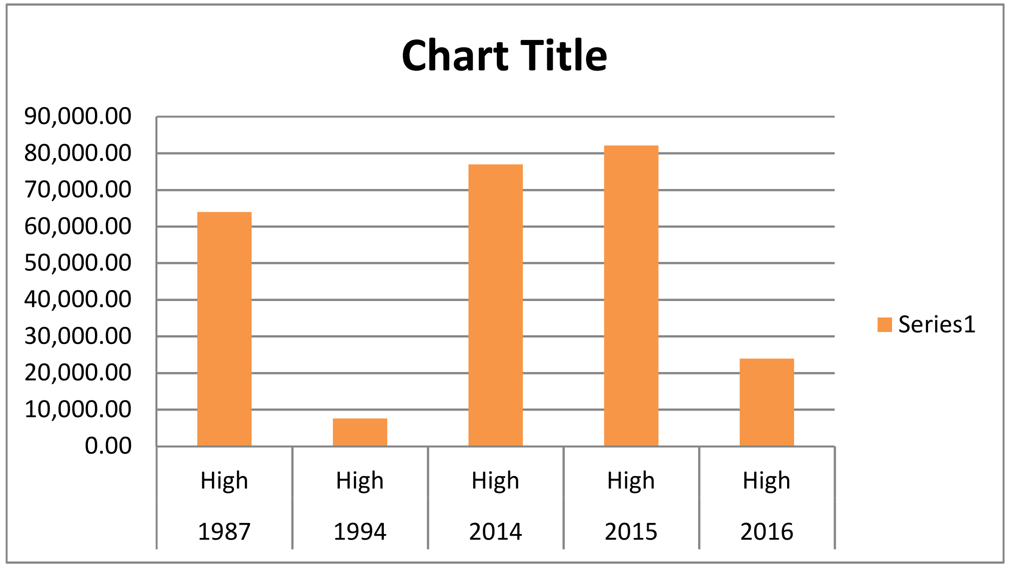
Fire 5YR Range	***Acres***	***Hectares***
1984 - 1989	881,993.72	356,930.20
1990 - 1994	474,608.66	192,067.31
1995 - 2000	445,392.96	180,244.14
2001 - 2006	1,731,330.03	700,644.40
2007 - 2012	1,350,675.71	546,599.07
2013 - 2018	3,226,918.46	1,305,887.57

		Population Specific Detail				
Threat	**Information source and overall summary (if appropriate)**	**SSN**	**NSN**	**NCSO**	**SOC**	**GENERAL or Other areas in 3-state DPS**
	pL Rule: Two separate native pops, one small and one ranging from 258- 4,018 individuals that have persisted but do not appear to be expanding; supplemented by one reintroduced pop > 30 years ago + two recent reintroduced pops	Pop estimate is ~300 individuals; no statistically detectable trend in occupancy.	Reintroduced; successfully bred & produced young; too early to determine the long-term persistence.	No discernible positive or negative total trends & studies have suggested both positive & negative pop trends at various times & at localized study sites; the status & pop estimate of the NCSO population as a whole is unclear.	Has persisted since established >30 years ago; does not appear to have expanded much	
	Withdrawal: All 3 studies (Hoopa, E Klamath, SSN) show population trend conf intervals that straddle 1.0; thus, the studies indicate a statistically stable trend.	Study 3, SSN POPULATION---study from 2008-2014 showed the survival rate (calculated using demographic parameters) of adult males, but not females, is lower than other pops in the DPS, and estimates a lambda of 0.97 (C.I.0.79–1.16) (Sweitzer et al. 2015a, pp. 781–783; Sweitzer et al. 2015b, p. 10). Sweizter et al. (2015d, p. 77), suggests a lower pop growth rate of 0.90 (95 percent C.I. 0.71–1.12) from 2008 to 2014; however, the pop growth rate was at 1.0 or above for the period from 2010 to 2014 (Sweitzer et al. 2015d, p. 77). Pop growth in the SSN is thus estimated to trend less than 1.0; the authors suggest the pop is not in persistent decline, however, but is offset by periods of stability or growth (Sweitzer et al. 2015a, p. 784).	Reintroduced; successfully bred & produced young; too early to determine the long-term persistence.	Study 1, HOOPA STUDY AREA is approximately 145 mi2 in size & represents the more mesic portion of the NCSO pop. area; fisher studies have been ongoing since 1996. The pop trend from 2005–2012 indicates a lambda (population growth rate) of 0.992 (C.I. 0.883–1.100) with a higher lambda rate for females (1.038 [C.I. 0.881–1.196]) than for males (0.912 [C.I. 0.777-1.047]) (Higley et al. 2014, p. 102, Higley 2015, pers. comm.). Demographic parameters show a decrease in annual male fisher survival. A lambda of approximately 1.0 indicates a stable overall pop trend. Study 2, EASTERN KLAMATH STUDY AREA is approximately 200 mi2 in size & represents the more xeric portion of the NCSO pop area. Monitoring has been conducted since 2006. Estimates for lambda from 2006–2013 are 1.06 (C.I. 0.97–1.15) (Powell et al. 2014, p. 23). This lambda of approximately 1.0 indicates a current stable pop within the study area	Has persisted since established >30 years ago; does not appear to have expanded much	
Population Trends	**New/updated information: Study sites in northwestern California and southern Sierra Nevada exhibited no trends in predicted resting habitat suitability that were significantly increasing or decreasing over the past 20 years (Zielinski and Gray 2018, p. 899, 904). Other new information for population trends in broken down by specific populations.**	Population growth rate 0.99 (95% CI: 0.86-1.10) in one study area of the SSN population (Purcell et al. 2018, p. 6). Confidence intervals overlap 1.0, so no conclusions can be drawn regarding the population trajectory beyond the appearance of fragile stability. Projecting over 50 yrs for the small area within the SSN populaiton results in gradually declining population, but results are inconclusive since there is such high variability in female survival rates and confidence interval values are large (Purcell et al. 2018, p. 56). Adult survival rate for the same small area was found to be 0.71 (95% CI: 0.65-0.77), with high annual variation across all ages (Purcell et al. 2018, p. 47). Females in the SSN population were found to reproduce at a rate comparible to or higher than elsewhere, gave birth at similar or later dates, but had the smallest reported litters (Green et al. 2018a, p. 537). A new occupancy analysis that includes climatic and vegetation covariates is currently in progress (expected April 15, 2019), and may provide updated population trend estimates for the SSN population (Tucker 2019, public comment). In addition, new population trends estimate for two smaller study areas within the SSN population is expected to be available soon (Thompson 2019, pers comm).	Estimates of survival and reproduction are consistent with a stable or growing population of NSN (Powell et al. 2016, p.2). Population modelling indicates the population is growing, but short-term population stability, or long-term viability, is not demonstrable before year-10 of the project, or 2020 (Powell et al. 2016, p. 2). Recent camera surveys outside the reintroduction area show that fishers from the NSN area are either expanding or traveling to find more suitable habitat (Johnson 2019, presentation). A population trends paper for the NSN population is currently in review (Matthews and Green 2019, pers comm)	Current modeling efforts indicate the population of fishers in NCSO was relatively stable from 2006-2013 (Green et al. 2017, p. 8). A significant decline in overall population between 2014-2015 was largely diven by declines within burned areas (Green et al. 2017, pp. 9-10). Average fisher density across the NCSO range was 6.6 fishers/100 km^2 (95% CI: 5.1-8.6) (Furnas et al. 2017 p. 12). Estimated total population size was 3196 fishers (95% CI: 2507-4184) (Furnas et al 2017, p. 12). Fishers occur in fewer places than were previously believed and neither the indigenous nor the reintroduced fisher populations have expanded or recovered portions of their range in Oregon beyond what was previously estimated by USFWS (Barry 2018, p. 22). New research is in progress to provide predicted occupancy models and predicted habitat suitability maps for the NCSO and SOC populations (NCASI 2019, public comment). The fisher population has shown no change in density for up to 3 years following the removals of fishers for translocation to the NSN population, however fisher occupancy did decrease in the years immediately following the translocations (Green et al. 2018b, p. 813).	The reintroduced fisher population persists but is lesser in extent than previously believed. The reintroduced population appears to have contracted, shifted south, or the previous popualtion extent was incorrectly estimated. Fishers persist near some of the 1977 release sites, but appear to be absent from most of the Cascade Mountains. The results suggest that fishers have had time to colonize well beyond the reintroduction area even under modest growth scenarios and have failed to do so (Barry 2018, p. 23). Given the number and spacing of detections in the Cascade Mountains, the population appears to be small and relatively isolated (Barry 2018, p. 23). New research is in progress to provide predicted occupancy models and predicted habitat suitability maps for the NCSO and SOC populations (NCASI 2019, public comment).	
	pL Rule: Fishers appear to have several characteristics related to small pop size that increase the species' vulnerability to extinction from stochastic events & other threats on the landscape. Susceptible to small increases in mortality factors due to low fecundity & low pop densities; prone to instability in pop sizes in response to fluctuations in prey availability; low reproductive rates retard recovery from declines ---> highly prone to localized extirpation; limited colonizing ability; slow to recover from deleterious impacts. Researchers IDd the greatest long-term risk to fishers as the isolation of small pops & the higher risk of extinction due to stochastic events. We concluded that small population size constitutes a threat to fisher, now and in the	A scarcity of verifiable sightings in the Western and Eastern Cascades in Washington and Oregon, coastal Oregon, and the north and central sections of the Sierra Nevada indicates that populations of fishers in southwestern Oregon and California are isolated from fishers elsewhere in North America.		A scarcity of verifiable sightings in the Western and Eastern Cascades in Washington and Oregon, coastal Oregon, and the north and central sections of the Sierra Nevada indicates that populations of fishers in southwestern Oregon and California are isolated from fishers elsewhere in North America.		
	Withdrawal:*We reiterated exact wording from above in blue font [see pL cell above], then we also said: The pL rule conclusion was based largely on the application of general theoretical principles regarding the implications of small pop size & isolation for the persistence of some generic species. We continue to recognize that fisher pops in the west coast States are, for the most part, relatively small & geographically isolated from one another (with likely exception of NCSO that now overlaps the NSN and SOC reintroduced pops), with little opportunity for genetic interchange. We noted that pops of forest carnivores are often isolated & generally occur in low densities; because we lack specific information about genetic processes in small, isolated forest carnivore populations, it is unknown whether generalities about persistence based on untested theoretical models may apply to fisher (Ruggiero et al. 1994, p. 146). *THIS DISCUSSION THEN TIES BACK TO TRENDS PRESENTED IN WITHDRAWAL. Overall Conclusion: The best available info does not suggest any negative consequences in terms of pop abundance or other indicators across the west coast States, or that small pop size or isolation are likely to cause significant impacts at either the population or rangewide scales in the future. Recent & ongoing reintroductions to establish additional pops reduce the likelihood of loss to random stochastic events.	Continue to recognize that fisher populations in the west coast States are, for the most part, relatively small and geographically isolated from one another (with the likely exception of the NCSO population, which now overlaps the NSN and SOC reintroduced populations), with little opportunity for genetic interchange. Scientific and commercial information available indicates that the separation of the SSN and NCSO populations occurred a very long time ago, possibly on the order of more than a thousand years, pre-European settlement (Tucker et al. 2012, pp. 1, 7). Despite their size and isolation, the native NCSO and SSN populations have persisted over a long period of time, and interchange between the native NCSO population and the reintroduced NSN and SOC populations may be beginning to occur (see Service 2016, pp. 38–41, 48).		Continue to recognize that fisher populations in the west coast States are, for the most part, relatively small and geographically isolated from one another (with the likely exception of the NCSO population, which now overlaps the NSN and SOC reintroduced populations), with little opportunity for genetic interchange. Scientific and commercial information available indicates that the separation of the SSN and NCSO populations occurred a very long time ago, possibly on the order of more than a thousand years, pre-European settlement (Tucker et al. 2012, pp. 1, 7). Despite their size and isolation, the native NCSO and SSN populations have persisted over a long period of time, and interchange between the native NCSO population and the reintroduced NSN and SOC populations may be beginning to occur (see Service 2016, pp. 38–41, 48).		

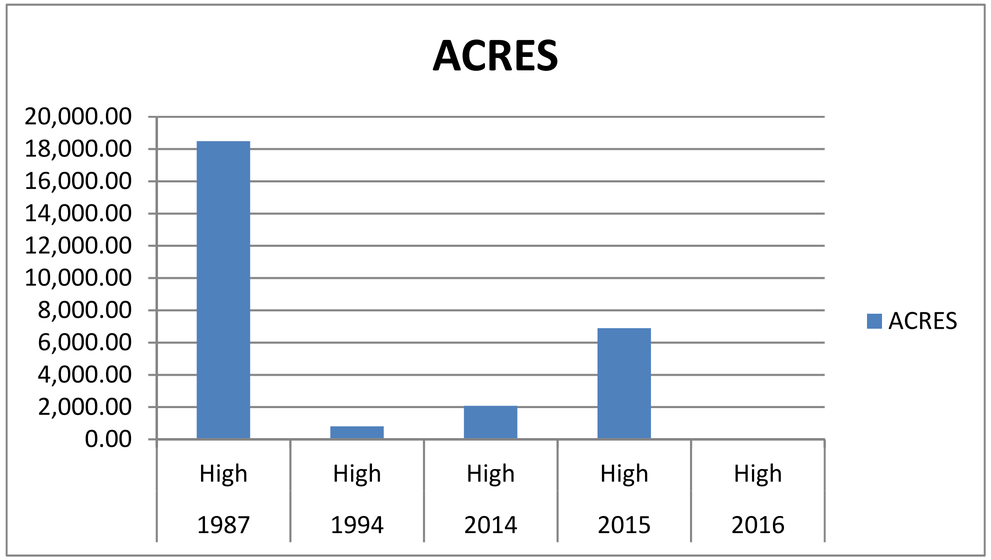
Effects associated with small populations	**New/updated information: In general, species that occupy a narrow geographic range with specific habitat requirements that always occur in small populations have a high conservation priority (Primack 2014, p. 158). Small populations are vulnerable to a rapid decline in their numbers and localized extinction due to the following: (1) loss of genetic variability (e.g., inbreeding depression, loss of evolutionary flexibility), (2) fluctuations in demographic parameters (e.g., birth and death rates, population growth rates, population density) and (3) environmental stochasticity or random fluctuations in the biological (e.g., predation, competition, disease) and physical environment (e.g., wildfire, drought events, flooding) (Primack 2014, pp. 252–268). Consideration of these three elements along with life history traits can provide an extinction vulnerability profile for the Pacific fisher. In sum, the Pacific fisher exhibits the following attributes that may limit its distribution and population growth: a. Loss or modification of large contiguous areas of historical habitat due to timber harvest practices, development, and large, high severity fires with frequencies and intensities magnified by climate change b. Dependence on specific elements of forest structure to meet basic life history needs with an even smaller set of habitat elements required for denning and resting. c. Susceptibility to injury or mortality due to predation from co-occurring larger predators, and potential loss of reproductive capacity due to exposure to toxicants introduced into the natural environment from human activities**	Research that is in progress for the SSN population includes a population genetic analysis of recent data for comparison to previous analyses to assess change in genetic diversity or connectivity in recent years (Tucker 2019, public comment). This work may provide new information related to small population size for the SSN population.				
Wildfire	PL Rule, P. 60429: Considered a threat to fisher habitat now & in the future because the frequency & size of wildfires are increasing. Expect trend to continue into the future. Based on fishers outside of the DPS range & other related species, we predict that large fires (particularly higher severity & larger scale) will cause shifts in home ranges & movement patterns, lower the fitness of fishers remaining in the burned area, and create barriers to dispersal.	P. 60429: Both fire & fire suppression are particularly problematic because of the narrow band of habitat that comprises SSN & the small pop size. Overall, the scope & severity are highest for the SSN and NCSO areas. B/c there is evidence of increasing fire severity in yellow pine–mixedconifer forests, which include the majority of fisher habitat in the Sierra Nevada, the estimate of the severity of stressors related to wildfire is likely to be an underestimate. B/c fisher habitat in the Sierra Nevada occurs in a narrow band running N to S, fires burning at high severity within fisher habitat have the potential to severely disrupt N-S connectivity of habitat within the Sierra Nevada which, if lost, could prevent pop expansion. Forests burned at high severity in this region may be replaced by chaparral or grassland, which may represent a permanent loss of fisher habitat.		, P. 60429: The fire regime in NCSO area is historically extremely variable, as is the forest composition within this region. In forests with a large hardwood or redwood component, post-fire stumpsprouting may speed the recovery of fisher habitat. However, fisher habitat is highly fragmented in many parts of NorCal & SW Oregon, & even temporary losses of habitat may impede dispersal & increase fragmentation of the resident fisher population. The degree to which fire-related effects impact NCSO is lower than SSN because the NCSO does not exist in a narrow band of habitat but rather covers a larger area. However, fire & fire suppression will likely have a negative effect on NCSO because fire will decrease connectivity in the highly fragmented habitat of NCSO. It is difficult to fully determine the impact at NCSO b/c the locations & severities of future fires relative to important habitat components are not known.		WA and rest of OR outside of NCSO: P. 60429: The effect of fire in scope & severity is lower than the other areas and much of this area is considered to be unoccupied. High-severity fires that remove fisher habitat have the potential to further disrupt habitat connectivity & availability. Fire in these areas is likely to have a negative impact on existing fisher pops only if they occur within or in proximity to occupied areas; however, as with NCSO, it is difficult to fully determine the potential impact b/c the locations & severities of future fires relative to important habitat components are not known.
	Withdrawal: no info in 12/18/18 table.					
	New/updated information:					
Anticoagulent Rodenticides	**pL Rule:** The scope of toxicants as a stressor varied across the landscape & our determination regarding the scope was influenced by the availability of data for different parts of the proposed DPS's range. Most fisher carcasses tested in SSN, NCSO, and ONP have ARs in their tissues, but we do not know the exposure rate of live fishers. Also, the min. amount of AR required for sublethal or lethal poisoning of fishers is unknown; however, we have evidence of fisher mortality and sublethal effects as a result of ARs. In those areas where data were available, the severity of the stressor was comparable to that of disease, noting that the data used to estimate the severity of toxicants was based solely on mortality (i.e., four mortalities from CA). Overall, ARs are likely a threat to fisher populations, although we do not have information about the population-level effects at this point in time.					
	Withdrawal: Documentation of a #r of fishers exposed to toxicants & mortalities of individual fishers directly caused by ARs. Exposure to ARs, resulting in death in some cases, has been documented in fishers in the two native populations (NCSO and SSN), and the reintroduced ONP population; however, sources of AR exposure in fishers have not been conclusively determined. Large quantities of ARs have been found at illegal marijuana cultivation sites within occupied fisher habitat on public, private, and tribal lands in CA (Gabriel et al. 2012a, p. 12; Thompson et al. 2014, pp. 97–98). In OR, AR residues were found in both fisher carcasses tested (Gabriel 2015, pers. comm.). Marijuana cultivation sites are not common in WA and only three fishers known to be exposed to rodenticides in WA (Happe et al. 2015, pp. 38–39). Six other carcasses of fishers reintroduced in WA tested positive for AR, but may have been exposed in British Columbia before translocation (Happe in litt. 2015). Of the three fishers that were exposed in WA, likely occurred as a result of legal applications in residential areas (Happe in litt. 2015). OVERALL--info does not suggest that any of the fisher pops where exposure is documented are in decline, nor does it suggest that significant AR impacts would occur as operative threats on the fisher pops in the west coast States as a whole to the degree that there would likely be significant impacts at either the pop- or rangewide-scales in the future. Info does not demonstrate there are significant deleterious sublethal effects in fishers at the pop- or rangewide-scales. Also, we are not aware of any info indicating use of ARs will increase within the DPS range in the future. assumptions (density of marijuana growing operations, whether each operation uses ARs, etc.).					

	New/updated information The following is about the threat of illegal grow sites, not the biology of toxicants. The footprint of grows has changed. They are finding in 2017 2018 (post legalization), that the sites are fewer, but have become larger and are covering more area. this means that a site that used to cover 1-2 fisher home ranges are now incorporating additional home ranges. Law enforcement has caused grow sites to be more dispersed reducing ability to detect grow sites. Policy changes in CA have led to an increase in 1st generation AR use since 2nd generation AR more restricted. A very high cost to clean up and reclamation and lack of funds within agencies means many "historical and newly identified sites" remain contaminated. DOJ report August 2018; 10 21% of known grows reclaimed (160 of 766 dating back to 2010); 2) 89% of sites confirmed or strongly suspected to have carbofuran or methanmidophos present up from 75% the previous year.		Generally, predators that are nocturnal, that are opportunistic in feeding habitats where rodents are an important part of their diet, that are nonmigratory that live close to or within landscapes that are heavily impacted by human activities (e.g., the grow sites) have a higher incidence ofexposure and found to have relatively high liver residue concentrations of multiple AR compounds (Hindmarch and Elliott 2018, p. 251).			
Disease and predation	**pL Rule:** It is unknown how disease and predation rates influence fisher population trends in general. We do not consider disease or predation to be threats to the fisher, now or in the future.					
	Withdrawal: Reaffirmed our PL conclusion (above).					
	New/updated information: No new significant information, review of available information reaffirms our pL conclusion.					
Vehicle Collisons	**pL Rule:** The severity of this stressor ranges from 1 to 4 percent of the pop that dies annually from this stressor. We conclude that vehicle collisions are not a threat to fisher, although over time, the impact of this stressor on fishers will likely accumulate and act syntergistically with other stressors to impact fishers where they occur.					
	Withdrawal: Reaffirmed our PL conclusion (above).					
	New/updated information: No new significant information; review of available information reaffirms our pL conclusion					
Climate Change	**pL Rule:** Fishers may be especially sensitive, physiologically, to warming summer temperatures. These observations suggest that fishers likely will either alter their use of microhabitats or shift their range northward and upslope, in order to avoid thermal stress associated with increased summer temperatures. However, we do not have sufficient data to reliably predict the effect on fisher populations at this time.	**(1) HABITAT--**Ecotype conversion to woodland, shrubland, or grassland would result in the loss of suitable fisher habitat; shift predicted in SSN (Gonzalez et al. 2010, Fig. 3; Lawler et al. 2012, p. 388). Shifts from conifer forest to hardwood-dominated mixed forest in the SSN are unlikely to have negative effects on fishers, and the species' response may be relatively neutral to such a change (Lawler et al. 2012, pp. 385–386; Loarie et al. 2008, p. 4 and Fig. 4).	No population specific information.	**(1) HABITAT--**Shifts from conifer forest to hardwood-dominated mixed forest in the Klamath region are unlikely to have negative effects on fishers, and the species' response may be relatively neutral to such a change (Lawler et al. 2012, pp. 385–386; Loarie et al. 2008, p. 4 and Fig. 4). **(2) FUTURE--**Climate projections within 50 years suggest that drier conditions will result in a narrower extent, greater fragmentation, and increasingly limited inland distribution of coastal forests (DellaSala 2013, entire).	No population specific information.	**(1) GENERAL/HABITAT--**Fishers may experience an overall net gain of suitable habitat in response to climate change, for example due to reduced snowpack, or that areas inhabited by fishers will remain in climate refugia (Burns et al. 2003, p. 11476; Olson et al. 2014, pp. 93, 94, 97). Others predict that fisher distribution will remain largely stable (Spencer et al. 2015, p. 143 and Table 9.6, Figures 9.3–9.5).
	not rise to the level of a threat now nor do we anticipate it as a threat in the					
	New/updated information WESTERN US: (1) HABITAT--Given that fishers are associated with mature forests, long time lags may exist between the loss of current habitat & formation of new habitat in areas that are currently unsuitable (McKelvey and Buotte 2018, p. 152). **(2) HABITAT--**Projected climate change toward substantially hotter & drier conditions in the western US are expected to become increasingly significant drivers of amplified forest fire activity & severity; assoc. climatic interactions with vegetation & fuel conditions will also increase in significance (Moritz et al. 2018, p. 36); hotter and drier (p. 37). The degree of change is not the same everywhere, yet fires interacting with climate & current forest conditions have the potential to create large patches and a relatively high proportion of areas burned with high severity (Moritz et al. 2018, p. 48). (**3) TEMPERATURE--**Higher temperatures during spring and summer, although correlated with early snow melt, will reduce moisture of both live fuels and dead surface fuels by increasing evaporative demands during the dry season (Kelly and Syphard 2016, pp. 2-3).	**(1) ECOLOGY--**Green (2017) investigated whether mean litter size of fisher across the range was correlated with climate variables (temperature, precipitation) as documented by Tökölyi et al. (2014) for a broader selection of carnivores. Sites with greater variability and seasonality of temperature are associated with larger litters, and those with warmer mean annual temperatures and greater mean annual precipitation tended to have smaller litters (p. 19). **(2) DROUGHT/ECOLOGY--**Drought induced by climate change may be stressing this isolated population (Kordosky 2019, p. 14). For fishers, tree mortality due to drought was found to be the leading variable influencing chronic stress (Kordosky 2019, p. 41). **(3) HABITAT--**Over the last 20 years, plots surveyed for resting habitat suitability...*those that were disturbed in southern Sierra and NW CA* showed decreased estimates of resting habitat suitability value (Sielinski and Gray 2018, p. 904). Estimates of resting habitat plots examined on the Eldorado and Sierra NFs suggest the beginning of a negative trend in resting habitat suitability (Sielinski and Gray, p. 903). **(4) HABITAT--**Fisher may be able to capitalize on the future potential reduction in snow at higher elevations and expand upslope into higher elevations than where they are currently found (Zielinski et al. 2017, pp. 543-544). However, fishers in the southern Sierra Nevada have low genetic diversity (Tucker et al. 2014), which may limit their local adaptation potential to rapidly changing environmental conditions. We expect the southern margins of suitable fisher habitat to migrate north over time (Zielinski et al. 2017, p. 544). **(5) RESILIENCY--**Spencer et al. 2016 (SSN Conservation Strategy) specifically states one of their five principles is "Current habitat conditions are not resilient." (Spencer et al. 2016, p. 5).	**(1) GENERAL TEMPERATURE--**Throughout the coastal areas where fishers may be found, the temperatures are projected to increase, although at a slower rate than other areas of Pacific Northwest (such as east of the Cascade Range), due to influences from Pacific Ocean (Brewer and Mass 2016a, p. 6398). **(2) GENERAL DROUGHT--**During the worst drought ever recorded for Oregon and California in 2014-2015, Oregon had nearly normal precipitation; however, the warmer winter temperatures prevented snow accumulation (Mote et al. 2016, pp. 10982-10983). While sea surface temperatures and anthropogenic greenhouse gases played a role in making 2014-2015 warmer, resulting in a snow drought, the impact varied between California and Oregon, with anthropogenic greenhouse gases having a larger impact in Oregon (and Washington) (Mote et al. 2016, pp. 10986-10987). The magnitude of the snow drought in Oregon was exacerbated by warm sea surface temperatures (Mote et al. 2016, pp. 10986-10987). **(3) OREGON TEMPERATURE--**Under continued increasing greenhouse gas emissions, Oregon's climate is projected to warm on average 3–7°F by the 2050s and 5–11°F by the 2080s; Summers are expected to warm more than the annual average and are likely to become drier. (Dalton et al. 2017, p. 4). **(4) OREGON PRECIPITATION--**Annual precipitation is projected to increase slightly, although with a high degree of uncertainty; extreme heat and precipitation events are expected to increase in frequency, duration, and intensity (Dalton et al. 2017, p. 8). **(5) FUTURE OREGON HABITAT--**The observed increase in wild-fire activity is partially due to human-caused climate change; increasing wildfire activity is expected under future warming (Dalton et al. 2017, p. 46).			**(1) CALIFORNIA HABITAT--**Climate change has not significantly affected resting habitat → Resting habitat for fisher stable over the past 20 years across all of California-portion of range, although habitat suitability tended to be lower on private land than public lands (Sielinski and Gray 2018, p. 899, 903). Estimates of resting habitat plots examined on the Eldorado and Sierra NFs suggest the beginning of a negative trend in resting habitat suitability (p. 903). **(2) CALIFORNIA TEMPERATURE--**The annual average temperatures have increased by about 0.8 degrees Celsius (1.5 degrees Fahrenheit) since 1895 (Kadir et al. 2013, p. 38). Additionally, extreme heating events have increased throughout the state (Kadir et al. 2013, p. 48). The predicted increase in mean annual temperature by 2060–2069 is 2.5 degrees Celsius (4.5 degrees Fahrenheit) for the Sierra Nevada area, 2.1 degrees Celsius (3.8 degrees Fahrenheit) for the coastal California area (Pierce et al. 2013, p. 842). **(3) CALIFORNIA PRECIPITATION--**for the peak of the wet season (December – February), a weak trend towards wetter winter conditions in [the State of] California is projected (Polade et al 2017, pp. 1, 7). **(4) CALIFORNIA DROUGHT--**anthropogenic-caused global warming is exacerbating the effects of drought; it is estimated to have contributed 5-18% to the severity of one of the worst recent droughts in 20th-century California history (keeley and Syphard 2016, p. 6). **(5) CALIFORNIA FUTURE--**Although we can expect that future droughts may be more intense, it is unknown whether or not droughts in the future will be worse than our worst droughts in the past (Keeley and Syphard 2016, p. 6). **(6) CALIFORNIA FUTURE (Synergy with wildfire)--**After correcting for potential over-estimates of the effects of climate-driven increases in area burned, California is likely to continue facing significant wildfire and air quality challenges with on-going climate change. While our results demonstrate that accounting for the vegetation-fre feedback leads to a lower rate of increase in area burned with changing climate, area burned remains likely to increase. (Hurteau et al. 2019, pp. 1, 3). **(7) RESILIENCE/FUTURE--**Fishers may have some ability to cope with warmer temperatures through behavioral adaptation (e.g., selection of cool microsites for resting, increased foraging activity at night), but persistently dry conditions during hotter summer months could impact fishers directly by limiting availability of free water and cool microclimates (e.g., in riparian areas), and indirectly by limiting productivity in forest ecosystems (e.g., tree growth, prey abundance); at what point changes in climatic conditions would affect fisher survival is currently unknown (Green 2017, p. 30).
Vegetation Management	resulting in habitat loss. We did not account for ingrowth of fisher habitat over our 40-					
	Withdrawal: Incorporated ingrowth data...looked at net forest change over time, but					
	New/updated information:					
Development	services, transportation, other infrastructure, & recreation; increasing pressure on					
	Withdrawal: Reaffirmed our PL conclusion (above).					
	New/updated information: No new significant information; review of	see comment				
Overutilization	capture is extremely low throughout the analysis area (SR, pp. 106-108). Research--not					
	Withdrawal: Reaffirmed our PL conclusion (above).					
	New/updated information: No new significant information related to					
Forest Insects and Tree Diseases	forest insects and tree diseases are beneficial, providing structures conducive to rest	No population specific information.	No population specific	Sudden oak death impacts forests in southwestern Oregon and northwestern	Sudden oak death impacts forests in	
	reduce the stand's suitability for fisher habitat may affect individuals, but there is no	No population specific information.	No population specific	Sudden oak death impacts forests in southwestern Oregon and northwestern	Sudden oak death impacts forests in	
	New/updated information: Since 2010 severe drought events have	Highest concentration of dead trees due to drought and beetle	No new information.	No new information. Sudden oak death is much smaller in scale compared to	No new information. Sudden oak	
Synergistic Effects	will likely interact to cause large-scale ecotype conversion including shifts away from fisher habitat types, which could impact the viability of pops & reduce the likelihood of reestablishing connectivity. ** Increases in disease caused by CC. **Human development, likely to increase vehicle collisions, conflicts with domestic animals, &					
	range-wide scales currently, nor are they expected to do so in the future. Rationale: Info does not indicate that one or more stressors (by themselves or cumulatively) are expected to interact to such a degree that they would significantly contribute to decreased reproductive viability, reduced distribution, or significant loss of habitat fo					
	New/updated information:					

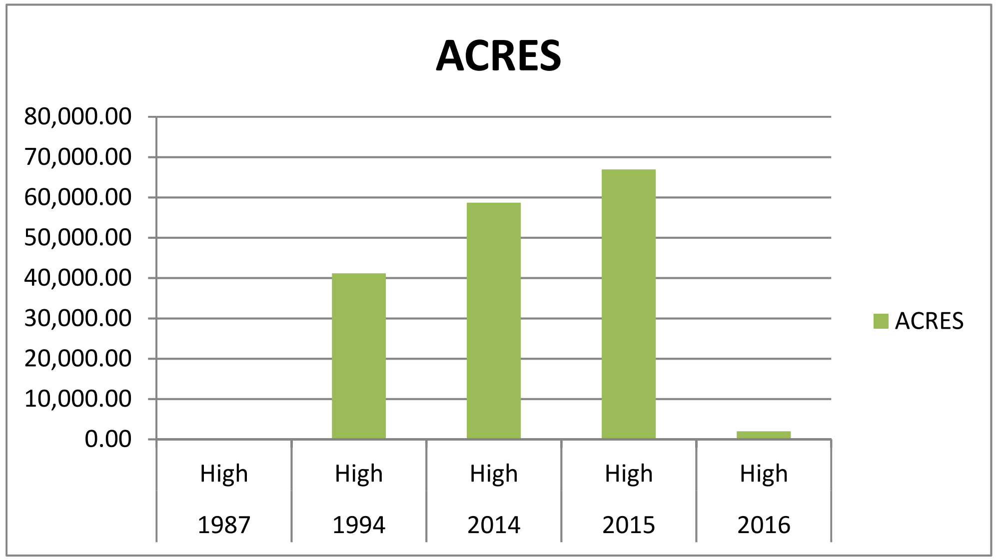
YEAR	BURN	ACRES
1987	High	63,909.95
1994	High	7,603.23
2014	High	76,908.49
2015	High	82,104.04
2016	High	23,947.03



YEAR	BURN	ACRES
1987	High	18,483.76
1994	High	802.85
2014	High	2,070.94
2015	High	6,890.03
2016	High	38.70



YEAR	BURN	ACRES
1987	High	0.00
1994	High	41,164.02
2014	High	58,696.23
2015	High	66,909.78
2016	High	1,989.54



Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	1,573.27
	High	63,909.95
	Low	178,475.13
	Mask Clouds Shadows Water	0.89
	Moderate	98,154.03
	Unburned to Low	133,731.19
California Total		**475,844.46**
Oregon	Area of Revegetation	301.28
	High	18,483.76
	Low	42,252.51
	Moderate	23,838.95
	Unburned to Low	53,219.06
Oregon Total		**138,095.56**
Washington	Unburned to Low	0.16
Washington Total		**0.16**
Grand Total		**613,940.17**

NAME	GRIDCODE	CODE	BURN_SEV	STATE	ACRES
Washington	1	1	Unburned to Low	WA	0.16
Oregon	1	1	Unburned to Low	OR	52,396.89
Oregon	2	2	Low	OR	40,705.88
Oregon	3	3	Moderate	OR	22,256.40
Oregon	4	4	High	OR	17,631.24
Oregon	5	5	Area of Revegetation	OR	288.49
Oregon	1	1	Unburned to Low	OR	44.90
Oregon	2	2	Low	OR	5.67
Oregon	3	3	Moderate	OR	0.18
Oregon	5	5	Area of Revegetation	OR	0.17
California	1	1	Unburned to Low	CA	42.32
California	2	2	Low	CA	3.43
California	3	3	Moderate	CA	0.01
California	4	4	High	CA	0.04
California	5	5	Area of Revegetation	OR	0.05
California	1	1	Unburned to Low	CA	132,641.24
California	2	2	Low	CA	176,407.23
California	3	3	Moderate	CA	96,446.84
California	4	4	High	CA	63,049.42
California	5	5	Area of Revegetation	CA	1,572.55
California	6	6	Mask Clouds Shadows Water	CA	0.89
Oregon	1	1	Unburned to Low	OR	611.35
Oregon	1	1	Unburned to Low	OR	148.32
Oregon	1	1	Unburned to Low	OR	11.79
Oregon	1	1	Unburned to Low	OR	0.81
Oregon	1	1	Unburned to Low	OR	5.00
Oregon	2	2	Low	OR	128.85
Oregon	2	2	Low	OR	1,224.16
Oregon	2	2	Low	OR	177.09
Oregon	2	2	Low	OR	10.62
Oregon	2	2	Low	OR	0.24
Oregon	3	3	Moderate	OR	7.94
Oregon	3	3	Moderate	OR	170.62
Oregon	3	3	Moderate	OR	1,254.78
Oregon	3	3	Moderate	OR	149.03
Oregon	4	4	High	OR	0.26
Oregon	4	4	High	OR	9.71
Oregon	4	4	High	OR	144.17
Oregon	4	4	High	OR	698.37
Oregon	5	5	Area of Revegetation	OR	4.39
Oregon	5	5	Area of Revegetation	OR	0.48
Oregon	5	5	Area of Revegetation	OR	0.04
Oregon	5	5	Area of Revegetation	OR	7.71
California	1	1	Unburned to Low	CA	843.88
California	2	2	Low	CA	174.53
California	3	3	Moderate	CA	10.13
California	4	4	High	CA	0.24
California	5	5	Area of Revegetation	CA	0.40
California	1	1	Unburned to Low	CA	190.91
California	2	2	Low	CA	1,640.84
California	3	3	Moderate	CA	227.52
California	4	4	High	CA	10.36
California	5	5	Area of Revegetation	CA	0.05
California	1	1	Unburned to Low	CA	12.04
California	2	2	Low	CA	237.37
California	3	3	Moderate	CA	1,340.93
California	4	4	High	CA	125.17
California	1	1	Unburned to Low	CA	0.39
California	2	2	Low	CA	11.72
California	3	3	Moderate	CA	128.59
California	4	4	High	CA	724.74
California	1	1	Unburned to Low	CA	0.42
California	5	5	Area of Revegetation	CA	0.21

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	259.36
	High	7,603.23
	Low	22,625.72
	Mask Clouds Shadows Water	2,446.57
	Moderate	12,340.54
	Unburned to Low	17,731.41
California Total		**63,006.83**
Oregon	Area of Revegetation	1.11
	High	802.85
	Low	2,226.39
	Moderate	3,706.21
	Unburned to Low	813.97
Oregon Total		**7,550.53**
Washington	Area of Revegetation	1,384.85
	High	41,164.02
	Low	70,585.73
	Mask Clouds Shadows Water	582.67
	Moderate	52,610.56
	Unburned to Low	44,625.17
Washington Total		**210,953.01**
Grand Total		**281,510.37**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	44625.17051210000
Washington	2.00000000000	Low	WA	70585.72829210000
Washington	3.00000000000	Moderate	WA	52610.56089770000
Washington	4.00000000000	High	WA	41164.02110920000
Washington	5.00000000000	Area of Revegetation	WA	1384.85268451000
Washington	6.00000000000	Mask Clouds Shadows Water	WA	582.67449082200
Oregon	1.00000000000	Unburned to Low	OR	813.96513625300
Oregon	2.00000000000	Low	OR	2226.39476261000
Oregon	3.00000000000	Moderate	OR	3706.21008350000
Oregon	4.00000000000	High	OR	802.84538243900
Oregon	5.00000000000	Area of Revegetation	OR	1.11197421667
California	1.00000000000	Unburned to Low	CA	17731.41247450000
California	2.00000000000	Low	CA	22625.71753270000
California	3.00000000000	Moderate	CA	12340.54001890000
California	4.00000000000	High	CA	7603.23489444000
California	5.00000000000	Area of Revegetation	CA	259.36098464000
California	6.00000000000	Mask Clouds Shadows Water	CA	2446.56567434000

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	1,217.22
	High	27,048.16
	Low	91,709.28
	Mask Clouds Shadows Water	1.78
	Moderate	42,272.40
	Unburned to Low	62,706.49
California Total		**224,955.34**
Oregon	Area of Revegetation	23.35
	High	311.58
	Low	731.23
	Moderate	373.62
	Unburned to Low	496.39
Oregon Total		**1,936.17**
Washingtor	Area of Revegetation	71.39
	High	616.70
	Low	693.87
	Moderate	1,139.55
	Unburned to Low	351.16
Washington Total		**2,872.67**
Grand Total		**229,764.18**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	351.16145237000
Washington	2.00000000000	Low	WA	693.87191020200
Washington	3.00000000000	Moderate	WA	1139.55117891000
Washington	4.00000000000	High	WA	616.70090042000
Washington	5.00000000000	Area of Revegetation	WA	71.38874450930
Oregon	1.00000000000	Unburned to Low	OR	496.38529139500
Oregon	2.00000000000	Low	OR	731.23424655900
Oregon	3.00000000000	Moderate	OR	373.62333973300
Oregon	4.00000000000	High	OR	311.57517374800
Oregon	5.00000000000	Area of Revegetation	OR	23.35145847070
California	1.00000000000	Unburned to Low	CA	62706.49497710000
California	2.00000000000	Low	CA	91709.27995920000
California	3.00000000000	Moderate	CA	42272.40012530000
California	4.00000000000	High	CA	27048.16249370000
California	5.00000000000	Area of Revegetation	CA	1217.22245996000
California	6.00000000000	Mask Clouds Shadows Water	CA	1.77915874667

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	159.01
	High	9,194.47
	Low	17,888.63
	Moderate	13,780.53
	Unburned to Low	18,402.50
California Total		**59,425.15**
Oregon	Area of Revegetation	4.45
	High	2,695.43
	Low	1,447.35
	Moderate	1,760.70
	Unburned to Low	911.15
Oregon Total		**6,819.07**
Washingtor	Area of Revegetation	330.92
	High	20,130.96
	Low	27,702.59
	Mask Clouds Shadows Water	0.67
	Moderate	18,895.11
	Unburned to Low	28,007.38
Washington Total		**95,067.63**
Grand Total		**161,311.85**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	28007.37699380000
Washington	2.00000000000	Low	WA	27702.59043730000
Washington	3.00000000000	Moderate	WA	18895.11065260000
Washington	4.00000000000	High	WA	20130.95882520000
Washington	5.00000000000	Area of Revegetation	WA	330.92352535100
Washington	6.00000000000	Mask Clouds Shadows Water	WA	0.66718452997
Oregon	1.00000000000	Unburned to Low	OR	911.15166733300
Oregon	2.00000000000	Low	OR	1447.34563810000
Oregon	3.00000000000	Moderate	OR	1760.69997207000
Oregon	4.00000000000	High	OR	2695.42550471000
Oregon	5.00000000000	Area of Revegetation	OR	4.44789693582
California	1.00000000000	Unburned to Low	CA	18402.50420920000
California	2.00000000000	Low	CA	17888.63119270000
California	3.00000000000	Moderate	CA	13780.53023830000
California	4.00000000000	High	CA	9194.47000491000
California	5.00000000000	Area of Revegetation	CA	159.01231219100

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	433.22
	High	44,524.31
	Low	54,309.73
	Moderate	58,687.64
	Unburned to Low	29,934.25
California Total		**187,889.14**
Oregon	Area of Revegetation	546.43
	High	147,604.90
	Low	109,775.29
	Mask Clouds Shadows Water	0.44
	Moderate	139,565.72
	Unburned to Low	105,320.55
Oregon Total		**502,813.33**
Washingtor	Area of Revegetation	464.81
	High	13,214.70
	Low	23,717.30
	Mask Clouds Shadows Water	307.57
	Moderate	11,102.84
	Unburned to Low	21,762.89
Washington Total		**70,570.11**
Grand Total		**761,272.58**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	21762.89221600000
Washington	2.00000000000	Low	WA	23717.29802650000
Washington	3.00000000000	Moderate	WA	11102.84017620000
Washington	4.00000000000	High	WA	13214.70159110000
Washington	5.00000000000	Area of Revegetation	WA	464.80522273200
Washington	6.00000000000	Mask Clouds Shadows Water	WA	307.57206798900
Oregon	1.00000000000	Unburned to Low	OR	8902.55865143000
Oregon	2.00000000000	Low	OR	9323.87509483000
Oregon	3.00000000000	Moderate	OR	8957.16595954000
Oregon	4.00000000000	High	OR	8844.76454889000
Oregon	5.00000000000	Area of Revegetation	OR	146.37298530900
Oregon	1.00000000000	Unburned to Low	OR	493.49711647800
Oregon	2.00000000000	Low	OR	54.76695883770
Oregon	3.00000000000	Moderate	OR	10.03434423430
Oregon	4.00000000000	High	OR	0.99819328185
Oregon	5.00000000000	Area of Revegetation	OR	4.00625656762
California	1.00000000000	Unburned to Low	CA	89.65302493710
California	2.00000000000	Low	CA	10.69381421660
California	3.00000000000	Moderate	CA	2.90350618273
California	4.00000000000	High	CA	0.24991762208
California	5.00000000000	Area of Revegetation	CA	0.22085834418
California	1.00000000000	Unburned to Low	CA	27749.60982600000
California	2.00000000000	Low	CA	48445.98690820000
California	3.00000000000	Moderate	CA	42648.26323640000
California	4.00000000000	High	CA	38775.69583290000
California	5.00000000000	Area of Revegetation	CA	419.96984542300
Oregon	1.00000000000	Unburned to Low	OR	78243.73660260000
Oregon	1.00000000000	Unburned to Low	OR	15655.70100650000
Oregon	1.00000000000	Unburned to Low	OR	1737.16863960000
Oregon	1.00000000000	Unburned to Low	OR	98.69256246830
Oregon	1.00000000000	Unburned to Low	OR	188.97559774300
Oregon	1.00000000000	Unburned to Low	OR	0.22239484333
Oregon	2.00000000000	Low	OR	15663.47093400000
Oregon	2.00000000000	Low	OR	65571.46639530000

