **El Dorado** | 011-090-08- | 18 11N 14E (M) | 311.23 |
| **El Dorado** | 011-090-43- | 20 11N 14E (M) | 388.55 |
| **El Dorado** | 011-090-48- | 19 11N 14E (M) | 307.85 |
| **El Dorado** | 011-090-50- | 21 11N 14E (M) | 431.35 |
| **El Dorado** | 011-100-01- | 14 11N 14E (M) | 38.27 |
| **El Dorado** | 011-100-01- | 15 11N 14E (M) | 282.07 |
| **El Dorado** | 011-100-02- | 14 11N 14E (M) | 38.1 |

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| **El Dorado** | 011-100-03- | 14 11N 14E (M) | 400 |
| **El Dorado** | 011-100-04- | 13 11N 14E (M) | 530.97 |
| **El Dorado** | 011-100-05- | 22 11N 14E (M) | 78.9 |
| **El Dorado** | 011-100-06- | 22 11N 14E (M) | 38.94 |
| **El Dorado** | 011-100-06- | 23 11N 14E (M) | 152.62 |
| **El Dorado** | 011-100-06- | 24 11N 14E (M) | 42.1 |
| **El Dorado** | 011-100-07- | 24 11N 14E (M) | 41.39 |
| **El Dorado** | 011-110-01- | 30 11N 14E (M) | 135 |
| **El Dorado** | 011-110-18- | 31 11N 14E (M) | 328.07 |
| **El Dorado** | 011-110-30- | 31 11N 14E (M) | 38.76 |
| **El Dorado** | 011-120-18- | 34 11N 14E (M) | 280 |
| **El Dorado** | 011-120-18- | 35 11N 14E (M) | 200 |
| **El Dorado** | 011-120-24- | 36 11N 14E (M) | 309.69 |
| **El Dorado** | 011-120-25- | 36 11N 14E (M) | 272.31 |
| **El Dorado** | 012-010-01- | 06 12N 15E (M) | 90.27 |
| **El Dorado** | 012-010-02- | 06 12N 15E (M) | 40.53 |
| **El Dorado** | 012-010-02- | 07 12N 15E (M) | 363.74 |
| **El Dorado** | 012-030-02- | 19 12N 15E (M) | 646.22 |
| **El Dorado** | 012-030-04- | 20 12N 15E (M) | 80 |
| **El Dorado** | 012-030-17- | 20 12N 15E (M) | 320 |
| **El Dorado** | 012-040-01- | 34 12N 15E (M) | 198.23 |
| **El Dorado** | 012-050-01- | 30 12N 15E (M) | 644.56 |
| **El Dorado** | 012-050-02- | 29 12N 15E (M) | 560 |
| **El Dorado** | 012-050-03- | 28 12N 15E (M) | 148.85 |
| **El Dorado** | 012-050-05- | 32 12N 15E (M) | 320 |
| **El Dorado** | 012-050-05- | 33 12N 15E (M) | 160 |
| **El Dorado** | 012-050-07- | 31 12N 15E (M) | 361.71 |
| **El Dorado** | 012-070-10- | 06 11N 15E (M) | 93.58 |
| **El Dorado** | 012-070-12- | 06 11N 15E (M) | 22.37 |
| **El Dorado** | 012-070-13- | 04 11N 15E (M) | 36.84 |
| **El Dorado** | 012-070-13- | 05 11N 15E (M) | 559.57 |
| **El Dorado** | 012-070-16- | 07 11N 15E (M) | 515.26 |
| **El Dorado** | 012-070-19- | 04 11N 15E (M) | 135.14 |
| **El Dorado** | 012-070-23- | 08 11N 15E (M) | 413.3 |
| **El Dorado** | 012-070-23- | 09 11N 15E (M) | 80.54 |
| **El Dorado** | 012-070-24- | 06 11N 15E (M) | 103.89 |
| **El Dorado** | 012-080-03- | 02 11N 15E (M) | 65 |
| **El Dorado** | 012-080-03- | 06 11N 16E (M) | 90.38 |
| **El Dorado** | 012-080-04- | 03 11N 15E (M) | 40.12 |
| **El Dorado** | 012-080-06- | 10 11N 15E (M) | 87.2 |
| **El Dorado** | 012-080-06- | 11 11N 15E (M) | 70.8 |
| **El Dorado** | 012-080-07- | 10 11N 15E (M) | 39.67 |
| **El Dorado** | 012-080-07- | 11 11N 15E (M) | 132.33 |
| **El Dorado** | 012-080-07- | 07 11N 16E (M) | 50 |

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| **El Dorado** | 012-080-07- | 18 11N 16E (M) | 5 |
| **El Dorado** | 012-080-08- | 10 11N 15E (M) | 160 |
| **El Dorado** | 012-080-11- | 03 11N 15E (M) | 40.13 |
| **El Dorado** | 012-090-01- | 18 11N 15E (M) | 525.11 |
| **El Dorado** | 012-090-02- | 17 11N 15E (M) | 559.53 |
| **El Dorado** | 012-090-03- | 16 11N 15E (M) | 640 |
| **El Dorado** | 012-090-04- | 19 11N 15E (M) | 77.29 |
| **El Dorado** | 012-090-05- | 19 11N 15E (M) | 160 |
| **El Dorado** | 012-090-05- | 20 11N 15E (M) | 320 |
| **El Dorado** | 012-090-06- | 21 11N 15E (M) | 200 |
| **El Dorado** | 012-100-01- | 15 11N 15E (M) | 360 |
| **El Dorado** | 012-100-02- | 14 11N 15E (M) | 32 |
| **El Dorado** | 012-100-02- | 18 11N 16E (M) | 35 |
| **El Dorado** | 012-100-03- | 14 11N 15E (M) | 32 |
| **El Dorado** | 012-100-03- | 18 11N 16E (M) | 87 |
| **El Dorado** | 012-100-03- | 19 11N 16E (M) | 10 |
| **El Dorado** | 012-100-04- | 14 11N 15E (M) | 32 |
| **El Dorado** | 012-100-04- | 18 11N 16E (M) | 12.5 |
| **El Dorado** | 012-100-05- | 15 11N 15E (M) | 80 |
| **El Dorado** | 012-100-05- | 22 11N 15E (M) | 160 |
| **El Dorado** | 012-110-09- | 32 11N 15E (M) | 240 |
| **El Dorado** | 012-110-09- | 33 11N 15E (M) | 120 |
| **El Dorado** | 012-110-44- | 31 11N 15E (M) | 40 |
| **El Dorado** | 012-110-44- | 32 11N 15E (M) | 160 |
| **El Dorado** | 012-110-45- | 31 11N 15E (M) | 72.6 |
| **El Dorado** | 012-110-45- | 32 11N 15E (M) | 150 |
| **El Dorado** | 012-110-46- | 28 11N 15E (M) | 39.08 |
| **El Dorado** | 012-110-46- | 33 11N 15E (M) | 140.84 |
| **El Dorado** | 013-150-12- | 18 11N 16E (M) | 124.83 |
| **El Dorado** | 039-170-02- | 05 10N 16E (M) | 324.87 |
| **El Dorado** | 039-170-03- | 04 10N 16E (M) | 32.6 |
| **El Dorado** | 039-190-03- | 08 10N 16E (M) | 78.22 |
| **El Dorado** | 039-190-04- | 09 10N 16E (M) | 640 |
| **El Dorado** | 039-190-10- | 07 10N 16E (M) | 135.84 |
| **El Dorado** | 039-200-01- | 10 10N 16E (M) | 236.81 |
| **El Dorado** | 039-210-06- | 16 10N 16E (M) | 640 |
| **El Dorado** | 039-210-24- | 18 10N 16E (M) | 445.58 |
| **El Dorado** | 039-210-25- | 19 10N 16E (M) | 221.56 |
| **El Dorado** | 039-210-28- | 20 10N 16E (M) | 223 |
| **El Dorado** | 039-210-40- | 17 10N 16E (M) | 116.437 |
| **El Dorado** | 039-210-42- | 17 10N 16E (M) | 73.996 |
| **El Dorado** | 039-210-44- | 20 10N 16E (M) | 73.339 |
| **El Dorado** | 039-220-01- | 15 10N 16E (M) | 497.87 |
| **El Dorado** | 039-230-01- | 29 10N 16E (M) | 145.4 |

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| **El Dorado** | 039-230-01- | 30 10N 16E (M) | 40 |
| **El Dorado** | 039-230-02- | 31 10N 16E (M) | 114.86 |
| **El Dorado** | 039-230-03- | 33 10N 16E (M) | 154.42 |
| **El Dorado** | 039-250-01- | 06 09N 16E (M) | 39.33 |
| **El Dorado** | 039-250-02- | 04 09N 16E (M) | 64.02 |
| **El Dorado** | 039-250-02- | 05 09N 16E (M) | 41.82 |
| **El Dorado** | 040-011-09 -1 | 05 08N 13E (M) | 6.271 |
| **El Dorado** | 040-011-10- | 04 08N 13E (M) | 14.74 |
| **El Dorado** | 040-011-14- | 04 08N 13E (M) | 60 |
| **El Dorado** | 040-011-14- | 09 08N 13E (M) | 34.74 |
| **El Dorado** | 040-011-18- | 07 08N 13E (M) | 46.07 |
| **El Dorado** | 040-011-20- | 07 08N 13E (M) | 10 |
| **El Dorado** | 040-011-21- | 07 08N 13E (M) | 30 |
| **El Dorado** | 040-011-22- | 07 08N 13E (M) | 20 |
| **El Dorado** | 040-011-29- | 09 08N 13E (M) | 80 |
| **El Dorado** | 040-011-31- | 09 08N 13E (M) | 120 |
| **El Dorado** | 040-011-32- | 04 08N 13E (M) | 39 |
| **El Dorado** | 040-011-32- | 09 08N 13E (M) | 10 |
| **El Dorado** | 040-011-33- | 04 08N 13E (M) | 110 |
| **El Dorado** | 040-011-34- | 04 08N 13E (M) | 136 |
| **El Dorado** | 040-011-35- | 06 08N 13E (M) | 120 |
| **El Dorado** | 040-011-36- | 06 08N 13E (M) | 40 |
| **El Dorado** | 040-020-05- | 01 08N 13E (M) | 65.8 |
| **El Dorado** | 040-020-06- | 11 08N 13E (M) | 238.77 |
| **El Dorado** | 040-030-02- | 18 08N 13E (M) | 53 |
| **El Dorado** | 040-030-04- | 17 08N 13E (M) | 80 |
| **El Dorado** | 040-030-11- | 20 08N 13E (M) | 80 |
| **El Dorado** | 040-030-14- | 19 08N 13E (M) | 40 |
| **El Dorado** | 040-030-15- | 19 08N 13E (M) | 128.49 |
| **El Dorado** | 040-030-18- | 20 08N 13E (M) | 60 |
| **El Dorado** | 040-030-31- | 18 08N 13E (M) | 41.21 |
| **El Dorado** | 040-030-32- | 18 08N 13E (M) | 56.19 |
| **El Dorado** | 040-030-33- | 16 08N 13E (M) | 160 |
| **El Dorado** | 040-030-33- | 17 08N 13E (M) | 367 |
| **El Dorado** | 040-030-33- | 18 08N 13E (M) | 36.76 |
| **El Dorado** | 040-030-34- | 18 08N 13E (M) | 192.55 |
| **El Dorado** | 040-030-36- | 21 08N 13E (M) | 40 |
| **El Dorado** | 040-030-45- | 19 08N 13E (M) | 80 |
| **El Dorado** | 040-030-45- | 20 08N 13E (M) | 40 |
| **El Dorado** | 040-030-47- | 20 08N 13E (M) | 10 |
| **El Dorado** | 040-030-49- | 17 08N 13E (M) | 30 |
| **El Dorado** | 040-030-49- | 18 08N 13E (M) | 94.18 |
| **El Dorado** | 040-030-51- | 20 08N 13E (M) | 30 |
| **El Dorado** | 040-030-52- | 16 08N 13E (M) | 20 |

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| **El Dorado** | 040-030-58- | 17 08N 13E (M) | 80 |
| **El Dorado** | 040-030-58- | 20 08N 13E (M) | 80 |
| **El Dorado** | 040-030-59- | 17 08N 13E (M) | 40 |
| **El Dorado** | 040-030-60- | 17 08N 13E (M) | 40 |
| **El Dorado** | 040-030-61- | 16 08N 13E (M) | 80 |
| **El Dorado** | 040-030-62- | 16 08N 13E (M) | 160 |
| **El Dorado** | 040-030-63- | 16 08N 13E (M) | 220 |
| **El Dorado** | 040-030-64- | 19 08N 13E (M) | 80 |
| **El Dorado** | 040-030-65- | 20 08N 13E (M) | 120 |
| **El Dorado** | 040-030-66- | 20 08N 13E (M) | 40 |
| **El Dorado** | 040-030-67- | 21 08N 13E (M) | 160 |
| **El Dorado** | 040-030-68- | 21 08N 13E (M) | 160 |
| **El Dorado** | 040-030-69- | 20 08N 13E (M) | 80 |
| **El Dorado** | 040-030-70- | 21 08N 13E (M) | 80 |
| **El Dorado** | 040-030-72- | 21 08N 13E (M) | 80 |
| **El Dorado** | 040-030-72- | 22 08N 13E (M) | 40 |
| **El Dorado** | 040-040-07- | 22 08N 13E (M) | 158.32 |
| **El Dorado** | 040-040-28- | 13 08N 13E (M) | 161.43 |
| **El Dorado** | 040-040-29- | 22 08N 13E (M) | 40 |
| **El Dorado** | 040-040-30- | 22 08N 13E (M) | 80 |
| **El Dorado** | 040-040-30- | 23 08N 13E (M) | 480 |
| **El Dorado** | 040-040-31- | 24 08N 13E (M) | 520 |
| **El Dorado** | 040-050-12- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-15- | 31 08N 13E (M) | 81.1 |
| **El Dorado** | 040-050-17- | 30 08N 13E (M) | 80 |
| **El Dorado** | 040-050-17- | 31 08N 13E (M) | 80 |
| **El Dorado** | 040-050-22- | 28 08N 13E (M) | 155 |
| **El Dorado** | 040-050-22- | 33 08N 13E (M) | 5 |
| **El Dorado** | 040-050-23- | 30 08N 13E (M) | 173.24 |
| **El Dorado** | 040-050-29- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-29- | 32 08N 13E (M) | 23 |
| **El Dorado** | 040-050-31- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-33- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-33- | 32 08N 13E (M) | 40 |
| **El Dorado** | 040-050-40- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-40- | 32 08N 13E (M) | 44 |
| **El Dorado** | 040-050-44- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-45- | 29 08N 13E (M) | 110 |
| **El Dorado** | 040-050-45- | 30 08N 13E (M) | 40 |
| **El Dorado** | 040-050-47- | 28 08N 13E (M) | 40 |
| **El Dorado** | 040-050-47- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-48- | 32 08N 13E (M) | 7.6 |
| **El Dorado** | 040-050-48- | 33 08N 13E (M) | 1 |
| **El Dorado** | 040-050-50- | 28 08N 13E (M) | 54 |

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| **El Dorado** | 040-050-51- | 20 08N 13E (M) | 40 |
| **El Dorado** | 040-050-51- | 29 08N 13E (M) | 80 |
| **El Dorado** | 040-050-52- | 28 08N 13E (M) | 65 |
| **El Dorado** | 040-050-52- | 29 08N 13E (M) | 75 |
| **El Dorado** | 040-050-53- | 21 08N 13E (M) | 80 |
| **El Dorado** | 040-050-53- | 28 08N 13E (M) | 160 |
| **El Dorado** | 040-050-54- | 31 08N 13E (M) | 56 |
| **El Dorado** | 040-050-55- | 31 08N 13E (M) | 55 |
| **El Dorado** | 040-050-56- | 32 08N 13E (M) | 17 |
| **El Dorado** | 040-050-57- | 29 08N 13E (M) | 40 |
| **El Dorado** | 040-050-57- | 30 08N 13E (M) | 127.08 |
| **El Dorado** | 040-060-22- | 25 08N 13E (M) | 331 |
| **El Dorado** | 040-060-23- | 26 08N 13E (M) | 398 |
| **El Dorado** | 040-060-25- | 27 08N 13E (M) | 566.7 |
| **El Dorado** | 040-060-25- | 34 08N 13E (M) | 10 |
| **El Dorado** | 040-070-52- | 09 08N 14E (M) | 131.38 |
| **El Dorado** | 040-090-08- | 19 08N 14E (M) | 80 |
| **El Dorado** | 040-090-08- | 20 08N 14E (M) | 142.6 |
| **El Dorado** | 040-090-21- | 21 08N 14E (M) | 122.31 |
| **El Dorado** | 040-090-42- | 16 08N 14E (M) | 240 |
| **El Dorado** | 040-090-43- | 17 08N 14E (M) | 160 |
| **El Dorado** | 040-090-43- | 18 08N 14E (M) | 120 |
| **El Dorado** | 040-090-43- | 20 08N 14E (M) | 234.84 |
| **El Dorado** | 040-090-44- | 19 08N 14E (M) | 614.01 |
| **El Dorado** | 040-090-45- | 18 08N 14E (M) | 272.26 |
| **El Dorado** | 040-090-46- | 21 08N 14E (M) | 80 |
| **El Dorado** | 040-090-51- | 20 08N 14E (M) | 120 |
| **El Dorado** | 040-100-06- | 13 08N 14E (M) | 40 |
| **El Dorado** | 040-100-06- | 14 08N 14E (M) | 40 |
| **El Dorado** | 040-100-07- | 13 08N 14E (M) | 63.27 |
| **El Dorado** | 040-100-10- | 22 08N 14E (M) | 61.2 |
| **El Dorado** | 040-100-11- | 22 08N 14E (M) | 40 |
| **El Dorado** | 040-100-12- | 23 08N 14E (M) | 25.89 |
| **El Dorado** | 040-100-15- | 15 08N 14E (M) | 120 |
| **El Dorado** | 040-100-16- | 22 08N 14E (M) | 38.32 |
| **El Dorado** | 040-100-18- | 15 08N 14E (M) | 40 |
| **El Dorado** | 040-100-19- | 15 08N 14E (M) | 120 |
| **El Dorado** | 040-100-20- | 22 08N 14E (M) | 95.87 |
| **El Dorado** | 040-100-31- | 15 08N 14E (M) | 80 |
| **El Dorado** | 040-100-31- | 22 08N 14E (M) | 80 |
| **El Dorado** | 040-100-44- | 14 08N 14E (M) | 40 |
| **El Dorado** | 040-100-46- | 14 08N 14E (M) | 57.83 |
| **El Dorado** | 040-110-03- | 29 08N 14E (M) | 15 |
| **El Dorado** | 040-110-04- | 30 08N 14E (M) | 11.1 |

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| **El Dorado** | 040-110-13- | 30 08N 14E (M) | 101.2 |
| **El Dorado** | 040-110-14- | 30 08N 14E (M) | 10 |
| **El Dorado** | 040-120-01- | 07 08N 15E (M) | 345.24 |
| **El Dorado** | 040-120-02- | 08 08N 15E (M) | 305.67 |
| **El Dorado** | 040-120-02- | 09 08N 15E (M) | 157.73 |
| **El Dorado** | 040-120-07- | 05 08N 15E (M) | 74.56 |
| **El Dorado** | 040-120-07- | 07 08N 15E (M) | 40 |
| **El Dorado** | 040-120-07- | 08 08N 15E (M) | 34.89 |
| **El Dorado** | 040-140-01- | 16 08N 15E (M) | 80 |
| **El Dorado** | 040-140-01- | 17 08N 15E (M) | 190 |
| **El Dorado** | 040-150-02- | 05 08N 13E (M) | 77.2 |
| **El Dorado** | 040-150-02- | 32 09N 13E (M) | 79.75 |
| **El Dorado** | 040-170-01- | 04 08N 13E (M) | 7.5 |
| **El Dorado** | 040-170-03- | 04 08N 13E (M) | 1 |
| **El Dorado** | 040-170-04- | 04 08N 13E (M) | 1 |
| **El Dorado** | 040-170-06- | 04 08N 13E (M) | 1 |
| **El Dorado** | 040-170-07- | 04 08N 13E (M) | 3.75 |
| **El Dorado** | 040-170-08- | 04 08N 13E (M) | 0.25 |
| **El Dorado** | 040-220-03- | 05 08N 13E (M) | 37.83 |
| **El Dorado** | 040-260-01- | 03 08N 13E (M) | 21.5 |
| **El Dorado** | 040-260-03- | 03 08N 13E (M) | 150 |
| **El Dorado** | 040-260-05- | 03 08N 13E (M) | 14.12 |
| **El Dorado** | 040-300-03- | 07 08N 13E (M) | 5.2 |
| **El Dorado** | 040-310-03- | 12 08N 13E (M) | 40 |
| **El Dorado** | 040-310-03- | 13 08N 13E (M) | 29.35 |
| **El Dorado** | 040-310-04- | 13 08N 13E (M) | 71.15 |
| **El Dorado** | 040-310-05- | 13 08N 13E (M) | 69.77 |
| **El Dorado** | 040-310-06- | 12 08N 13E (M) | 38 |
| **El Dorado** | 040-310-06- | 13 08N 13E (M) | 4.73 |
| **El Dorado** | 041-011-01- | 06 09N 13E (M) | 218.51 |
| **El Dorado** | 041-011-21- | 03 09N 13E (M) | 8 |
| **El Dorado** | 041-011-21- | 04 09N 13E (M) | 72 |
| **El Dorado** | 041-011-26- | 09 09N 13E (M) | 140 |
| **El Dorado** | 041-011-27- | 09 09N 13E (M) | 116.33 |
| **El Dorado** | 041-011-32- | 09 09N 13E (M) | 20 |
| **El Dorado** | 041-021-01- | 03 09N 13E (M) | 10.95 |
| **El Dorado** | 041-021-01- | 04 09N 13E (M) | 2 |
| **El Dorado** | 041-021-02- | 03 09N 13E (M) | 80 |
| **El Dorado** | 041-021-03- | 02 09N 13E (M) | 80 |
| **El Dorado** | 041-021-03- | 03 09N 13E (M) | 80 |
| **El Dorado** | 041-021-04- | 02 09N 13E (M) | 160 |
| **El Dorado** | 041-021-04- | 03 09N 13E (M) | 120 |
| **El Dorado** | 041-021-04- | 10 09N 13E (M) | 40 |
| **El Dorado** | 041-021-04- | 11 09N 13E (M) | 120 |

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| **El Dorado** | 041-120-02- | 27 09N 14E (M) | 154.81 |
| **El Dorado** | 041-140-02- | 01 09N 15E (M) | 60 |
| **El Dorado** | 041-140-04- | 01 09N 15E (M) | 60 |
| **El Dorado** | 041-140-09- | 01 09N 15E (M) | 40 |
| **El Dorado** | 041-191-03- | 31 09N 13E (M) | 235.5 |
| **El Dorado** | 041-191-12- | 04 08N 13E (M) | 15 |
| **El Dorado** | 041-191-12- | 33 09N 13E (M) | 43.67 |
| **El Dorado** | 041-191-16- | 32 09N 13E (M) | 0.19 |
| **El Dorado** | 041-191-17- | 32 09N 13E (M) | 17.97 |
| **El Dorado** | 041-191-19- | 32 09N 13E (M) | 69.13 |
| **El Dorado** | 041-191-22- | 32 09N 13E (M) | 40 |
| **El Dorado** | 041-960-08- | 06 08N 13E (M) | 68.28 |
| **El Dorado** | 041-960-08- | 31 09N 13E (M) | 87.43 |
| **El Dorado** | 042-011-04- | 04 10N 13E (M) | 16.72 |
| **El Dorado** | 042-011-05- | 04 10N 13E (M) | 200.51 |
| **El Dorado** | 042-011-05- | 05 10N 13E (M) | 52.87 |
| **El Dorado** | 042-011-06- | 04 10N 13E (M) | 178.71 |
| **El Dorado** | 042-011-07- | 04 10N 13E (M) | 40 |
| **El Dorado** | 042-011-09- | 09 10N 13E (M) | 15.4 |
| **El Dorado** | 042-011-12- | 09 10N 13E (M) | 38.6 |
| **El Dorado** | 042-011-13- | 09 10N 13E (M) | 5 |
| **El Dorado** | 042-011-14- | 08 10N 13E (M) | 40 |
| **El Dorado** | 042-011-14- | 09 10N 13E (M) | 75 |
| **El Dorado** | 042-011-15- | 05 10N 13E (M) | 31.14 |
| **El Dorado** | 042-011-15- | 08 10N 13E (M) | 40 |
| **El Dorado** | 042-021-02- | 03 10N 13E (M) | 237.95 |
| **El Dorado** | 042-021-03- | 03 10N 13E (M) | 138.75 |
| **El Dorado** | 042-021-05- | 03 10N 13E (M) | 61.25 |
| **El Dorado** | 042-021-07- | 02 10N 13E (M) | 154.08 |
| **El Dorado** | 042-021-16- | 01 10N 13E (M) | 155 |
| **El Dorado** | 042-021-16- | 02 10N 13E (M) | 148.41 |
| **El Dorado** | 042-021-17- | 01 10N 13E (M) | 284.2 |
| **El Dorado** | 042-021-18- | 11 10N 13E (M) | 40 |
| **El Dorado** | 042-021-18- | 12 10N 13E (M) | 480 |
| **El Dorado** | 042-021-21- | 10 10N 13E (M) | 134.2 |
| **El Dorado** | 042-021-21- | 11 10N 13E (M) | 120 |
| **El Dorado** | 042-021-23- | 10 10N 13E (M) | 80 |
| **El Dorado** | 042-021-23- | 11 10N 13E (M) | 80 |
| **El Dorado** | 042-030-53- | 18 10N 13E (M) | 38.68 |
| **El Dorado** | 042-030-53- | 19 10N 13E (M) | 80 |
| **El Dorado** | 042-030-54- | 19 10N 13E (M) | 89.78 |
| **El Dorado** | 042-030-55- | 19 10N 13E (M) | 81.32 |
| **El Dorado** | 042-030-65- | 19 10N 13E (M) | 40 |
| **El Dorado** | 042-030-65- | 20 10N 13E (M) | 120 |

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| **El Dorado** | 042-030-66- | 16 10N 13E (M) | 229.73 |
| **El Dorado** | 042-030-73- | 16 10N 13E (M) | 30.89 |
| **El Dorado** | 042-030-74- | 16 10N 13E (M) | 30.89 |
| **El Dorado** | 042-040-04- | 22 10N 13E (M) | 16 |
| **El Dorado** | 042-040-05- | 22 10N 13E (M) | 78.61 |
| **El Dorado** | 042-040-18- | 15 10N 13E (M) | 2 |
| **El Dorado** | 042-040-28- | 15 10N 13E (M) | 123.27 |
| **El Dorado** | 042-040-43- | 15 10N 13E (M) | 154.79 |
| **El Dorado** | 042-040-44- | 14 10N 13E (M) | 175 |
| **El Dorado** | 042-040-45- | 14 10N 13E (M) | 65 |
| **El Dorado** | 042-040-46- | 13 10N 13E (M) | 340 |
| **El Dorado** | 042-050-02- | 31 10N 13E (M) | 337.17 |
| **El Dorado** | 042-050-04- | 28 10N 13E (M) | 80 |
| **El Dorado** | 042-050-04- | 29 10N 13E (M) | 188.76 |
| **El Dorado** | 042-050-04- | 32 10N 13E (M) | 160 |
| **El Dorado** | 042-050-06- | 32 10N 13E (M) | 40 |
| **El Dorado** | 042-050-08- | 33 10N 13E (M) | 66.93 |
| **El Dorado** | 042-050-11- | 33 10N 13E (M) | 5.7 |
| **El Dorado** | 042-060-05- | 26 10N 13E (M) | 80 |
| **El Dorado** | 042-060-05- | 35 10N 13E (M) | 60 |
| **El Dorado** | 042-060-06- | 25 10N 13E (M) | 160 |
| **El Dorado** | 042-060-07- | 35 10N 13E (M) | 160 |
| **El Dorado** | 042-060-09- | 27 10N 13E (M) | 185 |
| **El Dorado** | 042-060-10- | 34 10N 13E (M) | 261.72 |
| **El Dorado** | 042-070-07- | 07 10N 14E (M) | 60 |
| **El Dorado** | 042-070-21- | 06 10N 14E (M) | 382.9 |
| **El Dorado** | 042-070-23- | 05 10N 14E (M) | 427.4 |
| **El Dorado** | 042-070-24- | 04 10N 14E (M) | 253.76 |
| **El Dorado** | 042-070-25- | 07 10N 14E (M) | 80 |
| **El Dorado** | 042-070-26- | 09 10N 14E (M) | 39.54 |
| **El Dorado** | 042-070-27- | 09 10N 14E (M) | 40.11 |
| **El Dorado** | 042-070-28- | 08 10N 14E (M) | 560 |
| **El Dorado** | 042-070-29- | 06 10N 14E (M) | 80 |
| **El Dorado** | 042-070-30- | 07 10N 14E (M) | 22.99 |
| **El Dorado** | 042-070-33- | 07 10N 14E (M) | 24 |
| **El Dorado** | 042-070-44- | 07 10N 14E (M) | 200 |
| **El Dorado** | 042-080-06- | 10 10N 14E (M) | 153.87 |
| **El Dorado** | 042-080-26- | 01 10N 14E (M) | 283.02 |
| **El Dorado** | 042-080-28- | 03 10N 14E (M) | 38.28 |
| **El Dorado** | 042-080-29- | 10 10N 14E (M) | 38.79 |
| **El Dorado** | 042-080-30- | 02 10N 14E (M) | 214.61 |
| **El Dorado** | 042-080-31- | 11 10N 14E (M) | 595.62 |
| **El Dorado** | 042-080-32- | 12 10N 14E (M) | 400 |
| **El Dorado** | 042-090-04- | 18 10N 14E (M) | 40 |

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| **El Dorado** | 042-090-25- | 18 10N 14E (M) | 120 |
| **El Dorado** | 042-090-26- | 17 10N 14E (M) | 42.76 |
| **El Dorado** | 042-090-27- | 17 10N 14E (M) | 400 |
| **El Dorado** | 042-090-28- | 20 10N 14E (M) | 126.38 |
| **El Dorado** | 042-090-29- | 21 10N 14E (M) | 169.19 |
| **El Dorado** | 042-090-30- | 16 10N 14E (M) | 640 |
| **El Dorado** | 042-100-23- | 15 10N 14E (M) | 17.5 |
| **El Dorado** | 042-100-46- | 15 10N 14E (M) | 582.5 |
| **El Dorado** | 042-100-47- | 22 10N 14E (M) | 400 |
| **El Dorado** | 042-100-48- | 14 10N 14E (M) | 640 |
| **El Dorado** | 042-100-49- | 23 10N 14E (M) | 400 |
| **El Dorado** | 042-100-50- | 24 10N 14E (M) | 193.54 |
| **El Dorado** | 042-100-51- | 13 10N 14E (M) | 600 |
| **El Dorado** | 042-100-54- | 22 10N 14E (M) | 40 |
| **El Dorado** | 042-100-55- | 13 10N 14E (M) | 41.91 |
| **El Dorado** | 042-100-59- | 24 10N 14E (M) | 38.83 |
| **El Dorado** | 042-100-61- | 15 10N 14E (M) | 39.75 |
| **El Dorado** | 042-120-12- | 27 10N 14E (M) | 160 |
| **El Dorado** | 042-130-01- | 05 10N 15E (M) | 78.41 |
| **El Dorado** | 042-130-01- | 06 10N 15E (M) | 405.97 |
| **El Dorado** | 042-130-02- | 07 10N 15E (M) | 434.27 |
| **El Dorado** | 042-130-05- | 04 10N 15E (M) | 116.17 |
| **El Dorado** | 042-130-06- | 08 10N 15E (M) | 462.47 |
| **El Dorado** | 042-130-06- | 09 10N 15E (M) | 150 |
| **El Dorado** | 042-140-01- | 03 10N 15E (M) | 40.39 |
| **El Dorado** | 042-140-02- | 10 10N 15E (M) | 110 |
| **El Dorado** | 042-140-02- | 11 10N 15E (M) | 324.27 |
| **El Dorado** | 042-140-03- | 12 10N 15E (M) | 303.31 |
| **El Dorado** | 042-160-01- | 18 10N 15E (M) | 220.98 |
| **El Dorado** | 042-160-01- | 19 10N 15E (M) | 43 |
| **El Dorado** | 042-160-04- | 16 10N 15E (M) | 640.7 |
| **El Dorado** | 042-160-05- | 19 10N 15E (M) | 300 |
| **El Dorado** | 042-160-17- | 17 10N 15E (M) | 118.81 |
| **El Dorado** | 042-160-17- | 20 10N 15E (M) | 39.16 |
| **El Dorado** | 042-160-17- | 21 10N 15E (M) | 197.48 |
| **El Dorado** | 042-170-02- | 13 10N 15E (M) | 320 |
| **El Dorado** | 042-170-02- | 24 10N 15E (M) | 320 |
| **El Dorado** | 042-170-10- | 15 10N 15E (M) | 80 |
| **El Dorado** | 042-180-03- | 29 10N 15E (M) | 155.7 |
| **El Dorado** | 042-180-04- | 28 10N 15E (M) | 320 |
| **El Dorado** | 042-190-01- | 27 10N 15E (M) | 160 |
| **El Dorado** | 042-190-01- | 34 10N 15E (M) | 160 |
| **El Dorado** | 042-190-02- | 36 10N 15E (M) | 640 |
| **El Dorado** | 042-240-03- | 33 10N 13E (M) | 8.48 |

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| **El Dorado** | 042-270-07- | 04 10N 13E (M) | 1.67 |
| **El Dorado** | 042-270-08- | 04 10N 13E (M) | 1.66 |
| **El Dorado** | 042-671-02- | 05 10N 13E (M) | 3.86 |
| **El Dorado** | 042-671-03- | 05 10N 13E (M) | 4 |
| **El Dorado** | 061-030-01- | 13 13N 10E (M) | 419.67 |
| **El Dorado** | 061-042-11- | 29 13N 10E (M) | 122.88 |
| **El Dorado** | 061-042-12- | 29 13N 10E (M) | 60.41 |
| **El Dorado** | 061-042-14- | 33 13N 10E (M) | 120 |
| **El Dorado** | 061-042-15- | 33 13N 10E (M) | 70 |
| **El Dorado** | 061-051-01- | 27 13N 10E (M) | 643.7 |
| **El Dorado** | 062-010-01- | 07 13N 11E (M) | 148.41 |
| **El Dorado** | 062-030-04- | 17 13N 11E (M) | 361.5 |
| **El Dorado** | 062-030-35- | 21 13N 11E (M) | 370 |
| **El Dorado** | 062-051-08- | 29 13N 11E (M) | 240 |
| **El Dorado** | 062-061-11- | 25 13N 11E (M) | 559.68 |
| **El Dorado** | 062-061-12- | 25 13N 11E (M) | 45.28 |
| **El Dorado** | 062-061-20- | 35 13N 11E (M) | 544.4 |
| **El Dorado** | 062-080-06- | 01 12N 11E (M) | 501.17 |
| **El Dorado** | 062-090-02- | 17 12N 11E (M) | 288.18 |
| **El Dorado** | 062-541-52- | 23 13N 11E (M) | 5.02 |
| **El Dorado** | 062-600-01- | 07 12N 11E (M) | 13.02 |
| **El Dorado** | 063-020-15- | 33 13N 12E (M) | 413 |
| **El Dorado** | 063-020-16- | 33 13N 12E (M) | 10 |
| **El Dorado** | 063-020-20- | 31 13N 12E (M) | 309.75 |
| **El Dorado** | 063-020-21- | 31 13N 12E (M) | 58.51 |
| **El Dorado** | 063-020-22- | 31 13N 12E (M) | 7.93 |
| **El Dorado** | 063-020-23- | 32 13N 12E (M) | 48 |
| **El Dorado** | 063-020-24- | 32 13N 12E (M) | 6 |
| **El Dorado** | 063-020-31- | 33 13N 12E (M) | 46 |
| **El Dorado** | 063-020-32- | 33 13N 12E (M) | 32 |
| **El Dorado** | 063-020-33- | 33 13N 12E (M) | 20 |
| **El Dorado** | 063-030-02- | 34 13N 12E (M) | 160 |
| **El Dorado** | 063-060-02- | 36 13N 13E (M) | 640 |
| **El Dorado** | 063-060-03- | 25 13N 13E (M) | 440 |
| **El Dorado** | 063-060-14- | 35 13N 13E (M) | 207.415 |
| **El Dorado** | 063-070-11- | 08 12N 12E (M) | 160 |
| **El Dorado** | 063-070-12- | 07 12N 12E (M) | 488.72 |
| **El Dorado** | 063-070-77- | 04 12N 12E (M) | 47.5 |
| **El Dorado** | 063-070-78- | 04 12N 12E (M) | 154.71 |
| **El Dorado** | 063-070-79- | 04 12N 12E (M) | 37.5 |
| **El Dorado** | 063-070-83- | 09 12N 12E (M) | 47.5 |
| **El Dorado** | 063-070-84- | 09 12N 12E (M) | 272.5 |
| **El Dorado** | 063-080-04- | 01 12N 12E (M) | 41.12 |
| **El Dorado** | 063-080-20- | 12 12N 12E (M) | 20.18 |

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| **El Dorado** | 063-080-26- | 11 12N 12E (M) | 16.48 |
| **El Dorado** | 063-080-26- | 12 12N 12E (M) | 5 |
| **El Dorado** | 063-080-27- | 12 12N 12E (M) | 19.59 |
| **El Dorado** | 063-080-30- | 10 12N 12E (M) | 25 |
| **El Dorado** | 063-080-36- | 11 12N 12E (M) | 50 |
| **El Dorado** | 063-080-40- | 10 12N 12E (M) | 30 |
| **El Dorado** | 063-080-41- | 10 12N 12E (M) | 425 |
| **El Dorado** | 063-080-42- | 10 12N 12E (M) | 42.5 |
| **El Dorado** | 063-080-43- | 10 12N 12E (M) | 52.5 |
| **El Dorado** | 063-080-44- | 10 12N 12E (M) | 65 |
| **El Dorado** | 063-080-45- | 11 12N 12E (M) | 7.5 |
| **El Dorado** | 063-080-46- | 11 12N 12E (M) | 2.5 |
| **El Dorado** | 063-080-52- | 02 12N 12E (M) | 320 |
| **El Dorado** | 063-080-52- | 03 12N 12E (M) | 258.18 |
| **El Dorado** | 063-080-54- | 03 12N 12E (M) | 49.29 |
| **El Dorado** | 063-080-56- | 11 12N 12E (M) | 135.78 |
| **El Dorado** | 063-080-56- | 12 12N 12E (M) | 36.34 |
| **El Dorado** | 063-080-64- | 11 12N 12E (M) | 111.49 |
| **El Dorado** | 063-090-01- | 18 12N 12E (M) | 547.46 |
| **El Dorado** | 063-090-02- | 17 12N 12E (M) | 320 |
| **El Dorado** | 063-090-03- | 16 12N 12E (M) | 320 |
| **El Dorado** | 063-090-06- | 20 12N 12E (M) | 371.12 |
| **El Dorado** | 063-090-07- | 21 12N 12E (M) | 280 |
| **El Dorado** | 063-090-13- | 19 12N 12E (M) | 798.42 |
| **El Dorado** | 063-090-14- | 21 12N 12E (M) | 40 |
| **El Dorado** | 063-090-17- | 18 12N 12E (M) | 147.95 |
| **El Dorado** | 063-100-01- | 15 12N 12E (M) | 640 |
| **El Dorado** | 063-100-02- | 14 12N 12E (M) | 640 |
| **El Dorado** | 063-100-05- | 24 12N 12E (M) | 84.85 |
| **El Dorado** | 063-100-06- | 24 12N 12E (M) | 160 |
| **El Dorado** | 063-100-08- | 23 12N 12E (M) | 578.32 |
| **El Dorado** | 063-100-09- | 22 12N 12E (M) | 640 |
| **El Dorado** | 063-100-10- | 13 12N 12E (M) | 223.39 |
| **El Dorado** | 063-100-13- | 13 12N 12E (M) | 113.65 |
| **El Dorado** | 063-100-18- | 13 12N 12E (M) | 168 |
| **El Dorado** | 063-100-19- | 23 12N 12E (M) | 83.62 |
| **El Dorado** | 063-100-19- | 24 12N 12E (M) | 276.38 |
| **El Dorado** | 063-110-01- | 30 12N 12E (M) | 234.75 |
| **El Dorado** | 063-110-03- | 29 12N 12E (M) | 560 |
| **El Dorado** | 063-110-04- | 28 12N 12E (M) | 400 |
| **El Dorado** | 063-110-05- | 32 12N 12E (M) | 40 |
| **El Dorado** | 063-110-05- | 33 12N 12E (M) | 440 |
| **El Dorado** | 063-110-06- | 32 12N 12E (M) | 280 |
| **El Dorado** | 063-110-09- | 31 12N 12E (M) | 792.86 |

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| **El Dorado** | 063-120-01- | 27 12N 12E (M) | 600 |
| **El Dorado** | 063-120-02- | 26 12N 12E (M) | 640 |
| **El Dorado** | 063-120-03- | 25 12N 12E (M) | 601.31 |
| **El Dorado** | 063-120-05- | 34 12N 12E (M) | 320 |
| **El Dorado** | 063-120-06- | 35 12N 12E (M) | 238.19 |
| **El Dorado** | 063-120-07- | 36 12N 12E (M) | 320 |
| **El Dorado** | 063-120-09- | 27 12N 12E (M) | 41.69 |
| **El Dorado** | 063-130-08- | 07 12N 13E (M) | 43.06 |
| **El Dorado** | 063-130-10- | 07 12N 13E (M) | 80 |
| **El Dorado** | 063-130-10- | 08 12N 13E (M) | 220 |
| **El Dorado** | 063-130-11- | 08 12N 13E (M) | 60 |
| **El Dorado** | 063-130-12- | 09 12N 13E (M) | 97.5 |
| **El Dorado** | 063-130-13- | 09 12N 13E (M) | 222.5 |
| **El Dorado** | 063-130-24- | 08 12N 13E (M) | 37 |
| **El Dorado** | 063-130-24- | 09 12N 13E (M) | 159.3 |
| **El Dorado** | 063-140-01- | 03 12N 13E (M) | 440 |
| **El Dorado** | 063-140-02- | 02 12N 13E (M) | 496 |
| **El Dorado** | 063-140-05- | 10 12N 13E (M) | 360 |
| **El Dorado** | 063-140-06- | 10 12N 13E (M) | 80 |
| **El Dorado** | 063-140-07- | 11 12N 13E (M) | 640 |
| **El Dorado** | 063-140-08- | 12 12N 13E (M) | 640 |
| **El Dorado** | 063-140-09- | 01 12N 13E (M) | 694.07 |
| **El Dorado** | 063-140-10- | 10 12N 13E (M) | 200 |
| **El Dorado** | 063-140-13- | 02 12N 13E (M) | 200 |
| **El Dorado** | 063-150-06- | 19 12N 13E (M) | 778.58 |
| **El Dorado** | 063-150-08- | 20 12N 13E (M) | 640 |
| **El Dorado** | 063-150-09- | 21 12N 13E (M) | 640 |
| **El Dorado** | 063-150-14- | 16 12N 13E (M) | 0.385 |
| **El Dorado** | 063-150-19- | 18 12N 13E (M) | 450.42 |
| **El Dorado** | 063-150-20- | 18 12N 13E (M) | 40 |
| **El Dorado** | 063-150-21- | 17 12N 13E (M) | 490 |
| **El Dorado** | 063-150-22- | 17 12N 13E (M) | 10 |
| **El Dorado** | 063-150-23- | 16 12N 13E (M) | 320 |
| **El Dorado** | 063-150-24- | 16 12N 13E (M) | 150 |
| **El Dorado** | 063-150-25- | 16 12N 13E (M) | 150 |
| **El Dorado** | 063-150-26- | 16 12N 13E (M) | 9.63 |
| **El Dorado** | 063-150-27- | 16 12N 13E (M) | 10 |
| **El Dorado** | 063-150-31- | 17 12N 13E (M) | 40 |
| **El Dorado** | 063-150-32- | 17 12N 13E (M) | 60 |
| **El Dorado** | 063-150-33- | 18 12N 13E (M) | 40 |
| **El Dorado** | 063-150-34- | 18 12N 13E (M) | 20 |
| **El Dorado** | 063-150-35- | 18 12N 13E (M) | 63.24 |
| **El Dorado** | 063-160-02- | 14 12N 13E (M) | 640 |
| **El Dorado** | 063-160-03- | 13 12N 13E (M) | 640 |

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| **El Dorado** | 063-160-04- | 22 12N 13E (M) | 640 |
| **El Dorado** | 063-160-06- | 24 12N 13E (M) | 640 |
| **El Dorado** | 063-160-08- | 23 12N 13E (M) | 640 |
| **El Dorado** | 063-160-12- | 15 12N 13E (M) | 37.5 |
| **El Dorado** | 063-160-13- | 15 12N 13E (M) | 602.5 |
| **El Dorado** | 063-170-03- | 29 12N 13E (M) | 520 |
| **El Dorado** | 063-170-04- | 28 12N 13E (M) | 404.88 |
| **El Dorado** | 063-170-05- | 31 12N 13E (M) | 321.05 |
| **El Dorado** | 063-170-05- | 32 12N 13E (M) | 160 |
| **El Dorado** | 063-170-06- | 30 12N 13E (M) | 643.4 |
| **El Dorado** | 063-180-01- | 27 12N 13E (M) | 640 |
| **El Dorado** | 063-180-02- | 26 12N 13E (M) | 640 |
| **El Dorado** | 063-180-03- | 25 12N 13E (M) | 520 |
| **El Dorado** | 063-180-07- | 36 12N 13E (M) | 624.75 |
| **El Dorado** | 079-010-24- | 36 10N 12E (M) | 10 |
| **El Dorado** | 079-010-25- | 36 10N 12E (M) | 192.34 |
| **El Dorado** | 079-010-26- | 36 10N 12E (M) | 37.98 |
| **El Dorado** | 085-020-27- | 24 11N 11E (M) | 88.05 |
| **El Dorado** | 093-021-02- | 02 09N 12E (M) | 84.98 |
| **El Dorado** | 095-011-40- | 35 09N 12E (M) | 39.17 |
| **El Dorado** | 095-011-77- | 34 09N 12E (M) | 10 |
| **El Dorado** | 095-011-79- | 34 09N 12E (M) | 60 |
| **El Dorado** | 095-011-80- | 36 09N 12E (M) | 80 |
| **El Dorado** | 095-011-81- | 36 09N 12E (M) | 80 |
| **El Dorado** | 095-011-82- | 36 09N 12E (M) | 10 |
| **El Dorado** | 095-011-84- | 34 09N 12E (M) | 40.003 |
| **El Dorado** | 095-011-85- | 34 09N 12E (M) | 51.416 |
| **El Dorado** | 095-011-86- | 34 09N 12E (M) | 42.78 |
| **El Dorado** | 095-011-87- | 34 09N 12E (M) | 75.603 |
| **El Dorado** | 095-021-54- | 09 08N 12E (M) | 80 |
| **El Dorado** | 095-021-54- | 10 08N 12E (M) | 80 |
| **El Dorado** | 095-030-17- | 11 08N 12E (M) | 168.51 |
| **El Dorado** | 095-030-21- | 10 08N 12E (M) | 160 |
| **El Dorado** | 095-030-31- | 02 08N 12E (M) | 320 |
| **El Dorado** | 095-030-31- | 11 08N 12E (M) | 183.51 |
| **El Dorado** | 095-030-33- | 01 08N 12E (M) | 77.42 |
| **El Dorado** | 095-030-44- | 01 08N 12E (M) | 7.3 |
| **El Dorado** | 095-030-45- | 01 08N 12E (M) | 57 |
| **El Dorado** | 095-030-46- | 03 08N 12E (M) | 80 |
| **El Dorado** | 095-030-46- | 10 08N 12E (M) | 80 |
| **El Dorado** | 095-030-47- | 03 08N 12E (M) | 80 |
| **El Dorado** | 095-030-47- | 10 08N 12E (M) | 80 |
| **El Dorado** | 095-030-48- | 03 08N 12E (M) | 160 |
| **El Dorado** | 095-030-50- | 11 08N 12E (M) | 40 |

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| **El Dorado** | 095-030-51- | 11 08N 12E (M) | 120 |
| **El Dorado** | 095-030-52- | 11 08N 12E (M) | 80 |
| **El Dorado** | 095-030-53- | 10 08N 12E (M) | 80 |
| **El Dorado** | 095-030-53- | 11 08N 12E (M) | 80 |
| **El Dorado** | 095-030-54- | 10 08N 12E (M) | 160 |
| **El Dorado** | 095-030-56- | 12 08N 12E (M) | 160 |
| **El Dorado** | 095-030-57- | 12 08N 12E (M) | 160 |
| **El Dorado** | 095-030-59- | 12 08N 12E (M) | 120 |
| **El Dorado** | 095-030-60- | 12 08N 12E (M) | 40 |
| **El Dorado** | 095-030-60- | 07 08N 13E (M) | 46.37 |
| **El Dorado** | 095-040-10- | 17 08N 12E (M) | 120 |
| **El Dorado** | 095-040-19- | 20 08N 12E (M) | 2.5 |
| **El Dorado** | 095-040-20- | 20 08N 12E (M) | 40 |
| **El Dorado** | 095-040-20- | 21 08N 12E (M) | 80 |
| **El Dorado** | 095-040-59- | 16 08N 12E (M) | 320 |
| **El Dorado** | 095-050-02- | 15 08N 12E (M) | 40 |
| **El Dorado** | 095-050-03- | 14 08N 12E (M) | 40 |
| **El Dorado** | 095-050-06- | 22 08N 12E (M) | 160 |
| **El Dorado** | 095-050-13- | 13 08N 12E (M) | 80 |
| **El Dorado** | 095-050-13- | 24 08N 12E (M) | 200 |
| **El Dorado** | 095-050-21- | 14 08N 12E (M) | 40 |
| **El Dorado** | 095-050-26- | 24 08N 12E (M) | 40 |
| **El Dorado** | 095-050-33- | 24 08N 12E (M) | 40 |
| **El Dorado** | 095-050-41- | 15 08N 12E (M) | 160 |
| **El Dorado** | 095-050-42- | 15 08N 12E (M) | 160 |
| **El Dorado** | 095-050-43- | 15 08N 12E (M) | 120 |
| **El Dorado** | 095-050-44- | 13 08N 12E (M) | 40 |
| **El Dorado** | 095-050-44- | 14 08N 12E (M) | 40 |
| **El Dorado** | 095-050-45- | 14 08N 12E (M) | 40 |
| **El Dorado** | 095-050-46- | 14 08N 12E (M) | 80 |
| **El Dorado** | 095-050-47- | 14 08N 12E (M) | 40 |
| **El Dorado** | 095-050-48- | 14 08N 12E (M) | 160 |
| **El Dorado** | 095-050-50- | 14 08N 12E (M) | 120 |
| **El Dorado** | 095-050-51- | 14 08N 12E (M) | 40 |
| **El Dorado** | 095-050-53- | 13 08N 12E (M) | 40 |
| **El Dorado** | 095-050-54- | 13 08N 12E (M) | 160 |
| **El Dorado** | 095-050-55- | 13 08N 12E (M) | 160 |
| **El Dorado** | 095-050-56- | 13 08N 12E (M) | 40 |
| **El Dorado** | 095-050-57- | 13 08N 12E (M) | 80 |
| **El Dorado** | 095-050-57- | 18 08N 13E (M) | 40 |
| **El Dorado** | 095-050-58- | 23 08N 12E (M) | 120 |
| **El Dorado** | 095-050-59- | 23 08N 12E (M) | 40 |
| **El Dorado** | 095-050-60- | 23 08N 12E (M) | 160 |
| **El Dorado** | 095-050-61- | 23 08N 12E (M) | 75 |