Oregon	2.00000000000	Low	OR	17504.59527430000
Oregon	2.00000000000	Low	OR	1605.11437603000
Oregon	2.00000000000	Low	OR	51.96010522170
Oregon	2.00000000000	Low	OR	0.04293335283
Oregon	3.00000000000	Moderate	OR	1707.88876099000
Oregon	3.00000000000	Moderate	OR	17509.06093700000
Oregon	3.00000000000	Moderate	OR	30121.47859110000
Oregon	3.00000000000	Moderate	OR	18552.24975490000
Oregon	3.00000000000	Moderate	OR	20250.12986110000
Oregon	3.00000000000	Moderate	OR	24867.15621760000
Oregon	3.00000000000	Moderate	OR	17582.77705640000
Oregon	3.00000000000	Moderate	OR	7.77563903696
Oregon	4.00000000000	High	OR	96.80569351910
Oregon	4.00000000000	High	OR	1607.86202156000
Oregon	4.00000000000	High	OR	17555.00725700000
Oregon	4.00000000000	High	OR	119498.49919200000
Oregon	4.00000000000	High	OR	0.96238499942
Oregon	5.00000000000	Area of Revegetation	OR	188.96357875300
Oregon	5.00000000000	Area of Revegetation	OR	48.87150510950
Oregon	5.00000000000	Area of Revegetation	OR	9.61864222589
Oregon	5.00000000000	Area of Revegetation	OR	1.25499583933
Oregon	5.00000000000	Area of Revegetation	OR	147.29791818400
Oregon	5.00000000000	Area of Revegetation	OR	0.04139685367
Oregon	6.00000000000	Mask Clouds Shadows Water	OR	0.15210475379
Oregon	6.00000000000	Mask Clouds Shadows Water	OR	0.11322344237
Oregon	6.00000000000	Mask Clouds Shadows Water	OR	0.04139685367
Oregon	6.00000000000	Mask Clouds Shadows Water	OR	0.13806463684
California	1.00000000000	Unburned to Low	CA	1598.31889839000
California	2.00000000000	Low	CA	393.49104191500
California	3.00000000000	Moderate	CA	84.43218920620
California	4.00000000000	High	CA	3.96953033363
California	5.00000000000	Area of Revegetation	CA	6.02082498317
California	1.00000000000	Unburned to Low	CA	397.72979168900
California	2.00000000000	Low	CA	3783.09036470000
California	3.00000000000	Moderate	CA	1623.04421964000

California	4.00000000000	High	CA	61.44161383140
California	5.00000000000	Area of Revegetation	CA	2.08760176757
California	1.00000000000	Unburned to Low	CA	88.49405383170
California	2.00000000000	Low	CA	1611.50887052000
California	3.00000000000	Moderate	CA	12943.11037400000
California	4.00000000000	High	CA	1398.03527525000
California	5.00000000000	Area of Revegetation	CA	0.67952210659
California	1.00000000000	Unburned to Low	CA	4.43614689702
California	2.00000000000	Low	CA	63.09523196660
California	3.00000000000	Moderate	CA	1385.30123522000
California	4.00000000000	High	CA	4284.79157419000
California	5.00000000000	Area of Revegetation	CA	0.13806463676
California	1.00000000000	Unburned to Low	CA	6.00547378040
California	2.00000000000	Low	CA	1.85943689101
California	3.00000000000	Moderate	CA	0.58050482155
California	4.00000000000	High	CA	0.12572706148
California	5.00000000000	Area of Revegetation	CA	4.10689996465

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	130.99
	High	6,169.93
	Low	18,517.18
	Moderate	9,636.27
	Unburned to Low	17,656.91
California Total		**52,111.28**
Oregon	High	503.58
	Low	68.96
	Moderate	138.06
	Unburned to Low	131.03
Oregon Total		**841.63**
Washington	Area of Revegetation	419.21
	High	51,108.56
	Low	19,486.24
	Mask Clouds Shadows Water	1,156.23
	Moderate	21,826.27
	Unburned to Low	26,371.14
Washington Total		**120,367.65**
Grand Total		**173,320.56**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	26371.13574810000
Washington	2.00000000000	Low	WA	19486.23617930000
Washington	3.00000000000	Moderate	WA	21826.27469930000
Washington	4.00000000000	High	WA	51108.55893440000
Washington	5.00000000000	Area of Revegetation	WA	419.21428485300
Washington	6.00000000000	Mask Clouds Shadows Water	WA	1156.23078937000
Oregon	1.00000000000	Unburned to Low	OR	131.02865757500
Oregon	2.00000000000	Low	OR	68.96017983440
Oregon	3.00000000000	Moderate	OR	138.06438614900
Oregon	4.00000000000	High	OR	503.57768057300
California	1.00000000000	Unburned to Low	CA	17656.90853100000
California	2.00000000000	Low	CA	18517.18390440000
California	3.00000000000	Moderate	CA	9636.26770617000
California	4.00000000000	High	CA	6169.92949068000
California	5.00000000000	Area of Revegetation	CA	130.99056259300

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	65.61
	High	1,691.97
	Low	7,821.19
	Moderate	3,706.40
	Unburned to Low	8,060.16
California Total		**21,345.32**
Oregon	Area of Revegetation	4.45
	High	1,396.52
	Low	673.21
	Moderate	611.36
	Unburned to Low	646.74
Oregon Total		**3,332.28**
Washingtor	Area of Revegetation	5.78
	High	443.90
	Low	869.34
	Moderate	731.46
	Unburned to Low	510.17
Washington Total		**2,560.65**
Grand Total		**27,238.26**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	510.17375844800
Washington	2.00000000000	Low	WA	869.34144035800
Washington	3.00000000000	Moderate	WA	731.45663968800
Washington	4.00000000000	High	WA	443.90010757900
Washington	5.00000000000	Area of Revegetation	WA	5.78226598566
Oregon	1.00000000000	Unburned to Low	OR	646.74060644900
Oregon	2.00000000000	Low	OR	673.21360976100
Oregon	3.00000000000	Moderate	OR	611.36131484600
Oregon	4.00000000000	High	OR	1396.51835671000
Oregon	5.00000000000	Area of Revegetation	OR	4.44789691654
California	1.00000000000	Unburned to Low	CA	8060.16299657000
California	2.00000000000	Low	CA	7821.18847669000
California	3.00000000000	Moderate	CA	3706.39897952000
California	4.00000000000	High	CA	1691.96517141000
California	5.00000000000	Area of Revegetation	CA	65.60647892450

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	241.52
	High	24,669.15
	Low	74,668.40
	Mask Clouds Shadows Water	19.79
	Moderate	35,565.16
	Unburned to Low	58,813.87
California Total		**193,977.90**
Oregon	Area of Revegetation	8.45
	High	448.79
	Low	1,099.30
	Moderate	732.12
	Unburned to Low	615.81
Oregon Total		**2,904.48**
Washingtor	Area of Revegetation	294.80
	High	95,088.94
	Low	48,805.20
	Mask Clouds Shadows Water	2,109.64
	Moderate	59,050.99
	Unburned to Low	27,922.72
Washington Total		**233,272.29**
Grand Total		**430,154.67**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	0.05166248547
Washington	2.00000000000	Low	WA	0.16323583481
Washington	3.00000000000	Moderate	WA	0.20929120346
Washington	4.00000000000	High	WA	0.49873840458
Washington	5.00000000000	Area of Revegetation	WA	0.02703020904
Washington	1.00000000000	Unburned to Low	WA	27922.66363500000
Washington	2.00000000000	Low	WA	48805.04056060000
Washington	3.00000000000	Moderate	WA	59050.78175990000
Washington	4.00000000000	High	WA	95088.44279110000
Washington	5.00000000000	Area of Revegetation	WA	294.77520193900
Washington	6.00000000000	Mask Clouds Shadows Water	WA	2109.63747947000
Oregon	1.00000000000	Unburned to Low	OR	615.81132288800
Oregon	2.00000000000	Low	OR	1099.29770841000
Oregon	3.00000000000	Moderate	OR	732.12382018700
Oregon	4.00000000000	High	OR	448.79279978200
Oregon	5.00000000000	Area of Revegetation	OR	8.45100409551
California	1.00000000000	Unburned to Low	CA	58813.87310500000
California	2.00000000000	Low	CA	74668.40147780000
California	3.00000000000	Moderate	CA	35565.16092290000
California	4.00000000000	High	CA	24669.14801300000
California	5.00000000000	Area of Revegetation	CA	241.52080016900
California	6.00000000000	Mask Clouds Shadows Water	CA	19.79314156980

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	2,062.42
	High	110,778.94
	Low	228,951.10
	Mask Clouds Shadows Water	2,475.03
	Moderate	152,911.94
	Unburned to Low	223,496.95
California Total		**720,676.39**
Oregon	Area of Revegetation	6.23
	High	4,836.20
	Low	6,062.71
	Moderate	6,003.77
	Unburned to Low	5,038.58
Oregon Total		**21,947.48**
Washingtor	Area of Revegetation	156.79
	High	3,123.76
	Low	3,495.79
	Moderate	2,208.60
	Unburned to Low	1,988.12
Washington Total		**10,973.06**
Grand Total		**753,596.92**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	1988.11757372000
Washington	2.00000000000	Low	WA	3495.78883213000
Washington	3.00000000000	Moderate	WA	2208.60318817000
Washington	4.00000000000	High	WA	3123.75797259000
Washington	5.00000000000	Area of Revegetation	WA	156.78836811800
Oregon	1.00000000000	Unburned to Low	OR	5038.57757447000
Oregon	2.00000000000	Low	OR	6062.70584668000
Oregon	3.00000000000	Moderate	OR	6003.77117747000
Oregon	4.00000000000	High	OR	4836.19826595000
Oregon	5.00000000000	Area of Revegetation	OR	6.22705557349
California	1.00000000000	Unburned to Low	CA	6129.88686594000
California	1.00000000000	Unburned to Low	CA	208077.91453600000
California	1.00000000000	Unburned to Low	CA	9289.15157705000
California	2.00000000000	Low	CA	11944.15548270000
California	2.00000000000	Low	CA	18970.17739240000
California	2.00000000000	Low	CA	57646.22838370000
California	2.00000000000	Low	CA	18685.47175320000
California	2.00000000000	Low	CA	109754.97580400000
California	2.00000000000	Low	CA	11950.09051560000
California	3.00000000000	Moderate	CA	3978.89037082000
California	3.00000000000	Moderate	CA	13759.45198760000
California	3.00000000000	Moderate	CA	33940.71468600000
California	3.00000000000	Moderate	CA	18690.31070490000
California	3.00000000000	Moderate	CA	70856.45506370000
California	3.00000000000	Moderate	CA	11686.12049350000
California	4.00000000000	High	CA	110778.94473200000
California	5.00000000000	Area of Revegetation	CA	2062.41517534000
California	6.00000000000	Mask Clouds Shadows Water	CA	2475.03220557000

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	220.39
	High	5,331.57
	Low	13,731.58
	Moderate	8,651.04
	Unburned to Low	9,662.66
California Total		**37,597.25**
Oregon	Area of Revegetation	0.22
	High	634.41
	Low	835.69
	Moderate	811.58
	Unburned to Low	379.77
Oregon Total		**2,661.67**
Washingtor	Area of Revegetation	14.46
	High	1,644.39
	Low	6,718.99
	Moderate	3,552.09
	Unburned to Low	3,085.51
Washington Total		**15,015.43**
Grand Total		**55,274.35**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	3085.50604547000
Washington	2.00000000000	Low	WA	6718.99301744000
Washington	3.00000000000	Moderate	WA	3552.09043518000
Washington	4.00000000000	High	WA	1644.38746814000
Washington	5.00000000000	Area of Revegetation	WA	14.45566489850
Oregon	1.00000000000	Unburned to Low	OR	379.76794870500
Oregon	2.00000000000	Low	OR	835.68902135000
Oregon	3.00000000000	Moderate	OR	811.58400657200
Oregon	4.00000000000	High	OR	634.40639175000
Oregon	5.00000000000	Area of Revegetation	OR	0.22239484335
California	1.00000000000	Unburned to Low	CA	9662.65992243000
California	2.00000000000	Low	CA	13731.58275750000
California	3.00000000000	Moderate	CA	8651.03827055000
California	4.00000000000	High	CA	5331.57270112000
California	5.00000000000	Area of Revegetation	CA	220.39329026300

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	23.57
	High	483.76
	Low	5,289.62
	Moderate	1,932.29
	Unburned to Low	3,708.31
California Total		**11,437.55**
Oregon	High	963.41
	Low	2,868.00
	Moderate	1,818.52
	Unburned to Low	2,452.13
Oregon Total		**8,102.07**
Washingtor	Area of Revegetation	90.62
	High	1,101.52
	Low	17,123.22
	Mask Clouds Shadows Water	532.41
	Moderate	8,503.86
	Unburned to Low	4,455.48
Washington Total		**31,807.12**
Grand Total		**51,346.74**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	4455.47943562000
Washington	2.00000000000	Low	WA	17123.22088840000
Washington	3.00000000000	Moderate	WA	8503.86426514000
Washington	4.00000000000	High	WA	1101.52166361000
Washington	5.00000000000	Area of Revegetation	WA	90.62361714020
Washington	6.00000000000	Mask Clouds Shadows Water	WA	532.41324084300
Oregon	1.00000000000	Unburned to Low	OR	2452.12553554000
Oregon	2.00000000000	Low	OR	2868.00388959000
Oregon	3.00000000000	Moderate	OR	1818.52264039000
Oregon	4.00000000000	High	OR	963.41446602100
California	1.00000000000	Unburned to Low	CA	3708.31275958000
California	2.00000000000	Low	CA	5289.62098038000
California	3.00000000000	Moderate	CA	1932.28504380000
California	4.00000000000	High	CA	483.76079170100
California	5.00000000000	Area of Revegetation	CA	23.57385363920

Sum of ACRES		
NAME	BURN_SEV	Total
California	Area of Revegetation	89.40
	High	1,232.73
	Low	6,763.94
	Mask Clouds Shadows Water	6,184.26
	Moderate	1,930.70
	Unburned to Low	4,582.89
California Total		**20,783.93**
Oregon	Area of Revegetation	3.34
	High	40.03
	Low	503.06
	Mask Clouds Shadows Water	285.55
	Moderate	292.00
	Unburned to Low	295.34
Oregon Total		**1,419.32**
Washington	Area of Revegetation	12.23
	High	124.32
	Low	10,816.88
	Mask Clouds Shadows Water	186.41
	Moderate	386.08
	Unburned to Low	1,190.62
Washington Total		**12,716.54**
Grand Total		**34,919.79**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	1190.62229032000
Washington	2.00000000000	Low	WA	10816.87880550000
Washington	3.00000000000	Moderate	WA	386.07744666900
Washington	4.00000000000	High	WA	124.31871914000
Washington	5.00000000000	Area of Revegetation	WA	12.23171632770
Washington	6.00000000000	Mask Clouds Shadows Water	WA	186.40703712000
Oregon	1.00000000000	Unburned to Low	OR	295.34035039800
Oregon	2.00000000000	Low	OR	503.05713798800
Oregon	3.00000000000	Moderate	OR	292.00442677100
Oregon	4.00000000000	High	OR	40.03107151030
Oregon	5.00000000000	Area of Revegetation	OR	3.33592261992
Oregon	6.00000000000	Mask Clouds Shadows Water	OR	285.55496733300
California	1.00000000000	Unburned to Low	CA	4582.88845368000
California	2.00000000000	Low	CA	6763.93817459000
California	3.00000000000	Moderate	CA	1930.70078660000
California	4.00000000000	High	CA	1232.73462106000
California	5.00000000000	Area of Revegetation	CA	89.40272738260
California	6.00000000000	Mask Clouds Shadows Water	CA	6184.26138608000

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	58.93
	High	37,632.72
	Low	57,729.66
	Mask Clouds Shadows Water	149.89
	Moderate	44,285.05
	Unburned to Low	18,230.95
California Total		**158,087.21**
Washington	Area of Revegetation	984.65
	High	21,448.65
	Low	70,335.40
	Mask Clouds Shadows Water	7,967.56
	Moderate	40,149.26
	Unburned to Low	37,929.63
Washington Total		**178,815.15**
Grand Total		**336,902.37**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1	Unburned to Low	WA	37,929.63
Washington	2	Low	WA	70,335.40
Washington	3	Moderate	WA	40,149.26
Washington	4	High	WA	21,448.65
Washington	5	Area of Revegetation	WA	984.65
Washington	6	Mask Clouds Shadows Water	WA	7,967.56
California	1	Unburned to Low	CA	18,230.95
California	2	Low	CA	57,729.66
California	3	Moderate	CA	44,285.05
California	4	High	CA	37,632.72
California	5	Area of Revegetation	CA	58.93
California	6	Mask Clouds Shadows Water	CA	149.89

Sum of ACRES		
NAME	BURN_SEV	Total
California	Area of Revegetation	56.49
	High	14,659.38
	Low	35,711.72
	Moderate	23,961.27
	Unburned to Low	12,203.25
California Total		**86,592.10**
Oregon	Area of Revegetation	31.78
	High	4,121.20
	Low	27,190.07
	Moderate	8,606.89
	Unburned to Low	7,963.12
Oregon Total		**47,913.05**
Washingtor	Area of Revegetation	73.16
	High	7,112.60
	Low	48,152.53
	Mask Clouds Shadows Water	426.11
	Moderate	17,438.80
	Unburned to Low	31,647.16
Washington Total		**104,850.35**
Grand Total		**239,355.51**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	31647.16009850000
Washington	2.00000000000	Low	WA	48152.53004380000
Washington	3.00000000000	Moderate	WA	17438.79564970000
Washington	4.00000000000	High	WA	7112.59807378000
Washington	5.00000000000	Area of Revegetation	WA	73.16126359070
Washington	6.00000000000	Mask Clouds Shadows Water	WA	426.10852119700
Oregon	1.00000000000	Unburned to Low	OR	7963.12104797000
Oregon	2.00000000000	Low	OR	27190.06834220000
Oregon	3.00000000000	Moderate	OR	8606.88682285000
Oregon	4.00000000000	High	OR	4121.19885237000
Oregon	5.00000000000	Area of Revegetation	OR	31.77646335000
California	1.00000000000	Unburned to Low	CA	12203.24982110000
California	2.00000000000	Low	CA	35711.71918230000
California	3.00000000000	Moderate	CA	23961.26520760000
California	4.00000000000	High	CA	14659.37848920000
California	5.00000000000	Area of Revegetation	CA	56.48828992370

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	172.13
	High	76,908.49
	Low	84,672.37
	Mask Clouds Shadows Water	26.69
	Moderate	72,313.11
	Unburned to Low	27,690.91
California Total		**261,783.70**
Oregon	Area of Revegetation	8.23
	High	2,070.94
	Low	2,117.20
	Mask Clouds Shadows Water	1.11
	Moderate	2,110.30
	Unburned to Low	603.80
Oregon Total		**6,911.59**
Washington	Area of Revegetation	1,460.24
	High	58,696.23
	Low	156,311.52
	Mask Clouds Shadows Water	1,045.70
	Moderate	112,568.85
	Unburned to Low	40,635.93
Washington Total		**370,718.47**
Grand Total		**639,413.76**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1.00000000000	Unburned to Low	WA	40635.92942110000
Washington	2.00000000000	Low	WA	156311.51766600000
Washington	3.00000000000	Moderate	WA	112568.85271500000
Washington	4.00000000000	High	WA	58696.22615940000
Washington	5.00000000000	Area of Revegetation	WA	1460.24454596000
Washington	6.00000000000	Mask Clouds Shadows Water	WA	1045.70055788000
Oregon	1.00000000000	Unburned to Low	OR	603.80199467800
Oregon	2.00000000000	Low	OR	2117.19892108000
Oregon	3.00000000000	Moderate	OR	2110.30466585000
Oregon	4.00000000000	High	OR	2070.94077754000
Oregon	5.00000000000	Area of Revegetation	OR	8.22860913221
Oregon	6.00000000000	Mask Clouds Shadows Water	OR	1.11197421654
California	1.00000000000	Unburned to Low	CA	27690.90864230000
California	2.00000000000	Low	CA	84672.36606140000
California	3.00000000000	Moderate	CA	72313.11342730000
California	4.00000000000	High	CA	76908.49313550000
California	5.00000000000	Area of Revegetation	CA	172.13360851100
California	6.00000000000	Mask Clouds Shadows Water	CA	26.68738110440

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	4,739.46
	High	82,104.04
	Low	175,921.48
	Mask Clouds Shadows Water	27.80
	Moderate	104,340.90
	Unburned to Low	91,093.52
California Total		**458,227.20**
Oregon	Area of Revegetation	16.01
	High	6,890.03
	Low	15,516.45
	Mask Clouds Shadows Water	1,065.49
	Moderate	10,056.91
	Unburned to Low	9,258.46
Oregon Total		**42,803.36**
Washington	Area of Revegetation	4,149.44
	High	66,909.78
	Low	134,030.50
	Mask Clouds Shadows Water	5,383.46
	Moderate	102,909.67
	Unburned to Low	55,842.31
Washington Total		**369,225.17**
Grand Total		**870,255.73**

NAME	CODE	BURN_SEV	STATE	ACRES
Washington	1	Unburned to Low	WA	55,842.31
Washington	2	Low	WA	134,030.50
Washington	3	Moderate	WA	102,909.67
Washington	4	High	WA	66,909.78
Washington	5	Area of Revegetation	WA	4,149.44
Washington	6	Mask Clouds Shadows Water	WA	5,383.46
Oregon	1	Unburned to Low	OR	9,258.46
Oregon	2	Low	OR	15,516.45
Oregon	3	Moderate	OR	10,056.91
Oregon	4	High	OR	6,890.03
Oregon	5	Area of Revegetation	OR	16.01
Oregon	6	Mask Clouds Shadows Water	OR	1,065.49
California	1	Unburned to Low	CA	91,093.52
California	2	Low	CA	175,921.48
California	3	Moderate	CA	104,340.90
California	4	High	CA	82,104.04
California	5	Area of Revegetation	CA	4,739.46
California	6	Mask Clouds Shadows Water	CA	27.80

Sum of ACRES		
NAME	**BURN_SEV**	**Total**
California	Area of Revegetation	307.79
	High	23,947.03
	Low	25,110.83
	Moderate	18,249.31
	Unburned to Low	13,515.34
California Total		**81,130.31**
Oregon	High	38.70
	Low	514.18
	Moderate	256.64
	Unburned to Low	234.18
Oregon Total		**1,043.70**
Washington	Area of Revegetation	21.57
	High	1,989.54
	Low	2,628.12
	Moderate	1,812.96
	Unburned to Low	2,094.25
Washington Total		**8,546.45**
Grand Total		**90,720.46**

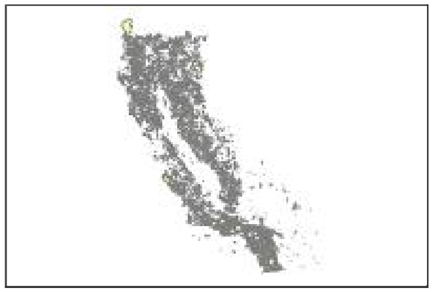
NAME	CODE	BURN_SEV	STATE	ACRES	HECTARES
Washington	1	Unburned to Low	WA	2,094.25	847.51
Washington	2	Low	WA	2,628.12	1,063.56
Washington	3	Moderate	WA	1,812.96	733.68
Washington	4	High	WA	1,989.54	805.14
Washington	5	Area of Revegetation	WA	21.57	8.73
Oregon	1	Unburned to Low	OR	234.18	94.77
Oregon	2	Low	OR	514.18	208.08
Oregon	3	Moderate	OR	256.64	103.86
Oregon	4	High	OR	38.70	15.66
California	1	Unburned to Low	CA	13,515.34	5,469.46
California	2	Low	CA	25,110.83	10,161.99
California	3	Moderate	CA	18,249.31	7,385.23
California	4	High	CA	23,947.03	9,691.02
California	5	Area of Revegetation	CA	307.79	124.56

CODE	BURN_SEV
1	Unburned to Low
2	Low
3	Moderate
4	High
5	Area of Revegetation
6	Mask Clouds Shadows Water

Name	Category	WC_FISH_AC
Northern California - Southwestern Oregon	Native	10,147,790.59
Northern Sierra Nevada	Reintroduced	412,530.82
Southern Sierra Nevada	Native	3,138,677.51
	CA Fisher Population Total Area	**13,698,998.93**

firep17_1

File Geodatabase Feature Class



Tags

Fire, Fire history, Fire perimeters, Wildfire

Summary

Provides a reasonable view of the spatial distribution of past large fires. Due to missing perimeters (see Use Limitations) this layer should be used carefully for statistical analysis and reporting.

Description

Version Information:

The data is updated yearly with fire perimeters from the previous fire season.

Fire17_1 was released April 13th, 2018. 612 wildfires from the 2017 fire season were added to the database. Three USFS wildfires from previous years were also added (1 from 2014, and 2 from 2016). Attributes from 3 USFS wildfires were also corrected (Willow 2015, Gilman and Meadow 2016). Two new USFS Forest were added to the domain list of Units (Rogue River-Siskiyou NF & Fremont NF).The Barry Point Fire is now attributed to the Rogue River-Siskiyou, previoulsy it was attributed to other (as a unit). There are two fires for 2018 already in the database.

CAL FIRE (including contract counties), USDA Forest Service Region 5, USDI Bureau of Land Managment & National Park Service, and other agencies jointly maintain a comprehensive fire perimeter GIS layer for public and private lands throughout the state. The data covers fires back to 1878 and 10 acres and greater. Detailed metadata is provided for each individual feature class.

Historic Update Information:

Fire16_1 was released May 4nd, 2017. I 2014 VNC fire perimeter was replaced by a more accurate version. 3 new periemters from 2014 were added (VNC). A new periemter from 2013 added. 66 new perimeters from 2015 were added. 92 new periemters in Marin County, from 1917 to 1934 were added. They were hand drawn by the Marin County fire Chief Garber and digitized and submitted by NPS. 8 duplicate fire perimeters were deleted.

Fire15_1 was released June 9th, 2016. The ALARM_DATE and CONT_DATE fields have been changed from STRING fields to DATE fields. In the many cases where only the year of a fire existed (ex. 19170000) the tool couldn't process the data and the entry is NULL. In those cases, the year can be found in the YEAR field.

Fire14_1 was released in May, 2014. After release, the NPS supplied corretions for 14 wildfires and 67 prescribed burns. The corrected data was posted to FRAP's data download page as fire14_1 in late May.

Fire 14_2 was released in July, 2015 to reflect that changes had been made to the original release in late May. Version 14_1 from late May is an exact copy of version 14_2 released in July.

Credits

CAL FIRE recognizes the various partners that have contributed to this dataset, including USDA Forest Service Region 5, USDI Bureau of Land Managment, National Park Service, National Fish and Wildlife, and numerous local agencies.

Use limitations

This is the most complete digital record of fire history in California. However it is still incomplete in many respects. Fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, were too small for the minimum cutoffs, had inadequate documentation or have not yet been incorporated into the database. The 2008 Lone Pine fire perimeter has been omitted, we hope to include it in the next update.

Other errors with the fire perimeter database include duplicate fires and over-generalization. While the data capture process attempts to identify duplicate fires resulting from multiple data sources (e.g., the USFS and CAL FIRE both captured and submitted the fire perimeter), some duplicates may still exist. Additionally, over-generalization, particularly with large old fires may show unburned "islands" within the final perimeter as burned. Users of the fire perimeter database must exercise caution in application of the data. Careful use of the fire perimeter database will prevent users from drawing inaccurate or erroneous conclusions from the data.

Extent

West	-124.536465	**East**	-113.684409
North	42.684604	**South**	32.432436

Scale Range

Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000

ArcGIS Metadata ►

Topics and Keywords ►

THEMES OR CATEGORIES OF THE RESOURCE environment

***** CONTENT TYPE Downloadable Data

Hide Topics and Keywords ▲

Citation ►

* TITLE firep17_1
CREATION DATE 2017-04-28 00:00:00
PUBLICATION DATE 2017-05-02 00:00:00

EDITION 2016 version 1

PRESENTATION FORMATS digital map

OTHER CITATION DETAILS
DISCLAIMER The State of California and the Department of Forestry and Fire Protection make no representations or warranties regarding the accuracy of data or maps. The user will not seek to hold the State or the Department liable under any circumstances for any damages with respect to any claim by the user or any third party on account of or arising from the use of data or maps. The user will cite the Department of Forestry and Fire Protection as the original source of the data, but will clearly denote cases where the original data have been updated, modified, or in any way altered from the original condition.

Hide Citation ▲

Citation Contacts ►

RESPONSIBLE PARTY
INDIVIDUAL'S NAME David Passovoy
ORGANIZATION'S NAME CAL FIRE
CONTACT'S POSITION Data Steward
CONTACT'S ROLE point of contact

RESPONSIBLE PARTY
INDIVIDUAL'S NAME Dave Sapsis
ORGANIZATION'S NAME CAL FIRE
CONTACT'S POSITION Data Gate Keeper
CONTACT'S ROLE point of contact

Hide Citation Contacts ▲

Resource Details ►

DATASET LANGUAGES English (UNITED STATES)
DATASET CHARACTER SET utf8 - 8 bit UCS Transfer Format

SPATIAL REPRESENTATION TYPE vector

SUPPLEMENTAL INFORMATION
Version 14_1: an effort was made to ensure multipart polygons were standardized throughout the dataset.

* PROCESSING ENVIRONMENT Microsoft Windows 7 Version 6.1 (Build 7601) Service Pack 1; Esri ArcGIS 10.4.1.5686

CREDITS

CAL FIRE recognizes the various partners that have contributed to this dataset, including USDA Forest Service Region 5, USDI Bureau of Land Managment, National Park Service, National Fish and Wildlife, and numerous local agencies.

ARCGIS ITEM PROPERTIES
* NAME firep17_1
* LOCATION file://\\ifw8csbd-gim.fws.doi.net\rdata\gis\state\fire\fire17_1.gdb
  * ACCESS PROTOCOL Local Area Network

Hide Resource Details ▲

Extents ►

EXTENT
GEOGRAPHIC EXTENT
BOUNDING RECTANGLE
EXTENT TYPE Extent used for searching
* WEST LONGITUDE -124.536465
* EAST LONGITUDE -113.684409
* NORTH LATITUDE 42.684604
* SOUTH LATITUDE 32.432436

EXTENT CONTAINS THE RESOURCE Yes

EXTENT IN THE ITEM'S COORDINATE SYSTEM
* WEST LONGITUDE -373237.543600
* EAST LONGITUDE 519987.848700
* SOUTH LATITUDE -604727.564300
* NORTH LATITUDE 518283.737600
* EXTENT CONTAINS THE RESOURCE Yes

Hide Extents ▲

Resource Points of Contact ►

POINT OF CONTACT
INDIVIDUAL'S NAME David Passovoy
ORGANIZATION'S NAME CAL FIRE
CONTACT'S POSITION Data Steward
CONTACT'S ROLE point of contact

CONTACT INFORMATION ►
PHONE
VOICE 916-445-4301

ADDRESS
TYPE physical
DELIVERY POINT 1300 U. St.
CITY Sacramento
ADMINISTRATIVE AREA CA
POSTAL CODE 95814
E-MAIL ADDRESS david.passovoy@fire.ca.gov

Hide Contact information ▲

Hide Resource Points of Contact ▲

Resource Maintenance ►

RESOURCE MAINTENANCE
UPDATE FREQUENCY annually

Hide Resource Maintenance ▲

Resource Constraints ►

CONSTRAINTS
LIMITATIONS OF USE

This is the most complete digital record of fire history in California. However it is still incomplete in many respects. Fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, were too small for the minimum cutoffs, had inadequate documentation or have not yet been incorporated into the database. The 2008 Lone Pine fire perimeter has been omitted, we hope to include it in the next update.

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Hide Resource Constraints ▲

Spatial Reference ►

ARCGIS COORDINATE SYSTEM
* TYPE Projected
* GEOGRAPHIC COORDINATE REFERENCE GCS_North_American_1983
* PROJECTION NAD_1983_California_Teale_Albers
* COORDINATE REFERENCE DETAILS

PROJECTED COORDINATE SYSTEM
WELL-KNOWN IDENTIFIER 3310
X ORIGIN -16909700
Y ORIGIN -8597000
XY SCALE 10000
Z ORIGIN -100000
Z SCALE 10000
M ORIGIN -100000
M SCALE 10000
XY TOLERANCE 0.001
Z TOLERANCE 0.001
M TOLERANCE 0.001
HIGH PRECISION true
LATEST WELL-KNOWN IDENTIFIER 3310
WELL-KNOWN TEXT PROJCS["NAD_1983_California_Teale_Albers",GEOGCS ["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID ["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT ["Degree",0.0174532925199433]],PROJECTION["Albers"],PARAMETER ["False_Easting",0.0],PARAMETER["False_Northing",-4000000.0],PARAMETER ["Central_Meridian",-120.0],PARAMETER["Standard_Parallel_1",34.0],PARAMETER

["Standard_Parallel_2",40.5],PARAMETER["Latitude_Of_Origin",0.0],UNIT ["Meter",1.0],AUTHORITY["EPSG",3310]]

REFERENCE SYSTEM IDENTIFIER
VALUE 3310
* CODESPACE EPSG
* VERSION 6.8(9.2.0)

Hide Spatial Reference ▲

Spatial Data Properties ►

VECTOR ►
* LEVEL OF TOPOLOGY FOR THIS DATASET geometry only

GEOMETRIC OBJECTS
FEATURE CLASS NAME firep17_1
* OBJECT TYPE composite
* OBJECT COUNT 20096

Hide Vector ▲

ARCGIS FEATURE CLASS PROPERTIES ►
FEATURE CLASS NAME firep17_1
* FEATURE TYPE Simple
* GEOMETRY TYPE Polygon
* HAS TOPOLOGY FALSE
* FEATURE COUNT 20096
* SPATIAL INDEX TRUE
* LINEAR REFERENCING FALSE

Hide ArcGIS Feature Class Properties ▲

Hide Spatial Data Properties ▲

Distribution ►

DISTRIBUTION FORMAT
VERSION 1
* NAME File Geodatabase Feature Class

Hide Distribution ▲

Fields ►

DETAILS FOR OBJECT firep17_1 ►
* TYPE Feature Class
* ROW COUNT 20096

FIELD OBJECTID ►
* ALIAS OBJECTID
* DATA TYPE OID
* WIDTH 4
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION
Internal feature number

DESCRIPTION SOURCE
ESRI

DESCRIPTION OF VALUES
Sequential unique whole numbers that are automatically generated.

Hide Field OBJECTID ▲

FIELD Shape ►
* ALIAS Shape
* DATA TYPE Geometry
* WIDTH 0
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION
Feature geometry.

DESCRIPTION SOURCE
ESRI

DESCRIPTION OF VALUES
Coordinates defining the features.

Hide Field Shape ▲

FIELD STATE ►
* ALIAS STATE
* DATA TYPE String
* WIDTH 2
* PRECISION 0
* SCALE 0

Hide Field STATE ▲

FIELD UNIT_ID ►
* ALIAS UNIT_ID
* DATA TYPE String
* WIDTH 3
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION
Unit of responsible agency where fire started (based on Direct Protection Area)

LIST OF VALUES
VALUE AEU
DESCRIPTION Amador-El Dorado CDF Unit

VALUE AFV
DESCRIPTION Vandenberg Air Force Base

VALUE ANF
DESCRIPTION Angeles National Forest

VALUE APF
DESCRIPTION US Army Post FD (Hunter Ligget)

VALUE BBD
DESCRIPTION Bakersfield District BLM

VALUE BDF
DESCRIPTION San Bernardino National Forest

VALUE BDU
DESCRIPTION San Bernardino CDF Unit

VALUE BEU
DESCRIPTION Monterey-San Benito CDF Unit

VALUE BNP
DESCRIPTION Lava Beds National Monument

VALUE BTU
DESCRIPTION Butte CDF Unit

VALUE CAP
DESCRIPTION Cabrillo National Monument

VALUE CCD
DESCRIPTION Carson City District BLM

VALUE CDD
DESCRIPTION CA Desert District BLM

VALUE CNF
DESCRIPTION Cleveland National Forest

VALUE CNP
DESCRIPTION Channel Islands National Park

VALUE CRB
DESCRIPTION Camp Roberts Military Base

VALUE CZU
DESCRIPTION San Mateo-Santa Cruz CDF Unit

VALUE DPP
DESCRIPTION Devils Postpile National Monument

VALUE DVP
DESCRIPTION Death Valley National Park

VALUE ENF
DESCRIPTION Eldorado National Forest

VALUE EOP
DESCRIPTION Eugene O'Neill National Historic Site

VALUE FKU
DESCRIPTION Fresno-Kings CDF Unit

VALUE FPP
DESCRIPTION Fort Point National Historic Site

VALUE GNP
DESCRIPTION Golden Gate National Park

VALUE HUU
DESCRIPTION Humboldt-Del Norte CDF Unit

VALUE INF
DESCRIPTION Inyo National Forest

VALUE JMP
DESCRIPTION John Muir National Historic Site

VALUE JTP
DESCRIPTION Joshua Tree National Monument

VALUE KNF
DESCRIPTION Klamath National Forest

VALUE KNP
DESCRIPTION Sequoia-Kings Canyon National Park

VALUE KRN
DESCRIPTION Kern County

VALUE LAC
DESCRIPTION Los Angeles County

VALUE LMU
DESCRIPTION Lassen-Modoc CDF Unit

VALUE LNF
DESCRIPTION Lassen National Forest

VALUE LNP
DESCRIPTION Lassen Volcanic National Park

VALUE LNU
DESCRIPTION Sonoma-Lake-Napa CDF Unit

VALUE LPF
DESCRIPTION Los Padres National Forest

VALUE MDF
DESCRIPTION Modoc National Forest

VALUE MEU
DESCRIPTION Mendocino CDF Unit

VALUE MMU
DESCRIPTION Merced-Mariposa CDF Unit

VALUE MNF

DESCRIPTION Mendocino National Forest

VALUE MNP
DESCRIPTION Mojave National Park

VALUE MRN
DESCRIPTION Marin County

VALUE MVU
DESCRIPTION San Diego CDF Unit

VALUE MWP
DESCRIPTION Muir Woods National Monument

VALUE NEU
DESCRIPTION Nevada-Yuba-Placer CDF Unit

VALUE NOD
DESCRIPTION Northern CA District

VALUE ORC
DESCRIPTION Orange County

VALUE PIP
DESCRIPTION Pinnacles National Monument

VALUE PNF
DESCRIPTION Plumas National Forest

VALUE PSF
DESCRIPTION Presidio of San Francisco

VALUE RNP
DESCRIPTION Point Reyes National Seashore

VALUE RRU
DESCRIPTION Riverside CDF Unit

VALUE RWP
DESCRIPTION Redwood National Park

VALUE SBC
DESCRIPTION Santa Barbara County

VALUE SCU
DESCRIPTION Santa Clara CDF Unit

VALUE SHF
DESCRIPTION Shasta-Trinity National Forest

VALUE SHU
DESCRIPTION Shasta-Trinity CDF Unit

VALUE SKU
DESCRIPTION Siskiyou CDF Unit

VALUE SLU
DESCRIPTION San Luis Obispo CDF Unit

Value SMP
Description Santa Monica Mountains National Recreation Area

Value SNF
Description Sierra National Forest

Value SNU
Description Sonoma CDF Unit

Value SQF
Description Sequoia National Forest

Value SRF
Description Six Rivers National Forest

Value STF
Description Stanislaus National Forest

Value TCU
Description Tuolumne-Calaveras CDF Unit

Value TGU
Description Tehama-Glenn CDF Unit

Value TMU
Description Lake Tahoe Basin Management Unit

Value TNF
Description Tahoe National Forest

Value TOI
Description Toiyabe National Forest

Value TUU
Description Tulare CDF Unit

Value VNC
Description Ventura County

Value WNP
Description Whiskeytown National Recreation Area

Value YNP
Description Yosemite National Park

Hide Field UNIT_ID ▲

Field FIRE_NUM ►
* Alias FIRE_NUM
* Data type String
* Width 8
* Precision 0
* Scale 0

Hide Field FIRE_NUM ▲

FIELD FIRE_NAME ▶

* ALIAS FIRE_NAME
* DATA TYPE String
* WIDTH 34
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION

Name assigned to fire by responsible agency

Hide Field FIRE_NAME ▲

FIELD AGENCY ▶

* ALIAS AGENCY
* DATA TYPE String
* WIDTH 3
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION

Direct Protection Agency who responed to the fire (based on UNIT_ID, assigned by Direct Protection Area)

DESCRIPTION SOURCE

CAL FIRE FRAP

LIST OF VALUES

VALUE BIA
DESCRIPTION USDI Bureau of Indian Affairs

VALUE BLM
DESCRIPTION Bureau of Land Management

VALUE CCO
DESCRIPTION Contract Counties

VALUE CDF
DESCRIPTION Cal Fire

VALUE DOD
DESCRIPTION Department of Defense

VALUE FWS
DESCRIPTION USDI Fish and Wildlife Service

VALUE LRA
DESCRIPTION Local Response Area

VALUE NOP
DESCRIPTION No Protection

VALUE OTH
DESCRIPTION Other

VALUE PVT
DESCRIPTION Private

VALUE USF

DESCRIPTION United States Forest Service

Hide Field AGENCY ▲

FIELD C_METHOD ▶
* ALIAS C_METHOD
* DATA TYPE SmallInteger
* WIDTH 2
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION
Method used to capture fire perimeter data

DESCRIPTION SOURCE
CAL FIRE FRAP

LIST OF VALUES
VALUE 1
DESCRIPTION GPS Ground

VALUE 2
DESCRIPTION GPS Air

VALUE 3
DESCRIPTION Infrared

VALUE 4
DESCRIPTION Other imagery

VALUE 5
DESCRIPTION Photo Interpretation

VALUE 6
DESCRIPTION Hand Drawn

VALUE 7
DESCRIPTION Mixed Collection Methods

VALUE 8
DESCRIPTION Unknown

Hide Field C_METHOD ▲

FIELD CAUSE ▶
* ALIAS CAUSE
* DATA TYPE SmallInteger
* WIDTH 2
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION
Reason fire ignited

DESCRIPTION SOURCE
CAL FIRE FRAP

LIST OF VALUES

VALUE 1
DESCRIPTION Lightning

VALUE 2
DESCRIPTION Equipment Use

VALUE 3
DESCRIPTION Smoking

VALUE 4
DESCRIPTION Campfire

VALUE 5
DESCRIPTION Debris

VALUE 6
DESCRIPTION Railroad

VALUE 7
DESCRIPTION Arson

VALUE 8
DESCRIPTION Playing with fire

VALUE 9
DESCRIPTION Miscellaneous

VALUE 10
DESCRIPTION Vehicle

VALUE 11
DESCRIPTION Powerline

VALUE 12
DESCRIPTION Firefighter Training

VALUE 13
DESCRIPTION Non-Firefighter Training

VALUE 14
DESCRIPTION Unknown / Unidentified

VALUE 15
DESCRIPTION Structure

VALUE 16
DESCRIPTION Aircraft

VALUE 17
DESCRIPTION Volcanic

VALUE 18
DESCRIPTION Escaped Prescribed Burn

VALUE 19
DESCRIPTION Illegal Alien Campfire

Hide Field CAUSE ▲

Field INC_NUM ▶
* Alias INC_NUM
* Data type String
* Width 8
* Precision 0
* Scale 0

Field description
The Incident number; a consecutive number assigned by the Emergency Command Center of the responsible agency for the fire.

Description source
CAL FIRE FRAP

Hide Field INC_NUM ▲

Field OBJECTIVE ▶
* Alias OBJECTIVE
* Data type SmallInteger
* Width 2
* Precision 0
* Scale 0

Field description
Either suppression or resource benefit (a fire that is allowed to burn in order to encourage environmental health.

Description source
CAL FIRE FRAP

List of values
Value 1
Description Suppression (Wildfire)

Value 2
Description Resource Benefit (Wildland Fire Use)

Hide Field OBJECTIVE ▲

Field COMMENTS ▶
* Alias COMMENTS
* Data type String
* Width 80
* Precision 0
* Scale 0

Hide Field COMMENTS ▲

Field REPORT_AC ▶
* Alias REPORT_AC
* Data type Double
* Width 8
* Precision 0
* Scale 0

Field description
Estimated area consumed in fire

Hide Field REPORT_AC ▲

FIELD GIS_ACRES ▶
- * ALIAS GIS_ACRES
- * DATA TYPE Single
- * WIDTH 4
- * PRECISION 0
- * SCALE 0

FIELD DESCRIPTION
Calculated area in acres based on Shape_Area.

DESCRIPTION SOURCE
CAL FIRE FRAP

Hide Field GIS_ACRES ▲

FIELD ALARM_DATE ▶
- * ALIAS ALARM_DATE
- * DATA TYPE Date
- * WIDTH 8
- * PRECISION 0
- * SCALE 0

Hide Field ALARM_DATE ▲

FIELD CONT_DATE ▶
- * ALIAS CONT_DATE
- * DATA TYPE Date
- * WIDTH 8
- * PRECISION 0
- * SCALE 0

Hide Field CONT_DATE ▲

FIELD Shape_Length ▶
- * ALIAS Shape_Length
- * DATA TYPE Double
- * WIDTH 8
- * PRECISION 0
- * SCALE 0

FIELD DESCRIPTION
Length of feature in internal units.

DESCRIPTION SOURCE
ESRI

DESCRIPTION OF VALUES
Positive real numbers that are automatically generated.