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| **El Dorado** | 095-050-61- | 24 08N 12E (M) | 120 |
| **El Dorado** | 095-050-62- | 24 08N 12E (M) | 40 |
| **El Dorado** | 095-050-62- | 19 08N 13E (M) | 87.09 |
| **El Dorado** | 095-050-63- | 23 08N 12E (M) | 6 |
| **El Dorado** | 095-050-63- | 24 08N 12E (M) | 40 |
| **El Dorado** | 095-050-64- | 24 08N 12E (M) | 80 |
| **El Dorado** | 095-050-65- | 23 08N 12E (M) | 40 |
| **El Dorado** | 095-050-66- | 23 08N 12E (M) | 159 |
| **El Dorado** | 095-050-67- | 14 08N 12E (M) | 40 |
| **El Dorado** | 095-050-67- | 24 08N 12E (M) | 80 |
| **El Dorado** | 095-060-06- | 28 08N 12E (M) | 120 |
| **El Dorado** | 095-060-06- | 29 08N 12E (M) | 40 |
| **El Dorado** | 095-060-07- | 29 08N 12E (M) | 37 |
| **El Dorado** | 095-060-08- | 28 08N 12E (M) | 50 |
| **El Dorado** | 095-060-08- | 29 08N 12E (M) | 3 |
| **El Dorado** | 095-060-09- | 28 08N 12E (M) | 80 |
| **El Dorado** | 095-060-10- | 28 08N 12E (M) | 150 |
| **El Dorado** | 095-060-11- | 27 08N 12E (M) | 38 |
| **El Dorado** | 095-060-11- | 28 08N 12E (M) | 25 |
| **El Dorado** | 095-070-03- | 27 08N 12E (M) | 40 |
| **El Dorado** | 095-070-11- | 36 08N 12E (M) | 26.5 |
| **El Dorado** | 095-070-16- | 36 08N 12E (M) | 135.91 |
| **El Dorado** | 095-070-17- | 25 08N 12E (M) | 160 |
| **El Dorado** | 095-070-23- | 36 08N 12E (M) | 41.7 |
| **El Dorado** | 095-070-24- | 36 08N 12E (M) | 40 |
| **El Dorado** | 095-070-28- | 27 08N 12E (M) | 160 |
| **El Dorado** | 095-070-29- | 27 08N 12E (M) | 160 |
| **El Dorado** | 095-070-30- | 23 08N 12E (M) | 40 |
| **El Dorado** | 095-070-30- | 26 08N 12E (M) | 80 |
| **El Dorado** | 095-070-30- | 27 08N 12E (M) | 40 |
| **El Dorado** | 095-070-32- | 34 08N 12E (M) | 68 |
| **El Dorado** | 095-070-33- | 35 08N 12E (M) | 59 |
| **El Dorado** | 095-070-34- | 35 08N 12E (M) | 122 |
| **El Dorado** | 095-070-36- | 27 08N 12E (M) | 120 |
| **El Dorado** | 095-070-37- | 25 08N 12E (M) | 160 |
| **El Dorado** | 095-070-39- | 26 08N 12E (M) | 160 |
| **El Dorado** | 095-070-40- | 25 08N 12E (M) | 80 |
| **El Dorado** | 095-070-40- | 26 08N 12E (M) | 80 |
| **El Dorado** | 095-070-41- | 25 08N 12E (M) | 80 |
| **El Dorado** | 095-070-42- | 26 08N 12E (M) | 80 |
| **El Dorado** | 095-070-42- | 35 08N 12E (M) | 80 |
| **El Dorado** | 095-190-12- | 16 08N 12E (M) | 40 |
| **El Dorado** | 095-190-15- | 16 08N 12E (M) | 5 |
| **El Dorado** | 095-210-07- | 36 08N 12E (M) | 4.68 |

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| **El Dorado** | 095-210-08- | 36 08N 12E (M) | 8.87 |
| **El Dorado** | 100-010-02- | 05 11N 12E (M) | 51.57 |
| **El Dorado** | 100-010-03- | 04 11N 12E (M) | 120 |
| **El Dorado** | 100-010-03- | 05 11N 12E (M) | 141.18 |
| **El Dorado** | 100-010-05- | 08 11N 12E (M) | 120 |
| **El Dorado** | 100-010-05- | 09 11N 12E (M) | 160 |
| **El Dorado** | 100-020-01- | 17 11N 12E (M) | 160 |
| **El Dorado** | 100-020-01- | 18 11N 12E (M) | 40 |
| **El Dorado** | 100-020-03- | 17 11N 12E (M) | 80 |
| **El Dorado** | 100-020-12- | 19 11N 12E (M) | 391.37 |
| **El Dorado** | 100-020-12- | 20 11N 12E (M) | 80 |
| **El Dorado** | 100-020-13- | 19 11N 12E (M) | 7.58 |
| **El Dorado** | 100-040-01- | 29 11N 12E (M) | 81.85 |
| **Lassen** | 001-010-20- | 30 39N 06E (M) | 5 |
| **Lassen** | 001-010-21- | 30 39N 06E (M) | 41.7 |
| **Lassen** | 001-010-23- | 30 39N 06E (M) | 27.13 |
| **Lassen** | 001-010-24- | 31 39N 06E (M) | 456.76 |
| **Lassen** | 001-010-25- | 32 39N 06E (M) | 560 |
| **Lassen** | 001-010-26- | 28 39N 06E (M) | 80 |
| **Lassen** | 001-010-26- | 33 39N 06E (M) | 320 |
| **Lassen** | 001-020-10- | 36 39N 06E (M) | 640 |
| **Lassen** | 001-020-11- | 25 39N 06E (M) | 20 |
| **Lassen** | 001-020-12- | 34 39N 06E (M) | 640 |
| **Lassen** | 001-020-13- | 27 39N 06E (M) | 80 |
| **Lassen** | 001-020-14- | 25 39N 06E (M) | 40 |
| **Lassen** | 001-020-14- | 26 39N 06E (M) | 81.98 |
| **Lassen** | 001-020-15- | 35 39N 06E (M) | 647.38 |
| **Lassen** | 001-030-14- | 31 39N 07E (M) | 98.35 |
| **Lassen** | 001-050-13- | 04 38N 06E (M) | 40 |
| **Lassen** | 001-050-24- | 06 38N 06E (M) | 40 |
| **Lassen** | 001-050-25- | 06 38N 06E (M) | 441.76 |
| **Lassen** | 001-050-25- | 07 38N 06E (M) | 17.69 |
| **Lassen** | 001-050-26- | 05 38N 06E (M) | 470.2 |
| **Lassen** | 001-050-27- | 08 38N 06E (M) | 520 |
| **Lassen** | 001-050-28- | 09 38N 06E (M) | 640 |
| **Lassen** | 001-060-05- | 02 38N 06E (M) | 160 |
| **Lassen** | 001-060-06- | 02 38N 06E (M) | 331.29 |
| **Lassen** | 001-060-07- | 01 38N 06E (M) | 200 |
| **Lassen** | 001-060-07- | 02 38N 06E (M) | 162.51 |
| **Lassen** | 001-060-17- | 12 38N 06E (M) | 160 |
| **Lassen** | 001-060-19- | 03 38N 06E (M) | 456.69 |
| **Lassen** | 001-060-20- | 10 38N 06E (M) | 520 |
| **Lassen** | 001-060-21- | 11 38N 06E (M) | 640 |
| **Lassen** | 001-060-22- | 12 38N 06E (M) | 240 |

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| **Lassen** | 001-060-23- | 01 38N 06E (M) | 444.38 |
| **Lassen** | 001-060-23- | 12 38N 06E (M) | 160 |
| **Lassen** | 001-070-01- | 06 38N 07E (M) | 253.37 |
| **Lassen** | 001-070-01- | 07 38N 07E (M) | 153.41 |
| **Lassen** | 001-070-08- | 07 38N 07E (M) | 148.1 |
| **Lassen** | 001-090-03- | 17 38N 06E (M) | 160 |
| **Lassen** | 001-090-05- | 16 38N 06E (M) | 280 |
| **Lassen** | 001-090-24- | 21 38N 06E (M) | 80 |
| **Lassen** | 001-100-08- | 24 38N 06E (M) | 80 |
| **Lassen** | 001-100-09- | 13 38N 06E (M) | 160 |
| **Lassen** | 001-100-31- | 24 38N 06E (M) | 40 |
| **Lassen** | 001-100-32- | 24 38N 06E (M) | 40 |
| **Lassen** | 001-100-33- | 24 38N 06E (M) | 80 |
| **Lassen** | 001-100-36- | 15 38N 06E (M) | 600 |
| **Lassen** | 001-100-37- | 14 38N 06E (M) | 640 |
| **Lassen** | 001-100-38- | 13 38N 06E (M) | 320 |
| **Lassen** | 001-100-39- | 24 38N 06E (M) | 280 |
| **Lassen** | 001-100-40- | 23 38N 06E (M) | 600 |
| **Lassen** | 001-100-41- | 22 38N 06E (M) | 640 |
| **Lassen** | 001-110-02- | 18 38N 07E (M) | 70.1 |
| **Lassen** | 001-260-01- | 27 38N 06E (M) | 200 |
| **Lassen** | 001-260-03- | 27 38N 06E (M) | 40 |
| **Lassen** | 001-260-04- | 27 38N 06E (M) | 40 |
| **Lassen** | 001-260-05- | 27 38N 06E (M) | 40 |
| **Lassen** | 001-260-07- | 26 38N 06E (M) | 640 |
| **Lassen** | 001-260-23- | 36 38N 06E (M) | 640 |
| **Lassen** | 001-260-26- | 25 38N 06E (M) | 31.82 |
| **Lassen** | 001-260-28- | 25 38N 06E (M) | 120 |
| **Lassen** | 001-260-29- | 25 38N 06E (M) | 480 |
| **Lassen** | 001-260-30- | 35 38N 06E (M) | 560 |
| **Lassen** | 001-270-12- | 31 38N 07E (M) | 156.8 |
| **Lassen** | 001-270-13- | 31 38N 07E (M) | 36.93 |
| **Lassen** | 001-270-35- | 30 38N 07E (M) | 102.01 |
| **Lassen** | 001-270-53- | 32 38N 07E (M) | 1.84 |
| **Lassen** | 001-270-60- | 31 38N 07E (M) | 294.89 |
| **Lassen** | 001-270-60- | 32 38N 07E (M) | 30 |
| **Lassen** | 003-150-13- | 32 38N 09E (M) | 40 |
| **Lassen** | 003-150-13- | 33 38N 09E (M) | 80 |
| **Lassen** | 013-030-10- | 01 37N 06E (M) | 119.81 |
| **Lassen** | 013-030-21- | 11 37N 06E (M) | 440 |
| **Lassen** | 013-030-33- | 02 37N 06E (M) | 223.69 |
| **Lassen** | 013-030-34- | 02 37N 06E (M) | 124 |
| **Lassen** | 013-030-54- | 02 37N 06E (M) | 119.47 |
| **Lassen** | 013-030-55- | 01 37N 06E (M) | 466.83 |

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| **Lassen** | 013-030-56- | 12 37N 06E (M) | 56.27 |
| **Lassen** | 013-030-57- | 12 37N 06E (M) | 521.289 |
| **Lassen** | 013-030-58- | 01 37N 06E (M) | 8 |
| **Lassen** | 013-030-81- | 01 37N 06E (M) | 0.05 |
| **Lassen** | 013-040-21- | 07 37N 07E (M) | 409.97 |
| **Lassen** | 013-040-21- | 06 37N 07E (M) | 2 |
| **Lassen** | 013-040-36- | 07 37N 07E (M) | 130.6 |
| **Lassen** | 013-040-38- | 08 37N 07E (M) | 400 |
| **Lassen** | 013-040-38- | 05 37N 07E (M) | 40 |
| **Lassen** | 013-040-39- | 06 37N 07E (M) | 408 |
| **Lassen** | 013-040-39- | 05 37N 07E (M) | 30 |
| **Lassen** | 013-040-40- | 05 37N 07E (M) | 208 |
| **Lassen** | 013-040-40- | 06 37N 07E (M) | 5 |
| **Lassen** | 013-070-18- | 14 37N 06E (M) | 280 |
| **Lassen** | 013-070-19- | 13 37N 06E (M) | 493 |
| **Lassen** | 013-070-20- | 23 37N 06E (M) | 120 |
| **Lassen** | 013-070-20- | 24 37N 06E (M) | 360 |
| **Lassen** | 013-080-07- | 17 37N 07E (M) | 80 |
| **Lassen** | 013-080-08- | 17 37N 07E (M) | 360 |
| **Lassen** | 013-080-12- | 19 37N 07E (M) | 555.95 |
| **Lassen** | 013-080-14- | 20 37N 07E (M) | 200 |
| **Lassen** | 013-080-17- | 20 37N 07E (M) | 80 |
| **Lassen** | 013-080-17- | 21 37N 07E (M) | 480 |
| **Lassen** | 013-080-21- | 18 37N 07E (M) | 590.6 |
| **Lassen** | 013-110-04- | 25 37N 06E (M) | 360 |
| **Lassen** | 013-110-04- | 26 37N 06E (M) | 120 |
| **Lassen** | 013-120-01- | 30 37N 07E (M) | 80 |
| **Lassen** | 013-120-03- | 30 37N 07E (M) | 40 |
| **Lassen** | 013-120-05- | 29 37N 07E (M) | 280 |
| **Lassen** | 013-120-05- | 30 37N 07E (M) | 80 |
| **Lassen** | 013-120-09- | 28 37N 07E (M) | 40 |
| **Lassen** | 013-120-12- | 31 37N 07E (M) | 77.87 |
| **Lassen** | 013-130-11- | 36 37N 07E (M) | 440 |
| **Lassen** | 015-020-07- | 12 37N 08E (M) | 40 |
| **Lassen** | 015-030-06- | 04 37N 09E (M) | 120 |
| **Lassen** | 015-030-06- | 09 37N 09E (M) | 40 |
| **Lassen** | 015-030-13- | 04 37N 09E (M) | 452.8 |
| **Lassen** | 015-030-13- | 05 37N 09E (M) | 320 |
| **Lassen** | 015-030-13- | 07 37N 09E (M) | 160 |
| **Lassen** | 015-030-13- | 08 37N 09E (M) | 480 |
| **Lassen** | 015-030-13- | 09 37N 09E (M) | 480 |
| **Lassen** | 015-060-05- | 13 37N 08E (M) | 40 |
| **Lassen** | 015-070-01- | 18 37N 09E (M) | 77.17 |
| **Lassen** | 015-070-03- | 18 37N 09E (M) | 160 |

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| **Lassen** | 015-070-07- | 18 37N 09E (M) | 40 |
| **Lassen** | 015-070-07- | 19 37N 09E (M) | 120 |
| **Lassen** | 015-070-07- | 20 37N 09E (M) | 160 |
| **Lassen** | 015-070-12- | 21 37N 09E (M) | 80 |
| **Lassen** | 015-070-13- | 21 37N 09E (M) | 160 |
| **Lassen** | 015-070-14- | 16 37N 09E (M) | 640 |
| **Lassen** | 015-070-14- | 17 37N 09E (M) | 446.4 |
| **Lassen** | 015-070-14- | 18 37N 09E (M) | 40 |
| **Lassen** | 015-070-14- | 19 37N 09E (M) | 80 |
| **Lassen** | 015-070-14- | 20 37N 09E (M) | 320 |
| **Lassen** | 015-070-14- | 21 37N 09E (M) | 320 |
| **Lassen** | 015-080-07- | 15 37N 09E (M) | 40 |
| **Lassen** | 015-080-07- | 22 37N 09E (M) | 280 |
| **Lassen** | 015-110-02- | 29 37N 09E (M) | 40 |
| **Lassen** | 015-110-05- | 28 37N 09E (M) | 80 |
| **Lassen** | 015-110-07- | 28 37N 09E (M) | 120 |
| **Lassen** | 015-120-01- | 27 37N 09E (M) | 40 |
| **Lassen** | 015-140-01- | 03 37N 09E (M) | 120 |
| **Lassen** | 015-140-37- | 10 37N 09E (M) | 40 |
| **Lassen** | 017-010-06- | 05 37N 10E (M) | 120 |
| **Lassen** | 017-010-16- | 09 37N 10E (M) | 280 |
| **Lassen** | 017-020-07- | 01 37N 10E (M) | 80 |
| **Lassen** | 017-020-12- | 12 37N 10E (M) | 240 |
| **Lassen** | 017-020-14- | 01 37N 10E (M) | 40 |
| **Lassen** | 017-020-14- | 02 37N 10E (M) | 320 |
| **Lassen** | 017-020-14- | 03 37N 10E (M) | 518 |
| **Lassen** | 017-020-14- | 10 37N 10E (M) | 560 |
| **Lassen** | 017-020-14- | 11 37N 10E (M) | 120 |
| **Lassen** | 017-050-19- | 16 37N 10E (M) | 640 |
| **Lassen** | 017-050-19- | 17 37N 10E (M) | 80 |
| **Lassen** | 017-050-19- | 20 37N 10E (M) | 40 |
| **Lassen** | 017-050-19- | 21 37N 10E (M) | 248 |
| **Lassen** | 017-060-13- | 14 37N 10E (M) | 80 |
| **Lassen** | 017-060-13- | 15 37N 10E (M) | 636 |
| **Lassen** | 025-120-14- | 31 36N 07E (M) | 18.43 |
| **Lassen** | 025-120-15- | 31 36N 07E (M) | 83.04 |
| **Lassen** | 029-020-19- | 10 36N 10E (M) | 159.82 |
| **Lassen** | 029-020-21- | 10 36N 10E (M) | 0.18 |
| **Lassen** | 037-040-03- | 08 35N 07E (M) | 43.08 |
| **Lassen** | 037-040-09- | 16 35N 07E (M) | 580.53 |
| **Lassen** | 037-040-16- | 08 35N 07E (M) | 2.6 |
| **Lassen** | 037-050-05- | 15 35N 07E (M) | 62.21 |
| **Lassen** | 037-050-22- | 23 35N 07E (M) | 40 |
| **Lassen** | 037-050-22- | 24 35N 07E (M) | 200 |

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| **Lassen** | 037-110-04- | 25 35N 07E (M) | 480 |
| **Lassen** | 037-110-08- | 36 35N 07E (M) | 320 |
| **Lassen** | 039-080-06- | 26 35N 09E (M) | 40 |
| **Lassen** | 039-080-06- | 27 35N 09E (M) | 40 |
| **Lassen** | 039-080-06- | 35 35N 09E (M) | 320 |
| **Lassen** | 049-080-05- | 16 34N 07E (M) | 480 |
| **Lassen** | 049-080-10- | 21 34N 07E (M) | 320 |
| **Lassen** | 049-080-12- | 19 34N 07E (M) | 160 |
| **Lassen** | 049-080-12- | 20 34N 07E (M) | 320 |
| **Lassen** | 049-080-15- | 19 34N 07E (M) | 120 |
| **Lassen** | 049-080-16- | 17 34N 07E (M) | 160 |
| **Lassen** | 049-080-16- | 19 34N 07E (M) | 40 |
| **Lassen** | 049-080-16- | 20 34N 07E (M) | 240 |
| **Lassen** | 049-080-19- | 17 34N 07E (M) | 40 |
| **Lassen** | 049-080-20- | 16 34N 07E (M) | 40 |
| **Lassen** | 049-080-20- | 17 34N 07E (M) | 280 |
| **Lassen** | 049-090-01- | 15 34N 07E (M) | 80 |
| **Lassen** | 049-090-02- | 15 34N 07E (M) | 560 |
| **Lassen** | 049-090-02- | 22 34N 07E (M) | 80 |
| **Lassen** | 049-090-03- | 14 34N 07E (M) | 320 |
| **Lassen** | 049-090-08- | 23 34N 07E (M) | 40 |
| **Lassen** | 049-090-09- | 23 34N 07E (M) | 360 |
| **Lassen** | 049-090-10- | 23 34N 07E (M) | 80 |
| **Lassen** | 049-090-11- | 23 34N 07E (M) | 160 |
| **Lassen** | 049-090-14- | 22 34N 07E (M) | 80 |
| **Lassen** | 049-120-01- | 30 34N 07E (M) | 40 |
| **Lassen** | 049-120-02- | 30 34N 07E (M) | 360 |
| **Lassen** | 049-120-02- | 31 34N 07E (M) | 40 |
| **Lassen** | 049-120-03- | 29 34N 07E (M) | 320 |
| **Lassen** | 049-120-07- | 30 34N 07E (M) | 40 |
| **Lassen** | 049-120-07- | 31 34N 07E (M) | 40 |
| **Lassen** | 049-120-08- | 31 34N 07E (M) | 40 |
| **Lassen** | 049-120-09- | 31 34N 07E (M) | 80 |
| **Lassen** | 049-120-10- | 32 34N 07E (M) | 40 |
| **Lassen** | 049-120-12- | 32 34N 07E (M) | 40 |
| **Lassen** | 049-120-13- | 32 34N 07E (M) | 40 |
| **Lassen** | 049-120-16- | 33 34N 07E (M) | 40 |
| **Lassen** | 049-120-17- | 33 34N 07E (M) | 40 |
| **Lassen** | 049-120-20- | 32 34N 07E (M) | 80 |
| **Lassen** | 049-120-21- | 32 34N 07E (M) | 80 |
| **Lassen** | 049-120-23- | 31 34N 07E (M) | 120 |
| **Lassen** | 049-120-24- | 32 34N 07E (M) | 120 |
| **Lassen** | 049-130-02- | 26 34N 07E (M) | 120 |
| **Lassen** | 049-130-07- | 25 34N 07E (M) | 40 |

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| **Lassen** | 049-130-14- | 27 34N 07E (M) | 40 |
| **Lassen** | 049-130-14- | 34 34N 07E (M) | 160 |
| **Lassen** | 049-130-15- | 35 34N 07E (M) | 560 |
| **Lassen** | 049-130-16- | 26 34N 07E (M) | 520 |
| **Lassen** | 049-130-17- | 25 34N 07E (M) | 280 |
| **Lassen** | 049-130-18- | 36 34N 07E (M) | 640 |
| **Lassen** | 049-130-20- | 25 34N 07E (M) | 40 |
| **Lassen** | 049-130-22- | 34 34N 07E (M) | 120 |
| **Lassen** | 049-130-22- | 35 34N 07E (M) | 80 |
| **Lassen** | 051-030-03- | 05 34N 09E (M) | 118.86 |
| **Lassen** | 051-030-10- | 08 34N 09E (M) | 400 |
| **Lassen** | 051-030-15- | 07 34N 09E (M) | 284.72 |
| **Lassen** | 051-030-16- | 04 34N 09E (M) | 358.92 |
| **Lassen** | 051-030-17- | 09 34N 09E (M) | 360 |
| **Lassen** | 051-040-10- | 11 34N 09E (M) | 640 |
| **Lassen** | 051-040-11- | 12 34N 09E (M) | 120 |
| **Lassen** | 051-040-12- | 12 34N 09E (M) | 120 |
| **Lassen** | 051-040-13- | 12 34N 09E (M) | 280 |
| **Lassen** | 051-040-15- | 02 34N 09E (M) | 200 |
| **Lassen** | 051-040-16- | 02 34N 09E (M) | 398.3 |
| **Lassen** | 051-040-18- | 03 34N 09E (M) | 400 |
| **Lassen** | 051-040-19- | 10 34N 09E (M) | 640 |
| **Lassen** | 051-050-02- | 18 34N 08E (M) | 40 |
| **Lassen** | 051-050-03- | 17 34N 08E (M) | 40 |
| **Lassen** | 051-050-03- | 18 34N 08E (M) | 240 |
| **Lassen** | 051-050-07- | 17 34N 08E (M) | 240 |
| **Lassen** | 051-050-09- | 17 34N 08E (M) | 40 |
| **Lassen** | 051-050-14- | 20 34N 08E (M) | 560 |
| **Lassen** | 051-050-15- | 20 34N 08E (M) | 40 |
| **Lassen** | 051-050-16- | 20 34N 08E (M) | 40 |
| **Lassen** | 051-050-18- | 21 34N 08E (M) | 600 |
| **Lassen** | 051-050-20- | 17 34N 08E (M) | 160 |
| **Lassen** | 051-050-21- | 19 34N 08E (M) | 320 |
| **Lassen** | 051-060-09- | 22 34N 08E (M) | 40 |
| **Lassen** | 051-070-02- | 17 34N 09E (M) | 240 |
| **Lassen** | 051-070-02- | 18 34N 09E (M) | 360 |
| **Lassen** | 051-070-04- | 16 34N 09E (M) | 640 |
| **Lassen** | 051-070-12- | 19 34N 09E (M) | 450.15 |
| **Lassen** | 051-070-12- | 20 34N 09E (M) | 80 |
| **Lassen** | 051-070-13- | 20 34N 09E (M) | 40 |
| **Lassen** | 051-070-14- | 21 34N 09E (M) | 640 |
| **Lassen** | 051-070-16- | 20 34N 09E (M) | 40 |
| **Lassen** | 051-080-03- | 15 34N 09E (M) | 80 |
| **Lassen** | 051-080-04- | 14 34N 09E (M) | 640 |

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| **Lassen** | 051-080-05- | 13 34N 09E (M) | 640 |
| **Lassen** | 051-080-06- | 22 34N 09E (M) | 40 |
| **Lassen** | 051-080-08- | 22 34N 09E (M) | 280 |
| **Lassen** | 051-080-09- | 22 34N 09E (M) | 240 |
| **Lassen** | 051-080-09- | 23 34N 09E (M) | 160 |
| **Lassen** | 051-080-10- | 23 34N 09E (M) | 40 |
| **Lassen** | 051-080-11- | 23 34N 09E (M) | 400 |
| **Lassen** | 051-080-12- | 24 34N 09E (M) | 640 |
| **Lassen** | 051-080-13- | 22 34N 09E (M) | 80 |
| **Lassen** | 051-080-14- | 23 34N 09E (M) | 40 |
| **Lassen** | 051-080-15- | 15 34N 09E (M) | 560 |
| **Lassen** | 051-090-02- | 30 34N 08E (M) | 240 |
| **Lassen** | 051-090-06- | 29 34N 08E (M) | 40 |
| **Lassen** | 051-090-07- | 29 34N 08E (M) | 560 |
| **Lassen** | 051-090-08- | 29 34N 08E (M) | 40 |
| **Lassen** | 051-090-09- | 28 34N 08E (M) | 520 |
| **Lassen** | 051-090-10- | 28 34N 08E (M) | 40 |
| **Lassen** | 051-090-12- | 31 34N 08E (M) | 647.5 |
| **Lassen** | 051-090-13- | 32 34N 08E (M) | 640 |
| **Lassen** | 051-090-14- | 33 34N 08E (M) | 120 |
| **Lassen** | 051-090-15- | 33 34N 08E (M) | 520 |
| **Lassen** | 051-090-16- | 28 34N 08E (M) | 40 |
| **Lassen** | 051-090-17- | 28 34N 08E (M) | 40 |
| **Lassen** | 051-090-18- | 30 34N 08E (M) | 159.05 |
| **Lassen** | 051-100-01- | 27 34N 08E (M) | 400 |
| **Lassen** | 051-100-02- | 27 34N 08E (M) | 40 |
| **Lassen** | 051-100-04- | 25 34N 08E (M) | 40 |
| **Lassen** | 051-100-04- | 26 34N 08E (M) | 360 |
| **Lassen** | 051-100-05- | 25 34N 08E (M) | 40 |
| **Lassen** | 051-100-07- | 25 34N 08E (M) | 40 |
| **Lassen** | 051-100-08- | 34 34N 08E (M) | 640 |
| **Lassen** | 051-100-09- | 35 34N 08E (M) | 80 |
| **Lassen** | 051-100-10- | 35 34N 08E (M) | 560 |
| **Lassen** | 051-100-11- | 36 34N 08E (M) | 640 |
| **Lassen** | 051-100-13- | 25 34N 08E (M) | 240 |
| **Lassen** | 051-100-15- | 26 34N 08E (M) | 120 |
| **Lassen** | 051-110-01- | 30 34N 09E (M) | 44.95 |
| **Lassen** | 051-110-02- | 30 34N 09E (M) | 80 |
| **Lassen** | 051-110-03- | 29 34N 09E (M) | 40 |
| **Lassen** | 051-110-03- | 30 34N 09E (M) | 415.51 |
| **Lassen** | 051-110-04- | 29 34N 09E (M) | 160 |
| **Lassen** | 051-110-05- | 29 34N 09E (M) | 440 |
| **Lassen** | 051-110-05- | 30 34N 09E (M) | 120 |
| **Lassen** | 051-110-06- | 28 34N 09E (M) | 640 |

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| **Lassen** | 051-110-07- | 31 34N 09E (M) | 659.4 |
| **Lassen** | 051-110-11- | 32 34N 09E (M) | 640 |
| **Lassen** | 051-110-12- | 33 34N 09E (M) | 640 |
| **Lassen** | 051-120-01- | 27 34N 09E (M) | 40 |
| **Lassen** | 051-120-03- | 27 34N 09E (M) | 80 |
| **Lassen** | 051-120-04- | 27 34N 09E (M) | 440 |
| **Lassen** | 051-120-05- | 26 34N 09E (M) | 600 |
| **Lassen** | 051-120-06- | 25 34N 09E (M) | 520 |
| **Lassen** | 051-120-07- | 25 34N 09E (M) | 40 |
| **Lassen** | 051-120-08- | 25 34N 09E (M) | 40 |
| **Lassen** | 051-120-09- | 34 34N 09E (M) | 640 |
| **Lassen** | 051-120-11- | 35 34N 09E (M) | 480 |
| **Lassen** | 051-120-15- | 27 34N 09E (M) | 80 |
| **Lassen** | 051-120-16- | 26 34N 09E (M) | 40 |
| **Lassen** | 053-010-09- | 07 34N 10E (M) | 392.15 |
| **Lassen** | 053-010-09- | 08 34N 10E (M) | 80 |
| **Lassen** | 053-010-12- | 08 34N 10E (M) | 80 |
| **Lassen** | 053-050-02- | 18 34N 10E (M) | 514.52 |
| **Lassen** | 053-050-03- | 17 34N 10E (M) | 120 |
| **Lassen** | 053-050-06- | 17 34N 10E (M) | 40 |
| **Lassen** | 053-050-07- | 17 34N 10E (M) | 240 |
| **Lassen** | 053-050-12- | 19 34N 10E (M) | 515.88 |
| **Lassen** | 053-050-14- | 20 34N 10E (M) | 40 |
| **Lassen** | 053-050-19- | 20 34N 10E (M) | 160 |
| **Lassen** | 053-070-09- | 19 34N 11E (M) | 80.63 |
| **Lassen** | 053-090-01- | 29 34N 10E (M) | 160 |
| **Lassen** | 053-090-01- | 30 34N 10E (M) | 397.89 |
| **Lassen** | 053-090-07- | 31 34N 10E (M) | 392.23 |
| **Lassen** | 053-090-09- | 31 34N 10E (M) | 120 |
| **Lassen** | 053-090-09- | 32 34N 10E (M) | 80 |
| **Lassen** | 053-090-11- | 29 34N 10E (M) | 120 |
| **Lassen** | 053-090-11- | 32 34N 10E (M) | 480 |
| **Lassen** | 053-090-13- | 28 34N 10E (M) | 160 |
| **Lassen** | 053-090-13- | 33 34N 10E (M) | 480 |
| **Lassen** | 053-110-01- | 30 34N 11E (M) | 80.6 |
| **Lassen** | 055-050-12- | 21 34N 12E (M) | 200 |
| **Lassen** | 055-060-15- | 22 34N 12E (M) | 320 |
| **Lassen** | 055-090-19- | 28 34N 12E (M) | 480 |
| **Lassen** | 055-090-19- | 33 34N 12E (M) | 320 |
| **Lassen** | 055-100-03- | 27 34N 12E (M) | 160 |
| **Lassen** | 055-100-03- | 34 34N 12E (M) | 40 |
| **Lassen** | 055-100-12- | 27 34N 12E (M) | 200 |
| **Lassen** | 055-100-13- | 34 34N 12E (M) | 80 |
| **Lassen** | 061-040-02- | 05 33N 07E (M) | 315.91 |

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| **Lassen** | 061-040-04- | 04 33N 07E (M) | 639.48 |
| **Lassen** | 061-040-09- | 09 33N 07E (M) | 40 |
| **Lassen** | 061-040-10- | 09 33N 07E (M) | 160 |
| **Lassen** | 061-040-12- | 05 33N 07E (M) | 309.94 |
| **Lassen** | 061-040-12- | 06 33N 07E (M) | 160 |
| **Lassen** | 061-040-12- | 07 33N 07E (M) | 640 |
| **Lassen** | 061-040-12- | 08 33N 07E (M) | 638.36 |
| **Lassen** | 061-040-12- | 09 33N 07E (M) | 440 |
| **Lassen** | 061-040-14- | 06 33N 07E (M) | 157.89 |
| **Lassen** | 061-080-01- | 18 33N 07E (M) | 148.2 |
| **Lassen** | 061-080-02- | 18 33N 07E (M) | 1.45 |
| **Lassen** | 061-080-04- | 18 33N 07E (M) | 50.15 |
| **Lassen** | 061-080-09- | 19 33N 07E (M) | 32 |
| **Lassen** | 061-080-09- | 20 33N 07E (M) | 8.66 |
| **Lassen** | 061-080-14- | 18 33N 07E (M) | 9 |
| **Lassen** | 061-080-16- | 16 33N 07E (M) | 640 |
| **Lassen** | 061-080-16- | 17 33N 07E (M) | 640 |
| **Lassen** | 061-080-16- | 18 33N 07E (M) | 390 |
| **Lassen** | 061-080-16- | 19 33N 07E (M) | 40 |
| **Lassen** | 061-080-16- | 20 33N 07E (M) | 230 |
| **Lassen** | 061-110-07- | 36 33N 06E (M) | 80 |
| **Lassen** | 061-110-08- | 36 33N 06E (M) | 40 |
| **Lassen** | 061-120-08- | 32 33N 07E (M) | 80 |
| **Lassen** | 061-120-10- | 33 33N 07E (M) | 79 |
| **Lassen** | 061-130-04- | 25 33N 07E (M) | 160 |
| **Lassen** | 061-130-04- | 26 33N 07E (M) | 320 |
| **Lassen** | 061-130-04- | 35 33N 07E (M) | 160 |
| **Lassen** | 061-130-07- | 35 33N 07E (M) | 40 |
| **Lassen** | 061-130-08- | 26 33N 07E (M) | 80 |
| **Lassen** | 061-130-08- | 35 33N 07E (M) | 120 |
| **Lassen** | 061-130-11- | 36 33N 07E (M) | 640 |
| **Lassen** | 061-130-12- | 35 33N 07E (M) | 320 |
| **Lassen** | 073-030-04- | 01 32N 06E (M) | 39.92 |
| **Lassen** | 073-030-06- | 01 32N 06E (M) | 120 |
| **Lassen** | 073-030-15- | 12 32N 06E (M) | 33.2 |
| **Lassen** | 073-030-16- | 12 32N 06E (M) | 1 |
| **Lassen** | 073-030-24- | 11 32N 06E (M) | 10 |
| **Lassen** | 073-030-24- | 12 32N 06E (M) | 14.76 |
| **Lassen** | 073-030-25- | 11 32N 06E (M) | 23.76 |
| **Lassen** | 073-030-25- | 12 32N 06E (M) | 20 |
| **Lassen** | 073-040-02- | 06 32N 07E (M) | 80 |
| **Lassen** | 073-040-04- | 05 32N 07E (M) | 79.59 |
| **Lassen** | 073-040-10- | 07 32N 07E (M) | 356 |
| **Lassen** | 073-040-28- | 05 32N 07E (M) | 80 |

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| **Lassen** | 073-040-28- | 07 32N 07E (M) | 40 |
| **Lassen** | 073-040-28- | 08 32N 07E (M) | 80 |
| **Lassen** | 073-060-01- | 16 32N 06E (M) | 640 |
| **Lassen** | 073-070-09- | 13 32N 06E (M) | 40 |
| **Lassen** | 073-070-10- | 13 32N 06E (M) | 39 |
| **Lassen** | 073-070-11- | 13 32N 06E (M) | 39 |
| **Lassen** | 073-070-13- | 13 32N 06E (M) | 200 |
| **Lassen** | 073-070-14- | 13 32N 06E (M) | 80 |
| **Lassen** | 073-070-14- | 24 32N 06E (M) | 40 |
| **Lassen** | 073-070-19- | 23 32N 06E (M) | 40 |
| **Lassen** | 073-070-19- | 24 32N 06E (M) | 80 |
| **Lassen** | 073-070-20- | 24 32N 06E (M) | 40 |
| **Lassen** | 073-070-21- | 24 32N 06E (M) | 80 |
| **Lassen** | 073-070-25- | 24 32N 06E (M) | 40 |
| **Lassen** | 073-070-26- | 24 32N 06E (M) | 40 |
| **Lassen** | 073-070-31- | 13 32N 06E (M) | 160 |
| **Lassen** | 073-070-31- | 14 32N 06E (M) | 40 |
| **Lassen** | 073-070-32- | 13 32N 06E (M) | 40 |
| **Lassen** | 073-070-32- | 14 32N 06E (M) | 120 |
| **Lassen** | 073-070-34- | 13 32N 06E (M) | 40 |
| **Lassen** | 073-070-34- | 14 32N 06E (M) | 40 |
| **Lassen** | 073-070-36- | 24 32N 06E (M) | 40 |
| **Lassen** | 073-070-38- | 24 32N 06E (M) | 200 |
| **Lassen** | 073-080-02- | 18 32N 07E (M) | 31 |
| **Lassen** | 073-080-09- | 19 32N 07E (M) | 318.24 |
| **Lassen** | 073-080-09- | 20 32N 07E (M) | 320 |
| **Lassen** | 073-080-10- | 19 32N 07E (M) | 317.76 |
| **Lassen** | 073-080-10- | 20 32N 07E (M) | 320 |
| **Lassen** | 073-080-13- | 21 32N 07E (M) | 320 |
| **Lassen** | 073-080-15- | 18 32N 07E (M) | 594 |
| **Lassen** | 073-080-16- | 17 32N 07E (M) | 480 |
| **Lassen** | 073-110-05- | 25 32N 06E (M) | 120 |
| **Lassen** | 073-110-08- | 36 32N 06E (M) | 40 |
| **Lassen** | 073-110-11- | 25 32N 06E (M) | 120 |
| **Lassen** | 073-120-01- | 30 32N 07E (M) | 38.4 |
| **Lassen** | 073-120-02- | 30 32N 07E (M) | 119 |
| **Lassen** | 073-120-12- | 28 32N 07E (M) | 160 |
| **Lassen** | 073-120-12- | 29 32N 07E (M) | 440 |
| **Lassen** | 077-110-03- | 28 32N 11E (M) | 80 |
| **Lassen** | 077-110-03- | 33 32N 11E (M) | 440 |
| **Lassen** | 077-120-09- | 34 32N 11E (M) | 600 |
| **Lassen** | 077-120-10- | 35 32N 11E (M) | 240 |
| **Lassen** | 077-120-16- | 34 32N 11E (M) | 40 |
| **Lassen** | 077-120-16- | 35 32N 11E (M) | 40 |

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| **Lassen** | 077-120-20- | 27 32N 11E (M) | 40 |
| **Lassen** | 077-120-24- | 27 32N 11E (M) | 440 |
| **Lassen** | 077-120-27- | 25 32N 11E (M) | 80 |
| **Lassen** | 077-120-27- | 36 32N 11E (M) | 440 |
| **Lassen** | 085-120-07- | 36 31N 07E (M) | 640 |
| **Lassen** | 087-120-18- | 33 31N 09E (M) | 40 |
| **Lassen** | 087-130-06- | 34 31N 09E (M) | 40 |
| **Lassen** | 087-130-07- | 34 31N 09E (M) | 40 |
| **Lassen** | 089-030-02- | 04 31N 11E (M) | 41.2 |
| **Lassen** | 089-030-03- | 04 31N 11E (M) | 481.2 |
| **Lassen** | 089-030-03- | 05 31N 11E (M) | 120 |
| **Lassen** | 089-030-04- | 08 31N 11E (M) | 160 |
| **Lassen** | 089-030-09- | 09 31N 11E (M) | 600 |
| **Lassen** | 089-030-15- | 08 31N 11E (M) | 20 |
| **Lassen** | 089-070-01- | 02 31N 11E (M) | 40.08 |
| **Lassen** | 089-070-01- | 03 31N 11E (M) | 482.2 |
| **Lassen** | 089-070-02- | 03 31N 11E (M) | 80 |
| **Lassen** | 089-070-05- | 01 31N 11E (M) | 41.16 |
| **Lassen** | 089-070-05- | 02 31N 11E (M) | 201.93 |
| **Lassen** | 089-070-05- | 11 31N 11E (M) | 40 |
| **Lassen** | 089-070-08- | 01 31N 11E (M) | 40 |
| **Lassen** | 089-070-11- | 10 31N 11E (M) | 600 |
| **Lassen** | 089-070-12- | 10 31N 11E (M) | 40 |
| **Lassen** | 089-070-13- | 11 31N 11E (M) | 280 |
| **Lassen** | 089-070-16- | 12 31N 11E (M) | 120 |
| **Lassen** | 089-090-03- | 14 31N 10E (M) | 70 |
| **Lassen** | 089-100-10- | 16 31N 11E (M) | 480 |
| **Lassen** | 089-100-12- | 20 31N 11E (M) | 80 |
| **Lassen** | 089-100-13- | 21 31N 11E (M) | 520 |
| **Lassen** | 089-100-21- | 18 31N 11E (M) | 160 |
| **Lassen** | 089-100-21- | 19 31N 11E (M) | 317.37 |
| **Lassen** | 089-100-23- | 17 31N 11E (M) | 240 |
| **Lassen** | 089-100-23- | 20 31N 11E (M) | 80 |
| **Lassen** | 089-100-28- | 17 31N 11E (M) | 40 |
| **Lassen** | 089-100-30- | 18 31N 11E (M) | 120 |
| **Lassen** | 089-110-01- | 15 31N 11E (M) | 600 |
| **Lassen** | 089-110-02- | 13 31N 11E (M) | 120 |
| **Lassen** | 089-110-02- | 14 31N 11E (M) | 480 |
| **Lassen** | 089-110-02- | 24 31N 11E (M) | 40 |
| **Lassen** | 089-110-03- | 14 31N 11E (M) | 120 |
| **Lassen** | 089-110-03- | 15 31N 11E (M) | 40 |
| **Lassen** | 089-110-06- | 13 31N 11E (M) | 40 |
| **Lassen** | 089-110-07- | 22 31N 11E (M) | 640 |
| **Lassen** | 089-110-08- | 23 31N 11E (M) | 600 |

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| **Lassen** | 089-110-08- | 24 31N 11E (M) | 40 |
| **Lassen** | 089-110-09- | 24 31N 11E (M) | 40 |
| **Lassen** | 089-110-11- | 24 31N 11E (M) | 240 |
| **Lassen** | 089-110-12- | 24 31N 11E (M) | 40 |
| **Lassen** | 089-110-13- | 23 31N 11E (M) | 40 |
| **Lassen** | 089-110-14- | 24 31N 11E (M) | 240 |
| **Lassen** | 089-120-12- | 32 31N 10E (M) | 160 |
| **Lassen** | 089-120-12- | 33 31N 10E (M) | 80 |
| **Lassen** | 089-140-05- | 28 31N 11E (M) | 600 |
| **Lassen** | 089-140-28- | 33 31N 11E (M) | 25.16 |
| **Lassen** | 089-140-29- | 33 31N 11E (M) | 609.36 |
| **Lassen** | 089-150-01- | 27 31N 11E (M) | 640 |
| **Lassen** | 089-150-02- | 26 31N 11E (M) | 40 |
| **Lassen** | 089-150-03- | 26 31N 11E (M) | 560 |
| **Lassen** | 089-150-05- | 25 31N 11E (M) | 160 |
| **Lassen** | 089-150-07- | 34 31N 11E (M) | 640 |
| **Lassen** | 089-150-08- | 35 31N 11E (M) | 636.91 |
| **Lassen** | 089-150-09- | 36 31N 11E (M) | 520 |
| **Lassen** | 091-050-06- | 19 31N 12E (M) | 80 |
| **Lassen** | 091-050-06- | 20 31N 12E (M) | 140 |
| **Lassen** | 091-050-14- | 19 31N 12E (M) | 136.08 |
| **Lassen** | 091-060-11- | 22 31N 12E (M) | 120 |
| **Lassen** | 091-090-04- | 28 31N 12E (M) | 600 |
| **Lassen** | 091-090-06- | 31 31N 12E (M) | 198.25 |
| **Lassen** | 091-090-07- | 29 31N 12E (M) | 80 |
| **Lassen** | 091-090-07- | 32 31N 12E (M) | 560 |
| **Lassen** | 091-090-08- | 33 31N 12E (M) | 640 |
| **Lassen** | 091-100-01- | 27 31N 12E (M) | 600 |
| **Lassen** | 091-100-12- | 34 31N 12E (M) | 520 |
| **Lassen** | 091-100-14- | 34 31N 12E (M) | 80 |
| **Lassen** | 091-100-17- | 35 31N 12E (M) | 160 |
| **Lassen** | 091-100-17- | 36 31N 12E (M) | 80 |
| **Lassen** | 091-100-24- | 35 31N 12E (M) | 160 |
| **Lassen** | 099-020-03- | 05 30N 10E (M) | 159.74 |
| **Lassen** | 099-020-04- | 05 30N 10E (M) | 160.1 |
| **Lassen** | 099-020-05- | 05 30N 10E (M) | 160 |
| **Lassen** | 099-020-11- | 09 30N 10E (M) | 160 |
| **Lassen** | 099-020-13- | 09 30N 10E (M) | 280 |
| **Lassen** | 099-020-14- | 09 30N 10E (M) | 80 |
| **Lassen** | 099-020-15- | 04 30N 10E (M) | 160 |
| **Lassen** | 099-020-15- | 09 30N 10E (M) | 120 |
| **Lassen** | 099-020-16- | 06 30N 10E (M) | 139.55 |
| **Lassen** | 099-020-17- | 06 30N 10E (M) | 478.57 |
| **Lassen** | 099-030-12- | 01 30N 10E (M) | 320 |

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| **Lassen** | 099-030-13- | 10 30N 10E (M) | 80 |
| **Lassen** | 099-030-18- | 10 30N 10E (M) | 40 |
| **Lassen** | 099-030-19- | 10 30N 10E (M) | 120 |
| **Lassen** | 099-030-20- | 10 30N 10E (M) | 80 |
| **Lassen** | 099-030-22- | 12 30N 10E (M) | 640 |
| **Lassen** | 099-030-23- | 02 30N 10E (M) | 280 |
| **Lassen** | 099-030-23- | 11 30N 10E (M) | 280 |
| **Lassen** | 099-030-25- | 03 30N 10E (M) | 160 |
| **Lassen** | 099-030-26- | 02 30N 10E (M) | 80 |
| **Lassen** | 099-030-26- | 03 30N 10E (M) | 40 |
| **Lassen** | 099-030-29- | 11 30N 10E (M) | 80 |
| **Lassen** | 099-030-32- | 10 30N 10E (M) | 40 |
| **Lassen** | 099-030-33- | 10 30N 10E (M) | 280 |
| **Lassen** | 099-040-02- | 06 30N 11E (M) | 504.95 |
| **Lassen** | 099-040-03- | 05 30N 11E (M) | 438.08 |
| **Lassen** | 099-040-06- | 07 30N 11E (M) | 627.2 |
| **Lassen** | 099-040-07- | 08 30N 11E (M) | 638.6 |
| **Lassen** | 099-040-11- | 04 30N 11E (M) | 252 |
| **Lassen** | 099-040-12- | 04 30N 11E (M) | 372.37 |
| **Lassen** | 099-040-12- | 09 30N 11E (M) | 183.23 |
| **Lassen** | 099-040-13- | 08 30N 11E (M) | 1.77 |
| **Lassen** | 099-040-13- | 09 30N 11E (M) | 455 |
| **Lassen** | 099-050-01- | 03 30N 11E (M) | 636.76 |
| **Lassen** | 099-050-02- | 02 30N 11E (M) | 637.5 |
| **Lassen** | 099-050-04- | 01 30N 11E (M) | 559.52 |
| **Lassen** | 099-050-05- | 10 30N 11E (M) | 640 |
| **Lassen** | 099-050-07- | 11 30N 11E (M) | 360 |
| **Lassen** | 099-050-08- | 11 30N 11E (M) | 40 |
| **Lassen** | 099-050-09- | 12 30N 11E (M) | 560 |
| **Lassen** | 099-050-10- | 12 30N 11E (M) | 40 |
| **Lassen** | 099-050-11- | 12 30N 11E (M) | 40 |
| **Lassen** | 099-060-03- | 16 30N 10E (M) | 640 |
| **Lassen** | 099-060-09- | 21 30N 10E (M) | 507.4 |
| **Lassen** | 099-060-10- | 21 30N 10E (M) | 32.9 |
| **Lassen** | 099-060-11- | 21 30N 10E (M) | 70.6 |
| **Lassen** | 099-060-12- | 21 30N 10E (M) | 4.6 |
| **Lassen** | 099-070-01- | 15 30N 10E (M) | 80 |
| **Lassen** | 099-070-03- | 14 30N 10E (M) | 40 |
| **Lassen** | 099-070-07- | 13 30N 10E (M) | 320 |
| **Lassen** | 099-070-07- | 24 30N 10E (M) | 160 |
| **Lassen** | 099-070-08- | 22 30N 10E (M) | 614.86 |
| **Lassen** | 099-070-09- | 23 30N 10E (M) | 560 |
| **Lassen** | 099-070-10- | 24 30N 10E (M) | 160 |
| **Lassen** | 099-070-11- | 24 30N 10E (M) | 320 |