Hide Field Shape_Length ▲

FIELD Shape_Area ►
* ALIAS Shape_Area
* DATA TYPE Double
* WIDTH 8
* PRECISION 0
* SCALE 0

FIELD DESCRIPTION
Area of feature in internal units squared.

DESCRIPTION SOURCE
ESRI

DESCRIPTION OF VALUES
Positive real numbers that are automatically generated.

Hide Field Shape_Area ▲

FIELD Year_ ►
* ALIAS YEAR_
* DATA TYPE String
* WIDTH 4
* PRECISION 0
* SCALE 0

Hide Field Year_ ▲

Hide Details for object firep17_1 ▲

OVERVIEW DESCRIPTION ►

ENTITY AND ATTRIBUTE DETAIL CITATION
As of Jan 1st, 2007 the term CAL FIRE will be used in reference to CDF and The California Department of Fosetry and Fire Protection. 2006 fire perimeters still use the term "CDF".

Hide Overview Description ▲

Hide Fields ▲

Metadata Details ►

METADATA LANGUAGE English (UNITED STATES)
METADATA CHARACTER SET utf8 - 8 bit UCS Transfer Format

SCOPE OF THE DATA DESCRIBED BY THE METADATA dataset
SCOPE NAME * dataset

* LAST UPDATE 2018-11-19

ARCGIS METADATA PROPERTIES
METADATA FORMAT ArcGIS 1.0
STANDARD OR PROFILE USED TO EDIT METADATA FGDC

METADATA STYLE FGDC CSDGM Metadata

CREATED IN ARCGIS FOR THE ITEM 2016-04-28 13:41:25
LAST MODIFIED IN ARCGIS FOR THE ITEM 2018-11-19 14:59:44

AUTOMATIC UPDATES
HAVE BEEN PERFORMED Yes
LAST UPDATE 2018-11-19 14:59:44

Hide Metadata Details ▲

Metadata Contacts ►

METADATA CONTACT
INDIVIDUAL'S NAME David Passovoy
ORGANIZATION'S NAME CAL FIRE
CONTACT'S POSITION Data Steward
CONTACT'S ROLE point of contact

CONTACT INFORMATION ►
PHONE
VOICE 916-445-4301

ADDRESS
CITY Sacramento
ADMINISTRATIVE AREA California
E-MAIL ADDRESS david.passovoy@fire.ca.gov

Hide Contact information ▲

Hide Metadata Contacts ▲

Metadata Maintenance ►

MAINTENANCE
DATE OF NEXT UPDATE 2019-03-31 00:00:00
UPDATE FREQUENCY annually

Hide Metadata Maintenance ▲

Metadata Constraints ►

CONSTRAINTS
LIMITATIONS OF USE
Public data - no constraints

Hide Metadata Constraints ▲

Thumbnail and Enclosures ►

THUMBNAIL
THUMBNAIL TYPE JPG

Hide Thumbnail and Enclosures ▲

FGDC Metadata (read-only) ▼

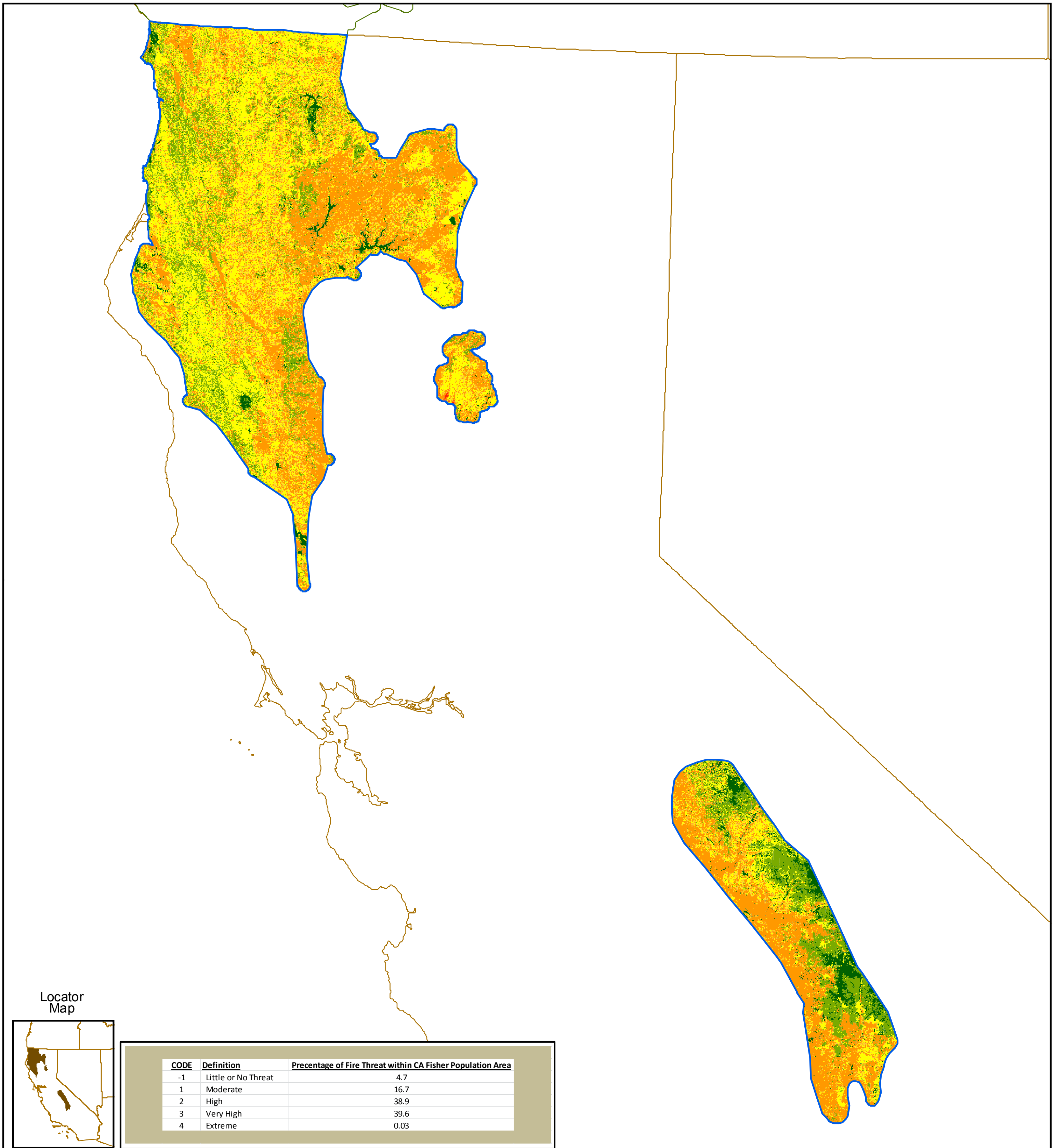
CODE	Definition	Acres
-1	Little or No Threat	640,352.24
1	Moderate	2,287,978.22
2	High	5,331,751.79
3	Very High	5,418,572.09
4	Extreme	4,315.47

U.S. Fish & Wildlife Service

Carlsbad Fish and Wildlife Office

2177 Salk Ave., Ste. 250, Carlsbad, CA 92008

Fire Threats in California Population Extent for the West Coast Fisher *(Pekania pennanti)*



CODE	Definition	Precentage of Fire Threat within CA Fisher Population Area
-1	Little or No Threat	4.7
1	Moderate	16.7
2	High	38.9
3	Very High	39.6
4	Extreme	0.03

PRODUCED BY GIS BRANCH
CARLSBAD FISH & WILDLIFE OFFICE
GIS CONTACT: ED TURNER
PROJECT BIOLOGIST: BETTY GRIZZLE
MAP DATE: 11/29/2018
DATA SOURCE: USFWS, CALFIRE
S:\stem\edstemp\Fisher\MXDs\CalFire_Threat_Map.mxd

Fire Threat (California Department of Forestry and Fire Protection, 2004)

- -1: Little or no threat
- 1: Moderate
- 2: High
- 3: Very high
- 4: Extreme

Information displayed is DELIBERATIVE and should be considered DRAFT for internal discussion.

CODE	***Definition***
-1	Little or No Threat
1	Moderate
2	High
3	Very High
4	Extreme

Anticoagulant Rodenticides---Summary of New Information/Literature since 2015

1. **Environmental impacts of marijuana cultivation from 2014 to 2016, trespass cultivation sites in California only** (Gabriel et al. 2017, key findings in abstract)
    a. This study used data collected to "scale up" their findings to landscape level by developing a predictive MAXENT model in order to spatially map relative likelihood of trespass marijuana cultivation on public and tribal lands. Their model found that, when overlayed onto fisher habitat map, 44% of high-quality fisher habitat was overlapped by areas predicted to be of moderate to high likelihood for grow sites (Figure 1, below))[1].
    b. Miscellaneous: Table 1 (below) summarizes the amount of rodenticides/insecticides found at 77 sites - number of sites and mean amount per site - and could be included in FR doc. In addition to documenting wildlife carcasses (Table 2, below), they investigated whether feces from fisher carcasses known to have died from AR poisoning could be used to detect AR exposure (found 3 of 9 tested positive). They did not find AR in fecal samples from fishers who died of other causes but had AR residues in their livers. They also assessed toxicant exposure in water and soil, finding (prelim results) that surface water and possibly ground water immediately below grow sites were contaminated. Their Table 3 (below) present summary of soil samples analyzed for rodenticides and insecticides. This study deployed remote infrared wildlife cameras at grow sites, and fisher was detected. They also conducted rodent trapping at 6 grow sites, and tested some of these for ARs; finding that most of the animals that died during handling tested positive.
    c. **Expert opinion related to any changes pre- and post-legalization of marijuana in California** (Gabriel 2018, pers. comm. with Betty):
        i. The footprint of the grows has changed. They are finding in 2017 and 2018 (post), that the sites are fewer, but have become larger and are covering more area. This means that a site that used to cover 1-2 fisher home ranges are now incorporating additional home ranges.
        ii. Law enforcement actions have caused "disbursement" reducing ability to find new? detections.
        iii. Results of policy changes related to pesticide use and additional restrictions place on the use of 2nd generation ARs. He said they are now finding less 2nd generation ARs being used at grow sites, but there is now more intensive use of 1st generation ARs. The “black market” is still there

[1] Publications are being submitted to peer-reviewed journals in the future. However, a new report is also expected to be available late January/early February 2019.

for growers to obtain these compounds, but the 1st generation ARs that are available at garden and farm stores are sold as a much larger bulk product and thus are more expensive to consumers. Thus, consumers are not likely to purchase these types of products for rodent control, but the growers are buying these very large (40 lb buckets) supplies for use at their sites. Usage of ARs is still high. In short, the policy changes have been less helpful for conservation of species.

iv. Dr. Wengart is currently trapping fishers and setting camera traps at both grow sites and no-grow sites, and is also evaluating reclaimed/mitigated sites to see if ongoing reclamation efforts are helping.

v. The very high cost of cleaning up/reclaiming sites, which he is actively involved in [documented in Gabriel et al. 2017 report], and the lack of funds (e.g. federal agencies) available/allocated for reclamation actions. There are still many legacy/historical grow sites that are contaminated with ARs and other chemicals. They are trying to prioritize reclamation of areas that contain fisher habitat and core areas for spotted owls.

2. **Influence of rodenticide use and predation rates on fishers in Oregon** (Barry 2018, Thesis, p. 27)
    a. The influence of the rodenticide use and predation rates on fishers in Oregon is unknown, but one indigenous female fisher has been poisoned (D. Clayton, unknown date, personal communication).
3. **Reaffirmation of indirect effects of marijuana cultivation (**Gabriel et al. 2017, Appendix D, p. 74, from presentation from 2015 Wildlife Society conference):
    a. pesticide residues in soil/water (can remain in soil months after sites are abandoned)
    b. enhanced predator movement along grower-constructed trail systems
    c. increasing congregating of species at garbage dumps within sites
4. **Reaffirmation or additional information (background information) on potential adverse effects to fishers--New Book: "Anticoagulant Rodenticides and Wildlife"** (Vanden Brink et al. 2018). Some info includes:
    a. Miscellaneous: Varying degree of toxicity of first generation ARs (FGARs) and SGARs; testing for toxicity–secondary exposure tests (where whole or ground carcasses of AR-exposed rats/mice or meat amended with ARs are provided to predators or scavengers) are "less standardized" (Rattner and Mastrota 2018, p. 51);; secondary exposure endpoints measured include death, overt signs of intoxication, blood clotting time (Rattner and Mastrota 2018, p. 59); Note: these tests have limitations; most common formulation is solid bait, which is consumed as food by rodents; alternatives include block baits, dusts, gels, and foam (van den Brink et al. 2018, p. 34).

Commented [1]: QUESTION FOR Washington FWS: Are you aware of anything or can you provide additional insight for AR use and predation in Washington?

Commented [2]: QUESTION FOR Oregon FWS: Is there anything relevant from this thesis or other information you (OR FWS) are aware of to provide additional insight for AR use and predation in Oregon?

b. ARs represent potent poisons to vertebrate species with the potential to cause harm to a number of non-target species (van den Brink et al. 2018, p. 32); risk to predators from 1st generation ARs is lower than for 2nd generation ARs (López-Perea and Mateo 2018, p. 182); 2nd generation ARs are more persistent (Heinrich and Elliott 2018, p. 230 – half-lives are presented)...***this is important relative to type of ARs found in California, etc. in order to better estimate risk of exposure to fisher.***
c. Sublethal effects (from Rattner and Mastrota 2018, pp. 68–71) – include prolonged clotting time, decreased hematocrit and anemia, gross and macroscopic evidence of hemorrhage (e.g., bruising), diarrhea, anorexia, and behavioral responses (e.g., lethargy) and perhaps more complex behavioral responses like prey capture efficiency, etc., those these have not been well-studied).
    i. Gabriel et al 2012. Found maternal transfer of ARs to young; transfer to kit that died from acute starvation and dehydration due to mother's death. {need to confirm this summary with primary literature}
    ii. Unlike some 1st generation ARs, there are some 2nd generation ARs that do not appear to undergo substantive biotransformation; thus, fecal excretion may contribute to the transfer/distribution of these compounds to the environment (Rattner and Mastrota 2018, pp. 90, 103).
d. Secondary exposure to ARs and effects on predators (Chapter 7):
    i. The ability of ARs to bioaccumulate in animal tissues and their high acute toxicity can cause the death of natural predators of rodent species (López-Perea and Mateo 2018, p. 159, *citing* Elliott et al. 2016, p. 401). "The continuous use of ARs against commensal rodents in environments can lead to long-term chronic accumulation of 2nd generation ARs in predators (López-Perea and Mateo 2018, p. 161).
    ii. What are levels in fisher liver tissue? (López-Perea and Mateo 2018, p. 170; Table 7.4: present in their table range of concentrations found in livers). For fisher, from Gabriel et al. 2012 study – says 79% of fishers had detections with mean sum of ARs of 1.610 µg/g {this is important for this threat relative to toxicity, exposure}
    iii. How does a predator use the habitat where ARs are used? (López-Perea and Mateo 2018, p. 167). {Relevant example, for marijuana grow sites} If there is an intense use of ARs for plant protection, then exposure is higher. Good summary sentence: "…how rodents contribute to the ingested biomass of a predator will determine the likelihood of exposure to ARs and the consequent risk of secondary poisoning" (López-Perea and Mateo 2018, p. 171).
    iv. Relative to discussion of mortality (Gabriel et al. 2012): study presented mortality/lethal concentration for fishers for some ARs; <u>summary point</u>:

secondary exposure to ARs in predators can be a cause of mortality (López-Perea and Mateo 2018, p. 177).

e. Spatial dimensions - risks of AR use to non-target small mammals (Coeurdassier et al. 2018, Chapter 8) {this discussion is relevant to describing exposure to prey species of predators like fisher}
    i. The exposure to ARs varies depending on the spatial heterogeneity of the environment, the spatial distribution and activity patterns of the receptor species, the properties of the landscape and/or habitat (Coeurdassier et al. 2018, p. 96, citing several references here). Summary point: to assess exposure and risk to non-target small mammals, need to consider spatial features related to the chemical(s), the receptor species, and the environment, and the multiple scales of these features (Coeurdassier et al. 2018, pp. 196-197). Common elements/conclusions from study of literature: (1) most small mammals exposed to ARs are found in the immediate vicinity (within 100 meters) of treatments; (2) as you get further away from the treatments, there is a decrease in both the frequency of occurrence of AR residues in animal populations and in tissue concentrations (Coeurdassier et al. 2018, p. 208) {possibly relate to fisher foraging distance}. More specifically, the likelihood of exposure to non-target small mammals depends, in part, on habitat preference, ability to adapt to a number of environments/habitats, home range size and mobility (though this can vary) (Coeurdassier et al. 2018, p. 212).

f. Ecological factors driving uptake of ARs in predators (Chapter 9) {discussion relevant to assessing risk [threat] based on exposure and toxicity}
    i. "The ecological factors that drive the uptake of ARs in predators and the likelihood of exposure are context specific and depend on the landscape that the predators inhabit, the management of the habitats within the landscape, and prey availability." (Hindmarch and Elliott 2018, p. 234). Preliminary data of the diversity and abundance of prey at grow sites (study underway by Dr. Wengart) suggest (though not confirmed) that the grow sites may be acting as sinks for prey (whether by attraction to 'flavored' baits, plants, or water pipelines), which could mean less prey available for fisher overall. There may also be changes to potential predators of fisher [predation represents the highest mortality risk to fisher, according to Gabriel et al. 2017, as well as other studies that we have previously cited] so that fishers may now have more direct conflict with their predators (particularly bobcat).
    ii. Generally, predators that are nocturnal, that are opportunistic in feeding habitats where rodents are an important part of their diet, that are non-migratory that live close to or within landscapes that are heavily impacted

by human activities (e.g., the grow sites) have a higher incidence of exposure and found to have relatively high liver residue concentrations of multiple AR compounds (Hindmarch and Elliott 2018, p. 251).

FIGURE 1--Likelihood of grow site presence based on MAXENT predictions using known grow site localities and several biotic and abiotic features as predictors. Red areas represent highest relative likelihood of grown sites presence, while yellow is moderate likelihood, and gree is low likelihood. Figure 6 in Gabriel et al. 2017.

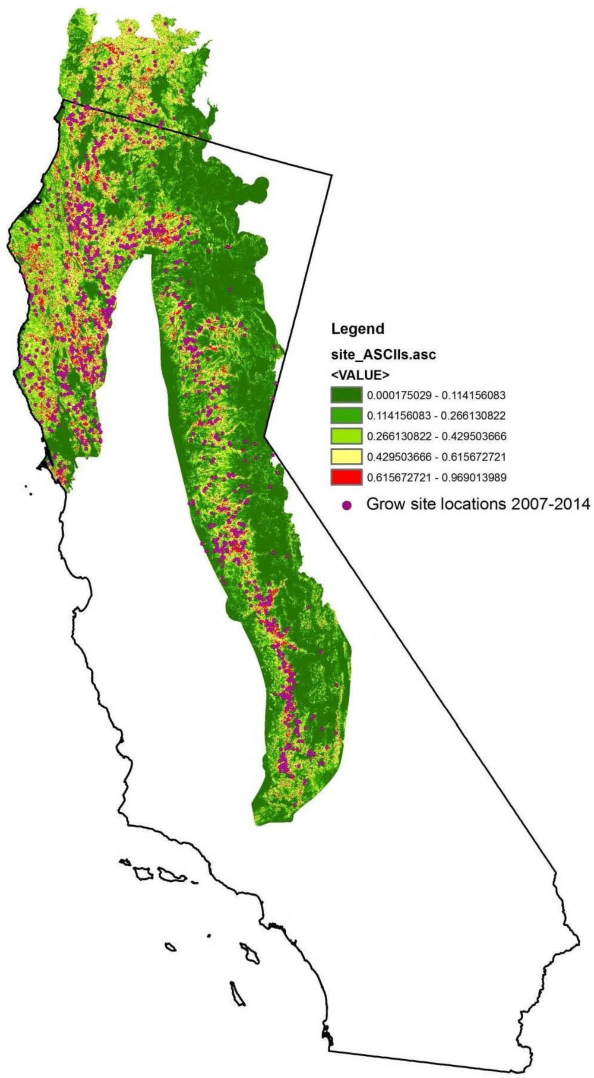


TABLE 1--Fertilizers, rodenticides, and pesticides discovered at trespass marijuana grow sites in northern California, 2014-2016. For this analysis, 77 grow sites were investigates thoroughly enough to be able to ascertain the approximate amount of these substances. The 77 grow sites also include sites visited through other projects and not necessarily funded through this Section 6 grant. AR=anticoagulent rodenticide. Table 3 in Gabriel et al. 2017.

Substance	Number of Sites at which Discovered (out of 77)	Mean Amount Discovered per site	Standard Error
Dry Fertilizer (lbs)	77 (100%)	1268.2	153.6
Liquid Fertilizer (oz)	33 (43%)	1353	554.3
Bromethalin (lbs)	16 (21%)	8.7	2.3
1st generation AR (lbs)	18 (23%)	16.7	4.1
2nd generation AR (lbs)	24 (31%)	8.6	2
Phosphide rodenticide (lbs)	12 (16%)	4.4	1.7
Carbamates (oz)	31 (40%)	48.1	8
Organophosphates (oz)	26 (34%)	82.2	17.1
Pyrethroids (oz)	42 (55%)	205.0	47.9
Avermectin (oz)	4 (5%)	90.0	56.5
Neonictinoids	3 (4%)	21.3	5.3
Molluscicide	4 (5%)	21.0	9.98

TABLE 2--List of dead wildlife found at 34 marijuana grow sites and suspected or confirmed causes of mortality. Fifteen addtional grow sites were thoroughly investigated for dead wildlife (total n=49), but none was found; thus, dead wildlife was found at 58% of grow sites investigated. Table 4 in Gabriel et al. 2017.

Marijuana Grow	Ownership/ Location	Sampling Initiated	Dead Wildlife	Field/Tox Results
Red Cap	SRNF	2013	Fisher, 2 gray fox	poison
Hobo Gulch 2013	TAW	2014	doe skull, two rattlesnakes	shot
Brush Mountain 2013	SRNF	2014	2 deer (does), 2 bears,1 thrush	Shot, poison
Oak Knob Complex	SRNF	2014	2 (3x4, 3x3)bucks, 1 bear	Shot, suspect poison
Bonta Creek	PNF	2015	2 bears,2 ground squirrels	poison
Go Road	SRNF	2015	3 gray foxes	poison
Long Valley Creek	PNF	2015	Bear, gray fox, towhee	poison
Big French 15	TAW	2015	1 buck (2x3), 1 fawn	shot
Rattlesnake Peak	PNF	2015	2 bucks (4x4)(3x3)	shot
Big French Wild	TAW	2015	2 does, 1 buck (2x2)	shot
Telephone Ridge Complex	STNF	2015	Raven	Shot
Road 16	STNF	2015	Ringtail	shot
Cedar Creek	PNF	2015	1 buck (3x3)	shot
Boat Gunwhale	IW	2015	Great horn Owl, gray fox	shot, suspect poison
Offield Saddle	KNF	2015	2 gray foxes	Suspect Poison
Mill Creek	LNF	2015	3 mice	Suspect Poison
LymeDyke1	STNF	2016	2 gray fox, 1 rabbit	poison
Potato Patch Complex	LNF	2016	Bear, gray fox, 2 vultures, 2 woodrats, 2 does	poison, shot
Antelope	TNF	2016	rabbit	poison
Screwdriver	LNF	2016	1 bear, 2 does	shot
Prairie Cr 2	STNF	2016	2 bucks (2x2)(2x3)	shot
Big French 6	STNF	2016	2 does	shot
China Peak	STNF	2016	black bear, buck (3x3)	shot
Big French 7	STNF	2016	Buck (2x2)	shot
Deer Horn	HVIR	2016	Buck (3x4)	shot
Big French 4	STNF	2016	doe, buck (2x3)	shot
Big French 2	STNF	2016	gopher snake, doe, buck (5x7)	shot
Saddle Gulch	STNF	2016	rattlesnake	shot
Wildwood	STNF	2016	Ringtail	shot
Dotty Springs	LNF	2016	gray fox	suspect poison
Gainor	SRNF	2016	bear	suspect poison
Prairie Cr 1	STNF	2016	gray squirrel	suspect poison
Hayman	STNF	2016	yellow legged frog	suspect poison
County Line	SPI	2016	woodrat (trapped)	Trapped

TABLE 3--Soil toxicology results for samples collected at trespass marijuana grow sites on Six Rivers National Forest (SRNF), Shasta-Trinity National Forest (STNF), Trinity Alps Wilderness (TAW), BLM King Range National Conservation Area, and Plumas National Forest in 2014 – 2016, Also shown is the number of days since eradication that the samples were collected, indicating long-term persistence of these toxicants in soil in many cases. Table 6 in Gabriel et al. 2017.

Grow Site Name	Ownership/ Location	Erad Year	# Samples at Eradication	Toxicology Results	# Samples Post-Eradication	Toxicology Results	# Days Since Eradication
Brush Mt 2013	SRNF	2013	0		3	NEG	>400
Huffman	TAW	2014	2		0		NA
Oak Knob	SRNF	2014	2	NEG	7	1 POS-Brodifacoum	527-569
Brush Mt 2014	SRNF	2014	6	1 POS-Brodifacoum **Not tested for Carbamates/OPs	5	1 POS-Diphacinone+ Chlorphacinone 3 POS-Carbofuran	476
Hobo 2014	TAW	2014	0		10	1 POS-Difenacoum	~574
Oak Knob Complex	SRNF	2014	0		6	1 POS-Carbofuran	>120
Telephone 1	STNF	2015	3	Negative	12	NEG	215
Telephone 2	STNF	2015	2	2 POS-Carbofuran	0		NA
Little Bear Wallow	STNF	2015	2- pooled	NEG	0		NA
Paradise	BLM King Range	2015	0		18	2 POS-Carbofuran	188
Bonta Creek	PNF	2015	1	NEG	0		NA
Hayshed	STNF	2015	0		6	NEG	230
Road 16	STNF	2015	0		12	NEG	171

Interpreting Population Growth Rates and Trends

1. **Interpreting Confidence Intervals**

[Note: there is a difference between lamba (λ) and 'r' when discussing demographic parameters for populations. r is continuous growth rate, lamba is geometric/finite/discrete growth rate; related by equation: $\lambda = e^r$. Lambda and r can be equivalent if time step is small.]

   a. General information and interpretation of 95% Confidence Intervals (CI):
      i. Confidence intervals provide a way to statistically infer your estimated value and provide a measure of precision for that estimate. If you were to conduct a study/sample a population an infinite number of times (in the case of population growth rate estimates, this generally means replicating/resampling population life history matrices via software/modeling), you would expect that 95% of the time the true value of the estimated effect/value (point estimate) will be contained within that interval. Conversely, 5% of the time, the estimate could be outside the CI range.
      ii. Another way of saying this: If you repeat a test/study infinitely many times and calculate 95% CI for the effect estimate each time you conduct the test/study, then 95% of the intervals that you calculated would contain the true effect estimate.

   b. Regarding Confidence Intervals for Population Growth Estimates:
      i. Citing/paraphrasing Nelson et al. 2010, p. e13628: [although confidence intervals that overlap lambda = 1, 'denote' a stable population]…this does not suggest that this is likely to be a stable population, but does highlight the uncertainty [that arises] from observation error alone. (This publication walks through one example of how to interpret CI values.)
      ii. Here is my (B. Grizzle) attempt to clarify a CI range (using 0.99 to 1.16): The relevant equation for population estimate (with some assumptions, e.g., deterministic model (i.e., growth rates are constant) for a population with discrete breeding periods) is $N_t = N_0 \times \lambda^t$, where N is population number at time zero or time t, and where t is the time period of interest. So, assuming a starting population of 1, for a 5-year period, if your upper 95% CI value of 1.16, plugging that into equation gives $1(1.16^5) = 2$ as the population in 5 years, which is essentially a doubling of population over 5 years, or 100% increase. Conversely, if you have a lower 95% CI value of 0.99, plugging that into equation gives $1(0.99^5) = 0.95$ as population in 5 years or a decline of 5% over 5 years.

2. How does this relate to information presented in the 2016 Species Report (relied on for the withdrawal)? On page 48, we said:
   a. *The Hoopa study area is approximately 145 mi² (370 km²) in size and represents the more mesic portion of the NCSO population area; fisher studies have been ongoing since 1996. The population trend from 2005–2012 indicates a lambda*

(population growth rate) of 0.992 (C.I. 0.883–1.100) with a higher lambda rate for females (1.038 [C.I. 0.881–1.196]) than for males (0.912 [C.I. 0.777-1.047]) (Higley et al. 2014, p. 102, Higley 2015, pers. comm.). Demographic parameters are showing a decrease in annual male fisher survival. A lambda of approximately 1.0 indicates a stable overall population trend.

b. *The Eastern Klamath Study Area is approximately 510 km² (200 mi²) in size and represents the more xeric portion of the NCSO population area. Monitoring has been conducted since 2006. Estimates for lambda from 2006–2013 are 1.06 (C.I. 0.97–1.15) (Powell et al. 2014, p. 23). This lambda of approximately 1.0 indicates a current stable population within the study area.*

c. *A recent study of radio collared fishers monitored from 2008 through 2014 in the SSN population showed the survival rate (calculated using demographic parameters) of adult males, but not females, is lower than other populations in the DPS, and estimates a lambda of 0.97 (C.I.0.79–1.16) (Sweitzer et al. 2015a, pp. 781–783; Sweitzer et al. 2015b, p. 10). A more recent analysis from this study (Sweizter et al. 2015d, p. 77), however, suggests a lower population growth rate of 0.90 (95 percent C.I. 0.71–1.12) from 2008 to 2014; however, the population growth rate was at 1.0 or above for the period from 2010 to 2014 (Sweitzer et al. 2015d, p. 77). Population growth in the SSN population area is thus estimated to trend less than 1.0; the authors suggest the population is not in persistent decline, however, but is offset by periods of stability or growth (Sweitzer et al. 2015a, p. 784).*

3. (re) Interpretation of the three studies:

[Note: there is a new publication by Furnas et al. (2017) that provides a total estimate of the native Northern California-Southwestern Oregon (NCSO) population – see *Population Abundance, Distribution, Trends---Summary of New Information/Literature since 2015* summary document]

a. Sweitzer et al. 2015 study, which is referred to as the Southern Sierra Nevada (SSN) population by the court.
    i. Some minor points of clarification: the 2016 Species Report did not accurately describe the information presented in this publication (especially Table 2, p. 779; *see below*). Also, to note, is the timing of Sweitzer's publications in 2015, this publication was submitted 24 May 2014 and accepted 11 May 2015, which is different than the Sweitzer et al. 2015d referenced discussed below.
    ii. NOTE: Court said our [withdrawal] failed to come to grips with the larger point of the Sweitzer et al. 2015 study re female survival rates. **Recommend** Sweitzer be contacted for any updates; however, he does not appear to be accessible (Stephanie is checking).
    iii. Their Table 2 (see below) presents a number of demographic parameters, such as reproductive and survival rate, fertility, and then presents at bottom of this table, their modeled estimate for lambda (0.966, 95% CI 0.786-1.155). In interpreting this finding, the authors say on page 784 (emphasis added): "Our [Leslie Matrix] model analysis **suggested slightly negative growth** (λ = 0.966) for the period of the research (Table 2). The

upper range for λ (1.155) was well above 1.0, however, **suggesting stability or growth in some years**. The estimated range for λ (Table 2) was consistent with the estimated population densities, which did not indicate a persistent decline during 4 years from 2008–2009 to 2011–2012." NOTE: these estimates are only for the Sierra National Forest, Bass Lake Ranger District population. This paper emphasized this point by stating (p. 784) "our fisher population at the north margin of the southern Sierra Nevada region in California was the only one [of other recent studies in Calif at that time] with **a growth rate trending below 1.0**." However, the 2016 Species Report also presented a "more recent" analysis from this study, Sweitzer et al. (2015d), which is not a peer-reviewed publication, but rather an Appendix to an unpublished Sierra Nevada Adaptive Mgt Project Report, dated May 3, 2015. On page 113 of the Results section of that report (Sweitzer et al. 2015d; NOT page 77 (which is page we used in the Species Report, but refers to a table of estimates in Method section)) the authors say: "The All Year survival and empirically derived demographic rates produced a λ of 0.90 (range 0.77-1.22). **While this point estimate suggests a negative growth rate**, it was encouraging that the range for the all year population growth rate extended above 1.0 (Table 34)."

Table 2, from Sweitzer et al. 2015, p. 779:

Table 2.—Information on age-specific reproductive rates and fertility used to estimate population growth rates for the fisher (*Pekania pennanti*) population in the Bass Lake Ranger District, Sierra National Forest, October 2008 to June 2013.

	Empirical estimates	Lower 95% *CI* value	Upper 95% *CI* value
Reproductive rate[a]			
Juvenile, subadult	0.000	0.000	0.000
Young adult (2 years old)	0.778	0.626	0.950
Adult (3–5 years old)	0.900	0.862	0.971
Mature adult (≥ 6 years old)[b]	0.750	0.750	0.750
Mean litter size[c]			
Juvenile, subadult	0.00	0.00	0.00
Young adult	1.40	1.02	1.50
Adult	1.62	1.28	1.90
Mature adult	1.71	1.71	1.71
Survival rates			
Kit survival in the den season[d]	0.823	0.766	0.870
Survival of adult females that weaned kits during summer[e]	0.880	0.792	0.968
Juvenile survival[f]	0.790	0.653	0.926
Juvenile (P_0)[g]	0.572	0.525	0.618
Subadult (P_1)[h]	0.724	0.592	0.856
Adult (P_{2-7})[h]	0.721	0.623	0.820
Fertility[i]			
Young adult (F_2)	0.311	0.168	0.440
Adult (F_3, F_4, F_5)	0.417	0.290	0.570
Mature adult (F_6, F_7, F_8)	0.367	0.337	0.396
Leslie matrix[j]	*0.966*	*0.786*	*1.155*

b. The Hoopa Valley Indian Reservation study, as reported/referenced as Higley et al. (2014) (reference in Admin Record); study area – Hoopa Valley Reservation in northwest California (northeast Humboldt County), encompassed within the NCSO population
    i. Study used a random effects model to determine estimates of lambda.
    ii. They report (p. 31): "The estimates for lambda indicate that the population as a whole is essentially stable while males are likely decreasing and females are possibly increasing…" (Figure 22 on page 102).
    iii. From that table (Table 24, p. 74), they estimated both combined and separate male and female lambda values:
        1. Combined λ = 0.992 (95% CI: 0.883 to 1.100).
        2. Males only: λ = 0.912 (95% CI: 0.777 to 1.0470.
        3. Females only: λ = 1.038 (95% CI: 0.881 to 1.196).
    iv. Re Capture-Mark-Recapture survival: "female apparent survival was increasing slightly from 0.73 to 0.82, while male apparent survival was decreasing substantially from 0.68 to 0.46." (p. 32)
    v. These authors also state on page 38: "The [Known Fate] and [Capture-Mark-Recapture] analysis have both shown a disturbing trend in male survival. In addition, **the annual population estimates and male only lambda estimates have indicated a declining male population**.
        1. We believe the primary reason for these declines has been AR poisoning associated with illegal marijuana growing. We believe that male fishers are at higher risk of encountering toxicants because they have much larger home ranges than females."

c. Third study (referenced by court): Eastern Klamath study, also encompassed within the NCSO population; referenced/cited as Powell et al. 2014.
    i. This is an annual report for 2013 related to reintroduction of fishers into Northern Sierra Nevada (Klamath study area) and not a peer-reviewed publication. [Note: the page number in the 2106 Species Report referencing this paper regarding population growth rate estimate is incorrect, this should be page 18, not page 23].
    ii. Study appears to use Mark-Recapture modeling to estimate demographic parameters. (pp. 17–18)
    iii. The authors stated on page 18: "We identified 22-32 individual fishers in the study area each year, totaling 125 over the entire period from 2006 through 2013. We detected between 14 and 21 new individuals each year, and 22 individuals were detected in the size-restricted study area in 2006."
    iv. "Apparent **survival rate** for fishers did not vary across years and was **0.60** (95% CI: 0.50-0.69)." (p. 18)
    v. "**Population growth rate** was estimated to be 1.06 (0.97-1.15), **suggesting** a stable or slightly growing population, which is consistent with a recruitment rate (0.45) slightly higher than the mortality rate (1 – 0.60 = 0.40)." (p. 18)

Population Abundance, Distribution, Trends---Summary of New Information/Literature since 2015

Recommendation for "Small Population Size" Discussion – recommend the section that follows be placed just prior to updated population size and trend information/discussion as an Introductory or Background paragraph. It might also be helpful to also create a "historical" vs. "current" range map to illustrate loss of habitat for fishers in North America (the 2004 Laliberte and Ripple paper estimated a 47 percent net loss in area of fisher habitat in North America, but, if needed, CFWO could construct our own analyses of this loss using detection information and ecological region mapping). However, more importantly, the revised status assessment needs to provide better interpretation of the three primary studies that the court cited in the remand. Please see separate document for details.

1. **Introduction**: In general, species that occupy a narrow geographic range with specific habitat requirements and always occur in small populations have a high conservation priority (Primack 2014, p. 158). Small populations are vulnerable to a rapid decline in their numbers and localized extinction due to the following: (1) loss of genetic variability (e.g., inbreeding depression, loss of evolutionary flexibility), (2) fluctuations in demographic parameters (e.g., birth and death rates, population growth rates, population density) and (3) environmental stochasticity or random fluctuations in the biological (e.g., predation, competition, disease) and physical environment (e.g., wildfire, drought events, flooding) (Primack 2014, pp. 252–268).

   Consideration of these three elements along with life history traits can provide an extinction vulnerability profile for the Pacific fisher. In sum, the Pacific fisher exhibits the following attributes that may limit its distribution and population growth:

a. Loss of large contiguous areas of historical habitat in combination with restriction of the species to forested habitats that has been loss or modified due to timber harvest practices, development, and large, high severity fires whose frequency and intensity are in turn influenced affected by the effects of climate change
b. Dependence on specific elements of forest structure, including microsites for denning and resting
c. Susceptibility to injury or mortality due to predation from co-occurring larger predators Susceptibility to injury or mortality, and potential loss of reproductive capacity, due to exposure to toxicants introduced into the natural environment from human activities.

Each of these vulnerabilities may separately, or together, exacerbate any of the threats described below in our analysis of the effects of stressors to the Pacific fisher.

2. New Information
   a. Furnas et al 2017; p. 12:
      i. Average fisher density across the Northern California-Southern Oregon (NCSO) range was 6.6 fishers/100 km^2 (95% CI 5.1-8.6). **Estimated total population size** was 3196 fishers (95% CI: 2507-4184).
      ii. Related information: average fall home range size in NCSO-range estimated at 8.33 km^2.
   b. Brent 2018 MS Thesis **Fisher distribution/abundance study in OR**:
      i. Page 22: "Fishers occur in fewer places than were previously believed and neither the indigenous nor the reintroduced fisher populations appear to have expanded or recovered portions of their range in Oregon beyond what was previously estimated by the US Fish and Wildlife Service."
      ii. Page 23: "We verified that **the reintroduced fisher population in the Oregon Cascade Mountains** persists but is lesser in extent than previously believed, and thus raises questions whether this should be considered a "successful reintroduction"."
      iii. Page 23 "**The introduced population appears to have contracted, shifted south, or the previous population extent was incorrectly estimated**. Fishers persist near some of the 1977 release sites, but appear to be absent from most of the Cascade Mountains...Our results suggest that fishers have had time to colonize well beyond the reintroduction area even under modest growth scenarios and have failed to do so. **Given the number and spacing of detections in the Cascade Mountains, the population appears small and relatively isolated**."
      iv. Re the 'native' population: "**The indigenous population** could be considered relatively common where they occur but were largely absent from the coastal segment of the Klamath Mountains, specifically from within the perimeter of the Biscuit Fire" (2002).
   c. From Zielinski and Gray 2018:
      i. This publication used previously developed predictive resting habitat models (fisher data collected in the mountains of the southern Sierra Nevada, and northwestern and northcentral California) and, using the most recent three cycles of Forest Inventory and Analysis (FIA) data available in each region **to estimate regional trends in resting habitat suitability** over an approximately 20-year period; that is, estimates of change in fisher resting habitat over a large portion of their range in California.
      ii. Page 905: Because resting habitat is a critical resource we hypothesize that if it is stable and sufficiently abundant, that – other things being equal – the population of fishers in the same area should also be stable, or at least not decreasing. This prediction is supported by two independent sources of fisher population monitoring data in the southern Sierra." (and they evaluated the info from those studies).
      iii. However, they caution (p. 906): factors other than resting habitat affect fisher population growth rates (e.g., predation pressure, foraging habitat, disease, poisoning), so stability in the [Resting Habitat Suitability (RHS)] over time does not guarantee that the fisher population will necessarily be

spared negative effects nor enjoy positive effects. Something other than resting habitat can be limiting the population. **Knowledge of the status of resting habitat is but one of the factors that can affect fisher population status**. A stable or increasing trend in resting habitat is a necessary, but not sufficient, condition for determining the health of a fisher population."

iv. Page 907: Examining the effects of disturbances **suggests that fire had the most obvious and negative effect** on RHS. They did not distinguish between types of fires (wild vs prescribed) in our analysis.

v. Page 907: "Contrary to the substantial effect of fire on RHS, the values before and after **harvest** were indistinguishable from the values for the plots that had no disturbance. Future analyses will likely benefit from the larger sample sizes which, in turn, will allow us to characterize whether type of harvest, silvicultural prescription or ecological goal have different effects on RHS. That there was **no effect of harvest** on RHS was surprising but agrees with the results of Sweitzer et al. (2016) who also found no evidence that extractive management activities (i.e., timber harvest) contributed to reduced occupancy or local persistence of fishers.

vi. They recommend caution relative to their interpretations.

vii. One other "stressor" that they mention in their discussion, p. 907: "We also anticipate value in applying the fisher resting habitat model to **assess the impact that the recent historic drought in California has had on forest habitat**. The drought of 2012–2015, and induced water stress, led to significant mortality of small and large trees (Asner et al., 2016; Young et al., 2017).

1. The effects of this mortality on forest structure and composition will be monitored by the USDA Forest Service over time using the FIA plot information. This information could also be used to predict values of habitat suitability via the fisher FIA-based model.
2. The result would be an assessment of the: (1) effects of drought-induced tree mortality on resting habitat and (2) effects of how implementing management actions in drought-affected landscapes change the status of fisher resting habitat.

d. R. Green Doctoral Dissertation, 2017: **Reproductive ecology study - southern Sierra Nevada population** of fisher

i. From abstract (*recommend rewriting this text and put in context of demographic trends/survival estimates*): “On average across its range, 71% of adult females reproduced (range, 40 – 100%; n = 16), parturition occurred on 25 March (range, 3 March – 17 April; n = 16), and litter size was 2.5 (range, 1 – 4; n = 16).

1. In our study area, we tracked 35 of 42 adult female fishers to 257 reproductive dens; 86% (range across years, 79 – 100%) of females attempted denning and 75% (range across years, 64 – 100%) were successful; mean parturition date was 30 March (range 17 March – 12 April; n = 69), and mean litter size was 1.57 (range, 1 – 3; n = 75).

2. **In this region, females reproduced at a rate comparable to or higher than elsewhere, gave birth at similar or later dates, but had the smallest reported litters**." [conservation implications of these findings and hypotheses for small litter size discussed later]

ii. Page 30: "Alternative explanations for small litter size include diet limitations, smaller body size, and limited genetic diversity. The fisher diet in the Sierra Nevada differs notably from that in other geographic areas." {**relates to DPS**}

iii. Page 26: "Based on studies from our literature review where individuals were monitored during parturition, the **overall mean proportion of adult females showing signs of reproduction in the wild was moderately high (72%), but dropped to 59% where success could be determined**."

iv. Also on page 26: "Data from our study area show that both the proportion of females attempting to reproduce (86%) and the proportion that did so successfully (75%) exceeded these range-wide mean values." - see paragraph below.

v. Page 21: "We monitored 42 adult females using telemetry in ≥ 1 denning season, and confirmed 35 females at reproductive dens in ≥ 1 year. **Over 7 reproductive seasons we documented 93 den opportunities, 80 den attempts (86%), and 68 den successes (75%**; Table 5); the mean proportion of females attempting to den at Kings River across all years (0.86, 95% CI = 0.79 – 0.93) was higher than the mean from our literature review (0.71; Table 3) and greater than 77% of the other studies in Table 2.".

vi. Regarding issue of **predation**, page 21: "We documented 3 confirmed den failures when females were killed by predators while away from their dens; in each case we recovered 1 live kit from a den tree, 1 of which survived long enough to be reared in captivity and successfully released."

e. From Southern Sierra Nevada Fisher Working Group meeting (Sept 2018 – notes sent by Stephanie Eyes, SFWO): Sugar Pine Project (final report 2007–2017?) (Base Lake RD and Sierra NF; collaborative study (SNAMP) with USFS, UC Berkeley; Rachel Roberts and Kathryn Purcell) [see also *Wildland Fire---Summary of New Information/Literature since 2015* handout]

i. Adult survival rate 0.71, with high annual variation across all ages

ii. Causes of mortality: 61% predation (mostly bobcat); rodenticide poisoning

iii. Success rate of breeding females: 54 percent

iv. **Population growth rate**: 0.99 (95% CI: 0.86–1.10); simulation conducted out 50 years found that rate stabilized at 0.989 at 20 years (based only on fecundity and survival, not veg. treatment)

v. Higher than average **predation** rates; produced fewer kits/litters than other North American fisher populations

f. From D. Green et al. 2017 (first study, pre-wildfires) (see additional discussion re wildland fire provided in separate document).
   i. Study concluded that (page 8): "The current modeling efforts indicate the population of fishers in the Klamath [the Klamath-Siskiyou ecoregion in northern California and southern Oregon] was relatively stable from 2006 to 2013. The abundance estimates are unchanged among years, with no statistically significant differences (95% credible intervals overlap…)." See their Table 1 below.