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| **Lassen** | 099-070-12- | 22 30N 10E (M) | 0.5 |
| **Lassen** | 099-070-13- | 13 30N 10E (M) | 320 |
| **Lassen** | 099-070-13- | 14 30N 10E (M) | 160 |
| **Lassen** | 099-070-14- | 14 30N 10E (M) | 280 |
| **Lassen** | 099-070-14- | 23 30N 10E (M) | 80 |
| **Lassen** | 099-070-15- | 14 30N 10E (M) | 160 |
| **Lassen** | 099-070-16- | 15 30N 10E (M) | 80 |
| **Lassen** | 099-070-17- | 15 30N 10E (M) | 80 |
| **Lassen** | 099-070-18- | 15 30N 10E (M) | 400 |
| **Lassen** | 099-080-02- | 18 30N 11E (M) | 524 |
| **Lassen** | 099-080-03- | 17 30N 11E (M) | 542.2 |
| **Lassen** | 099-080-04- | 17 30N 11E (M) | 89.3 |
| **Lassen** | 099-080-07- | 20 30N 11E (M) | 75.35 |
| **Lassen** | 099-080-08- | 21 30N 11E (M) | 103.39 |
| **Lassen** | 099-080-09- | 21 30N 11E (M) | 531.4 |
| **Lassen** | 099-080-10- | 16 30N 11E (M) | 636.5 |
| **Lassen** | 099-080-11- | 16 30N 11E (M) | 2 |
| **Lassen** | 099-080-12- | 17 30N 11E (M) | 1.9 |
| **Lassen** | 099-080-13- | 19 30N 11E (M) | 625.55 |
| **Lassen** | 099-080-13- | 20 30N 11E (M) | 564.65 |
| **Lassen** | 099-090-01- | 15 30N 11E (M) | 320 |
| **Lassen** | 099-090-02- | 15 30N 11E (M) | 320 |
| **Lassen** | 099-090-08- | 13 30N 11E (M) | 40 |
| **Lassen** | 099-090-11- | 13 30N 11E (M) | 200 |
| **Lassen** | 099-090-18- | 23 30N 11E (M) | 40 |
| **Lassen** | 099-090-19- | 23 30N 11E (M) | 80 |
| **Lassen** | 099-090-30- | 24 30N 11E (M) | 80 |
| **Lassen** | 099-090-40- | 14 30N 11E (M) | 40 |
| **Lassen** | 099-090-40- | 23 30N 11E (M) | 120 |
| **Lassen** | 099-090-41- | 14 30N 11E (M) | 160 |
| **Lassen** | 099-090-41- | 22 30N 11E (M) | 640 |
| **Lassen** | 099-090-41- | 23 30N 11E (M) | 341.6 |
| **Lassen** | 099-090-41- | 24 30N 11E (M) | 40 |
| **Lassen** | 099-110-01- | 27 30N 10E (M) | 552.05 |
| **Lassen** | 099-110-03- | 27 30N 10E (M) | 1.95 |
| **Lassen** | 099-110-04- | 26 30N 10E (M) | 333.1 |
| **Lassen** | 099-110-05- | 26 30N 10E (M) | 264 |
| **Lassen** | 099-110-09- | 36 30N 10E (M) | 560 |
| **Lassen** | 099-110-11- | 25 30N 10E (M) | 39.89 |
| **Lassen** | 099-110-12- | 25 30N 10E (M) | 268.11 |
| **Lassen** | 099-110-13- | 25 30N 10E (M) | 269.2 |
| **Lassen** | 099-110-14- | 25 30N 10E (M) | 38.8 |
| **Lassen** | 099-120-16- | 32 30N 11E (M) | 2.25 |
| **Lassen** | 099-120-18- | 32 30N 11E (M) | 1 |

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| **Lassen** | 099-120-26- | 28 30N 11E (M) | 440 |
| **Lassen** | 099-120-26- | 29 30N 11E (M) | 640 |
| **Lassen** | 099-120-26- | 30 30N 11E (M) | 630 |
| **Lassen** | 099-120-26- | 31 30N 11E (M) | 350 |
| **Lassen** | 099-120-26- | 32 30N 11E (M) | 164.92 |
| **Lassen** | 099-120-27- | 30 30N 11E (M) | 15 |
| **Lassen** | 099-120-27- | 31 30N 11E (M) | 300 |
| **Lassen** | 099-120-27- | 32 30N 11E (M) | 171.44 |
| **Lassen** | 099-120-28- | 32 30N 11E (M) | 5.2 |
| **Lassen** | 099-120-29- | 32 30N 11E (M) | 57.8 |
| **Lassen** | 099-150-11- | 25 30N 11E (M) | 0.08 |
| **Lassen** | 099-170-07- | 34 30N 11E (M) | 18.16 |
| **Lassen** | 099-260-01- | 27 30N 11E (M) | 131.79 |
| **Lassen** | 099-260-03- | 26 30N 11E (M) | 120 |
| **Lassen** | 099-260-05- | 25 30N 11E (M) | 20 |
| **Lassen** | 099-260-05- | 26 30N 11E (M) | 119.6 |
| **Lassen** | 099-260-06- | 25 30N 11E (M) | 200 |
| **Lassen** | 099-260-06- | 26 30N 11E (M) | 80 |
| **Lassen** | 099-260-09- | 25 30N 11E (M) | 40 |
| **Lassen** | 099-260-22- | 35 30N 11E (M) | 3.1 |
| **Lassen** | 099-260-25- | 34 30N 11E (M) | 40 |
| **Lassen** | 099-260-25- | 35 30N 11E (M) | 125.97 |
| **Lassen** | 099-260-59- | 26 30N 11E (M) | 200 |
| **Lassen** | 099-260-59- | 27 30N 11E (M) | 422.66 |
| **Lassen** | 099-260-59- | 35 30N 11E (M) | 51.1 |
| **Lassen** | 101-010-01- | 06 30N 12E (M) | 614.59 |
| **Lassen** | 101-010-05- | 05 30N 12E (M) | 436.12 |
| **Lassen** | 101-010-06- | 04 30N 12E (M) | 625.3 |
| **Lassen** | 101-010-07- | 09 30N 12E (M) | 600 |
| **Lassen** | 101-010-08- | 09 30N 12E (M) | 40 |
| **Lassen** | 101-010-09- | 08 30N 12E (M) | 560 |
| **Lassen** | 101-010-14- | 07 30N 12E (M) | 395.1 |
| **Lassen** | 101-010-16- | 07 30N 12E (M) | 40 |
| **Lassen** | 101-010-17- | 07 30N 12E (M) | 34.9 |
| **Lassen** | 101-010-18- | 05 30N 12E (M) | 155.99 |
| **Lassen** | 101-020-01- | 03 30N 12E (M) | 615.22 |
| **Lassen** | 101-020-02- | 02 30N 12E (M) | 606.79 |
| **Lassen** | 101-020-04- | 01 30N 12E (M) | 301.09 |
| **Lassen** | 101-020-07- | 12 30N 12E (M) | 40 |
| **Lassen** | 101-020-10- | 11 30N 12E (M) | 40 |
| **Lassen** | 101-020-13- | 10 30N 12E (M) | 40 |
| **Lassen** | 101-020-14- | 10 30N 12E (M) | 40 |
| **Lassen** | 101-020-15- | 10 30N 12E (M) | 40 |
| **Lassen** | 101-020-18- | 01 30N 12E (M) | 160 |

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| **Lassen** | 101-020-18- | 12 30N 12E (M) | 80 |
| **Lassen** | 101-020-19- | 10 30N 12E (M) | 200 |
| **Lassen** | 101-020-19- | 11 30N 12E (M) | 120 |
| **Lassen** | 101-030-03- | 06 30N 13E (M) | 139.3 |
| **Lassen** | 101-050-23- | 19 30N 12E (M) | 148.3 |
| **Lassen** | 101-050-42- | 17 30N 12E (M) | 80 |
| **Lassen** | 101-270-01- | 30 30N 12E (M) | 34.77 |
| **Lassen** | 113-100-16- | 25 29N 09E (M) | 1.27 |
| **Lassen** | 113-100-18- | 35 29N 09E (M) | 109 |
| **Lassen** | 113-100-23- | 25 29N 09E (M) | 138.73 |
| **Lassen** | 113-100-23- | 35 29N 09E (M) | 44.35 |
| **Lassen** | 113-100-23- | 36 29N 09E (M) | 640 |
| **Lassen** | 115-120-25- | 31 29N 10E (M) | 250.97 |
| **Lassen** | 115-120-25- | 32 29N 10E (M) | 40 |
| **Lassen** | 115-120-28- | 29 29N 10E (M) | 40 |
| **Lassen** | 115-120-28- | 30 29N 10E (M) | 80 |
| **Lassen** | 115-120-28- | 31 29N 10E (M) | 120 |
| **Lassen** | 115-120-28- | 32 29N 10E (M) | 400 |
| **Lassen** | 115-130-04- | 36 29N 10E (M) | 640 |
| **Lassen** | 115-130-09- | 26 29N 10E (M) | 80 |
| **Lassen** | 115-130-09- | 35 29N 10E (M) | 240 |
| **Lassen** | 115-200-54- | 05 29N 11E (M) | 175 |
| **Lassen** | 115-200-54- | 06 29N 11E (M) | 441.08 |
| **Lassen** | 123-100-11- | 12 28N 09E (M) | 175.1 |
| **Lassen** | 123-100-18- | 11 28N 09E (M) | 57.4 |
| **Lassen** | 123-100-20- | 11 28N 09E (M) | 217.3 |
| **Lassen** | 123-100-23- | 02 28N 09E (M) | 296.7 |
| **Lassen** | 123-100-25- | 01 28N 09E (M) | 639.7 |
| **Lassen** | 123-100-25- | 02 28N 09E (M) | 183.3 |
| **Lassen** | 123-100-25- | 11 28N 09E (M) | 176.4 |
| **Lassen** | 123-100-25- | 12 28N 09E (M) | 464.9 |
| **Lassen** | 123-110-14- | 11 28N 08E (M) | 10.5 |
| **Lassen** | 123-110-14- | 14 28N 08E (M) | 38.2 |
| **Lassen** | 123-110-15- | 14 28N 08E (M) | 10.4 |
| **Lassen** | 123-110-22- | 14 28N 08E (M) | 40 |
| **Lassen** | 123-110-28- | 23 28N 08E (M) | 160 |
| **Lassen** | 123-110-29- | 14 28N 08E (M) | 30 |
| **Lassen** | 123-110-32- | 14 28N 08E (M) | 120 |
| **Lassen** | 123-110-32- | 23 28N 08E (M) | 320 |
| **Lassen** | 123-130-10- | 13 28N 09E (M) | 82.6 |
| **Lassen** | 123-130-18- | 13 28N 09E (M) | 462.1 |
| **Lassen** | 123-130-18- | 14 28N 09E (M) | 10 |
| **Lassen** | 123-140-07- | 36 28N 08E (M) | 9 |
| **Lassen** | 123-140-13- | 26 28N 08E (M) | 80 |

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| **Lassen** | 123-140-17- | 26 28N 08E (M) | 160 |
| **Lassen** | 123-150-28- | 28 28N 09E (M) | 40 |
| **Lassen** | 123-150-28- | 29 28N 09E (M) | 40 |
| **Lassen** | 123-150-28- | 33 28N 09E (M) | 120 |
| **Lassen** | 123-150-29- | 28 28N 09E (M) | 40 |
| **Lassen** | 123-150-29- | 29 28N 09E (M) | 120 |
| **Lassen** | 123-150-29- | 32 28N 09E (M) | 40 |
| **Lassen** | 123-150-30- | 28 28N 09E (M) | 40 |
| **Lassen** | 123-150-31- | 28 28N 09E (M) | 40 |
| **Lassen** | 123-160-25- | 34 28N 09E (M) | 40 |
| **Lassen** | 123-160-25- | 35 28N 09E (M) | 120 |
| **Lassen** | 127-010-12- | 04 28N 10E (M) | 120 |
| **Lassen** | 127-010-12- | 05 28N 10E (M) | 683.2 |
| **Lassen** | 127-010-12- | 06 28N 10E (M) | 640 |
| **Lassen** | 127-010-12- | 07 28N 10E (M) | 640 |
| **Lassen** | 127-010-12- | 08 28N 10E (M) | 640 |
| **Lassen** | 127-010-12- | 09 28N 10E (M) | 160 |
| **Lassen** | 127-020-03- | 02 28N 10E (M) | 158.6 |
| **Lassen** | 127-020-04- | 01 28N 10E (M) | 520.679 |
| **Lassen** | 127-020-12- | 12 28N 10E (M) | 280 |
| **Lassen** | 127-050-12- | 17 28N 10E (M) | 636 |
| **Lassen** | 127-050-12- | 18 28N 10E (M) | 600 |
| **Lassen** | 127-090-12- | 06 27N 10E (M) | 206.83 |
| **Lassen** | 127-090-12- | 07 27N 10E (M) | 377.5 |
| **Lassen** | 129-020-17- | 12 28N 12E (M) | 160 |
| **Modoc** | 010-090-09- | 21 42N 06E (M) | 240 |
| **Modoc** | 010-100-06- | 22 42N 06E (M) | 120 |
| **Modoc** | 010-100-10- | 24 42N 06E (M) | 40 |
| **Modoc** | 010-100-11- | 14 42N 06E (M) | 80 |
| **Modoc** | 010-100-11- | 15 42N 06E (M) | 80 |
| **Modoc** | 010-100-11- | 22 42N 06E (M) | 520 |
| **Modoc** | 010-100-11- | 23 42N 06E (M) | 480 |
| **Modoc** | 010-110-07- | 31 42N 06E (M) | 120 |
| **Modoc** | 010-110-07- | 32 42N 06E (M) | 200 |
| **Modoc** | 010-110-09- | 32 42N 06E (M) | 40 |
| **Modoc** | 010-110-10- | 32 42N 06E (M) | 40 |
| **Modoc** | 010-110-13- | 33 42N 06E (M) | 80 |
| **Modoc** | 010-110-17- | 28 42N 06E (M) | 320 |
| **Modoc** | 010-110-17- | 33 42N 06E (M) | 430.08 |
| **Modoc** | 010-120-07- | 27 42N 06E (M) | 160 |
| **Modoc** | 010-120-07- | 34 42N 06E (M) | 320 |
| **Modoc** | 010-120-11- | 26 42N 06E (M) | 280 |
| **Modoc** | 010-120-11- | 27 42N 06E (M) | 240 |
| **Modoc** | 010-120-11- | 34 42N 06E (M) | 200 |

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| **Modoc** | 010-120-11- | 35 42N 06E (M) | 360 |
| **Modoc** | 010-120-12- | 25 42N 06E (M) | 320 |
| **Modoc** | 010-120-12- | 26 42N 06E (M) | 360 |
| **Modoc** | 010-120-12- | 27 42N 06E (M) | 240 |
| **Modoc** | 010-120-12- | 34 42N 06E (M) | 120 |
| **Modoc** | 010-120-12- | 35 42N 06E (M) | 280 |
| **Modoc** | 010-120-12- | 36 42N 06E (M) | 640 |
| **Modoc** | 010-130-05- | 07 42N 07E (M) | 80 |
| **Modoc** | 010-130-06- | 08 42N 07E (M) | 40 |
| **Modoc** | 010-130-08- | 08 42N 07E (M) | 160 |
| **Modoc** | 010-130-10- | 09 42N 07E (M) | 80 |
| **Modoc** | 010-140-01- | 03 42N 07E (M) | 162 |
| **Modoc** | 010-140-02- | 03 42N 07E (M) | 484.52 |
| **Modoc** | 010-140-03- | 02 42N 07E (M) | 281.4 |
| **Modoc** | 010-140-07- | 10 42N 07E (M) | 340 |
| **Modoc** | 010-140-08- | 10 42N 07E (M) | 40 |
| **Modoc** | 010-140-10- | 10 42N 07E (M) | 80 |
| **Modoc** | 010-140-11- | 11 42N 07E (M) | 360 |
| **Modoc** | 010-150-01- | 18 42N 07E (M) | 316 |
| **Modoc** | 010-150-09- | 16 42N 07E (M) | 640 |
| **Modoc** | 010-150-09- | 17 42N 07E (M) | 640 |
| **Modoc** | 010-150-09- | 18 42N 07E (M) | 316 |
| **Modoc** | 010-150-09- | 19 42N 07E (M) | 636.24 |
| **Modoc** | 010-150-09- | 20 42N 07E (M) | 640 |
| **Modoc** | 010-150-09- | 21 42N 07E (M) | 640 |
| **Modoc** | 010-160-01- | 15 42N 07E (M) | 220 |
| **Modoc** | 010-160-03- | 15 42N 07E (M) | 40 |
| **Modoc** | 010-160-15- | 24 42N 07E (M) | 520 |
| **Modoc** | 010-170-07- | 28 42N 07E (M) | 640 |
| **Modoc** | 010-170-07- | 29 42N 07E (M) | 640 |
| **Modoc** | 010-170-07- | 30 42N 07E (M) | 637.22 |
| **Modoc** | 010-170-07- | 31 42N 07E (M) | 635 |
| **Modoc** | 010-170-07- | 32 42N 07E (M) | 640 |
| **Modoc** | 010-170-07- | 33 42N 07E (M) | 640 |
| **Modoc** | 010-180-01- | 27 42N 07E (M) | 80 |
| **Modoc** | 010-180-03- | 27 42N 07E (M) | 80 |
| **Modoc** | 010-180-05- | 27 42N 07E (M) | 40 |
| **Modoc** | 010-180-08- | 26 42N 07E (M) | 200 |
| **Modoc** | 010-180-09- | 25 42N 07E (M) | 360 |
| **Modoc** | 010-180-09- | 26 42N 07E (M) | 80 |
| **Modoc** | 010-180-13- | 34 42N 07E (M) | 40 |
| **Modoc** | 010-180-14- | 34 42N 07E (M) | 40 |
| **Modoc** | 010-290-03- | 29 41N 05E (M) | 40 |
| **Modoc** | 010-290-11- | 28 41N 05E (M) | 240 |

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| **Modoc** | 010-290-11- | 29 41N 05E (M) | 440 |
| **Modoc** | 010-290-11- | 30 41N 05E (M) | 479 |
| **Modoc** | 010-290-11- | 31 41N 05E (M) | 639 |
| **Modoc** | 010-290-11- | 32 41N 05E (M) | 640 |
| **Modoc** | 010-290-11- | 33 41N 05E (M) | 640 |
| **Modoc** | 010-300-08- | 25 41N 05E (M) | 320 |
| **Modoc** | 010-300-08- | 26 41N 05E (M) | 320 |
| **Modoc** | 010-300-08- | 27 41N 05E (M) | 320 |
| **Modoc** | 010-300-08- | 34 41N 05E (M) | 640 |
| **Modoc** | 010-300-08- | 35 41N 05E (M) | 640 |
| **Modoc** | 010-300-08- | 36 41N 05E (M) | 640 |
| **Modoc** | 010-310-02- | 05 41N 06E (M) | 81.29 |
| **Modoc** | 010-310-02- | 06 41N 06E (M) | 243 |
| **Modoc** | 010-310-04- | 05 41N 06E (M) | 240 |
| **Modoc** | 010-310-04- | 06 41N 06E (M) | 40 |
| **Modoc** | 010-310-04- | 08 41N 06E (M) | 160 |
| **Modoc** | 010-310-06- | 04 41N 06E (M) | 200 |
| **Modoc** | 010-310-08- | 04 41N 06E (M) | 25.26 |
| **Modoc** | 010-310-10- | 07 41N 06E (M) | 197.2 |
| **Modoc** | 010-310-10- | 08 41N 06E (M) | 40 |
| **Modoc** | 010-310-11- | 04 41N 06E (M) | 3 |
| **Modoc** | 010-310-11- | 05 41N 06E (M) | 227 |
| **Modoc** | 010-310-11- | 08 41N 06E (M) | 210.63 |
| **Modoc** | 010-310-13- | 04 41N 06E (M) | 80 |
| **Modoc** | 010-310-13- | 05 41N 06E (M) | 4 |
| **Modoc** | 010-310-13- | 08 41N 06E (M) | 99 |
| **Modoc** | 010-310-13- | 09 41N 06E (M) | 240 |
| **Modoc** | 010-310-15- | 04 41N 06E (M) | 31.62 |
| **Modoc** | 010-310-15- | 05 41N 06E (M) | 80 |
| **Modoc** | 010-310-16- | 04 41N 06E (M) | 280 |
| **Modoc** | 010-310-16- | 09 41N 06E (M) | 400 |
| **Modoc** | 010-320-10- | 01 41N 06E (M) | 635.5 |
| **Modoc** | 010-320-10- | 02 41N 06E (M) | 476 |
| **Modoc** | 010-320-10- | 03 41N 06E (M) | 238 |
| **Modoc** | 010-320-10- | 12 41N 06E (M) | 640 |
| **Modoc** | 010-320-11- | 02 41N 06E (M) | 160 |
| **Modoc** | 010-320-11- | 03 41N 06E (M) | 400 |
| **Modoc** | 010-320-11- | 10 41N 06E (M) | 640 |
| **Modoc** | 010-320-11- | 11 41N 06E (M) | 640 |
| **Modoc** | 010-330-02- | 18 41N 06E (M) | 240 |
| **Modoc** | 010-330-03- | 17 41N 06E (M) | 408.01 |
| **Modoc** | 010-330-04- | 17 41N 06E (M) | 65.81 |
| **Modoc** | 010-330-08- | 16 41N 06E (M) | 640 |
| **Modoc** | 010-330-12- | 21 41N 06E (M) | 120 |

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| **Modoc** | 010-330-13- | 21 41N 06E (M) | 200 |
| **Modoc** | 010-330-14- | 21 41N 06E (M) | 40 |
| **Modoc** | 010-330-15- | 21 41N 06E (M) | 40 |
| **Modoc** | 010-330-17- | 17 41N 06E (M) | 154 |
| **Modoc** | 010-330-17- | 18 41N 06E (M) | 395 |
| **Modoc** | 010-330-17- | 19 41N 06E (M) | 595 |
| **Modoc** | 010-330-17- | 20 41N 06E (M) | 513 |
| **Modoc** | 010-330-17- | 21 41N 06E (M) | 235.11 |
| **Modoc** | 010-340-02- | 15 41N 06E (M) | 40 |
| **Modoc** | 010-340-04- | 14 41N 06E (M) | 240 |
| **Modoc** | 010-340-05- | 13 41N 06E (M) | 80 |
| **Modoc** | 010-340-11- | 22 41N 06E (M) | 360 |
| **Modoc** | 010-340-12- | 23 41N 06E (M) | 440 |
| **Modoc** | 010-340-18- | 13 41N 06E (M) | 40 |
| **Modoc** | 010-340-18- | 24 41N 06E (M) | 40 |
| **Modoc** | 010-340-28- | 13 41N 06E (M) | 480 |
| **Modoc** | 010-340-28- | 14 41N 06E (M) | 400 |
| **Modoc** | 010-340-28- | 15 41N 06E (M) | 600 |
| **Modoc** | 010-340-28- | 22 41N 06E (M) | 280 |
| **Modoc** | 010-340-28- | 23 41N 06E (M) | 200 |
| **Modoc** | 010-340-28- | 24 41N 06E (M) | 560 |
| **Modoc** | 010-350-05- | 28 41N 06E (M) | 156.67 |
| **Modoc** | 010-350-08- | 28 41N 06E (M) | 1.55 |
| **Modoc** | 010-350-17- | 28 41N 06E (M) | 38.34 |
| **Modoc** | 010-360-01- | 27 41N 06E (M) | 640 |
| **Modoc** | 010-360-02- | 26 41N 06E (M) | 640 |
| **Modoc** | 010-360-03- | 25 41N 06E (M) | 40 |
| **Modoc** | 010-360-04- | 25 41N 06E (M) | 600 |
| **Modoc** | 010-360-05- | 34 41N 06E (M) | 40 |
| **Modoc** | 010-360-06- | 34 41N 06E (M) | 80 |
| **Modoc** | 010-360-07- | 34 41N 06E (M) | 320 |
| **Modoc** | 010-360-08- | 34 41N 06E (M) | 52.52 |
| **Modoc** | 010-360-13- | 35 41N 06E (M) | 640 |
| **Modoc** | 010-360-14- | 36 41N 06E (M) | 640 |
| **Modoc** | 010-370-02- | 06 41N 07E (M) | 37.86 |
| **Modoc** | 010-370-07- | 04 41N 07E (M) | 478.2 |
| **Modoc** | 010-370-14- | 06 41N 07E (M) | 395.34 |
| **Modoc** | 010-370-14- | 07 41N 07E (M) | 395.33 |
| **Modoc** | 010-370-15- | 04 41N 07E (M) | 160 |
| **Modoc** | 010-370-15- | 05 41N 07E (M) | 471.78 |
| **Modoc** | 010-370-15- | 06 41N 07E (M) | 200 |
| **Modoc** | 010-370-15- | 07 41N 07E (M) | 240 |
| **Modoc** | 010-370-15- | 08 41N 07E (M) | 640 |
| **Modoc** | 010-370-15- | 09 41N 07E (M) | 640 |

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| **Modoc** | 010-380-01- | 03 41N 07E (M) | 39.68 |
| **Modoc** | 010-380-14- | 11 41N 07E (M) | 105.26 |
| **Modoc** | 010-380-14- | 12 41N 07E (M) | 120 |
| **Modoc** | 010-380-17- | 03 41N 07E (M) | 80 |
| **Modoc** | 010-380-17- | 10 41N 07E (M) | 119.68 |
| **Modoc** | 010-390-07- | 19 41N 07E (M) | 240 |
| **Modoc** | 010-390-09- | 20 41N 07E (M) | 80 |
| **Modoc** | 010-390-12- | 20 41N 07E (M) | 40 |
| **Modoc** | 010-390-13- | 21 41N 07E (M) | 600 |
| **Modoc** | 010-390-14- | 16 41N 07E (M) | 320 |
| **Modoc** | 010-390-14- | 17 41N 07E (M) | 640 |
| **Modoc** | 010-390-14- | 18 41N 07E (M) | 638.2 |
| **Modoc** | 010-390-14- | 19 41N 07E (M) | 400 |
| **Modoc** | 010-390-14- | 20 41N 07E (M) | 320 |
| **Modoc** | 010-400-05- | 13 41N 07E (M) | 40 |
| **Modoc** | 010-400-05- | 14 41N 07E (M) | 34.44 |
| **Modoc** | 010-400-37- | 15 41N 07E (M) | 200 |
| **Modoc** | 010-400-37- | 22 41N 07E (M) | 640 |
| **Modoc** | 010-410-01- | 30 41N 07E (M) | 559.2 |
| **Modoc** | 010-410-02- | 29 41N 07E (M) | 160 |
| **Modoc** | 010-410-07- | 28 41N 07E (M) | 40 |
| **Modoc** | 010-410-10- | 31 41N 07E (M) | 160 |
| **Modoc** | 010-410-14- | 28 41N 07E (M) | 80 |
| **Modoc** | 010-410-14- | 33 41N 07E (M) | 240 |
| **Modoc** | 010-410-16- | 30 41N 07E (M) | 40 |
| **Modoc** | 010-410-17- | 29 41N 07E (M) | 400 |
| **Modoc** | 010-410-17- | 32 41N 07E (M) | 40 |
| **Modoc** | 010-410-18- | 30 41N 07E (M) | 40 |
| **Modoc** | 010-410-19- | 31 41N 07E (M) | 399.86 |
| **Modoc** | 010-410-19- | 32 41N 07E (M) | 80 |
| **Modoc** | 011-010-12- | 04 40N 05E (M) | 686.5 |
| **Modoc** | 011-010-12- | 09 40N 05E (M) | 633 |
| **Modoc** | 011-010-13- | 05 40N 05E (M) | 696 |
| **Modoc** | 011-010-13- | 06 40N 05E (M) | 680 |
| **Modoc** | 011-010-13- | 07 40N 05E (M) | 445.13 |
| **Modoc** | 011-010-13- | 08 40N 05E (M) | 600 |
| **Modoc** | 011-010-14- | 07 40N 05E (M) | 157.85 |
| **Modoc** | 011-010-15- | 07 40N 05E (M) | 12 |
| **Modoc** | 011-010-15- | 08 40N 05E (M) | 32.58 |
| **Modoc** | 011-020-07- | 01 40N 05E (M) | 580.44 |
| **Modoc** | 011-020-07- | 02 40N 05E (M) | 640 |
| **Modoc** | 011-020-07- | 03 40N 05E (M) | 640 |
| **Modoc** | 011-020-07- | 10 40N 05E (M) | 640 |
| **Modoc** | 011-020-07- | 11 40N 05E (M) | 640 |

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| **Modoc** | 011-020-07- | 12 40N 05E (M) | 580.44 |
| **Modoc** | 011-030-04- | 18 40N 05E (M) | 40 |
| **Modoc** | 011-030-16 -1 | 20 40N 05E (M) | 90 |
| **Modoc** | 011-030-16 -1 | 21 40N 05E (M) | 20 |
| **Modoc** | 011-030-16 -2 | 20 40N 05E (M) | 70 |
| **Modoc** | 011-030-16 -2 | 21 40N 05E (M) | 60 |
| **Modoc** | 011-030-27- | 16 40N 05E (M) | 349.11 |
| **Modoc** | 011-030-28- | 21 40N 05E (M) | 39.19 |
| **Modoc** | 011-030-29- | 21 40N 05E (M) | 278.08 |
| **Modoc** | 011-030-30- | 16 40N 05E (M) | 271.36 |
| **Modoc** | 011-030-31- | 18 40N 05E (M) | 33.23 |
| **Modoc** | 011-030-32- | 17 40N 05E (M) | 61.96 |
| **Modoc** | 011-030-33- | 18 40N 05E (M) | 42.93 |
| **Modoc** | 011-030-34- | 19 40N 05E (M) | 460.11 |
| **Modoc** | 011-030-34- | 20 40N 05E (M) | 30 |
| **Modoc** | 011-030-35- | 18 40N 05E (M) | 531.58 |
| **Modoc** | 011-030-36- | 19 40N 05E (M) | 177.28 |
| **Modoc** | 011-030-36- | 20 40N 05E (M) | 130 |
| **Modoc** | 011-030-37- | 18 40N 05E (M) | 3.35 |
| **Modoc** | 011-030-38- | 18 40N 05E (M) | 2.44 |
| **Modoc** | 011-030-39- | 17 40N 05E (M) | 140.46 |
| **Modoc** | 011-040-19- | 15 40N 05E (M) | 160.3 |
| **Modoc** | 011-040-20- | 15 40N 05E (M) | 160.3 |
| **Modoc** | 011-040-21- | 14 40N 05E (M) | 159.22 |
| **Modoc** | 011-040-22- | 14 40N 05E (M) | 158.74 |
| **Modoc** | 011-040-23- | 13 40N 05E (M) | 175.96 |
| **Modoc** | 011-040-24- | 15 40N 05E (M) | 157.81 |
| **Modoc** | 011-040-25- | 15 40N 05E (M) | 159.24 |
| **Modoc** | 011-040-26- | 14 40N 05E (M) | 151.78 |
| **Modoc** | 011-040-27- | 14 40N 05E (M) | 154.12 |
| **Modoc** | 011-040-28- | 13 40N 05E (M) | 160.73 |
| **Modoc** | 011-040-29- | 24 40N 05E (M) | 12.25 |
| **Modoc** | 011-040-30- | 13 40N 05E (M) | 96.87 |
| **Modoc** | 011-040-31- | 24 40N 05E (M) | 116.6 |
| **Modoc** | 011-040-32- | 22 40N 05E (M) | 158.74 |
| **Modoc** | 011-040-33- | 22 40N 05E (M) | 156.35 |
| **Modoc** | 011-040-34- | 23 40N 05E (M) | 157.97 |
| **Modoc** | 011-040-35- | 23 40N 05E (M) | 158.57 |
| **Modoc** | 011-040-36- | 24 40N 05E (M) | 219.2 |
| **Modoc** | 011-040-37- | 24 40N 05E (M) | 168.73 |
| **Modoc** | 011-040-38- | 22 40N 05E (M) | 160.26 |
| **Modoc** | 011-040-39- | 22 40N 05E (M) | 160.26 |
| **Modoc** | 011-040-40- | 23 40N 05E (M) | 157.52 |
| **Modoc** | 011-040-41- | 23 40N 05E (M) | 156.78 |

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| **Modoc** | 011-040-42- | 13 40N 05E (M) | 95.83 |
| **Modoc** | 011-050-02- | 30 40N 05E (M) | 163.41 |
| **Modoc** | 011-050-04 -1 | 29 40N 05E (M) | 34 |
| **Modoc** | 011-050-04 -2 | 29 40N 05E (M) | 6 |
| **Modoc** | 011-050-15- | 31 40N 05E (M) | 40.56 |
| **Modoc** | 011-050-17- | 31 40N 05E (M) | 40.56 |
| **Modoc** | 011-050-27- | 28 40N 05E (M) | 80 |
| **Modoc** | 011-050-30- | 28 40N 05E (M) | 149.34 |
| **Modoc** | 011-050-31- | 28 40N 05E (M) | 10.6 |
| **Modoc** | 011-050-32- | 28 40N 05E (M) | 2 |
| **Modoc** | 011-050-32- | 29 40N 05E (M) | 448 |
| **Modoc** | 011-050-32- | 30 40N 05E (M) | 461.15 |
| **Modoc** | 011-050-32- | 31 40N 05E (M) | 240 |
| **Modoc** | 011-050-32- | 32 40N 05E (M) | 520 |
| **Modoc** | 011-050-32- | 33 40N 05E (M) | 341 |
| **Modoc** | 011-050-33- | 33 40N 05E (M) | 59 |
| **Modoc** | 011-050-33- | 28 40N 05E (M) | 115 |
| **Modoc** | 011-050-33- | 29 40N 05E (M) | 165.82 |
| **Modoc** | 011-060-11- | 25 40N 05E (M) | 168.18 |
| **Modoc** | 011-060-12- | 25 40N 05E (M) | 180.62 |
| **Modoc** | 011-060-13- | 27 40N 05E (M) | 160 |
| **Modoc** | 011-060-14- | 27 40N 05E (M) | 160 |
| **Modoc** | 011-060-15- | 26 40N 05E (M) | 160 |
| **Modoc** | 011-060-16- | 26 40N 05E (M) | 160 |
| **Modoc** | 011-060-17- | 25 40N 05E (M) | 169.49 |
| **Modoc** | 011-060-18- | 27 40N 05E (M) | 160 |
| **Modoc** | 011-060-19- | 27 40N 05E (M) | 160 |
| **Modoc** | 011-060-20- | 26 40N 05E (M) | 160 |
| **Modoc** | 011-060-21- | 26 40N 05E (M) | 160 |
| **Modoc** | 011-060-22- | 36 40N 05E (M) | 183.04 |
| **Modoc** | 011-060-23 -1 | 36 40N 05E (M) | 81.64 |
| **Modoc** | 011-060-23 -2 | 36 40N 05E (M) | 90 |
| **Modoc** | 011-060-24- | 34 40N 05E (M) | 160 |
| **Modoc** | 011-060-25- | 34 40N 05E (M) | 200 |
| **Modoc** | 011-060-26- | 35 40N 05E (M) | 160 |
| **Modoc** | 011-060-27- | 35 40N 05E (M) | 160 |
| **Modoc** | 011-060-28- | 36 40N 05E (M) | 171.48 |
| **Modoc** | 011-060-29- | 34 40N 05E (M) | 120 |
| **Modoc** | 011-060-30- | 35 40N 05E (M) | 160 |
| **Modoc** | 011-060-31- | 35 40N 05E (M) | 160 |
| **Modoc** | 011-070-07- | 06 40N 06E (M) | 33.93 |
| **Modoc** | 011-070-07- | 07 40N 06E (M) | 334.31 |
| **Modoc** | 011-080-03- | 03 40N 06E (M) | 20.64 |
| **Modoc** | 011-080-13- | 01 40N 06E (M) | 635.44 |

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| **Modoc** | 011-090-23- | 18 40N 06E (M) | 80 |
| **Modoc** | 011-090-24- | 18 40N 06E (M) | 160 |
| **Modoc** | 011-090-25- | 18 40N 06E (M) | 160 |
| **Modoc** | 011-090-26- | 17 40N 06E (M) | 200 |
| **Modoc** | 011-090-27- | 17 40N 06E (M) | 160 |
| **Modoc** | 011-090-28- | 18 40N 06E (M) | 120 |
| **Modoc** | 011-090-28- | 19 40N 06E (M) | 80 |
| **Modoc** | 011-090-29- | 18 40N 06E (M) | 120 |
| **Modoc** | 011-090-29- | 19 40N 06E (M) | 120 |
| **Modoc** | 011-090-30- | 20 40N 06E (M) | 160 |
| **Modoc** | 011-090-31- | 20 40N 06E (M) | 160 |
| **Modoc** | 011-090-32- | 21 40N 06E (M) | 160 |
| **Modoc** | 011-090-33- | 21 40N 06E (M) | 160 |
| **Modoc** | 011-090-34- | 19 40N 06E (M) | 163.3 |
| **Modoc** | 011-090-35- | 19 40N 06E (M) | 187.25 |
| **Modoc** | 011-090-36- | 20 40N 06E (M) | 160 |
| **Modoc** | 011-090-37- | 20 40N 06E (M) | 160 |
| **Modoc** | 011-090-38- | 21 40N 06E (M) | 160 |
| **Modoc** | 011-090-39- | 21 40N 06E (M) | 160 |
| **Modoc** | 011-090-40- | 19 40N 06E (M) | 71.71 |
| **Modoc** | 011-100-40- | 22 40N 06E (M) | 160 |
| **Modoc** | 011-100-41- | 22 40N 06E (M) | 200 |
| **Modoc** | 011-110-47- | 30 40N 06E (M) | 139.82 |
| **Modoc** | 011-110-48- | 30 40N 06E (M) | 153.16 |
| **Modoc** | 011-110-49- | 29 40N 06E (M) | 205.91 |
| **Modoc** | 011-110-50- | 29 40N 06E (M) | 156.64 |
| **Modoc** | 011-110-51- | 28 40N 06E (M) | 159.54 |
| **Modoc** | 011-110-52- | 28 40N 06E (M) | 160.42 |
| **Modoc** | 011-110-53- | 30 40N 06E (M) | 160 |
| **Modoc** | 011-110-54- | 30 40N 06E (M) | 160 |
| **Modoc** | 011-110-54- | 29 40N 06E (M) | 26.46 |
| **Modoc** | 011-110-55- | 29 40N 06E (M) | 80 |
| **Modoc** | 011-110-55- | 32 40N 06E (M) | 120.66 |
| **Modoc** | 011-110-56- | 28 40N 06E (M) | 161.89 |
| **Modoc** | 011-110-57- | 28 40N 06E (M) | 161.89 |
| **Modoc** | 011-110-58 -1 | 31 40N 06E (M) | 283.22 |
| **Modoc** | 011-110-58 -2 | 31 40N 06E (M) | 5 |
| **Modoc** | 011-110-59- | 31 40N 06E (M) | 161.92 |
| **Modoc** | 011-110-59- | 32 40N 06E (M) | 80 |
| **Modoc** | 011-110-60- | 31 40N 06E (M) | 162.24 |
| **Modoc** | 011-110-61- | 32 40N 06E (M) | 159.75 |
| **Modoc** | 011-110-62- | 32 40N 06E (M) | 161.56 |
| **Modoc** | 011-130-01- | 06 40N 07E (M) | 495.56 |
| **Modoc** | 011-130-13- | 05 40N 07E (M) | 194.84 |

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| **Modoc** | 011-130-13- | 06 40N 07E (M) | 120 |
| **Modoc** | 011-130-13- | 07 40N 07E (M) | 160 |
| **Modoc** | 011-130-13- | 08 40N 07E (M) | 480 |
| **Modoc** | 011-130-13- | 09 40N 07E (M) | 40 |
| **Modoc** | 011-150-04- | 17 40N 07E (M) | 320 |
| **Modoc** | 011-250-07- | 04 39N 05E (M) | 79.36 |
| **Modoc** | 011-260-02- | 03 39N 05E (M) | 40.58 |
| **Modoc** | 011-260-07- | 02 39N 05E (M) | 40 |
| **Modoc** | 011-260-21- | 03 39N 05E (M) | 40.67 |
| **Modoc** | 011-260-31- | 02 39N 05E (M) | 200 |
| **Modoc** | 011-260-32- | 02 39N 05E (M) | 160 |
| **Modoc** | 011-260-33- | 01 39N 05E (M) | 160 |
| **Modoc** | 011-260-34- | 01 39N 05E (M) | 160 |
| **Modoc** | 011-260-35- | 01 39N 05E (M) | 160 |
| **Modoc** | 011-260-35- | 02 39N 05E (M) | 40 |
| **Modoc** | 011-260-36- | 01 39N 05E (M) | 160 |
| **Modoc** | 011-300-42- | 25 39N 05E (M) | 420 |
| **Modoc** | 011-310-05- | 05 39N 06E (M) | 80 |
| **Modoc** | 011-310-20- | 04 39N 06E (M) | 161.07 |
| **Modoc** | 011-310-21- | 05 39N 06E (M) | 196.92 |
| **Modoc** | 011-310-22- | 04 39N 06E (M) | 155.21 |
| **Modoc** | 011-310-23- | 06 39N 06E (M) | 246.2 |
| **Modoc** | 011-310-24- | 05 39N 06E (M) | 200 |
| **Modoc** | 011-310-24- | 06 39N 06E (M) | 272.39 |
| **Modoc** | 011-310-25- | 05 39N 06E (M) | 153.73 |
| **Modoc** | 011-330-24- | 19 39N 06E (M) | 200 |
| **Modoc** | 011-330-24- | 20 39N 06E (M) | 120 |
| **Modoc** | 011-340-47- | 13 39N 06E (M) | 160 |
| **Modoc** | 011-340-47- | 24 39N 06E (M) | 480 |
| **Modoc** | 011-350-07- | 28 39N 06E (M) | 560 |
| **Modoc** | 011-350-10- | 30 39N 06E (M) | 470.51 |
| **Modoc** | 011-360-01- | 27 39N 06E (M) | 400 |
| **Modoc** | 011-360-06- | 26 39N 06E (M) | 246.06 |
| **Modoc** | 011-360-21- | 25 39N 06E (M) | 380 |
| **Modoc** | 017-290-10- | 22 41N 09E (M) | 40 |
| **Modoc** | 017-290-10- | 23 41N 09E (M) | 120 |
| **Modoc** | 017-290-12- | 24 41N 09E (M) | 360 |
| **Modoc** | 017-290-14- | 24 41N 09E (M) | 160 |
| **Modoc** | 017-310-06- | 25 41N 09E (M) | 160 |
| **Modoc** | 017-340-01- | 17 41N 10E (M) | 160 |
| **Modoc** | 017-340-01- | 18 41N 10E (M) | 474.4 |
| **Modoc** | 017-340-02- | 18 41N 10E (M) | 40 |
| **Modoc** | 017-340-07- | 17 41N 10E (M) | 160 |
| **Modoc** | 017-340-11- | 19 41N 10E (M) | 595.72 |

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| **Modoc** | 017-340-12- | 19 41N 10E (M) | 40 |
| **Modoc** | 017-340-13- | 20 41N 10E (M) | 320 |
| **Modoc** | 017-340-14- | 20 41N 10E (M) | 320 |
| **Modoc** | 017-340-14- | 21 41N 10E (M) | 320 |
| **Modoc** | 017-350-10- | 22 41N 10E (M) | 80 |
| **Modoc** | 017-350-11- | 22 41N 10E (M) | 145 |
| **Modoc** | 017-360-02- | 29 41N 10E (M) | 80 |
| **Modoc** | 017-360-02- | 30 41N 10E (M) | 400 |
| **Modoc** | 017-360-04- | 30 41N 10E (M) | 39.64 |
| **Modoc** | 017-360-06- | 29 41N 10E (M) | 160 |
| **Modoc** | 017-360-09- | 28 41N 10E (M) | 600 |
| **Modoc** | 017-360-12- | 32 41N 10E (M) | 160 |
| **Modoc** | 017-360-14- | 33 41N 10E (M) | 520 |
| **Modoc** | 017-370-02- | 27 41N 10E (M) | 80 |
| **Modoc** | 017-370-03- | 27 41N 10E (M) | 400 |
| **Modoc** | 017-370-06- | 26 41N 10E (M) | 160 |
| **Modoc** | 017-370-09- | 34 41N 10E (M) | 480 |
| **Modoc** | 017-370-11- | 25 41N 10E (M) | 120 |
| **Modoc** | 017-370-11- | 26 41N 10E (M) | 160 |
| **Modoc** | 017-370-11- | 35 41N 10E (M) | 360 |
| **Modoc** | 017-370-14- | 36 41N 10E (M) | 600 |
| **Modoc** | 018-080-03- | 04 40N 10E (M) | 71.98 |
| **Modoc** | 018-080-04- | 04 40N 10E (M) | 40 |
| **Modoc** | 018-080-06- | 04 40N 10E (M) | 80 |
| **Modoc** | 018-080-08- | 04 40N 10E (M) | 40 |
| **Modoc** | 018-080-09- | 04 40N 10E (M) | 120 |
| **Modoc** | 018-080-15- | 09 40N 10E (M) | 280 |
| **Modoc** | 018-090-01- | 03 40N 10E (M) | 427.68 |
| **Modoc** | 018-090-02- | 03 40N 10E (M) | 40 |
| **Modoc** | 018-090-07- | 10 40N 10E (M) | 280 |
| **Modoc** | 018-100-04- | 16 40N 10E (M) | 80 |
| **Modoc** | 018-100-05- | 16 40N 10E (M) | 160 |
| **Modoc** | 018-100-09- | 20 40N 10E (M) | 120 |
| **Modoc** | 018-110-02- | 15 40N 10E (M) | 440 |
| **Modoc** | 018-110-02- | 22 40N 10E (M) | 80 |
| **Modoc** | 018-110-04- | 14 40N 10E (M) | 400 |
| **Modoc** | 018-110-11- | 23 40N 10E (M) | 40 |
| **Modoc** | 018-110-12- | 23 40N 10E (M) | 40 |
| **Nevada** | 003-280-01- | 15 18N 09E (M) | 2.33 |
| **Nevada** | 003-280-04- | 15 18N 09E (M) | 48.6 |
| **Nevada** | 003-280-20- | 15 18N 09E (M) | 0.64 |
| **Nevada** | 003-330-14- | 01 17N 09E (M) | 48.97 |
| **Nevada** | 003-330-15- | 01 17N 09E (M) | 83.53 |
| **Nevada** | 013-070-01- | 13 19N 11E (M) | 63 |

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| **Nevada** | 013-070-03- | 23 19N 11E (M) | 126 |
| **Nevada** | 013-080-01- | 33 19N 11E (M) | 86 |
| **Nevada** | 013-090-03- | 25 19N 11E (M) | 640 |
| **Nevada** | 013-090-08- | 35 19N 11E (M) | 160 |
| **Nevada** | 013-090-11- | 36 19N 11E (M) | 320 |
| **Nevada** | 013-090-12- | 35 19N 11E (M) | 160 |
| **Nevada** | 013-090-14- | 35 19N 11E (M) | 244 |
| **Nevada** | 013-100-08- | 07 18N 11E (M) | 561 |
| **Nevada** | 013-100-13- | 09 18N 11E (M) | 205.6 |
| **Nevada** | 013-100-14- | 09 18N 11E (M) | 94.7 |
| **Nevada** | 013-180-01- | 03 18N 11E (M) | 31.07 |
| **Nevada** | 013-180-03- | 03 18N 11E (M) | 313.44 |
| **Nevada** | 013-180-04- | 02 18N 11E (M) | 230.96 |
| **Nevada** | 013-180-06- | 01 18N 11E (M) | 637.16 |
| **Nevada** | 013-180-19- | 12 18N 11E (M) | 210.8 |
| **Nevada** | 013-180-20- | 12 18N 11E (M) | 425.7 |
| **Nevada** | 013-220-04- | 17 18N 11E (M) | 118.5 |
| **Nevada** | 013-220-06- | 17 18N 11E (M) | 19.8 |
| **Nevada** | 013-220-09- | 17 18N 11E (M) | 400.9 |
| **Nevada** | 013-220-34- | 19 18N 11E (M) | 302.83 |
| **Nevada** | 013-230-09- | 13 18N 11E (M) | 320 |
| **Nevada** | 013-240-04- | 29 18N 11E (M) | 560 |
| **Nevada** | 013-250-06- | 25 18N 11E (M) | 640 |
| **Nevada** | 013-250-10- | 35 18N 11E (M) | 232.9 |
| **Nevada** | 013-250-11- | 35 18N 11E (M) | 1 |
| **Nevada** | 013-270-01- | 11 19N 12E (M) | 2.3 |
| **Nevada** | 013-280-02- | 17 19N 12E (M) | 640 |
| **Nevada** | 013-280-04- | 19 19N 12E (M) | 640 |
| **Nevada** | 013-280-06- | 21 19N 12E (M) | 640 |
| **Nevada** | 013-280-07- | 16 19N 12E (M) | 318.52 |
| **Nevada** | 013-290-07- | 13 19N 12E (M) | 400 |
| **Nevada** | 013-300-01- | 30 19N 12E (M) | 640 |
| **Nevada** | 013-300-02- | 29 19N 12E (M) | 640 |
| **Nevada** | 013-300-08- | 33 19N 12E (M) | 640 |
| **Nevada** | 013-300-09- | 31 19N 12E (M) | 595 |
| **Nevada** | 013-310-01- | 27 19N 12E (M) | 640 |
| **Nevada** | 013-310-03- | 25 19N 12E (M) | 640 |
| **Nevada** | 013-310-05- | 35 19N 12E (M) | 637 |
| **Nevada** | 013-310-06- | 35 19N 12E (M) | 2.5 |
| **Nevada** | 013-320-01- | 06 18N 12E (M) | 574.94 |
| **Nevada** | 013-320-02- | 06 18N 12E (M) | 52.24 |
| **Nevada** | 013-320-25- | 07 18N 12E (M) | 42.9 |
| **Nevada** | 013-320-26- | 07 18N 12E (M) | 597.9 |
| **Nevada** | 013-330-09- | 01 18N 12E (M) | 640.92 |

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| **Nevada** | 013-340-05- | 19 18N 12E (M) | 575.65 |
| **Nevada** | 013-340-09- | 21 18N 12E (M) | 120 |
| **Nevada** | 013-360-17- | 33 18N 12E (M) | 320 |
| **Nevada** | 013-360-31- | 29 18N 12E (M) | 590 |
| **Nevada** | 013-420-01- | 36 19N 11E (M) | 40.77 |
| **Nevada** | 013-420-02- | 36 19N 11E (M) | 40.72 |
| **Nevada** | 013-420-03- | 36 19N 11E (M) | 40.67 |
| **Nevada** | 013-420-04- | 36 19N 11E (M) | 40.62 |
| **Nevada** | 013-420-05- | 36 19N 11E (M) | 40.57 |
| **Nevada** | 013-420-06- | 36 19N 11E (M) | 40.52 |
| **Nevada** | 013-420-07- | 36 19N 11E (M) | 40.47 |
| **Nevada** | 013-420-08- | 36 19N 11E (M) | 40.43 |
| **Nevada** | 014-160-18- | 23 17N 10E (M) | 310.59 |
| **Nevada** | 014-190-02- | 27 17N 10E (M) | 160 |
| **Nevada** | 014-231-07- | 21 17N 10E (M) | 20.72 |
| **Nevada** | 015-010-09- | 19 19N 13E (M) | 141.32 |
| **Nevada** | 015-010-10- | 19 19N 13E (M) | 99.5 |
| **Nevada** | 015-020-15- | 29 19N 13E (M) | 131.62 |
| **Nevada** | 015-020-16- | 29 19N 13E (M) | 40 |
| **Nevada** | 015-030-09- | 09 18N 13E (M) | 75 |
| **Nevada** | 015-030-10- | 09 18N 13E (M) | 582 |
| **Nevada** | 015-040-01- | 03 18N 13E (M) | 5.5 |
| **Nevada** | 015-040-02- | 03 18N 13E (M) | 30.6 |
| **Nevada** | 015-040-05- | 11 18N 13E (M) | 562 |
| **Nevada** | 015-060-01- | 15 18N 13E (M) | 600 |
| **Nevada** | 015-060-06- | 13 18N 13E (M) | 419 |
| **Nevada** | 015-060-07- | 13 18N 13E (M) | 208 |
| **Nevada** | 015-060-18- | 23 18N 13E (M) | 520 |
| **Nevada** | 015-080-11- | 25 18N 13E (M) | 240 |
| **Nevada** | 015-100-04- | 01 17N 13E (M) | 643.24 |
| **Nevada** | 015-100-08- | 11 17N 13E (M) | 440 |
| **Nevada** | 015-120-01- | 15 17N 13E (M) | 640 |
| **Nevada** | 015-120-05- | 23 17N 13E (M) | 640 |
| **Nevada** | 015-120-06- | 24 17N 13E (M) | 320 |
| **Nevada** | 015-130-04- | 09 18N 14E (M) | 536 |
| **Nevada** | 015-150-03- | 17 18N 14E (M) | 640 |
| **Nevada** | 015-150-07- | 19 18N 14E (M) | 637.84 |
| **Nevada** | 015-150-09- | 21 18N 14E (M) | 645.6 |
| **Nevada** | 015-170-13- | 31 18N 14E (M) | 160 |
| **Nevada** | 015-170-14- | 31 18N 14E (M) | 160 |
| **Nevada** | 015-170-15- | 31 18N 14E (M) | 157.86 |
| **Nevada** | 015-170-17- | 31 18N 14E (M) | 80 |
| **Nevada** | 015-190-02- | 05 17N 14E (M) | 649.8 |
| **Nevada** | 015-190-08- | 09 17N 14E (M) | 40 |

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| **Nevada** | 015-210-01- | 31 19N 13E (M) | 38.79 |
| **Nevada** | 015-210-02- | 31 19N 13E (M) | 178.36 |
| **Nevada** | 015-210-04- | 31 19N 13E (M) | 322.79 |
| **Nevada** | 016-040-01- | 15 18N 15E (M) | 640 |
| **Nevada** | 016-040-06- | 13 18N 15E (M) | 640 |
| **Nevada** | 016-040-09- | 23 18N 15E (M) | 320 |
| **Nevada** | 016-060-01- | 27 18N 15E (M) | 633.37 |
| **Nevada** | 038-050-03- | 06 16N 10E (M) | 155.95 |
| **Nevada** | 047-010-02- | 18 17N 14E (M) | 160 |
| **Nevada** | 047-010-03- | 17 17N 14E (M) | 560 |
| **Nevada** | 047-010-05- | 19 17N 14E (M) | 287.73 |
| **Nevada** | 047-110-13- | 20 17N 14E (M) | 120 |
| **Nevada** | 049-050-04- | 15 17N 17E (M) | 216 |
| **Nevada** | 063-010-06- | 16 18N 10E (M) | 100 |
| **Nevada** | 063-010-06- | 17 18N 10E (M) | 10 |
| **Nevada** | 063-010-06- | 20 18N 10E (M) | 164.7 |
| **Nevada** | 063-010-06- | 21 18N 10E (M) | 150 |
| **Nevada** | 063-010-06- | 29 18N 10E (M) | 10 |
| **Nevada** | 063-010-12- | 20 18N 10E (M) | 160 |
| **Nevada** | 063-010-13- | 20 18N 10E (M) | 11 |
| **Nevada** | 063-010-13- | 29 18N 10E (M) | 21.7 |
| **Nevada** | 063-010-50- | 17 18N 10E (M) | 46.7 |
| **Nevada** | 063-010-51- | 17 18N 10E (M) | 40.34 |
| **Nevada** | 063-010-52- | 17 18N 10E (M) | 40.24 |
| **Nevada** | 063-010-53- | 17 18N 10E (M) | 40.23 |
| **Nevada** | 063-010-54- | 17 18N 10E (M) | 41.34 |
| **Nevada** | 063-010-55- | 17 18N 10E (M) | 50.93 |
| **Nevada** | 063-010-56- | 17 18N 10E (M) | 119.82 |
| **Nevada** | 063-010-70- | 18 18N 10E (M) | 187 |
| **Nevada** | 063-010-72- | 16 18N 10E (M) | 32.28 |
| **Nevada** | 063-010-73- | 20 18N 10E (M) | 272.53 |
| **Nevada** | 063-010-75- | 19 18N 10E (M) | 341.1 |
| **Nevada** | 063-050-01- | 27 18N 10E (M) | 84.43 |
| **Nevada** | 063-050-02- | 27 18N 10E (M) | 80.82 |
| **Nevada** | 063-050-03- | 27 18N 10E (M) | 123.36 |
| **Nevada** | 063-050-04- | 27 18N 10E (M) | 34.69 |
| **Nevada** | 063-050-05- | 27 18N 10E (M) | 79.42 |
| **Nevada** | 063-050-13- | 25 18N 10E (M) | 136.31 |
| **Nevada** | 063-050-14- | 34 18N 10E (M) | 495.23 |
| **Nevada** | 063-050-24- | 35 18N 10E (M) | 7.29 |
| **Nevada** | 063-050-25- | 35 18N 10E (M) | 241.87 |
| **Nevada** | 063-050-28- | 27 18N 10E (M) | 241.93 |
| **Nevada** | 063-110-18- | 05 17N 10E (M) | 70.01 |
| **Nevada** | 063-110-19- | 05 17N 10E (M) | 4 |

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| **Nevada** | 063-110-20- | 05 17N 10E (M) | 8 |
| **Nevada** | 063-110-29- | 07 17N 10E (M) | 19.86 |
| **Nevada** | 063-110-32- | 07 17N 10E (M) | 417.32 |
| **Nevada** | 063-110-59- | 04 17N 10E (M) | 144.53 |
| **Nevada** | 063-110-59- | 05 17N 10E (M) | 2 |
| **Nevada** | 063-160-01- | 03 17N 10E (M) | 620.85 |
| **Nevada** | 064-130-09- | 01 17N 11E (M) | 40 |
| **Nevada** | 064-160-01- | 03 17N 12E (M) | 643 |
| **Nevada** | 064-160-05- | 11 17N 12E (M) | 480 |
| **Nevada** | 064-210-15- | 13 17N 11E (M) | 380 |
| **Nevada** | 064-210-19- | 23 17N 11E (M) | 426.89 |
| **Nevada** | 064-220-02- | 17 17N 11E (M) | 420.48 |
| **Nevada** | 064-220-19- | 21 17N 11E (M) | 159.1 |
| **Nevada** | 064-290-01- | 34 17N 11E (M) | 80 |
| **Nevada** | 064-300-01- | 34 17N 11E (M) | 26.12 |
| **Nevada** | 064-300-02- | 34 17N 11E (M) | 52.39 |
| **Nevada** | 065-010-01- | 05 16N 10E (M) | 213.05 |
| **Nevada** | 065-010-02- | 05 16N 10E (M) | 30.35 |
| **Nevada** | 065-010-03- | 05 16N 10E (M) | 69.81 |
| **Nevada** | 065-020-03- | 05 16N 10E (M) | 155.19 |
| **Nevada** | 065-050-02- | 09 16N 10E (M) | 269.53 |
| **Nevada** | 065-090-02- | 03 16N 10E (M) | 417.4 |
| **Nevada** | 065-090-07- | 01 16N 10E (M) | 388.11 |
| **Nevada** | 065-090-08- | 01 16N 10E (M) | 80 |
| **Nevada** | 065-090-10- | 10 16N 10E (M) | 80 |
| **Nevada** | 065-090-12- | 10 16N 10E (M) | 293.01 |
| **Nevada** | 065-090-12- | 11 16N 10E (M) | 110 |
| **Nevada** | 065-100-12- | 08 16N 11E (M) | 31.81 |
| **Nevada** | 065-100-13- | 08 16N 11E (M) | 20 |
| **Nevada** | 065-100-14- | 08 16N 11E (M) | 399 |
| **Nevada** | 065-120-01- | 15 16N 10E (M) | 694 |
| **Nevada** | 065-120-13- | 22 16N 10E (M) | 280 |
| **Nevada** | 065-120-14- | 22 16N 10E (M) | 440.8 |
| **Nevada** | 065-120-15- | 23 16N 10E (M) | 142.8 |
| **Nevada** | 065-120-16- | 23 16N 10E (M) | 2.4 |
| **Nevada** | 065-130-05- | 16 16N 10E (M) | 84.77 |
| **Nevada** | 065-150-01- | 17 16N 10E (M) | 240 |
| **Nevada** | 065-180-02- | 20 16N 10E (M) | 159.9 |
| **Nevada** | 065-190-01- | 21 16N 10E (M) | 339 |
| **Nevada** | 065-200-01- | 21 16N 10E (M) | 53.8 |
| **Nevada** | 065-200-03- | 21 16N 10E (M) | 223.52 |
| **Nevada** | 065-200-04- | 21 16N 10E (M) | 15 |
| **Nevada** | 065-220-01- | 27 16N 10E (M) | 160 |
| **Nevada** | 065-230-08- | 33 16N 10E (M) | 195 |

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| **Nevada** | 065-230-11- | 33 16N 10E (M) | 61 |
| **Placer** | 062-020-076- | 25 16N 10E (M) | 138.7 |
| **Placer** | 062-030-003- | 33 16N 10E (M) | 5.7 |
| **Placer** | 062-230-005- | 02 16N 11E (M) | 80 |
| **Placer** | 062-251-024- | 14 16N 11E (M) | 28.73 |
| **Placer** | 062-252-001- | 14 16N 11E (M) | 0.01 |
| **Placer** | 062-252-019- | 23 16N 11E (M) | 80 |
| **Placer** | 062-252-024- | 23 16N 11E (M) | 160 |
| **Placer** | 062-252-028- | 13 16N 11E (M) | 80 |
| **Placer** | 062-300-001- | 27 16N 11E (M) | 480 |
| **Placer** | 062-300-010- | 35 16N 11E (M) | 320 |
| **Placer** | 062-300-014- | 25 16N 11E (M) | 640 |
| **Placer** | 063-010-004- | 05 15N 10E (M) | 114.6 |
| **Placer** | 064-031-041- | 35 15N 10E (M) | 83.7 |
| **Placer** | 064-040-024- | 07 14N 10E (M) | 40.65 |
| **Placer** | 064-040-085- | 06 14N 10E (M) | 80 |
| **Placer** | 066-140-006- | 05 16N 12E (M) | 160 |
| **Placer** | 066-150-001- | 03 16N 12E (M) | 636.64 |
| **Placer** | 066-150-005- | 11 16N 12E (M) | 480 |
| **Placer** | 066-160-003- | 17 16N 12E (M) | 80 |
| **Placer** | 066-160-005- | 19 16N 12E (M) | 445.4 |
| **Placer** | 066-170-003- | 14 16N 12E (M) | 40 |
| **Placer** | 066-170-006- | 23 16N 12E (M) | 160 |
| **Placer** | 066-170-010- | 13 16N 12E (M) | 640 |
| **Placer** | 066-180-019- | 33 16N 12E (M) | 1 |
| **Placer** | 066-190-002- | 27 16N 12E (M) | 160 |
| **Placer** | 066-200-006- | 07 16N 13E (M) | 642.42 |
| **Placer** | 066-200-009- | 09 16N 13E (M) | 640 |
| **Placer** | 066-220-002- | 17 16N 13E (M) | 640 |
| **Placer** | 067-030-009- | 08 15N 12E (M) | 120 |
| **Placer** | 067-030-011- | 09 15N 12E (M) | 518.6 |
| **Placer** | 067-030-011- | 10 15N 12E (M) | 7 |
| **Placer** | 067-030-012- | 10 15N 12E (M) | 19.6 |
| **Placer** | 067-030-013- | 10 15N 12E (M) | 19.6 |
| **Placer** | 067-030-014- | 10 15N 12E (M) | 19.6 |
| **Placer** | 067-030-015- | 09 15N 12E (M) | 4.6 |
| **Placer** | 067-030-015- | 10 15N 12E (M) | 15 |
| **Placer** | 067-030-016- | 09 15N 12E (M) | 9.6 |
| **Placer** | 067-030-016- | 10 15N 12E (M) | 10 |
| **Placer** | 067-030-017- | 09 15N 12E (M) | 16.4 |
| **Placer** | 067-030-017- | 10 15N 12E (M) | 3 |
| **Placer** | 067-030-018- | 09 15N 12E (M) | 19.4 |
| **Placer** | 067-030-019- | 09 15N 12E (M) | 19.4 |
| **Placer** | 067-030-020- | 09 15N 12E (M) | 12 |

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| **Placer** | 067-030-020- | 10 15N 12E (M) | 219.5 |
| **Placer** | 067-050-002- | 17 15N 12E (M) | 569 |
| **Placer** | 067-050-004- | 19 15N 12E (M) | 277 |
| **Placer** | 067-070-005- | 31 15N 12E (M) | 413.86 |
| **Placer** | 068-100-006- | 22 14N 13E (M) | 27.72 |
| **Placer** | 068-100-024- | 22 14N 13E (M) | 325.7 |
| **Placer** | 068-100-025- | 22 14N 13E (M) | 319.5 |
| **Placer** | 068-100-026- | 22 14N 13E (M) | 3.1 |
| **Placer** | 068-110-004- | 28 14N 13E (M) | 182 |
| **Placer** | 068-110-006- | 31 14N 13E (M) | 597.6 |
| **Placer** | 068-130-002- | 05 13N 12E (M) | 64.2 |
| **Placer** | 068-130-002- | 06 13N 12E (M) | 274.9 |
| **Placer** | 068-130-006- | 04 13N 12E (M) | 382.5 |
| **Placer** | 068-130-009- | 08 13N 12E (M) | 157.3 |
| **Placer** | 068-140-004- | 10 13N 12E (M) | 266.7 |
| **Placer** | 068-150-009- | 21 13N 12E (M) | 200.6 |
| **Placer** | 069-180-003- | 28 17N 15E (M) | 80 |
| **Placer** | 069-190-005- | 26 17N 15E (M) | 80 |
| **Placer** | 069-190-014- | 25 17N 15E (M) | 303 |
| **Placer** | 069-190-015- | 25 17N 15E (M) | 1 |
| **Placer** | 069-190-017- | 34 17N 15E (M) | 240 |
| **Placer** | 069-190-019- | 34 17N 15E (M) | 80 |
| **Placer** | 069-190-021- | 35 17N 15E (M) | 640 |
| **Placer** | 069-190-022- | 36 17N 15E (M) | 520 |
| **Placer** | 069-270-003- | 01 16N 15E (M) | 553.5 |
| **Placer** | 070-160-004- | 31 15N 15E (M) | 637.6 |
| **Placer** | 070-190-014- | 03 14N 14E (M) | 548.39 |
| **Placer** | 070-190-016- | 11 14N 14E (M) | 603.5 |
| **Placer** | 070-210-005- | 23 14N 14E (M) | 600 |
| **Placer** | 070-210-008- | 15 14N 14E (M) | 627.6 |
| **Placer** | 070-230-001- | 27 14N 14E (M) | 640 |
| **Placer** | 070-230-002- | 26 14N 14E (M) | 480 |
| **Placer** | 070-230-004- | 25 14N 14E (M) | 640 |
| **Placer** | 070-270-005- | 19 14N 15E (M) | 642.48 |
| **Placer** | 070-290-002- | 29 14N 15E (M) | 640 |
| **Placer** | 080-070-005- | 30 17N 16E (M) | 326.38 |
| **Placer** | 080-070-010- | 31 17N 16E (M) | 612.6 |
| **Placer** | 080-170-001- | 06 16N 16E (M) | 265.21 |
| **Placer** | 080-170-003- | 05 16N 16E (M) | 643.24 |
| **Placer** | 080-170-016- | 07 16N 16E (M) | 309.52 |
| **Placer** | 090-010-011- | 31 17N 18E (M) | 620.5 |
| **Placer** | 090-010-014- | 31 17N 18E (M) | 4.6 |
| **Placer** | 090-010-015- | 31 17N 18E (M) | 6.3 |
| **Placer** | 110-010-025- | 21 17N 17E (M) | 322.9 |

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| **Placer** | 110-020-001- | 15 17N 17E (M) | 17.5 |
| **Placer** | 110-020-003- | 22 17N 17E (M) | 520 |
| **Placer** | 110-020-005- | 23 17N 17E (M) | 520 |
| **Placer** | 110-020-012- | 25 17N 17E (M) | 4 |
| **Placer** | 110-020-028- | 24 17N 17E (M) | 223 |
| **Placer** | 110-020-029- | 25 17N 17E (M) | 156.1 |
| **Placer** | 110-030-048- | 28 17N 17E (M) | 80 |
| **Placer** | 110-030-050- | 33 17N 17E (M) | 320 |
| **Placer** | 110-040-001- | 27 17N 17E (M) | 640 |
| **Placer** | 110-040-002- | 26 17N 17E (M) | 640 |
| **Placer** | 110-040-003- | 25 17N 17E (M) | 440 |
| **Placer** | 110-040-013- | 35 17N 17E (M) | 156.2 |
| **Placer** | 110-040-014- | 35 17N 17E (M) | 0.8 |
| **Placer** | 110-040-016- | 35 17N 17E (M) | 457 |
| **Placer** | 110-040-017- | 35 17N 17E (M) | 26 |
| **Placer** | 110-040-018- | 34 17N 17E (M) | 480 |
| **Placer** | 110-040-020- | 34 17N 17E (M) | 160 |
| **Placer** | 110-050-009- | 04 16N 17E (M) | 80 |
| **Placer** | 110-050-029- | 09 16N 17E (M) | 235.2 |
| **Placer** | 110-050-030- | 09 16N 17E (M) | 54.2 |
| **Placer** | 110-050-031- | 09 16N 17E (M) | 10.6 |
| **Placer** | 110-050-034- | 04 16N 17E (M) | 534 |
| **Placer** | 110-050-065- | 04 16N 17E (M) | 19.6 |
| **Placer** | 110-060-014- | 02 16N 17E (M) | 155 |
| **Placer** | 110-060-029- | 03 16N 17E (M) | 161.1 |
| **Placer** | 110-060-030- | 03 16N 17E (M) | 2.2 |
| **Placer** | 110-060-031- | 03 16N 17E (M) | 2.6 |
| **Placer** | 110-060-056- | 03 16N 17E (M) | 169.4 |
| **Placer** | 110-060-060- | 03 16N 17E (M) | 17.8 |
| **Placer** | 110-060-062- | 03 16N 17E (M) | 93.1 |
| **Placer** | 110-060-065- | 03 16N 17E (M) | 18.9 |
| **Placer** | 110-060-067- | 03 16N 17E (M) | 4 |
| **Plumas** | 001-130-011- | 10 28N 06E (M) | 80 |
| **Plumas** | 001-130-012- | 09 28N 06E (M) | 40 |
| **Plumas** | 001-130-020- | 16 28N 06E (M) | 268.11 |
| **Plumas** | 001-130-021- | 15 28N 06E (M) | 271.54 |
| **Plumas** | 001-130-034- | 03 28N 06E (M) | 40.6 |
| **Plumas** | 001-130-040- | 01 28N 06E (M) | 80 |
| **Plumas** | 001-130-063- | 12 28N 06E (M) | 153.17 |
| **Plumas** | 001-130-068- | 16 28N 06E (M) | 39.3 |
| **Plumas** | 001-130-073- | 02 28N 06E (M) | 462.34 |
| **Plumas** | 001-130-074- | 01 28N 06E (M) | 561.12 |
| **Plumas** | 001-130-074- | 02 28N 06E (M) | 3.2 |
| **Plumas** | 001-130-074- | 12 28N 06E (M) | 57.29 |

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| **Plumas** | 001-140-033- | 03 28N 07E (M) | 165.8 |
| **Plumas** | 001-140-034- | 02 28N 07E (M) | 443.58 |
| **Plumas** | 001-140-048- | 01 28N 07E (M) | 633.99 |
| **Plumas** | 001-150-006- | 08 28N 08E (M) | 639.28 |
| **Plumas** | 001-150-007- | 09 28N 08E (M) | 640 |
| **Plumas** | 001-150-013- | 06 28N 08E (M) | 595 |
| **Plumas** | 001-150-014- | 05 28N 08E (M) | 589 |
| **Plumas** | 001-150-020- | 07 28N 08E (M) | 564.68 |
| **Plumas** | 001-150-021- | 18 28N 08E (M) | 59.97 |
| **Plumas** | 001-150-022- | 17 28N 08E (M) | 311.75 |
| **Plumas** | 001-150-023- | 16 28N 08E (M) | 428 |
| **Plumas** | 001-150-025- | 10 28N 08E (M) | 608.39 |
| **Plumas** | 001-150-026- | 15 28N 08E (M) | 505.3 |
| **Plumas** | 001-160-004- | 22 28N 06E (M) | 80.03 |
| **Plumas** | 001-160-005- | 22 28N 06E (M) | 40 |
| **Plumas** | 001-160-007- | 22 28N 06E (M) | 80 |
| **Plumas** | 001-160-009- | 23 28N 06E (M) | 520 |
| **Plumas** | 001-160-017- | 26 28N 06E (M) | 160 |
| **Plumas** | 001-160-020- | 27 28N 06E (M) | 400 |
| **Plumas** | 001-160-031- | 32 28N 06E (M) | 160 |
| **Plumas** | 001-160-033- | 33 28N 06E (M) | 160 |
| **Plumas** | 001-160-035- | 34 28N 06E (M) | 520 |
| **Plumas** | 001-160-038- | 35 28N 06E (M) | 440 |
| **Plumas** | 001-160-039- | 36 28N 06E (M) | 640 |
| **Plumas** | 001-160-049- | 24 28N 06E (M) | 393.55 |
| **Plumas** | 001-160-050- | 25 28N 06E (M) | 69.4 |
| **Plumas** | 001-160-060- | 26 28N 06E (M) | 268.87 |
| **Plumas** | 001-160-074- | 22 28N 06E (M) | 83.1 |
| **Plumas** | 001-180-004- | 27 28N 08E (M) | 233.75 |
| **Plumas** | 001-180-005- | 34 28N 08E (M) | 162.07 |
| **Plumas** | 001-180-006- | 34 28N 08E (M) | 160 |
| **Plumas** | 001-180-009- | 21 28N 08E (M) | 28.13 |
| **Plumas** | 001-180-010- | 22 28N 08E (M) | 612.12 |
| **Plumas** | 001-180-011- | 26 28N 08E (M) | 160 |
| **Plumas** | 001-180-011- | 35 28N 08E (M) | 546.94 |
| **Plumas** | 001-180-013- | 26 28N 08E (M) | 80 |
| **Plumas** | 001-190-016- | 16 27N 07E (M) | 80 |
| **Plumas** | 001-200-001- | 01 27N 08E (M) | 78.17 |
| **Plumas** | 001-200-003- | 02 27N 08E (M) | 79.23 |
| **Plumas** | 001-200-004- | 02 27N 08E (M) | 80 |
| **Plumas** | 001-200-006- | 03 27N 08E (M) | 160 |
| **Plumas** | 001-200-007- | 11 27N 08E (M) | 360 |
| **Plumas** | 001-200-010- | 12 27N 08E (M) | 200 |
| **Plumas** | 001-200-013- | 14 27N 08E (M) | 240 |

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| **Plumas** | 001-200-015- | 02 27N 08E (M) | 79.7 |
| **Plumas** | 001-200-016- | 01 27N 08E (M) | 398.25 |
| **Plumas** | 001-200-016- | 12 27N 08E (M) | 160 |
| **Plumas** | 001-220-006- | 21 27N 07E (M) | 80 |
| **Plumas** | 001-220-008- | 21 27N 07E (M) | 40 |
| **Plumas** | 001-220-010- | 22 27N 07E (M) | 40 |
| **Plumas** | 001-220-013- | 23 27N 07E (M) | 280 |
| **Plumas** | 001-220-015- | 24 27N 07E (M) | 360 |
| **Plumas** | 001-220-016- | 26 27N 07E (M) | 320 |
| **Plumas** | 001-220-019- | 27 27N 07E (M) | 80 |
| **Plumas** | 001-230-001- | 19 27N 08E (M) | 83.66 |
| **Plumas** | 001-241-001- | 06 28N 07E (M) | 76.93 |
| **Plumas** | 001-241-003- | 06 28N 07E (M) | 40.25 |
| **Plumas** | 001-241-004- | 06 28N 07E (M) | 116.73 |
| **Plumas** | 001-241-005- | 06 28N 07E (M) | 40 |
| **Plumas** | 001-370-001- | 27 27N 08E (M) | 19.09 |
| **Plumas** | 001-440-001- | 03 28N 07E (M) | 42.35 |
| **Plumas** | 001-440-003- | 02 28N 07E (M) | 102.8 |
| **Plumas** | 001-450-004- | 11 28N 07E (M) | 17.73 |
| **Plumas** | 001-450-009- | 12 28N 07E (M) | 45.35 |
| **Plumas** | 001-450-011- | 11 28N 07E (M) | 59.62 |
| **Plumas** | 001-450-012- | 12 28N 07E (M) | 50.49 |
| **Plumas** | 001-450-014- | 12 28N 07E (M) | 1.33 |
| **Plumas** | 001-500-021- | 13 28N 06E (M) | 325.62 |
| **Plumas** | 001-500-021- | 14 28N 06E (M) | 200 |
| **Plumas** | 002-010-008- | 03 27N 06E (M) | 80 |
| **Plumas** | 002-010-014- | 10 27N 06E (M) | 120 |
| **Plumas** | 002-030-010- | 28 27N 06E (M) | 360 |
| **Plumas** | 002-030-011- | 29 27N 06E (M) | 280 |
| **Plumas** | 002-030-012- | 31 27N 06E (M) | 241.18 |
| **Plumas** | 002-030-013- | 32 27N 06E (M) | 480 |
| **Plumas** | 002-030-014- | 33 27N 06E (M) | 360 |
| **Plumas** | 002-030-023- | 34 27N 06E (M) | 160 |
| **Plumas** | 002-030-028- | 33 27N 06E (M) | 80 |
| **Plumas** | 002-030-029- | 33 27N 06E (M) | 80 |
| **Plumas** | 002-060-001- | 05 26N 07E (M) | 28.21 |
| **Plumas** | 002-120-004- | 10 26N 09E (M) | 8.64 |
| **Plumas** | 002-150-002- | 24 26N 08E (M) | 0.35 |
| **Plumas** | 002-150-002- | 25 26N 08E (M) | 20 |
| **Plumas** | 002-150-002- | 30 26N 09E (M) | 0.3 |
| **Plumas** | 002-160-003- | 20 26N 09E (M) | 120 |
| **Plumas** | 002-160-004- | 21 26N 09E (M) | 320 |
| **Plumas** | 002-160-006- | 22 26N 09E (M) | 200 |
| **Plumas** | 002-200-006- | 16 25N 08E (M) | 640 |

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| **Plumas** | 002-210-001- | 21 25N 05E (M) | 320 |
| **Plumas** | 002-250-001-1 | 03 24N 05E (M) | 643 |
| **Plumas** | 002-250-003-1 | 11 24N 05E (M) | 640 |
| **Plumas** | 002-250-004- | 10 24N 05E (M) | 640 |
| **Plumas** | 002-250-005-1 | 09 24N 05E (M) | 320 |
| **Plumas** | 002-250-006- | 16 24N 05E (M) | 320 |
| **Plumas** | 002-250-007- | 15 24N 05E (M) | 640 |
| **Plumas** | 002-250-008- | 14 24N 05E (M) | 640 |
| **Plumas** | 002-250-009- | 13 24N 05E (M) | 217.24 |
| **Plumas** | 002-270-001- | 22 24N 05E (M) | 640 |
| **Plumas** | 002-270-002-1 | 23 24N 05E (M) | 640 |
| **Plumas** | 002-270-003- | 24 24N 05E (M) | 160 |
| **Plumas** | 002-270-004- | 25 24N 05E (M) | 215.96 |
| **Plumas** | 002-270-005- | 26 24N 05E (M) | 640 |
| **Plumas** | 002-270-006- | 27 24N 05E (M) | 640 |
| **Plumas** | 002-270-007- | 28 24N 05E (M) | 640 |
| **Plumas** | 002-270-013- | 24 24N 05E (M) | 56.92 |
| **Plumas** | 002-280-003- | 18 24N 06E (M) | 100 |
| **Plumas** | 002-280-003- | 19 24N 06E (M) | 372.84 |
| **Plumas** | 002-290-001-1 | 03 23N 05E (M) | 644.36 |
| **Plumas** | 002-290-002- | 34 24N 05E (M) | 80 |
| **Plumas** | 002-290-003- | 34 24N 05E (M) | 560 |
| **Plumas** | 002-290-004-1 | 35 24N 05E (M) | 640 |
| **Plumas** | 002-290-005- | 36 24N 05E (M) | 189.13 |
| **Plumas** | 002-290-009-1 | 05 23N 06E (M) | 564.03 |
| **Plumas** | 002-290-013- | 36 24N 05E (M) | 20 |
| **Plumas** | 002-290-013- | 31 24N 06E (M) | 789.59 |
| **Plumas** | 002-310-002- | 19 23N 06E (M) | 200 |
| **Plumas** | 002-310-005- | 27 23N 06E (M) | 160 |
| **Plumas** | 002-310-014- | 33 23N 06E (M) | 469.95 |
| **Plumas** | 003-110-003- | 03 22N 06E (M) | 348.93 |
| **Plumas** | 003-110-004- | 11 22N 06E (M) | 320 |
| **Plumas** | 003-110-005- | 13 22N 06E (M) | 160 |
| **Plumas** | 003-110-008- | 03 22N 06E (M) | 27.09 |
| **Plumas** | 003-120-001- | 09 22N 07E (M) | 40 |
| **Plumas** | 003-120-005- | 16 22N 07E (M) | 60 |
| **Plumas** | 003-130-001- | 17 22N 08E (M) | 160 |
| **Plumas** | 003-130-002- | 16 22N 08E (M) | 640 |
| **Plumas** | 003-140-005- | 16 22N 09E (M) | 364.74 |
| **Plumas** | 003-150-003- | 34 22N 07E (M) | 11 |
| **Plumas** | 003-150-003- | 35 22N 07E (M) | 60 |
| **Plumas** | 003-150-003- | 36 22N 07E (M) | 50 |
| **Plumas** | 003-170-001- | 22 22N 08E (M) | 240 |
| **Plumas** | 003-170-002- | 23 22N 08E (M) | 40 |

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| **Plumas** | 003-170-003- | 26 22N 08E (M) | 320 |
| **Plumas** | 003-170-004- | 26 22N 08E (M) | 40 |
| **Plumas** | 003-170-005- | 27 22N 08E (M) | 160 |
| **Plumas** | 003-170-006- | 28 22N 08E (M) | 80 |
| **Plumas** | 003-170-007- | 29 22N 08E (M) | 320 |
| **Plumas** | 003-170-008- | 29 22N 08E (M) | 40 |
| **Plumas** | 003-170-010- | 30 22N 08E (M) | 251.68 |
| **Plumas** | 003-170-011- | 31 22N 08E (M) | 304.92 |
| **Plumas** | 003-170-013- | 32 22N 08E (M) | 160 |
| **Plumas** | 003-170-014- | 33 22N 08E (M) | 40 |
| **Plumas** | 003-170-015- | 33 22N 08E (M) | 80 |
| **Plumas** | 003-170-016- | 34 22N 08E (M) | 120 |
| **Plumas** | 003-170-017- | 34 22N 08E (M) | 120 |
| **Plumas** | 003-170-018- | 35 22N 08E (M) | 320 |
| **Plumas** | 003-190-001- | 04 21N 07E (M) | 40 |
| **Plumas** | 003-190-002- | 04 21N 07E (M) | 40 |
| **Plumas** | 003-190-003- | 03 21N 07E (M) | 378.39 |
| **Plumas** | 003-190-005- | 02 21N 07E (M) | 418.61 |
| **Plumas** | 003-190-006- | 01 21N 07E (M) | 402.67 |
| **Plumas** | 003-190-007- | 12 21N 07E (M) | 504.98 |
| **Plumas** | 003-190-008- | 11 21N 07E (M) | 533.43 |
| **Plumas** | 003-190-009- | 10 21N 07E (M) | 287.42 |
| **Plumas** | 003-190-010- | 14 21N 07E (M) | 640 |
| **Plumas** | 003-190-011- | 13 21N 07E (M) | 600 |
| **Plumas** | 003-190-012- | 24 21N 07E (M) | 613.84 |
| **Plumas** | 003-190-013- | 23 21N 07E (M) | 160 |
| **Plumas** | 003-190-014- | 24 21N 07E (M) | 21.16 |
| **Plumas** | 003-190-015- | 24 21N 07E (M) | 5 |
| **Plumas** | 003-190-016- | 10 21N 07E (M) | 120 |
| **Plumas** | 003-190-017- | 11 21N 07E (M) | 40 |
| **Plumas** | 003-200-001- | 06 21N 08E (M) | 484.63 |
| **Plumas** | 003-200-002- | 05 21N 08E (M) | 385.84 |
| **Plumas** | 003-200-003- | 04 21N 08E (M) | 538.53 |
| **Plumas** | 003-200-004- | 03 21N 08E (M) | 50 |
| **Plumas** | 003-200-004- | 04 21N 08E (M) | 80 |
| **Plumas** | 003-200-004- | 09 21N 08E (M) | 103.24 |
| **Plumas** | 003-200-005- | 04 21N 08E (M) | 9.66 |
| **Plumas** | 003-200-006- | 03 21N 08E (M) | 162.07 |
| **Plumas** | 003-200-007- | 03 21N 08E (M) | 40 |
| **Plumas** | 003-200-008- | 02 21N 08E (M) | 74.71 |
| **Plumas** | 003-200-009- | 02 21N 08E (M) | 40 |
| **Plumas** | 003-200-011- | 10 21N 08E (M) | 200 |
| **Plumas** | 003-200-012- | 10 21N 08E (M) | 40 |
| **Plumas** | 003-200-013- | 09 21N 08E (M) | 451.2 |

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| **Plumas** | 003-200-014- | 08 21N 08E (M) | 640 |
| **Plumas** | 003-200-015- | 07 21N 08E (M) | 527.94 |
| **Plumas** | 003-200-016- | 18 21N 08E (M) | 519.28 |
| **Plumas** | 003-200-017- | 17 21N 08E (M) | 320 |
| **Plumas** | 003-200-018- | 16 21N 08E (M) | 120 |
| **Plumas** | 003-200-020- | 15 21N 08E (M) | 40 |
| **Plumas** | 003-220-001- | 19 21N 08E (M) | 488.78 |
| **Plumas** | 003-220-002- | 20 21N 08E (M) | 80 |
| **Plumas** | 003-220-021- | 30 21N 08E (M) | 80 |
| **Plumas** | 003-220-022- | 30 21N 08E (M) | 160 |
| **Plumas** | 003-220-023- | 31 21N 08E (M) | 274.3 |
| **Plumas** | 004-010-001- | 24 28N 10E (M) | 120 |
| **Plumas** | 004-010-002- | 25 28N 10E (M) | 120 |
| **Plumas** | 004-010-003- | 25 28N 10E (M) | 40 |
| **Plumas** | 004-010-008- | 35 28N 10E (M) | 40 |
| **Plumas** | 004-010-009- | 35 28N 10E (M) | 80 |
| **Plumas** | 004-010-011- | 36 28N 10E (M) | 80 |
| **Plumas** | 004-010-012- | 36 28N 10E (M) | 160 |
| **Plumas** | 004-010-013- | 36 28N 10E (M) | 400 |
| **Plumas** | 004-010-015- | 35 28N 10E (M) | 200 |
| **Plumas** | 004-020-022- | 14 27N 10E (M) | 20 |
| **Plumas** | 004-020-028- | 15 27N 10E (M) | 40 |
| **Plumas** | 004-020-029- | 03 27N 10E (M) | 200 |
| **Plumas** | 004-020-029- | 10 27N 10E (M) | 400 |
| **Plumas** | 004-020-030- | 15 27N 10E (M) | 320 |
| **Plumas** | 004-040-006- | 31 27N 10E (M) | 140 |
| **Plumas** | 004-090-002- | 36 27N 09E (M) | 40 |
| **Plumas** | 004-120-030- | 32 27N 10E (M) | 10.01 |
| **Plumas** | 004-120-031- | 32 27N 10E (M) | 10.01 |
| **Plumas** | 005-170-002- | 28 25N 09E (M) | 1 |
| **Plumas** | 005-170-002- | 33 25N 09E (M) | 16 |
| **Plumas** | 005-170-002- | 34 25N 09E (M) | 16.12 |
| **Plumas** | 005-170-003- | 34 25N 09E (M) | 0.57 |
| **Plumas** | 005-330-003- | 03 24N 10E (M) | 40 |
| **Plumas** | 005-330-003- | 04 24N 10E (M) | 80 |
| **Plumas** | 005-330-003- | 09 24N 10E (M) | 120 |
| **Plumas** | 005-330-003- | 10 24N 10E (M) | 80 |
| **Plumas** | 005-330-004- | 05 24N 10E (M) | 40 |
| **Plumas** | 005-330-005- | 11 24N 10E (M) | 130 |
| **Plumas** | 005-330-012- | 14 24N 10E (M) | 200 |
| **Plumas** | 005-330-013- | 15 24N 10E (M) | 104.83 |
| **Plumas** | 005-360-010- | 25 24N 09E (M) | 60 |
| **Plumas** | 005-370-007- | 33 24N 10E (M) | 40 |
| **Plumas** | 005-370-008- | 34 24N 10E (M) | 120 |

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| **Plumas** | 005-370-009- | 35 24N 10E (M) | 320 |
| **Plumas** | 005-370-010- | 36 24N 10E (M) | 639.84 |
| **Plumas** | 006-040-001- | 16 23N 09E (M) | 640 |
| **Plumas** | 006-050-002- | 04 23N 10E (M) | 40 |
| **Plumas** | 006-050-003- | 03 23N 10E (M) | 120 |
| **Plumas** | 006-050-004- | 03 23N 10E (M) | 80 |
| **Plumas** | 006-050-005- | 02 23N 10E (M) | 160 |
| **Plumas** | 006-050-006- | 01 23N 10E (M) | 111.9 |
| **Plumas** | 006-050-007- | 01 23N 10E (M) | 333.46 |
| **Plumas** | 006-050-009- | 02 23N 10E (M) | 100 |
| **Plumas** | 006-050-009- | 03 23N 10E (M) | 30 |
| **Plumas** | 006-050-009- | 10 23N 10E (M) | 80 |
| **Plumas** | 006-050-009- | 11 23N 10E (M) | 80 |
| **Plumas** | 006-050-030- | 02 23N 10E (M) | 288.72 |
| **Plumas** | 006-050-030- | 03 23N 10E (M) | 128.72 |
| **Plumas** | 006-050-030- | 34 24N 10E (M) | 40 |
| **Plumas** | 006-050-030- | 35 24N 10E (M) | 120 |
| **Plumas** | 006-050-031- | 03 23N 10E (M) | 250 |
| **Plumas** | 006-050-031- | 04 23N 10E (M) | 80 |
| **Plumas** | 006-050-031- | 09 23N 10E (M) | 40 |
| **Plumas** | 006-050-031- | 10 23N 10E (M) | 237.55 |
| **Plumas** | 006-100-003- | 35 23N 09E (M) | 16 |
| **Plumas** | 006-100-003- | 36 23N 09E (M) | 143.22 |
| **Plumas** | 009-010-004- | 07 24N 11E (M) | 638.11 |
| **Plumas** | 009-010-005- | 08 24N 11E (M) | 40 |
| **Plumas** | 009-010-006- | 17 24N 11E (M) | 240 |
| **Plumas** | 009-010-007- | 16 24N 11E (M) | 640 |
| **Plumas** | 009-020-003- | 18 24N 11E (M) | 5 |
| **Plumas** | 009-020-005- | 18 24N 11E (M) | 198.25 |
| **Plumas** | 009-020-006- | 18 24N 11E (M) | 666.69 |
| **Plumas** | 009-030-001- | 25 24N 11E (M) | 40 |
| **Plumas** | 009-030-002- | 36 24N 11E (M) | 160 |
| **Plumas** | 009-030-004- | 19 24N 11E (M) | 80 |
| **Plumas** | 009-030-005- | 20 24N 11E (M) | 320 |
| **Plumas** | 009-030-006- | 20 24N 11E (M) | 160 |
| **Plumas** | 009-030-007- | 20 24N 11E (M) | 40 |
| **Plumas** | 009-030-008- | 21 24N 11E (M) | 200 |
| **Plumas** | 009-030-009- | 29 24N 11E (M) | 160 |
| **Plumas** | 009-030-010- | 28 24N 11E (M) | 240 |
| **Plumas** | 009-030-011- | 30 24N 11E (M) | 120 |
| **Plumas** | 009-030-012- | 29 24N 11E (M) | 120 |
| **Plumas** | 009-030-015- | 32 24N 11E (M) | 627.15 |
| **Plumas** | 009-040-005- | 29 24N 11E (M) | 240 |
| **Plumas** | 009-040-005- | 30 24N 11E (M) | 170 |

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| **Plumas** | 009-050-002- | 31 24N 11E (M) | 4.38 |
| **Plumas** | 009-050-003- | 25 24N 10E (M) | 30 |
| **Plumas** | 009-050-003- | 30 24N 11E (M) | 105.79 |
| **Plumas** | 009-050-003- | 31 24N 11E (M) | 40 |
| **Plumas** | 009-060-001- | 31 24N 11E (M) | 19.58 |
| **Plumas** | 009-060-003- | 31 24N 11E (M) | 1.91 |
| **Plumas** | 009-060-013- | 31 24N 11E (M) | 85.94 |
| **Plumas** | 009-060-017- | 31 24N 11E (M) | 330.08 |
| **Plumas** | 009-060-018- | 31 24N 11E (M) | 144.21 |
| **Plumas** | 009-060-020- | 31 24N 11E (M) | 16.53 |
| **Plumas** | 009-100-002- | 01 24N 11E (M) | 0.5 |
| **Plumas** | 009-100-002- | 12 24N 11E (M) | 36.82 |
| **Plumas** | 009-100-002- | 07 24N 12E (M) | 4 |
| **Plumas** | 009-100-003- | 01 24N 11E (M) | 4 |
| **Plumas** | 009-100-003- | 12 24N 11E (M) | 0.5 |
| **Plumas** | 009-100-003- | 06 24N 12E (M) | 15.16 |
| **Plumas** | 009-100-003- | 07 24N 12E (M) | 1 |
| **Plumas** | 009-100-004- | 12 24N 11E (M) | 1 |
| **Plumas** | 009-100-004- | 06 24N 12E (M) | 6 |
| **Plumas** | 009-100-004- | 07 24N 12E (M) | 34.32 |
| **Plumas** | 009-100-005- | 06 24N 12E (M) | 1 |
| **Plumas** | 009-100-005- | 07 24N 12E (M) | 19.66 |
| **Plumas** | 009-100-006- | 06 24N 12E (M) | 3 |
| **Plumas** | 009-100-006- | 07 24N 12E (M) | 12.85 |
| **Plumas** | 009-100-007- | 07 24N 12E (M) | 20.66 |
| **Plumas** | 009-100-008- | 07 24N 12E (M) | 20.66 |
| **Plumas** | 009-120-004- | 33 24N 12E (M) | 160 |
| **Plumas** | 009-120-005- | 29 24N 12E (M) | 40 |
| **Plumas** | 009-120-006- | 30 24N 12E (M) | 198.26 |
| **Plumas** | 009-120-007- | 31 24N 12E (M) | 633.4 |
| **Plumas** | 009-120-008- | 32 24N 12E (M) | 80 |
| **Plumas** | 009-240-001- | 28 24N 11E (M) | 80 |
| **Plumas** | 009-240-001- | 29 24N 11E (M) | 80 |
| **Plumas** | 011-060-011- | 13 29N 06E (M) | 120 |
| **Plumas** | 011-060-012- | 14 29N 06E (M) | 160 |
| **Plumas** | 011-060-017- | 04 29N 06E (M) | 80 |
| **Plumas** | 011-060-017- | 09 29N 06E (M) | 320 |
| **Plumas** | 011-060-017- | 16 29N 06E (M) | 440 |
| **Plumas** | 011-070-001- | 01 29N 07E (M) | 80 |
| **Plumas** | 011-070-002- | 12 29N 07E (M) | 200 |
| **Plumas** | 011-070-003- | 13 29N 07E (M) | 640 |
| **Plumas** | 011-070-004- | 14 29N 07E (M) | 440 |
| **Plumas** | 011-070-005- | 14 29N 07E (M) | 40 |
| **Plumas** | 011-070-006- | 15 29N 07E (M) | 160 |

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| **Plumas** | 011-070-007- | 15 29N 07E (M) | 40 |
| **Plumas** | 011-070-008- | 16 29N 07E (M) | 640 |
| **Plumas** | 011-070-009- | 17 29N 07E (M) | 80 |
| **Plumas** | 011-070-010- | 18 29N 07E (M) | 276.94 |
| **Plumas** | 011-070-012- | 14 29N 07E (M) | 40 |
| **Plumas** | 011-070-013- | 14 29N 07E (M) | 80 |
| **Plumas** | 011-070-015- | 15 29N 07E (M) | 400 |
| **Plumas** | 011-070-016- | 14 29N 07E (M) | 40 |
| **Plumas** | 011-070-016- | 15 29N 07E (M) | 40 |
| **Plumas** | 011-080-004- | 06 29N 08E (M) | 36 |
| **Plumas** | 011-080-005- | 07 29N 08E (M) | 144.8 |
| **Plumas** | 011-080-006- | 07 29N 08E (M) | 40 |
| **Plumas** | 011-080-013- | 18 29N 08E (M) | 626.62 |
| **Plumas** | 011-100-003- | 23 29N 06E (M) | 640 |
| **Plumas** | 011-100-004- | 24 29N 06E (M) | 640 |
| **Plumas** | 011-100-005- | 25 29N 06E (M) | 640 |
| **Plumas** | 011-100-006- | 26 29N 06E (M) | 640 |
| **Plumas** | 011-100-017- | 35 29N 06E (M) | 360 |
| **Plumas** | 011-100-019- | 36 29N 06E (M) | 640 |
| **Plumas** | 011-110-001- | 19 29N 07E (M) | 627 |
| **Plumas** | 011-110-002- | 20 29N 07E (M) | 480 |
| **Plumas** | 011-110-003- | 21 29N 07E (M) | 160 |
| **Plumas** | 011-110-005- | 23 29N 07E (M) | 160 |
| **Plumas** | 011-110-006- | 24 29N 07E (M) | 640 |
| **Plumas** | 011-110-007- | 25 29N 07E (M) | 640 |
| **Plumas** | 011-110-008- | 26 29N 07E (M) | 80 |
| **Plumas** | 011-110-009- | 26 29N 07E (M) | 40 |
| **Plumas** | 011-110-010- | 27 29N 07E (M) | 80 |
| **Plumas** | 011-110-011- | 27 29N 07E (M) | 160 |
| **Plumas** | 011-110-012- | 28 29N 07E (M) | 419 |
| **Plumas** | 011-110-013- | 29 29N 07E (M) | 253.7 |
| **Plumas** | 011-110-014- | 30 29N 07E (M) | 625.98 |
| **Plumas** | 011-110-015- | 31 29N 07E (M) | 505.3 |
| **Plumas** | 011-110-018- | 32 29N 07E (M) | 40 |
| **Plumas** | 011-110-020- | 33 29N 07E (M) | 159 |
| **Plumas** | 011-110-021- | 34 29N 07E (M) | 400 |
| **Plumas** | 011-110-022- | 35 29N 07E (M) | 400 |
| **Plumas** | 011-110-026- | 20 29N 07E (M) | 40 |
| **Plumas** | 011-110-028- | 31 29N 07E (M) | 40 |
| **Plumas** | 011-110-029- | 21 29N 07E (M) | 480 |
| **Plumas** | 011-110-034- | 22 29N 07E (M) | 640 |
| **Plumas** | 011-110-034- | 23 29N 07E (M) | 480 |
| **Plumas** | 011-110-034- | 26 29N 07E (M) | 520 |
| **Plumas** | 011-110-034- | 27 29N 07E (M) | 400 |