Table 1. Derived posterior parameter estimates of **annual population density, abundance, and population growth** of fishers in the Klamath. Parameters are presented as median [95% credible interval].

Year	Density (fishers/100 km^2)	Abundance	Lambda
2006	6.64 [4.94, 8.35]	39 [29, 49]	-
2007	6.64 [4.94, 8.18]	39 [29, 48]	1 [0.71, 1.35]
2008	6.99 [5.62, 8.69]	41 [32, 50]	1.06 [0.78, 1.4]
2009	6.47 [5.11, 8.18]	38 [29, 47]	0.92 [0.67, 1.2]
2010	5.79 [4.43, 7.33]	34 [26, 43]	0.91 [0.64, 1.21]
2011	6.47 [5.11, 8.18]	38 [28, 46]	1.09 [0.78, 1.45]
2012	6.3 [4.94, 8.18]	37 [27, 46]	0.98 [0.72, 1.33]
2013	6.99 [5.62, 8.69]	41 [32, 50]	1.11 [0.81, 1.49]

g. From D. Green et al. 2017 (second study, post wildfires) (see additional details re wildland fire provided in separate document). NOTE: The table does not include density numbers for 2014 and 2015.
   i. Study concluded that (p. 9): "Our results indicate the population of fishers in the Klamath was relatively stable from 2006 to 2013. The abundance estimates are unchanged among years, with no statistically significant differences."
   ii. Page 9: The relative stability of the overall population between 2013 and 2014 and a decline in density within the burn area suggests fishers moved outside of the burn area immediately following the fire but remained within our larger study area." (see their Table 1 below).
   iii. Pages 9-10: "The significant decline in the overall population between 2014 and 2015 appears largely driven by declines within the burned area. We suspect fishers began redistributing themselves on the landscape immediately following the fire and the significant decline observed between 2014 and 2015 was a function of a lag effect as fishers redistributed themselves on the post-fire landscape."

Table 1. Derived posterior parameter estimates of annual **population density and abundance** of fishers in the Klamath. Parameters are presented as median [95% credible interval].

Year	Density (fishers/100 km^2)	Abundance
2006	5.81 [4.09, 7.96]	27 [19, 37]
2007	6.24 [4.52, 7.74]	29 [21, 36]
2008	7.31 [5.59, 9.03]	34 [26, 42]
2009	6.67 [5.16, 8.6]	31 [24, 40]
2010	6.02 [4.73, 7.96]	28 [22, 37]
2011	6.67 [4.95, 8.39]	31 [23, 39]
2012	6.67 [4.95, 8.39]	31 [23, 39]
2013	7.53 [5.81, 9.25]	35 [27, 43]

3. Washington State Reintroductions: **Summary from Cascades Fisher Reintroduction Project – Progress Report from March 2017 to Feb 2018**

Source/citation: Lewis, J.C., T. Chestnut, J.I. Ransom, and D.O. Werntz. 2018. Cascades Fisher Reintroduction Project: Progress Report for March 2017 to February 2018. Washington Department of Fish and Wildlife, National Park Service, and Conservation Northwest, unpublished progress report. Washington Department of Fish and Wildlife, Olympia, WA. 20 pp.

[This report provides a detailed summary of progress of the fisher reintroduction project in the southern Cascade Range in Washington made from March 2017 to February 2018.]

a. Background info: Together, the Washington Department of Fish and Wildlife (WDFW), the National Park Service (NPS), and Conservation Northwest (CNW) have partnered to plan, implement, and monitor the reintroductions of fishers to the Olympic Peninsula (Lewis 2014, Happe et al. 2017 – *see original citations in document, as needed; some may already be in the admin record*) and the Cascade Range, in an effort to restore fishers to the largest portions of their historical range in Washington (Lewis et al. 2018, p. 3). The Project partners worked with the British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNRO), the British Columbia Ministry of Environment (MOE) and the Tsilhqot'in, Secwepemc, and Dakelh First Nations for approval of a permit for capture and transport, and then translocation of up to 160 fishers over 5 years to the State of Washington (Lewis et al. 2018, p. 3). The goal for this program is to re-establish a self-sustaining fisher population in the southern and northern portions of the Cascade Recovery Area (Lewis et al. 2018, p. 3), as outlined in the State's fisher recovery plan (Hayes and Lewis 2006).
b. **Summary of Progress to date**:

i. During the first year of the project (December 2015 to November 2016), 23 fishers (11 females, 12 males) were successfully captured in central British Columbia, transported to Washington, and subsequently released (four events) from December 2015 to February 2016 near the Cispus Learning Center; these 23 fishers were identified as Cohort 1 (Lewis et al. 2018, p. 5). In the second year of the project (December 2016 to November 2017), 46 fishers were captured and transported to Washington (27 females, 19 males), and 16 (8 females, 8 males) were released at the Longmire release site on Mount Rainier National Park and 30 (19 females, 11 males) were released at the Cispus Learning Center; these 46 fishers were identified as Cohort 2 (Lewis et al. 2018, p. 5). Thus, as of February 2018, a total of 69 fishers have been released in the southern Cascade Range (Lewis et al. 2018, p. 5).

c. **Project findings**:
   i. This project monitored post-release movements, survival, home range establishment, and reproduction in an effort to evaluate initial reintroduction success during the 3–4 years when fishers can be tracked with functioning radio-transmitters (Lewis et al. 2018, pp. 5–12). Study of home range establishment provided the researchers with supporting information of habitat suitability for reintroduced fishers and was used as an initial measure of reintroduction success (Lewis et al. 2018, p. 10). Initial findings indicate the following:
      1. Post-release movements indicated that the mean distance to all telemetry locations for Cohort 1 male and female fishers was approximately 25 km (15.53 mi) from the Cispus release site (Lewis et al. 2018, p. 10). Researchers concluded that this observed mean distance suggests that many fishers used areas relatively close to the Cispus release site and the center of the recovery area, which may help to ensure survival of individuals since extended movements away from a release site are associated with greater mortality risks (Lewis et al. 2018, p. 10). For Cohort 2, the mean distance was slightly smaller for Cohort 2 females and substantially smaller for Cohort 2 males, which was likely due to presence of Cohort 1 animals (Lewis et al. 2018, p. 10).
      2. Regarding home range, for Cohort 1 fishers, the study identified 9 of 11 females (82 percent) and 5 of 12 males (42 percent) that appeared to establish a home range (Lewis et al. 2018, p. 10). Of the 9 females, 8 established home ranges within or partly within the recovery area, and all 5 males established home ranges within or partly within the recovery area (Lewis et al. 2018, p. 10). For Cohort 2, the study identified 8 of 27 females (30 percent) and 8 of 19 males (42 percent) that appeared to establish a home range in their first year, with all 8 females and 7 of the 8 males establishing their

home ranges within the recovery area (Lewis et al. 2018, p. 10).

3. Regarding survival and mortality, the study documented, as of February 2018, a total of 21 mortalities, and recovered the remains or a transmitter (or both) for 17 of these (Lewis et al. 2018, p. 11). Of these 17 mortalities, the researchers determined the cause of death for six recovered fishers, which included predation (two females), vehicle collision (one female), injury/broken-back (one female), starvation following an injury (one female), and infection of wound following a fight (one male) (Lewis et al. 2018, p. 11). The cause of death for the remaining 11 fishers, the cause of death was unknown for 7 animals, and unknown/possible predation for the other four fishers (Lewis et al. 2018, pp. 10–11).
4. The study did not document reproduction for Cohort 1 females in the spring of 2016, but did document reproduction by one female (released in 2016) in May/June of 2017, and suspected, but not confirmed, reproduction by another female in 2017 (Lewis et al. 2018, p. 12).

d. During the spring of 2018, the project was expected to continue to conduct flights to focus on obtaining locations for females in an effort to document denning and reproductive success in Year 3, remote cameras will be installed at suspected den sites to confirm reproduction (Lewis et al. 2018, p. 16) [*Do we have any preliminary results?*] In addition, the study is investigating the acquisition of fishers from an Alberta source population (since acquiring animals from British Columbia is no longer an option) to continue the reintroduction project in the North Cascades and to complete releases in the south Cascades (Lewis et al. 2018, p. 16).
e. **UPDATE** – from Zach Radmer via Jeff Lewis (WDFW) (email sent to Dan Russell and Betty Grizzle, dated December 3, 2018): On October 27, 2018, 4 additional fishers (2 male 2 female) were released at Mt. Rainier National Park. WDFW plans to release 7 more into the South Cascades this winter, which will supplement the individuals released 2015-2017. On December 5, 2018, 8 fishers will be released into the North Cascades from Newhalem (Alberta). WDFW plans to release at least 32 more into the North Cascades this winter.

4. <u>Ancillary information</u> that might be relevant to potential changes in predator numbers and incidental trapping (and, thus, populations of fisher) **and** potential reduction of exposure to toxicants:

a. Settlement agreement from Northern District of California (Case No. 3:17-cv-3564-WHA) U.S. Department of Agriculture Wildlife Services (Wildlife Services) has agreed to interim measures within the North District, including 1) not using EPA-labeled pesticides targeting mammals, 2) not to use body-gripping traps, glue traps, or spring-powered harpoon traps in Wilderness Areas and Wilderness Study Areas, and 3) not to conduct aerial operations in

Wilderness Areas and Wilderness Study Areas, pending environmental analysis of wildlife management activities in California's North District.

5. Additional new information related to fisher habitat use (relates to avoiding predation)
   a. Aubrey et al. (2018): investigated selection of rest structures and microsites by fishers in southern Oregon (study area – upper Rogue River drainage)
      i. Background: "When fishers are not actively hunting or traveling, they use protected sites for resting that help them conserve energy, avoid predation, gain thermoregulatory advantages, and consume prey safely (Lofroth et al. 2010, Raley et al. 2012)." (p. 2)
      ii. Found that the most important characteristics of snags with cavities and logs with hollow ends was whether snags or logs were in moderate stages of decay, and also whether they were relatively large in diameter at breast height (for snags) or the diameter measured 3 meters from the large end (for logs) (p. 1).
      iii. Found that suitable rest microsites for fishers were uncommon in study area and might be a limited resource (p. 1).

<u>RE this stressor discussion</u>:

1. Recommend restructuring the wildland fire analyses such that effects to fisher habitat from vegetation management actions related to fire prevention/suppression are presented as Factor A discussion. Wildland fire itself would be separate stressor discussion under Factor D discussion (see discussion and new information/new analyses below) and should include any studies that may provide insights into effects to prey of fisher (example reference: Bond 2015).

2. Relatedly, recommend developing a separate synergistic discussion of wildland fire/tree mortality/climate change (esp. drought events) from recently released/published documents, some of which is summarized below.

Wildland Fire---Summary of New Information/Literature since 2015

1. Background: CFWO created an updated populations map for the Pacific Fisher using map data presented in the previous proposed rule (Yreka FWO) combined with reintroduced population area for fishers in Washington State (data provided by Lacey FWO).
    a. **New CFWO spatial analysis** specific for fisher population areas begins on page 20 of this document)
    b. <u>Not presented here</u>: other background information (few paragraphs) on fire history in CA, southern Oregon, and Washington.

2. New general information on this topic

    a. More recently, wildland fires in California have burned more area, have occurred more frequently, often due to human ignitions (Balch *et al*. 2017, p. 2,946), and, in some areas of the State, have increased in severity due to warmer temperatures and prolonged drought conditions/decreased precipitation (Wehner *et al*. 2017; Holden *et al*. 2018).

    However, Hanson and Odion 2016 (entire) assessed reference conditions in low- to mid-elevation Sierra Nevada forests. Their findings: "Based on evaluation of all forest inventory data conducted in 1910 and 1911 by the US Forest Service, we found considerable evidence for substantial portions of large areas affected by high-severity fires [an average of 26% high-severity fire effects] …" "Moreover, it was clear that mixed-severity fire regimes were characteristic of ponderosa pine and mixed conifer forests of the western slope of the central and southern Sierra Nevada **before fire suppression**. Therefore, our findings were contrary to hypotheses articulated in North et al. (2009), Collins et al. (2011), Fulé et al. (2014), Stephens et al. (2013), and recent modeling (Mallek et al. 2013) that high-severity fire was relatively rare in forest in this mountain range before fire suppression, and ranged from 4–13% (Mallek et al. 2013)."

    b. Coppoletta et al. 2016 (p. 686): This study used field plots established after four fires occurred in the northern Sierra Nevada, California, between 2000 and 2010, that were subsequently reburned in 2012. The study results suggest "high-to moderate-severity fire in the initial fires led to an increase in standing snags and shrub vegetation, which in combination with severe fire weather promoted high-severity fire effects in the subsequent reburn. Although fire behavior is largely driven by weather, our study demonstrates that post-fire vegetation composition and structure are also important drivers of reburn severity."

3. Effects to fisher/fisher habitat

   a. Suggestion for background information: In North America, fishers use both microsite and structural features within mature and late-successional mixed conifer forests for denning and resting habitat (Raley et al. 2012, p. 1 (*admin record does not have final publication*), Weir et al. 2012, p. 234; Zhao et al. 2012, p. 113; Aubry et al. 2013, p. 966; Green 2017, p. 10; Aubry et al. 2018, p. 2), areas that are at higher risk of large forest fires (Thompson et al. 2011; Kane et al. 2015 – *need citations*). For example, in a recent study of fisher population in the southern Sierra Nevada region, at the microsite scale, both male and female fishers rested in tree cavities, branch platforms, broken top platforms (collectively, 82.9 percent), as well as burrows and log cavities (Green 2017, p. 62). This study found that all but two females used tree cavities for both natal and maternal den microsites (two used late maternal dens in hollow logs) (Green 2017, pp. 21, 62), which the study found (using temperature data loggers) to provide good insulation from ambient, cold temperatures (Green 2017, p. 142). At the structure scale, this study found that both males and females rested in live conifers, live hardwoods, and conifer snags, and denning females used live hardwoods, live conifers and conifer snags (Green 2017, p. 62).

   b. New information related to wildland fire effects to fisher:
      i. **Barry 2018 MS Thesis (OR study)**, p. 25: "Wildfire has previously been identified as a threat to fisher habitat and conservation (USFWS 2014) but the relationship between fishers and fire is poorly understood. Nevertheless, habitat is likely rendered unsuitable for fishers when stand-replacing fire removes canopy cover at large spatial scales and reduces the prevalence of structural elements required for rest and den sites (Weir and Harestad 1997, Weir and Corbould 2010, Aubry et al. 2013)."
         1. Re Biscuit Fire (p. 25): "The absence of fisher detections from within the area of the Biscuit fire is of concern...The Biscuit Fire, however, appears to have been unusually large and severe for the Klamath-Siskiyou region based on estimates of crown damage (Odion et al. 2004) and area affected by surface fire (Campbell et al. 2007, Thompson and Spies 2009). In total, the Biscuit fire burned over 2,020 km^2, of which 1,861 km^2 were within Oregon (Azuma et al. 2004), representing ~25% of the indigenous fisher population range in Oregon."
         2. Page 26: "The absence of fisher detections from within the Biscuit Fire and the burning of a substantial additional component of the range of fisher in Oregon during the 2017 fire season indicates that fire poses a potential danger to the stability and recovery of fisher

populations in Oregon. A fire of similar size and severity to the Biscuit could affect much of the remaining habitat available to fishers in either population." [p. 26: "the 2017 wildfire season in southern Oregon burned 10 % of the indigenous range and 3 % of the introduced range"]

ii. From Zielinski and Gray 2018 (*Using routinely collected regional forest inventory data to conclude that resting habitat for the fisher (*Pekania pennanti*) in California is stable over ~20 years*), p. 907: "Sweitzer et al. (2016) also found that occupancy of sample units by fishers trended lower among those units that had been burned by either prescribed burning or wildfire. Nonetheless, the sum of their research did not identify a consistent negative effect of fire on fisher habitat use. Truex and Zielinski (2013) found that predicted resting habitat was significantly lower for a combination treatment of mechanical thinning plus fire but the controls didn't differ from the fire-only or the mechanical-only treatment. The lack of significant effects of fire was probably because the fire treatments in that study were from prescribed fire only."

iii. **Bomdahl 2018 MS Thesis (Utah State Univ)**: Study examined effects of fire on fisher habitat, via modeling in Sierra NF and Yosemite NP (latter not occupied by fisher).
   1. Page 72: Results suggest that the variables of forest structure that fishers (appear to) consider when selecting suitable denning habitat are maintained in burned forests, though primarily those with low-severity conditions. [*To note, this study evaluated fisher habitat at intermediate scale (within home-range scale), not at microsite scale*.]
   2. Page 79; Author says that the question that remains unanswered is whether the microsite features (e.g., snags, dead stems, hardwood density) occupied by fishers for denning and resting are maintained after burning.

iv. **D. Green et al. 2017** (not yet published article; authors say results are preliminary: *The effects of mixed-severity wildfires on fisher (Pekania pennanti) population dynamics; Baseline report of population dynamics **pre-wildfires***):
   1. Study monitored fishers in a portion of the Klamath-Siskiyou ecoregion in northern California and southern Oregon to investigate the effects of wildfires on fisher populations; developed a spatial capture-recapture model to determine the effects of the two perturbations (i.e., wildfire, translocation) on the population demography of fishers (pp. 3, 5).
   2. Page 8: (related population information) Study identified a total of 139 unique individuals from 2006 to 2013, with 27.0 ± 3.4 individual fishers detected each year.

3. Page 8: Results from the spatial capture-recapture model found that the population of fishers in the study area was "relatively stable before the fires occurred and for the three years immediately following the removal of fishers for translocations." Thus, "The current modeling efforts indicate the population of fishers in the [study area] was relatively stable from 2006 to 2013." Page 9: Both our current results and previous work indicate a stable population of fishers in [this study area] before the wildfires occurred in 2014, and for up to 3 years following the translocation efforts."

v. D. Green et al. 2017 (**post-fire study,** *The effects of mixed-severity wildfires on fisher (Pekania pennanti) population dynamics*)
   1. Page 5: This study "evaluated the effects of removing fishers on population dynamics in Klamath with a spatial Jolly-Seber open population model." [see summary above for details on study area]
   2. This study used non-invasive sampling techniques and individual identifications with genetics;
   3. Page 8: (related population information) They identified "a total of 178 unique individuals from 2006 to 2015, with 28.1 ± 3.8 individual fishers detected each year. Fishers were detected at multiple sampling units each year (1.7 ± 0.2). Interannual re-capture rates were also fairly stable over time; 15.8 ± 2.9 individuals sampled each year had been identified to be present in previous years."
   4. Page 8-9: "The spatial Jolly-Seber model indicated the population of fishers in the Klamath was relatively stable before the fires occurred and for the three years immediately following the removal of fishers for translocations."
   5. Page 9: "The fisher population declined after wildfires between 2014 and 2015…., with notable decreases within the burn area in both 2014 and 2015… Fisher density was affected most by >50% change in canopy within the burn area between 2013 and 2015…"
   6. Page 9: Study concluded: "The relative stability of the overall population between 2013 and 2014 and a decline in density within the burn area suggests fishers moved outside of the burn area immediately following the fire but remained within our larger study area."
   7. Further conclusion, pp. 9-10: "The significant decline in the overall population between 2014 and 2015 appears largely driven by declines within the burned area. We suspect fishers began redistributing themselves on the landscape immediately following the fire and the significant decline observed between 2014 and 2015 was a function of a lag effect as fishers redistributed themselves on the post-fire landscape."
   8. Additionally, p. 10: "We also found fisher densities declined across all levels of fire severity and densities declined the most in regions with more than 50% change in canopy cover. Thus,

wildfires where canopy declines by more than 50% will have the largest, negative effect on fishers."

vi. From Southern Sierra Nevada Fisher Working Group meeting (Sept 2018 – notes sent by Stephanie Eyes, SFWO; additional summaries below) Yosemite study area (Erika Blomdahl and Jim Lutz) – Is fisher habitat maintained in forests that have been altered by **fire suppression**? Do **burned areas** contain the habitat elements required by fishers? Study modeled fisher den habitat using regression models [these results include new life history information for predicting den presence]
   1. Low severity vs. high severity – study found that places that burned at high severity did not have suitable den characteristics (low den probability); low severity fire can be beneficial for maintaining den characteristics that fishers select for
   2. Study did not look at microsite characteristics, but concluded that it was important to manage for 'tall trees'

[NOTE: There may also be relevant and new references cited in the most recent California spotted owl SSA Report. (e.g., Jones, G. M., R.J. Gutiérrez, D.J. Tempel, S.A. Whitmore, W.J. Berigan, and M.Z. Peery. 2016. Megafires: an emerging threat to old-forest species. Frontiers in Ecology and the Environment 14:300–306.)]

4. Other Effects – Tree Mortality (fire, drought, bark beetles)
   a. Stephens et al. 2018 (*Drought, Tree Mortality, and Wildfire in Forests Adapted to Frequent Fire* advanced access publication)
      i. This article summarizes research to help understand the near- and longer-term effects of a massive tree mortality event in frequent fire (FF) forests in California (p. 2).
      ii. It presents data and results from the 2015 Rough Fire (southern Sierra Nevada) to illustrate how drought-induced tree mortality affected fire behavior (p. 2).
      iii. Article provides some good background information re tree mortality in Sierra Nevada and useful graphics as to how vegetation and fuel dynamics are altered due to severe tree mortality from bark beetles
         1. "Tree mortality has long been known to play an important role in altering fuel dynamics within forests." (p. 2).
         2. "Unprecedented Sierra Nevada tree mortality has rapidly occurred after a severe drought with effects compounded by forest densification from decades of fire suppression. In the central and southern Sierra Nevada some areas have experienced more than 90% tree mortality, producing extensive landscapes of standing dead trees." (p. 9)
      iv. General conclusions:
         1. "In the first decade, wildfire severity in bark beetle killed FF forests may be little affected over current conditions. Other than a brief increase during the "red phase" when most dead needles are still on recently killed trees, the reduction in canopy fuels is

counterbalanced by an increase in surface fuels" (pp. 9-10). But, "current conditions in the majority of mixed-conifer and yellow pine forests in California already consist of unnaturally high surface fuel loads and corresponding elevated fire hazards" (p. 10)

2. "The more troubling projection is how extensive loading of large-sized woody fuels in future decades may contribute to dangerous mass fires beyond the predictive capacity of current fire models. These fires can generate their own wind and weather conditions and create extensive spotting, making fire behavior and its impact on structures and public safety difficult to manage and predict. In addition, such intense fires could prevent forests from becoming re-established." (p. 10)
3. [Without these 'legacy' live trees], large unburned areas of dead trees may also produce unusual forest succession patterns. These patterns will likely favor shade-tolerant and hardwood tree regeneration, limited shrub growth, and accumulating large woody fuels that would likely kill regenerating forests when wildfire inevitably occurs." (p. 10)
4. "For long-term adaptation to climate change, we highlight the importance of moving beyond triage of dead and dying trees to making "green" (live) forests more resilient." (p. 1).

b. Berner et al. 2017: (*Tree mortality from fires, bark beetles, and timber harvest during a hot and dry decade in the western United States (2003–2012)*)
   i. Study **estimated tree mortality from fires and beetles** in western U.S. using tree aboveground carbon stock and disturbance data sets derived largely from remote sensing. They quantified tree mortality from harvest using data from Forest Service reports.
   ii. "Tree mortality from harvest was concentrated in Washington and Oregon, where harvest accounted for ~80% of [mortality from harvest, beetles, and fires] in each state." (p. 1)
   iii. Tree mortality from beetles occurred widely at low levels across the region, yet beetles had pronounced impacts in Colorado and Montana, where they accounted for ~80% of [mortality from harvest, beetles and fire]. (p. 1)
   iv. "Tree mortality from fires was highest in California..." (p. 1)
   v. "Drought and human activities shaped regional variation in tree mortality…and [r]ising temperatures and greater risk of drought will likely increase tree mortality from fires and bark beetles during coming decades in this region." (p. 1)
   vi. Useful graphic from this report (p. 7):

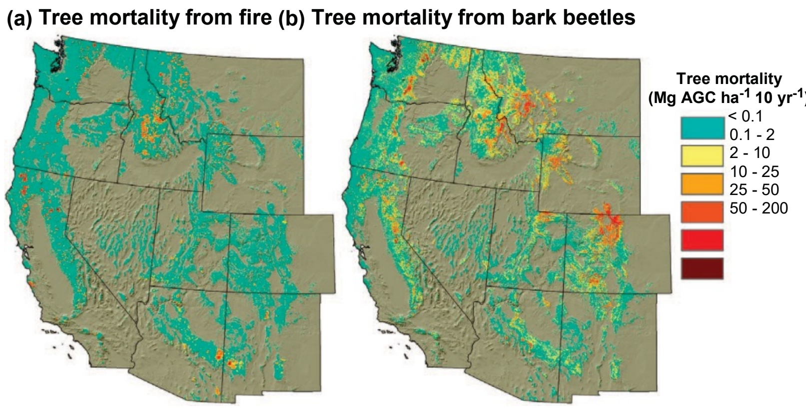


Figure 4. **Cumulative tree mortality due to (*a*) fires and (*b*) bark beetles from 2003–2012** on forestland in the western United States. Tree mortality was quantified as the amount of aboveground carbon (AGC) stored in tree biomass killed by disturbance (e.g. Mg AGC ha^{-1}). Note that (*a*) tree mortality from fire was concentrated in northern California, central Idaho, and southern Arizona/New Mexico, whereas (*b*) tree mortality from bark beetles occurred widely at low levels, but was highest in northern Colorado and western Montana.

c. Hart et al. 2018 (*Area burned in the western United States is unaffected by recent mountain pine beetle outbreaks*)
   i. Summary points (p. 1)
      1. Contrary to the expectation of increased wildfire activity in recently infested red-stage stands, we found no difference between observed area and expected area burned in red-stage or subsequent gray-stage stands during three peak years of wildfire activity, which account for 46% of area burned during the 2002–2013 period.
      2. Although [mountain pine beetle] infestation and fire activity both independently increased in conjunction with recent warming, our results demonstrate that the annual area burned in the western United States has not increased in direct response to bark beetle activity.

d. Hicke et al. 2016 (*Recent Tree Mortality in the Western United States from Bark Beetles and Forest Fires*)
   i. This is a broad-scale study across western U.S. that "used two recently developed data sets to estimate the amount of mortality area (canopy area of killed trees) from forest fires [MTBS or Monitoring trends in burn severity]and bark beetle outbreaks (NOTE: CFWO used the MTBS data set for its analyses)
   ii. Selected summary points (p. 146):
      1. "Forest fires caused lower tree mortality in the western United States than bark beetles."
      2. "The peak years of mortality caused by fires were 1988, 2000, 2002, 2003, 2006, 2007, and 2012, in which about 0.45– 0.6 Mha of trees were killed annually."

3. "Fires were less damaging to forests in earlier years of the study period, with only fires in 1988 causing substantial (0.5 Mha) mortality; annual average mortality area was 0.11 Mha/year before 2000. In contrast, mortality area has been notably higher since 2000 (0.32 Mha/year), but still less than that from bark beetles."

iii. "Examples of extensive forest fires include… the Biscuit Fire in southern Oregon [ponderosa pine forest type] and… the Tripod Complex in northern Washington in 2007 (lodgepole pine forest type)." (p. 146)

e. Meigs et al. 2016 (*Do insect outbreaks reduce the severity of subsequent forest fires?*)
   i. Study presents present a regional census of large wildfire severity following outbreaks of two prevalent bark beetle and defoliator species, mountain pine beetle and western spruce budworm across the US Pacific Northwest (forested areas of OR and WA)
   ii. Page 1/Abstract (online publication) Found that "insects *generally reduce the severity* of subsequent wildfires."
      1. "…both insects decrease the abundance of live vegetation susceptible to wildfire at multiple time lags. By dampening subsequent burn severity, native insects could buffer rather than exacerbate fire regime changes expected due to land use and climate change."

f. From Southern Sierra Nevada Fisher Working Group meeting (Sept 2018 – notes sent by Stephanie Eyes, SFWO, uploaded to shared drive)
   i. Tree mortality mapping research underway (presented by Carlos Ramirez): using Landsat images to produce tree mortality maps; unclear how this relates to "fisher strategy."
   ii. Stress response of fishers to climate change and tree mortality, Kings River study area (Jenny Kordosky; also presented at July 2018 Martes Symposium): using model selection, found that levels of tree mortality within a fisher's home range significantly influenced cortisol levels across three home range estimators.
      1. Chronic stress can affect reproduction, survival, body condition
      2. Fishers prefer late-successional forest in the core of their home ranges
      3. Cortisol levels have risen over last few years, 2014 to 2016
   iii. Tree mortality and fisher habitat selection study in Kings River study area (Kathryn Purcell)
      1. Percent of tree mortality increased significantly from 2015 to 2017
      2. Fishers found in areas with lower percent tree mortality; fishers avoid edges; found closer to streams (more live trees)
   iv. Sugar Pine Project (final report) (Base Lake RD and Sierra NF; collaborative study with USFS, UC Berkeley; Rachel Roberts and Kathryn Purcell)

1. Study question/objective: Do current rates of survival and reproduction allow fishers to persist in Sierra Nevada with active **forest (vegetation) management** to reduce fuels and risk of severe wildfire?
2. Population growth rate simulation conducted out to 50 years found that rate stabilized at 0.989 at 20 years, but this is based only on fecundity and survival, not veg. treatment
3. Fishers said to be less likely to be detected (in grid cells) with greater percent impacted by harvest or thinning call during the year of management, with percent harvest having greater effect on fisher behavior than percent thinned
4. Tree mortality impacts unknown
5. Fishers may be tolerant of forest management as long as treatment duration and scope is limited and critical structure (large oaks, conifers with 'defects'/damage) is retained

5. Other Effects – Synergistic and other effects to forests (wildland fire, drought, and projections of climate change effects)
    a. Buotte et al. 2018 (*Near-future forest vulnerability to drought and fire varies across the western United States*)
        i. Study used Community Land Model to simulate forest drought stress and fire; developed metrics of forest vulnerability to drought (western U.S.)
            1. Publication "represented future vulnerability to fire based on the difference in simulated future (2020–2049) minus simulated past (1980–2009) area burned weighted by the future area burned." (p. 5)
        ii. "Forest vulnerability to drought stress between 2020 and 2049 varies widely across the western United States …. Low drought vulnerability, covering 64% of the domain…is expected across most of the coastal and western Cascade regions…" (p. 7)
        iii. Future forest vulnerability to fire: "Future area burned is expected to increase under both climate projections…, primarily in the Sierra Nevada and Rocky Mountains." (p. 7)
        iv. "Between 2020 and 2049, most (82%) of the western United States is predicted to experience low vulnerability to fire regardless of climate projections" [see Figure 5 and Table 1 below]. "High fire vulnerability, covering 14% of the domain, is primarily expected in the intermountain region, the Sierra Nevada, and Klamath Mountains." (p. 7)
        v. "The coastal Douglas fir, hemlock/cedar, and redwood forest types are expected to experience low vulnerability to drought or fire… All other forest types are expected to experience high vulnerability to drought or fire in at least 10% of their range, regardless of climate projections." (p. 9)
        vi. "Widespread vulnerability to drought or fire, and therefore elevated risk of forest mortality, is expected in the Rocky Mountains, Sierra Nevada, Southwest, and Great Basin regions of the western United States. (p. 11)
        vii. "Under future climate conditions represented by two general circulation models and the highest CO_2 scenario (RCP 8.5), forest vulnerability to drought-related and fire mortality is likely to continue at recent levels or increase in the near future, depending on location and environmental conditions." (p. 11)

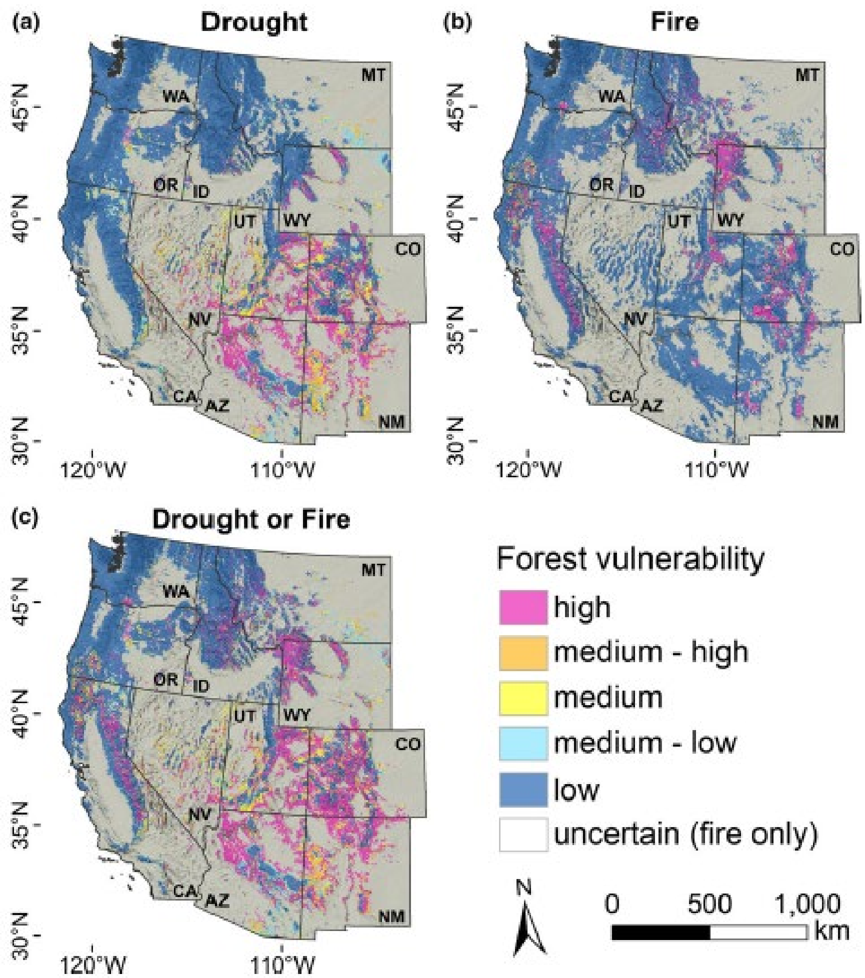


FIGURE 5 Vulnerability of forested areas during 2020–2049 to (a) drought, (b) fire, and (c) either drought or fire. Colors indicate agreement between CLM simulations with two climate projections, where one GCM low and one high (uncertain) = gray, both GCMs low = dark blue, one low one med = cyan, both medium = yellow, one medium one high = orange, and both high = magenta

TABLE 1 Forested area (km^2) in each drought, fire, and total (maximum of drought or fire) vulnerability category during 2020–2049

	Uncertain	Low	Medium–Low	Medium	Medium–High	High
Drought	0	815,600	108,960	86,960	63,248	201,936
Fire	13,728	1,046,160	33,840	17,680	25,520	139,776
Total	0	651,616	118,544	93,952	75,184	337,408

Note. Categories reflect agreement between CLM simulations run with two climate projections, as described in the main text.

Figure and Table from Buotte et al. 2018.

b. Halofsky et al. 201X (*Changing wildfire, changing forests: a synthesis on the effects of climate change on fire regimes and vegetation in the Pacific Northwest*, in press, to be produced as a Forest Service GTR publ.)
   i. Presents a state-of-science report on **potential effects of changing climate and fire regimes on forests in the Pacific Northwest** (note: paper provides valuable and timely background information on this topic)
      1. For example: "In 2014, a record was set for the largest wildfire in Washington State history, the 103,640-ha Carlton Complex Fire. One year later, 2015 was a hot year with very low snowpack across the Pacific Northwest, and 688,000 ha were burned in Oregon and Washington, with over 3.6 million ha burned in the western United States. Several fires in 2015 occurred in west-side conifer forests, including a rare fire event in coastal temperate rainforest on the Olympic Peninsula. In some areas, increased area burned has resulted in short-interval reburns." (Gifford Pinchot National Forest in southwestern Washington; SW Oregon) (p. 4)
   ii. "Evidence is strong that a warming climate will profoundly affect future wildfire and associated ecological disturbances in the Pacific Northwest by the mid-21st century. However, uncertainties remain, for example, about the influence of future human behavior on fire and vegetation, potential effects of higher concentrations of carbon dioxide on forest productivity, and effects of repeated fire and drought on forest regeneration." (p. 4)
   iii. Paper presents overview of climate projections for region
   iv. **Fire projections under climate change**: "Overall, mechanistic model simulations for the Pacific Northwest suggest that both fire frequency and area burned will increase in the future. Fire severity may also increase, depending partly on forest composition, structure, and productivity over time. Warmer temperatures in winter and spring, and increased precipitation during the growing season (even early in the growing season), could increase forest productivity." (p. 14)
      1. "Future increased fire frequency without increased vegetation productivity is likely to eventually result in decreased fire severity (see section 4). However, in highly productive ecosystems such as forests west of the Cascade Crest, future fires will probably be both more frequent (compared to the last century) and of high severity (Halofsky et al. in press, Rogers et al. 2011)." (p. 14)
   v. Report presents discussion of "stress complexes" or combinations of abiotic and biotic stressors (e.g., interactions between insects, drought events, and fires)
      1. Related to tree mortality: "…multiple stressors are generally required to kill large numbers of normally drought-tolerant tree species. No evidence exists to date of specific interactions between large-scale tree mortality events and fire, other than the effects of a short-term increase in fine (dead) fuels. Although fuels may be

elevated for several years after mortality events, it is uncertain whether they would be a long-term contributor to fire severity." (p. 20)

vii. Report presents discussion of climate change on post-fire processes (e.g., forest regeneration, interactions with hydrological processes

viii. Tables 2-4 [*not copied here*] present "a summary of the authors' **conclusions on the potential risks** to natural resource management associated with climate-fire interactions discussed in this paper: wildfire frequency, extent, and severity, reburns, stress interactions, regeneration, and hydrologic interactions for moist coniferous forest (low to mid elevation) (table 2); dry coniferous forest and woodland (low to mid 1142 elevation) (table 3); and subalpine coniferous forest and woodland (high elevation) (table 4). The likelihood, magnitude of consequences, and confidence in inferences are described for each risk." (p. 26)

1. Overall, for Pacific Northwest forests: "climate-fire risks in moist coniferous forests are low, except for hydrologic risks." (p. 26). "…risks in dry coniferous forest and woodlands are high for increased fire frequency, extent, and severity." "Increased fire frequency and extent in lower-elevation forests with climate change will likely spread to higher-elevation systems, resulting in moderate risks there." (p. 26)

c. Note: The Coastal Marten SSA Report (July 2018) contains discussion of Wildfire and Climate Change stressors for northern coastal California and southwestern Oregon.

i. For example: "Fires are a regular occurrence outside of the high severity fire regime and in southwest Oregon and northwest California portion of the historical range, where the southern 3 marten population areas occur. We used Gradient Nearest Neighbor (GNN) data (Davis *et al.* 2015, pp. 9–26; Cohen *et al.* 2018, entire; LEMMA 2018, entire) to quantify fire and other disturbance events in all forest age classes in each of the population areas as well as the coastal marten historical range between 1987 and 2016…" (p. 57)

ii. The type of analyses presented in this report would require updating range maps and/or suitable habitat maps for Pacific fisher.

d. Spies, T.A.; Stine, P.A.; Gravenmier, R.; Long, J.W.; Reilly, M.J., tech. coords. 2018. *Synthesis of science to inform land management within the **Northwest Forest Plan area***. Gen. Tech. Rep. PNW-GTR-966. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 1020 pp. 3 volumes

i. Chapter 2 contains discussion of CC and Wildland Fire, including sections titled: 20th-Century Climate Change in the Northwest Forest Plan Area (background information) and Projecting Climate Change for the 21st Century (future projections)

ii. From page 50: "The effects of recent fires have been extremely variable across the region, with most recent fire activity occurring in the Klamath Mountains, eastern Cascades, and western Cascades of Oregon (fig. 2-7)." [*copied below*]

iii. "The annual area burned increased in most vegetation zones since the mid-1980s, but dry vegetation zones, including ponderosa pine, Douglas-fir, and grand fir/white fir, experienced less fire than they would have during presettlement times because of fire suppression (Miller et al. 2012, Reilly et al. 2017) (see chapter 3 for more discussion)." (p. 50)

iv. "Mean and maximum fire size from 1910 to 2008 increased in northwest California (Miller et al. 2012)." (p. 50)

v. Although the area burned has increased in all major vegetation zones [since the mid-1980s], there is little evidence that the proportion burning at high severity has increased across the region (Law and Waring 2015, Miller et al. 2012, Reilly et al. 2017)." (pp. 50–51)

vi. "Although they found no increase in the proportion of high-severity fire, Reilly et al. (2017) found that increases in high-severity patch size during this time were associated with more area burned during drought years in all major vegetation zones." (p. 51)

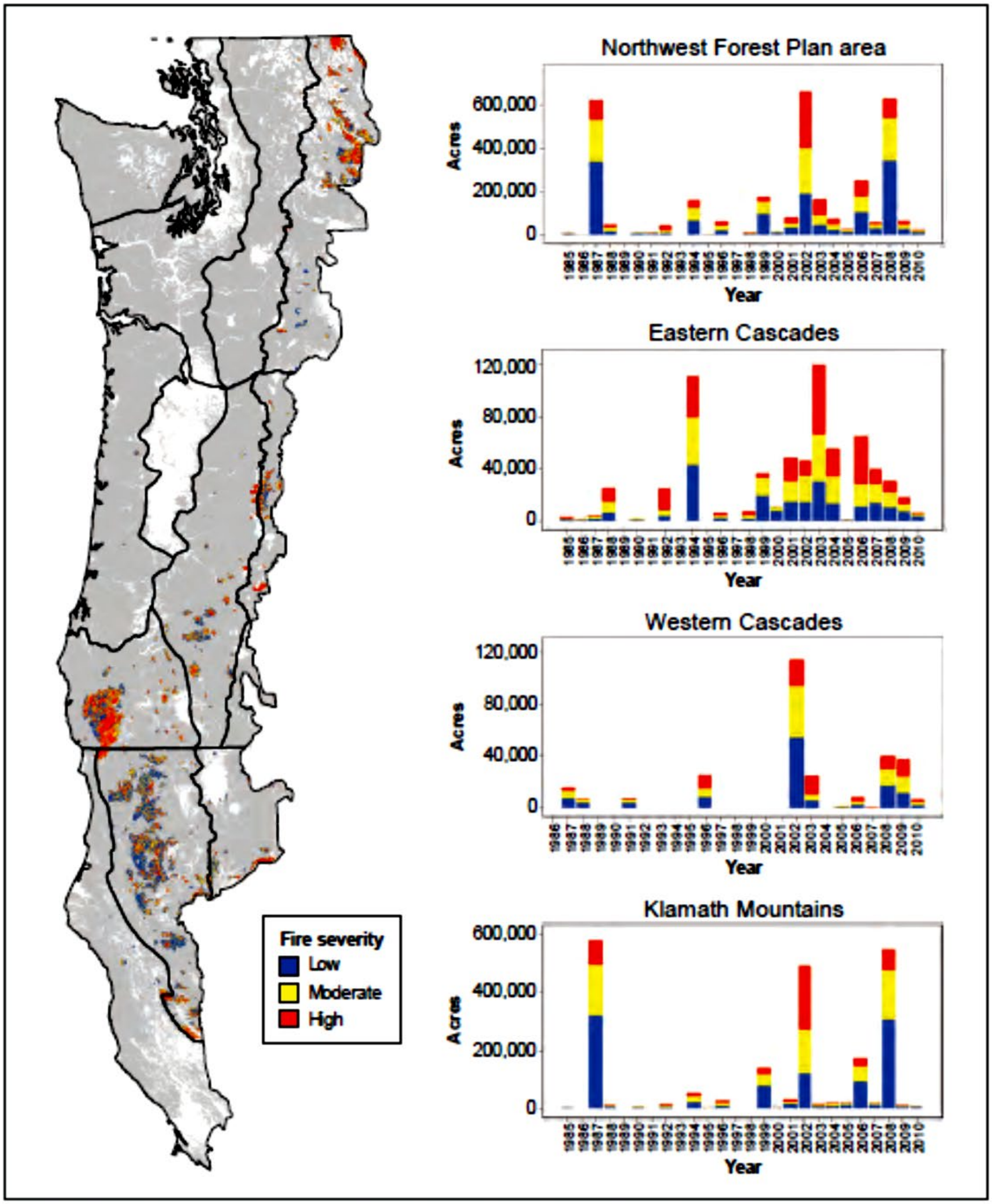


Figure 2-7—Geographic patterns of burn severity from 1985 to 2010 in the Northwest Forest Plan area. Burn severity is derived from the relativized version of the difference in the normalized burn ratio and is based on the percentage of basal area mortality as follows: low (<25 percent), moderate (25 to 75 percent), and high (>75 percent) (Reilly et al. 2017). Map boundaries correspond with the physiographic provinces in figure 2-1.

e. Dalton et al. 2017: *Third Oregon Climate Assessment Report*: This report builds "on the previous two assessment reports (Dalton et al., 2013; Dello and Mote, 2010) by summarizing recent published literature between 2013 and 2016 on climate change science and impacts as it relates to the state of Oregon." (p. 2)
    i. From Chapter 5: Forest Ecosystems
        1. "Future warming and changes in precipitation may considerably alter the spatial distribution of suitable climate for many important tree species and vegetation types in Oregon by the end of the 21st century (Littell et al., 2013). Furthermore, **the cumulative effects of changes due to wildfire, insect infestation, tree diseases, and the interactions between them, will likely dominate changes in forest landscapes over the coming decades** (Littell et al., 2013). Forest management practices will continue to affect the forest economy and the resilience to climate change of forests and the wildlife they support." (p. 46)
        2. **Wildfire:** Over the last several decades, warmer and drier conditions during the summer months have contributed to an increase in fuel aridity and enabled more frequent large fires, an increase in the total area burned, and a longer fire season across the western United States, particularly in forested ecosystems (Dennison et al., 2014; Jolly et al., 2015; Westerling, 2016; Williams and Abatzoglou, 2016). The lengthening of the fire season is largely due to declining mountain snowpack and earlier spring snowmelt (Westerling, 2016). In the Pacific Northwest, the fire season length increased over each of the last four decades, from 23 days in the 1970s, to 43 days in the 1980s, 84 days in the 1990s, and 116 days in the 2000s (Westerling, 2016). Recent wildfire activity in forested ecosystems is partially attributed to human-caused climate change…" (p. 46)
        3. "Under **future climate change**, wildfire frequency and area burned are expected to continue increasing in the Pacific Northwest (Barbero et al., 2015; Sheehan et al., 2015) (fig. 5.2). Model simulations for areas west of the Cascade Range, including the Klamath Mountains, project that the fire return interval, or average number of years between fires, may decrease by about half, from about 80 years in the 20th century to 47 years in the 21st century (Sheehan et al., 2015). The same model projects an increase of almost 140% in the annual area burned in the 21st century compared to the 20th century, assuming effective fire suppression management and a high emissions pathway (RCP 8.5) (Sheehan et al., 2015)." (p. 47) [report has additional info on eastern mountains of Pacific NW]
            a. "[T]he probability of climatic conditions conducive to very large wildfires is projected to increase by the end of the century in the western United States (Barbero et al., 2015; Stavros et al., 2014). (p. 47)

4. The report also provides summary of insects and diseases, and drought, relative to forest ecosystems, including projected CC effects (pp. 49–51; 52–53)

f. *California's Fourth Climate Assessment* – Sierra Nevada region (Dettinger et al. 2018)
   i. This report has summary box (Box 1. **Wildfire in the Sierra Nevada Region**) specific for wildfire, including history of fire, etc.
   ii. Discussion of 'Trends and Projections' begins on page 28; for Wildfire:
      1. "In the Sierra Nevada, currently projected changes in climate are associated with large increases in the area burned by wildfire [see graph: Fig. 3.1.1, p. 28) and in the frequency of large fires with large fires defined as burning more 24,700 acres (Westerling et al. in review)." (p. 28).
      2. "The predicted changes exacerbate trends in the fire regime already evident in the Sierra Nevada [see Box 1;and citing Miller et al. 2009, Mallek et al. 2013, Steel et al. 2015]. Regardless of the emissions pathway, wildfire is expected to increase throughout the century." (p. 28)
   iii. Report also presents other CC effects for this region, specific to fisher:
      1. Under effects section (p. 30) : "While evidence of direct physiological effects of climate change on wildlife are difficult to detect, impacts have been hypothesized for a variety of species in the Sierra Nevada, particularly old growth specialists of concern like spotted owls (*Strix occidentalis*) and **Pacific fishers** (*Pekania pennanti*). In some parts of the spotted owl's range, drought and high temperatures during the previous summer have been linked to lower survival and recruitment the following year (Franklin et al. 2000, Glenn et al. 2011, Jones et al. 2016a)..."
      2. Uunder vulnerability section (p. 32): "High elevation forests and old-growth mixed conifer forests are the most vulnerable to projected changes in climate and wildfire. Wildlife species dependent on these habitats are also imperiled. Projections suggest much of the low- and mid-elevation forests in the Sierra Nevada, where species like owl and **fisher** reside, are vulnerable to conversion to woodlands, shrublands, and grasslands. Projections of future climate and vegetation conditions using the MC1 vegetation change model (Bachelet et al. 2001, Lenihan et al. 2008) suggest a major decrease in suitable old forest mixed conifer habitat over the next 50 years (Spencer et al., unpublished analyses performed for the Yale Framework Climate Adaptation Project: http://yale.databasin.org/pages/cbi), although these models may not adequately account for topographic effects on local microclimate and vegetation, which may partially mitigate the changes in mountainous terrain. In a recent study (Thorne et al. 2016), trees in the Sierra Nevada forests as a whole were shown to be only

moderately vulnerable to projected climate conditions even though the region will experience some of the most extreme shifts in climate in the state because the elevation gradient provides avenues for species to escape "uphill" as the climate warms. However, forests at the highest elevations are more vulnerable simply because there is no place to move as the climate warms."

3. Synergistic effects re wildfire: "The **projected increases in areas burned (Fig. 3.1.1) and wildfire severity** are likely to drive changes in tree species compositions (Lenihan et al. 2003, 2008) and reduce the extent of late-successional forests (McKenzie et al. 2004, Safford and Stevens 2017, Restaino and Safford, in press), which could alter the extent, abundance, or occurrence of species associated with these habitats (McKenzie et al. 2004; Purcell et al. 2012)." (p. 33)
4. Report includes discussion of **drought** (related to precipitation decrease and temperature increase projections) and effects such as **tree mortality** (pp. 28, 49–50):
    a. For example: "Forests that experience drought are more susceptible to stand-altering wildfires and pest such as bark beetle (Section 3.1). Loss of forest due to wildfire or tree mortality leads to changes in overall yield of streamflow and groundwater (Goulden and Bales 2014), to erosion, and to altered water quality." (p. 49)
    b. Also: "Liang et al. (2017) modelled the interactive effects of climate warming and wildfire on forest composition and carbon storage for the Sierra Nevada. Their end-of-century projections include declines in forest productivity, reductions in species richness, and shifts in forest composition. The observed increase in tree mortality in the Westside South subregion provides a contemporary, empirical example of climate change impacts." (p. 28)

g. *California's Fourth Climate Assessment* – North Coast region (Grantham 2018)
    i. General summary statement: "Wildfires will continue to be a major disturbance in the region. **Future wildfire projections suggest a longer fire season, an increase in wildfire frequency, and an expansion of the area susceptible to fire**." (p. 6)
    ii. "There is general agreement that temperature increases will **extend fire season throughout the region**, and especially in higher elevation sites with variable and decreasing snow pack (Micheli et al. 2018, Westerling et al. 2006)." (p. 23)
        1. "Lightning ignitions have historically been the most common cause of fire in the region, and **lightning-ignited wildfires are likely to increase due to a longer fire season** and more available fuels (data from other parts of CA support this assumption; see Lutz et al. (2009)).

2. Re increase in fires: "Increased populations will also increase the probability of human-ignited wildfire, especially in more populated parts of the North Coast (Krawchuk and Moritz 2012, Micheli et al. 2018). " (p. 23)
3. "Westerling et al. (2011) predict that **increases in area burned** in northern California forests will exceed 100% in both lower and higher emissions scenarios." (p. 23)
4. Re vegetation changes: "**Increased fire frequencies and fire severities** will favor more frequent-fire adapted and/or early seral vegetation communities, including oak woodlands and chaparral (Ackerly et al. 2015)." (p. 23)

iii. Additional relevant background/general information:
   1. "The direct impacts of climate change on wildlife will interact with non-climate factors, including land use change, the spread of pests and pathogens, and invasive species." (p. 32)
   2. Synergistic effects: "The boom of cannabis cultivation in the North Coast region has caused significant environmental impacts, including the dewatering of streams, water pollution, and forest fragmentation (Carah et al. 2015), and **may reduce the resilience of wildlife to climate change**." (p. 32)
      a. "Cannabis production affects wildlife communities directly through the use of rodenticides, insecticides, and fertilizers, and indirectly through habitat conversion and fragmentation (Gabriel et al. 2018, Gabriel et al. 2015, Wang Ian et al. 2017). These impacts adversely affect animal fitness and survival, as well as their behavior and movement (Carah et al. 2015, Gabriel et al. 2012)." (p. 32)

h. Kerns et al. 2016 (*US exposure to multiple landscape stressors and climate change*, online publication)
   i. Study examined **landscape exposure to wildfire potential, insects and disease risk, and urban and exurban development** for the conterminous United States [*broad-scale evaluation*]
      1. "The two most prevalent coinciding stressors were (1) wildfire potential combined with insects and disease risk, and (2) climate departure combined with urban and exurban development." (p. 3)

New Wildland Fire Analyses (CFWO):

A. Fire History

Using the Pacific fisher population map (updated with Washington State reintroduced populations), we evaluated fire history using USFS data (earliest year available was 1984). Table 1 contains a summary of the burned areas, across all population areas. A composite map of these results is shown in Figure 1. (Note: we can also prepare separate maps for each region in order to provide more visual detail of area burned)

Table 1. Area burned across the Pacific fisher populations in California, southern Oregon, and Washington.

Source data: Northwest Interagency Coordination Center (NWCC) Fire History 2000-2018, CalFire Fire17_1 (history), and Monitoring Trends in Burn Severity (MTBS) Fire Occurrence Dataset 1984-2016.

5-Year Time Interval	Area Burned, acres (hectares)
1984 - 1989	881,993.72 (356,930.20)
1990 - 1994	474,608.66 (192,067.31)
1995 - 2000	445,392.96 (180,244.14)
2001 - 2006	1,731,330.03 (700,644.40)
2007 - 2012	1,350,675.71 (546,599.07)
2013 - 2018	3,226,918.46 (1,305,887.57)

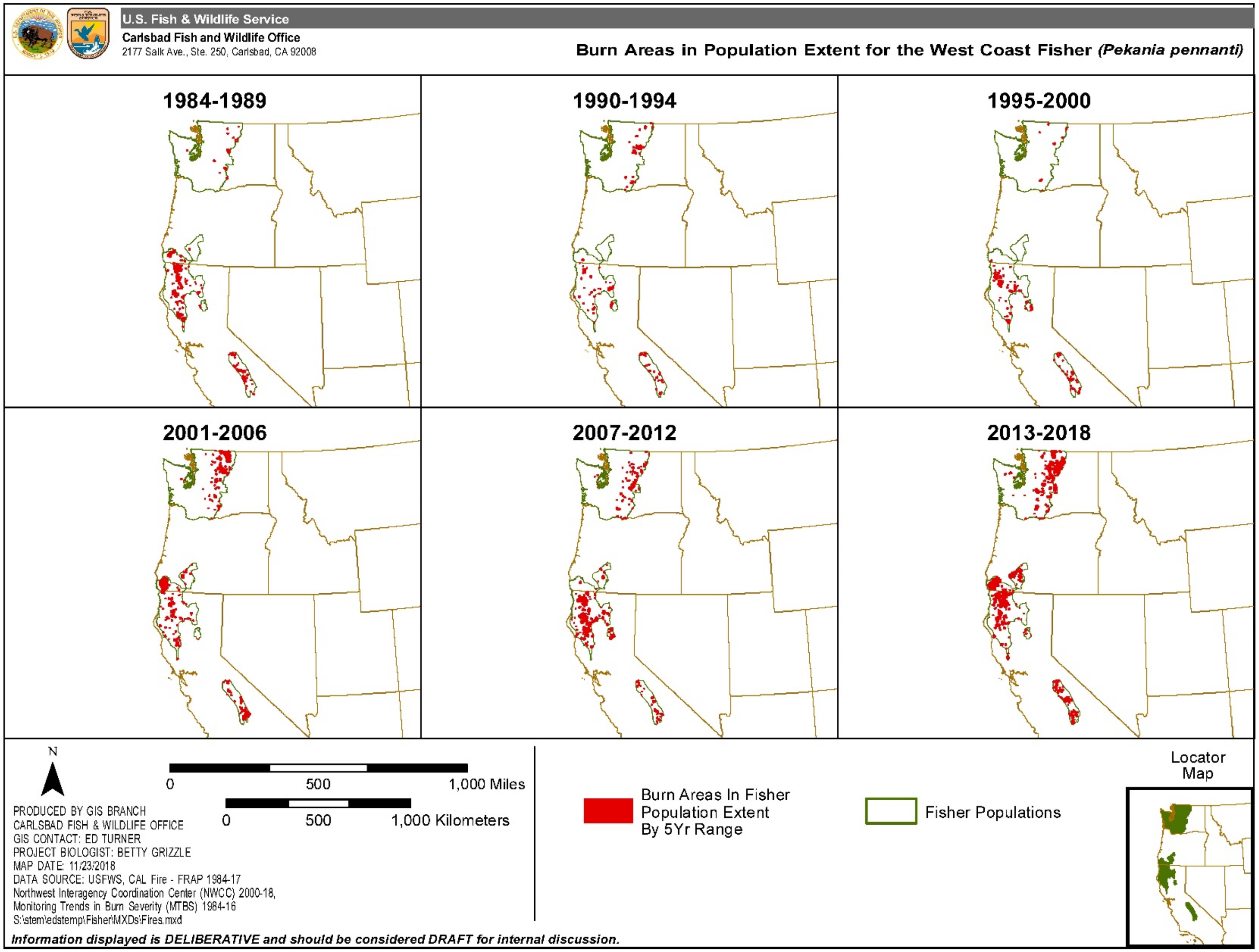


Figure 1. Fire burn history for Pacific fisher population areas.

B. Fire Threat [Note: this dataset only available for California]

Using the areas of fisher populations in California and CalFire data, we evaluated the risk of fire (fire threat). We used a GIS data layer from the California Department of Forestry and Fire Protection (CDF 2004) called 'fire threat', which is based on two factors: 1) fire frequency, or the likelihood of a given area burning, and 2) potential fire behavior. These are combined to create five numerical index classes of fire threat ranging from little or no threat to extreme. This fire risk metric can be used to estimate the potential for impacts to resources that are susceptible to fire, that is, impacts are more likely to occur or be of increased severity for higher threat classes (e.g., very high or extreme) (CDF 2004). This analysis is shown in Table 2 below for the fisher population areas in California. A map of this analysis is presented in Figure 2.

Table 2. Fire Threat within Fisher Populations in California.

Source data: California Department of Forestry and Fire Protection (2004 Statewide GIS layer fthrt05_1).

Code	Definition	Acres	Percent
-1	Little or No Threat	640,352.24	4.7
1	Moderate	2,287,978.22	16.7
2	High	5,331,751.79	38.9
3	Very High	5,418,572.09	39.6
4	Extreme	4,315.47	0.03

The area assessed is based on the following values:

California Fisher Populations

Area	Population Type	Acres
Northern California - Southwestern Oregon	Native	10,147,790.59
Northern Sierra Nevada	Reintroduced	412,530.82
Southern Sierra Nevada	Native	3,138,677.51
	Total Area	13,698,998.93

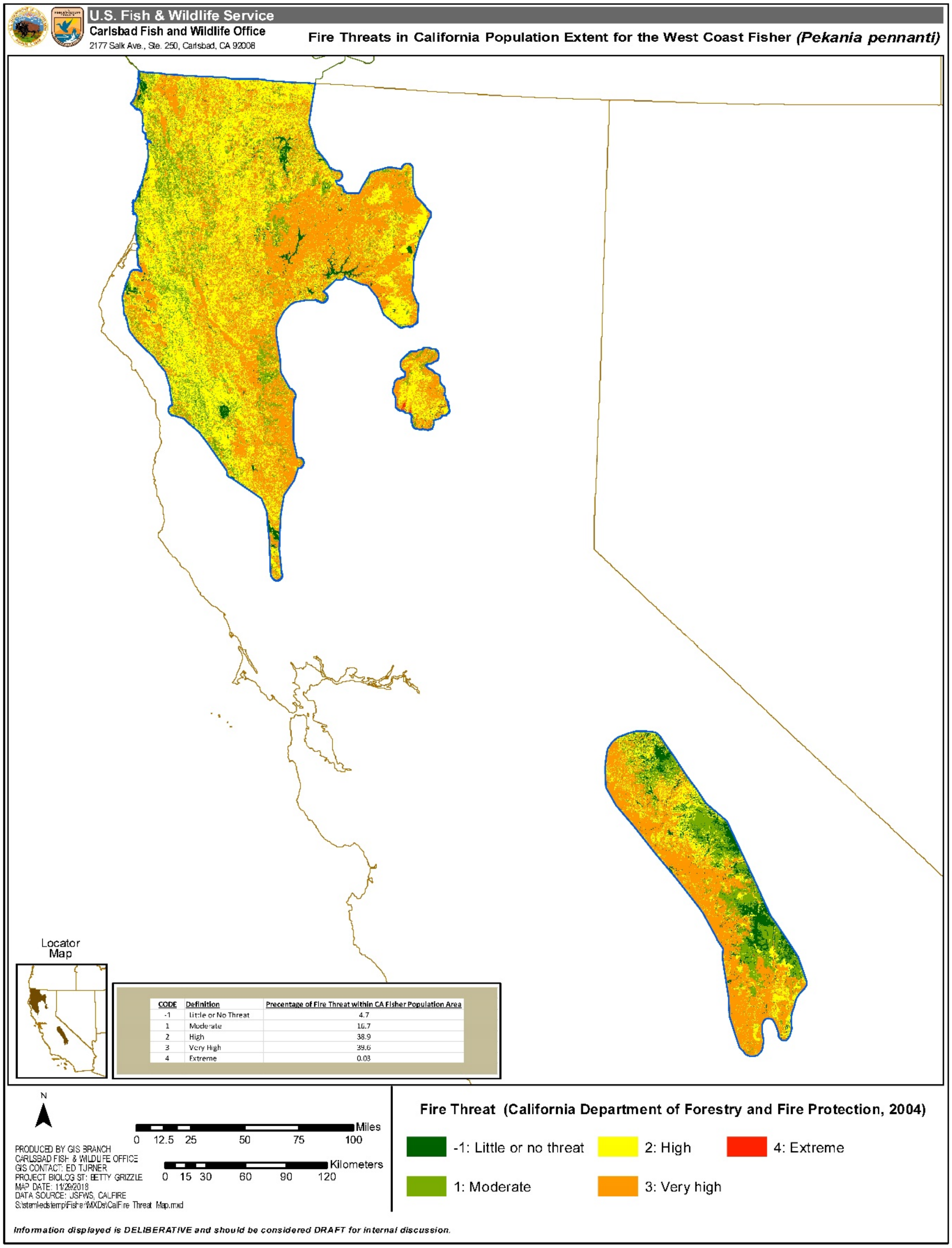


Figure 2. Fire threat for fisher populations in California.

C. Fire Burn Severity

We are using Monitoring Trends in Burn Severity (MTBS) data sets for fires from 1984 to 2016 and are able to clip each data set (for each State and for each year) to create an assessment of the severity of fires that burned in fisher population areas. However, this analysis is time consuming, particularly if there are numerous fires in each State.

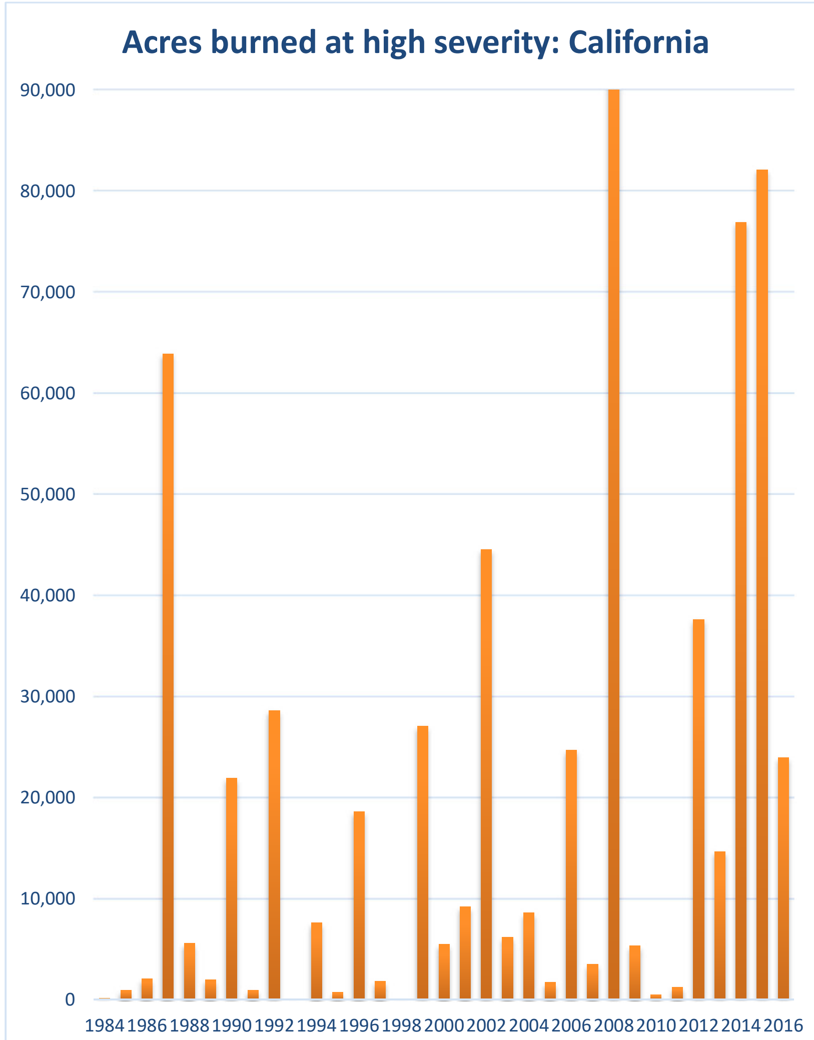
Example analyses from 1987, 2015, and 2016 are shown below:

STATE	BURN SEVERITY - 1987	TOTAL (acres)
California	Area of Revegetation	1,573.27
	High	63,909.95
	Low	178,475.13
	Mask Clouds Shadows Water	0.89
	Moderate	98,154.03
	Unburned to Low	133,731.19
California Total		**475,844.46**
Oregon	Area of Revegetation	301.28
	High	18,483.76
	Low	42,252.51
	Moderate	23,838.95
	Unburned to Low	53,219.06
Oregon Total		**138,095.56**
Washington	Unburned to Low	0.16
Washington Total		**0.16**
Grand Total		**613,940.17**

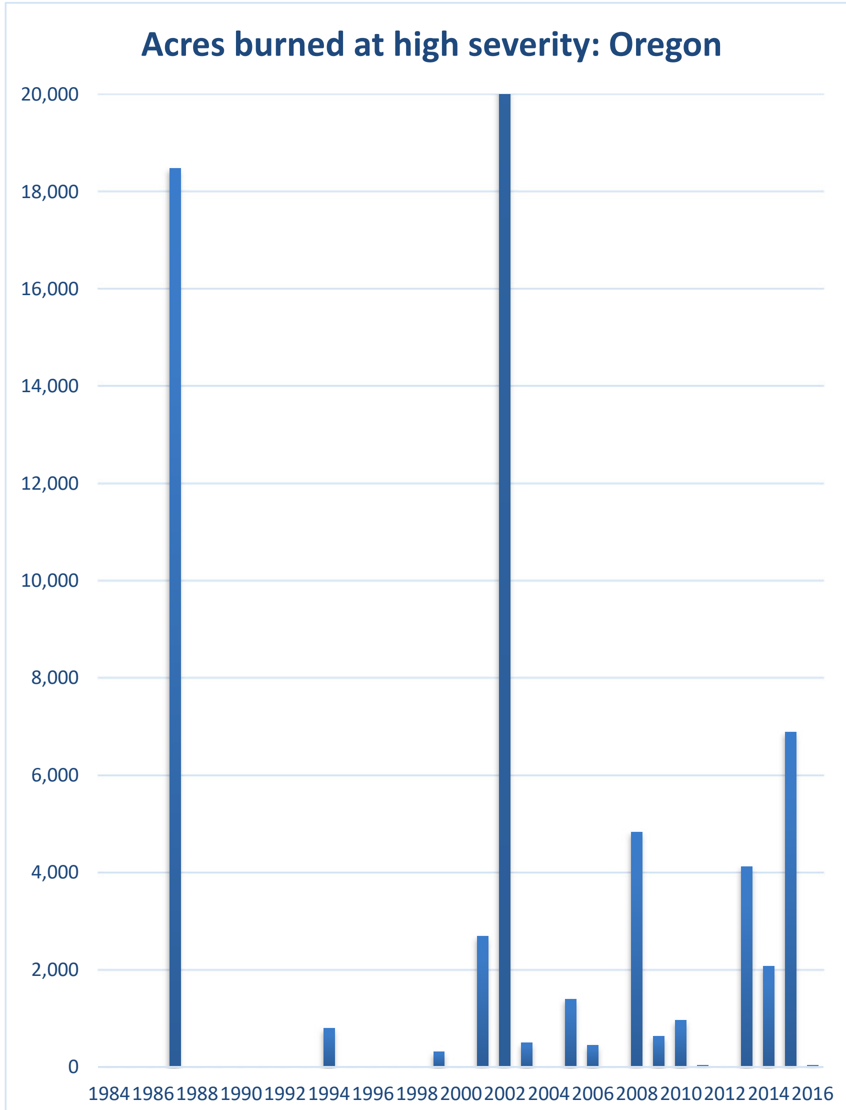
STATE	BURN SEVERITY - 2016	TOTAL (acres)
California	Area of Revegetation	307.79
	High	23,947.03
	Low	25,110.83
	Moderate	18,249.31
	Unburned to Low	13,515.34
California Total		**81,130.31**
Oregon	High	38.70
	Low	514.18
	Moderate	256.64
	Unburned to Low	234.18
Oregon Total		**1,043.70**
Washington	Area of Revegetation	21.57
	High	1,989.54
	Low	2,628.12
	Moderate	1,812.96
	Unburned to Low	2,094.25
Washington Total		**8,546.45**
Grand Total		**90,720.46**

STATE	BURN SEVERITY - 2015	TOTAL (acres)
California	Area of Revegetation	4,739.46
	High	82,104.04
	Low	175,921.48
	Mask Clouds Shadows Water	27.80
	Moderate	104,340.90
	Unburned to Low	91,093.52
California Total		**458,227.20**
Oregon	Area of Revegetation	16.01
	High	6,890.03
	Low	15,516.45
	Mask Clouds Shadows Water	1,065.49
	Moderate	10,056.91
	Unburned to Low	9,258.46
Oregon Total		**42,803.36**
Washington	Area of Revegetation	4,149.44
	High	66,909.78
	Low	134,030.50
	Mask Clouds Shadows Water	5,383.46
	Moderate	102,909.67
	Unburned to Low	55,842.31
Washington Total		**369,225.17**
Grand Total		**870,255.73**

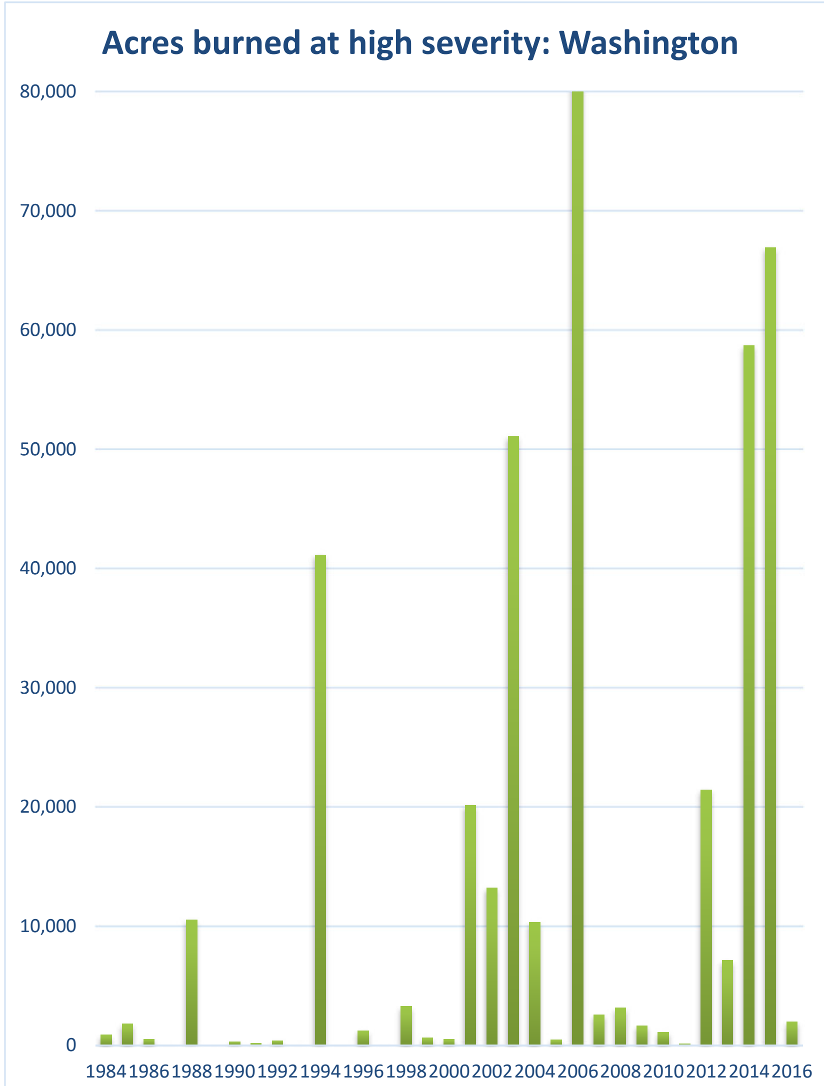
YEAR	ACRES
1984	142.96
1985	916.49
1986	2,060.04
1987	63,909.95
1988	5,560.09
1989	1,985.54
1990	21,904.59
1991	933.61
1992	28,605.54
1993	31.58
1994	7,603.23
1995	712.11
1996	18,595.69
1997	1,814.30
1998	59.16
1999	27,048.16
2000	5,483.61
2001	9,194.47
2002	44,524.31
2003	6,169.93
2004	8,592.12
2005	1,691.97
2006	24,669.15
2007	3,509.39
2008	110,778.94
2009	5,331.57
2010	483.76
2011	1,232.73
2012	37,632.72
2013	14,659.38
2014	76,908.49
2015	82,104.04
2016	23,947.03



YEAR	ACRES
1984	0.00
1985	0.00
1986	0.00
1987	18,483.76
1988	0.00
1989	0.00
1990	0.00
1991	0.00
1992	0.00
1993	0.00
1994	802.85
1995	0.00
1996	0.00
1997	0.00
1998	0.00
1999	311.58
2000	0.00
2001	2,695.43
2002	147,604.90
2003	503.58
2004	0.00
2005	1,396.52
2006	448.79
2007	0.00
2008	4,836.20
2009	634.41
2010	963.41
2011	40.03
2012	0.00
2013	4,121.20
2014	2,070.94
2015	6,890.03
2016	38.70



YEAR	ACRES
1984	865.80
1985	1,809.85
1986	506.62
1987	0.00
1988	10,508.38
1989	4.45
1990	317.58
1991	145.67
1992	378.96
1993	0.00
1994	41,164.02
1995	34.47
1996	1,238.07
1997	0.00
1998	3,271.43
1999	616.70
2000	482.60
2001	20,130.96
2002	13,214.70
2003	51,108.56
2004	10,325.79
2005	443.90
2006	95,088.94
2007	2,576.84
2008	3,123.76
2009	1,644.39
2010	1,101.52
2011	124.32
2012	21,448.65
2013	7,112.60
2014	58,696.23
2015	66,909.78
2016	1,989.54



RE this stressor discussion:

1. Recommend restructuring the wildland fire analyses such that effects to fisher habitat from vegetation management actions related to fire prevention/suppression are presented as Factor A discussion. Wildland fire itself would be separate stressor discussion under Factor D discussion (see discussion and new information/new analyses below) and should include any studies that may provide insights into effects to prey of fisher (example reference: Bond 2015). 2. Relatedly, recommend developing a separate synergistic discussion of wildland fire/tree mortality/climate change (esp. drought events) from recently released/published documents, some of which is summarized below.

Wildland Fire---Summary of New Information/Literature since 2015

1. Background: CFWO created an updated populations map for the Pacific Fisher using map data presented in the previous proposed rule (Yreka FWO) combined with reintroduced population area for fishers in Washington State (data provided by Lacey FWO).

   a. **New CFWO spatial analysis** specific for fisher population areas begins on page 20 of this document) b. Not presented here: other background information (few paragraphs) on fire history in CA, southern Oregon, and Washington.

2. New general information on this topic

   a. More recently, wildland fires in California have burned more area, have occurred more frequently, often due to human ignitions (Balch *et al*. 2017, p. 2,946), and, in some areas of the State, have increased in severity due to warmer temperatures and prolonged drought conditions/decreased precipitation (Wehner *et al*. 2017; Holden *et al*. 2018).

   However, Hanson and Odion 2016 (entire) assessed reference conditions in low- to mid-elevation Sierra Nevada forests. Their findings: “Based on evaluation of all forest inventory data conducted in 1910 and 1911 by the US Forest Service, we found considerable evidence for substantial portions of large areas affected by high-severity fires [an average of 26% high-severity fire effects] ...” “Moreover, it was clear that mixed-severity fire regimes were characteristic of ponderosa pine and mixed conifer forests of the western slope of the central and southern Sierra Nevada **before fire suppression**. Therefore, our findings were contrary to hypotheses articulated in North et al. (2009), Collins et al. (2011), Fulé et al. (2014), Stephens et al. (2013), and recent modeling (Mallek et al. 2013) that high-severity fire was relatively rare in forest in this mountain range before fire suppression, and ranged from 4–13% (Mallek et al. 2013)."

b. Coppoletta et al. 2016 (p. 686): This study used field plots established after four fires occurred in the northern Sierra Nevada, California, between 2000 and 2010, that were subsequently reburned in 2012. The study results suggest "high-to moderate-severity fire in the initial fires led to an increase in standing snags and shrub vegetation, which in combination with severe fire weather promoted high-severity fire effects in the subsequent reburn. Although fire behavior is largely driven by weather, our study demonstrates that post-fire vegetation composition and structure are also important drivers of reburn severity."

3. Effects to fisher/fisher habitat

a. Suggestion for background information: In North America, fishers use both microsite and structural features within mature and late-successional mixed conifer forests for denning and resting habitat (Raley et al. 2012, p. 1 (*admin record does not have final publication*), Weir et al. 2012, p. 234; Zhao et al. 2012, p. 113; Aubry et al. 2013, p. 966; Green 2017, p. 10; Aubry et al. 2018, p. 2), areas that are at higher risk of large forest fires (Thompson et al. 2011; Kane et al. 2015 – *need citations*). For example, in a recent study of fisher population in the southern Sierra Nevada region, at the microsite scale, both male and female fishers rested in tree cavities, branch platforms, broken top platforms (collectively, 82.9 percent), as well as burrows and log cavities (Green 2017, p. 62). This study found that all but two females used tree cavities for both natal and maternal den microsites (two used late maternal dens in hollow logs) (Green 2017, pp. 21, 62), which the study found (using temperature data loggers) to provide good insulation from ambient, cold temperatures (Green 2017, p. 142). At the structure scale, this study found that both males and females rested in live conifers, live hardwoods, and conifer snags, and denning females used live hardwoods, live conifers and conifer snags (Green 2017, p. 62).

b. New information related to wildland fire effects to fisher:

i. **Barry 2018 MS Thesis (OR study)**, p. 25: "Wildfire has previously been identified as a threat to fisher habitat and conservation (USFWS 2014) but the relationship between fishers and fire is poorly understood. Nevertheless, habitat is likely rendered unsuitable for fishers when stand- replacing fire removes canopy cover at large spatial scales and reduces the prevalence of structural elements required for rest and den sites (Weir and Harestad 1997, Weir and Corbould 2010, Aubry et al. 2013)."

1. Re Biscuit Fire (p. 25): "The absence of fisher detections from within the area of the Biscuit fire is of concern...The Biscuit Fire, however, appears to have been unusually large and severe for the Klamath-Siskiyou region based on estimates of crown damage (Odion et al. 2004) and area affected by surface fire (Campbell et al. 2007, Thompson and Spies 2009). In total, the Biscuit fire burned over 2,020 km^2, of which 1,861 km^2 were within Oregon (Azuma et al. 2004), representing ~25% of the indigenous fisher population range in Oregon." 2. Page 26: "The absence of fisher detections from within the Biscuit

Fire and the burning of a substantial additional component of the range of fisher in Oregon during the 2017 fire season indicates that fire poses a potential danger to the stability and recovery of fisher

populations in Oregon. A fire of similar size and severity to the Biscuit could affect much of the remaining habitat available to fishers in either population." [p. 26: "the 2017 wildfire season in southern Oregon burned 10 % of the indigenous range and 3 % of the introduced range"]

ii. From Zielinski and Gray 2018 (*Using routinely collected regional forest inventory data to conclude that resting habitat for the fisher (*Pekania pennanti*) in California is stable over* *20 years*), p. 907: "Sweitzer et al. (2016) also found that occupancy of sample units by fishers trended lower among those units that had been burned by either prescribed burning or wildfire. Nonetheless, the sum of their research did not identify a consistent negative effect of fire on fisher habitat use. Truex and Zielinski (2013) found that predicted resting habitat was significantly lower for a combination treatment of mechanical thinning plus fire but the controls didn't differ from the fire-only or the mechanical-only treatment. The lack of significant effects of fire was probably because the fire treatments in that study were from prescribed fire only."

iii. **Bomdahl 2018 MS Thesis (Utah State Univ)**: Study examined effects of fire on fisher habitat, via modeling in Sierra NF and Yosemite NP (latter not occupied by fisher).

1. Page 72: Results suggest that the variables of forest structure that fishers (appear to) consider when selecting suitable denning habitat are maintained in burned forests, though primarily those with low-severity conditions. [*To note, this study evaluated fisher habitat at intermediate scale (within home-range scale), not at microsite scale*.]
2. Page 79; Author says that the question that remains unanswered is whether the microsite features (e.g., snags, dead stems, hardwood density) occupied by fishers for denning and resting are maintained after burning.

iv. **D. Green et al. 2017** (not yet published article; authors say results are preliminary: *The effects of mixed-severity wildfires on fisher (Pekania pennanti) population dynamics; Baseline report of population dynamics* ***pre-wildfires***):

1. Study monitored fishers in a portion of the Klamath-Siskiyou ecoregion in northern California and southern Oregon to investigate the effects of wildfires on fisher populations; developed a spatial capture-recapture model to determine the effects of the two perturbations (i.e., wildfire, translocation) on the population demography of fishers (pp. 3, 5). 2. Page 8: (related population information) Study identified a total of 139 unique individuals from 2006 to 2013, with 27.0 ± 3.4 individual fishers detected each year.

3. Page 8: Results from the spatial capture-recapture model found that the population of fishers in the study area was "relatively stable before the fires occurred and for the three years immediately following the removal of fishers for translocations." Thus, "The current modeling efforts indicate the population of fishers in the [study area] was relatively stable from 2006 to 2013." Page 9: Both our current results and previous work indicate a stable population of fishers in [this study area] before the wildfires occurred in 2014, and for up to 3 years following the translocation efforts." v. D. Green et al. 2017 (**post-fire study,** *The effects of mixed-severity wildfires on fisher (Pekania pennanti) population dynamics*)

1. Page 5: This study "evaluated the effects of removing fishers on population dynamics in Klamath with a spatial Jolly-Seber open population model." [see summary above for details on study area] 2. This study used non-invasive sampling techniques and individual identifications with genetics; 3. Page 8: (related population information) They identified "a total of 178 unique individuals from 2006 to 2015, with 28.1 ± 3.8 individual fishers detected each year. Fishers were detected at multiple sampling units each year (1.7 ± 0.2). Interannual re- capture rates were also fairly stable over time; 15.8 ± 2.9 individuals sampled each year had been identified to be present in previous years." 4. Page 8-9: "The spatial Jolly-Seber model indicated the population of fishers in the Klamath was relatively stable before the fires occurred and for the three years immediately following the removal of fishers for translocations." 5. Page 9: "The fisher population declined after wildfires between 2014 and 2015...., with notable decreases within the burn area in both 2014 and 2015... Fisher density was affected most by >50% change in canopy within the burn area between 2013 and 2015..." 6. Page 9: Study concluded: "The relative stability of the overall population between 2013 and 2014 and a decline in density within the burn area suggests fishers moved outside of the burn area immediately following the fire but remained within our larger study area." 7. Further conclusion, pp. 9-10: "The significant decline in the overall population between 2014 and 2015 appears largely driven by declines within the burned area. We suspect fishers began redistributing themselves on the landscape immediately following the fire and the significant decline observed between 2014 and 2015 was a function of a lag effect as fishers redistributed themselves on the post-fire landscape." 8. Additionally, p. 10: "We also found fisher densities declined across all levels of fire severity and densities declined the most in regions with more than 50% change in canopy cover. Thus,

wildfires where canopy declines by more than 50% will have the largest, negative effect on fishers." vi. From Southern Sierra Nevada Fisher Working Group meeting (Sept 2018 – notes sent by Stephanie Eyes, SFWO; additional summaries below) Yosemite study area (Erika Blomdahl and Jim

Lutz) – Is fisher habitat maintained in forests that have been altered by **fire suppression**? Do **burned areas** contain the habitat elements required by fishers? Study modeled fisher den habitat using regression models [these results include new life history information for predicting den presence]

1. Low severity vs. high severity – study found that places that burned at high severity did not have suitable den characteristics (low den probability); low severity fire can be beneficial for maintaining den characteristics that fishers select for 2. Study did not look at microsite characteristics, but concluded that it was important to manage for 'tall trees'

[NOTE: There may also be relevant and new references cited in the most recent California spotted owl SSA Report. (e.g., Jones, G. M., R.J. Gutiérrez, D.J. Tempel, S.A. Whitmore, W.J. Berigan, and M.Z. Peery. 2016. Megafires: an emerging threat to old-forest species. Frontiers in Ecology and the Environment 14:300–306.)]

4. Other Effects – Tree Mortality (fire, drought, bark beetles)

a. Stephens et al. 2018 (*Drought, Tree Mortality, and Wildfire in Forests Adapted to Frequent Fire* advanced access publication)

i. This article summarizes research to help understand the near- and longer-term effects of a massive tree mortality event in frequent fire (FF) forests in California (p. 2). ii. It presents data and results from the 2015 Rough Fire (southern Sierra Nevada) to illustrate how drought-induced tree mortality affected fire behavior (p. 2). iii. Article provides some good background information re tree mortality in Sierra Nevada and useful graphics as to how vegetation and fuel dynamics are altered due to severe tree mortality from bark beetles

1. "Tree mortality has long been known to play an important role in altering fuel dynamics within forests." (p. 2). 2. "Unprecedented Sierra Nevada tree mortality has rapidly occurred after a severe drought with effects compounded by forest densification from decades of fire suppression. In the central and southern Sierra Nevada some areas have experienced more than 90% tree mortality, producing extensive landscapes of standing dead trees." (p. 9) iv. General conclusions:

1. "In the first decade, wildfire severity in bark beetle killed FF forests may be little affected over current conditions. Other than a brief increase during the "red phase" when most dead needles are still on recently killed trees, the reduction in canopy fuels is

counterbalanced by an increase in surface fuels" (pp. 9-10). But, "current conditions in the majority of mixed-conifer and yellow pine forests in California already consist of unnaturally high surface fuel loads and corresponding elevated fire hazards" (p. 10) 2. "The more troubling projection is how extensive loading of large-sized woody fuels in future decades may contribute to dangerous mass fires beyond the predictive capacity of current fire models. These fires can generate their own wind and weather conditions and create extensive spotting, making fire behavior and its impact on structures and public safety difficult to manage and predict. In addition, such intense fires could prevent forests from becoming re-established." (p. 10) 3. [Without these 'legacy' live trees], large unburned areas of dead trees may also produce unusual forest succession patterns. These patterns will likely favor shade-tolerant and hardwood tree regeneration, limited shrub growth, and accumulating large woody fuels that would likely kill regenerating forests when wildfire inevitably occurs." (p. 10) 4. "For long-term adaptation to climate change, we highlight the importance of moving beyond triage of dead and dying trees to making "green" (live) forests more resilient." (p. 1).

b. Berner et al. 2017: (*Tree mortality from fires, bark beetles, and timber harvest during a hot and dry decade in the western United States (2003–2012)*)

i. Study **estimated tree mortality from fires and beetles** in western U.S. using tree aboveground carbon stock and disturbance data sets derived largely from remote sensing. They quantified tree mortality from harvest using data from Forest Service reports. ii. "Tree mortality from harvest was concentrated in Washington and Oregon, where harvest accounted for ~80% of [mortality from harvest, beetles, and fires] in each state." (p. 1) iii. Tree mortality from beetles occurred widely at low levels across the region, yet beetles had pronounced impacts in Colorado and Montana, where they accounted for ~80% of [mortality from harvest, beetles and fire]. (p. 1) iv. "Tree mortality from fires was highest in California..." (p. 1)

v. "Drought and human activities shaped regional variation in tree mortality...and [r]ising temperatures and greater risk of drought will likely increase tree mortality from fires and bark beetles during coming decades in this region.” (p. 1) vi. Useful graphic from this report (p. 7):

(a) Tree mortality from fire (b) Tree mortality from bark beetles

Tree mortality (Mg AGC ha^{-1} 10 yr^{-1})

< 0.1
0.1 - 2 2
- 10 10 -
25 25 -
50 50 -
200

Tree mortality was quantified as the amount of aboveground carbon (AGC) stored in tree biomass killed by disturbance (e.g. Mg

AGC N *a* Idaho souther izona/N Mexico, whereas (*b*) tree mortality from bark beetles occurred widely at low levels, but was highest in northern Colorado and western

c. Hart et al. 2018 (*Area burned in the western United States is unaffected by recent mountain pine beetle outbreaks*)

i. Summary points (p. 1)

1. Contrary to the expectation of increased wildfire activity in recently infested red-stage stands, we found no difference between observed area and expected area burned in red-stage or subsequent gray-stage stands during three peak years of wildfire activity, which account for 46% of area burned during the 2002–2013 period. 2. Although [mountain pine beetle] infestation and fire activity both independently increased in conjunction with recent warming, our results demonstrate that the annual area burned in the western United States has not increased in direct response to bark beetle activity.

d. Hicke et al. 2016 (*Recent Tree Mortality in the Western United States from Bark Beetles and Forest Fires*)

i. This is a broad-scale study across western U.S. that “used two recently developed data sets to estimate the amount of mortality area (canopy area of killed trees) from forest fires [MTBS or Monitoring trends in burn severity]and bark beetle outbreaks (NOTE: CFWO used the MTBS data set for its analyses) ii. Selected summary points (p. 146):

1. "Forest fires caused lower tree mortality in the western United States than bark beetles." 2. "The peak years of mortality caused by fires were 1988, 2000,

2002, 2003, 2006, 2007, and 2012, in which about 0.45– 0.6 Mha of trees were killed annually."