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| **Plumas** | 011-110-034- | 34 29N 07E (M) | 100 |
| **Plumas** | 011-110-036- | 36 29N 07E (M) | 601.55 |
| **Plumas** | 011-120-001- | 19 29N 08E (M) | 627.04 |
| **Plumas** | 011-120-007- | 29 29N 08E (M) | 640 |
| **Plumas** | 011-120-008- | 30 29N 08E (M) | 625.6 |
| **Plumas** | 011-120-010- | 32 29N 08E (M) | 640 |
| **Plumas** | 011-120-013- | 31 29N 08E (M) | 623.74 |
| **Plumas** | 025-010-001- | 03 23N 12E (M) | 84.01 |
| **Plumas** | 025-010-002- | 03 23N 12E (M) | 80 |
| **Plumas** | 025-010-003- | 04 23N 12E (M) | 563 |
| **Plumas** | 025-010-004- | 05 23N 12E (M) | 642.25 |
| **Plumas** | 025-010-005- | 06 23N 12E (M) | 522 |
| **Plumas** | 025-010-006- | 07 23N 12E (M) | 160 |
| **Plumas** | 025-010-007- | 08 23N 12E (M) | 600 |
| **Plumas** | 025-010-008- | 09 23N 12E (M) | 480 |
| **Plumas** | 025-010-009- | 16 23N 12E (M) | 240 |
| **Plumas** | 025-010-010- | 16 23N 12E (M) | 80 |
| **Plumas** | 025-010-011- | 16 23N 12E (M) | 80 |
| **Plumas** | 025-010-012- | 16 23N 12E (M) | 40 |
| **Plumas** | 025-010-013- | 16 23N 12E (M) | 200 |
| **Plumas** | 025-010-014- | 17 23N 12E (M) | 200 |
| **Plumas** | 025-040-006- | 33 23N 12E (M) | 40 |
| **Plumas** | 025-140-002- | 32 23N 12E (M) | 3.6 |
| **Plumas** | 025-140-013- | 32 23N 12E (M) | 153.2 |
| **Plumas** | 025-140-014- | 33 23N 12E (M) | 140 |
| **Plumas** | 103-010-001- | 12 28N 07E (M) | 5 |
| **Plumas** | 103-010-002- | 12 28N 07E (M) | 43.16 |
| **Plumas** | 106-030-009- | 34 28N 08E (M) | 107.01 |
| **Plumas** | 106-320-003- | 27 28N 08E (M) | 4.32 |
| **Plumas** | 110-220-009- | 11 26N 09E (M) | 40 |
| **Plumas** | 111-010-019- | 11 26N 09E (M) | 12.75 |
| **Plumas** | 111-010-019- | 14 26N 09E (M) | 1 |
| **Plumas** | 111-010-020- | 10 26N 09E (M) | 35 |
| **Plumas** | 111-010-020- | 11 26N 09E (M) | 69.95 |
| **Plumas** | 111-010-022- | 11 26N 09E (M) | 9.64 |
| **Plumas** | 111-020-002- | 14 26N 09E (M) | 120 |
| **Plumas** | 111-020-003- | 11 26N 09E (M) | 10 |
| **Plumas** | 111-020-003- | 14 26N 09E (M) | 55.68 |
| **Plumas** | 111-150-001-1 | 27 26N 09E (M) | 160 |
| **Plumas** | 120-090-005- | 28 26N 10E (M) | 29.2 |
| **Plumas** | 120-090-006- | 28 26N 10E (M) | 60 |
| **Plumas** | 122-010-002- | 16 23N 11E (M) | 540 |
| **Plumas** | 122-020-005- | 05 23N 11E (M) | 13 |
| **Plumas** | 122-020-005- | 06 23N 11E (M) | 15.93 |

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| **Plumas** | 122-020-006- | 06 23N 11E (M) | 9.1 |
| **Plumas** | 122-020-013- | 05 23N 11E (M) | 532.66 |
| **Plumas** | 122-020-013- | 06 23N 11E (M) | 5 |
| **Plumas** | 122-020-013- | 08 23N 11E (M) | 1 |
| **Plumas** | 122-020-016- | 06 23N 11E (M) | 12.45 |
| **Plumas** | 122-020-017- | 06 23N 11E (M) | 18.05 |
| **Plumas** | 122-020-018- | 06 23N 11E (M) | 11.11 |
| **Plumas** | 122-020-019- | 06 23N 11E (M) | 15.5 |
| **Plumas** | 122-020-020- | 06 23N 11E (M) | 61.59 |
| **Plumas** | 122-020-021- | 06 23N 11E (M) | 274.06 |
| **Plumas** | 122-020-022- | 06 23N 11E (M) | 75.05 |
| **Plumas** | 122-030-002- | 08 23N 11E (M) | 62.67 |
| **Plumas** | 122-070-005- | 14 23N 11E (M) | 232.42 |
| **Plumas** | 122-070-006- | 14 23N 11E (M) | 2.6 |
| **Plumas** | 122-070-020- | 10 23N 11E (M) | 88.28 |
| **Plumas** | 122-070-021- | 15 23N 11E (M) | 35.7 |
| **Plumas** | 122-080-005- | 14 23N 11E (M) | 21.01 |
| **Plumas** | 122-080-005- | 15 23N 11E (M) | 80 |
| **Plumas** | 122-240-001- | 17 23N 12E (M) | 11 |
| **Plumas** | 122-240-001- | 18 23N 12E (M) | 124.77 |
| **Plumas** | 123-020-017- | 36 22N 12E (M) | 326 |
| **Plumas** | 123-020-018- | 35 22N 12E (M) | 164 |
| **Plumas** | 123-020-019- | 34 22N 12E (M) | 40 |
| **Plumas** | 123-020-019- | 35 22N 12E (M) | 124 |
| **Plumas** | 123-020-020- | 35 22N 12E (M) | 163 |
| **Shasta** | 011-270-029- | 33 32N 07W (M) | 402 |
| **Shasta** | 011-290-046- | 07 32N 07W (M) | 447 |
| **Shasta** | 011-310-019- | 02 32N 08W (M) | 240 |
| **Shasta** | 014-280-001- | 01 38N 05W (M) | 277 |
| **Shasta** | 014-290-002- | 03 38N 05W (M) | 301 |
| **Shasta** | 014-300-001- | 05 38N 05W (M) | 196 |
| **Shasta** | 014-300-004- | 01 38N 06W (M) | 139 |
| **Shasta** | 014-330-001- | 13 38N 05W (M) | 685 |
| **Shasta** | 014-330-003- | 23 38N 05W (M) | 621 |
| **Shasta** | 014-330-005- | 19 38N 04W (M) | 627 |
| **Shasta** | 014-370-001- | 25 38N 05W (M) | 626 |
| **Shasta** | 014-370-003- | 35 38N 05W (M) | 650 |
| **Shasta** | 014-560-001- | 33 38N 04W (M) | 40 |
| **Shasta** | 014-560-002- | 33 38N 04W (M) | 16 |
| **Shasta** | 014-560-005- | 33 38N 04W (M) | 79 |
| **Shasta** | 014-570-010- | 33 38N 04W (M) | 43 |
| **Shasta** | 014-580-012- | 28 38N 04W (M) | 23 |
| **Shasta** | 014-700-003- | 24 38N 04W (M) | 560 |
| **Shasta** | 014-700-004- | 23 38N 04W (M) | 700 |

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| **Shasta** | 014-700-005- | 22 38N 04W (M) | 235 |
| **Shasta** | 014-770-004- | 27 38N 04W (M) | 302 |
| **Shasta** | 014-790-003- | 25 38N 04W (M) | 605 |
| **Shasta** | 014-790-004- | 26 38N 04W (M) | 582 |
| **Shasta** | 014-790-005- | 34 38N 04W (M) | 231 |
| **Shasta** | 014-790-006- | 34 38N 04W (M) | 360 |
| **Shasta** | 014-790-007- | 35 38N 04W (M) | 637 |
| **Shasta** | 014-790-010- | 36 38N 04W (M) | 609 |
| **Shasta** | 016-070-011- | 31 38N 02E (M) | 888 |
| **Shasta** | 016-110-061- | 09 38N 03E (M) | 521.65 |
| **Shasta** | 016-110-075- | 09 38N 03E (M) | 115 |
| **Shasta** | 016-120-007- | 10 38N 03E (M) | 644 |
| **Shasta** | 016-130-041- | 16 38N 03E (M) | 635.09 |
| **Shasta** | 016-130-045- | 21 38N 03E (M) | 631.42 |
| **Shasta** | 016-180-015- | 28 38N 03E (M) | 40 |
| **Shasta** | 016-190-001- | 27 38N 03E (M) | 524 |
| **Shasta** | 016-190-003- | 26 38N 03E (M) | 80 |
| **Shasta** | 016-190-010- | 34 38N 03E (M) | 200 |
| **Shasta** | 016-190-012- | 35 38N 03E (M) | 240 |
| **Shasta** | 016-190-013- | 35 38N 03E (M) | 393 |
| **Shasta** | 016-190-014- | 36 38N 03E (M) | 636 |
| **Shasta** | 016-190-018- | 25 38N 03E (M) | 480 |
| **Shasta** | 016-190-038- | 26 38N 03E (M) | 320 |
| **Shasta** | 016-190-039- | 26 38N 03E (M) | 80 |
| **Shasta** | 016-190-040- | 26 38N 03E (M) | 160 |
| **Shasta** | 016-360-039- | 25 39N 05E (M) | 60 |
| **Shasta** | 016-360-039- | 36 39N 05E (M) | 320 |
| **Shasta** | 016-550-006- | 01 38N 05E (M) | 80 |
| **Shasta** | 016-550-007- | 01 38N 05E (M) | 200 |
| **Shasta** | 016-550-008- | 01 38N 05E (M) | 40 |
| **Shasta** | 016-550-009- | 01 38N 05E (M) | 40 |
| **Shasta** | 016-560-002- | 22 38N 03E (M) | 649 |
| **Shasta** | 016-560-003- | 23 38N 03E (M) | 40 |
| **Shasta** | 016-560-023- | 15 38N 03E (M) | 503 |
| **Shasta** | 016-560-024- | 15 38N 03E (M) | 134 |
| **Shasta** | 016-560-025- | 14 38N 03E (M) | 494 |
| **Shasta** | 016-560-026- | 14 38N 03E (M) | 146.2 |
| **Shasta** | 016-560-029- | 23 38N 03E (M) | 500.65 |
| **Shasta** | 016-560-033- | 23 38N 03E (M) | 106.35 |
| **Shasta** | 016-560-033- | 24 38N 03E (M) | 35.24 |
| **Shasta** | 016-560-036- | 24 38N 03E (M) | 14.73 |
| **Shasta** | 016-570-032- | 31 38N 04E (M) | 198 |
| **Shasta** | 017-010-011- | 35 37N 05W (M) | 243 |
| **Shasta** | 017-020-008- | 36 37N 05W (M) | 80 |

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| **Shasta** | 017-090-005- | 17 37N 04W (M) | 39.21 |
| **Shasta** | 017-130-023- | 05 37N 04W (M) | 24 |
| **Shasta** | 017-140-004- | 04 37N 04W (M) | 86 |
| **Shasta** | 017-150-002- | 33 37N 05W (M) | 551 |
| **Shasta** | 017-160-002- | 27 37N 05W (M) | 677 |
| **Shasta** | 017-170-004- | 35 37N 05W (M) | 326 |
| **Shasta** | 017-190-001- | 21 37N 05W (M) | 285 |
| **Shasta** | 017-190-004- | 22 37N 05W (M) | 18.77 |
| **Shasta** | 017-300-002- | 29 37N 05W (M) | 647 |
| **Shasta** | 017-320-003- | 23 37N 06W (M) | 324 |
| **Shasta** | 017-350-001- | 13 37N 06W (M) | 617 |
| **Shasta** | 017-360-001- | 15 37N 06W (M) | 167 |
| **Shasta** | 017-370-003- | 11 37N 06W (M) | 377 |
| **Shasta** | 017-380-003- | 07 37N 05W (M) | 503 |
| **Shasta** | 017-400-001- | 31 37N 04W (M) | 645 |
| **Shasta** | 017-410-001- | 33 37N 04W (M) | 662 |
| **Shasta** | 017-430-001- | 26 37N 04W (M) | 640 |
| **Shasta** | 017-430-002- | 25 37N 04W (M) | 563 |
| **Shasta** | 017-440-001- | 28 37N 04W (M) | 602 |
| **Shasta** | 017-440-002- | 27 37N 04W (M) | 663 |
| **Shasta** | 017-450-002- | 29 37N 04W (M) | 581 |
| **Shasta** | 017-460-007- | 17 37N 04W (M) | 228 |
| **Shasta** | 017-460-012- | 17 37N 04W (M) | 75 |
| **Shasta** | 017-470-001- | 21 37N 04W (M) | 603 |
| **Shasta** | 017-470-003- | 22 37N 04W (M) | 180 |
| **Shasta** | 017-470-004- | 22 37N 04W (M) | 460 |
| **Shasta** | 017-480-001- | 23 37N 04W (M) | 671 |
| **Shasta** | 017-480-004- | 24 37N 04W (M) | 520 |
| **Shasta** | 017-490-002- | 13 37N 04W (M) | 590 |
| **Shasta** | 017-490-004- | 14 37N 04W (M) | 80 |
| **Shasta** | 017-490-005- | 14 37N 04W (M) | 340 |
| **Shasta** | 017-500-002- | 15 37N 04W (M) | 566 |
| **Shasta** | 017-500-004- | 16 37N 04W (M) | 550 |
| **Shasta** | 017-510-001- | 09 37N 04W (M) | 652 |
| **Shasta** | 017-510-003- | 10 37N 04W (M) | 456 |
| **Shasta** | 017-520-001- | 11 37N 04W (M) | 681 |
| **Shasta** | 017-520-002- | 12 37N 04W (M) | 640 |
| **Shasta** | 017-530-001- | 02 37N 04W (M) | 693 |
| **Shasta** | 017-530-002- | 01 37N 04W (M) | 596 |
| **Shasta** | 017-540-002- | 04 37N 04W (M) | 92 |
| **Shasta** | 017-540-003- | 03 37N 04W (M) | 612 |
| **Shasta** | 019-030-004- | 19 36N 06W (M) | 18 |
| **Shasta** | 019-050-003- | 03 36N 06W (M) | 40 |
| **Shasta** | 019-050-004- | 03 36N 06W (M) | 16 |

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| **Shasta** | 019-060-004- | 09 36N 06W (M) | 7 |
| **Shasta** | 019-070-003- | 16 36N 06W (M) | 40 |
| **Shasta** | 019-120-001- | 25 36N 06W (M) | 615 |
| **Shasta** | 019-200-002- | 19 36N 05W (M) | 650 |
| **Shasta** | 019-210-001- | 29 36N 05W (M) | 612 |
| **Shasta** | 019-260-002- | 25 36N 05W (M) | 664 |
| **Shasta** | 019-270-001- | 13 36N 05W (M) | 630 |
| **Shasta** | 019-270-003- | 15 36N 05W (M) | 38 |
| **Shasta** | 019-280-001- | 11 36N 05W (M) | 290 |
| **Shasta** | 019-290-001- | 01 36N 05W (M) | 567 |
| **Shasta** | 019-310-028- | 34 36N 05W (M) | 19.69 |
| **Shasta** | 019-310-029- | 27 36N 05W (M) | 82 |
| **Shasta** | 019-310-029- | 34 36N 05W (M) | 5 |
| **Shasta** | 019-320-012- | 27 36N 05W (M) | 24 |
| **Shasta** | 019-340-004- | 15 36N 05W (M) | 44 |
| **Shasta** | 019-350-027- | 11 36N 05W (M) | 101.25 |
| **Shasta** | 019-350-028- | 11 36N 05W (M) | 2.75 |
| **Shasta** | 019-360-093- | 11 36N 05W (M) | 28 |
| **Shasta** | 019-410-005- | 21 36N 05W (M) | 174 |
| **Shasta** | 019-410-006- | 21 36N 05W (M) | 140 |
| **Shasta** | 019-410-017- | 21 36N 05W (M) | 82 |
| **Shasta** | 019-430-002- | 09 36N 05W (M) | 338 |
| **Shasta** | 019-440-002- | 03 36N 05W (M) | 581 |
| **Shasta** | 020-030-001- | 05 36N 04W (M) | 601 |
| **Shasta** | 020-050-002- | 09 36N 04W (M) | 630 |
| **Shasta** | 020-060-002- | 11 36N 04W (M) | 633 |
| **Shasta** | 020-080-001- | 15 36N 04W (M) | 631 |
| **Shasta** | 020-090-001- | 17 36N 04W (M) | 629 |
| **Shasta** | 020-110-002- | 21 36N 04W (M) | 628 |
| **Shasta** | 020-130-001- | 25 36N 04W (M) | 616 |
| **Shasta** | 020-150-001- | 29 36N 04W (M) | 632 |
| **Shasta** | 020-160-004- | 31 36N 04W (M) | 609 |
| **Shasta** | 020-180-002- | 35 36N 04W (M) | 640 |
| **Shasta** | 020-190-001- | 01 36N 03W (M) | 643 |
| **Shasta** | 020-200-001- | 03 36N 03W (M) | 633 |
| **Shasta** | 020-210-001- | 05 36N 03W (M) | 615 |
| **Shasta** | 020-240-002- | 11 36N 03W (M) | 624 |
| **Shasta** | 020-250-001- | 13 36N 03W (M) | 628 |
| **Shasta** | 020-270-001- | 17 36N 03W (M) | 595 |
| **Shasta** | 020-300-002- | 23 36N 03W (M) | 618 |
| **Shasta** | 020-310-001- | 25 36N 03W (M) | 624 |
| **Shasta** | 020-320-001- | 27 36N 03W (M) | 610 |
| **Shasta** | 020-360-002- | 35 36N 03W (M) | 609 |
| **Shasta** | 020-470-002- | 27 37N 03W (M) | 320 |

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| **Shasta** | 020-480-001- | 25 37N 03W (M) | 651 |
| **Shasta** | 020-490-002- | 35 37N 03W (M) | 306 |
| **Shasta** | 020-490-003- | 35 37N 03W (M) | 320 |
| **Shasta** | 021-030-002- | 17 37N 02W (M) | 627 |
| **Shasta** | 021-030-005- | 19 37N 02W (M) | 839 |
| **Shasta** | 021-030-007- | 21 37N 02W (M) | 647 |
| **Shasta** | 021-040-001- | 15 37N 02W (M) | 645 |
| **Shasta** | 021-040-003- | 13 37N 02W (M) | 660 |
| **Shasta** | 021-040-005- | 23 37N 02W (M) | 697 |
| **Shasta** | 021-050-004- | 31 37N 02W (M) | 841 |
| **Shasta** | 021-050-006- | 33 37N 02W (M) | 642 |
| **Shasta** | 021-050-007- | 29 37N 02W (M) | 640 |
| **Shasta** | 021-060-001- | 27 37N 02W (M) | 657 |
| **Shasta** | 021-060-003- | 25 37N 02W (M) | 648 |
| **Shasta** | 021-060-005- | 35 37N 02W (M) | 636 |
| **Shasta** | 021-070-004- | 07 37N 01W (M) | 290 |
| **Shasta** | 021-100-009- | 23 37N 01W (M) | 600 |
| **Shasta** | 021-100-015- | 24 37N 01W (M) | 80 |
| **Shasta** | 021-100-028- | 24 37N 01W (M) | 20 |
| **Shasta** | 021-110-004- | 31 37N 01W (M) | 633 |
| **Shasta** | 021-110-006- | 33 37N 01W (M) | 613 |
| **Shasta** | 021-120-007- | 35 37N 01W (M) | 80 |
| **Shasta** | 021-130-002- | 05 36N 02W (M) | 636 |
| **Shasta** | 021-130-004- | 07 36N 02W (M) | 831 |
| **Shasta** | 021-130-006- | 09 36N 02W (M) | 624 |
| **Shasta** | 021-140-001- | 03 36N 02W (M) | 597 |
| **Shasta** | 021-140-003- | 01 36N 02W (M) | 622 |
| **Shasta** | 021-140-005- | 11 36N 02W (M) | 635 |
| **Shasta** | 021-150-002- | 17 36N 02W (M) | 638 |
| **Shasta** | 021-150-003- | 16 36N 02W (M) | 316 |
| **Shasta** | 021-150-005- | 19 36N 02W (M) | 827 |
| **Shasta** | 021-150-007- | 21 36N 02W (M) | 625 |
| **Shasta** | 021-170-002- | 29 36N 02W (M) | 610 |
| **Shasta** | 021-170-006- | 33 36N 02W (M) | 588 |
| **Shasta** | 021-190-002- | 05 36N 01W (M) | 717 |
| **Shasta** | 021-190-004- | 07 36N 01W (M) | 553 |
| **Shasta** | 021-190-006- | 09 36N 01W (M) | 278 |
| **Shasta** | 021-200-001- | 03 36N 01W (M) | 80 |
| **Shasta** | 021-200-017- | 10 36N 01W (M) | 160 |
| **Shasta** | 021-220-002- | 17 36N 01W (M) | 669 |
| **Shasta** | 021-220-005- | 19 36N 01W (M) | 472 |
| **Shasta** | 021-240-002- | 29 36N 01W (M) | 343 |
| **Shasta** | 021-240-007- | 31 36N 01W (M) | 557 |
| **Shasta** | 021-240-010- | 33 36N 01W (M) | 320 |

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| **Shasta** | 021-270-005- | 36 37N 01W (M) | 17.69 |
| **Shasta** | 021-290-003- | 14 36N 01W (M) | 40 |
| **Shasta** | 021-290-005- | 14 36N 01W (M) | 20.19 |
| **Shasta** | 022-010-002- | 05 37N 01E (M) | 641 |
| **Shasta** | 022-010-003- | 04 37N 01E (M) | 639 |
| **Shasta** | 022-010-005- | 08 37N 01E (M) | 640 |
| **Shasta** | 022-010-006- | 09 37N 01E (M) | 640 |
| **Shasta** | 022-020-001- | 03 37N 01E (M) | 639 |
| **Shasta** | 022-020-002- | 02 37N 01E (M) | 640 |
| **Shasta** | 022-020-003- | 01 37N 01E (M) | 641 |
| **Shasta** | 022-020-004- | 10 37N 01E (M) | 640 |
| **Shasta** | 022-020-005- | 11 37N 01E (M) | 640 |
| **Shasta** | 022-020-006- | 12 37N 01E (M) | 640 |
| **Shasta** | 022-040-001- | 15 37N 01E (M) | 640 |
| **Shasta** | 022-040-002- | 14 37N 01E (M) | 640 |
| **Shasta** | 022-040-003- | 13 37N 01E (M) | 640 |
| **Shasta** | 022-040-004- | 22 37N 01E (M) | 156 |
| **Shasta** | 022-040-005- | 22 37N 01E (M) | 480 |
| **Shasta** | 022-040-006- | 23 37N 01E (M) | 640 |
| **Shasta** | 022-070-001- | 27 37N 01E (M) | 636 |
| **Shasta** | 022-070-002- | 26 37N 01E (M) | 640 |
| **Shasta** | 022-080-004- | 05 36N 01E (M) | 242 |
| **Shasta** | 022-090-007- | 06 36N 01E (M) | 160 |
| **Shasta** | 022-100-001- | 03 36N 01E (M) | 155 |
| **Shasta** | 022-130-011- | 28 36N 01E (M) | 320 |
| **Shasta** | 022-130-012- | 28 36N 01E (M) | 160 |
| **Shasta** | 022-130-018- | 33 36N 01E (M) | 640 |
| **Shasta** | 022-140-004- | 25 36N 01E (M) | 80 |
| **Shasta** | 022-150-001- | 07 37N 02E (M) | 369 |
| **Shasta** | 022-250-005- | 28 36N 02E (M) | 40 |
| **Shasta** | 022-300-004- | 19 37N 01E (M) | 439 |
| **Shasta** | 022-300-007- | 19 37N 01E (M) | 5 |
| **Shasta** | 022-300-008- | 19 37N 01E (M) | 5 |
| **Shasta** | 022-300-009- | 19 37N 01E (M) | 5 |
| **Shasta** | 022-300-010- | 19 37N 01E (M) | 5 |
| **Shasta** | 022-300-011- | 17 37N 01E (M) | 20 |
| **Shasta** | 022-300-014- | 17 37N 01E (M) | 480 |
| **Shasta** | 022-300-019- | 20 37N 01E (M) | 160 |
| **Shasta** | 022-300-030- | 20 37N 01E (M) | 160 |
| **Shasta** | 022-300-031- | 16 37N 01E (M) | 640 |
| **Shasta** | 022-300-032- | 21 37N 01E (M) | 637 |
| **Shasta** | 022-310-001- | 30 37N 01E (M) | 40.1 |
| **Shasta** | 022-310-002- | 30 37N 01E (M) | 40 |
| **Shasta** | 022-310-016- | 32 37N 01E (M) | 120 |

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| **Shasta** | 022-310-017- | 32 37N 01E (M) | 80 |
| **Shasta** | 022-310-018- | 33 37N 01E (M) | 640 |
| **Shasta** | 022-310-023- | 29 37N 01E (M) | 562.41 |
| **Shasta** | 022-310-031- | 28 37N 01E (M) | 537.34 |
| **Shasta** | 023-050-006- | 01 37N 03E (M) | 165 |
| **Shasta** | 023-490-002- | 06 37N 04E (M) | 160 |
| **Shasta** | 024-200-001- | 03 34N 07W (M) | 606 |
| **Shasta** | 024-210-003- | 09 34N 07W (M) | 182 |
| **Shasta** | 024-220-001- | 11 34N 07W (M) | 629 |
| **Shasta** | 024-240-001- | 15 34N 07W (M) | 557 |
| **Shasta** | 024-240-003- | 16 34N 07W (M) | 228 |
| **Shasta** | 024-250-003- | 21 34N 07W (M) | 180 |
| **Shasta** | 024-260-001- | 23 34N 07W (M) | 584 |
| **Shasta** | 024-280-001- | 27 34N 07W (M) | 620 |
| **Shasta** | 024-290-002- | 29 34N 07W (M) | 87 |
| **Shasta** | 024-300-003- | 31 34N 07W (M) | 216 |
| **Shasta** | 024-300-004- | 31 34N 07W (M) | 24 |
| **Shasta** | 024-360-001- | 05 35N 06W (M) | 901 |
| **Shasta** | 024-370-002- | 07 35N 06W (M) | 594 |
| **Shasta** | 024-380-002- | 09 35N 06W (M) | 637 |
| **Shasta** | 024-390-002- | 11 35N 06W (M) | 36 |
| **Shasta** | 024-390-003- | 11 35N 06W (M) | 588 |
| **Shasta** | 024-400-001- | 13 35N 06W (M) | 659 |
| **Shasta** | 024-410-001- | 15 35N 06W (M) | 548 |
| **Shasta** | 024-410-004- | 15 35N 06W (M) | 120 |
| **Shasta** | 024-420-003- | 17 35N 06W (M) | 160 |
| **Shasta** | 024-430-002- | 19 35N 06W (M) | 595 |
| **Shasta** | 024-440-002- | 21 35N 06W (M) | 538 |
| **Shasta** | 024-450-002- | 23 35N 06W (M) | 632 |
| **Shasta** | 024-470-001- | 27 35N 06W (M) | 354 |
| **Shasta** | 024-470-003- | 27 35N 06W (M) | 283 |
| **Shasta** | 024-480-001- | 29 35N 06W (M) | 665 |
| **Shasta** | 024-490-002- | 31 35N 06W (M) | 510 |
| **Shasta** | 024-500-002- | 33 35N 06W (M) | 565 |
| **Shasta** | 024-520-001- | 01 35N 07W (M) | 394 |
| **Shasta** | 024-540-002- | 13 35N 07W (M) | 347 |
| **Shasta** | 024-550-002- | 23 35N 07W (M) | 307 |
| **Shasta** | 024-560-001- | 25 35N 07W (M) | 665 |
| **Shasta** | 024-570-002- | 27 35N 07W (M) | 84 |
| **Shasta** | 024-580-002- | 33 35N 07W (M) | 73 |
| **Shasta** | 024-590-002- | 35 35N 07W (M) | 640 |
| **Shasta** | 026-020-001- | 03 35N 03W (M) | 883 |
| **Shasta** | 026-020-003- | 01 35N 03W (M) | 894 |
| **Shasta** | 026-040-002- | 11 35N 03W (M) | 638 |

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| **Shasta** | 026-060-003- | 13 35N 03W (M) | 695 |
| **Shasta** | 026-060-005- | 23 35N 03W (M) | 594 |
| **Shasta** | 026-070-036- | 33 35N 03W (M) | 40 |
| **Shasta** | 026-070-037- | 33 35N 03W (M) | 40 |
| **Shasta** | 026-070-039- | 33 35N 03W (M) | 40 |
| **Shasta** | 026-080-001- | 27 35N 03W (M) | 640 |
| **Shasta** | 026-080-003- | 25 35N 03W (M) | 657 |
| **Shasta** | 026-080-005- | 35 35N 03W (M) | 591 |
| **Shasta** | 026-100-001- | 03 34N 03W (M) | 620 |
| **Shasta** | 026-260-005- | 13 34N 02W (M) | 320 |
| **Shasta** | 026-260-008- | 23 34N 02W (M) | 640 |
| **Shasta** | 026-260-009- | 24 34N 02W (M) | 640 |
| **Shasta** | 026-420-001- | 25 34N 02W (M) | 640 |
| **Shasta** | 027-010-002- | 05 35N 01W (M) | 470 |
| **Shasta** | 027-010-006- | 04 35N 01W (M) | 160 |
| **Shasta** | 027-030-006- | 09 35N 01W (M) | 187 |
| **Shasta** | 027-050-005- | 19 35N 01W (M) | 804 |
| **Shasta** | 027-050-008- | 16 35N 01W (M) | 416 |
| **Shasta** | 027-050-010- | 21 35N 01W (M) | 617 |
| **Shasta** | 027-070-002- | 29 35N 01W (M) | 560 |
| **Shasta** | 027-110-012- | 05 35N 01E (M) | 483 |
| **Shasta** | 027-110-014- | 04 35N 01E (M) | 160 |
| **Shasta** | 027-120-003- | 02 35N 01E (M) | 171 |
| **Shasta** | 027-120-004- | 01 35N 01E (M) | 658 |
| **Shasta** | 027-120-007- | 11 35N 01E (M) | 631 |
| **Shasta** | 027-120-008- | 12 35N 01E (M) | 640 |
| **Shasta** | 027-140-005- | 13 35N 01E (M) | 640 |
| **Shasta** | 027-140-018- | 24 35N 01E (M) | 360 |
| **Shasta** | 027-140-019- | 24 35N 01E (M) | 40 |
| **Shasta** | 027-140-020- | 24 35N 01E (M) | 80 |
| **Shasta** | 027-300-002- | 26 35N 01W (M) | 445 |
| **Shasta** | 027-300-006- | 35 35N 01W (M) | 36 |
| **Shasta** | 027-300-018- | 34 35N 01W (M) | 240 |
| **Shasta** | 028-370-006- | 21 35N 03E (M) | 40 |
| **Shasta** | 028-410-001- | 19 35N 03E (M) | 11.32 |
| **Shasta** | 028-410-002- | 19 35N 03E (M) | 25.6 |
| **Shasta** | 029-010-004- | 05 34N 01W (M) | 402 |
| **Shasta** | 029-010-008- | 08 34N 01W (M) | 640 |
| **Shasta** | 029-010-009- | 09 34N 01W (M) | 480 |
| **Shasta** | 029-010-012- | 04 34N 01W (M) | 604 |
| **Shasta** | 029-030-006- | 03 34N 01W (M) | 5 |
| **Shasta** | 029-050-003- | 17 34N 01W (M) | 640 |
| **Shasta** | 029-050-005- | 19 34N 01W (M) | 773 |
| **Shasta** | 029-050-014- | 18 34N 01W (M) | 289 |

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| **Shasta** | 029-050-018- | 20 34N 01W (M) | 520 |
| **Shasta** | 029-050-019- | 16 34N 01W (M) | 637 |
| **Shasta** | 029-340-003- | 10 34N 01W (M) | 40 |
| **Shasta** | 029-340-043- | 10 34N 01W (M) | 393.35 |
| **Shasta** | 029-340-044- | 10 34N 01W (M) | 113.61 |
| **Shasta** | 029-340-045- | 03 34N 01W (M) | 507.18 |
| **Shasta** | 029-340-046- | 03 34N 01W (M) | 52.85 |
| **Shasta** | 029-400-012- | 35 34N 01W (M) | 80 |
| **Shasta** | 029-400-032- | 35 34N 01W (M) | 160 |
| **Shasta** | 029-410-009- | 36 34N 01W (M) | 224 |
| **Shasta** | 029-440-067- | 30 34N 01W (M) | 756 |
| **Shasta** | 029-440-068- | 30 34N 01W (M) | 1 |
| **Shasta** | 029-440-071- | 33 34N 01W (M) | 145 |
| **Shasta** | 029-440-072- | 33 34N 01W (M) | 9 |
| **Shasta** | 029-480-006- | 02 34N 01W (M) | 44 |
| **Shasta** | 029-540-001- | 11 34N 01W (M) | 200 |
| **Shasta** | 029-610-007- | 15 34N 01W (M) | 554 |
| **Shasta** | 030-010-003- | 05 35N 02E (M) | 447 |
| **Shasta** | 030-010-008- | 07 35N 02E (M) | 212 |
| **Shasta** | 030-010-009- | 07 35N 02E (M) | 46 |
| **Shasta** | 030-010-016- | 06 35N 02E (M) | 160 |
| **Shasta** | 030-010-017- | 07 35N 02E (M) | 360 |
| **Shasta** | 030-010-019- | 09 35N 02E (M) | 41 |
| **Shasta** | 030-020-010- | 10 35N 02E (M) | 160 |
| **Shasta** | 030-020-011- | 10 35N 02E (M) | 160 |
| **Shasta** | 030-020-013- | 11 35N 02E (M) | 40 |
| **Shasta** | 030-020-014- | 11 35N 02E (M) | 160 |
| **Shasta** | 030-020-017- | 12 35N 02E (M) | 40 |
| **Shasta** | 030-020-018- | 12 35N 02E (M) | 400 |
| **Shasta** | 030-020-028- | 10 35N 02E (M) | 40 |
| **Shasta** | 030-020-029- | 10 35N 02E (M) | 40 |
| **Shasta** | 030-020-030- | 10 35N 02E (M) | 120 |
| **Shasta** | 030-020-031- | 11 35N 02E (M) | 80 |
| **Shasta** | 030-030-001- | 18 35N 02E (M) | 130 |
| **Shasta** | 030-030-003- | 18 35N 02E (M) | 44 |
| **Shasta** | 030-030-004- | 18 35N 02E (M) | 130 |
| **Shasta** | 030-030-005- | 18 35N 02E (M) | 86 |
| **Shasta** | 030-030-008- | 19 35N 02E (M) | 201 |
| **Shasta** | 030-030-009- | 19 35N 02E (M) | 430 |
| **Shasta** | 030-030-010- | 20 35N 02E (M) | 40 |
| **Shasta** | 030-030-011- | 20 35N 02E (M) | 560 |
| **Shasta** | 030-030-011- | 21 35N 02E (M) | 40 |
| **Shasta** | 030-030-014- | 17 35N 02E (M) | 120 |
| **Shasta** | 030-030-017- | 20 35N 02E (M) | 40 |

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| **Shasta** | 030-030-018- | 21 35N 02E (M) | 360 |
| **Shasta** | 030-040-002- | 15 35N 02E (M) | 160 |
| **Shasta** | 030-040-004- | 14 35N 02E (M) | 40 |
| **Shasta** | 030-040-010- | 22 35N 02E (M) | 5 |
| **Shasta** | 030-040-011- | 22 35N 02E (M) | 80 |
| **Shasta** | 030-040-013- | 22 35N 02E (M) | 40 |
| **Shasta** | 030-040-038- | 23 35N 02E (M) | 1 |
| **Shasta** | 030-040-041- | 13 35N 02E (M) | 80 |
| **Shasta** | 030-040-042- | 13 35N 02E (M) | 40 |
| **Shasta** | 030-040-047- | 15 35N 02E (M) | 40 |
| **Shasta** | 030-040-048- | 13 35N 02E (M) | 120 |
| **Shasta** | 030-040-048- | 14 35N 02E (M) | 400 |
| **Shasta** | 030-040-054- | 23 35N 02E (M) | 29 |
| **Shasta** | 030-040-056- | 23 35N 02E (M) | 26 |
| **Shasta** | 030-040-060- | 24 35N 02E (M) | 40 |
| **Shasta** | 030-040-064- | 24 35N 02E (M) | 6.41 |
| **Shasta** | 030-040-065- | 24 35N 02E (M) | 217 |
| **Shasta** | 030-040-068- | 22 35N 02E (M) | 148 |
| **Shasta** | 030-070-013- | 24 35N 02E (M) | 0.17 |
| **Shasta** | 030-080-003- | 29 35N 02E (M) | 75 |
| **Shasta** | 030-080-009- | 29 35N 02E (M) | 512 |
| **Shasta** | 030-080-012- | 28 35N 02E (M) | 656 |
| **Shasta** | 030-080-015- | 32 35N 02E (M) | 251 |
| **Shasta** | 030-080-016- | 33 35N 02E (M) | 580 |
| **Shasta** | 030-090-005- | 27 35N 02E (M) | 36 |
| **Shasta** | 030-090-006- | 27 35N 02E (M) | 156 |
| **Shasta** | 030-090-014- | 25 35N 02E (M) | 40 |
| **Shasta** | 030-090-016- | 34 35N 02E (M) | 40 |
| **Shasta** | 030-090-022- | 25 35N 02E (M) | 93 |
| **Shasta** | 030-090-022- | 26 35N 02E (M) | 4 |
| **Shasta** | 030-090-023- | 26 35N 02E (M) | 103 |
| **Shasta** | 030-110-013- | 10 35N 03E (M) | 160 |
| **Shasta** | 030-110-014- | 10 35N 03E (M) | 40 |
| **Shasta** | 030-110-015- | 11 35N 03E (M) | 40 |
| **Shasta** | 030-280-002- | 15 35N 03E (M) | 40 |
| **Shasta** | 030-280-007- | 22 35N 03E (M) | 160 |
| **Shasta** | 030-290-003- | 30 35N 03E (M) | 280 |
| **Shasta** | 030-290-006- | 29 35N 03E (M) | 240 |
| **Shasta** | 030-290-009- | 31 35N 03E (M) | 40 |
| **Shasta** | 030-290-011- | 31 35N 03E (M) | 160 |
| **Shasta** | 030-290-014- | 32 35N 03E (M) | 319 |
| **Shasta** | 030-300-002- | 27 35N 03E (M) | 40 |
| **Shasta** | 030-390-003- | 06 35N 03E (M) | 120 |
| **Shasta** | 030-390-003- | 07 35N 03E (M) | 119 |

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| **Shasta** | 030-390-004- | 07 35N 03E (M) | 278 |
| **Shasta** | 030-390-007- | 07 35N 03E (M) | 80 |
| **Shasta** | 031-080-002- | 30 35N 04E (M) | 120 |
| **Shasta** | 031-120-002- | 06 34N 04E (M) | 80 |
| **Shasta** | 034-010-012- | 09 34N 02E (M) | 160 |
| **Shasta** | 034-010-015- | 08 34N 02E (M) | 20 |
| **Shasta** | 034-020-002- | 03 34N 02E (M) | 320 |
| **Shasta** | 034-020-005- | 02 34N 02E (M) | 280 |
| **Shasta** | 034-020-008- | 10 34N 02E (M) | 520 |
| **Shasta** | 034-020-010- | 11 34N 02E (M) | 480 |
| **Shasta** | 034-020-015- | 12 34N 02E (M) | 40 |
| **Shasta** | 034-020-016- | 12 34N 02E (M) | 120 |
| **Shasta** | 034-030-001- | 18 34N 02E (M) | 423 |
| **Shasta** | 034-030-003- | 17 34N 02E (M) | 324 |
| **Shasta** | 034-030-004- | 17 34N 02E (M) | 320 |
| **Shasta** | 034-030-005- | 16 34N 02E (M) | 640 |
| **Shasta** | 034-040-001- | 15 34N 02E (M) | 640 |
| **Shasta** | 034-040-007- | 13 34N 02E (M) | 200 |
| **Shasta** | 034-040-009- | 22 34N 02E (M) | 40 |
| **Shasta** | 034-040-012- | 24 34N 02E (M) | 280 |
| **Shasta** | 034-060-002- | 27 34N 02E (M) | 200 |
| **Shasta** | 034-060-005- | 26 34N 02E (M) | 160 |
| **Shasta** | 034-060-011- | 34 34N 02E (M) | 80 |
| **Shasta** | 034-060-013- | 35 34N 02E (M) | 360 |
| **Shasta** | 034-060-016- | 25 34N 02E (M) | 220 |
| **Shasta** | 034-070-002- | 06 34N 03E (M) | 162 |
| **Shasta** | 034-070-008- | 04 34N 03E (M) | 40 |
| **Shasta** | 034-070-010- | 07 34N 03E (M) | 120 |
| **Shasta** | 034-070-012- | 07 34N 03E (M) | 80 |
| **Shasta** | 034-070-014- | 07 34N 03E (M) | 40 |
| **Shasta** | 034-070-023- | 05 34N 03E (M) | 320 |
| **Shasta** | 034-090-001- | 18 34N 03E (M) | 319 |
| **Shasta** | 034-110-002- | 30 34N 03E (M) | 81 |
| **Shasta** | 034-110-009- | 31 34N 03E (M) | 81 |
| **Shasta** | 034-110-010- | 31 34N 03E (M) | 240 |
| **Shasta** | 034-110-013- | 32 34N 03E (M) | 400 |
| **Shasta** | 034-110-021- | 31 34N 03E (M) | 40 |
| **Shasta** | 034-130-010- | 08 33N 02E (M) | 40 |
| **Shasta** | 034-130-012- | 09 33N 02E (M) | 40 |
| **Shasta** | 034-130-013- | 09 33N 02E (M) | 40 |
| **Shasta** | 034-130-014- | 09 33N 02E (M) | 40 |
| **Shasta** | 034-130-016- | 08 33N 02E (M) | 280 |
| **Shasta** | 034-130-018- | 09 33N 02E (M) | 360 |
| **Shasta** | 034-140-004- | 03 33N 02E (M) | 40 |

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| **Shasta** | 034-140-009- | 01 33N 02E (M) | 7 |
| **Shasta** | 034-140-017- | 10 33N 02E (M) | 120 |
| **Shasta** | 034-140-018- | 10 33N 02E (M) | 40 |
| **Shasta** | 034-140-020- | 10 33N 02E (M) | 80 |
| **Shasta** | 034-140-029- | 12 33N 02E (M) | 180 |
| **Shasta** | 034-140-031- | 02 33N 02E (M) | 414 |
| **Shasta** | 034-140-034- | 11 33N 02E (M) | 259 |
| **Shasta** | 034-140-040- | 03 33N 02E (M) | 242 |
| **Shasta** | 034-140-041- | 03 33N 02E (M) | 80 |
| **Shasta** | 034-140-042- | 10 33N 02E (M) | 360 |
| **Shasta** | 034-140-043- | 10 33N 02E (M) | 40 |
| **Shasta** | 034-140-058- | 01 33N 02E (M) | 241 |
| **Shasta** | 034-140-060- | 03 33N 02E (M) | 40 |
| **Shasta** | 034-150-002- | 17 33N 02E (M) | 160 |
| **Shasta** | 034-150-003- | 17 33N 02E (M) | 440 |
| **Shasta** | 034-150-005- | 16 33N 02E (M) | 640 |
| **Shasta** | 034-150-014- | 21 33N 02E (M) | 160 |
| **Shasta** | 034-150-017- | 21 33N 02E (M) | 480 |
| **Shasta** | 034-150-022- | 20 33N 02E (M) | 120 |
| **Shasta** | 034-160-002- | 15 33N 02E (M) | 120 |
| **Shasta** | 034-160-003- | 14 33N 02E (M) | 40 |
| **Shasta** | 034-160-011- | 13 33N 02E (M) | 639 |
| **Shasta** | 034-160-013- | 22 33N 02E (M) | 40 |
| **Shasta** | 034-160-015- | 23 33N 02E (M) | 80 |
| **Shasta** | 034-160-017- | 14 33N 02E (M) | 120 |
| **Shasta** | 034-160-019- | 15 33N 02E (M) | 320 |
| **Shasta** | 034-160-021- | 22 33N 02E (M) | 480 |
| **Shasta** | 034-160-023- | 24 33N 02E (M) | 160 |
| **Shasta** | 034-170-004- | 29 33N 02E (M) | 480 |
| **Shasta** | 034-170-015- | 28 33N 02E (M) | 240 |
| **Shasta** | 034-170-016- | 30 33N 02E (M) | 518 |
| **Shasta** | 034-170-018- | 29 33N 02E (M) | 80 |
| **Shasta** | 034-170-020- | 28 33N 02E (M) | 400 |
| **Shasta** | 034-170-020- | 29 33N 02E (M) | 80 |
| **Shasta** | 034-180-005- | 26 33N 02E (M) | 440 |
| **Shasta** | 034-180-007- | 25 33N 02E (M) | 160 |
| **Shasta** | 034-180-009- | 25 33N 02E (M) | 40 |
| **Shasta** | 034-180-013- | 27 33N 02E (M) | 320 |
| **Shasta** | 034-190-003- | 06 33N 03E (M) | 26 |
| **Shasta** | 034-190-021- | 06 33N 03E (M) | 600 |
| **Shasta** | 034-190-022- | 05 33N 03E (M) | 639 |
| **Shasta** | 034-190-023- | 07 33N 03E (M) | 573 |
| **Shasta** | 034-190-024- | 08 33N 03E (M) | 640 |
| **Shasta** | 034-210-001- | 18 33N 03E (M) | 640 |

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| **Shasta** | 034-210-009- | 19 33N 03E (M) | 40 |
| **Shasta** | 034-210-019- | 19 33N 03E (M) | 440 |
| **Shasta** | 034-210-023- | 17 33N 03E (M) | 320 |
| **Shasta** | 034-210-025- | 20 33N 03E (M) | 320 |
| **Shasta** | 034-230-001- | 30 33N 03E (M) | 400 |
| **Shasta** | 034-250-004- | 06 32N 02E (M) | 104 |
| **Shasta** | 034-250-005- | 05 32N 02E (M) | 41 |
| **Shasta** | 034-250-016- | 05 32N 02E (M) | 160 |
| **Shasta** | 034-250-016- | 06 32N 02E (M) | 160 |
| **Shasta** | 034-260-004- | 02 32N 02E (M) | 480 |
| **Shasta** | 034-260-009- | 01 32N 02E (M) | 120 |
| **Shasta** | 034-270-014- | 18 32N 02E (M) | 152 |
| **Shasta** | 034-270-016- | 17 32N 02E (M) | 640 |
| **Shasta** | 034-280-005- | 15 32N 02E (M) | 120 |
| **Shasta** | 034-290-002- | 19 32N 02E (M) | 475 |
| **Shasta** | 034-290-014- | 28 32N 02E (M) | 216 |
| **Shasta** | 034-300-005- | 24 32N 02E (M) | 80 |
| **Shasta** | 034-300-006- | 27 32N 02E (M) | 640 |
| **Shasta** | 034-300-017- | 24 32N 02E (M) | 240 |
| **Shasta** | 034-300-018- | 25 32N 02E (M) | 560 |
| **Shasta** | 034-300-019- | 26 32N 02E (M) | 360 |
| **Shasta** | 034-310-005- | 33 32N 02E (M) | 164 |
| **Shasta** | 034-320-013- | 35 32N 02E (M) | 480 |
| **Shasta** | 034-320-015- | 36 32N 02E (M) | 640 |
| **Shasta** | 034-320-016- | 34 32N 02E (M) | 639 |
| **Shasta** | 034-390-002- | 31 32N 03E (M) | 288 |
| **Shasta** | 034-390-010- | 32 32N 03E (M) | 400 |
| **Shasta** | 034-390-010- | 33 32N 03E (M) | 200 |
| **Shasta** | 041-010-003- | 35 31N 08W (M) | 451 |
| **Shasta** | 041-030-007- | 31 31N 08W (M) | 40 |
| **Shasta** | 041-030-033- | 31 31N 08W (M) | 200 |
| **Shasta** | 041-030-034- | 36 31N 09W (M) | 640 |
| **Shasta** | 041-030-035- | 32 31N 08W (M) | 240 |
| **Shasta** | 041-030-037- | 31 31N 08W (M) | 206 |
| **Shasta** | 041-040-002- | 25 31N 08W (M) | 403 |
| **Shasta** | 041-050-001- | 27 31N 08W (M) | 575 |
| **Shasta** | 041-060-006- | 30 31N 08W (M) | 40 |
| **Shasta** | 041-060-007- | 30 31N 08W (M) | 113 |
| **Shasta** | 041-060-011- | 21 31N 08W (M) | 80 |
| **Shasta** | 041-060-012- | 21 31N 08W (M) | 83 |
| **Shasta** | 041-060-018- | 30 31N 08W (M) | 112 |
| **Shasta** | 041-070-004- | 23 31N 08W (M) | 672 |
| **Shasta** | 041-090-001- | 13 31N 08W (M) | 556 |
| **Shasta** | 041-100-001- | 15 31N 08W (M) | 621 |