3. "Fires were less damaging to forests in earlier years of the study period, with only fires in 1988 causing substantial (0.5 Mha) mortality; annual average mortality area was 0.11 Mha/year before 2000. In contrast, mortality area has been notably higher since 2000 (0.32 Mha/year), but still less than that from bark beetles." iii. "Examples of extensive forest fires include... the Biscuit Fire in southern Oregon [ponderosa pine forest type] and... the Tripod Complex in northern Washington in 2007 (lodgepole pine forest type)." (p. 146)

e. Meigs et al. 2016 (*Do insect outbreaks reduce the severity of subsequent forest fires?*)

i. Study presents present a regional census of large wildfire severity following outbreaks of two prevalent bark beetle and defoliator species, mountain pine beetle and western spruce budworm across the US Pacific Northwest (forested areas of OR and WA) ii. Page 1/Abstract (online publication) Found that "insects *generally reduce the severity* of subsequent wildfires."

1. "...both insects decrease the abundance of live vegetation susceptible to wildfire at multiple time lags. By dampening subsequent burn severity, native insects could buffer rather than exacerbate fire regime changes expected due to land use and climate change."

f. From Southern Sierra Nevada Fisher Working Group meeting (Sept 2018 – notes sent by Stephanie Eyes, SFWO, uploaded to shared drive)

i. Tree mortality mapping research underway (presented by Carlos Ramirez): using Landsat images to produce tree mortality maps; unclear how this relates to "fisher strategy." ii. Stress response of fishers to climate change and tree mortality, Kings River study area (Jenny Kordosky; also presented at July 2018 Martes

Symposium): using model selection, found that levels of tree mortality within a fisher's home range significantly influenced cortisol levels across three home range estimators.

1. Chronic stress can affect reproduction, survival, body condition
2. Fishers prefer late-successional forest in the core of their home

ranges 3. Cortisol levels have risen over last few years, 2014 to 2016 iii. Tree mortality and fisher habitat selection study in Kings River study area

(Kathryn Purcell)

1. Percent of tree mortality increased significantly from 2015 to 2017
2. Fishers found in areas with lower percent tree mortality; fishers

avoid edges; found closer to streams (more live trees) iv. Sugar Pine Project (final report) (Base Lake RD and Sierra NF;

collaborative study with USFS, UC Berkeley; Rachel Roberts and Kathryn Purcell)

1. Study question/objective: Do current rates of survival and reproduction allow fishers to persist in Sierra Nevada with active **forest (vegetation) management** to reduce fuels and risk of severe wildfire? 2. Population growth rate simulation conducted out to 50 years found that rate stabilized at 0.989 at 20 years, but this is based only on fecundity and survival, not veg. treatment 3. Fishers said to be less likely to be detected (in grid cells) with

greater percent impacted by harvest or thinning call during the year of management, with percent harvest having greater effect on fisher behavior than percent thinned 4. Tree mortality impacts unknown 5. Fishers may be tolerant of forest management as long as treatment duration and scope is limited and critical structure (large oaks, conifers with 'defects'/damage) is retained

5. Other Effects – Synergistic and other effects to forests (wildland fire, drought, and projections of climate change effects)

a. Buotte et al. 2018 (*Near-future forest vulnerability to drought and fire varies across the western United States*)

i. Study used Community Land Model to simulate forest drought stress and fire; developed metrics of forest vulnerability to drought (western U.S.)

1. Publication "represented future vulnerability to fire based on the difference in simulated future (2020–2049) minus simulated past (1980–2009) area burned weighted by the future area burned." (p. 5) ii. "Forest vulnerability to drought stress between 2020 and 2049 varies widely across the western United States .... Low drought vulnerability, covering 64% of the domain...is expected across most of the coastal and western Cascade regions..." (p. 7) iii. Future forest vulnerability to fire: "Future area burned is expected to increase under both climate projections..., primarily in the Sierra Nevada and Rocky Mountains." (p. 7) iv. "Between 2020 and 2049, most (82%) of the western United States is predicted to experience low vulnerability to fire regardless of climate projections" [see Figure 5 and Table 1 below]. "High fire vulnerability, covering 14% of the domain, is primarily expected in the intermountain region, the Sierra Nevada, and Klamath Mountains." (p. 7) v. "The coastal Douglas fir, hemlock/cedar, and redwood forest types are expected to experience low vulnerability to drought or fire... All other forest types are expected to experience high vulnerability to drought or fire in at least 10% of their range, regardless of climate projections." (p. 9) vi. "Widespread vulnerability to drought or fire, and therefore elevated risk of forest mortality, is expected in the Rocky Mountains, Sierra Nevada, Southwest, and Great Basin regions of the western United States. (p. 11) vii. "Under future climate conditions represented by two general circulation models and the highest CO_2 scenario (RCP 8.5), forest vulnerability to drought-related and fire mortality is likely to continue at recent levels or increase in the near future, depending on location and environmental conditions." (p. 11)

Figure and Table from Buotte et al. 2018.

b. Halofsky et al. 201X (*Changing wildfire, changing forests: a synthesis on the effects of climate change on fire regimes and vegetation in the Pacific Northwest*, in press, to be produced as a Forest Service GTR publ.)

i. Presents a state-of-science report on **potential effects of changing climate and fire regimes on forests in the Pacific Northwest** (note: paper provides valuable and timely background information on this topic)

1. For example: "In 2014, a record was set for the largest wildfire in Washington State history, the 103,640-ha Carlton Complex Fire. One year later, 2015 was a hot year with very low snowpack across the Pacific Northwest, and 688,000 ha were burned in Oregon and Washington, with over 3.6 million ha burned in the western United States. Several fires in 2015 occurred in west-side conifer forests, including a rare fire event in coastal temperate rainforest on the Olympic Peninsula. In some areas, increased area burned has resulted in short-interval reburns." (Gifford Pinchot National Forest in southwestern Washington; SW Oregon) (p. 4) ii. "Evidence is strong that a warming climate will profoundly affect future wildfire and associated ecological disturbances in the Pacific Northwest by the mid-21st century. However, uncertainties remain, for example, about the influence of future human behavior on fire and vegetation, potential effects of higher concentrations of carbon dioxide on forest productivity, and effects of repeated fire and drought on forest regeneration." (p. 4) iii. Paper presents overview of climate projections for region iv. **Fire projections under climate change**: "Overall, mechanistic model

simulations for the Pacific Northwest suggest that both fire frequency and area burned will increase in the future. Fire severity may also increase, depending partly on forest composition, structure, and productivity over time. Warmer temperatures in winter and spring, and increased precipitation during the growing season (even early in the growing season), could increase forest productivity." (p. 14)

1. "Future increased fire frequency without increased vegetation productivity is likely to eventually result in decreased fire severity (see section 4). However, in highly productive ecosystems such as forests west of the Cascade Crest, future fires will probably be both more frequent (compared to the last century) and of high severity (Halofsky et al. in press, Rogers et al. 2011)." (p. 14) v. Report presents discussion of "stress complexes" or combinations of

abiotic and biotic stressors (e.g., interactions between insects, drought events, and fires)

1. Related to tree mortality: "...multiple stressors are generally required to kill large numbers of normally drought-tolerant tree species. No evidence exists to date of specific interactions between large-scale tree mortality events and fire, other than the effects of a short-term increase in fine (dead) fuels. Although fuels may be

elevated for several years after mortality events, it is uncertain whether they would be a long-term contributor to fire severity." (p. 20) vii. Report presents discussion of climate change on post-fire processes (e.g.,

forest regeneration, interactions with hydrological processes viii.

Tables 2-4 [*not copied here*] present "a summary of the authors' **conclusions on the potential risks** to natural resource management associated with climate-fire interactions discussed in this paper: wildfire frequency, extent, and severity, reburns, stress interactions, regeneration, and hydrologic interactions for moist coniferous forest (low to mid elevation) (table 2); dry coniferous forest and woodland (low to mid 1142 elevation) (table 3); and subalpine coniferous forest and woodland (high elevation) (table 4). The likelihood, magnitude of consequences, and confidence in inferences are described for each risk." (p. 26)

1. Overall, for Pacific Northwest forests: "climate-fire risks in moist coniferous forests are low, except for hydrologic risks." (p. 26). "...risks in dry coniferous forest and woodlands are high for increased fire frequency, extent, and severity." "Increased fire frequency and extent in lower-elevation forests with climate change will likely spread to higher-elevation systems, resulting in moderate risks there." (p. 26)

c. Note: The Coastal Marten SSA Report (July 2018) contains discussion of Wildfire and Climate Change stressors for northern coastal California and southwestern Oregon.

i. For example: "Fires are a regular occurrence outside of the high severity fire regime and in southwest Oregon and northwest California portion of the historical range, where the southern 3 marten population areas occur. We used Gradient Nearest Neighbor (GNN) data (Davis *et al.* 2015, pp. 9– 26; Cohen *et al.* 2018, entire; LEMMA 2018, entire) to quantify fire and other disturbance events in all forest age classes in each of the population areas as well as the coastal marten historical range between 1987 and 2016..." (p. 57)

ii. The type of analyses presented in this report would require updating range maps and/or suitable habitat maps for Pacific fisher.

d. Spies, T.A.; Stine, P.A.; Gravenmier, R.; Long, J.W.; Reilly, M.J., tech. coords. 2018. *Synthesis of science to inform land management within the* ***Northwest Forest Plan area***. Gen. Tech. Rep. PNW-GTR-966. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 1020 pp. 3 volumes

i. Chapter 2 contains discussion of CC and Wildland Fire, including sections titled: 20th-Century Climate Change in the Northwest Forest Plan Area (background information) and Projecting Climate Change for the 21st Century (future projections)

ii. From page 50: "The effects of recent fires have been extremely variable across the region, with most recent fire activity occurring in the Klamath Mountains, eastern Cascades, and western Cascades of Oregon (fig. 2-7)." [*copied below*] iii. "The annual area burned increased in most vegetation zones since the mid-
1980s, but dry vegetation zones, including ponderosa pine, Douglas-fir, and grand fir/white fir, experienced less fire than they would have during presettlement times because of fire suppression (Miller et al. 2012, Reilly et al. 2017) (see chapter 3 for more discussion)." (p. 50) iv. "Mean and maximum fire size from 1910 to 2008 increased in northwest California (Miller et al. 2012)." (p. 50) v. Although the area burned has increased in all major vegetation zones
[since the mid-1980s], there is little evidence that the proportion burning at high severity has increased across the region (Law and Waring 2015, Miller et al. 2012, Reilly et al. 2017)." (pp. 50–51) vi. "Although they found no increase in the proportion of high-severity fire,
Reilly et al. (2017) found that increases in high-severity patch size during this time were associated with more area burned during drought years in all major vegetation zones." (p. 51)

e. Dalton et al. 2017: *Third Oregon Climate Assessment Report*: This report builds "on the previous two assessment reports (Dalton et al., 2013; Dello and Mote, 2010) by summarizing recent published literature between 2013 and 2016 on climate change science and impacts as it relates to the state of Oregon." (p. 2)

i. From Chapter 5: Forest Ecosystems

1. "Future warming and changes in precipitation may considerably alter the spatial distribution of suitable climate for many important tree species and vegetation types in Oregon by the end of the 21st century (Littell et al., 2013). Furthermore, **the cumulative effects of changes due to wildfire, insect infestation, tree diseases, and the interactions between them, will likely dominate changes in forest landscapes over the coming decades** (Littell et al., 2013). Forest management practices will continue to affect the forest economy and the resilience to climate change of forests and the wildlife they support." (p. 46) 2. **Wildfire:** Over the last several decades, warmer and drier

conditions during the summer months have contributed to an increase in fuel aridity and enabled more frequent large fires, an increase in the total area burned, and a longer fire season across the western United States, particularly in forested ecosystems (Dennison et al., 2014; Jolly et al., 2015; Westerling, 2016; Williams and Abatzoglou, 2016). The lengthening of the fire season is largely due to declining mountain snowpack and earlier spring snowmelt (Westerling, 2016). In the Pacific Northwest, the fire season length increased over each of the last four decades, from 23 days in the 1970s, to 43 days in the 1980s, 84 days in the 1990s, and 116 days in the 2000s (Westerling, 2016). Recent wildfire activity in forested ecosystems is partially attributed to human-caused climate change..." (p. 46) 3. "Under **future climate change**, wildfire frequency and area burned are expected to continue increasing in the Pacific Northwest (Barbero et al., 2015; Sheehan et al., 2015) (fig. 5.2). Model simulations for areas west of the Cascade Range, including the Klamath Mountains, project that the fire return interval, or average number of years between fires, may decrease by about half, from about 80 years in the 20th century to 47 years in the 21st century (Sheehan et al., 2015). The same model projects an increase of almost 140% in the annual area burned in the 21st century compared to the 20th century, assuming effective fire suppression management and a high emissions pathway (RCP 8.5) (Sheehan et al., 2015)." (p. 47) [report has additional info on eastern mountains of Pacific NW]

a. "[T]he probability of climatic conditions conducive to very large wildfires is projected to increase by the end of the century in the western United States (Barbero et al., 2015;

Stavros et al., 2014). (p. 47)

4. The report also provides summary of insects and diseases, and drought, relative to forest ecosystems, including projected CC effects (pp. 49–51; 52–53)

f. *California's Fourth Climate Assessment* – Sierra Nevada region (Dettinger et al. 2018) i. This report has summary box (Box 1. **Wildfire in the Sierra Nevada Region**) specific for wildfire, including history of fire, etc. ii. Discussion of 'Trends and Projections' begins on page 28; for Wildfire: 1. "In the Sierra Nevada, currently projected changes in climate are associated with large increases in the area burned by wildfire [see graph: Fig. 3.1.1, p. 28) and in the frequency of large fires with large fires defined as burning more 24,700 acres (Westerling et al. in review)." (p. 28). 2. "The predicted changes exacerbate trends in the fire regime already evident in the Sierra Nevada [see Box 1;and citing Miller et al. 2009, Mallek et al. 2013, Steel et al. 2015]. Regardless of the emissions pathway, wildfire is expected to increase throughout the century." (p. 28) iii. Report also presents other CC effects for this region, specific to fisher:

1. Under effects section (p. 30) : "While evidence of direct physiological effects of climate change on wildlife are difficult to detect, impacts have been hypothesized for a variety of species in the Sierra Nevada, particularly old growth specialists of concern like spotted owls (*Strix occidentalis*) and **Pacific fishers** (*Pekania pennanti*). In some parts of the spotted owl's range, drought and high temperatures during the previous summer have been linked to lower survival and recruitment the following year (Franklin et al. 2000, Glenn et al. 2011, Jones et al. 2016a)..." 2. Uunder vulnerability section (p. 32): "High elevation forests and old-growth mixed conifer forests are the most vulnerable to projected changes in climate and wildfire. Wildlife species dependent on these habitats are also imperiled. Projections suggest much of the low- and mid-elevation forests in the Sierra Nevada, where species like owl and **fisher** reside, are vulnerable to conversion to woodlands, shrublands, and grasslands. Projections of future climate and vegetation conditions using the MC1

vegetation change model (Bachelet et al. 2001, Lenihan et al. 2008) suggest a major decrease in suitable old forest mixed conifer habitat over the next 50 years (Spencer et al., unpublished analyses performed for the Yale Framework Climate Adaptation Project: http://yale.databasin.org/pages/cbi), although these models may not adequately account for topographic effects on local microclimate and vegetation, which may partially mitigate the changes in mountainous terrain. In a recent study (Thorne et al. 2016), trees in the Sierra Nevada forests as a whole were shown to be only

moderately vulnerable to projected climate conditions even though the region will experience some of the most extreme shifts in climate in the state because the elevation gradient provides avenues for species to escape "uphill" as the climate warms. However, forests at the highest elevations are more vulnerable simply because there is no place to move as the climate warms." 3. Synergistic effects re wildfire: "The **projected increases in areas burned (Fig. 3.1.1) and wildfire severity** are likely to drive changes in tree species compositions (Lenihan et al. 2003, 2008) and reduce the extent of late-successional forests (McKenzie et al. 2004, Safford and Stevens 2017, Restaino and Safford, in press), which could alter the extent, abundance, or occurrence of species associated with these habitats (McKenzie et al. 2004; Purcell et al. 2012)." (p. 33) 4. Report includes discussion of **drought** (related to precipitation

decrease and temperature increase projections) and effects such as **tree mortality** (pp. 28, 49–50):

a. For example: "Forests that experience drought are more susceptible to stand-altering wildfires and pest such as bark beetle (Section 3.1). Loss of forest due to wildfire or tree mortality leads to changes in overall yield of streamflow and groundwater (Goulden and Bales 2014), to erosion, and to altered water quality." (p. 49) b. Also: "Liang et al. (2017) modelled the interactive effects

of climate warming and wildfire on forest composition and carbon storage for the Sierra Nevada. Their end-of-century projections include declines in forest productivity, reductions in species richness, and shifts in forest composition. The observed increase in tree mortality in the Westside South subregion provides a contemporary, empirical example of climate change impacts." (p. 28)

g. *California's Fourth Climate Assessment* – North Coast region (Grantham 2018)

i. General summary statement: "Wildfires will continue to be a major disturbance in the region. **Future wildfire projections suggest a longer fire season, an increase in wildfire frequency, and an expansion of the area susceptible to fire**." (p. 6) ii. "There is general agreement that temperature increases will **extend fire season throughout the region**, and especially in higher elevation sites with variable and decreasing snow pack (Micheli et al. 2018, Westerling et al. 2006)." (p. 23)

1. "Lightning ignitions have historically been the most common cause of fire in the region, and **lightning-ignited wildfires are likely to increase due to a longer fire season** and more available fuels (data from other parts of CA support this assumption; see Lutz et al. (2009)).

2. Re increase in fires: "Increased populations will also increase the probability of human-ignited wildfire, especially in more populated parts of the North Coast (Krawchuk and Moritz 2012, Micheli et al. 2018). " (p. 23) 3. "Westerling et al. (2011) predict that **increases in area burned** in northern California forests will exceed 100% in both lower and higher emissions scenarios." (p. 23) 4. Re vegetation changes: "**Increased fire frequencies and fire severities** will favor more frequent-fire adapted and/or early seral vegetation communities, including oak woodlands and chaparral (Ackerly et al. 2015)." (p. 23) iii. Additional relevant background/general information:

1. "The direct impacts of climate change on wildlife will interact with non-climate factors, including land use change, the spread of pests and pathogens, and invasive species." (p. 32) 2. Synergistic effects: "The boom of cannabis cultivation in the North Coast region has caused significant environmental impacts, including the dewatering of streams, water pollution, and forest fragmentation (Carah et al. 2015), and **may reduce the resilience of wildlife to climate change**." (p. 32)

a. "Cannabis production affects wildlife communities directly through the use of rodenticides, insecticides, and fertilizers, and indirectly through habitat conversion and fragmentation (Gabriel et al. 2018, Gabriel et al. 2015, Wang Ian et al. 2017). These impacts adversely affect animal fitness and survival, as well as their behavior and movement (Carah et al. 2015, Gabriel et al. 2012).” (p. 32)

h. Kerns et al. 2016 (*US exposure to multiple landscape stressors and climate change*, online publication)

i. Study examined **landscape exposure to wildfire potential, insects and disease risk, and urban and exurban development** for the conterminous United States [*broad-scale evaluation*]

1. “The two most prevalent coinciding stressors were (1) wildfire potential combined with insects and disease risk, and (2) climate departure combined with urban and exurban development.” (p. 3)

New Wildland Fire Analyses (CFWO):

A. Fire History

Using the Pacific fisher population map (updated with Washington State reintroduced populations), we evaluated fire history using USFS data (earliest year available was 1984). Table 1 contains a summary of the burned areas, across all population areas. A composite map of these results is shown in Figure 1. (Note: we can also prepare separate maps for each region in order to provide more visual detail of area burned)

Table 1. Area burned across the Pacific fisher populations in California, southern Oregon, and Washington.

Source data: Northwest Interagency Coordination Center (NWCC) Fire History 2000-2018, CalFire Fire17_1 (history), and Monitoring Trends in Burn Severity (MTBS) Fire Occurrence Dataset 1984-2016.

5-Year Time Interval Area Burned, acres (hectares) 1984 - 1989 881,993.72 (356,930.20) 1990 - 1994 474,608.66 (192,067.31) 1995 - 2000 445,392.96 (180,244.14) 2001 - 2006 1,731,330.03 (700,644.40) 2007 - 2012 1,350,675.71 (546,599.07) 2013 - 2018 3,226,918.46 (1,305,887.57)

Figure 1. Fire burn history for Pacific fisher population areas.

B. Fire Threat [Note: this dataset only available for California]

Using the areas of fisher populations in California and CalFire data, we evaluated the risk of fire (fire threat). We used a GIS data layer from the California Department of Forestry and Fire Protection (CDF 2004) called 'fire threat', which is based on two factors: 1) fire frequency, or the likelihood of a given area burning, and 2) potential fire behavior. These are combined to create five numerical index classes of fire threat ranging from little or no threat to extreme. This fire risk metric can be used to estimate the potential for impacts to resources that are susceptible to fire, that is, impacts are more likely to occur or be of increased severity for higher threat classes (e.g., very high or extreme) (CDF 2004). This analysis is shown in Table 2 below for the fisher population areas in California. A map of this analysis is presented in Figure 2.

Table 2. Fire Threat within Fisher Populations in California.

Source data: California Department of Forestry and Fire Protection (2004 Statewide GIS layer fthrt05_1).

Code	**Definition**	**Acres**	**Percent**
-1	Little or No Threat	640,352.24	4.7
1	Moderate	2,287,978.22	16.7
2	High	5,331,751.79	38.9
3	Very High	5,418,572.09	39.6
4	Extreme	4,315.47	0.03

The area assessed is based on the following values:

California Fisher Populations

Area	**Population Type**	**Acres**
Northern California - Southwestern Oregon	Native	10,147,790.59
Northern Sierra Nevada	Reintroduced	412,530.82
Southern Sierra Nevada	Native	3,138,677.51
Total Area		13,698,998.93

Figure 2. Fire threat for fisher populations in California.

C. Fire Burn Severity

We are using Monitoring Trends in Burn Severity (MTBS) data sets for fires from 1984 to 2016 and are able to clip each data set (for each State and for each year) to create an assessment of the severity of fires that burned in fisher population areas. However, this analysis is time consuming, particularly if there are numerous fires in each State.

Example analyses from 1987, 2015, and 2016 are shown below:

STATE BURN SEVERITY - 1987 TOTAL (acres) California Area of Revegetation 1,573.27 High 63,909.95 Low 178,475.13 Mask Clouds Shadows Water 0.89 Moderate 98,154.03 Unburned to Low 133,731.19 **California Total 475,844.46 Oregon** Area of Revegetation 301.28 High 18,483.76 Low 42,252.51 Moderate 23,838.95 Unburned to Low 53,219.06 **Oregon Total 138,095.56 Washington** Unburned to Low 0.16 **Washington Total 0.16 Grand Total 613,940.17**

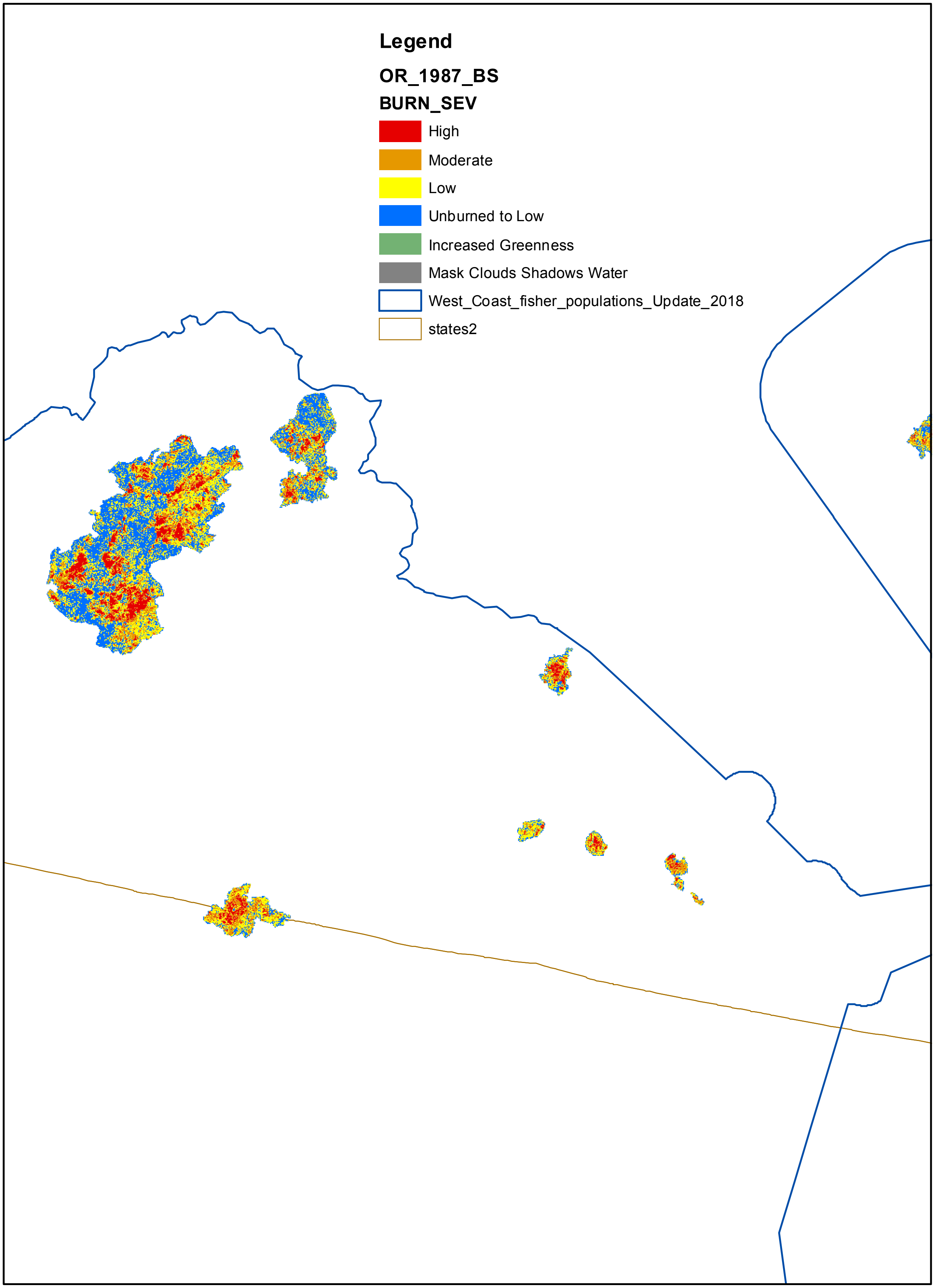
STATE BURN SEVERITY - 2016 TOTAL (acres) California Area of Revegetation 307.79 High 23,947.03 Low 25,110.83 Moderate 18,249.31 Unburned to Low 13,515.34 **California Total 81,130.31 Oregon** High 38.70 Low 514.18 Moderate 256.64 Unburned to Low 234.18 **Oregon Total 1,043.70 Washington** Area of Revegetation 21.57 High 1,989.54 Low 2,628.12 Moderate 1,812.96 Unburned to Low 2,094.25 **Washington Total 8,546.45 Grand Total 90,720.46**

STATE BURN SEVERITY - 2015 TOTAL (acres) California Area of Revegetation 4,739.46 High 82,104.04 Low 175,921.48 Mask Clouds Shadows Water 27.80 Moderate 104,340.90 Unburned to Low 91,093.52 **California Total 458,227.20 Oregon** Area of Revegetation 16.01 High 6,890.03 Low 15,516.45 Mask Clouds Shadows Water 1,065.49 Moderate 10,056.91 Unburned to Low 9,258.46 **Oregon Total 42,803.36 Washington** Area of Revegetation 4,149.44 High 66,909.78 Low 134,030.50 Mask Clouds Shadows Water 5,383.46 Moderate 102,909.67 Unburned to Low 55,842.31 **Washington Total 369,225.17 Grand Total 870,255.73**

Fire Threat work for the Fisher Population areas of California.

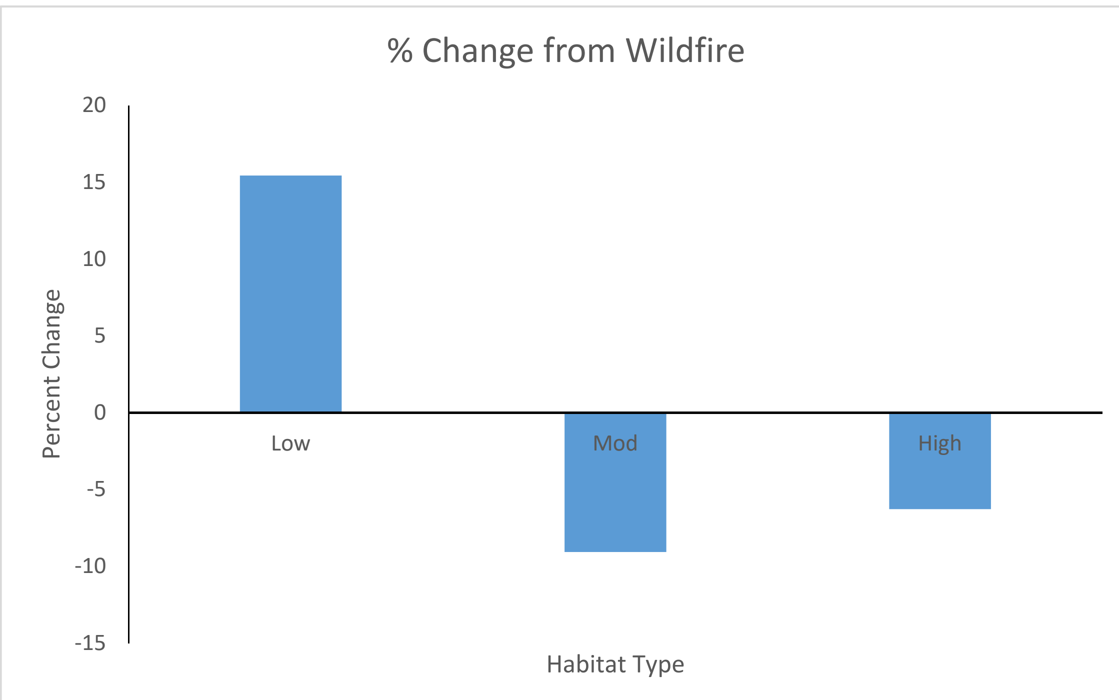
Downloaded the fthrt05_1, Statewide GIS layer (GRID format) of fire threat from the CalFire efforts, which combines expected fire frequency with potential fire behavior to create 4 threat classes (v05_1).

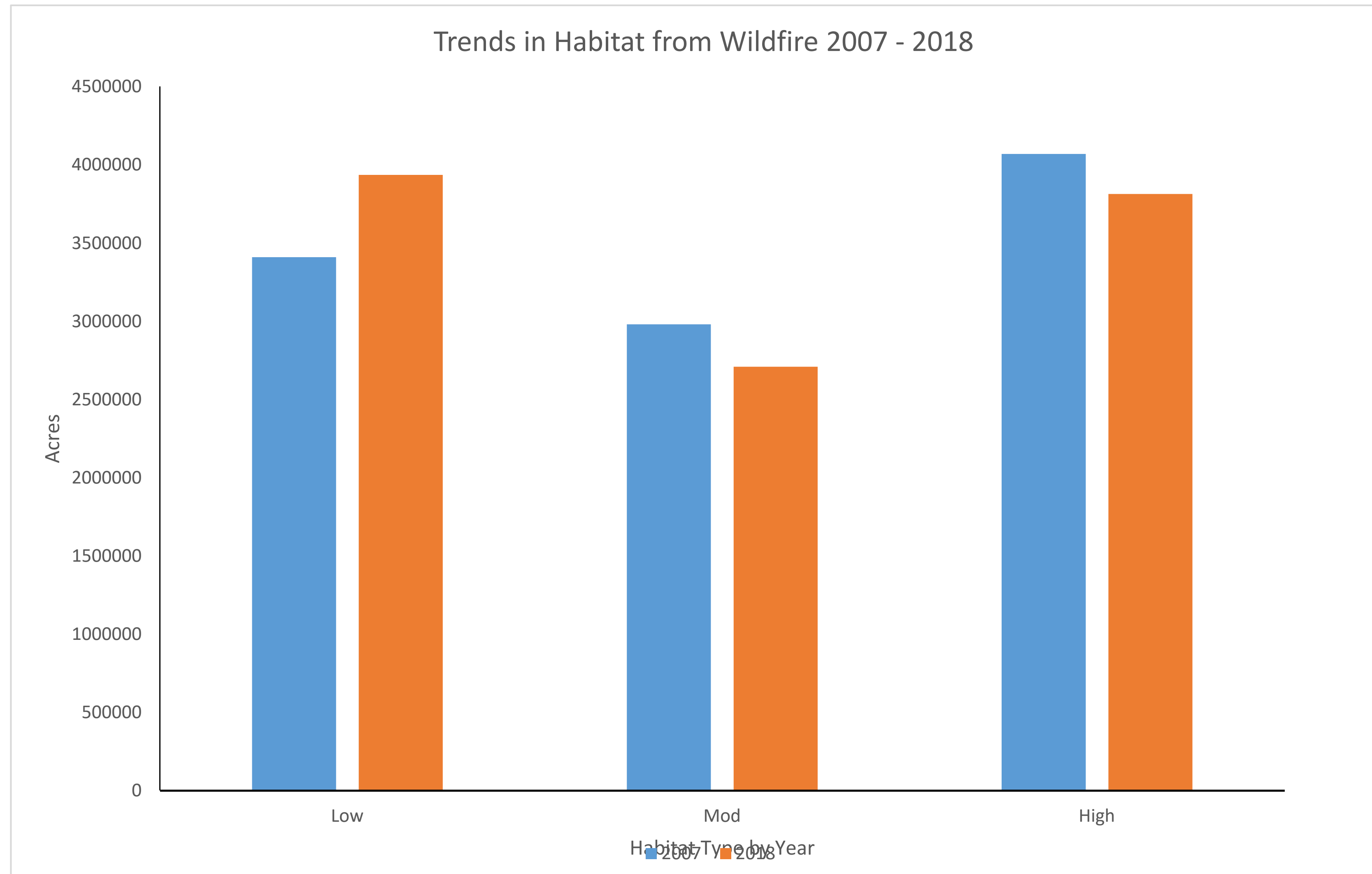
1. Projected the Statewide GIS layer (GRID format) to the Fisher custom Albers projection.
2. Edited the 2018 updated West Coast Fisher Population Area GIS data to only retain the California portions.
3. Extracted the Statewide GIS layer (GRID format) data to that of the CA Fisher Population area for ease of use.
4. Converted the extracted portion of the Statewide GIS layer (GRID format) data to a polygon dataset using the Threats value as the GridCode and chose not to simplify polygons so we would retain full cells as they approach the population boundary.
5. Joined the Fire Threat LUT table that I created to include threat levels and text descriptions.
6. Exported that to a new dataset to retain those values.
7. Dissolved the cells based on the threat classes to make the data manageable for acreage and percentage use.
8. Clipped the resulting data to the CA Fisher Populations boundary to fine trim cells that fall beyond the boundary of the population area. This is a result of the raster and trying to retain full representation.
9. Calculate acreage for the CA populations area as a whole.
10. Calculate acreage for the CA fire threat levels within the CA Population area.
11. Output to DBF tables and convert to Excel tables to calculate one combined table with all values and calculate percentages and build table for the map. Percentage represents the amount of threat level within CA population area.


Legend
OR_1987_BS
BURN_SEV
High
Moderate
Low
Unburned to Low
Increased Greenness
Mask Clouds Shadows Water
West_Coast_fisher_populations_Update_2018
states2

Sum of POLY_AREA	
Hab_2018	Total
1	3935783.607
2	2709425.037
3	3814185.816
(blank)	102202.9097
Grand Total	10561597.37

Habitat Type	2007	2018	% Change
Low	3409577	3935784	15.43319
Mod	2980040	2709425	-9.080907
High	4069995	3814186	-6.285252
Total	10459612		





OBJECTID	Hab	Hab_2008	Hab_2009	Hab_2010	Hab_2013	Hab_2014	Hab_2015	Hab_2017	gridcode	Hab_2018	Hab_2011	Hab_2012	Hab_2016	Shape_Length	Shape_Area	POLY_AREA
1	0								0					226196.4714	193565618.3	47831.06365
2	0	0							0					15818.13962	8009480.669	1979.184026
3	0	0	0	0					0					40128.07024	6422537.831	1587.042258
4	0	0	0	0	0	0			0					15369.59863	68327.04296	16.88396509
5	0	0	0	0	0	0	0		0					29982.98567	722285.3704	178.4804442
6	0	0	0	0					0		0			171939.3679	50386091.26	12450.6633
7	0	0	0	0	0				0		0	0		28352.87748	10252660.2	2533.485269
8	0	0	0	0	0	0			0		0	0		106183.8259	11054679.54	2731.668389
9	0	0	0	0	0	0	0		0		0	0		1800.924336	27841.11842	6.879684107
10	0	0	0	0	0	0	0		0		0	0	0	194965.3922	130593996.7	32270.45084
11	0	0	0	0	0	0	0	0	0		0	0	0	10638.04832	48842.69338	12.06928171
12	1	1	1	1	1	1	1	1	0	1				4764359.987	5400041784	1334378.205
13	1	1	1	1	1	1	1	1	0	1	1	1	1	9410546.371	7439185987	1838261.266
14	2	1	1	1	1	1	1	1	0	1				79782.47286	3549099.211	877.0007391
15	2	1	1	1	1	1	1	1	0	1	1	1	1	3844833.203	125864510	31101.77027
16	2	2	1	1	1	1	1	1	0	1	1	1	1	114142.9203	4451616.093	1100.01732
17	2	2	2	1	1	1	1	1	0	1				50022.21182	2020135.399	499.1858871
18	2	2	2	2	1	1	1	1	0	1				113514.2978	3756254.748	928.1899419
19	2	2	2	2	2	1	1	1	0	1				67969.49168	2778099.43	686.4827126
20	2	2	2	2	2	2	1	1	0	1				330436.7356	13282450.08	3282.161993
21	2	2	2	2	2	2	2	1	0	1				2579206.878	184340622	45551.51945
22	2	2	2	2	2	2	2	2	0	2				9790397.647	4006244596	989963.7239
23	2	2	2	2	1	1	1	1	0	1	1	1	1	1876.348041	33843.64	8.36293818
24	2	2	2	2	1	1	1	1	0	1	2	1	1	1003005.06	42877939.75	10595.36029
25	2	2	2	2	1	1	1	1	0	1	2	2	1	508356.1081	24962471.44	6168.355574
26	2	2	2	2	2	1	1	1	0	1	2	2	1	1971435.594	106100801.6	26218.05587
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28	2	2	2	2	2	2	2	1	0	1	2	2	1	86690.83867	3559465.286	879.5622497
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33	3	3	1	1	1	1	1	1	0	1				692.3832064	5882.555041	1.453609722
34	3	3	1	1	1	1	1	1	0	1	1	1	1	39187.35872	1416733.476	350.0821566
35	3	3	3	1	1	1	1	1	0	1				35990.10093	1445750.269	357.2523558
36	3	3	3	3	1	1	1	1	0	1				52278.06224	1003751.139	248.0320889
37	3	3	3	3	3	1	1	1	0	1				61111.45874	3468813.968	857.1618411
38	3	3	3	3	3	3	1	1	0	1				95621.96955	2896019.077	715.6212661
39	3	3	3	3	3	3	3	1	0	1				1171015.165	63126389.01	15598.85665
40	3	3	3	3	3	3	3	3	0	3				6045919.47	4227318423	1044592.208
41	3	3	3	3	1	1	1	1	0	1	1	1	1	34300.37762	1566847.538	387.1761162
42	3	3	3	3	1	1	1	1	0	1	3	1	1	1698856.083	75321523.64	18612.33738
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49	0								1					3606.063377	32220.72976	7.961908679
50	0	0	0	0	0	0	0	0	1					5064.469683	173868.2906	42.96375229
51	0	0	0	0	0	0	0	0	1		0	0	0	58286.7757	354818.8017	87.67755784
52	1	1	1	1	1	1	1	1	1	1				2214327.811	86027939.18	21257.94793
53	1	1	1	1	1	1	1	1	1	1	1	1	1	4053323.725	77071817.3	19044.84398
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55	2	2	2	1	1	1	1	1	1	1				28164.31161	506978.9718	125.2771215
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61	2	2	2	2	1	1	1	1	1	1	2	1	1	169929.7789	1939910.242	479.3618366
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63	2	2	2	2	2	2	2	2	1	2	2	2	2	5745435.078	155795851.4	38497.95926
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66	3	3	3	3	3	1	1	1	1	1				6798.855503	74103.86465	18.31144756
67	3	3	3	3	3	3	1	1	1	1				3045.474635	68640.16081	16.96133813
68	3	3	3	3	3	3	3	1	1	1				59.15028536	211.2496237	0.052200873
69	3	3	3	3	3	3	3	3	1	3				4363335.633	201578414.7	49811.06703
70	3	3	3	3	1	1	1	1	1	1	3	1	1	266852.2757	3228418.63	797.7589119