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| **Shasta** | 041-100-011- | 11 31N 08W (M) | 546 |
| **Shasta** | 041-100-014- | 17 31N 08W (M) | 3 |
| **Shasta** | 041-100-026- | 09 31N 08W (M) | 157 |
| **Shasta** | 041-130-001- | 01 31N 08W (M) | 428 |
| **Shasta** | 041-140-011- | 02 31N 07W (M) | 80 |
| **Shasta** | 041-160-001- | 05 31N 07W (M) | 619 |
| **Shasta** | 041-160-008- | 03 31N 07W (M) | 495 |
| **Shasta** | 041-170-001- | 08 31N 07W (M) | 160 |
| **Shasta** | 041-170-004- | 07 31N 07W (M) | 690 |
| **Shasta** | 041-180-005- | 09 31N 07W (M) | 366 |
| **Shasta** | 041-190-002- | 12 31N 07W (M) | 459 |
| **Shasta** | 041-190-003- | 11 31N 07W (M) | 630 |
| **Shasta** | 041-200-001- | 13 31N 07W (M) | 631 |
| **Shasta** | 041-200-002- | 14 31N 07W (M) | 640 |
| **Shasta** | 041-210-001- | 15 31N 07W (M) | 738 |
| **Shasta** | 041-220-001- | 17 31N 07W (M) | 679 |
| **Shasta** | 041-230-002- | 20 31N 07W (M) | 304 |
| **Shasta** | 041-230-006- | 19 31N 07W (M) | 516 |
| **Shasta** | 041-280-001- | 29 31N 07W (M) | 289 |
| **Shasta** | 041-280-009- | 29 31N 07W (M) | 160 |
| **Shasta** | 041-280-009- | 30 31N 07W (M) | 144 |
| **Shasta** | 041-320-001- | 31 31N 07W (M) | 160 |
| **Shasta** | 041-450-008- | 07 31N 06W (M) | 571 |
| **Shasta** | 041-520-001- | 35 31N 09W (M) | 16 |
| **Shasta** | 041-520-013- | 35 31N 09W (M) | 150 |
| **Shasta** | 041-520-016- | 35 31N 09W (M) | 8 |
| **Shasta** | 042-010-001- | 01 30N 08W (M) | 469 |
| **Shasta** | 042-020-001- | 03 30N 08W (M) | 569 |
| **Shasta** | 042-050-002- | 09 30N 08W (M) | 639 |
| **Shasta** | 042-060-003- | 11 30N 08W (M) | 549 |
| **Shasta** | 042-080-001- | 15 30N 08W (M) | 640 |
| **Shasta** | 042-190-001- | 01 30N 09W (M) | 85 |
| **Shasta** | 042-190-002- | 01 30N 09W (M) | 162 |
| **Shasta** | 042-190-004- | 01 30N 09W (M) | 238 |
| **Shasta** | 042-190-012- | 03 30N 09W (M) | 256 |
| **Shasta** | 042-190-013- | 03 30N 09W (M) | 38 |
| **Shasta** | 042-190-015- | 02 30N 09W (M) | 170 |
| **Shasta** | 042-190-016- | 02 30N 09W (M) | 320 |
| **Shasta** | 042-200-010- | 09 30N 09W (M) | 79 |
| **Shasta** | 042-200-013- | 04 30N 09W (M) | 36.12 |
| **Shasta** | 042-200-013- | 09 30N 09W (M) | 30 |
| **Shasta** | 042-200-017- | 08 30N 09W (M) | 5 |
| **Shasta** | 042-210-009- | 17 30N 09W (M) | 5 |
| **Shasta** | 042-220-001- | 12 30N 09W (M) | 80 |

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| **Shasta** | 042-250-006- | 26 30N 10W (M) | 33.89 |
| **Shasta** | 042-250-007- | 26 30N 10W (M) | 82 |
| **Shasta** | 042-250-019- | 26 30N 10W (M) | 108 |
| **Shasta** | 042-250-020- | 27 30N 10W (M) | 107 |
| **Shasta** | 042-260-009- | 28 30N 10W (M) | 30 |
| **Shasta** | 042-260-011- | 34 30N 10W (M) | 378 |
| **Shasta** | 042-270-002- | 21 30N 09W (M) | 640 |
| **Shasta** | 042-390-001- | 36 30N 10W (M) | 640 |
| **Shasta** | 042-390-018- | 35 30N 10W (M) | 200 |
| **Shasta** | 042-400-007- | 35 30N 10W (M) | 30 |
| **Shasta** | 043-290-008- | 08 29N 10W (M) | 14 |
| **Shasta** | 046-260-003- | 09 33N 07W (M) | 389 |
| **Shasta** | 046-360-001- | 05 33N 07W (M) | 655 |
| **Shasta** | 046-370-003- | 24 33N 08W (M) | 1.89 |
| **Shasta** | 046-370-004- | 23 33N 08W (M) | 25 |
| **Shasta** | 046-390-003- | 35 33N 08W (M) | 479 |
| **Shasta** | 046-440-001- | 01 33N 08W (M) | 218 |
| **Shasta** | 083-010-001- | 05 35N 04W (M) | 948 |
| **Shasta** | 083-010-009- | 08 35N 04W (M) | 644 |
| **Shasta** | 083-020-001- | 03 35N 04W (M) | 928 |
| **Shasta** | 083-020-003- | 09 35N 04W (M) | 643 |
| **Shasta** | 083-030-004- | 11 35N 04W (M) | 652 |
| **Shasta** | 083-040-005- | 13 35N 04W (M) | 638 |
| **Shasta** | 083-120-001- | 15 35N 04W (M) | 158 |
| **Shasta** | 083-120-021- | 15 35N 04W (M) | 39.71 |
| **Shasta** | 083-130-004- | 17 35N 04W (M) | 599 |
| **Shasta** | 083-130-017- | 16 35N 04W (M) | 39.96 |
| **Shasta** | 083-390-001- | 14 35N 04W (M) | 163.8 |
| **Shasta** | 095-010-010- | 08 31N 01E (M) | 388 |
| **Shasta** | 096-160-004- | 36 31N 01E (M) | 320 |
| **Shasta** | 098-140-030- | 01 33N 01W (M) | 12.5 |
| **Shasta** | 098-220-003- | 26 33N 01W (M) | 320 |
| **Shasta** | 098-360-001- | 27 33N 01E (M) | 320 |
| **Shasta** | 098-360-005- | 25 33N 01E (M) | 589 |
| **Shasta** | 098-360-008- | 36 33N 01E (M) | 640 |
| **Shasta** | 098-360-009- | 35 33N 01E (M) | 640 |
| **Shasta** | 098-360-018- | 34 33N 01E (M) | 67.57 |
| **Shasta** | 098-360-019- | 34 33N 01E (M) | 480 |
| **Shasta** | 098-360-023- | 25 33N 01E (M) | 28.48 |
| **Shasta** | 098-360-025- | 27 33N 01E (M) | 310 |
| **Shasta** | 098-360-026- | 27 33N 01E (M) | 3 |
| **Shasta** | 098-360-028- | 34 33N 01E (M) | 32 |
| **Shasta** | 098-360-029- | 34 33N 01E (M) | 45 |
| **Shasta** | 098-360-031- | 34 33N 01E (M) | 5 |

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| **Shasta** | 098-360-032- | 34 33N 01E (M) | 5 |
| **Shasta** | 098-360-033- | 26 33N 01E (M) | 526 |
| **Shasta** | 098-360-034- | 26 33N 01E (M) | 91 |
| **Shasta** | 098-510-002- | 14 33N 01W (M) | 200 |
| **Shasta** | 098-510-006- | 23 33N 01W (M) | 448 |
| **Shasta** | 098-510-009- | 13 33N 01W (M) | 200 |
| **Shasta** | 098-510-021- | 15 33N 01W (M) | 589.15 |
| **Shasta** | 098-510-022- | 15 33N 01W (M) | 45.89 |
| **Shasta** | 098-510-024- | 22 33N 01W (M) | 12.67 |
| **Shasta** | 098-510-025- | 22 33N 01W (M) | 359.43 |
| **Shasta** | 098-530-014- | 29 33N 01E (M) | 320 |
| **Shasta** | 098-530-031- | 32 33N 01E (M) | 159 |
| **Shasta** | 098-530-032- | 28 33N 01E (M) | 80 |
| **Shasta** | 098-530-041- | 33 33N 01E (M) | 120 |
| **Shasta** | 098-530-043- | 33 33N 01E (M) | 80 |
| **Shasta** | 098-530-066- | 33 33N 01E (M) | 163 |
| **Shasta** | 098-530-067- | 33 33N 01E (M) | 207 |
| **Shasta** | 098-540-007- | 02 33N 01W (M) | 40 |
| **Shasta** | 098-540-019- | 11 33N 01W (M) | 437 |
| **Shasta** | 098-540-021- | 01 33N 01W (M) | 80 |
| **Shasta** | 098-540-042- | 12 33N 01W (M) | 152 |
| **Shasta** | 098-540-043- | 12 33N 01W (M) | 112.3 |
| **Shasta** | 098-560-003- | 02 33N 01W (M) | 78 |
| **Shasta** | 099-200-001- | 03 32N 01E (M) | 642 |
| **Shasta** | 099-200-002- | 02 32N 01E (M) | 482 |
| **Shasta** | 099-200-003- | 02 32N 01E (M) | 80 |
| **Shasta** | 099-200-004- | 02 32N 01E (M) | 40 |
| **Shasta** | 099-200-005- | 01 32N 01E (M) | 480 |
| **Shasta** | 099-200-013- | 10 32N 01E (M) | 80 |
| **Shasta** | 099-220-008- | 22 32N 01E (M) | 160 |
| **Shasta** | 700-040-009- | 16 31N 02E (M) | 630 |
| **Shasta** | 700-040-011- | 20 31N 02E (M) | 640 |
| **Shasta** | 700-070-003- | 21 31N 02E (M) | 2.35 |
| **Shasta** | 700-070-005- | 21 31N 02E (M) | 3.1 |
| **Shasta** | 700-070-007- | 21 31N 02E (M) | 13.11 |
| **Shasta** | 700-070-008- | 21 31N 02E (M) | 49.9 |
| **Shasta** | 700-240-001- | 30 31N 02E (M) | 594 |
| **Shasta** | 700-240-003- | 32 31N 02E (M) | 640 |
| **Shasta** | 700-240-004- | 29 31N 02E (M) | 514 |
| **Shasta** | 700-240-005- | 28 31N 02E (M) | 640 |
| **Shasta** | 700-240-006- | 31 31N 02E (M) | 480 |
| **Shasta** | 700-240-007- | 31 31N 02E (M) | 160 |
| **Shasta** | 700-260-001- | 33 31N 02E (M) | 468 |
| **Shasta** | 701-010-005- | 02 31N 02E (M) | 120 |

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| **Shasta** | 701-010-009- | 01 31N 02E (M) | 399 |
| **Shasta** | 701-010-017- | 11 31N 02E (M) | 400 |
| **Shasta** | 701-010-018- | 12 31N 02E (M) | 640 |
| **Shasta** | 701-090-003- | 14 31N 02E (M) | 280 |
| **Shasta** | 701-090-004- | 13 31N 02E (M) | 400 |
| **Shasta** | 701-090-005- | 13 31N 02E (M) | 40 |
| **Shasta** | 701-090-006- | 13 31N 02E (M) | 40 |
| **Shasta** | 701-090-017- | 22 31N 02E (M) | 585 |
| **Shasta** | 701-090-018- | 23 31N 02E (M) | 589 |
| **Shasta** | 701-090-020- | 24 31N 02E (M) | 307 |
| **Shasta** | 701-090-021- | 24 31N 02E (M) | 32 |
| **Shasta** | 701-160-001- | 22 31N 02E (M) | 2.7 |
| **Shasta** | 701-170-027- | 24 31N 02E (M) | 25 |
| **Shasta** | 701-190-004- | 25 31N 02E (M) | 600 |
| **Shasta** | 701-190-006- | 26 31N 02E (M) | 520 |
| **Shasta** | 701-200-001- | 27 31N 02E (M) | 330 |
| **Shasta** | 701-200-002- | 27 31N 02E (M) | 70 |
| **Shasta** | 701-200-004- | 35 31N 02E (M) | 610 |
| **Shasta** | 701-200-005- | 36 31N 02E (M) | 568 |
| **Shasta** | 701-200-008- | 34 31N 02E (M) | 640 |
| **Shasta** | 702-010-001- | 06 31N 03E (M) | 516 |
| **Shasta** | 702-010-002- | 05 31N 03E (M) | 599 |
| **Shasta** | 702-010-004- | 04 31N 03E (M) | 40 |
| **Shasta** | 702-010-006- | 04 31N 03E (M) | 120 |
| **Shasta** | 702-010-007- | 09 31N 03E (M) | 10 |
| **Shasta** | 702-010-008- | 09 31N 03E (M) | 310 |
| **Shasta** | 702-010-010- | 08 31N 03E (M) | 480 |
| **Shasta** | 702-010-012- | 07 31N 03E (M) | 532 |
| **Shasta** | 702-030-011- | 22 31N 03E (M) | 240 |
| **Shasta** | 702-040-001- | 18 31N 03E (M) | 495 |
| **Shasta** | 702-040-004- | 19 31N 03E (M) | 94 |
| **Shasta** | 702-040-005- | 19 31N 03E (M) | 95 |
| **Shasta** | 702-040-006- | 19 31N 03E (M) | 25 |
| **Shasta** | 702-040-009- | 19 31N 03E (M) | 65 |
| **Shasta** | 702-040-010- | 19 31N 03E (M) | 27 |
| **Shasta** | 702-040-011- | 17 31N 03E (M) | 622 |
| **Shasta** | 702-040-012- | 20 31N 03E (M) | 636 |
| **Shasta** | 702-040-013- | 16 31N 03E (M) | 626 |
| **Shasta** | 702-040-014- | 21 31N 03E (M) | 600 |
| **Shasta** | 702-040-016- | 19 31N 03E (M) | 38 |
| **Shasta** | 702-060-003- | 19 31N 03E (M) | 1 |
| **Shasta** | 702-070-002- | 19 31N 03E (M) | 3 |
| **Shasta** | 702-170-006- | 32 31N 03E (M) | 0.16 |
| **Shasta** | 702-180-001- | 30 31N 03E (M) | 367 |

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| **Shasta** | 702-180-002- | 30 31N 03E (M) | 180 |
| **Shasta** | 702-180-005- | 29 31N 03E (M) | 20 |
| **Shasta** | 702-180-007- | 31 31N 03E (M) | 626 |
| **Shasta** | 702-180-013- | 29 31N 03E (M) | 20 |
| **Shasta** | 702-180-020- | 29 31N 03E (M) | 9.51 |
| **Shasta** | 702-180-027- | 29 31N 03E (M) | 6.63 |
| **Shasta** | 702-180-028- | 29 31N 03E (M) | 1.14 |
| **Shasta** | 702-180-036- | 28 31N 03E (M) | 6.48 |
| **Shasta** | 702-180-045- | 33 31N 03E (M) | 34.49 |
| **Shasta** | 702-180-046- | 33 31N 03E (M) | 38.82 |
| **Shasta** | 702-180-047- | 33 31N 03E (M) | 37.3 |
| **Shasta** | 702-180-048- | 33 31N 03E (M) | 36.72 |
| **Shasta** | 702-180-049- | 33 31N 03E (M) | 39.96 |
| **Shasta** | 702-180-051- | 33 31N 03E (M) | 26.6 |
| **Shasta** | 702-180-052- | 33 31N 03E (M) | 23.18 |
| **Shasta** | 702-180-053- | 33 31N 03E (M) | 22.82 |
| **Shasta** | 702-180-054- | 33 31N 03E (M) | 23.3 |
| **Shasta** | 702-180-055- | 33 31N 03E (M) | 23.39 |
| **Shasta** | 702-180-060- | 32 31N 03E (M) | 17.54 |
| **Shasta** | 702-180-061- | 32 31N 03E (M) | 24.69 |
| **Shasta** | 702-180-062- | 32 31N 03E (M) | 19.65 |
| **Shasta** | 702-180-063- | 32 31N 03E (M) | 21.88 |
| **Shasta** | 702-180-064- | 32 31N 03E (M) | 42.95 |
| **Shasta** | 702-180-070- | 29 31N 03E (M) | 42.21 |
| **Shasta** | 702-180-071- | 29 31N 03E (M) | 35.12 |
| **Shasta** | 702-180-072- | 29 31N 03E (M) | 45.86 |
| **Shasta** | 702-180-072- | 32 31N 03E (M) | 20 |
| **Shasta** | 702-180-073- | 32 31N 03E (M) | 4 |
| **Shasta** | 702-180-073- | 33 31N 03E (M) | 17.86 |
| **Shasta** | 702-180-074- | 32 31N 03E (M) | 4 |
| **Shasta** | 702-180-074- | 33 31N 03E (M) | 14.93 |
| **Shasta** | 702-180-075- | 32 31N 03E (M) | 441.38 |
| **Shasta** | 702-180-075- | 33 31N 03E (M) | 190 |
| **Shasta** | 702-180-076- | 28 31N 03E (M) | 28.47 |
| **Shasta** | 702-180-076- | 33 31N 03E (M) | 12 |
| **Shasta** | 702-180-077- | 28 31N 03E (M) | 33.23 |
| **Shasta** | 702-180-077- | 33 31N 03E (M) | 17 |
| **Shasta** | 702-180-078- | 28 31N 03E (M) | 55.85 |
| **Shasta** | 702-180-078- | 33 31N 03E (M) | 8 |
| **Shasta** | 702-180-079- | 28 31N 03E (M) | 48.07 |
| **Shasta** | 702-180-079- | 33 31N 03E (M) | 14 |
| **Shasta** | 702-180-080- | 28 31N 03E (M) | 36.22 |
| **Shasta** | 702-180-080- | 33 31N 03E (M) | 18 |
| **Shasta** | 702-180-081- | 29 31N 03E (M) | 314.95 |

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| **Shasta** | 702-180-081- | 28 31N 03E (M) | 400 |
| **Shasta** | 702-190-001- | 27 31N 03E (M) | 360 |
| **Shasta** | 702-200-001- | 03 30N 03E (M) | 19 |
| **Shasta** | 702-200-002- | 03 30N 03E (M) | 80 |
| **Shasta** | 702-200-006- | 10 30N 03E (M) | 80 |
| **Shasta** | 702-200-008- | 10 30N 03E (M) | 120 |
| **Shasta** | 702-200-009- | 10 30N 03E (M) | 80 |
| **Shasta** | 702-210-001- | 15 30N 03E (M) | 240 |
| **Shasta** | 702-210-005- | 22 30N 03E (M) | 280 |
| **Shasta** | 702-220-006- | 27 30N 03E (M) | 2 |
| **Shasta** | 702-230-001- | 29 30N 03E (M) | 8 |
| **Shasta** | 702-230-002- | 28 30N 03E (M) | 260 |
| **Shasta** | 702-240-001- | 18 30N 03E (M) | 642 |
| **Shasta** | 702-240-002- | 17 30N 03E (M) | 580 |
| **Shasta** | 702-240-004- | 17 30N 03E (M) | 40 |
| **Shasta** | 702-240-005- | 16 30N 03E (M) | 640 |
| **Shasta** | 702-240-006- | 21 30N 03E (M) | 640 |
| **Shasta** | 702-240-007- | 20 30N 03E (M) | 598 |
| **Shasta** | 702-240-008- | 19 30N 03E (M) | 515 |
| **Shasta** | 702-260-001- | 06 30N 03E (M) | 241 |
| **Shasta** | 702-260-002- | 05 30N 03E (M) | 238 |
| **Shasta** | 702-260-003- | 04 30N 03E (M) | 236 |
| **Shasta** | 702-260-004- | 07 30N 03E (M) | 642 |
| **Shasta** | 702-260-005- | 08 30N 03E (M) | 640 |
| **Shasta** | 702-260-006- | 09 30N 03E (M) | 640 |
| **Shasta** | 702-270-001- | 03 30N 02E (M) | 4 |
| **Shasta** | 702-270-003- | 03 30N 02E (M) | 107 |
| **Shasta** | 702-270-005- | 02 30N 02E (M) | 239 |
| **Shasta** | 702-270-006- | 01 30N 02E (M) | 239 |
| **Shasta** | 702-270-008- | 10 30N 02E (M) | 480 |
| **Shasta** | 702-270-009- | 11 30N 02E (M) | 640 |
| **Shasta** | 702-270-010- | 12 30N 02E (M) | 640 |
| **Shasta** | 702-280-001- | 15 30N 02E (M) | 640 |
| **Shasta** | 702-280-002- | 14 30N 02E (M) | 200 |
| **Shasta** | 702-280-006- | 13 30N 02E (M) | 640 |
| **Shasta** | 702-280-010- | 24 30N 02E (M) | 320 |
| **Shasta** | 702-280-011- | 24 30N 02E (M) | 136 |
| **Shasta** | 702-280-012- | 24 30N 02E (M) | 78.7 |
| **Shasta** | 702-280-013- | 23 30N 02E (M) | 593 |
| **Shasta** | 702-280-031- | 14 30N 02E (M) | 320 |
| **Shasta** | 702-290-002- | 18 30N 02E (M) | 120 |
| **Shasta** | 702-290-005- | 17 30N 02E (M) | 637 |
| **Shasta** | 702-290-007- | 16 30N 02E (M) | 40 |
| **Shasta** | 702-290-009- | 16 30N 02E (M) | 200 |

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| **Shasta** | 702-290-011- | 19 30N 02E (M) | 165 |
| **Shasta** | 702-290-012- | 20 30N 02E (M) | 399 |
| **Shasta** | 702-290-013- | 21 30N 02E (M) | 452 |
| **Shasta** | 702-290-014- | 16 30N 02E (M) | 80 |
| **Shasta** | 702-300-001- | 06 30N 02E (M) | 104 |
| **Shasta** | 702-300-002- | 06 30N 02E (M) | 131 |
| **Shasta** | 702-300-003- | 05 30N 02E (M) | 130 |
| **Shasta** | 702-300-004- | 05 30N 02E (M) | 128 |
| **Shasta** | 702-300-005- | 04 30N 02E (M) | 126 |
| **Shasta** | 702-300-007- | 07 30N 02E (M) | 642 |
| **Shasta** | 702-300-008- | 08 30N 02E (M) | 520 |
| **Shasta** | 702-300-009- | 08 30N 02E (M) | 40 |
| **Shasta** | 702-300-010- | 08 30N 02E (M) | 80 |
| **Shasta** | 702-300-011- | 09 30N 02E (M) | 634 |
| **Shasta** | 703-160-003- | 02 30N 01E (M) | 80 |
| **Shasta** | 703-160-011- | 12 30N 01E (M) | 137 |
| **Shasta** | 703-160-012- | 11 30N 01E (M) | 160 |
| **Sierra** | 002-080-004- | 25 20N 09E (M) | 309.9 |
| **Sierra** | 002-080-004- | 36 20N 09E (M) | 20 |
| **Sierra** | 002-150-004- | 25 20N 10E (M) | 200 |
| **Sierra** | 004-070-005- | 13 19N 09E (M) | 520 |
| **Sierra** | 004-070-008- | 23 19N 09E (M) | 40 |
| **Sierra** | 004-070-009- | 23 19N 09E (M) | 360 |
| **Sierra** | 004-080-002- | 30 19N 09E (M) | 80 |
| **Sierra** | 004-080-010- | 33 19N 09E (M) | 56.17 |
| **Sierra** | 004-080-014- | 33 19N 09E (M) | 70.25 |
| **Sierra** | 004-080-016- | 33 19N 09E (M) | 5.61 |
| **Sierra** | 004-080-017- | 33 19N 09E (M) | 34.39 |
| **Sierra** | 004-090-004- | 25 19N 09E (M) | 640 |
| **Sierra** | 004-100-008- | 07 19N 10E (M) | 39.47 |
| **Sierra** | 004-100-009- | 07 19N 10E (M) | 126.18 |
| **Sierra** | 004-100-013- | 09 19N 10E (M) | 117.88 |
| **Sierra** | 004-150-008- | 01 19N 10E (M) | 238 |
| **Sierra** | 004-150-009- | 01 19N 10E (M) | 20 |
| **Sierra** | 004-150-011- | 01 19N 10E (M) | 20 |
| **Sierra** | 004-160-006- | 19 19N 10E (M) | 39.54 |
| **Sierra** | 004-160-008- | 19 19N 10E (M) | 99.39 |
| **Sierra** | 004-170-007- | 13 19N 10E (M) | 77 |
| **Sierra** | 004-170-009- | 13 19N 10E (M) | 56.75 |
| **Sierra** | 004-180-006- | 31 19N 10E (M) | 32.009 |
| **Sierra** | 004-180-007- | 31 19N 10E (M) | 34.23 |
| **Sierra** | 004-180-008- | 31 19N 10E (M) | 27.86 |
| **Sierra** | 004-180-010- | 31 19N 10E (M) | 164.77 |
| **Sierra** | 004-180-011- | 31 19N 10E (M) | 75.18 |

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| **Sierra** | 004-190-006- | 25 19N 10E (M) | 540 |
| **Sierra** | 006-010-006- | 05 18N 09E (M) | 65 |
| **Sierra** | 006-010-007- | 05 18N 09E (M) | 447 |
| **Sierra** | 006-010-024- | 09 18N 09E (M) | 475 |
| **Sierra** | 006-010-026- | 01 18N 08E (M) | 70.1 |
| **Sierra** | 006-010-043- | 07 18N 09E (M) | 16 |
| **Sierra** | 006-010-044- | 07 18N 09E (M) | 556 |
| **Sierra** | 006-010-047- | 08 18N 09E (M) | 119.96 |
| **Sierra** | 006-020-001- | 03 18N 09E (M) | 666.1 |
| **Sierra** | 006-020-002- | 02 18N 09E (M) | 547 |
| **Sierra** | 006-020-005- | 01 18N 09E (M) | 396.4 |
| **Sierra** | 006-020-009- | 11 18N 09E (M) | 600 |
| **Sierra** | 006-020-012- | 10 18N 09E (M) | 320 |
| **Sierra** | 006-020-014- | 12 18N 09E (M) | 118.22 |
| **Sierra** | 006-030-001- | 13 18N 08E (M) | 75.4 |
| **Sierra** | 006-030-011- | 17 18N 09E (M) | 161 |
| **Sierra** | 006-030-114- | 19 18N 09E (M) | 400.22 |
| **Sierra** | 006-040-001- | 15 18N 09E (M) | 575 |
| **Sierra** | 006-100-002- | 07 18N 10E (M) | 221 |
| **Sierra** | 008-030-006- | 19 20N 11E (M) | 80 |
| **Sierra** | 008-030-010- | 21 20N 11E (M) | 280 |
| **Sierra** | 008-040-007- | 13 20N 11E (M) | 11.48 |
| **Sierra** | 008-040-012- | 13 20N 11E (M) | 113.61 |
| **Sierra** | 008-050-007- | 31 20N 11E (M) | 120 |
| **Sierra** | 008-050-010- | 31 20N 11E (M) | 22.73 |
| **Sierra** | 008-050-022- | 29 20N 11E (M) | 320 |
| **Sierra** | 008-050-023- | 29 20N 11E (M) | 320 |
| **Sierra** | 008-110-007- | 13 20N 12E (M) | 420 |
| **Sierra** | 008-110-011- | 23 20N 12E (M) | 233 |
| **Sierra** | 008-130-010- | 25 20N 12E (M) | 613.91 |
| **Sierra** | 008-130-012- | 35 20N 12E (M) | 463.54 |
| **Sierra** | 010-010-007- | 07 19N 11E (M) | 83 |
| **Sierra** | 010-010-009- | 07 19N 11E (M) | 83 |
| **Sierra** | 010-010-010- | 07 19N 11E (M) | 160 |
| **Sierra** | 010-010-013- | 09 19N 11E (M) | 90 |
| **Sierra** | 010-010-015- | 09 19N 11E (M) | 340 |
| **Sierra** | 010-010-016- | 05 19N 11E (M) | 180.57 |
| **Sierra** | 010-010-017- | 05 19N 11E (M) | 320.91 |
| **Sierra** | 010-020-001- | 03 19N 11E (M) | 645 |
| **Sierra** | 010-020-003- | 01 19N 11E (M) | 642 |
| **Sierra** | 010-020-004- | 10 19N 11E (M) | 640 |
| **Sierra** | 010-020-005- | 11 19N 11E (M) | 637.72 |
| **Sierra** | 010-030-004- | 17 19N 11E (M) | 320 |
| **Sierra** | 010-030-008- | 19 19N 11E (M) | 481 |

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| **Sierra** | 010-030-012- | 21 19N 11E (M) | 10 |
| **Sierra** | 010-030-015- | 21 19N 11E (M) | 300 |
| **Sierra** | 010-040-001- | 15 19N 11E (M) | 320 |
| **Sierra** | 010-040-002- | 15 19N 11E (M) | 80 |
| **Sierra** | 010-040-004- | 15 19N 11E (M) | 90 |
| **Sierra** | 010-040-008- | 13 19N 11E (M) | 467 |
| **Sierra** | 010-040-010- | 23 19N 11E (M) | 514 |
| **Sierra** | 010-050-005- | 29 19N 11E (M) | 80 |
| **Sierra** | 010-050-007- | 31 19N 11E (M) | 818 |
| **Sierra** | 010-050-009- | 33 19N 11E (M) | 10 |
| **Sierra** | 010-050-012- | 33 19N 11E (M) | 204 |
| **Sierra** | 010-050-013- | 33 19N 11E (M) | 60 |
| **Sierra** | 010-050-014- | 30 19N 11E (M) | 248.05 |
| **Sierra** | 010-050-015- | 30 19N 11E (M) | 569.13 |
| **Sierra** | 010-060-001- | 27 19N 11E (M) | 440 |
| **Sierra** | 010-070-004- | 05 19N 12E (M) | 454.28 |
| **Sierra** | 010-070-008- | 07 19N 12E (M) | 323.67 |
| **Sierra** | 010-080-001- | 03 19N 12E (M) | 637 |
| **Sierra** | 010-080-006- | 11 19N 12E (M) | 397.7 |
| **Sierra** | 010-110-002- | 05 18N 11E (M) | 368 |
| **Sierra** | 010-110-006- | 07 18N 11E (M) | 3.65 |
| **Sierra** | 010-110-010- | 07 18N 11E (M) | 76 |
| **Sierra** | 013-010-005- | 07 20N 13E (M) | 471 |
| **Sierra** | 013-010-008- | 09 20N 13E (M) | 400 |
| **Sierra** | 013-020-009- | 11 20N 13E (M) | 155.09 |
| **Sierra** | 013-030-002- | 17 20N 13E (M) | 640 |
| **Sierra** | 013-030-004- | 19 20N 13E (M) | 622 |
| **Sierra** | 013-030-006- | 21 20N 13E (M) | 640 |
| **Sierra** | 013-040-001- | 15 20N 13E (M) | 640 |
| **Sierra** | 013-040-003- | 13 20N 13E (M) | 640 |
| **Sierra** | 013-040-007- | 23 20N 13E (M) | 320 |
| **Sierra** | 013-040-008- | 23 20N 13E (M) | 320 |
| **Sierra** | 013-050-002- | 29 20N 13E (M) | 640 |
| **Sierra** | 013-050-004- | 31 20N 13E (M) | 616 |
| **Sierra** | 013-050-006- | 33 20N 13E (M) | 640.29 |
| **Sierra** | 013-060-001- | 27 20N 13E (M) | 640 |
| **Sierra** | 013-060-004- | 25 20N 13E (M) | 480 |
| **Sierra** | 013-060-005- | 25 20N 13E (M) | 160 |
| **Sierra** | 013-060-007- | 35 20N 13E (M) | 646.9 |
| **Sierra** | 013-070-003- | 05 20N 14E (M) | 307 |
| **Sierra** | 013-070-014- | 09 20N 14E (M) | 80 |
| **Sierra** | 013-070-015- | 09 20N 14E (M) | 160 |
| **Sierra** | 013-070-016- | 09 20N 14E (M) | 80 |
| **Sierra** | 013-100-001- | 17 20N 14E (M) | 623 |

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| **Sierra** | 013-100-004- | 21 20N 14E (M) | 640 |
| **Sierra** | 013-120-001- | 29 20N 14E (M) | 615 |
| **Sierra** | 013-130-001- | 27 20N 14E (M) | 639.72 |
| **Sierra** | 014-010-002- | 05 19N 13E (M) | 640 |
| **Sierra** | 014-010-004- | 07 19N 13E (M) | 618 |
| **Sierra** | 014-010-006- | 09 19N 13E (M) | 640 |
| **Sierra** | 014-020-001- | 03 19N 13E (M) | 643 |
| **Sierra** | 014-020-003- | 01 19N 13E (M) | 650.25 |
| **Sierra** | 014-020-006- | 11 19N 13E (M) | 640 |
| **Sierra** | 014-030-008- | 21 19N 13E (M) | 640 |
| **Sierra** | 014-030-009- | 17 19N 13E (M) | 567 |
| **Sierra** | 014-040-001- | 15 19N 13E (M) | 640 |
| **Sierra** | 014-040-003- | 13 19N 13E (M) | 640 |
| **Sierra** | 014-040-005- | 23 19N 13E (M) | 640 |
| **Sierra** | 014-050-005- | 33 19N 13E (M) | 640 |
| **Sierra** | 014-060-001- | 27 19N 13E (M) | 640 |
| **Sierra** | 014-060-003- | 25 19N 13E (M) | 640 |
| **Sierra** | 014-060-005- | 35 19N 13E (M) | 640 |
| **Sierra** | 014-070-002- | 05 19N 14E (M) | 643 |
| **Sierra** | 014-070-004- | 07 19N 14E (M) | 626 |
| **Sierra** | 014-070-006- | 09 19N 14E (M) | 640 |
| **Sierra** | 014-090-002- | 17 19N 14E (M) | 640 |
| **Sierra** | 014-090-004- | 19 19N 14E (M) | 625 |
| **Sierra** | 014-090-007- | 21 19N 14E (M) | 160 |
| **Sierra** | 014-090-024- | 20 19N 14E (M) | 6 |
| **Sierra** | 014-090-024- | 21 19N 14E (M) | 5.84 |
| **Sierra** | 014-100-001- | 15 19N 14E (M) | 640 |
| **Sierra** | 014-100-005- | 23 19N 14E (M) | 617 |
| **Sierra** | 014-110-002- | 29 19N 14E (M) | 300.45 |
| **Sierra** | 014-110-006- | 31 19N 14E (M) | 626 |
| **Sierra** | 014-110-010- | 33 19N 14E (M) | 276.27 |
| **Sierra** | 014-120-002- | 26 19N 14E (M) | 21.8 |
| **Sierra** | 014-120-010- | 35 19N 14E (M) | 483.63 |
| **Sierra** | 014-140-001- | 03 18N 13E (M) | 603 |
| **Sierra** | 014-140-003- | 01 18N 13E (M) | 640.42 |
| **Sierra** | 014-140-006- | 11 18N 13E (M) | 122 |
| **Sierra** | 014-150-006- | 09 18N 14E (M) | 120 |
| **Siskiyou** | 018-120-040- | 31 42N 01E (M) | 320 |
| **Siskiyou** | 018-130-010- | 03 41N 01E (M) | 641 |
| **Siskiyou** | 018-130-020- | 01 41N 01E (M) | 80 |
| **Siskiyou** | 018-130-040- | 11 41N 01E (M) | 480 |
| **Siskiyou** | 018-130-080- | 11 41N 01E (M) | 160 |
| **Siskiyou** | 018-140-070- | 09 41N 01E (M) | 640 |
| **Siskiyou** | 018-150-010- | 15 41N 01E (M) | 640 |

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| **Siskiyou** | 018-150-020- | 23 41N 01E (M) | 640 |
| **Siskiyou** | 018-150-050- | 22 41N 01E (M) | 640 |
| **Siskiyou** | 018-150-070- | 14 41N 01E (M) | 80 |
| **Siskiyou** | 018-150-080- | 14 41N 01E (M) | 560 |
| **Siskiyou** | 018-160-020- | 17 41N 01E (M) | 640 |
| **Siskiyou** | 018-160-050- | 21 41N 01E (M) | 640 |
| **Siskiyou** | 018-160-080- | 20 41N 01E (M) | 560 |
| **Siskiyou** | 018-170-010- | 27 41N 01E (M) | 640 |
| **Siskiyou** | 018-170-020- | 25 41N 01E (M) | 160 |
| **Siskiyou** | 018-170-030- | 35 41N 01E (M) | 640 |
| **Siskiyou** | 018-170-040- | 36 41N 01E (M) | 80 |
| **Siskiyou** | 018-170-050- | 36 41N 01E (M) | 200 |
| **Siskiyou** | 018-170-080- | 34 41N 01E (M) | 640 |
| **Siskiyou** | 018-170-100- | 26 41N 01E (M) | 320 |
| **Siskiyou** | 018-170-120- | 26 41N 01E (M) | 80 |
| **Siskiyou** | 018-170-130- | 26 41N 01E (M) | 240 |
| **Siskiyou** | 018-180-030- | 31 41N 01E (M) | 436 |
| **Siskiyou** | 018-180-040- | 33 41N 01E (M) | 640 |
| **Siskiyou** | 018-180-070- | 30 41N 01E (M) | 433.3 |
| **Siskiyou** | 018-180-080- | 28 41N 01E (M) | 320 |
| **Siskiyou** | 018-180-090- | 32 41N 01E (M) | 480 |
| **Siskiyou** | 018-470-010- | 36 42N 04E (M) | 600 |
| **Siskiyou** | 018-490-040- | 12 41N 04E (M) | 40 |
| **Siskiyou** | 018-490-220- | 01 41N 04E (M) | 478 |
| **Siskiyou** | 018-490-220- | 02 41N 04E (M) | 80 |
| **Siskiyou** | 018-490-230- | 03 41N 04E (M) | 40 |
| **Siskiyou** | 018-490-230- | 10 41N 04E (M) | 80 |
| **Siskiyou** | 018-490-230- | 11 41N 04E (M) | 40 |
| **Siskiyou** | 018-490-240- | 02 41N 04E (M) | 40 |
| **Siskiyou** | 018-490-240- | 11 41N 04E (M) | 240 |
| **Siskiyou** | 018-490-240- | 12 41N 04E (M) | 40 |
| **Siskiyou** | 018-510-160- | 13 41N 04E (M) | 280 |
| **Siskiyou** | 018-510-160- | 14 41N 04E (M) | 600 |
| **Siskiyou** | 018-510-160- | 15 41N 04E (M) | 40 |
| **Siskiyou** | 018-510-160- | 22 41N 04E (M) | 320 |
| **Siskiyou** | 018-510-160- | 23 41N 04E (M) | 640 |
| **Siskiyou** | 018-510-160- | 24 41N 04E (M) | 320 |
| **Siskiyou** | 018-530-010- | 27 41N 04E (M) | 2 |
| **Siskiyou** | 018-530-020- | 27 41N 04E (M) | 36 |
| **Siskiyou** | 018-530-060- | 34 41N 04E (M) | 562 |
| **Siskiyou** | 018-530-210- | 25 41N 04E (M) | 120 |
| **Siskiyou** | 018-530-210- | 26 41N 04E (M) | 200 |
| **Siskiyou** | 018-530-210- | 27 41N 04E (M) | 80 |
| **Siskiyou** | 018-530-220- | 25 41N 04E (M) | 200 |

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| **Siskiyou** | 018-530-230- | 25 41N 04E (M) | 40 |
| **Siskiyou** | 018-530-230- | 26 41N 04E (M) | 400 |
| **Siskiyou** | 018-530-230- | 34 41N 04E (M) | 70 |
| **Siskiyou** | 018-530-230- | 35 41N 04E (M) | 640 |
| **Siskiyou** | 018-530-230- | 36 41N 04E (M) | 560 |
| **Siskiyou** | 018-530-240- | 36 41N 04E (M) | 80 |
| **Siskiyou** | 018-540-110- | 28 41N 04E (M) | 160 |
| **Siskiyou** | 018-540-110- | 33 41N 04E (M) | 600 |
| **Siskiyou** | 019-360-010- | 29 42N 02W (M) | 640 |
| **Siskiyou** | 019-360-020- | 31 42N 02W (M) | 502 |
| **Siskiyou** | 019-360-030- | 33 42N 02W (M) | 640 |
| **Siskiyou** | 019-370-010- | 03 41N 02W (M) | 665 |
| **Siskiyou** | 019-370-030- | 11 41N 02W (M) | 640 |
| **Siskiyou** | 019-380-010- | 05 41N 02W (M) | 679 |
| **Siskiyou** | 019-380-020- | 07 41N 02W (M) | 512 |
| **Siskiyou** | 019-380-030- | 09 41N 02W (M) | 640 |
| **Siskiyou** | 019-390-010- | 17 41N 02W (M) | 640 |
| **Siskiyou** | 019-390-030- | 19 41N 02W (M) | 534 |
| **Siskiyou** | 019-390-040- | 21 41N 02W (M) | 640 |
| **Siskiyou** | 019-400-010- | 15 41N 02W (M) | 320 |
| **Siskiyou** | 019-400-040- | 13 41N 02W (M) | 640 |
| **Siskiyou** | 019-400-050- | 23 41N 02W (M) | 640 |
| **Siskiyou** | 019-410-010- | 27 41N 02W (M) | 640 |
| **Siskiyou** | 019-410-020- | 25 41N 02W (M) | 640 |
| **Siskiyou** | 019-410-030- | 35 41N 02W (M) | 640 |
| **Siskiyou** | 019-410-050- | 26 41N 02W (M) | 160 |
| **Siskiyou** | 019-410-060- | 34 41N 02W (M) | 640 |
| **Siskiyou** | 019-410-070- | 26 41N 02W (M) | 480 |
| **Siskiyou** | 019-420-010- | 29 41N 02W (M) | 640 |
| **Siskiyou** | 019-420-030- | 33 41N 02W (M) | 640 |
| **Siskiyou** | 019-420-050- | 28 41N 02W (M) | 640 |
| **Siskiyou** | 019-530-030- | 35 42N 01W (M) | 640 |
| **Siskiyou** | 019-540-030- | 33 42N 01W (M) | 640 |
| **Siskiyou** | 019-550-010- | 03 41N 01W (M) | 640 |
| **Siskiyou** | 019-550-020- | 01 41N 01W (M) | 563 |
| **Siskiyou** | 019-560-010- | 05 41N 01W (M) | 641 |
| **Siskiyou** | 019-560-020- | 07 41N 01W (M) | 635 |
| **Siskiyou** | 019-560-030- | 09 41N 01W (M) | 640 |
| **Siskiyou** | 019-580-010- | 15 41N 01W (M) | 320 |
| **Siskiyou** | 019-580-070- | 23 41N 01W (M) | 320 |
| **Siskiyou** | 027-010-010- | 03 40N 01E (M) | 640 |
| **Siskiyou** | 027-010-020- | 01 40N 01E (M) | 299 |
| **Siskiyou** | 027-010-030- | 11 40N 01E (M) | 640 |
| **Siskiyou** | 027-020-010- | 05 40N 01E (M) | 641 |

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| **Siskiyou** | 027-040-010- | 15 40N 01E (M) | 480 |
| **Siskiyou** | 027-390-180- | 02 40N 04E (M) | 132 |
| **Siskiyou** | 027-390-190- | 01 40N 04E (M) | 366 |
| **Siskiyou** | 027-390-220- | 02 40N 04E (M) | 443.16 |
| **Siskiyou** | 027-390-220- | 03 40N 04E (M) | 641.84 |
| **Siskiyou** | 027-390-220- | 10 40N 04E (M) | 630 |
| **Siskiyou** | 027-390-220- | 11 40N 04E (M) | 140 |
| **Siskiyou** | 027-390-230- | 02 40N 04E (M) | 21.21 |
| **Siskiyou** | 027-390-240- | 02 40N 04E (M) | 5 |
| **Siskiyou** | 027-390-250- | 01 40N 04E (M) | 292 |
| **Siskiyou** | 027-390-250- | 12 40N 04E (M) | 361.27 |
| **Siskiyou** | 027-390-260- | 03 40N 04E (M) | 20 |
| **Siskiyou** | 027-390-260- | 10 40N 04E (M) | 10 |
| **Siskiyou** | 027-390-260- | 11 40N 04E (M) | 150.01 |
| **Siskiyou** | 027-390-270- | 11 40N 04E (M) | 80 |
| **Siskiyou** | 027-390-270- | 02 40N 04E (M) | 58.79 |
| **Siskiyou** | 027-390-280- | 12 40N 04E (M) | 278.73 |
| **Siskiyou** | 027-400-180- | 04 40N 04E (M) | 654.6 |
| **Siskiyou** | 027-400-180- | 09 40N 04E (M) | 520 |
| **Siskiyou** | 027-410-160- | 16 40N 04E (M) | 480 |
| **Siskiyou** | 027-410-160- | 21 40N 04E (M) | 280 |
| **Siskiyou** | 027-420-090- | 13 40N 04E (M) | 137.74 |
| **Siskiyou** | 027-420-090- | 14 40N 04E (M) | 20 |
| **Siskiyou** | 027-420-100- | 13 40N 04E (M) | 502.26 |
| **Siskiyou** | 027-420-100- | 14 40N 04E (M) | 620 |
| **Siskiyou** | 027-420-100- | 15 40N 04E (M) | 640 |
| **Siskiyou** | 027-420-100- | 22 40N 04E (M) | 640 |
| **Siskiyou** | 027-420-100- | 23 40N 04E (M) | 600 |
| **Siskiyou** | 027-420-100- | 24 40N 04E (M) | 640 |
| **Siskiyou** | 027-430-010- | 27 40N 04E (M) | 80 |
| **Siskiyou** | 027-430-040- | 25 40N 04E (M) | 160 |
| **Siskiyou** | 027-430-190- | 26 40N 04E (M) | 120 |
| **Siskiyou** | 027-430-190- | 27 40N 04E (M) | 40 |
| **Siskiyou** | 028-010-020- | 02 40N 03W (M) | 626 |
| **Siskiyou** | 028-010-030- | 01 40N 03W (M) | 622 |
| **Siskiyou** | 028-010-040- | 11 40N 03W (M) | 640 |
| **Siskiyou** | 028-030-030- | 19 40N 03W (M) | 619 |
| **Siskiyou** | 028-030-040- | 21 40N 03W (M) | 640 |
| **Siskiyou** | 028-040-010- | 15 40N 03W (M) | 640 |
| **Siskiyou** | 028-040-020- | 13 40N 03W (M) | 640 |
| **Siskiyou** | 028-050-010- | 27 40N 03W (M) | 160 |
| **Siskiyou** | 028-070-030- | 29 40N 03W (M) | 640 |
| **Siskiyou** | 028-070-060- | 31 40N 03W (M) | 5 |
| **Siskiyou** | 028-070-150- | 30 40N 03W (M) | 133 |

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| **Siskiyou** | 028-070-160- | 30 40N 03W (M) | 18 |
| **Siskiyou** | 028-070-210- | 31 40N 03W (M) | 275 |
| **Siskiyou** | 028-070-220- | 31 40N 03W (M) | 194 |
| **Siskiyou** | 028-070-230- | 31 40N 03W (M) | 40 |
| **Siskiyou** | 028-190-020- | 01 40N 02W (M) | 639 |
| **Siskiyou** | 028-190-030- | 02 40N 02W (M) | 633.8 |
| **Siskiyou** | 028-190-060- | 10 40N 02W (M) | 480 |
| **Siskiyou** | 028-190-070- | 10 40N 02W (M) | 160 |
| **Siskiyou** | 028-200-010- | 05 40N 02W (M) | 544 |
| **Siskiyou** | 028-200-020- | 07 40N 02W (M) | 618 |
| **Siskiyou** | 028-330-110- | 06 40N 01W (M) | 151.3 |
| **Siskiyou** | 030-150-070- | 03 38N 05W (M) | 178.79 |
| **Siskiyou** | 030-150-090- | 01 38N 05W (M) | 202.66 |
| **Siskiyou** | 031-280-010- | 01 39N 08W (M) | 42 |
| **Siskiyou** | 036-160-230- | 19 40N 04W (M) | 424 |
| **Siskiyou** | 036-250-340- | 31 40N 04W (M) | 150 |
| **Tehama** | 011-280-019-T | 01 28N 01E (M) | 80 |
| **Tehama** | 011-280-020-T | 01 28N 01E (M) | 80 |
| **Tehama** | 013-010-002- | 21 30N 02E (M) | 27.54 |
| **Tehama** | 013-010-004- | 19 30N 02E (M) | 234.92 |
| **Tehama** | 013-010-005- | 20 30N 02E (M) | 241 |
| **Tehama** | 013-020-002- | 23 30N 02E (M) | 7.14 |
| **Tehama** | 013-020-003- | 24 30N 02E (M) | 23.98 |
| **Tehama** | 013-030-001- | 19 30N 03E (M) | 125 |
| **Tehama** | 013-030-001- | 20 30N 03E (M) | 38.61 |
| **Tehama** | 013-040-016- | 30 30N 02E (M) | 80 |
| **Tehama** | 013-040-017- | 29 30N 02E (M) | 600 |
| **Tehama** | 013-040-023- | 28 30N 02E (M) | 240 |
| **Tehama** | 013-040-025- | 31 30N 02E (M) | 320 |
| **Tehama** | 013-040-026- | 32 30N 02E (M) | 640 |
| **Tehama** | 013-040-028- | 33 30N 02E (M) | 120 |
| **Tehama** | 013-040-055- | 33 30N 02E (M) | 520 |
| **Tehama** | 013-060-002- | 27 30N 02E (M) | 320 |
| **Tehama** | 013-060-004- | 26 30N 02E (M) | 320 |
| **Tehama** | 013-060-005- | 25 30N 02E (M) | 640 |
| **Tehama** | 013-060-009- | 35 30N 02E (M) | 640 |
| **Tehama** | 013-060-010- | 36 30N 02E (M) | 640 |
| **Tehama** | 013-060-014- | 34 30N 02E (M) | 400 |
| **Tehama** | 013-060-015- | 34 30N 02E (M) | 240 |
| **Tehama** | 013-070-001- | 30 30N 03E (M) | 641.64 |
| **Tehama** | 013-070-002- | 29 30N 03E (M) | 631.93 |
| **Tehama** | 013-070-003- | 28 30N 03E (M) | 380.33 |
| **Tehama** | 013-070-004- | 31 30N 03E (M) | 637.02 |
| **Tehama** | 013-070-005- | 32 30N 03E (M) | 640 |