71	3	3	3	3	3	3	3	3	1	3	3	3	3	9006016.668	279051747.5	68955.12755
72	0								2					917.2266993	3575.922887	0.883629008
73	0	0	0	0	0	0	0	0	2					3137.641912	32167.04787	7.948643608
74	0	0	0	0	0	0	0	0	2		0	0	0	35188.54717	148144.441	36.60725625
75	1	1	1	1	1	1	1	1	2	1				3200104.967	45732966.97	11300.85226
76	1	1	1	1	1	1	1	1	2	1	1	1	1	5418202.21	94318231.01	23306.52185
77	2	1	1	1	1	1	1	1	2	1	1	1	1	919.0266607	7712.347071	1.90576078
78	2	2	2	1	1	1	1	1	2	1				16771.0484	121431.1002	30.00625181
79	2	2	2	2	1	1	1	1	2	1				19158.71592	148958.3502	36.80837741
80	2	2	2	2	2	1	1	1	2	1				1079.679944	6102.347491	1.507921572
81	2	2	2	2	2	2	1	1	2	1				1779.489831	8087.506141	1.998464523
82	2	2	2	2	2	2	2	1	2	1				2625.149893	18530.37549	4.578951455
83	2	2	2	2	2	2	2	2	2	2				4568100.53	62759875.49	15508.28926
84	2	2	2	2	1	1	1	1	2	1	2	1	1	136854.0327	1769998.353	437.3757315
85	2	2	2	2	2	2	2	1	2	1	2	2	2	1429.143738	12875.26562	3.181544609
86	2	2	2	2	2	2	2	2	2	2	2	2	2	5207688.882	90904321.29	22462.92713
87	3	1	1	1	1	1	1	1	2	1	1	1	1	69482.92782	595141.2591	147.0624779
88	3	3	3	1	1	1	1	1	2	1				7118.34918	47771.03497	11.80446938
89	3	3	3	3	3	1	1	1	2	1				2355.398878	13336.46533	3.29550944
90	3	3	3	3	3	3	1	1	2	1				534.6473803	3853.060932	0.95211125
91	3	3	3	3	3	3	3	1	2	1				147.1172745	940.9102129	0.232503772
92	3	3	3	3	3	3	3	3	2	3				5883470.124	88849778.38	21955.23897
93	3	3	3	3	1	1	1	1	2	1	3	1	1	138382.5246	1656752.128	409.3920047
94	3	3	3	3	3	3	3	3	2	3	3	3	3	6497960.956	91293667.16	22559.13651
95	0								3					1080.972345	3589.479989	0.886979038
96	0	0	0	0	0	0	0	0	3					1581.509218	13403.73588	3.31213234
97	0	0	0	0	0	0	0	0	3		0	0	0	86053.4173	435815.2879	107.6922078
98	1	1	1	1	1	1	1	1	3	1				3177377.14	56630271.87	13993.63256
99	1	1	1	1	1	1	1	1	3	1	1	1	1	3920927.186	493771780.5	122013.5563
100	2	1	1	1	1	1	1	1	3	1	1	1	1	1731.427305	14243.03212	3.519526773
101	2	2	2	1	1	1	1	1	3	1				18506.86201	150332.1992	37.14786259
102	2	2	2	2	1	1	1	1	3	1				26947.52601	262415.9741	64.84434205
103	2	2	2	2	2	1	1	1	3	1				1274.092257	17543.6555	4.335127851
104	2	2	2	2	2	2	1	1	3	1				599.2481829	2214.483494	0.547210305
105	2	2	2	2	2	2	2	1	3	1				4241.92702	36624.1233	9.050009958
106	2	2	2	2	2	2	2	2	3	1				4285143.338	68081686.67	16823.33628
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110	3	1	1	1	1	1	1	1	3	1	1	1	1	88288.68479	838168.527	207.1157705
111	3	3	3	1	1	1	1	1	3	1				10163.87754	85622.58729	21.15778339
112	3	3	3	3	3	1	1	1	3	1				2174.617674	17535.35533	4.333076837
113	3	3	3	3	3	3	3	1	3	1				206.8958769	1020.907392	0.252271487
114	3	3	3	3	3	3	3	3	3	1				4696217.97	72263393.55	17856.65764
115	3	3	3	3	1	1	1	1	3	1	3	1	1	100903.0926	3758753.595	928.8074199
116	3	3	3	3	3	3	3	3	3	1	3	3	3	4498889.025	101711514.4	25133.44034
117	0								4					4317.321484	58230.81511	14.38913506
118	0	0	0	0	0	0	0	0	4					322.7062234	2078.3593	0.513573314
119	0	0	0	0	0	0	0	0	4		0	0	0	36229.0499	309734.7658	76.53705978
120	1	1	1	1	1	1	1	1	4	1				1681885.432	79130100.46	19553.45637
121	1	1	1	1	1	1	1	1	4	1	1	1	1	499104.5383	25625004.91	6332.071016
122	2	1	1	1	1	1	1	1	4	1	1	1	1	1672.644245	29063.67158	7.181783304
123	2	2	2	1	1	1	1	1	4	1				18522.8343	271903.8218	67.1888382
124	2	2	2	2	1	1	1	1	4	1				15811.39423	336380.5514	83.12137098
125	2	2	2	2	2	1	1	1	4	1				524.7937268	6089.752813	1.504809362
126	2	2	2	2	2	2	1	1	4	1				472.0272685	4362.476308	1.077990419
127	2	2	2	2	2	2	2	1	4	1				10530.82397	445635.1375	110.1187433
128	2	2	2	2	2	2	2	2	4	1				2421429.238	110775750.3	27373.25983
129	2	2	2	2	2	2	2	1	4	1	2	2	2	485.6410014	3173.381242	0.784158889
130	2	2	2	2	2	2	2	2	4	1	2	2	2	946986.2664	51972724.51	12842.72856
131	3	1	1	1	1	1	1	1	4	1	1	1	1	140259.318	4729832.299	1168.765981
132	3	3	3	1	1	1	1	1	4	1				9542.807585	97123.8321	23.99980036
133	3	3	3	3	3	1	1	1	4	1				648.1501525	2735.803066	0.676031063
134	3	3	3	3	3	3	3	1	4	1				1419.900965	42965.68826	10.6170434
135	3	3	3	3	3	3	3	3	4	1				2361709.179	111054146.3	27442.05292
136	3	3	3	3	3	3	3	3	4	1	3	3	3	2782702.364	153222710.8	37862.12294
137	1	1	1	1	1	1	1	1	5		1	1	1	13387.87581	545595.4718	134.819458
138	2	2	2	2	2	2	2	2	5		2	2	2	7618.403806	321743.8863	79.50457547
139	3	3	3	3	3	3	3	3	5		3	3	3	1524.274578	13519.55928	3.3407529

Code	Definition	Acres	CA Fisher Population Area	Precentage of Fire Threat within CA Fisher Population Area
-1	Little or No Threat	640,352.24	13,698,998.93	4.7
1	Moderate	2,287,978.22	13,698,998.93	16.7
2	High	5,331,751.79	13,698,998.93	38.9
3	Very High	5,418,572.09	13,698,998.93	39.6
4	Extreme	4,315.47	13,698,998.93	0.03

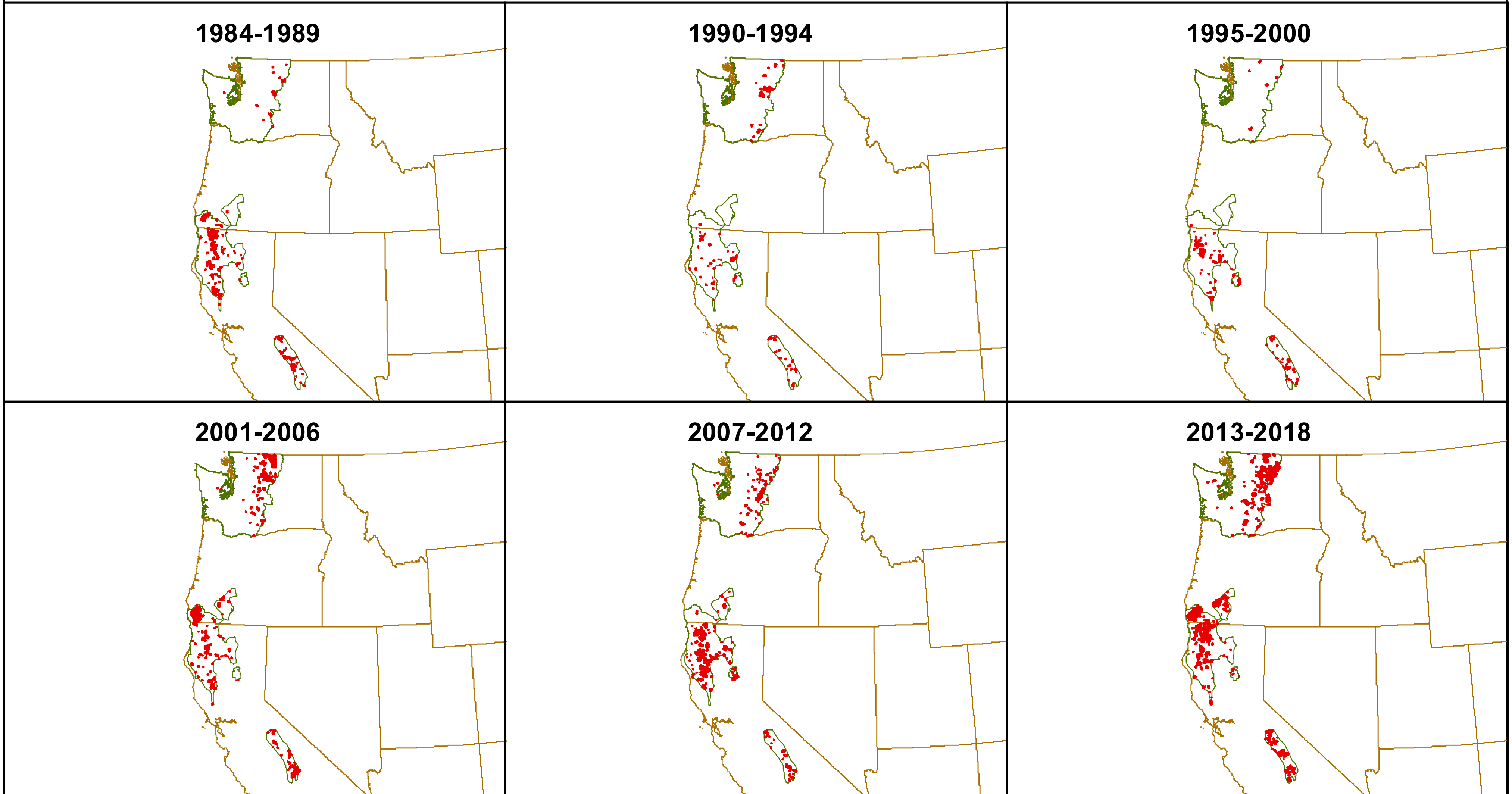
CODE	Definition	Precentage of Fire Threat within CA Fisher Population Area
-1	Little or No Threat	4.7
1	Moderate	16.7
2	High	38.9
3	Very High	39.6
4	Extreme	0.03

U.S. Fish & Wildlife Service

Carlsbad Fish and Wildlife Office

2177 Salk Ave., Ste. 250, Carlsbad, CA 92008

Burn Areas in Population Extent for the West Coast Fisher *(Pekania pennanti)*



N

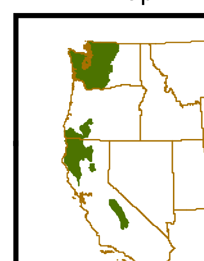
0 500 1,000 Miles

0 500 1,000 Kilometers

Burn Areas In Fisher Population Extent By 5Yr Range

Fisher Populations

Locator Map



PRODUCED BY GIS BRANCH
CARLSBAD FISH & WILDLIFE OFFICE
GIS CONTACT: ED TURNER
PROJECT BIOLOGIST: BETTY GRIZZLE
MAP DATE: 11/23/2018
DATA SOURCE: USFWS, CAL Fire - FRAP 1984-17
Northwest Interagency Coordination Center (NWCC) 2000-18,
Monitoring Trends in Burn Severity (MTBS) 1984-16
S:\stem\edstemp\Fisher\MXDs\Fires.mxd

Information displayed is DELIBERATIVE and should be considered DRAFT for internal discussion.

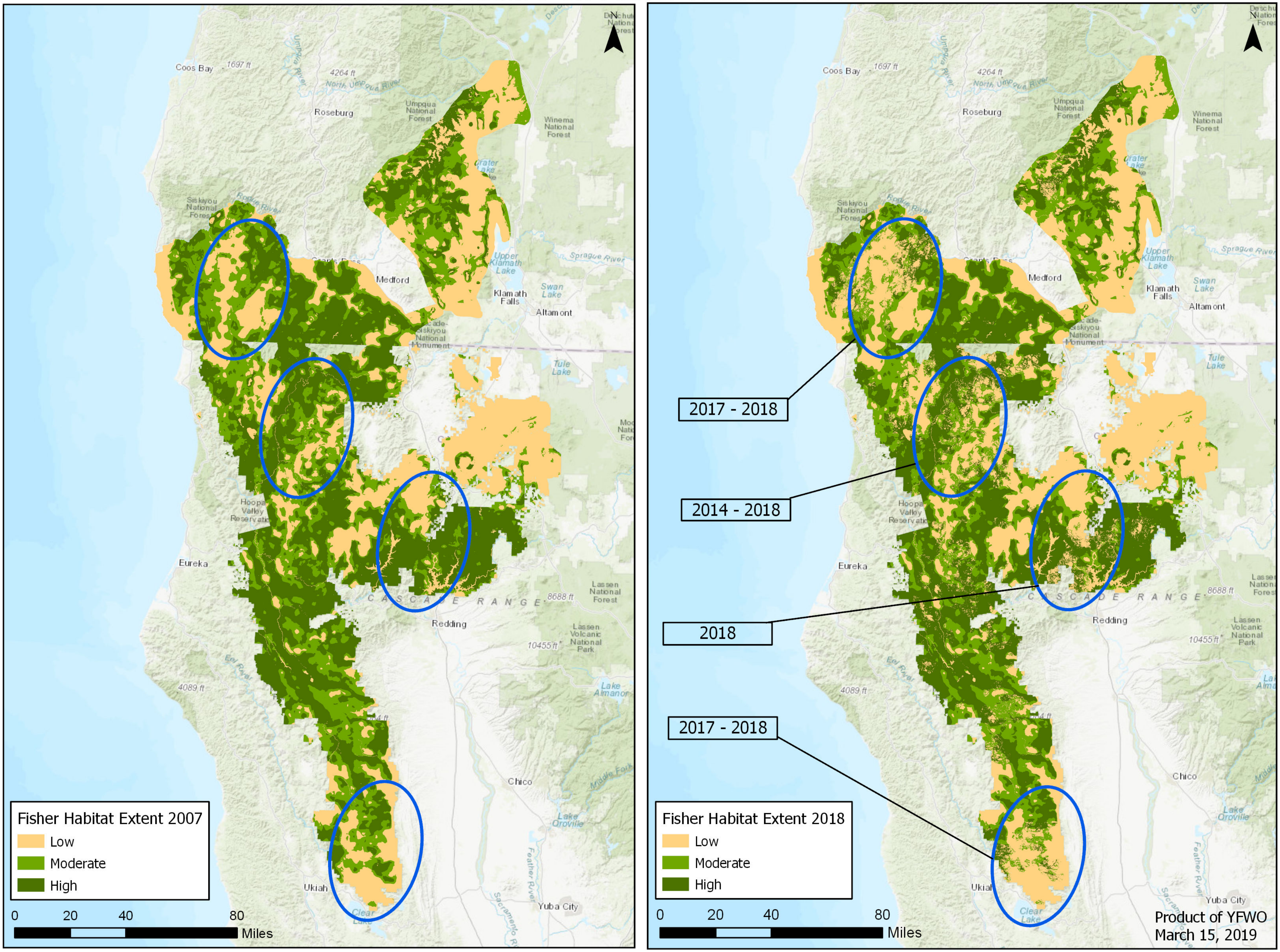
Fisher fire history: 1:32,588,299

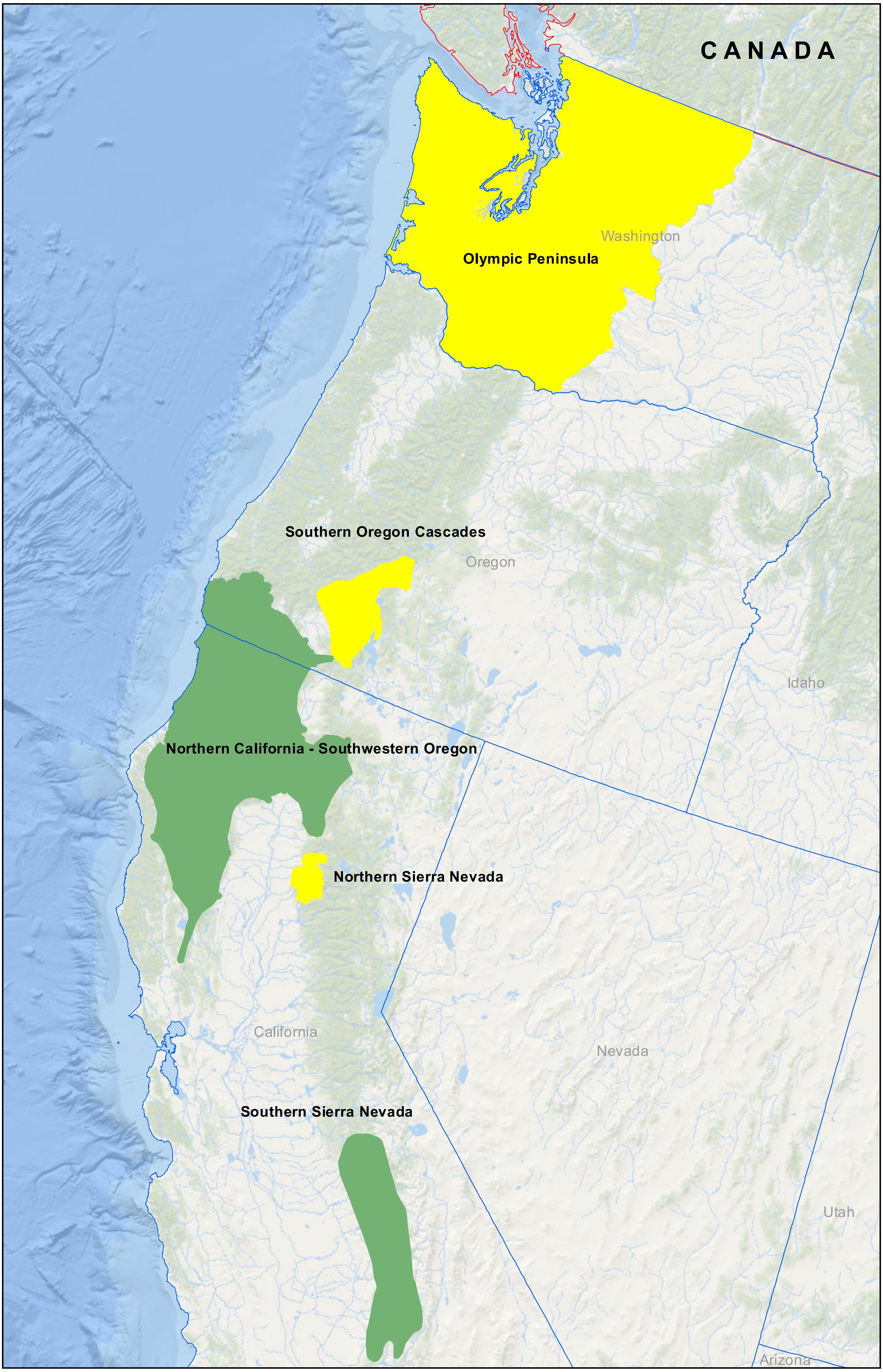
I combined three different fire history data into one complete set to represent burns based on 5 year increments (1984-1989, 1990-1994, 1995-2000, 2001-2006, 2007-2012, 2013-2018). The datasets we are using are set to a date range from 1984 – 2018. We are using the following data in the fire history combination; Northwest Interagency Coordination Center (NWCC) Fire History 2000-2018 (downloaded from ArcGIS Online), CalFire Fire17_1 (history) (CAL Fire - FRAP), and Monitoring Trends in Burn Severity (MTBS) Fire Occurrence Dataset 1984-2016.There could be overlap, but I needed to try to get full fire perimeters and these three seemed to give me what I needed. Due to overlap of fires from the datasets along jurisdictional boundaries, it was necessary to run each dataset individually within the limits of the Fisher populations area data to determine fires by the 5 year breakout range. Once this process was complete it was easier to combine the data from each set. ***(more on this)***

Once fire data was combined, I have year of fire and can set data by decade. Following that I can dissolve on decade, as I do not need individual fire date or name, I simply need the fire as nice contiguous blobs (polygons) based on decade. I will use the combined set, which contains fire name and year to get an idea of what burn severity data I need to download. Once I have years I can search where that falls in the population and select those years from the Monitoring Trends in Burn Severity (MTBS) fire site.

1. Before I can process any data I must project all sets into a consistent projection. I'm using a custom Fisher Albers projection (see project notes).
2. The MTBS dataset covers the US, so for ease of use I first the data to the vicinity of WA, OR, CA with included some fire overlay into adjacent states. Once complete additional process was faster.
3. Combine each dataset with the Fisher population updated 2018 data that CFWO created using the ESRI clip function. This will limit each dataset and provide a list of fires, dates, years, etc.
4. Edit each dataset attribute table to retain like codes within each for future use. Codes: "STATE" = represents state, "FIRE_NAME" (or like) = name of burn, "FIRE_YEAR" = Year fire burned, "START_DATE" = date of ignition, Source type code (MTBS, CALFIRE, NWCC). Note that these items are retained in the clipped data, but will not carry forward with data processing. The "5YR_RANGE" = 5 year span of burn combo increments (1984-1989, 1990-1994, 1995-2000, 2001-2006, 2007-2012, 2013-2018), this field will push forward.
5. Combined all data with only the source type code and the 5YR Range values.
6. Select each set of 5YR Range values that were possible from all three sources and output to 5YR Range specific files for dissolving into range fire burn blobs. Due to the fact that we are selecting from all three datasets each 5yr range, we will have areas that meet the 5yr range limit, but may have fires from other years in one of two of those datasets. This is not a problem because fires are overlapping burns and we are selecting for all possible ranges and will have complete coverage.
7.

Effects of Wildfire on Fisher Habitat: 2007 - 2018





PRODUCED BY GIS SERVICES
CARLSBAD FIELD OFFICE
GIS CONTACT: ED TURNER
BIOLOGY CONTACT: BETTY GRIZZLE
(760) 431-9440
DATA SOURCE: USFWS
IMAGE SOURCE: ESRI Online Mapper
Dec 03, 2018
S:\stem\edstemp\Fisher\MXDs\Fisher_Populations_Update_2018.mxd

N

0 25 50 100 Miles

0 30 60 120 Kilometers

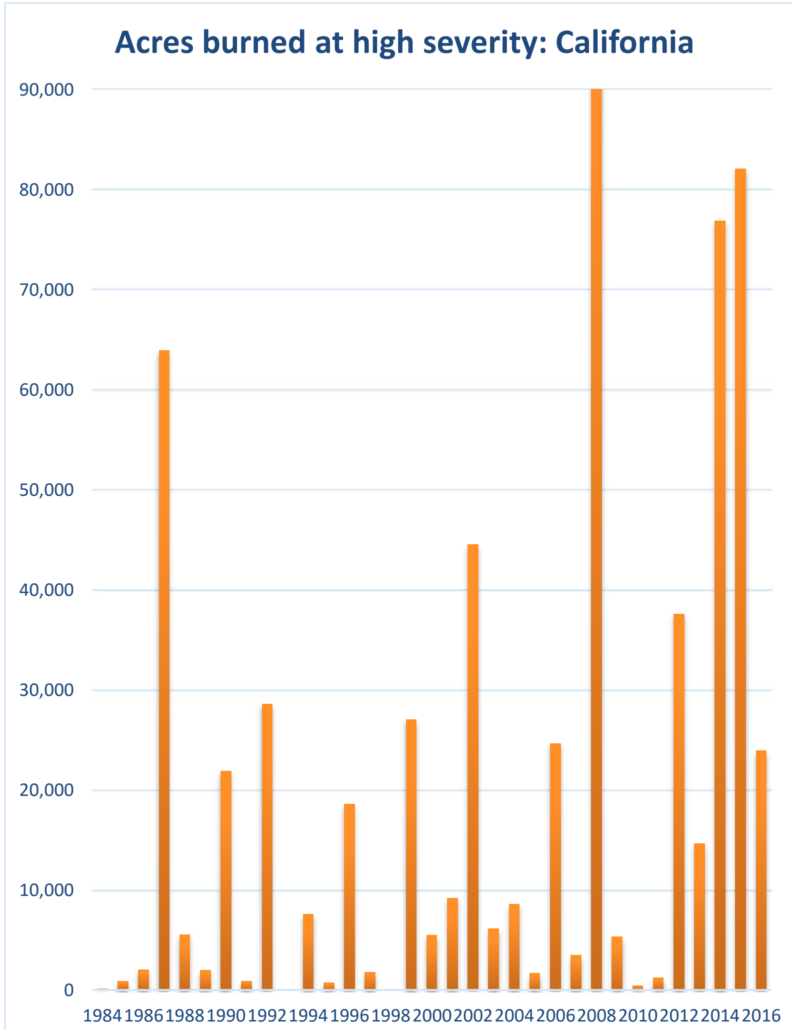
Legend

Native West Coast Fisher Populations

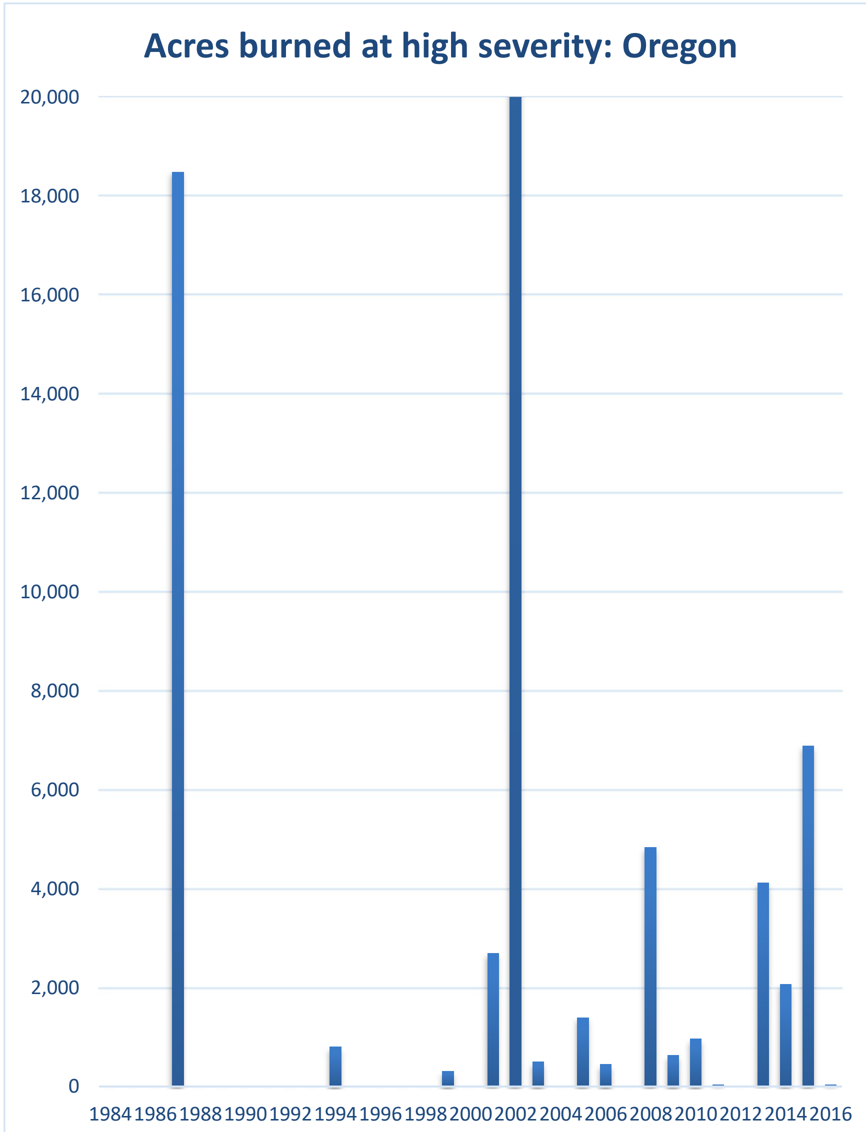
Reintroduced West Coast Fisher Populations

Information displayed is DELIBERATIVE and should be considered DRAFT for internal discussion.

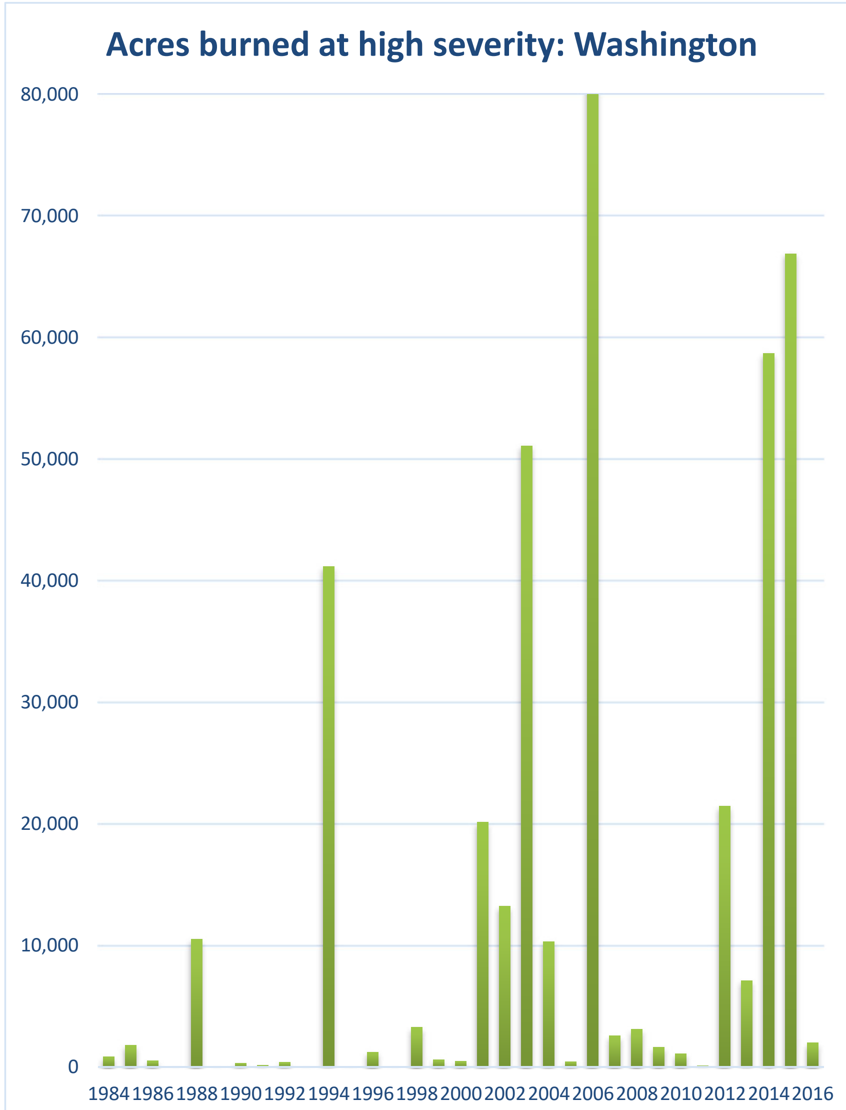
YEAR	ACRES
1984	142.96
1985	916.49
1986	2,060.04
1987	63,909.95
1988	5,560.09
1989	1,985.54
1990	21,904.59
1991	933.61
1992	28,605.54
1993	31.58
1994	7,603.23
1995	712.11
1996	18,595.69
1997	1,814.30
1998	59.16
1999	27,048.16
2000	5,483.61
2001	9,194.47
2002	44,524.31
2003	6,169.93
2004	8,592.12
2005	1,691.97
2006	24,669.15
2007	3,509.39
2008	110,778.94
2009	5,331.57
2010	483.76
2011	1,232.73
2012	37,632.72
2013	14,659.38
2014	76,908.49
2015	82,104.04
2016	23,947.03



YEAR	ACRES
1984	0.00
1985	0.00
1986	0.00
1987	18,483.76
1988	0.00
1989	0.00
1990	0.00
1991	0.00
1992	0.00
1993	0.00
1994	802.85
1995	0.00
1996	0.00
1997	0.00
1998	0.00
1999	311.58
2000	0.00
2001	2,695.43
2002	147,604.90
2003	503.58
2004	0.00
2005	1,396.52
2006	448.79
2007	0.00
2008	4,836.20
2009	634.41
2010	963.41
2011	40.03
2012	0.00
2013	4,121.20
2014	2,070.94
2015	6,890.03
2016	38.70



YEAR	ACRES
1984	865.80
1985	1,809.85
1986	506.62
1987	0.00
1988	10,508.38
1989	4.45
1990	317.58
1991	145.67
1992	378.96
1993	0.00
1994	41,164.02
1995	34.47
1996	1,238.07
1997	0.00
1998	3,271.43
1999	616.70
2000	482.60
2001	20,130.96
2002	13,214.70
2003	51,108.56
2004	10,325.79
2005	443.90
2006	95,088.94
2007	2,576.84
2008	3,123.76
2009	1,644.39
2010	1,101.52
2011	124.32
2012	21,448.65
2013	7,112.60
2014	58,696.23
2015	66,909.78
2016	1,989.54



MTBS Burn Area Boundary

ESRI geodatabase (72MB)

shape file (187MB)

Date of last refresh: Aug 3, 2018

Abstract

The Monitoring Trends in Burn Severity (MTBS) project assesses the frequency, extent, and magnitude (size and severity) of all large wildland fires (includes wildfire, wildland fire use, and prescribed fire) in the conterminous United States (CONUS), Alaska, Hawaii, and Puerto Rico for the period of 1984 through 2016. All fires reported as greater than 1,000 acres in the western U.S. and greater than 500 acres in the eastern U.S. are mapped across all ownerships. MTBS produces a series of geospatial and tabular data for analysis at a range of spatial, temporal, and thematic scales and are intended to meet a variety of information needs that require consistent data about fire effects through space and time. This map layer is a vector polygon of the location of all currently inventoried and mappable MTBS fires occurring between calendar year 1984 and 2016 for the continental United States, Alaska, Hawaii and Puerto Rico.

Purpose:

The data generated by Monitoring Trends in Burn Severity (MTBS) will be used to identify national trends in burn severity, providing information necessary to monitor the effectiveness of the National Fire Plan and Healthy Forests Restoration Act. MTBS is sponsored by the Wildland Fire Leadership Council (WFLC), a multi-agency oversight group responsible for implementing and coordinating the National Fire Plan and Federal Wildland Fire Management Policies. The MTBS project objective is to provide consistent, 30 meter resolution burn severity data and burned area delineations that will serve four primary user groups: 1. National policies and policy makers such as the National Fire Plan and WFLC which require information about long-term trends in burn severity and recent burn severity impacts within vegetation types, fuel models, condition classes, and land management activities. 2. Field management units that benefit from mid to broad scale GIS-ready maps and data for pre- and post-fire assessment and monitoring. Field units that require finer scale burn severity data will also benefit from increased efficiency, reduced costs, and data consistency by starting with MTBS data. 3. Existing databases from other comparably scaled programs, such as Fire Regime and Condition Class (FRCC) within LANDFIRE, that will benefit from MTBS data for validation and updating of geospatial data sets. 4. Academic and agency research entities interested in fire severity data over significant geographic and temporal extents.

Why does the MTBS data record begin in 1984?

MTBS leverages Landsat (TM/ETM+/OLI) satellite data for mapping and characterizing fires. Although the Landsat mission extends back to 1972, the first Thematic Mapper sensor was launched on Landsat 4 in 1982. Consequently, Landsat Thematic Mapper data continuity extends back to 1984.

MTBS Thematic Burn Severity:

Monitoring Trends in Burn Severity (MTBS) Fire Occurrence Dataset 1984-2016

Burn severity layers are thematic images depicting severity as unburned to low (1), low (2), moderate (3), high (4), and increased greenness (increased postfire vegetation response) (5). The layer may also have a sixth (6) class representing a mask for clouds, shadows, large water bodies, or other features on the landscape that erroneously affect the severity classification.

What are the MTBS thematic burn severity data class descriptions?

Increased Greenness (CFOW Area of Revegetation) - Areas that burned but display more vegetation cover, density, and/or productivity (vigor), usually within one growing season after fire. This is a fire-caused effect from release of nutrients into soil, and/or reduced competition for nutrients, light and water (much like a thinning effect). These areas are usually herbaceous or low shrub communities that undergo little change in species composition after fire.

Unburned to Low - Areas that are either unburned, or when visible fire effects occupy a small proportion of the site, on the order of less than 5 percent. If more of the site is burned, then effects are limited to a few biophysical components. The class may also include areas that recover very quickly after fire, such as grasslands or light surface burns under dense, non-impacted forest canopies.

Low - Areas where more than a small proportion of the site burned. Collectively, all strata are slightly altered from the pre-fire state. Duff, woody debris and newly exposed mineral soil typically exhibit some change. Low vegetation (<1 meter) and shrubs or trees (1-5 meters) may show significant aboveground scorch, char or consumption, and vegetation density or cover may be greatly altered. These prefire plants are generally still viable and recover quickly (within a year or two), with little change in species composition. An exception is western conifers, where sapling-sized trees may exhibit 50 percent or more mortality. Intermediate and large overstory trees may exhibit up to 25 percent mortality evidenced by crown char or scorch. Where charring does not kill tree crowns, as is common in the southeast, higher percentages of black char may occur. Char height from ground flames is typically less than 3 meters.

Moderate - The moderate class is difficult if not impossible to briefly describe. Indicators may be fairly consistent across biophysical strata and will exhibit traits between the low and high severity classes. On the other hand, numerous potential combinations of distinct low and high indicators may occur to yield a moderate classification overall within the minimum mapping unit. Conditions are transitional in magnitude and/or uniformity between the low and high characteristics described.

High - This class is characterized by fairly consistent effects across a site. In forested ecosystems, litter is totally consumed; duff is typically nearly entirely consumed. Medium and heavy woody debris are at least partially consumed and at least deeply charred with mostly ash and charcoal remaining. Overstory trees typically exhibit greater than 75 percent mortality. Biomass consumption and above-ground changes in carbon balances are significant. Crown char is frequently 100 percent from torching fire, and significant branch loss is evident at the highest crown levels. Where crown torching did not occur, char height from ground flames often exceeds 4 meters. Overstory tree effects are generally long lasting. New tree establishment may occur 1-3 years post-fire, but forest development often takes many decades. Herbaceous plants and shrubs are almost completely charred or consumed above ground, often with notable branch loss on taller shrubs, which may be reduced to small stubs. Resprouting from perennial plants, except grasses, is strongly reduced, as most individuals lose viability with a significant reduction in cover.

1. Download raster data for all states by all years that are needed. (https://www.mtbs.gov/direct-download)
2. Project to the Fisher projection. Output "st_year_fpj.shp"
3. Extract by Mask; raster data to the limits of the West Coast Populations boundary. "st_year_f.shp"
4. Convert from raster to polygon and Uncheck Simplify. "st_year_no_clip.shp"
5. Clip polygon data to the West Coast Fisher Population boundary *** IF needed or save time and not run. "st_year_clip.shp"
6. Join the Burn Severity LUT excel file and export to new dataset. File **Burn_Severity_LUT.xlsx**
7. Export to data set "st_year_no_dis.shp"
8. Dissolve data on the burn severity codes out to new set. "st_year.shp"
9. Add a State code to data. STATE text 2 "CA", "OR", "WA".
10. Union all three along with the States data for full state name and see if we have overlap issues. File in year folder " BS_year.shp"
11. Looks at overlap and code based on state name and if it matches state abbreviation. Edit all fields as needed to code data correctly for the state.
12. Use editor to delete polys that are from state data but not fisher populations.

13. Build table of the year run by state for acres. ** Betty built a table that graphs our results and I just continue to add years as completed.

Count of FIRE_YEAR		
STATE	**FIRE_YEAR**	**Total**
CA	1984	5
	1985	5
	1986	4
	1987	44
	1988	12
	1989	4
	1990	14
	1991	3
	1992	6
	1993	1
	1994	8
	1995	3
	1996	9
	1997	2
	1998	4
	1999	18
	2000	7
	2001	10
	2002	6
	2003	13
	2004	8
	2005	7
	2006	15
	2007	9
	2008	48
	2009	12
	2010	3
	2011	4
	2012	13
	2013	6
	2014	15
	2015	22
	2016	10
CA Total		**350**
OR	1987	8
	1994	1
	1999	1
	2001	1
	2002	7
	2003	1
	2005	3
	2006	1
	2008	3
	2009	1
	2010	1
	2011	1
	2013	3
	2014	2
	2015	4
	2016	1
OR Total		**39**
WA	1984	1
	1985	8
	1986	1
	1988	2
	1989	1
	1990	3
	1991	1
	1992	4
	1994	15
	1995	1
	1996	1
	1998	3
	1999	1
	2000	3
	2001	11
	2002	6
	2003	12
	2004	3
	2005	2
	2006	9
	2007	6
	2008	2
	2009	3
	2010	6
	2011	4
	2012	20
	2013	9
	2014	11
	2015	13
	2016	4
WA Total		**166**
Grand Total		**555**

Fire_Name	STATE	FIRE_YEAR	START_DATE	MTBS	5YR_RANGE
SHIRLEY	CA	2014	6/13/2014	MTBS	2013-2018
WAY	CA	2014	8/18/2014	MTBS	2013-2018
CEDAR	CA	2016	8/16/2016	MTBS	2013-2018
FAY	CA	1987	8/30/1987	MTBS	1984-1989
STORMY	CA	1990	8/5/1990	MTBS	1990-1994
BULL	CA	2010	7/26/2010	MTBS	2007-2012
GOLDLEDGE	CA	2007	6/3/2007	MTBS	2007-2012
MANTER	CA	2000	7/22/2000	MTBS	1995-2000
MEADOW	CA	2016	10/30/2016	MTBS	2013-2018
ROCK 2	CA	2007	7/6/2007	MTBS	2007-2012
CHOLOLLO	CA	1996	8/18/1996	MTBS	1995-2000
MCNALLY	CA	2002	7/21/2002	MTBS	2001-2006
SLATE	CA	2016	10/4/2016	MTBS	2013-2018
CRAG WFU	CA	2005	7/24/2005	MTBS	2001-2006
ALBANITA AND HOOKER	CA	2003	9/3/2003	MTBS	2001-2006
CLOVER	CA	2008	5/31/2008	MTBS	2007-2012
BRODER WFU	CA	2006	7/26/2006	MTBS	2001-2006
GEORGE	CA	2012	6/1/2012	MTBS	2007-2012
LION COMPLEX (GRANITE)	CA	2009	7/21/2009	MTBS	2007-2012
COFFEE	CA	1997	9/24/1997	MTBS	1995-2000
LION COMPLEX (LION)	CA	2009	6/30/2009	MTBS	2007-2012
DEEP	CA	2004	8/12/2004	MTBS	2001-2006
FISH	CA	2013	8/23/2013	MTBS	2013-2018
SUMMIT COMPLEX	CA	2003	8/27/2003	MTBS	2001-2006
JACOBSON	CA	2016	10/21/2016	MTBS	2013-2018
CABIN	CA	2015	7/19/2015	MTBS	2013-2018
HIDDEN	CA	2016	11/2/2016	MTBS	2013-2018
LION	CA	2011	7/8/2011	MTBS	2007-2012
GROUSE	CA	2007	8/27/2007	MTBS	2007-2012
SHOTGUN	CA	2009	6/17/2009	MTBS	2007-2012
MAGGIE	CA	2006	7/9/2006	MTBS	2001-2006
KAWEAH-KERN COMPLEX (WEST KERN)	CA	2003	8/24/2003	MTBS	2001-2006
GROUSE VMP	CA	1988	9/1/1988	MTBS	1984-1989
COONEY WFU	CA	2003	8/1/2003	MTBS	2001-2006
BAR-O	CA	1984	8/29/1984	MTBS	1984-1989
CASE	CA	1987	8/29/1987	MTBS	1984-1989
SALT CREEK VMP	CA	1986	10/6/1986	MTBS	1984-1989
TAR GAP RX	CA	2002	10/10/2002	MTBS	2001-2006
EFR MOSQUITO RX	CA	2014	10/20/2014	MTBS	2013-2018
BIG ARROYO	CA	1996	8/2/1996	MTBS	1995-2000
EAST FORK HIGHBRIDGE RX	CA	2005	10/6/2005	MTBS	2001-2006
MINERAL 1	CA	1995	10/11/1995	MTBS	1995-2000
ATWOOD	CA	2003	6/25/2003	MTBS	2001-2006
KAWEAH-KERN COMPLEX (PARADISE 2)	CA	2003	9/27/2003	MTBS	2001-2006
KAWEAH	CA	1996	8/13/1996	MTBS	1995-2000
BEAR CREEK	CA	1984	10/10/1984	MTBS	1984-1989
CASTLE COMPLEX	CA	1996	7/26/1996	MTBS	1995-2000
CASTLE WF	CA	1995	11/9/1995	MTBS	1995-2000
BUCKEYE	CA	1988	10/16/1988	MTBS	1984-1989
SHADE 1/4	CA	1996	9/1/1996	MTBS	1995-2000
SUWANEE R	CA	1992	10/4/1992	MTBS	1990-1994
HIDDEN	CA	2008	9/10/2008	MTBS	2007-2012
KAWEAH-KERN COMPLEX (WILLIAMS)	CA	2003	7/28/2003	MTBS	2001-2006
SUGARLOAF	CA	1985	7/28/1985	MTBS	1984-1989
AVALANCHE1	CA	1990	7/13/1990	MTBS	1990-1994
CEDAR GROVE ROARING	CA	2006	7/23/2006	MTBS	2001-2006
CEDAR BLUFFS	CA	2008	10/17/2008	MTBS	2007-2012
HIGHWAY	CA	2001	7/3/2001	MTBS	2001-2006
SHEEP COMPLEX	CA	2010	7/16/2010	MTBS	2007-2012
COMB COMPLEX	CA	2005	7/17/2005	MTBS	2001-2006
BUCK PEAK	CA	1993	6/22/1993	MTBS	1990-1994
LEWIS CREEK	CA	1998	10/13/1998	MTBS	1995-2000
LEWIS CREEK	CA	1999	10/3/1999	MTBS	1995-2000
CHOKE	CA	1997	8/6/1997	MTBS	1995-2000
DEER	CA	1986	9/9/1986	MTBS	1984-1989
ROUGH	CA	2015	8/1/2015	MTBS	2013-2018
GARNET	CA	1988	8/30/1988	MTBS	1984-1989
OBELISK	CA	1988	7/24/1988	MTBS	1984-1989
OAT MT	CA	1998	9/17/1998	MTBS	1995-2000
TRIMMER	CA	1996	8/17/1996	MTBS	1995-2000
KIRCH	CA	1990	7/20/1990	MTBS	1990-1994
UNNAMED	CA	1987	8/1/1987	MTBS	1984-1989
SYCAMORE	CA	1986	7/21/1986	MTBS	1984-1989
SACATA	CA	2016	10/11/2016	MTBS	2013-2018
UNNAMED	CA	1989	7/29/1989	MTBS	1984-1989
TEHIPITE	CA	2008	7/19/2008	MTBS	2007-2012