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| **Tehama** | 013-070-006- | 33 30N 03E (M) | 640 |
| **Tehama** | 013-080-002- | 27 30N 03E (M) | 117.91 |
| **Tehama** | 013-080-006- | 34 30N 03E (M) | 480 |
| **Tehama** | 013-080-009- | 35 30N 03E (M) | 160 |
| **Tehama** | 013-090-002- | 06 29N 02E (M) | 250.07 |
| **Tehama** | 013-090-003- | 06 29N 02E (M) | 40 |
| **Tehama** | 013-090-005- | 06 29N 02E (M) | 120 |
| **Tehama** | 013-090-006- | 05 29N 02E (M) | 901.24 |
| **Tehama** | 013-090-009- | 04 29N 02E (M) | 800 |
| **Tehama** | 013-090-010- | 04 29N 02E (M) | 108.8 |
| **Tehama** | 013-100-001- | 03 29N 02E (M) | 936.6 |
| **Tehama** | 013-100-002- | 02 29N 02E (M) | 478 |
| **Tehama** | 013-100-003- | 02 29N 02E (M) | 484 |
| **Tehama** | 013-110-001- | 07 29N 02E (M) | 627 |
| **Tehama** | 013-110-002- | 08 29N 02E (M) | 640 |
| **Tehama** | 013-110-003- | 09 29N 02E (M) | 640 |
| **Tehama** | 013-120-001- | 10 29N 02E (M) | 640 |
| **Tehama** | 013-120-002- | 11 29N 02E (M) | 634.96 |
| **Tehama** | 013-130-001- | 06 29N 03E (M) | 635.68 |
| **Tehama** | 013-130-002- | 05 29N 03E (M) | 641.6 |
| **Tehama** | 013-130-003- | 04 29N 03E (M) | 115.62 |
| **Tehama** | 013-130-006- | 04 29N 03E (M) | 74.99 |
| **Tehama** | 013-130-009- | 04 29N 03E (M) | 40 |
| **Tehama** | 013-130-009- | 09 29N 03E (M) | 40 |
| **Tehama** | 013-130-010- | 07 29N 03E (M) | 635.2 |
| **Tehama** | 013-130-011- | 08 29N 03E (M) | 640 |
| **Tehama** | 013-130-013- | 09 29N 03E (M) | 342.22 |
| **Tehama** | 013-130-018- | 09 29N 03E (M) | 40 |
| **Tehama** | 013-140-002- | 03 29N 03E (M) | 77.1 |
| **Tehama** | 013-140-003- | 02 29N 03E (M) | 77.35 |
| **Tehama** | 013-140-007- | 10 29N 03E (M) | 267.36 |
| **Tehama** | 013-140-008- | 10 29N 03E (M) | 40 |
| **Tehama** | 013-140-010- | 11 29N 03E (M) | 38.45 |
| **Tehama** | 013-150-009- | 17 29N 02E (M) | 638.11 |
| **Tehama** | 013-150-010- | 17 29N 02E (M) | 1.89 |
| **Tehama** | 013-150-011- | 16 29N 02E (M) | 640 |
| **Tehama** | 013-170-001- | 15 29N 02E (M) | 640 |
| **Tehama** | 013-170-002- | 14 29N 02E (M) | 474 |
| **Tehama** | 013-200-001- | 18 29N 03E (M) | 635.04 |
| **Tehama** | 013-200-002- | 17 29N 03E (M) | 640 |
| **Tehama** | 013-200-003- | 16 29N 03E (M) | 640 |
| **Tehama** | 013-200-004- | 19 29N 03E (M) | 240 |
| **Tehama** | 013-200-005- | 19 29N 03E (M) | 77.72 |
| **Tehama** | 013-200-007- | 19 29N 03E (M) | 117.92 |

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| **Tehama** | 013-200-008- | 20 29N 03E (M) | 510.85 |
| **Tehama** | 013-200-009- | 21 29N 03E (M) | 640 |
| **Tehama** | 013-200-010- | 19 29N 03E (M) | 41 |
| **Tehama** | 013-200-011- | 20 29N 03E (M) | 89.15 |
| **Tehama** | 013-210-001- | 15 29N 03E (M) | 192.42 |
| **Tehama** | 013-210-006- | 22 29N 03E (M) | 34.33 |
| **Tehama** | 013-210-007- | 22 29N 03E (M) | 47.06 |
| **Tehama** | 013-220-010- | 31 29N 02E (M) | 637.2 |
| **Tehama** | 013-220-012- | 32 29N 02E (M) | 377.88 |
| **Tehama** | 013-220-013- | 32 29N 02E (M) | 102.12 |
| **Tehama** | 013-220-019- | 33 29N 02E (M) | 359.99 |
| **Tehama** | 013-220-020- | 33 29N 02E (M) | 280.01 |
| **Tehama** | 013-220-032- | 28 29N 02E (M) | 160 |
| **Tehama** | 013-220-033- | 28 29N 02E (M) | 446.91 |
| **Tehama** | 013-260-002- | 26 29N 02E (M) | 13.46 |
| **Tehama** | 013-260-002- | 27 29N 02E (M) | 0.2 |
| **Tehama** | 013-260-003- | 26 29N 02E (M) | 570.83 |
| **Tehama** | 013-260-004- | 26 29N 02E (M) | 47.93 |
| **Tehama** | 013-260-005- | 34 29N 02E (M) | 159.24 |
| **Tehama** | 013-260-005- | 35 29N 02E (M) | 8 |
| **Tehama** | 013-260-008- | 35 29N 02E (M) | 633.79 |
| **Tehama** | 013-260-009- | 36 29N 02E (M) | 330.68 |
| **Tehama** | 013-260-010- | 34 29N 02E (M) | 478.97 |
| **Tehama** | 013-260-012- | 27 29N 02E (M) | 618.83 |
| **Tehama** | 013-270-001- | 30 29N 03E (M) | 2.5 |
| **Tehama** | 013-270-003- | 30 29N 03E (M) | 344.38 |
| **Tehama** | 013-270-004- | 29 29N 03E (M) | 302.73 |
| **Tehama** | 013-270-005- | 29 29N 03E (M) | 251.84 |
| **Tehama** | 013-270-006- | 29 29N 03E (M) | 79.31 |
| **Tehama** | 013-270-007- | 28 29N 03E (M) | 47.26 |
| **Tehama** | 013-270-008- | 28 29N 03E (M) | 280.27 |
| **Tehama** | 013-270-009- | 28 29N 03E (M) | 27.09 |
| **Tehama** | 013-270-010- | 28 29N 03E (M) | 17.58 |
| **Tehama** | 013-270-011- | 28 29N 03E (M) | 245.23 |
| **Tehama** | 013-270-012- | 31 29N 03E (M) | 122.92 |
| **Tehama** | 013-270-013- | 31 29N 03E (M) | 516.28 |
| **Tehama** | 013-270-014- | 32 29N 03E (M) | 3.64 |
| **Tehama** | 013-270-015- | 32 29N 03E (M) | 636.36 |
| **Tehama** | 013-270-017- | 30 29N 03E (M) | 290.19 |
| **Tehama** | 013-280-018- | 26 29N 03E (M) | 80 |
| **Tehama** | 013-280-020- | 35 29N 03E (M) | 80 |
| **Tehama** | 013-280-027- | 27 29N 03E (M) | 136.13 |
| **Tehama** | 013-280-029- | 27 29N 03E (M) | 37.17 |
| **Tehama** | 013-280-031- | 27 29N 03E (M) | 425.7 |

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| **Tehama** | 013-420-010- | 04 29N 03E (M) | 8.92 |
| **Tehama** | 013-420-011- | 04 29N 03E (M) | 9.07 |
| **Tehama** | 013-420-012- | 04 29N 03E (M) | 9.04 |
| **Tehama** | 013-420-013- | 04 29N 03E (M) | 9.01 |
| **Tehama** | 013-430-001- | 09 29N 03E (M) | 37.73 |
| **Tehama** | 013-430-003- | 09 29N 03E (M) | 9.96 |
| **Tehama** | 013-430-004- | 09 29N 03E (M) | 9.98 |
| **Tehama** | 013-430-005- | 09 29N 03E (M) | 10 |
| **Tehama** | 013-430-006- | 09 29N 03E (M) | 10.02 |
| **Tehama** | 013-430-007- | 09 29N 03E (M) | 39.3 |
| **Tehama** | 013-430-008- | 09 29N 03E (M) | 9.75 |
| **Tehama** | 013-430-009- | 09 29N 03E (M) | 9.72 |
| **Tehama** | 013-430-010- | 09 29N 03E (M) | 9.82 |
| **Tehama** | 013-430-011- | 09 29N 03E (M) | 9.79 |
| **Tehama** | 017-010-006- | 05 28N 02E (M) | 4 |
| **Tehama** | 017-010-017- | 09 28N 02E (M) | 600 |
| **Tehama** | 017-010-020- | 06 28N 02E (M) | 66 |
| **Tehama** | 017-010-027- | 04 28N 02E (M) | 635.52 |
| **Tehama** | 017-010-036- | 05 28N 02E (M) | 589.78 |
| **Tehama** | 017-010-037- | 08 28N 02E (M) | 580 |
| **Tehama** | 017-010-041- | 06 28N 02E (M) | 20.42 |
| **Tehama** | 017-010-042- | 07 28N 02E (M) | 91.58 |
| **Tehama** | 017-010-043- | 06 28N 02E (M) | 256 |
| **Tehama** | 017-010-044- | 07 28N 02E (M) | 206 |
| **Tehama** | 017-010-045- | 06 28N 02E (M) | 70 |
| **Tehama** | 017-010-046- | 06 28N 02E (M) | 71.64 |
| **Tehama** | 017-020-001- | 03 28N 02E (M) | 160.62 |
| **Tehama** | 017-020-004- | 02 28N 02E (M) | 641.32 |
| **Tehama** | 017-020-007- | 01 28N 02E (M) | 640.84 |
| **Tehama** | 017-020-009- | 10 28N 02E (M) | 635 |
| **Tehama** | 017-020-010- | 11 28N 02E (M) | 640 |
| **Tehama** | 017-020-011- | 12 28N 02E (M) | 640 |
| **Tehama** | 017-030-002- | 18 28N 02E (M) | 160 |
| **Tehama** | 017-030-004- | 17 28N 02E (M) | 640 |
| **Tehama** | 017-030-005- | 16 28N 02E (M) | 640 |
| **Tehama** | 017-030-011- | 21 28N 02E (M) | 360 |
| **Tehama** | 017-040-001- | 15 28N 02E (M) | 640 |
| **Tehama** | 017-040-003- | 14 28N 02E (M) | 640 |
| **Tehama** | 017-040-004- | 13 28N 02E (M) | 640 |
| **Tehama** | 017-040-006- | 22 28N 02E (M) | 160 |
| **Tehama** | 017-040-007- | 23 28N 02E (M) | 640 |
| **Tehama** | 017-040-008- | 24 28N 02E (M) | 640 |
| **Tehama** | 017-050-003- | 29 28N 02E (M) | 240 |
| **Tehama** | 017-050-009- | 32 28N 02E (M) | 80 |

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| **Tehama** | 017-050-010- | 33 28N 02E (M) | 640 |
| **Tehama** | 017-050-012- | 31 28N 02E (M) | 480 |
| **Tehama** | 017-060-002- | 27 28N 02E (M) | 320 |
| **Tehama** | 017-060-003- | 26 28N 02E (M) | 640 |
| **Tehama** | 017-060-004- | 25 28N 02E (M) | 640 |
| **Tehama** | 017-060-005- | 34 28N 02E (M) | 480 |
| **Tehama** | 017-060-007- | 35 28N 02E (M) | 640 |
| **Tehama** | 017-060-008- | 36 28N 02E (M) | 640 |
| **Tehama** | 017-070-001- | 06 28N 03E (M) | 726.99 |
| **Tehama** | 017-070-002- | 06 28N 03E (M) | 244.63 |
| **Tehama** | 017-090-001- | 07 28N 03E (M) | 643.2 |
| **Tehama** | 017-110-001- | 18 28N 03E (M) | 240.78 |
| **Tehama** | 017-110-002- | 18 28N 03E (M) | 403.54 |
| **Tehama** | 017-110-005- | 19 28N 03E (M) | 645.56 |
| **Tehama** | 017-110-006- | 20 28N 03E (M) | 640 |
| **Tehama** | 017-110-007- | 21 28N 03E (M) | 640 |
| **Tehama** | 017-110-008- | 17 28N 03E (M) | 160 |
| **Tehama** | 017-120-004- | 22 28N 03E (M) | 640 |
| **Tehama** | 017-120-005- | 23 28N 03E (M) | 320 |
| **Tehama** | 017-130-001- | 30 28N 03E (M) | 644.04 |
| **Tehama** | 017-130-003- | 29 28N 03E (M) | 640 |
| **Tehama** | 017-130-004- | 28 28N 03E (M) | 640 |
| **Tehama** | 017-130-005- | 31 28N 03E (M) | 641.82 |
| **Tehama** | 017-130-006- | 32 28N 03E (M) | 640 |
| **Tehama** | 017-130-007- | 33 28N 03E (M) | 640 |
| **Tehama** | 017-140-001- | 27 28N 03E (M) | 640 |
| **Tehama** | 017-140-002- | 26 28N 03E (M) | 320 |
| **Tehama** | 017-140-007- | 34 28N 03E (M) | 320 |
| **Tehama** | 017-140-011- | 35 28N 03E (M) | 40 |
| **Tehama** | 017-190-005- | 32 28N 04E (M) | 120 |
| **Tehama** | 017-190-007- | 33 28N 04E (M) | 320 |
| **Tehama** | 017-200-006- | 26 28N 04E (M) | 320 |
| **Tehama** | 017-200-008- | 25 28N 04E (M) | 80 |
| **Tehama** | 017-200-011- | 34 28N 04E (M) | 80 |
| **Tehama** | 017-200-014- | 35 28N 04E (M) | 360 |
| **Tehama** | 017-250-002- | 30 28N 05E (M) | 159 |
| **Tehama** | 017-250-010- | 31 28N 05E (M) | 160 |
| **Tehama** | 017-250-014- | 32 28N 05E (M) | 80 |
| **Tehama** | 053-010-002- | 05 27N 02E (M) | 40.43 |
| **Tehama** | 053-010-004- | 04 27N 02E (M) | 480.89 |
| **Tehama** | 053-020-001- | 03 27N 02E (M) | 640.57 |
| **Tehama** | 053-020-002- | 02 27N 02E (M) | 642.46 |
| **Tehama** | 053-020-003- | 01 27N 02E (M) | 644.27 |
| **Tehama** | 053-020-004- | 10 27N 02E (M) | 640 |

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| **Tehama** | 053-020-005- | 11 27N 02E (M) | 640 |
| **Tehama** | 053-020-006- | 12 27N 02E (M) | 160 |
| **Tehama** | 053-030-002- | 05 27N 03E (M) | 561.64 |
| **Tehama** | 053-030-004- | 04 27N 03E (M) | 261.64 |
| **Tehama** | 053-030-008- | 09 27N 03E (M) | 640 |
| **Tehama** | 053-030-009- | 06 27N 03E (M) | 160 |
| **Tehama** | 053-030-010- | 07 27N 03E (M) | 160 |
| **Tehama** | 053-030-011- | 07 27N 03E (M) | 160 |
| **Tehama** | 053-030-012- | 06 27N 03E (M) | 367 |
| **Tehama** | 053-040-001- | 03 27N 03E (M) | 512 |
| **Tehama** | 053-040-015- | 12 27N 03E (M) | 80 |
| **Tehama** | 053-070-002- | 17 27N 03E (M) | 331.3 |
| **Tehama** | 053-070-004- | 17 27N 03E (M) | 308.7 |
| **Tehama** | 053-070-005- | 16 27N 03E (M) | 640 |
| **Tehama** | 053-070-007- | 19 27N 03E (M) | 535.04 |
| **Tehama** | 053-070-009- | 20 27N 03E (M) | 320 |
| **Tehama** | 053-070-012- | 21 27N 03E (M) | 320 |
| **Tehama** | 053-080-003- | 14 27N 03E (M) | 120 |
| **Tehama** | 053-080-006- | 14 27N 03E (M) | 120 |
| **Tehama** | 053-080-007- | 13 27N 03E (M) | 640 |
| **Tehama** | 053-080-009- | 23 27N 03E (M) | 640 |
| **Tehama** | 053-080-010- | 24 27N 03E (M) | 200 |
| **Tehama** | 053-080-011- | 24 27N 03E (M) | 80 |
| **Tehama** | 053-110-003- | 30 27N 03E (M) | 320 |
| **Tehama** | 053-110-006- | 29 27N 03E (M) | 320 |
| **Tehama** | 053-110-011- | 33 27N 03E (M) | 640 |
| **Tehama** | 053-120-004- | 26 27N 03E (M) | 80 |
| **Tehama** | 053-120-010- | 34 27N 03E (M) | 560 |
| **Tehama** | 053-120-011- | 35 27N 03E (M) | 640 |
| **Tehama** | 053-120-014- | 36 27N 03E (M) | 347.07 |
| **Tehama** | 053-120-015- | 36 27N 03E (M) | 282.18 |
| **Tehama** | 053-150-004- | 04 26N 03E (M) | 394.38 |
| **Tehama** | 053-150-009- | 09 26N 03E (M) | 280 |
| **Tehama** | 053-160-001- | 03 26N 03E (M) | 642.26 |
| **Tehama** | 053-160-002- | 02 26N 03E (M) | 640.3 |
| **Tehama** | 053-160-005- | 10 26N 03E (M) | 560 |
| **Tehama** | 053-160-007- | 11 26N 03E (M) | 640 |
| **Tehama** | 053-160-008- | 12 26N 03E (M) | 40 |
| **Tehama** | 053-160-010- | 12 26N 03E (M) | 0.03 |
| **Tehama** | 053-160-011- | 12 26N 03E (M) | 599.3 |
| **Tehama** | 053-160-012- | 01 26N 03E (M) | 480.92 |
| **Tehama** | 053-160-013- | 01 26N 03E (M) | 149.24 |
| **Tehama** | 053-190-008- | 21 26N 03E (M) | 160 |
| **Tehama** | 053-200-001- | 15 26N 03E (M) | 640 |

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| **Tehama** | 053-200-002- | 14 26N 03E (M) | 640 |
| **Tehama** | 053-200-005- | 22 26N 03E (M) | 640 |
| **Tehama** | 053-200-006- | 23 26N 03E (M) | 640 |
| **Tehama** | 053-200-007- | 24 26N 03E (M) | 160 |
| **Tehama** | 053-200-013- | 13 26N 03E (M) | 425.42 |
| **Tehama** | 053-200-014- | 13 26N 03E (M) | 194.36 |
| **Tehama** | 053-230-004- | 28 26N 03E (M) | 560 |
| **Tehama** | 053-230-007- | 33 26N 03E (M) | 640 |
| **Tehama** | 053-240-001- | 27 26N 03E (M) | 640 |
| **Tehama** | 053-240-002- | 26 26N 03E (M) | 430.45 |
| **Tehama** | 053-240-005- | 26 26N 03E (M) | 7.73 |
| **Tehama** | 053-240-006- | 34 26N 03E (M) | 320 |
| **Tehama** | 053-240-008- | 35 26N 03E (M) | 320.51 |
| **Tehama** | 053-240-009- | 35 26N 03E (M) | 311.93 |
| **Tehama** | 055-010-004- | 06 27N 04E (M) | 280 |
| **Tehama** | 055-010-006- | 05 27N 04E (M) | 109.6 |
| **Tehama** | 055-010-010- | 05 27N 04E (M) | 474.55 |
| **Tehama** | 055-010-011- | 04 27N 04E (M) | 538 |
| **Tehama** | 055-010-015- | 07 27N 04E (M) | 40 |
| **Tehama** | 055-010-021- | 08 27N 04E (M) | 440 |
| **Tehama** | 055-010-025- | 09 27N 04E (M) | 80 |
| **Tehama** | 055-020-002- | 03 27N 04E (M) | 349.28 |
| **Tehama** | 055-020-005- | 02 27N 04E (M) | 458.55 |
| **Tehama** | 055-020-009- | 01 27N 04E (M) | 34.64 |
| **Tehama** | 055-090-006- | 31 27N 04E (M) | 639 |
| **Tehama** | 055-090-009- | 31 27N 04E (M) | 0.48 |
| **Tehama** | 055-120-003- | 05 26N 04E (M) | 641.46 |
| **Tehama** | 055-120-005- | 04 26N 04E (M) | 160 |
| **Tehama** | 055-120-008- | 08 26N 04E (M) | 600 |
| **Tehama** | 055-120-009- | 08 26N 04E (M) | 40 |
| **Tehama** | 055-120-010- | 09 26N 04E (M) | 320 |
| **Tehama** | 055-120-012- | 09 26N 04E (M) | 160 |
| **Tehama** | 055-120-013- | 09 26N 04E (M) | 40 |
| **Tehama** | 055-120-014- | 09 26N 04E (M) | 40 |
| **Tehama** | 055-120-017- | 07 26N 04E (M) | 581.86 |
| **Tehama** | 055-120-018- | 06 26N 04E (M) | 636.51 |
| **Tehama** | 055-120-019- | 06 26N 04E (M) | 2.47 |
| **Tehama** | 055-120-020- | 07 26N 04E (M) | 58.03 |
| **Tehama** | 055-130-008- | 10 26N 04E (M) | 160 |
| **Tehama** | 055-150-001- | 18 26N 04E (M) | 120 |
| **Tehama** | 055-150-002- | 18 26N 04E (M) | 480 |
| **Tehama** | 055-150-003- | 18 26N 04E (M) | 40 |
| **Tehama** | 055-150-004- | 17 26N 04E (M) | 640 |
| **Tehama** | 055-150-005- | 16 26N 04E (M) | 640 |

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| **Tehama** | 055-160-001- | 15 26N 04E (M) | 400 |
| **Tehama** | 055-160-006- | 14 26N 04E (M) | 80 |
| **Tehama** | 081-040-007- | 11 25N 02E (M) | 160 |
| **Tehama** | 081-040-008- | 11 25N 02E (M) | 160 |
| **Tehama** | 081-040-010- | 12 25N 02E (M) | 320 |
| **Tehama** | 081-050-002- | 06 25N 03E (M) | 176 |
| **Tehama** | 081-050-003- | 05 25N 03E (M) | 391.78 |
| **Tehama** | 081-050-005- | 04 25N 03E (M) | 336 |
| **Tehama** | 081-050-006- | 07 25N 03E (M) | 693.5 |
| **Tehama** | 081-050-007- | 08 25N 03E (M) | 640 |
| **Tehama** | 081-050-008- | 09 25N 03E (M) | 640 |
| **Tehama** | 081-060-001- | 03 25N 03E (M) | 440 |
| **Tehama** | 081-060-002- | 02 25N 03E (M) | 73.13 |
| **Tehama** | 081-060-003- | 02 25N 03E (M) | 223.13 |
| **Tehama** | 081-060-004- | 10 25N 03E (M) | 471.13 |
| **Tehama** | 081-060-005- | 10 25N 03E (M) | 7.13 |
| **Tehama** | 081-060-006- | 15 25N 03E (M) | 160 |
| **Tehama** | 081-100-006- | 13 25N 02E (M) | 640 |
| **Tehama** | 081-100-012- | 24 25N 02E (M) | 640 |
| **Tehama** | 081-110-012- | 14 25N 02E (M) | 40 |
| **Tehama** | 081-120-001- | 18 25N 03E (M) | 694.66 |
| **Tehama** | 081-120-002- | 17 25N 03E (M) | 640 |
| **Tehama** | 081-120-003- | 16 25N 03E (M) | 640 |
| **Tehama** | 081-120-004- | 19 25N 03E (M) | 692.9 |
| **Tehama** | 081-120-005- | 20 25N 03E (M) | 640 |
| **Tehama** | 081-120-006- | 21 25N 03E (M) | 640 |
| **Tehama** | 081-130-009- | 23 25N 02E (M) | 21.17 |
| **Tehama** | 081-130-010- | 23 25N 02E (M) | 20.91 |
| **Tehama** | 081-130-011- | 23 25N 02E (M) | 31.4 |
| **Tehama** | 081-130-012- | 23 25N 02E (M) | 10.47 |
| **Tehama** | 081-130-013- | 23 25N 02E (M) | 20.96 |
| **Tehama** | 081-130-017- | 23 25N 02E (M) | 38.96 |
| **Tehama** | 081-130-018- | 23 25N 02E (M) | 10.59 |
| **Tehama** | 081-130-021- | 23 25N 02E (M) | 10.59 |
| **Tehama** | 081-130-026- | 23 25N 02E (M) | 20.5 |
| **Tehama** | 081-130-027- | 23 25N 02E (M) | 20 |
| **Tehama** | 081-130-028- | 23 25N 02E (M) | 20.53 |
| **Tehama** | 081-170-001- | 27 25N 02E (M) | 320 |
| **Tehama** | 081-170-004- | 26 25N 02E (M) | 240 |
| **Tehama** | 081-170-012- | 35 25N 02E (M) | 80 |
| **Tehama** | 081-170-013- | 35 25N 02E (M) | 240 |
| **Tehama** | 081-170-016- | 25 25N 02E (M) | 40 |
| **Tehama** | 081-170-017- | 25 25N 02E (M) | 40 |
| **Tehama** | 081-170-018- | 25 25N 02E (M) | 200 |

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| **Tehama** | 081-170-019- | 25 25N 02E (M) | 160 |
| **Tehama** | 081-170-020- | 25 25N 02E (M) | 160 |
| **Tehama** | 081-170-021- | 25 25N 02E (M) | 20 |
| **Tehama** | 081-170-023- | 36 25N 02E (M) | 160 |
| **Tehama** | 081-170-024- | 36 25N 02E (M) | 157.5 |
| **Tehama** | 081-170-025- | 36 25N 02E (M) | 160 |
| **Tehama** | 081-170-026- | 36 25N 02E (M) | 23.47 |
| **Tehama** | 081-170-027- | 26 25N 02E (M) | 160 |
| **Tehama** | 081-170-028- | 26 25N 02E (M) | 160 |
| **Tehama** | 081-170-029- | 26 25N 02E (M) | 40 |
| **Tehama** | 081-180-002- | 30 25N 03E (M) | 240 |
| **Tehama** | 081-180-003- | 29 25N 03E (M) | 640 |
| **Tehama** | 081-180-004- | 28 25N 03E (M) | 480 |
| **Tehama** | 081-180-005- | 31 25N 03E (M) | 347.2 |
| **Tehama** | 081-180-007- | 32 25N 03E (M) | 240 |
| **Tehama** | 081-180-008- | 33 25N 03E (M) | 160 |
| **Tehama** | 081-220-004- | 02 24N 02E (M) | 144.8 |
| **Tehama** | 081-220-005- | 01 24N 02E (M) | 36.82 |
| **Tehama** | 081-300-001- | 14 25N 02E (M) | 80 |
| **Tehama** | 081-300-012- | 14 25N 02E (M) | 80 |
| **Trinity** | 003-160-01- | 05 39N 07W (M) | 168 |
| **Trinity** | 003-160-02- | 05 39N 07W (M) | 174 |
| **Trinity** | 003-160-03- | 07 39N 07W (M) | 597 |
| **Trinity** | 003-160-04- | 09 39N 07W (M) | 659 |
| **Trinity** | 003-170-01- | 03 39N 07W (M) | 626 |
| **Trinity** | 003-200-01- | 17 39N 07W (M) | 634 |
| **Trinity** | 003-200-02- | 19 39N 07W (M) | 668 |
| **Trinity** | 003-210-04- | 23 39N 07W (M) | 487 |
| **Trinity** | 003-210-14- | 24 39N 07W (M) | 621 |
| **Trinity** | 003-210-18- | 15 39N 07W (M) | 622.84 |
| **Trinity** | 003-220-02- | 19 39N 06W (M) | 673 |
| **Trinity** | 003-250-01- | 27 39N 07W (M) | 635 |
| **Trinity** | 003-250-02- | 25 39N 07W (M) | 630 |
| **Trinity** | 003-250-17- | 35 39N 07W (M) | 552 |
| **Trinity** | 003-260-02- | 31 39N 06W (M) | 657 |
| **Trinity** | 003-280-01- | 05 38N 06W (M) | 674 |
| **Trinity** | 003-280-02- | 07 38N 06W (M) | 702 |
| **Trinity** | 003-280-03- | 09 38N 06W (M) | 760 |
| **Trinity** | 003-290-01- | 03 38N 06W (M) | 693 |
| **Trinity** | 003-290-02- | 01 38N 06W (M) | 422 |
| **Trinity** | 003-290-03- | 11 38N 06W (M) | 688 |
| **Trinity** | 003-300-01- | 07 38N 05W (M) | 370 |
| **Trinity** | 003-320-01- | 17 38N 06W (M) | 619 |
| **Trinity** | 003-320-02- | 19 38N 06W (M) | 649 |

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| **Trinity** | 003-320-05- | 18 38N 06W (M) | 621 |
| **Trinity** | 003-380-02- | 19 38N 05W (M) | 508 |
| **Trinity** | 003-390-01- | 29 38N 06W (M) | 527 |
| **Trinity** | 003-390-05- | 33 38N 06W (M) | 732 |
| **Trinity** | 003-400-03- | 25 38N 06W (M) | 704 |
| **Trinity** | 003-400-04- | 35 38N 06W (M) | 627 |
| **Trinity** | 003-410-02- | 31 38N 05W (M) | 528 |
| **Trinity** | 004-060-02- | 07 38N 07W (M) | 618 |
| **Trinity** | 004-060-03- | 09 38N 07W (M) | 649 |
| **Trinity** | 004-070-02- | 01 38N 07W (M) | 648 |
| **Trinity** | 004-070-08- | 11 38N 07W (M) | 629 |
| **Trinity** | 004-070-13- | 03 38N 07W (M) | 583 |
| **Trinity** | 004-120-01- | 17 38N 07W (M) | 612 |
| **Trinity** | 004-120-02- | 19 38N 07W (M) | 623 |
| **Trinity** | 004-120-10- | 21 38N 07W (M) | 4 |
| **Trinity** | 004-120-18- | 21 38N 07W (M) | 610 |
| **Trinity** | 004-130-02- | 13 38N 07W (M) | 635 |
| **Trinity** | 004-130-03- | 23 38N 07W (M) | 646 |
| **Trinity** | 004-190-08- | 31 38N 07W (M) | 419 |
| **Trinity** | 004-190-15- | 29 38N 07W (M) | 19.5 |
| **Trinity** | 004-190-16- | 29 38N 07W (M) | 575 |
| **Trinity** | 004-190-17- | 31 38N 07W (M) | 40 |
| **Trinity** | 004-240-06- | 09 37N 08W (M) | 467 |
| **Trinity** | 004-260-03- | 01 37N 08W (M) | 349 |
| **Trinity** | 004-260-04- | 03 37N 08W (M) | 153 |
| **Trinity** | 004-280-06- | 15 37N 08W (M) | 466 |
| **Trinity** | 004-280-07- | 13 37N 08W (M) | 36 |
| **Trinity** | 004-280-09- | 13 37N 08W (M) | 316 |
| **Trinity** | 004-280-22- | 12 37N 08W (M) | 64.03 |
| **Trinity** | 004-280-22- | 13 37N 08W (M) | 134.44 |
| **Trinity** | 004-310-02- | 23 37N 08W (M) | 477 |
| **Trinity** | 004-310-03- | 23 37N 08W (M) | 80 |
| **Trinity** | 004-350-02- | 25 37N 08W (M) | 649 |
| **Trinity** | 004-350-03- | 35 37N 08W (M) | 612 |
| **Trinity** | 004-350-06- | 36 37N 08W (M) | 657 |
| **Trinity** | 004-390-15- | 20 38N 07W (M) | 26 |
| **Trinity** | 007-010-06- | 07 37N 07W (M) | 183.22 |
| **Trinity** | 007-010-11- | 09 37N 07W (M) | 130 |
| **Trinity** | 007-010-16- | 09 37N 07W (M) | 101 |
| **Trinity** | 007-030-02- | 03 37N 07W (M) | 367 |
| **Trinity** | 007-040-01- | 05 37N 06W (M) | 690 |
| **Trinity** | 007-040-03- | 09 37N 06W (M) | 727 |
| **Trinity** | 007-050-01- | 03 37N 06W (M) | 645 |
| **Trinity** | 007-050-02- | 01 37N 06W (M) | 467 |

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| **Trinity** | 007-050-03- | 11 37N 06W (M) | 282 |
| **Trinity** | 007-060-03- | 07 37N 05W (M) | 61 |
| **Trinity** | 007-070-08- | 19 37N 07W (M) | 337 |
| **Trinity** | 007-070-17- | 21 37N 07W (M) | 160 |
| **Trinity** | 007-080-01- | 15 37N 07W (M) | 456 |
| **Trinity** | 007-080-02- | 23 37N 07W (M) | 600 |
| **Trinity** | 007-080-05- | 22 37N 07W (M) | 615 |
| **Trinity** | 007-080-06- | 24 37N 07W (M) | 555 |
| **Trinity** | 007-080-07- | 15 37N 07W (M) | 225 |
| **Trinity** | 007-090-01- | 17 37N 06W (M) | 586 |
| **Trinity** | 007-090-04- | 19 37N 06W (M) | 666 |
| **Trinity** | 007-090-05- | 21 37N 06W (M) | 646 |
| **Trinity** | 007-110-01- | 15 37N 06W (M) | 547 |
| **Trinity** | 007-110-02- | 23 37N 06W (M) | 304 |
| **Trinity** | 007-120-10- | 31 37N 07W (M) | 558 |
| **Trinity** | 007-120-46- | 33 37N 07W (M) | 350 |
| **Trinity** | 007-150-01- | 27 37N 07W (M) | 657 |
| **Trinity** | 007-150-02- | 25 37N 07W (M) | 642 |
| **Trinity** | 007-150-11- | 35 37N 07W (M) | 631 |
| **Trinity** | 007-150-12- | 26 37N 07W (M) | 682 |
| **Trinity** | 007-160-04- | 29 37N 06W (M) | 387 |
| **Trinity** | 007-160-09- | 31 37N 06W (M) | 321 |
| **Trinity** | 007-160-10- | 33 37N 06W (M) | 594 |
| **Trinity** | 007-190-01- | 27 37N 06W (M) | 497 |
| **Trinity** | 007-200-08- | 09 36N 08W (M) | 411 |
| **Trinity** | 007-210-01- | 03 36N 08W (M) | 562 |
| **Trinity** | 007-210-02- | 01 36N 08W (M) | 573 |
| **Trinity** | 007-210-03- | 11 36N 08W (M) | 698 |
| **Trinity** | 007-210-04- | 02 36N 08W (M) | 627 |
| **Trinity** | 007-210-06- | 12 36N 08W (M) | 492 |
| **Trinity** | 007-220-13- | 07 36N 07W (M) | 330 |
| **Trinity** | 007-220-66- | 06 36N 07W (M) | 590 |
| **Trinity** | 007-250-05- | 01 36N 07W (M) | 35 |
| **Trinity** | 007-250-11- | 03 36N 07W (M) | 587 |
| **Trinity** | 007-250-40- | 01 36N 07W (M) | 309 |
| **Trinity** | 007-260-01- | 05 36N 06W (M) | 643 |
| **Trinity** | 007-260-02- | 07 36N 06W (M) | 727 |
| **Trinity** | 007-260-03- | 09 36N 06W (M) | 197 |
| **Trinity** | 007-270-01- | 03 36N 06W (M) | 462 |
| **Trinity** | 007-280-08- | 21 36N 08W (M) | 1152 |
| **Trinity** | 007-290-01- | 15 36N 08W (M) | 634 |
| **Trinity** | 007-290-03- | 13 36N 08W (M) | 308 |
| **Trinity** | 007-290-04- | 23 36N 08W (M) | 661 |
| **Trinity** | 007-290-05- | 14 36N 08W (M) | 40 |

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| **Trinity** | 007-290-06- | 14 36N 08W (M) | 490 |
| **Trinity** | 007-290-07- | 22 36N 08W (M) | 675 |
| **Trinity** | 007-300-51- | 19 36N 07W (M) | 33.91 |
| **Trinity** | 007-300-52- | 19 36N 07W (M) | 15.15 |
| **Trinity** | 007-300-55- | 19 36N 07W (M) | 421.88 |
| **Trinity** | 007-300-66- | 18 36N 07W (M) | 578 |
| **Trinity** | 007-310-08- | 23 36N 07W (M) | 674 |
| **Trinity** | 007-310-15- | 13 36N 07W (M) | 616 |
| **Trinity** | 007-320-03- | 19 36N 06W (M) | 327 |
| **Trinity** | 007-330-04- | 33 36N 08W (M) | 657 |
| **Trinity** | 007-330-05- | 28 36N 08W (M) | 750 |
| **Trinity** | 007-330-09- | 29 36N 08W (M) | 328 |
| **Trinity** | 007-340-01- | 27 36N 08W (M) | 527 |
| **Trinity** | 007-340-02- | 25 36N 08W (M) | 424 |
| **Trinity** | 007-340-03- | 35 36N 08W (M) | 660 |
| **Trinity** | 007-340-08- | 34 36N 08W (M) | 20 |
| **Trinity** | 007-340-09- | 34 36N 08W (M) | 617.5 |
| **Trinity** | 007-340-11- | 26 36N 08W (M) | 475 |
| **Trinity** | 007-350-04- | 31 36N 07W (M) | 653 |
| **Trinity** | 007-350-11- | 33 36N 07W (M) | 485 |
| **Trinity** | 007-350-13- | 29 36N 07W (M) | 342 |
| **Trinity** | 007-360-10- | 27 36N 07W (M) | 516 |
| **Trinity** | 007-360-15- | 35 36N 07W (M) | 668 |
| **Trinity** | 007-360-17- | 25 36N 07W (M) | 613 |
| **Trinity** | 009-190-03- | 21 35N 09W (M) | 619 |
| **Trinity** | 009-200-01- | 29 35N 09W (M) | 607 |
| **Trinity** | 009-200-04- | 33 35N 09W (M) | 599 |
| **Trinity** | 009-220-03- | 23 35N 09W (M) | 755 |
| **Trinity** | 009-220-07- | 24 35N 09W (M) | 596 |
| **Trinity** | 009-220-09- | 15 35N 09W (M) | 441 |
| **Trinity** | 009-220-10- | 13 35N 09W (M) | 20 |
| **Trinity** | 009-220-11- | 13 35N 09W (M) | 556 |
| **Trinity** | 009-230-02- | 25 35N 09W (M) | 646 |
| **Trinity** | 009-230-14- | 27 35N 09W (M) | 594 |
| **Trinity** | 010-010-03- | 03 35N 08W (M) | 100 |
| **Trinity** | 010-010-03- | 04 35N 08W (M) | 160 |
| **Trinity** | 010-010-63- | 04 35N 08W (M) | 538 |
| **Trinity** | 010-010-63- | 05 35N 08W (M) | 21.28 |
| **Trinity** | 010-020-01- | 03 35N 08W (M) | 630 |
| **Trinity** | 010-020-03- | 11 35N 08W (M) | 611 |
| **Trinity** | 010-020-05- | 01 35N 08W (M) | 617 |
| **Trinity** | 010-040-01- | 03 35N 07W (M) | 864 |
| **Trinity** | 010-040-02- | 01 35N 07W (M) | 422 |
| **Trinity** | 010-040-08- | 11 35N 07W (M) | 660 |

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| **Trinity** | 010-050-04- | 17 35N 08W (M) | 40 |
| **Trinity** | 010-050-07- | 21 35N 08W (M) | 529 |
| **Trinity** | 010-060-12- | 23 35N 08W (M) | 593 |
| **Trinity** | 010-060-58- | 15 35N 08W (M) | 7 |
| **Trinity** | 010-060-59- | 15 35N 08W (M) | 531 |
| **Trinity** | 010-070-11- | 21 35N 07W (M) | 672 |
| **Trinity** | 010-070-18- | 17 35N 07W (M) | 377 |
| **Trinity** | 010-080-01- | 15 35N 07W (M) | 714 |
| **Trinity** | 010-080-02- | 13 35N 07W (M) | 293 |
| **Trinity** | 010-080-03- | 23 35N 07W (M) | 300 |
| **Trinity** | 010-100-13- | 27 35N 08W (M) | 265 |
| **Trinity** | 010-110-02- | 29 35N 07W (M) | 528 |
| **Trinity** | 010-110-04- | 33 35N 07W (M) | 538 |
| **Trinity** | 010-110-07- | 31 35N 07W (M) | 737 |
| **Trinity** | 010-120-01- | 27 35N 07W (M) | 628 |
| **Trinity** | 010-140-10- | 09 34N 09W (M) | 167 |
| **Trinity** | 010-150-05- | 03 34N 09W (M) | 303 |
| **Trinity** | 010-150-13- | 11 34N 09W (M) | 640 |
| **Trinity** | 010-160-12- | 09 34N 08W (M) | 303 |
| **Trinity** | 010-170-03- | 01 34N 08W (M) | 637 |
| **Trinity** | 010-180-01- | 05 34N 07W (M) | 516 |
| **Trinity** | 010-180-02- | 07 34N 07W (M) | 691 |
| **Trinity** | 010-180-03- | 09 34N 07W (M) | 316 |
| **Trinity** | 010-180-04- | 09 34N 07W (M) | 135.5 |
| **Trinity** | 010-210-01- | 13 34N 09W (M) | 320 |
| **Trinity** | 010-210-02- | 23 34N 09W (M) | 662 |
| **Trinity** | 010-210-06- | 15 34N 09W (M) | 609 |
| **Trinity** | 010-210-09- | 14 34N 09W (M) | 645 |
| **Trinity** | 010-210-10- | 14 34N 09W (M) | 19 |
| **Trinity** | 010-220-10- | 17 34N 08W (M) | 666 |
| **Trinity** | 010-240-02- | 19 34N 07W (M) | 619 |
| **Trinity** | 010-240-03- | 21 34N 07W (M) | 364 |
| **Trinity** | 010-240-04- | 17 34N 07W (M) | 284 |
| **Trinity** | 010-240-05- | 17 34N 07W (M) | 284 |
| **Trinity** | 010-240-06- | 16 34N 07W (M) | 222 |
| **Trinity** | 010-240-07- | 16 34N 07W (M) | 190 |
| **Trinity** | 010-240-10- | 20 34N 07W (M) | 539 |
| **Trinity** | 010-250-02- | 33 34N 10W (M) | 161 |
| **Trinity** | 010-260-02- | 25 34N 10W (M) | 451 |
| **Trinity** | 010-260-04- | 35 34N 10W (M) | 621 |
| **Trinity** | 010-290-01- | 27 34N 09W (M) | 317 |
| **Trinity** | 010-290-03- | 25 34N 09W (M) | 658 |
| **Trinity** | 010-290-05- | 35 34N 09W (M) | 561 |
| **Trinity** | 010-290-07- | 36 34N 09W (M) | 150 |

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| **Trinity** | 010-300-01- | 29 34N 08W (M) | 624 |
| **Trinity** | 010-320-01- | 29 34N 07W (M) | 494 |
| **Trinity** | 010-320-02- | 31 34N 07W (M) | 359.58 |
| **Trinity** | 010-320-03- | 31 34N 07W (M) | 56 |
| **Trinity** | 010-320-05- | 30 34N 07W (M) | 608 |
| **Trinity** | 010-690-18- | 17 34N 09W (M) | 218 |
| **Trinity** | 010-690-39- | 19 34N 09W (M) | 492 |
| **Trinity** | 012-230-01- | 36 33N 11W (M) | 640 |
| **Trinity** | 015-010-07- | 11 32N 11W (M) | 160 |
| **Trinity** | 015-010-12- | 02 32N 11W (M) | 320 |
| **Trinity** | 015-010-41- | 01 32N 11W (M) | 642 |
| **Trinity** | 015-040-03- | 14 32N 11W (M) | 160 |
| **Trinity** | 015-040-07- | 23 32N 11W (M) | 160 |
| **Trinity** | 015-040-08- | 23 32N 11W (M) | 160 |
| **Trinity** | 015-040-09- | 24 32N 11W (M) | 160 |
| **Trinity** | 015-040-14- | 13 32N 11W (M) | 640 |
| **Trinity** | 015-040-15- | 24 32N 11W (M) | 320 |
| **Trinity** | 015-040-20- | 14 32N 11W (M) | 480 |
| **Trinity** | 015-050-02- | 26 32N 11W (M) | 240 |
| **Trinity** | 015-050-02- | 27 32N 11W (M) | 80 |
| **Trinity** | 015-050-28- | 34 32N 11W (M) | 480 |
| **Trinity** | 015-050-30- | 36 32N 11W (M) | 200 |
| **Trinity** | 015-050-51- | 27 32N 11W (M) | 280 |
| **Trinity** | 015-050-52- | 26 32N 11W (M) | 80 |
| **Trinity** | 015-050-54- | 02 31N 11W (M) | 155 |
| **Trinity** | 015-050-54- | 35 32N 11W (M) | 32.5 |
| **Trinity** | 015-070-01- | 03 32N 10W (M) | 607 |
| **Trinity** | 015-070-02- | 01 32N 10W (M) | 198.9 |
| **Trinity** | 015-070-07- | 11 32N 10W (M) | 324 |
| **Trinity** | 015-070-08- | 11 32N 10W (M) | 320 |
| **Trinity** | 015-090-08- | 04 32N 10W (M) | 160 |
| **Trinity** | 015-090-12- | 09 32N 10W (M) | 335 |
| **Trinity** | 015-090-13- | 09 32N 10W (M) | 334 |
| **Trinity** | 015-090-27- | 05 32N 10W (M) | 40 |
| **Trinity** | 015-090-27- | 08 32N 10W (M) | 640 |
| **Trinity** | 015-090-28- | 06 32N 10W (M) | 80 |
| **Trinity** | 015-090-28- | 07 32N 10W (M) | 510 |
| **Trinity** | 015-100-03- | 17 32N 10W (M) | 316 |
| **Trinity** | 015-100-04- | 17 32N 10W (M) | 315 |
| **Trinity** | 015-100-05- | 16 32N 10W (M) | 480 |
| **Trinity** | 015-100-12- | 21 32N 10W (M) | 591 |
| **Trinity** | 015-100-13- | 16 32N 10W (M) | 160 |
| **Trinity** | 015-100-14- | 18 32N 10W (M) | 228 |
| **Trinity** | 015-100-19- | 18 32N 10W (M) | 290 |

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| **Trinity** | 015-100-21- | 19 32N 10W (M) | 489 |
| **Trinity** | 015-100-23- | 20 32N 10W (M) | 160 |
| **Trinity** | 015-100-24- | 20 32N 10W (M) | 478 |
| **Trinity** | 015-110-01- | 15 32N 10W (M) | 564 |
| **Trinity** | 015-110-05- | 13 32N 10W (M) | 133 |
| **Trinity** | 015-110-07- | 13 32N 10W (M) | 70 |
| **Trinity** | 015-110-08- | 13 32N 10W (M) | 137.13 |
| **Trinity** | 015-110-10- | 22 32N 10W (M) | 274 |
| **Trinity** | 015-110-13- | 23 32N 10W (M) | 584 |
| **Trinity** | 015-110-21- | 24 32N 10W (M) | 470 |
| **Trinity** | 015-110-89- | 24 32N 10W (M) | 65 |
| **Trinity** | 015-110-90- | 22 32N 10W (M) | 60 |
| **Trinity** | 015-110-94- | 22 32N 10W (M) | 104 |
| **Trinity** | 015-120-01- | 27 32N 10W (M) | 628 |
| **Trinity** | 015-120-04- | 25 32N 10W (M) | 630 |
| **Trinity** | 015-120-08- | 35 32N 10W (M) | 743 |
| **Trinity** | 015-120-10- | 36 32N 10W (M) | 40 |
| **Trinity** | 015-120-14- | 34 32N 10W (M) | 640 |
| **Trinity** | 015-120-20- | 26 32N 10W (M) | 320 |
| **Trinity** | 015-120-21- | 36 32N 10W (M) | 600 |
| **Trinity** | 015-130-03- | 29 32N 10W (M) | 591 |
| **Trinity** | 015-130-10- | 33 32N 10W (M) | 724 |
| **Trinity** | 015-130-12- | 29 32N 10W (M) | 67 |
| **Trinity** | 015-130-35- | 28 32N 10W (M) | 472.86 |
| **Trinity** | 015-140-02- | 03 32N 09W (M) | 292.4 |
| **Trinity** | 015-140-07- | 01 32N 09W (M) | 643 |
| **Trinity** | 015-140-08- | 10 32N 09W (M) | 160 |
| **Trinity** | 015-140-09- | 10 32N 09W (M) | 480 |
| **Trinity** | 015-140-12- | 11 32N 09W (M) | 640 |
| **Trinity** | 015-140-16- | 12 32N 09W (M) | 80 |
| **Trinity** | 015-140-17- | 12 32N 09W (M) | 560 |
| **Trinity** | 015-140-19- | 03 32N 09W (M) | 107 |
| **Trinity** | 015-140-20- | 03 32N 09W (M) | 172 |
| **Trinity** | 015-140-21- | 03 32N 09W (M) | 85 |
| **Trinity** | 015-140-28- | 02 32N 09W (M) | 480.82 |
| **Trinity** | 015-160-01- | 17 32N 09W (M) | 631 |
| **Trinity** | 015-160-03- | 19 32N 09W (M) | 610.5 |
| **Trinity** | 015-160-04- | 21 32N 09W (M) | 645 |
| **Trinity** | 015-170-01- | 15 32N 09W (M) | 660 |
| **Trinity** | 015-170-02- | 13 32N 09W (M) | 640 |
| **Trinity** | 015-180-04- | 26 32N 09W (M) | 160 |
| **Trinity** | 015-180-14- | 35 32N 09W (M) | 710 |
| **Trinity** | 015-180-19- | 25 32N 09W (M) | 120 |
| **Trinity** | 015-180-20- | 36 32N 09W (M) | 480 |

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| **Trinity** | 015-180-41- | 34 32N 09W (M) | 302 |
| **Trinity** | 015-190-02- | 29 32N 09W (M) | 460 |
| **Trinity** | 015-190-07- | 31 32N 09W (M) | 100 |
| **Trinity** | 015-190-10- | 33 32N 09W (M) | 40 |
| **Trinity** | 015-190-60- | 31 32N 09W (M) | 40 |
| **Trinity** | 015-190-64- | 31 32N 09W (M) | 10 |
| **Trinity** | 015-190-65- | 31 32N 09W (M) | 379 |
| **Trinity** | 015-190-82- | 32 32N 09W (M) | 2.5 |
| **Trinity** | 015-190-83- | 32 32N 09W (M) | 79.66 |
| **Trinity** | 015-190-84- | 32 32N 09W (M) | 575.75 |
| **Trinity** | 015-190-85- | 33 32N 09W (M) | 5 |
| **Trinity** | 015-190-86- | 33 32N 09W (M) | 248 |
| **Trinity** | 015-200-04- | 02 32N 08W (M) | 77.3 |
| **Trinity** | 015-210-11- | 07 32N 08W (M) | 639 |
| **Trinity** | 015-210-14- | 08 32N 08W (M) | 160 |
| **Trinity** | 015-210-48- | 06 32N 08W (M) | 40.94 |
| **Trinity** | 015-210-49- | 06 32N 08W (M) | 442.36 |
| **Trinity** | 015-220-12- | 20 32N 08W (M) | 150.2 |
| **Trinity** | 015-220-16- | 17 32N 08W (M) | 320 |
| **Trinity** | 015-220-16- | 18 32N 08W (M) | 500.87 |
| **Trinity** | 015-250-06- | 29 32N 08W (M) | 542 |
| **Trinity** | 015-250-10- | 31 32N 08W (M) | 625 |
| **Trinity** | 015-250-16- | 33 32N 08W (M) | 756 |
| **Trinity** | 015-250-26- | 32 32N 08W (M) | 480 |
| **Trinity** | 015-250-27- | 32 32N 08W (M) | 120 |
| **Trinity** | 015-250-28- | 32 32N 08W (M) | 40 |
| **Trinity** | 015-410-09- | 33 32N 11W (M) | 160 |
| **Trinity** | 015-440-26- | 05 32N 09W (M) | 101 |
| **Trinity** | 015-440-49- | 05 32N 09W (M) | 260 |
| **Trinity** | 015-450-04- | 08 32N 09W (M) | 160 |
| **Trinity** | 015-450-05- | 09 32N 09W (M) | 630 |
| **Trinity** | 015-450-07- | 08 32N 09W (M) | 164 |
| **Trinity** | 015-450-08- | 07 32N 09W (M) | 301 |
| **Trinity** | 016-190-01- | 26 31N 12W (M) | 160 |
| **Trinity** | 016-190-05- | 26 31N 12W (M) | 160 |
| **Trinity** | 017-080-01- | 03 31N 10W (M) | 822 |
| **Trinity** | 017-080-03- | 02 31N 10W (M) | 208 |
| **Trinity** | 017-080-04- | 01 31N 10W (M) | 737 |
| **Trinity** | 017-080-08- | 11 31N 10W (M) | 602 |
| **Trinity** | 017-080-12- | 10 31N 10W (M) | 640 |
| **Trinity** | 017-080-13- | 02 31N 10W (M) | 590 |
| **Trinity** | 017-080-14- | 12 31N 10W (M) | 258 |
| **Trinity** | 017-080-15- | 12 31N 10W (M) | 400 |
| **Trinity** | 017-090-01- | 04 31N 10W (M) | 153.28 |

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| **Trinity** | 017-090-03- | 07 31N 10W (M) | 320.6 |
| **Trinity** | 017-090-04- | 04 31N 10W (M) | 614 |
| **Trinity** | 017-090-05- | 05 31N 10W (M) | 798 |
| **Trinity** | 017-090-09- | 08 31N 10W (M) | 777 |
| **Trinity** | 017-090-10- | 09 31N 10W (M) | 664 |
| **Trinity** | 017-100-01- | 16 31N 10W (M) | 640 |
| **Trinity** | 017-100-03- | 17 31N 10W (M) | 725 |
| **Trinity** | 017-100-04- | 18 31N 10W (M) | 636 |
| **Trinity** | 017-100-06- | 20 31N 10W (M) | 604 |
| **Trinity** | 017-100-07- | 21 31N 10W (M) | 513 |
| **Trinity** | 017-110-01- | 15 31N 10W (M) | 611 |
| **Trinity** | 017-110-02- | 14 31N 10W (M) | 160 |
| **Trinity** | 017-110-03- | 13 31N 10W (M) | 580 |
| **Trinity** | 017-110-04- | 23 31N 10W (M) | 286 |
| **Trinity** | 017-110-07- | 22 31N 10W (M) | 577 |
| **Trinity** | 017-110-08- | 23 31N 10W (M) | 300 |
| **Trinity** | 017-120-01- | 25 31N 10W (M) | 80 |
| **Trinity** | 017-120-04- | 36 31N 10W (M) | 560 |
| **Trinity** | 017-130-15- | 28 31N 10W (M) | 160 |
| **Trinity** | 017-130-17- | 28 31N 10W (M) | 2 |
| **Trinity** | 017-130-22- | 28 31N 10W (M) | 30 |
| **Trinity** | 017-130-24- | 28 31N 10W (M) | 60 |
| **Trinity** | 017-130-25- | 29 31N 10W (M) | 612 |
| **Trinity** | 017-140-08- | 01 31N 09W (M) | 636 |
| **Trinity** | 017-140-10- | 10 31N 09W (M) | 160 |
| **Trinity** | 017-140-11- | 10 31N 09W (M) | 160 |
| **Trinity** | 017-140-14- | 11 31N 09W (M) | 632 |
| **Trinity** | 017-140-34- | 02 31N 09W (M) | 448 |
| **Trinity** | 017-140-35- | 12 31N 09W (M) | 605 |
| **Trinity** | 017-140-37- | 03 31N 09W (M) | 35.5 |
| **Trinity** | 017-140-37- | 10 31N 09W (M) | 160 |
| **Trinity** | 017-150-05- | 05 31N 09W (M) | 697 |
| **Trinity** | 017-150-06- | 04 31N 09W (M) | 150 |
| **Trinity** | 017-150-15- | 09 31N 09W (M) | 703 |
| **Trinity** | 017-150-22- | 08 31N 09W (M) | 160 |
| **Trinity** | 017-150-23- | 08 31N 09W (M) | 480 |
| **Trinity** | 017-150-24- | 07 31N 09W (M) | 18 |
| **Trinity** | 017-150-25- | 07 31N 09W (M) | 42 |
| **Trinity** | 017-150-26- | 07 31N 09W (M) | 650 |
| **Trinity** | 017-150-34- | 04 31N 09W (M) | 246.08 |
| **Trinity** | 017-160-01- | 17 31N 09W (M) | 606 |
| **Trinity** | 017-160-03- | 19 31N 09W (M) | 455 |
| **Trinity** | 017-160-04- | 19 31N 09W (M) | 161.5 |
| **Trinity** | 017-160-05- | 21 31N 09W (M) | 160 |

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| **Trinity** | 017-160-06- | 21 31N 09W (M) | 160 |
| **Trinity** | 017-160-07- | 21 31N 09W (M) | 160 |
| **Trinity** | 017-160-08- | 21 31N 09W (M) | 160 |
| **Trinity** | 017-160-25- | 18 31N 09W (M) | 644.56 |
| **Trinity** | 017-160-39- | 16 31N 09W (M) | 160 |
| **Trinity** | 017-160-41- | 16 31N 09W (M) | 220 |
| **Trinity** | 017-170-01- | 15 31N 09W (M) | 676 |
| **Trinity** | 017-170-06- | 13 31N 09W (M) | 638 |
| **Trinity** | 017-170-14- | 23 31N 09W (M) | 160 |
| **Trinity** | 017-170-18- | 14 31N 09W (M) | 480 |
| **Trinity** | 017-180-03- | 27 31N 09W (M) | 40 |
| **Trinity** | 017-180-13- | 25 31N 09W (M) | 39 |
| **Trinity** | 017-180-16- | 34 31N 09W (M) | 160 |
| **Trinity** | 017-180-20- | 35 31N 09W (M) | 33 |
| **Trinity** | 017-180-21- | 35 31N 09W (M) | 152 |
| **Trinity** | 017-180-22- | 35 31N 09W (M) | 24 |
| **Trinity** | 017-180-27- | 27 31N 09W (M) | 400 |
| **Trinity** | 017-180-28- | 34 31N 09W (M) | 240 |
| **Trinity** | 017-190-01- | 30 31N 09W (M) | 160 |
| **Trinity** | 017-190-04- | 30 31N 09W (M) | 160 |
| **Trinity** | 017-190-06- | 29 31N 09W (M) | 160 |
| **Trinity** | 017-190-09- | 28 31N 09W (M) | 480 |
| **Trinity** | 017-190-15- | 32 31N 09W (M) | 160 |
| **Trinity** | 017-190-28- | 30 31N 09W (M) | 280 |
| **Trinity** | 017-190-29- | 31 31N 09W (M) | 500 |
| **Trinity** | 017-190-30- | 32 31N 09W (M) | 480 |
| **Trinity** | 017-190-31- | 33 31N 09W (M) | 640 |
| **Trinity** | 017-190-32- | 29 31N 09W (M) | 480 |
| **Trinity** | 017-200-01- | 02 31N 08W (M) | 40 |
| **Trinity** | 017-200-01- | 03 31N 08W (M) | 670.17 |
| **Trinity** | 017-200-03- | 01 31N 08W (M) | 210 |
| **Trinity** | 017-200-13- | 11 31N 08W (M) | 26.15 |
| **Trinity** | 017-210-01- | 06 31N 08W (M) | 160 |
| **Trinity** | 017-210-02- | 06 31N 08W (M) | 160 |
| **Trinity** | 017-210-03- | 05 31N 08W (M) | 648 |
| **Trinity** | 017-210-04- | 05 31N 08W (M) | 40 |
| **Trinity** | 017-210-06- | 07 31N 08W (M) | 583 |
| **Trinity** | 017-210-07- | 08 31N 08W (M) | 157.45 |
| **Trinity** | 017-210-15- | 08 31N 08W (M) | 160 |
| **Trinity** | 017-210-17- | 09 31N 08W (M) | 165 |
| **Trinity** | 017-240-05- | 17 31N 08W (M) | 279 |
| **Trinity** | 017-240-09- | 19 31N 08W (M) | 40.54 |
| **Trinity** | 017-250-02- | 30 31N 08W (M) | 48 |
| **Trinity** | 017-250-11- | 30 31N 08W (M) | 2 |

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| **Trinity** | 017-300-01- | 22 30N 10W (M) | 200 |
| **Trinity** | 017-310-06- | 26 30N 10W (M) | 6.1 |
| **Trinity** | 017-310-12- | 26 30N 10W (M) | 151 |
| **Trinity** | 017-310-12- | 27 30N 10W (M) | 480 |
| **Trinity** | 017-320-09- | 28 30N 10W (M) | 250 |
| **Trinity** | 017-330-01- | 04 30N 09W (M) | 172 |
| **Trinity** | 017-330-02- | 04 30N 09W (M) | 170 |
| **Trinity** | 017-330-04- | 09 30N 09W (M) | 10 |
| **Trinity** | 017-330-08- | 02 30N 09W (M) | 77 |
| **Trinity** | 017-330-10- | 09 30N 09W (M) | 27.1 |
| **Trinity** | 017-330-13- | 03 30N 09W (M) | 28 |
| **Trinity** | 017-330-15- | 03 30N 09W (M) | 44 |
| **Trinity** | 017-330-17- | 03 30N 09W (M) | 127 |
| **Trinity** | 017-330-19- | 04 30N 09W (M) | 113 |
| **Trinity** | 017-330-22- | 04 30N 09W (M) | 80 |
| **Trinity** | 017-330-29- | 03 30N 09W (M) | 82 |
| **Trinity** | 017-340-01- | 06 30N 09W (M) | 169.2 |
| **Trinity** | 017-340-03- | 05 30N 09W (M) | 510 |
| **Trinity** | 017-340-05- | 07 30N 09W (M) | 160 |
| **Trinity** | 017-340-05- | 08 30N 09W (M) | 480 |
| **Trinity** | 017-340-06- | 08 30N 09W (M) | 40 |
| **Trinity** | 017-340-06- | 17 30N 09W (M) | 115 |
| **Trinity** | 019-120-01- | 25 30N 11W (M) | 80 |
| **Trinity** | 019-120-03- | 36 30N 11W (M) | 160 |
| **Trinity** | 019-200-40- | 12 29N 11W (M) | 60 |
| **Trinity** | 019-200-42- | 01 29N 11W (M) | 70 |
| **Trinity** | 019-260-03- | 07 29N 10W (M) | 55 |
| **Trinity** | 019-260-09- | 08 29N 10W (M) | 70 |
| **Trinity** | 019-260-25- | 08 29N 10W (M) | 94 |
| **Trinity** | 019-260-27- | 07 29N 10W (M) | 38 |
| **Trinity** | 019-260-29- | 07 29N 10W (M) | 72 |
| **Trinity** | 019-260-40- | 06 29N 10W (M) | 149 |
| **Trinity** | 021-050-01- | 36 28N 12W (M) | 640 |
| **Trinity** | 024-020-12- | 17 33N 10W (M) | 80 |
| **Trinity** | 024-020-22- | 17 33N 10W (M) | 20 |
| **Trinity** | 024-020-23- | 17 33N 10W (M) | 60 |
| **Trinity** | 024-020-29- | 21 33N 10W (M) | 320 |
| **Trinity** | 024-020-30- | 09 33N 10W (M) | 6 |
| **Trinity** | 024-020-30- | 16 33N 10W (M) | 522 |
| **Trinity** | 024-030-03- | 30 33N 10W (M) | 100 |
| **Trinity** | 024-030-04- | 30 33N 10W (M) | 80 |
| **Trinity** | 024-030-04- | 31 33N 10W (M) | 80 |
| **Trinity** | 024-030-43- | 33 33N 10W (M) | 450 |
| **Trinity** | 024-050-03- | 15 33N 10W (M) | 60 |

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| **Trinity** | 024-050-03- | 22 33N 10W (M) | 20 |
| **Trinity** | 024-050-08- | 23 33N 10W (M) | 70 |
| **Trinity** | 024-050-61- | 15 33N 10W (M) | 580 |
| **Trinity** | 024-050-62- | 22 33N 10W (M) | 220 |
| **Trinity** | 024-060-02- | 26 33N 10W (M) | 143 |
| **Trinity** | 024-070-06- | 04 33N 09W (M) | 160 |
| **Trinity** | 024-070-20- | 05 33N 09W (M) | 373.93 |
| **Trinity** | 024-070-21- | 08 33N 09W (M) | 44.81 |
| **Trinity** | 024-070-38- | 04 33N 09W (M) | 40 |
| **Trinity** | 024-070-38- | 09 33N 09W (M) | 553.56 |
| **Trinity** | 024-070-41- | 08 33N 09W (M) | 194.04 |
| **Trinity** | 024-080-01- | 19 33N 09W (M) | 387 |
| **Trinity** | 024-080-03- | 19 33N 09W (M) | 63 |
| **Trinity** | 024-080-04- | 17 33N 09W (M) | 317 |
| **Trinity** | 024-080-08- | 21 33N 09W (M) | 360 |
| **Trinity** | 024-080-31- | 17 33N 09W (M) | 111.18 |
| **Trinity** | 024-080-32- | 17 33N 09W (M) | 108.22 |
| **Trinity** | 024-090-19- | 31 33N 09W (M) | 556.4 |
| **Trinity** | 024-090-21- | 29 33N 09W (M) | 596 |
| **Trinity** | 024-200-15- | 05 33N 09W (M) | 148.92 |
| **Trinity** | 024-430-51- | 07 33N 09W (M) | 10 |
| **Trinity** | 024-660-01- | 03 33N 10W (M) | 317 |
| **Trinity** | 024-680-40- | 10 33N 10W (M) | 240 |
| **Trinity** | 024-680-41- | 11 33N 10W (M) | 60 |
| **Trinity** | 025-010-04- | 11 33N 09W (M) | 669 |
| **Trinity** | 025-010-05- | 10 33N 09W (M) | 160 |
| **Trinity** | 025-010-17- | 01 33N 09W (M) | 5 |
| **Trinity** | 025-010-18- | 01 33N 09W (M) | 5 |
| **Trinity** | 025-010-19- | 01 33N 09W (M) | 20 |
| **Trinity** | 025-010-20- | 01 33N 09W (M) | 600 |
| **Trinity** | 025-020-01- | 15 33N 09W (M) | 598 |
| **Trinity** | 025-020-03- | 14 33N 09W (M) | 330 |
| **Trinity** | 025-030-01- | 21 33N 09W (M) | 350 |
| **Trinity** | 025-030-02- | 33 33N 09W (M) | 167 |
| **Trinity** | 025-030-07- | 27 33N 09W (M) | 209 |
| **Trinity** | 025-040-02- | 06 33N 08W (M) | 160 |
| **Trinity** | 025-040-04- | 07 33N 08W (M) | 502 |
| **Trinity** | 025-040-10- | 09 33N 08W (M) | 463 |
| **Trinity** | 025-050-03- | 21 33N 08W (M) | 653 |
| **Trinity** | 025-050-04- | 17 33N 08W (M) | 440 |
| **Trinity** | 025-050-22- | 16 33N 08W (M) | 20 |
| **Trinity** | 025-050-23- | 16 33N 08W (M) | 40 |
| **Trinity** | 025-050-24- | 16 33N 08W (M) | 40 |
| **Trinity** | 025-050-31- | 16 33N 08W (M) | 260 |

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| **Trinity** | 025-050-32- | 16 33N 08W (M) | 60 |
| **Trinity** | 025-060-01- | 25 33N 09W (M) | 640 |
| **Trinity** | 025-060-06- | 35 33N 09W (M) | 56 |
| **Trinity** | 025-060-24- | 31 33N 08W (M) | 146.81 |
| **Trinity** | 025-070-04- | 01 33N 08W (M) | 410 |
| **Trinity** | 025-080-02- | 14 33N 08W (M) | 232 |
| **Trinity** | 025-080-04- | 23 33N 08W (M) | 733 |
| **Trinity** | 025-080-05- | 24 33N 08W (M) | 118 |
| **Trinity** | 025-090-15- | 29 33N 08W (M) | 80 |
| **Trinity** | 025-100-01- | 03 33N 09W (M) | 244 |
| **Trinity** | 025-100-08- | 02 33N 09W (M) | 321 |
| **Trinity** | 025-100-10- | 02 33N 09W (M) | 160 |
| **Trinity** | 025-100-11- | 02 33N 09W (M) | 10 |
| **Trinity** | 025-100-19- | 03 33N 09W (M) | 38 |
| **Trinity** | 025-100-20- | 02 33N 09W (M) | 40 |
| **Trinity** | 025-100-21- | 02 33N 09W (M) | 40 |
| **Trinity** | 025-100-24- | 02 33N 09W (M) | 40 |
| **Trinity** | 025-100-40- | 02 33N 09W (M) | 30 |
| **Trinity** | 025-100-40- | 03 33N 09W (M) | 140 |
| **Trinity** | 025-110-01- | 14 33N 09W (M) | 160 |
| **Trinity** | 025-110-03- | 13 33N 09W (M) | 90 |
| **Trinity** | 025-110-58- | 13 33N 09W (M) | 30 |
| **Trinity** | 025-110-58- | 14 33N 09W (M) | 160 |
| **Trinity** | 025-190-07- | 36 33N 09W (M) | 302 |
| **Tuolumne** | 016-010-04- | 35 05N 15E (M) | 240 |
| **Tuolumne** | 016-010-06- | 36 05N 15E (M) | 180 |
| **Tuolumne** | 016-020-01- | 03 05N 16E (M) | 160 |
| **Tuolumne** | 016-020-01- | 10 05N 16E (M) | 280 |
| **Tuolumne** | 016-020-02- | 02 05N 16E (M) | 514.35 |
| **Tuolumne** | 016-020-02- | 11 05N 16E (M) | 80 |
| **Tuolumne** | 016-020-03 -2 | 01 05N 16E (M) | 472.049 |
| **Tuolumne** | 016-020-03 -2 | 02 05N 16E (M) | 40 |
| **Tuolumne** | 016-020-04- | 01 05N 16E (M) | 37.55 |
| **Tuolumne** | 016-020-05- | 01 05N 16E (M) | 80 |
| **Tuolumne** | 016-020-05- | 12 05N 16E (M) | 80 |
| **Tuolumne** | 016-020-06 -2 | 10 05N 16E (M) | 40 |
| **Tuolumne** | 016-020-07 -2 | 10 05N 16E (M) | 240 |
| **Tuolumne** | 016-020-07 -2 | 11 05N 16E (M) | 200 |
| **Tuolumne** | 016-020-08 -3 | 11 05N 16E (M) | 240 |
| **Tuolumne** | 016-020-08 -3 | 12 05N 16E (M) | 40 |
| **Tuolumne** | 016-020-09 -2 | 12 05N 16E (M) | 240 |
| **Tuolumne** | 016-020-10- | 01 05N 16E (M) | 40 |
| **Tuolumne** | 016-020-11- | 11 05N 16E (M) | 80 |
| **Tuolumne** | 016-020-12- | 11 05N 16E (M) | 40 |

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| **Tuolumne** | 016-020-13- | 12 05N 16E (M) | 40 |
| **Tuolumne** | 016-020-14- | 12 05N 16E (M) | 240 |
| **Tuolumne** | 016-030-01- | 03 05N 16E (M) | 192.55 |
| **Tuolumne** | 016-030-01- | 04 05N 16E (M) | 200 |
| **Tuolumne** | 016-030-02 -2 | 02 05N 16E (M) | 74.25 |
| **Tuolumne** | 016-030-02 -2 | 03 05N 16E (M) | 273.65 |
| **Tuolumne** | 016-030-02 -2 | 04 05N 16E (M) | 80 |
| **Tuolumne** | 016-030-04- | 04 05N 16E (M) | 40 |
| **Tuolumne** | 016-030-04- | 09 05N 16E (M) | 440 |
| **Tuolumne** | 016-030-05 -2 | 09 05N 16E (M) | 80 |
| **Tuolumne** | 016-030-06 -2 | 09 05N 16E (M) | 80 |
| **Tuolumne** | 016-030-13- | 09 05N 16E (M) | 40 |
| **Tuolumne** | 016-030-17- | 08 05N 16E (M) | 139.94 |
| **Tuolumne** | 016-040-01- | 08 05N 16E (M) | 30 |
| **Tuolumne** | 016-040-01- | 17 05N 16E (M) | 360 |
| **Tuolumne** | 016-040-02 -2 | 17 05N 16E (M) | 160 |
| **Tuolumne** | 016-040-03- | 16 05N 16E (M) | 640 |
| **Tuolumne** | 016-040-04- | 19 05N 16E (M) | 403.2 |
| **Tuolumne** | 016-040-05- | 20 05N 16E (M) | 600 |
| **Tuolumne** | 016-040-06- | 21 05N 16E (M) | 560 |
| **Tuolumne** | 016-040-10- | 19 05N 16E (M) | 40 |
| **Tuolumne** | 016-040-11- | 20 05N 16E (M) | 40 |
| **Tuolumne** | 016-040-12- | 21 05N 16E (M) | 40 |
| **Tuolumne** | 016-040-13- | 21 05N 16E (M) | 40 |
| **Tuolumne** | 016-050-01- | 10 05N 16E (M) | 80 |
| **Tuolumne** | 016-050-01- | 15 05N 16E (M) | 360 |
| **Tuolumne** | 016-050-03 -2 | 15 05N 16E (M) | 40 |
| **Tuolumne** | 016-050-04- | 14 05N 16E (M) | 120 |
| **Tuolumne** | 016-050-04- | 15 05N 16E (M) | 40 |
| **Tuolumne** | 016-050-05 -2 | 14 05N 16E (M) | 240 |
| **Tuolumne** | 016-050-06- | 13 05N 16E (M) | 640 |
| **Tuolumne** | 016-050-09- | 22 05N 16E (M) | 640 |
| **Tuolumne** | 016-050-10- | 23 05N 16E (M) | 600 |
| **Tuolumne** | 016-050-11- | 24 05N 16E (M) | 640 |
| **Tuolumne** | 016-050-16- | 23 05N 16E (M) | 40 |
| **Tuolumne** | 016-060-01- | 27 05N 16E (M) | 640 |
| **Tuolumne** | 016-060-02- | 26 05N 16E (M) | 640 |
| **Tuolumne** | 016-060-03- | 25 05N 16E (M) | 640 |
| **Tuolumne** | 016-060-04- | 34 05N 16E (M) | 600 |
| **Tuolumne** | 016-060-05- | 35 05N 16E (M) | 640 |
| **Tuolumne** | 016-060-06- | 36 05N 16E (M) | 640 |
| **Tuolumne** | 016-070-14- | 28 05N 16E (M) | 210 |
| **Tuolumne** | 016-070-19- | 32 05N 16E (M) | 191 |
| **Tuolumne** | 016-070-21- | 33 05N 16E (M) | 600 |

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| **Tuolumne** | 016-080-01- | 01 05N 17E (M) | 44.16 |
| **Tuolumne** | 016-080-02- | 12 05N 17E (M) | 240 |
| **Tuolumne** | 016-080-02- | 13 05N 17E (M) | 320 |
| **Tuolumne** | 016-080-03- | 11 05N 17E (M) | 160 |
| **Tuolumne** | 016-080-03- | 14 05N 17E (M) | 400 |
| **Tuolumne** | 016-090-01 -2 | 04 05N 17E (M) | 120.05 |
| **Tuolumne** | 016-090-01 -2 | 05 05N 17E (M) | 40 |
| **Tuolumne** | 016-090-02- | 16 05N 17E (M) | 669.173 |
| **Tuolumne** | 016-100-01- | 04 05N 17E (M) | 39.75 |
| **Tuolumne** | 016-100-01- | 05 05N 17E (M) | 317.45 |
| **Tuolumne** | 016-100-01- | 06 05N 17E (M) | 160 |
| **Tuolumne** | 016-100-02 -2 | 05 05N 17E (M) | 38.55 |
| **Tuolumne** | 016-100-02 -2 | 06 05N 17E (M) | 393.17 |
| **Tuolumne** | 016-100-02 -2 | 07 05N 17E (M) | 40 |
| **Tuolumne** | 016-100-03 -2 | 05 05N 17E (M) | 40 |
| **Tuolumne** | 016-100-03 -2 | 07 05N 17E (M) | 40 |
| **Tuolumne** | 016-100-03 -2 | 08 05N 17E (M) | 80 |
| **Tuolumne** | 016-100-04- | 08 05N 17E (M) | 120 |
| **Tuolumne** | 016-100-05- | 08 05N 17E (M) | 80 |
| **Tuolumne** | 016-100-05- | 17 05N 17E (M) | 80 |
| **Tuolumne** | 016-100-06- | 08 05N 17E (M) | 80 |
| **Tuolumne** | 016-100-06- | 17 05N 17E (M) | 320 |
| **Tuolumne** | 016-100-07- | 17 05N 17E (M) | 40 |
| **Tuolumne** | 016-100-09- | 18 05N 17E (M) | 607.84 |
| **Tuolumne** | 016-100-10 -2 | 07 05N 17E (M) | 122.1 |
| **Tuolumne** | 016-100-11- | 07 05N 17E (M) | 280 |
| **Tuolumne** | 016-100-12- | 05 05N 17E (M) | 200 |
| **Tuolumne** | 016-100-13- | 08 05N 17E (M) | 280 |
| **Tuolumne** | 016-100-16- | 06 05N 17E (M) | 83.17 |
| **Tuolumne** | 016-100-17- | 07 05N 17E (M) | 84.17 |
| **Tuolumne** | 016-100-18- | 07 05N 17E (M) | 42.11 |
| **Tuolumne** | 016-100-19- | 07 05N 17E (M) | 40 |
| **Tuolumne** | 016-110-01- | 20 05N 17E (M) | 120 |
| **Tuolumne** | 016-110-02- | 19 05N 17E (M) | 567 |
| **Tuolumne** | 016-130-01- | 25 05N 17E (M) | 40 |
| **Tuolumne** | 016-130-07- | 36 05N 17E (M) | 639.025 |
| **Tuolumne** | 016-130-08- | 26 05N 17E (M) | 160 |
| **Tuolumne** | 016-130-08- | 34 05N 17E (M) | 80 |
| **Tuolumne** | 016-130-08- | 35 05N 17E (M) | 400 |
| **Tuolumne** | 016-140-01- | 24 06N 16E (M) | 140.97 |
| **Tuolumne** | 016-150-01 -2 | 25 06N 16E (M) | 160 |
| **Tuolumne** | 016-150-02 -2 | 35 06N 16E (M) | 320 |
| **Tuolumne** | 016-150-03- | 36 06N 16E (M) | 640 |
| **Tuolumne** | 016-200-02- | 36 06N 17E (M) | 640 |

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| **Tuolumne** | 016-210-01 -2 | 30 06N 17E (M) | 157.64 |
| **Tuolumne** | 016-210-02- | 31 06N 17E (M) | 119.89 |
| **Tuolumne** | 016-210-03 -2 | 31 06N 17E (M) | 40 |
| **Tuolumne** | 016-210-03 -2 | 32 06N 17E (M) | 280 |
| **Tuolumne** | 016-210-03 -2 | 33 06N 17E (M) | 160 |
| **Tuolumne** | 016-210-04- | 32 06N 17E (M) | 40 |
| **Tuolumne** | 016-210-04- | 33 06N 17E (M) | 80 |
| **Tuolumne** | 017-080-02- | 31 06N 18E (M) | 160 |
| **Tuolumne** | 022-010-01- | 01 04N 15E (M) | 559.1 |
| **Tuolumne** | 022-010-04- | 11 04N 15E (M) | 400 |
| **Tuolumne** | 022-010-05- | 12 04N 15E (M) | 440 |
| **Tuolumne** | 022-010-15- | 12 04N 15E (M) | 40 |
| **Tuolumne** | 022-010-16- | 12 04N 15E (M) | 40 |
| **Tuolumne** | 022-030-01- | 14 04N 15E (M) | 120 |
| **Tuolumne** | 022-030-02- | 13 04N 15E (M) | 80 |
| **Tuolumne** | 022-030-02- | 14 04N 15E (M) | 80 |
| **Tuolumne** | 022-030-03- | 13 04N 15E (M) | 400 |
| **Tuolumne** | 022-100-06- | 11 03N 15E (M) | 120 |
| **Tuolumne** | 022-100-06- | 14 03N 15E (M) | 40 |
| **Tuolumne** | 023-010-01- | 03 04N 16E (M) | 645.88 |
| **Tuolumne** | 023-010-02- | 02 04N 16E (M) | 562.49 |
| **Tuolumne** | 023-010-03- | 01 04N 16E (M) | 160 |
| **Tuolumne** | 023-010-04- | 01 04N 16E (M) | 80.48 |
| **Tuolumne** | 023-010-05- | 10 04N 16E (M) | 600 |
| **Tuolumne** | 023-010-06- | 11 04N 16E (M) | 520 |
| **Tuolumne** | 023-010-08- | 12 04N 16E (M) | 420.34 |
| **Tuolumne** | 023-010-08- | 13 04N 16E (M) | 40 |
| **Tuolumne** | 023-010-12- | 11 04N 16E (M) | 40 |
| **Tuolumne** | 023-010-13- | 11 04N 16E (M) | 80 |
| **Tuolumne** | 023-010-14- | 12 04N 16E (M) | 40 |
| **Tuolumne** | 023-010-16- | 01 04N 16E (M) | 160 |
| **Tuolumne** | 023-020-02- | 05 04N 16E (M) | 563.08 |
| **Tuolumne** | 023-020-03- | 04 04N 16E (M) | 604.01 |
| **Tuolumne** | 023-020-04- | 07 04N 16E (M) | 521.02 |
| **Tuolumne** | 023-020-05- | 08 04N 16E (M) | 640 |
| **Tuolumne** | 023-020-06- | 09 04N 16E (M) | 640 |
| **Tuolumne** | 023-020-08- | 06 04N 16E (M) | 510.1 |
| **Tuolumne** | 023-020-10- | 05 04N 16E (M) | 80 |
| **Tuolumne** | 023-020-13- | 07 04N 16E (M) | 41.07 |
| **Tuolumne** | 023-030-01- | 18 04N 16E (M) | 403.69 |
| **Tuolumne** | 023-030-02- | 17 04N 16E (M) | 600 |
| **Tuolumne** | 023-030-03- | 16 04N 16E (M) | 640 |
| **Tuolumne** | 023-030-04- | 18 04N 16E (M) | 80 |
| **Tuolumne** | 023-040-01- | 15 04N 16E (M) | 600 |

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| **Tuolumne** | 023-040-02- | 14 04N 16E (M) | 640 |
| **Tuolumne** | 023-040-03- | 13 04N 16E (M) | 320 |
| **Tuolumne** | 023-040-04- | 22 04N 16E (M) | 80 |
| **Tuolumne** | 023-050-01- | 26 04N 16E (M) | 280 |
| **Tuolumne** | 023-050-01- | 27 04N 16E (M) | 200 |
| **Tuolumne** | 023-050-02- | 25 04N 16E (M) | 320 |
| **Tuolumne** | 023-050-03- | 34 04N 16E (M) | 112.4 |
| **Tuolumne** | 023-050-04- | 36 04N 16E (M) | 320 |
| **Tuolumne** | 023-060-01- | 29 04N 16E (M) | 120 |
| **Tuolumne** | 023-060-01- | 30 04N 16E (M) | 40 |
| **Tuolumne** | 023-060-03- | 27 04N 16E (M) | 40 |
| **Tuolumne** | 023-060-03- | 28 04N 16E (M) | 320 |
| **Tuolumne** | 023-060-03- | 29 04N 16E (M) | 80 |
| **Tuolumne** | 023-060-03- | 33 04N 16E (M) | 120 |
| **Tuolumne** | 023-060-27- | 28 04N 16E (M) | 40 |
| **Tuolumne** | 023-060-29- | 29 04N 16E (M) | 10 |
| **Tuolumne** | 023-060-30- | 29 04N 16E (M) | 10 |
| **Tuolumne** | 023-060-52- | 32 04N 16E (M) | 20 |
| **Tuolumne** | 023-060-55- | 29 04N 16E (M) | 10 |
| **Tuolumne** | 023-060-67- | 29 04N 16E (M) | 10 |
| **Tuolumne** | 023-060-68- | 29 04N 16E (M) | 10 |
| **Tuolumne** | 023-060-69- | 29 04N 16E (M) | 10 |
| **Tuolumne** | 023-060-70- | 29 04N 16E (M) | 10 |
| **Tuolumne** | 023-070-01- | 02 04N 17E (M) | 80 |
| **Tuolumne** | 023-070-01- | 03 04N 17E (M) | 78.25 |
| **Tuolumne** | 023-070-02- | 10 04N 17E (M) | 400 |
| **Tuolumne** | 023-070-02- | 11 04N 17E (M) | 80 |
| **Tuolumne** | 023-080-01- | 05 04N 17E (M) | 240 |
| **Tuolumne** | 023-080-01- | 06 04N 17E (M) | 231.23 |
| **Tuolumne** | 023-080-02- | 04 04N 17E (M) | 297.94 |
| **Tuolumne** | 023-080-02- | 09 04N 17E (M) | 80 |
| **Tuolumne** | 023-080-04- | 08 04N 17E (M) | 560 |
| **Tuolumne** | 023-080-06- | 07 04N 17E (M) | 368.18 |
| **Tuolumne** | 023-090-02- | 17 04N 17E (M) | 640 |
| **Tuolumne** | 023-090-03- | 16 04N 17E (M) | 640 |
| **Tuolumne** | 023-090-04- | 21 04N 17E (M) | 160 |
| **Tuolumne** | 023-090-07- | 18 04N 17E (M) | 334.28 |
| **Tuolumne** | 023-120-27- | 28 04N 17E (M) | 200 |
| **Tuolumne** | 023-120-27- | 29 04N 17E (M) | 200 |
| **Tuolumne** | 023-160-13- | 08 03N 17E (M) | 37.61 |
| **Tuolumne** | 023-160-13- | 09 03N 17E (M) | 120 |
| **Tuolumne** | 023-160-18- | 05 03N 17E (M) | 1.07 |
| **Tuolumne** | 023-170-01- | 18 03N 17E (M) | 162.16 |
| **Tuolumne** | 023-170-02- | 18 03N 17E (M) | 207.54 |

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| **Tuolumne** | 023-170-02- | 19 03N 17E (M) | 160 |
| **Tuolumne** | 023-170-12- | 19 03N 17E (M) | 239.56 |
| **Tuolumne** | 023-170-18- | 18 03N 17E (M) | 12 |
| **Tuolumne** | 023-170-19- | 18 03N 17E (M) | 8 |
| **Tuolumne** | 023-170-26- | 19 03N 17E (M) | 79.75 |
| **Tuolumne** | 023-490-22- | 32 04N 16E (M) | 4.76 |
| **Tuolumne** | 023-490-32- | 32 04N 16E (M) | 2.36 |
| **Tuolumne** | 023-490-33- | 32 04N 16E (M) | 2.35 |
| **Tuolumne** | 024-090-19- | 16 04N 18E (M) | 68.24 |
| **Tuolumne** | 024-090-19- | 21 04N 18E (M) | 15 |
| **Tuolumne** | 027-010-01- | 30 03N 17E (M) | 39.82 |
| **Tuolumne** | 028-010-04- | 02 03N 16E (M) | 40 |
| **Tuolumne** | 028-010-06- | 01 03N 16E (M) | 79.69 |
| **Tuolumne** | 028-010-07- | 01 03N 16E (M) | 120 |
| **Tuolumne** | 028-010-12- | 11 03N 16E (M) | 40 |
| **Tuolumne** | 028-010-22- | 03 03N 16E (M) | 89.88 |
| **Tuolumne** | 028-010-23- | 03 03N 16E (M) | 40.41 |
| **Tuolumne** | 028-020-02- | 06 03N 16E (M) | 160 |
| **Tuolumne** | 028-030-05- | 19 03N 16E (M) | 120 |
| **Tuolumne** | 028-030-05- | 20 03N 16E (M) | 440 |
| **Tuolumne** | 028-030-05- | 21 03N 16E (M) | 80 |
| **Tuolumne** | 028-040-03- | 13 03N 16E (M) | 145.6 |
| **Tuolumne** | 028-040-05- | 13 03N 16E (M) | 13 |
| **Tuolumne** | 028-040-06- | 13 03N 16E (M) | 19 |
| **Tuolumne** | 028-040-06- | 24 03N 16E (M) | 11 |
| **Tuolumne** | 028-040-07- | 22 03N 16E (M) | 120 |
| **Tuolumne** | 028-040-11- | 13 03N 16E (M) | 30 |
| **Tuolumne** | 028-040-11- | 24 03N 16E (M) | 80 |
| **Tuolumne** | 028-040-14- | 24 03N 16E (M) | 63.2 |
| **Tuolumne** | 028-040-14- | 25 03N 16E (M) | 40 |
| **Tuolumne** | 028-040-15- | 24 03N 16E (M) | 4.5 |
| **Tuolumne** | 028-040-16- | 13 03N 16E (M) | 1 |
| **Tuolumne** | 028-040-16- | 24 03N 16E (M) | 1.5 |
| **Tuolumne** | 028-051-01- | 27 03N 16E (M) | 120 |
| **Tuolumne** | 028-051-16- | 25 03N 16E (M) | 120 |
| **Tuolumne** | 028-051-18- | 25 03N 16E (M) | 197.04 |
| **Tuolumne** | 028-051-18- | 26 03N 16E (M) | 40 |
| **Tuolumne** | 028-051-24- | 34 03N 16E (M) | 80 |
| **Tuolumne** | 028-051-25- | 34 03N 16E (M) | 87.63 |
| **Tuolumne** | 028-051-26- | 34 03N 16E (M) | 0.5 |
| **Tuolumne** | 028-051-27- | 35 03N 16E (M) | 80 |
| **Tuolumne** | 028-051-28- | 35 03N 16E (M) | 40 |
| **Tuolumne** | 028-051-38- | 25 03N 16E (M) | 160 |
| **Tuolumne** | 028-051-40- | 36 03N 16E (M) | 60 |

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| **Tuolumne** | 028-051-44- | 26 03N 16E (M) | 199.88 |
| **Tuolumne** | 029-090-08- | 21 03N 18E (M) | 120 |
| **Tuolumne** | 029-110-02- | 36 03N 18E (M) | 640 |
| **Tuolumne** | 046-010-01- | 35 03N 16E (M) | 7 |
| **Tuolumne** | 046-010-56- | 35 03N 16E (M) | 60.43 |
| **Tuolumne** | 046-020-01- | 35 03N 16E (M) | 14.03 |
| **Tuolumne** | 047-010-01- | 03 02N 16E (M) | 159.09 |
| **Tuolumne** | 052-030-07- | 19 02N 17E (M) | 320 |
| **Tuolumne** | 052-030-07- | 20 02N 17E (M) | 80 |
| **Tuolumne** | 052-030-24- | 20 02N 17E (M) | 40 |
| **Tuolumne** | 052-030-29- | 20 02N 17E (M) | 40 |
| **Tuolumne** | 052-060-03- | 28 02N 17E (M) | 170 |
| **Tuolumne** | 052-060-03- | 33 02N 17E (M) | 40 |
| **Tuolumne** | 052-060-05- | 32 02N 17E (M) | 350 |
| **Tuolumne** | 052-060-15- | 31 02N 17E (M) | 190 |
| **Tuolumne** | 052-060-16- | 31 02N 17E (M) | 133.47 |
| **Tuolumne** | 052-060-20- | 29 02N 17E (M) | 100 |
| **Tuolumne** | 052-060-21- | 29 02N 17E (M) | 120 |
| **Tuolumne** | 052-060-22- | 29 02N 17E (M) | 200 |
| **Tuolumne** | 052-060-23- | 28 02N 17E (M) | 190 |
| **Tuolumne** | 052-060-24- | 28 02N 17E (M) | 280 |
| **Tuolumne** | 052-060-27- | 31 02N 17E (M) | 90 |
| **Tuolumne** | 052-060-28- | 31 02N 17E (M) | 40 |
| **Tuolumne** | 052-060-29- | 32 02N 17E (M) | 10 |
| **Tuolumne** | 052-060-30- | 32 02N 17E (M) | 140 |
| **Tuolumne** | 052-060-31- | 32 02N 17E (M) | 140 |
| **Tuolumne** | 052-060-32- | 33 02N 17E (M) | 440 |
| **Tuolumne** | 052-060-38- | 29 02N 17E (M) | 50 |
| **Tuolumne** | 052-060-40- | 31 02N 17E (M) | 25.47 |
| **Tuolumne** | 052-060-42- | 30 02N 17E (M) | 10 |
| **Tuolumne** | 052-060-45- | 29 02N 17E (M) | 20 |
| **Tuolumne** | 052-060-45- | 30 02N 17E (M) | 80 |
| **Tuolumne** | 052-060-46- | 29 02N 17E (M) | 140 |
| **Tuolumne** | 052-060-47- | 30 02N 17E (M) | 10.86 |
| **Tuolumne** | 052-060-49- | 30 02N 17E (M) | 108.71 |
| **Tuolumne** | 052-080-05- | 09 02N 18E (M) | 149.33 |
| **Tuolumne** | 052-080-06- | 09 02N 18E (M) | 10.67 |
| **Tuolumne** | 052-110-04- | 27 02N 18E (M) | 40 |
| **Tuolumne** | 052-110-04- | 34 02N 18E (M) | 170 |
| **Tuolumne** | 052-110-12- | 34 02N 18E (M) | 50 |
| **Tuolumne** | 052-110-13- | 34 02N 18E (M) | 60 |
| **Tuolumne** | 052-110-15- | 35 02N 18E (M) | 250 |
| **Tuolumne** | 052-110-21- | 34 02N 18E (M) | 100 |
| **Tuolumne** | 052-110-22- | 35 02N 18E (M) | 60 |

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| **Tuolumne** | 052-110-26- | 34 02N 18E (M) | 260 |
| **Tuolumne** | 052-110-27- | 35 02N 18E (M) | 10 |
| **Tuolumne** | 052-120-24- | 33 02N 18E (M) | 120 |
| **Tuolumne** | 052-120-25- | 33 02N 18E (M) | 20 |
| **Tuolumne** | 052-120-26- | 33 02N 18E (M) | 40 |
| **Tuolumne** | 052-120-27- | 33 02N 18E (M) | 30 |
| **Tuolumne** | 052-120-29- | 33 02N 18E (M) | 430 |
| **Tuolumne** | 052-130-02- | 03 01N 17E (M) | 159.82 |
| **Tuolumne** | 052-130-05- | 10 01N 17E (M) | 560 |
| **Tuolumne** | 052-130-05- | 11 01N 17E (M) | 40 |
| **Tuolumne** | 052-130-06- | 11 01N 17E (M) | 120 |
| **Tuolumne** | 052-140-01- | 06 01N 17E (M) | 516.46 |
| **Tuolumne** | 052-140-03- | 04 01N 17E (M) | 235 |
| **Tuolumne** | 052-140-03- | 05 01N 17E (M) | 400 |
| **Tuolumne** | 052-140-07- | 07 01N 17E (M) | 99.33 |
| **Tuolumne** | 052-140-08- | 07 01N 17E (M) | 320 |
| **Tuolumne** | 052-150-03- | 16 01N 17E (M) | 640 |
| **Tuolumne** | 052-150-05- | 17 01N 17E (M) | 40 |
| **Tuolumne** | 052-150-05- | 18 01N 17E (M) | 40 |
| **Tuolumne** | 052-160-01- | 14 01N 17E (M) | 40 |
| **Tuolumne** | 052-160-01- | 15 01N 17E (M) | 360 |
| **Tuolumne** | 052-160-03- | 14 01N 17E (M) | 160 |
| **Tuolumne** | 052-160-04- | 22 01N 17E (M) | 160 |
| **Tuolumne** | 052-160-04- | 23 01N 17E (M) | 160 |
| **Tuolumne** | 052-160-05- | 21 01N 17E (M) | 80 |
| **Tuolumne** | 052-160-05- | 22 01N 17E (M) | 320 |
| **Tuolumne** | 052-180-05- | 29 01N 17E (M) | 40 |
| **Tuolumne** | 052-180-06- | 28 01N 17E (M) | 40 |
| **Tuolumne** | 052-180-07- | 28 01N 17E (M) | 40 |
| **Tuolumne** | 052-180-08- | 29 01N 17E (M) | 40 |
| **Tuolumne** | 052-190-02- | 02 01N 18E (M) | 640.46 |
| **Tuolumne** | 052-190-03- | 01 01N 18E (M) | 640.97 |
| **Tuolumne** | 052-190-04- | 10 01N 18E (M) | 640 |
| **Tuolumne** | 052-190-05- | 11 01N 18E (M) | 595 |
| **Tuolumne** | 052-190-06- | 12 01N 18E (M) | 520 |
| **Tuolumne** | 052-190-08- | 03 01N 18E (M) | 200 |
| **Tuolumne** | 052-190-09- | 03 01N 18E (M) | 142.01 |
| **Tuolumne** | 052-190-10- | 03 01N 18E (M) | 10 |
| **Tuolumne** | 052-190-11- | 03 01N 18E (M) | 290.36 |
| **Tuolumne** | 052-200-04- | 09 01N 18E (M) | 400 |
| **Tuolumne** | 052-200-07- | 04 01N 18E (M) | 180.67 |
| **Tuolumne** | 052-200-16- | 04 01N 18E (M) | 230.25 |
| **Tuolumne** | 052-200-17- | 04 01N 18E (M) | 20 |
| **Tuolumne** | 052-200-18- | 04 01N 18E (M) | 41.29 |

| | | | |
|---|---|---|---|
| **Tuolumne** | 052-200-19- | 04 01N 18E (M) | 170 |
| **Tuolumne** | 052-200-22- | 09 01N 18E (M) | 160 |
| **Tuolumne** | 052-200-23- | 09 01N 18E (M) | 80 |
| **Tuolumne** | 052-210-02- | 16 01N 18E (M) | 640 |
| **Tuolumne** | 052-220-01- | 14 01N 18E (M) | 240 |
| **Tuolumne** | 052-220-01- | 15 01N 18E (M) | 80 |
| **Tuolumne** | 052-220-02- | 13 01N 18E (M) | 480 |
| **Tuolumne** | 052-220-02- | 24 01N 18E (M) | 160 |
| **Tuolumne** | 052-220-03- | 15 01N 18E (M) | 560 |
| **Tuolumne** | 052-220-04- | 14 01N 18E (M) | 400 |
| **Tuolumne** | 052-220-05- | 13 01N 18E (M) | 160 |
| **Tuolumne** | 053-140-01- | 06 01N 19E (M) | 526.51 |
| **Tuolumne** | 053-140-03- | 07 01N 19E (M) | 595.58 |
| **Tuolumne** | 053-140-05- | 06 01N 19E (M) | 29.58 |
| **Tuolumne** | 053-150-01- | 18 01N 19E (M) | 551.9 |
| **Tuolumne** | 053-150-04- | 19 01N 19E (M) | 321.63 |
| **Tuolumne** | 053-150-05- | 18 01N 19E (M) | 40 |
| **Tuolumne** | 062-010-05- | 01 01N 16E (M) | 35.34 |
| **Tuolumne** | 062-010-07- | 01 01N 16E (M) | 40 |
| **Tuolumne** | 062-010-11- | 12 01N 16E (M) | 200 |
| **Tuolumne** | 062-280-02- | 25 01N 16E (M) | 107.5 |
| **Tuolumne** | 062-280-02- | 26 01N 16E (M) | 80 |
| **Tuolumne** | 066-171-19- | 35 01S 16E (M) | 20 |
| **Tuolumne** | 066-271-05- | 03 02S 16E (M) | 217 |
| **Tuolumne** | 066-271-06- | 03 02S 16E (M) | 60 |
| **Tuolumne** | 066-271-07- | 03 02S 16E (M) | 20 |
| **Tuolumne** | 066-271-07- | 10 02S 16E (M) | 40 |
| **Tuolumne** | 066-271-11- | 01 02S 16E (M) | 119.4 |
| **Yuba** | 054-210-002- | 17 19N 08E (M) | 156.57 |
| **Yuba** | 054-210-007- | 16 19N 08E (M) | 80 |
| **Yuba** | 054-210-007- | 21 19N 08E (M) | 240 |
| **Yuba** | 054-210-010- | 20 19N 08E (M) | 640 |
| **Yuba** | 054-230-011- | 14 19N 08E (M) | 40 |
| **Yuba** | 054-230-011- | 15 19N 08E (M) | 160 |
| **Yuba** | 054-230-011- | 22 19N 08E (M) | 240 |
| **Yuba** | 054-230-011- | 23 19N 08E (M) | 120 |
| **Yuba** | 054-280-008- | 19 19N 08E (M) | 80 |
| **Yuba** | 054-280-008- | 29 19N 08E (M) | 520 |
| **Yuba** | 054-280-008- | 30 19N 08E (M) | 40 |
| **Yuba** | 064-170-005- | 01 18N 08E (M) | 83.5 |
| **Yuba** | 064-180-006- | 11 18N 08E (M) | 274.05 |
| **Yuba** | 064-250-015- | 13 18N 08E (M) | 571.2 |
| **Yuba** | 064-260-035- | 26 18N 07E (M) | 77.99 |