UNNAMED	CA	1987	8/1/1987	MTBS	1984-1989
BURNT	CA	2001	7/30/2001	MTBS	2001-2006
BURROUGH	CA	1989	7/23/1989	MTBS	1984-1989
GOOSE	CA	2016	7/30/2016	MTBS	2013-2018
SOS 06	CA	2006	12/1/2006	MTBS	2001-2006
POWERHOUSE	CA	1989	7/28/1989	MTBS	1984-1989
ITALIAN	CA	1992	8/13/1992	MTBS	1990-1994
WYLE VMP #2	CA	1988	7/9/1988	MTBS	1984-1989
CORRINE	CA	2015	6/19/2015	MTBS	2013-2018
BIG CREEK	CA	1994	8/24/1994	MTBS	1990-1994
UNNAMED	CA	1987	6/22/1987	MTBS	1984-1989
NORTH FORK	CA	2001	8/20/2001	MTBS	2001-2006
FRENCH	CA	2014	7/28/2014	MTBS	2013-2018
ASPEN	CA	2013	7/22/2013	MTBS	2013-2018
WILLOW	CA	2015	7/25/2015	MTBS	2013-2018
BL MAST WUI06	CA	2006	9/1/2006	MTBS	2001-2006
STUMPFIELD	CA	1996	8/1/1996	MTBS	1995-2000
OLIVER	CA	2008	6/21/2008	MTBS	2007-2012
WAWONA NW	CA	2008	4/9/2008	MTBS	2007-2012
JACK	CA	2007	10/29/2007	MTBS	2007-2012
LAKES	CA	2016	6/26/2016	MTBS	2013-2018
SOUTH PARK COMPLEX	CA	1999	7/11/1999	MTBS	1995-2000
SAVAGE	CA	1990	8/30/1990	MTBS	1990-1994
HORIZON	CA	1994	8/9/1994	MTBS	1990-1994
HOOVER COMPLEX (HOOVER)	CA	2001	7/10/2001	MTBS	2001-2006
AVALANCHE	CA	2011	7/31/2011	MTBS	2007-2012
MOTOR	CA	2011	8/25/2011	MTBS	2007-2012
LOST BEAR	CA	1987	7/23/1987	MTBS	1984-1989
EL PORTAL	CA	2014	7/26/2014	MTBS	2013-2018
ALASKA	CA	1988	8/18/1988	MTBS	1984-1989
MEADOW COMPLEX (MEADOW)	CA	2004	7/1/2004	MTBS	2001-2006
STEAMBOAT	CA	1990	8/7/1990	MTBS	1990-1994
GROUSE	CA	2009	5/30/2009	MTBS	2007-2012
A-ROCK	CA	1990	8/7/1990	MTBS	1990-1994
ILL	CA	1991	9/24/1991	MTBS	1990-1994
MEADOW	CA	2014	8/15/2014	MTBS	2013-2018
BIG MEADOW	CA	2009	8/26/2009	MTBS	2007-2012
ECHO	CA	1988	6/21/1988	MTBS	1984-1989
CASCADE CR	CA	1986	7/27/1986	MTBS	1984-1989
CASCADE	CA	2012	6/16/2012	MTBS	2007-2012
GEYSERS	CA	2004	9/3/2004	MTBS	2001-2006
VALLEY	CA	2015	9/12/2015	MTBS	2013-2018
UNNAMED	CA	1987	4/16/1987	MTBS	1984-1989
FORK	CA	1996	8/11/1996	MTBS	1995-2000
UNNAMED	CA	1988	11/15/1988	MTBS	1984-1989
MILL	CA	2012	7/7/2012	MTBS	2007-2012
FOUTS	CA	1987	9/1/1987	MTBS	1984-1989
SODA COMPLEX (BACK)	CA	2008	6/21/2008	MTBS	2007-2012
DEER	CA	2005	8/9/2005	MTBS	2001-2006
TROUGH	CA	2001	8/8/2001	MTBS	2001-2006
SODA COMPLEX (BIG)	CA	2008	6/21/2008	MTBS	2007-2012
LAUDER	CA	1987	9/29/1987	MTBS	1984-1989
CABBAGE	CA	2000	4/1/2000	MTBS	1995-2000
SODA COMPLEX (MILL)	CA	2008	6/21/2008	MTBS	2007-2012
GRINDSTONE COMPLEX (DEAFY)	CA	2003	9/3/2003	MTBS	2001-2006
GRINDSTONE COMPLEX (HAPPY CAMP)	CA	2003	9/3/2003	MTBS	2001-2006
MENDENHALL	CA	1987	8/31/1987	MTBS	1984-1989
SODA COMPLEX (MONKEY ROCK)	CA	2008	6/21/2008	MTBS	2007-2012
TOWN	CA	2000	3/31/2000	MTBS	1995-2000
GRINDSTONE BRUSH (GS)	CA	2004	1/15/2004	MTBS	2001-2006
SPANISH	CA	2003	9/28/2003	MTBS	2001-2006
POWDERHOUSE	CA	1988	8/26/1988	MTBS	1984-1989
HUNTER	CA	2006	7/24/2006	MTBS	2001-2006
MEU LIGHTNING COMPLEX (BUTCH)	CA	2008	7/4/2008	MTBS	2007-2012
DIAMOND H VMP	CA	1991	9/16/1991	MTBS	1990-1994
HIGHWAY 70	CA	2001	10/24/2001	MTBS	2001-2006
LODGE COMPLEX	CA	2014	7/30/2014	MTBS	2013-2018
MEU LIGHTNING COMPLEX (LOST PIPE)	CA	2008	7/4/2008	MTBS	2007-2012
LINN/RECER/ELKHORN	CA	1990	8/9/1990	MTBS	1990-1994
MUSTY	CA	1999	8/23/1999	MTBS	1995-2000
CANYON COMPLEX (BEAR)	CA	2008	6/21/2008	MTBS	2007-2012
BTU LIGHTNING COMPLEX (LONG BRANCH-JACK)	CA	2008	8/14/2008	MTBS	2007-2012
WHISKEY	CA	2008	6/12/2008	MTBS	2007-2012
NORTH PASS	CA	2012	8/18/2012	MTBS	2007-2012
SUGARFOOT	CA	1994	8/27/1994	MTBS	1990-1994
MHRD COMPLEX (BUCKS)	CA	1999	8/23/1999	MTBS	1995-2000
MEU LIGHTNING COMPLEX (RED MOUNTAIN)	CA	2008	6/21/2008	MTBS	2007-2012

WEINSTEIN	CA	2000	9/29/2000	MTBS	1995-2000
UNNAMED	CA	1984	7/5/1984	MTBS	1984-1989
NOBLE	CA	2006	9/24/2006	MTBS	2001-2006
COHASSET	CA	1990	11/1/1990	MTBS	1990-1994
CHIPS	CA	2012	7/29/2012	MTBS	2007-2012
BRUSHY	CA	1984	9/7/1984	MTBS	1984-1989
MEU LIGHTNING COMPLEX (TRAVIS)	CA	2008	7/5/2008	MTBS	2007-2012
STORRIE	CA	2000	8/17/2000	MTBS	1995-2000
ISLAND	CA	1990	9/23/1990	MTBS	1990-1994
CAMPBELL	CA	1990	8/6/1990	MTBS	1990-1994
HARVEY	CA	2006	6/26/2006	MTBS	2001-2006
BTU LIGHTNING COMPLEX (SMOKEY)	CA	2008	6/20/2008	MTBS	2007-2012
LAZYMAN	CA	1987	9/2/1987	MTBS	1984-1989
TRAVIS	CA	1987	8/31/1987	MTBS	1984-1989
YOLLA BOLLY COMPLEX (IRON)	CA	2008	6/21/2008	MTBS	2007-2012
BARKLEY	CA	1994	9/18/1994	MTBS	1990-1994
MAD RIVER COMPLEX (TRAVIS)	CA	2008	6/21/2008	MTBS	2007-2012
STEELHEAD	CA	2015	7/30/2015	MTBS	2013-2018
GUN 2	CA	1999	9/28/1999	MTBS	1995-2000
HERMIT	CA	1988	9/28/1988	MTBS	1984-1989
YOLLA BOLLY COMPLEX (TROUGH)	CA	2008	6/21/2008	MTBS	2007-2012
PANTHER	CA	2013	5/1/2013	MTBS	2013-2018
ROCK	CA	1996	8/14/1996	MTBS	1995-2000
CUB COMPLEX (CUB)	CA	2008	6/21/2008	MTBS	2007-2012
MILL	CA	2012	8/13/2012	MTBS	2007-2012
MAD RIVER COMPLEX (BONANZA)	CA	2008	6/21/2008	MTBS	2007-2012
RUTH	CA	2011	9/23/2011	MTBS	2007-2012
CANOE	CA	2003	9/30/2003	MTBS	2001-2006
LIME COMPLEX (NOBLE)	CA	2008	6/21/2008	MTBS	2007-2012
RAINBOW	CA	1990	8/8/1990	MTBS	1990-1994
JOURNEY	CA	2000	10/7/2000	MTBS	1995-2000
PICKETT	CA	2015	7/31/2015	MTBS	2013-2018
PEAKS	CA	1990	8/8/1990	MTBS	1990-1994
GOBBLER	CA	2015	7/31/2015	MTBS	2013-2018
LASSICS	CA	2015	8/6/2015	MTBS	2013-2018
GULCH	CA	2008	9/7/2008	MTBS	2007-2012
PONDEROSA	CA	2012	8/18/2012	MTBS	2007-2012
BLUE	CA	2015	7/30/2015	MTBS	2013-2018
FLUME	CA	1987	8/30/1987	MTBS	1984-1989
BULLY	CA	2014	7/11/2014	MTBS	2013-2018
LIME COMPLEX (TELEPHONE)	CA	2008	6/20/2008	MTBS	2007-2012
UNNAMED	CA	1992	8/3/1992	MTBS	1990-1994
MANTON	CA	2005	8/26/2005	MTBS	2001-2006
WALLOW	CA	1987	8/30/1987	MTBS	1984-1989
SHU LIGHTNING COMPLEX (DEERLICK)	CA	2008	6/21/2008	MTBS	2007-2012
BUCK	CA	2015	8/6/2015	MTBS	2013-2018
UNNAMED	CA	1989	8/11/1989	MTBS	1984-1989
SHIELL	CA	2015	7/31/2015	MTBS	2013-2018
PEANUT	CA	1987	8/30/1987	MTBS	1984-1989
LIME COMPLEX (DEADSHOT)	CA	2008	6/21/2008	MTBS	2007-2012
PEAK	CA	2015	8/3/2015	MTBS	2013-2018
WALLOW	CA	2007	8/29/2007	MTBS	2007-2012
LIME COMPLEX (LIME)	CA	2008	6/20/2008	MTBS	2007-2012
FRIENDLY	CA	1987	8/30/1987	MTBS	1984-1989
ROCK	CA	1991	9/18/1991	MTBS	1990-1994
COLD	CA	1987	8/30/1987	MTBS	1984-1989
SHU LIGHTNING COMPLEX (MOON)	CA	2008	6/21/2008	MTBS	2007-2012
STAFFORD	CA	2012	9/5/2012	MTBS	2007-2012
KANAKA	CA	1990	8/8/1990	MTBS	1990-1994
BLUE MTN. WEST	CA	1985	8/27/1985	MTBS	1984-1989
HYAMPOM	CA	2001	8/31/2001	MTBS	2001-2006
JESSIE	CA	1987	8/30/1987	MTBS	1984-1989
PANTHER	CA	2002	11/20/2002	MTBS	2001-2006
BLAKE	CA	1987	8/30/1987	MTBS	1984-1989
POWER TOWER	CA	2004	3/21/2004	MTBS	2001-2006
BARKER	CA	2015	7/31/2015	MTBS	2013-2018
TRINITY	CA	1987	8/30/1987	MTBS	1984-1989
BARKER	CA	1992	8/20/1992	MTBS	1990-1994
WHITMORE	CA	2003	10/27/2003	MTBS	2001-2006
LIME COMPLEX (MINERS)	CA	2008	6/21/2008	MTBS	2007-2012
SHU LIGHTNING COMPLEX (LOWER)	CA	2008	6/21/2008	MTBS	2007-2012
ROUTE COMPLEX	CA	2015	7/31/2015	MTBS	2013-2018
DANIELS	CA	1984	10/5/1984	MTBS	1984-1989
UNNAMED	CA	1985	6/29/1985	MTBS	1984-1989
JONES	CA	1999	10/16/1999	MTBS	1995-2000
MILL RX	CA	1998	9/30/1998	MTBS	1995-2000
BEAR	CA	1987	8/30/1987	MTBS	1984-1989

FERN	CA	1988	9/17/1988	MTBS	1984-1989
GULCH	CA	1987	8/30/1987	MTBS	1984-1989
LIME COMPLEX (SLIDE)	CA	2008	6/21/2008	MTBS	2007-2012
PATTISON	CA	2015	7/31/2015	MTBS	2013-2018
COFFIN	CA	2009	8/12/2009	MTBS	2007-2012
SADDLE	CA	2015	6/10/2015	MTBS	2013-2018
LOWDEN	CA	1999	7/2/1999	MTBS	1995-2000
SHU LIGHTNING COMPLEX (MOTION)	CA	2008	6/22/2008	MTBS	2007-2012
SIMS	CA	2004	7/28/2004	MTBS	2001-2006
IRON AND ALPS COMPLEXES (EAGLE)	CA	2008	6/21/2008	MTBS	2007-2012
BEAR	CA	2004	8/11/2004	MTBS	2001-2006
BROWNS	CA	1994	7/12/1994	MTBS	1990-1994
BOW	CA	1990	8/8/1990	MTBS	1990-1994
SHU LIGHTNING COMPLEX (PINE)	CA	2008	6/20/2008	MTBS	2007-2012
GULCH	CA	2014	9/10/2014	MTBS	2013-2018
FRENCH	CA	2004	8/14/2004	MTBS	2001-2006
JUNCTION	CA	2006	7/29/2006	MTBS	2001-2006
OREGON	CA	2001	8/28/2001	MTBS	2001-2006
IRON AND ALPS COMPLEXES (CEDAR)	CA	2008	6/21/2008	MTBS	2007-2012
HELL'S HALF FIRE (HALF)	CA	2008	6/20/2008	MTBS	2007-2012
BOHEMOTASH	CA	1999	8/23/1999	MTBS	1995-2000
SHU LIGHTNING COMPLEX (STEIN)	CA	2008	6/21/2008	MTBS	2007-2012
LOMA	CA	2003	9/14/2003	MTBS	2001-2006
FLAT	CA	2012	7/11/2012	MTBS	2007-2012
TRELOAR COMPLEX	CA	1985	7/26/1985	MTBS	1984-1989
IRON AND ALPS COMPLEXES (IRONSIDE)	CA	2008	6/21/2008	MTBS	2007-2012
EAST	CA	1987	8/30/1987	MTBS	1984-1989
IRON AND ALPS COMPLEXES (BUCKHORN)	CA	2008	6/21/2008	MTBS	2007-2012
SALT CREEK	CA	2012	8/1/2012	MTBS	2007-2012
UNNAMED	CA	1999	9/8/1999	MTBS	1995-2000
JACKASS	CA	1999	8/23/1999	MTBS	1995-2000
FOUNTAIN	CA	1992	8/20/1992	MTBS	1990-1994
IRON AND ALPS COMPLEXES (ZEIGLER)	CA	2008	6/21/2008	MTBS	2007-2012
SUGAR	CA	1999	8/23/1999	MTBS	1995-2000
SHEEP #1	CA	1999	8/23/1999	MTBS	1995-2000
BIG BAR COMPLEX (ONION)	CA	1999	8/23/1999	MTBS	1995-2000
RIPSTEIN	CA	1987	8/30/1987	MTBS	1984-1989
LUNCH	CA	1999	8/23/1999	MTBS	1995-2000
RIVER COMPLEX	CA	2015	7/31/2015	MTBS	2013-2018
PIGEON	CA	2006	9/2/2006	MTBS	2001-2006
DELTA	CA	1985	7/18/1985	MTBS	1984-1989
HIGH COMPLEX	CA	1999	8/23/1999	MTBS	1995-2000
SHU LIGHTNING COMPLEX (GOOSE)	CA	2009	8/2/2009	MTBS	2007-2012
REPTILE	CA	1999	8/23/1999	MTBS	1995-2000
SHU LIGHTNING COMPLEX (CHALK)	CA	2009	8/2/2009	MTBS	2007-2012
STRAUSE	CA	1987	9/1/1987	MTBS	1984-1989
BAGLEY	CA	2012	8/18/2012	MTBS	2007-2012
CORRAL COMPLEX	CA	2013	8/10/2013	MTBS	2013-2018
BIG BAR COMPLEX (MEGRAM)	CA	1999	9/27/1999	MTBS	1995-2000
CHINA	CA	1987	8/30/1987	MTBS	1984-1989
BEAR WALLOW COMPLEX (CARIBOU)	CA	2008	6/21/2008	MTBS	2007-2012
BACKBONE	CA	2009	7/2/2009	MTBS	2007-2012
IRON AND ALPS COMPLEXES (CAREY)	CA	2008	6/21/2008	MTBS	2007-2012
RUSH	CA	2006	7/24/2006	MTBS	2001-2006
ST.CLAIRE	CA	1987	8/30/1987	MTBS	1984-1989
COYOTE RX	CA	2010	9/15/2010	MTBS	2007-2012
COYOTE	CA	2005	9/21/2005	MTBS	2001-2006
COYOTE	CA	1998	8/27/1998	MTBS	1995-2000
COFFEE COMPLEX	CA	2014	8/2/2014	MTBS	2013-2018
REDSPOT	CA	2009	7/5/2009	MTBS	2007-2012
HOTELLING	CA	1987	8/30/1987	MTBS	1984-1989
DOE	CA	1987	8/31/1987	MTBS	1984-1989
MILL CREEK 4	CA	2009	10/7/2009	MTBS	2007-2012
GLASGOW	CA	1987	8/30/1987	MTBS	1984-1989
MARTIN	CA	1992	9/19/1992	MTBS	1990-1994
WHITES	CA	2014	7/31/2014	MTBS	2013-2018
FORKS	CA	2002	6/9/2002	MTBS	2001-2006
SALMON RIVER COMPLEX	CA	2013	7/31/2013	MTBS	2013-2018
BUTLER	CA	2013	7/31/2013	MTBS	2013-2018
ORLEANS COMPLEX	CA	2006	7/24/2006	MTBS	2001-2006
BEAR WALLOW COMPLEX (UKONOM)	CA	2008	6/20/2008	MTBS	2007-2012
NIELON	CA	1987	8/31/1987	MTBS	1984-1989
SPECIMEN	CA	1994	9/19/1994	MTBS	1990-1994
YELLOW #2	CA	1987	8/30/1987	MTBS	1984-1989
UNCLES COMPLEX	CA	2006	7/23/2006	MTBS	2001-2006
HANCOCK	CA	2006	7/24/2006	MTBS	2001-2006
MUSSOLINI	CA	2002	7/13/2002	MTBS	2001-2006

NICKOWITZ	CA	2015 8/1/2015	MTBS	2013-2018
WOOLEY	CA	2005 9/20/2005	MTBS	2001-2006
BEAR WALLOW COMPLEX (ANTHONY MILNE)	CA	2008 6/28/2008	MTBS	2007-2012
MAN	CA	2014 8/13/2014	MTBS	2013-2018
PANTHER	CA	2008 7/22/2008	MTBS	2007-2012
LOG	CA	2014 7/31/2014	MTBS	2013-2018
PEAK	CA	2015 8/2/2015	MTBS	2013-2018
RED ROCK	CA	2009 8/21/2009	MTBS	2007-2012
TITUS	CA	2006 7/23/2006	MTBS	2001-2006
KLAMATH	CA	1988 9/11/1988	MTBS	1984-1989
SISKIYOU-BLUE 2 COMPLEX (BLUE 2)	CA	2008 6/21/2008	MTBS	2007-2012
ELK COMPLEX (ELK)	CA	2007 7/10/2007	MTBS	2007-2012
PONY	CA	2016 6/7/2016	MTBS	2013-2018
JACK #1	CA	1994 7/22/1994	MTBS	1990-1994
HAPPY CAMP COMPLEX (SWILLUP)	CA	2001 9/15/2001	MTBS	2001-2006
PONY	CA	1995 8/1/1995	MTBS	1995-2000
KING TITUS	CA	1987 8/30/1987	MTBS	1984-1989
KELSEY	CA	1987 8/30/1987	MTBS	1984-1989
STANZA	CA	2002 7/22/2002	MTBS	2001-2006
ELK COMPLEX (KING CREEK 2)	CA	2007 7/10/2007	MTBS	2007-2012
BEAR	CA	1994 7/21/1994	MTBS	1990-1994
LAKE	CA	1987 9/1/1987	MTBS	1984-1989
EAST	CA	1999 7/24/1999	MTBS	1995-2000
TEN BALD	CA	1987 8/30/1987	MTBS	1984-1989
GULCH	CA	1987 8/30/1987	MTBS	1984-1989
COON	CA	2015 8/1/2015	MTBS	2013-2018
BEARCAT	CA	1987 8/30/1987	MTBS	1984-1989
HAPPY CAMP COMPLEX	CA	2014 8/14/2014	MTBS	2013-2018
BEAR	CA	2015 8/1/2015	MTBS	2013-2018
ELK COMPLEX (LITTLE GRIDER)	CA	2007 7/10/2007	MTBS	2007-2012
CHINA	CA	1987 8/30/1987	MTBS	1984-1989
SLATER	CA	1987 8/30/1987	MTBS	1984-1989
CHINA BACK COMPLEX	CA	2007 7/10/2007	MTBS	2007-2012
ELK LICK	CA	1987 8/30/1987	MTBS	1984-1989
GAP	CA	2016 8/28/2016	MTBS	2013-2018
BARK	CA	2000 7/21/2000	MTBS	1995-2000
JONES	CA	2001 5/9/2001	MTBS	2001-2006
FORT COMPLEX	CA	2012 8/5/2012	MTBS	2007-2012
FORT COPPER	CA	1987 8/30/1987	MTBS	1984-1989
KNF BEAVER	CA	2014 7/30/2014	MTBS	2013-2018
THOMPSON	CA	1987 8/30/1987	MTBS	1984-1989
HELLO	CA	2012 8/5/2012	MTBS	2007-2012
LONGWOOD	CA	1987 8/30/1987	MTBS	1984-1989
REPEATER	OR	1999 9/28/1999	MTBS	1995-2000
QUARTZ	OR	2001 8/9/2001	MTBS	2001-2006
BUCKSKIN	OR	2015 6/11/2015	MTBS	2013-2018
CANTRALL	OR	1987 7/15/1987	MTBS	1984-1989
BLOSSOM COMPLEX (MENDENHALL)	OR	1994 7/21/1994	MTBS	1990-1994
STAR GULCH	OR	1987 8/30/1987	MTBS	1984-1989
NINEMILE	OR	1987 8/30/1987	MTBS	1984-1989
SQUIRE PEAK	OR	2002 7/13/2002	MTBS	2001-2006
DEER CREEK	OR	2005 8/25/2005	MTBS	2001-2006
SILVER	OR	1987 8/30/1987	MTBS	1984-1989
COLLIER BUTTE	OR	2015 8/2/2015	MTBS	2013-2018
SAVAGE CRK	OR	1987 8/30/1987	MTBS	1984-1989
WILD RIVERS COMPLEX (HORSE MOUNTAIN)	OR	2008 8/16/2008	MTBS	2007-2012
LABRADOR	OR	2013 7/26/2013	MTBS	2013-2018
WASSON	OR	2005 7/26/2005	MTBS	2001-2006
OAK FLAT	OR	2010 8/13/2010	MTBS	2007-2012
BISCUIT COMPLEX (BISCUIT)	OR	2002 7/13/2002	MTBS	2001-2006
ONION MOUNTAIN	OR	2014 9/13/2014	MTBS	2013-2018
DOUBLEDAY	OR	2008 9/17/2008	MTBS	2007-2012
JIMBO	OR	1987 8/31/1987	MTBS	1984-1989
HOWARD CRK	OR	1987 8/30/1987	MTBS	1984-1989
BIG WINDY COMPLEX	OR	2013 7/26/2013	MTBS	2013-2018
790 FIRE	OR	2014 7/31/2014	MTBS	2013-2018
BLOSSOM	OR	2005 7/22/2005	MTBS	2001-2006
E. SIDE BURNT PEAK	OR	1987 8/30/1987	MTBS	1984-1989
TIMBERED ROCK	OR	2002 7/13/2002	MTBS	2001-2006
MIDDLE FORK COMPLEX	OR	2008 8/16/2008	MTBS	2007-2012
WHISKEY	OR	2013 7/26/2013	MTBS	2013-2018
BYBEE COMPLEX	OR	2006 7/23/2006	MTBS	2001-2006
BYBEE CREEK	OR	2016 7/28/2016	MTBS	2013-2018
STOUTS CREEK	OR	2015 7/30/2015	MTBS	2013-2018
CROOKED	OR	2002 7/19/2002	MTBS	2001-2006
TILLER COMPLEX (TALLOW)	OR	2002 7/15/2002	MTBS	2001-2006
REDCONE	OR	2011 8/20/2011	MTBS	2007-2012

NATIONAL CREEK COMPLEX	OR	2015	8/1/2015	MTBS	2013-2018
BUCKEYE	OR	2002	7/13/2002	MTBS	2001-2006
BIG BEND	OR	2002	7/14/2002	MTBS	2001-2006
RAINBOW CREEK	OR	2009	9/22/2009	MTBS	2007-2012
KELSAY COMPLEX (KELSAY)	OR	2003	7/27/2003	MTBS	2001-2006
DALLESPORT	WA	2010	7/12/2010	MTBS	2007-2012
HORSETHIEF BUTTE	WA	2015	9/13/2015	MTBS	2013-2018
HORSETHIEF	WA	2012	7/26/2012	MTBS	2007-2012
WISHRAMII	WA	2011	8/29/2011	MTBS	2007-2012
AVERY	WA	1998	7/10/1998	MTBS	1995-2000
UNNAMED	WA	1994	8/19/1994	MTBS	1990-1994
JUNCTION FIRE	WA	2015	7/2/2015	MTBS	2013-2018
HIWAY 8	WA	2010	8/27/2010	MTBS	2007-2012
HIGHWAY 141	WA	2012	9/5/2012	MTBS	2007-2012
SNOOKUM	WA	1992	8/4/1992	MTBS	1990-1994
MONASTERYCOMPLEX	WA	2011	9/7/2011	MTBS	2007-2012
MILE MARKER 28	WA	2013	7/24/2013	MTBS	2013-2018
LAKEBEDS	WA	1994	7/24/1994	MTBS	1990-1994
ROAD 135	WA	1994	7/25/1994	MTBS	1990-1994
HIGH BRIDGE	WA	2001	8/31/2001	MTBS	2001-2006
COLD SPRINGS	WA	2008	6/29/2008	MTBS	2007-2012
LIZZY	WA	1992	6/24/1992	MTBS	1990-1994
CASCADE CREEK	WA	2012	9/9/2012	MTBS	2007-2012
COUGAR CREEK	WA	2015	8/11/2015	MTBS	2013-2018
SPRING CK	WA	1994	7/26/1994	MTBS	1990-1994
PINE SPRINGS	WA	2007	8/11/2007	MTBS	2007-2012
RANGE	WA	2000	6/23/2000	MTBS	1995-2000
OAK SPRINGS	WA	2003	6/6/2003	MTBS	2001-2006
TULE 6	WA	2016	8/22/2016	MTBS	2013-2018
STONE GIANT	WA	2000	7/13/2000	MTBS	1995-2000
PUMPHOUSE	WA	2002	7/13/2002	MTBS	2001-2006
PUMPHOUSE	WA	2001	6/19/2001	MTBS	2001-2006
YEDLICK	WA	1994	7/24/1994	MTBS	1990-1994
HAMBRE MT	WA	1984	10/17/1984	MTBS	1984-1989
UNNAMED	WA	1992	6/7/1992	MTBS	1990-1994
DISCOVERY	WA	2009	7/29/2009	MTBS	2007-2012
CONRAD LAKE	WA	2013	8/9/2013	MTBS	2013-2018
AHTANUM RIDGE	WA	2003	6/27/2003	MTBS	2001-2006
MIDDLE FORK	WA	2003	7/11/2003	MTBS	2001-2006
UNNAMED	WA	1985	7/20/1985	MTBS	1984-1989
N. AHTANUM	WA	2012	8/31/2012	MTBS	2007-2012
DOME PEAK	WA	2001	8/13/2001	MTBS	2001-2006
COWICHE MILL	WA	2010	7/18/2010	MTBS	2007-2012
WILD ROSE	WA	2012	9/8/2012	MTBS	2007-2012
BOOMER	WA	2007	5/17/2007	MTBS	2007-2012
UNNAMED	WA	2002	8/14/2002	MTBS	2001-2006
UNNAMED	WA	2003	7/10/2003	MTBS	2001-2006
ROSA	WA	1985	7/29/1985	MTBS	1984-1989
COTTONWOOD 2	WA	2014	6/17/2014	MTBS	2013-2018
RATTLESNAKE CREEK	WA	2007	8/5/2007	MTBS	2007-2012
MUD LAKE	WA	2004	8/9/2004	MTBS	2001-2006
MEEKS TABLE	WA	2015	9/12/2015	MTBS	2013-2018
UNNAMED	WA	1990	8/14/1990	MTBS	1990-1994
I-82 MANASTASH	WA	2014	7/3/2014	MTBS	2013-2018
ROCK CREEK	WA	2016	9/10/2016	MTBS	2013-2018
MANASTASH RIDGE	WA	2013	8/9/2013	MTBS	2013-2018
FALLS CREEK	WA	1988	7/26/1988	MTBS	1984-1989
SNAG CANYON	WA	2014	8/3/2014	MTBS	2013-2018
TAYLOR BRIDGE	WA	2012	8/13/2012	MTBS	2007-2012
TABLE MOUNTAIN COMPLEX	WA	2012	9/8/2012	MTBS	2007-2012
COLOCKUM TARPS	WA	2013	7/27/2013	MTBS	2013-2018
MILEPOST 10	WA	2013	8/9/2013	MTBS	2013-2018
POLLALIE	WA	2006	9/4/2006	MTBS	2001-2006
CANYON	WA	2012	9/8/2012	MTBS	2007-2012
POISON	WA	2012	9/8/2012	MTBS	2007-2012
CRYSTAL CREEK	WA	2003	9/23/2003	MTBS	2001-2006
SLEEPY HOLLOW	WA	2015	6/28/2015	MTBS	2013-2018
SUNNYSLOPE	WA	1992	5/20/1992	MTBS	1990-1994
BEAR GULCH II	WA	2006	7/25/2006	MTBS	2001-2006
HANSEL CREEK	WA	2014	8/3/2014	MTBS	2013-2018
EASY STREET	WA	2007	7/7/2007	MTBS	2007-2012
HATCHERY COMPLEX (RAT)	WA	1994	7/29/1994	MTBS	1990-1994
BEAVER	WA	1985	8/24/1985	MTBS	1984-1989
MT. CASHMERE	WA	2012	9/8/2012	MTBS	2007-2012
SWAKANE	WA	2010	7/10/2010	MTBS	2007-2012
WENATCHEE RIVER COMPLEX	WA	2010	8/1/2010	MTBS	2007-2012
FOURTH OF JULY	WA	2001	8/13/2001	MTBS	2001-2006

FISCHER	WA	2004	8/8/2004	MTBS	2001-2006
HATCHERY COMPLEX (HATCHERY)	WA	1994	7/24/1994	MTBS	1990-1994
DINKELMAN	WA	1988	9/4/1988	MTBS	1984-1989
EAGLE	WA	2013	8/19/2013	MTBS	2013-2018
SQUARE LAKE FIRE	WA	2003	8/8/2003	MTBS	2001-2006
MILLS CANYON	WA	2014	7/8/2014	MTBS	2013-2018
UNNAMED	WA	1990	7/24/1990	MTBS	1990-1994
BIGHUMP	WA	2011	8/31/2011	MTBS	2007-2012
PARADISE	WA	2015	6/15/2015	MTBS	2013-2018
CHIWAUKUM COMPLEX	WA	2014	7/15/2014	MTBS	2013-2018
BYRD	WA	2012	9/8/2012	MTBS	2007-2012
ROUND MTN	WA	1994	7/26/1994	MTBS	1990-1994
NAVARRE	WA	2012	7/5/2012	MTBS	2007-2012
TYEE CREEK	WA	1994	7/24/1994	MTBS	1990-1994
CHELANBTTE	WA	1991	9/1/1991	MTBS	1990-1994
HAYES TWO	WA	2016	7/26/2016	MTBS	2013-2018
DIRTY FACE	WA	2005	7/30/2005	MTBS	2001-2006
DEER MT	WA	2002	8/5/2002	MTBS	2001-2006
FIRST CREEK	WA	2015	8/14/2015	MTBS	2013-2018
FIRST CREEK	WA	2012	9/8/2012	MTBS	2007-2012
UNION VALLEY	WA	2001	7/28/2001	MTBS	2001-2006
PRESTON-FOX	WA	2009	10/4/2009	MTBS	2007-2012
ANTOINE 2	WA	2012	8/5/2012	MTBS	2007-2012
KLONE PEAK	WA	2012	9/8/2012	MTBS	2007-2012
BASALT	WA	2012	9/8/2012	MTBS	2007-2012
NORTH 25	WA	1998	8/4/1998	MTBS	1995-2000
POT PEAK-SISI RIDGE COMPLEX	WA	2004	6/26/2004	MTBS	2001-2006
DEER POINT	WA	2002	7/15/2002	MTBS	2001-2006
25 MILE	WA	2013	7/4/2013	MTBS	2013-2018
MAPLE	WA	2003	9/5/2003	MTBS	2001-2006
DUNCAN	WA	2014	7/16/2014	MTBS	2013-2018
GOAT	WA	2012	9/16/2012	MTBS	2007-2012
WHITE RIVER	WA	1990	7/14/1990	MTBS	1990-1994
BLACK CANYON	WA	2015	8/14/2015	MTBS	2013-2018
PYRAMID	WA	2012	9/8/2012	MTBS	2007-2012
SQUAW CREEK	WA	2005	9/8/2005	MTBS	2001-2006
TINPAN	WA	2006	7/6/2006	MTBS	2001-2006
BUCK CREEK	WA	2016	7/23/2016	MTBS	2013-2018
DOMKE LAKE COMPLEX	WA	2007	8/5/2007	MTBS	2007-2012
UNNAMED	WA	1985	8/6/1985	MTBS	1984-1989
REX CREEK COMPLEX (REX CREEK)	WA	2001	8/12/2001	MTBS	2001-2006
OKANOGAN COMPLEX	WA	2012	9/9/2012	MTBS	2007-2012
BUCKHORN	WA	2012	9/8/2012	MTBS	2007-2012
VALLEY RD	WA	1989	7/7/1989	MTBS	1984-1989
UNNAMED	WA	2001	8/13/2001	MTBS	2001-2006
MONSE	WA	1985	6/23/1985	MTBS	1984-1989
CARLTON COMPLEX	WA	2014	7/14/2014	MTBS	2013-2018
LIBBY SOUTH	WA	2001	7/9/2001	MTBS	2001-2006
MOORE POINT	WA	2013	7/28/2013	MTBS	2013-2018
WOLVERINE	WA	2015	6/29/2015	MTBS	2013-2018
SALMON	WA	2011	8/29/2011	MTBS	2007-2012
VIRGINIA L	WA	2001	8/13/2001	MTBS	2001-2006
MINNIE	WA	1985	8/28/1985	MTBS	1984-1989
MALOTT	WA	1999	9/25/1999	MTBS	1995-2000
FLICK CREEK	WA	2006	7/26/2006	MTBS	2001-2006
B AND O	WA	2013	7/15/2013	MTBS	2013-2018
ODEN ROAD	WA	2009	8/21/2009	MTBS	2007-2012
BUTTE CK#2	WA	1994	7/25/1994	MTBS	1990-1994
RAINBOW BRIDGE	WA	2010	7/29/2010	MTBS	2007-2012
LONE MOUNTAIN 1	WA	2014	7/14/2014	MTBS	2013-2018
TWISP RIVER	WA	2015	8/19/2015	MTBS	2013-2018
REX CREEK COMPLEX (GLORY MOUNTAIN)	WA	2001	8/13/2001	MTBS	2001-2006
LITTLE BRIDGE CREEK	WA	2014	8/2/2014	MTBS	2013-2018
MINERAL PARK	WA	2003	8/15/2003	MTBS	2001-2006
GREEN LAKE	WA	2008	7/31/2008	MTBS	2007-2012
HUBBARD CR	WA	1985	7/21/1985	MTBS	1984-1989
UNNAMED	WA	1998	8/29/1998	MTBS	1995-2000
CEDAR CREEK	WA	2006	8/22/2006	MTBS	2001-2006
TRIPOD COMPLEX (TRIPOD)	WA	2006	7/24/2006	MTBS	2001-2006
LIMEBELT	WA	2015	8/14/2015	MTBS	2013-2018
NEEDLES	WA	2003	8/5/2003	MTBS	2001-2006
ISABEL	WA	2003	9/7/2003	MTBS	2001-2006
METHOW COMPLEX (WHITEFACE)	WA	1994	8/4/1994	MTBS	1990-1994
GOODELL	WA	2015	8/11/2015	MTBS	2013-2018
EUREKA	WA	1986	8/2/1986	MTBS	1984-1989
UNNAMED	WA	1995	9/4/1995	MTBS	1995-2000
UNNAMED	WA	2000	7/22/2000	MTBS	1995-2000

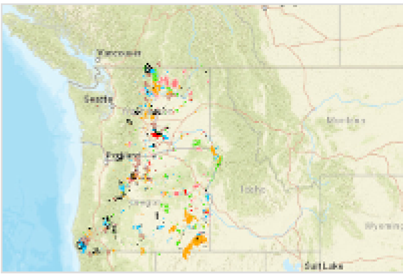
UPPER FALLS	WA	2014	8/5/2014	MTBS	2013-2018
UNNAMED	WA	1994	7/25/1994	MTBS	1990-1994
BIGBEAVER	WA	2003	8/5/2003	MTBS	2001-2006
THUNDER	WA	1994	7/24/1994	MTBS	1990-1994
THIRTY MILE	WA	2001	7/9/2001	MTBS	2001-2006
GOLD HILL	WA	1985	8/28/1985	MTBS	1984-1989
FAWN PEAK COMPLEX (FAREWELL)	WA	2003	6/30/2003	MTBS	2001-2006
TRIPOD COMPLEX (SPUR PEAK)	WA	2006	7/3/2006	MTBS	2001-2006
QUARTZ MT. COMPLEX (MIDDLE MOUNTAIN)	WA	2002	8/17/2002	MTBS	2001-2006
ELBOW BASIN	WA	1996	7/28/1996	MTBS	1995-2000
VAN PEAK	WA	2006	9/5/2006	MTBS	2001-2006
QUARTZ MT. COMPLEX (QUARTZ MOUNTAIN)	WA	2002	8/17/2002	MTBS	2001-2006
LITTLE CHOPAKA	WA	2007	7/7/2007	MTBS	2007-2012
UNNAMED	WA	1994	8/3/1994	MTBS	1990-1994
TATOOSH COMPLEX	WA	2006	8/22/2006	MTBS	2001-2006
NEWBY LAKE	WA	2015	7/2/2015	MTBS	2013-2018
UNNAMED	WA	1994	8/3/1994	MTBS	1990-1994

COMPLETED

Count of FIRE_YEAR		
STATE	***FIRE_YEAR***	***Total Fires by Year***
CA	1984	5
	1985	5
	1986	4
	1987	44
	1988	12
	1989	4
	1990	14
	1991	3
	1992	6
	1993	1
	1994	8
	1995	3
	1996	9
	1997	2
	1998	4
	1999	18
	2000	7
	2001	10
	2002	6
	2003	13
	2004	8
	2005	7
	2006	15
	2007	9
	2008	48
	2009	12
	2010	3
	2011	4
	2012	13
	2013	6
	2014	15
	2015	22
	2016	10
CA Total		350
OR	1987	8
	1994	1
	1999	1
	2001	1
	2002	7
	2003	1
	2005	3
	2006	1
	2008	3
	2009	1
	2010	1
	2011	1
	2013	3
	2014	2
	2015	4
	2016	1
OR Total		39
WA	1984	1
	1985	8
	1986	1
	1988	2
	1989	1
	1990	3
	1991	1
	1992	4
	1994	15
	1995	1
	1996	1
	1998	3
	1999	1
	2000	3
	2001	11
	2002	6
	2003	12
	2004	3
	2005	2
	2006	9
	2007	6
	2008	2
	2009	3
	2010	6
	2011	4
	2012	20
	2013	9
	2014	11
	2015	13
	2016	4
WA Total		166
Grand Total		555

NWCC Fire History/Fire Occurrence Map

Overview



Description of the map.

Web Map by NWCC_GIS

Created: Mar 21, 2014 Updated: Oct 31, 2018

View Count: 5,757

Open in Map Viewer

Open in ArcGIS Desktop

Open Presentation

Description

The NWCC Fire History layer contains large fire perimeters, compiled and maintained in-house inclusive of years 2000 to 2018. This dataset is not intended to be the definitive source for all large fires occurring in Oregon and Washington during those years. For the most comprehensive and official fire perimeter information please contact the appropriate federal, state, or local agency where the fire occurred.

The FPA Fire Occurrence layer included in this map contains wildfires originating on federal, state, or other local agencies, filtered for 10 acres and greater; 1992 thru 2015. The display of this layer is scale dependent - features are revealed as you zoom in.

To learn more about this dataset or to download the entire database please visit:

Details

Size: 22 KB

Owner

NWCC_GIS

Tags

https://www.fs.usda.gov/rds/archive/Product/RDS-2013-0009.4/

For questions or comments about this map product, please contact the NWCC (Northwest Interagency Coordination Center) GIS Department - 503-808-2741 or ornwc_gis@firenet.gov

Layers

FPA - Fire Occurrence Database

NWCC Fire History (2000-2018)

USA Topographic Maps

Streets

- World Street Map

Terms of Use

No special restrictions or limitations on using the item's content have been provided.

Comments (0)

wildfire, NWCC, fire history, fire occurrence, Oregon, Washington, perimeter

Credits (Attribution)

No acknowledgements.

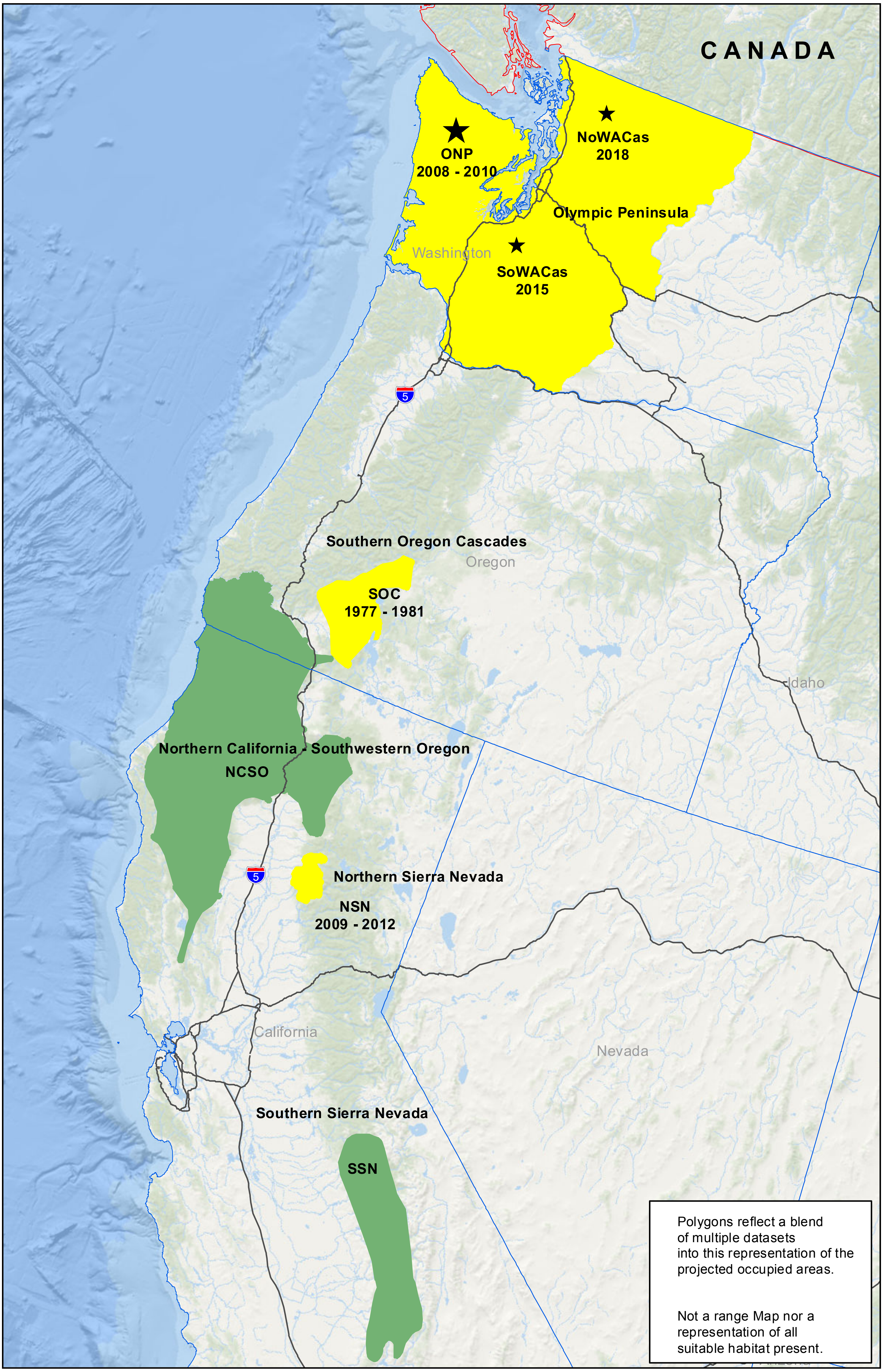
Sign in to add a comment.

THREATS DIRECTIONS

1. Review FRdocDraftText file
2. Look in References folder to see if new information is available for your topic
    a. Look at Stephanie Eye's New Literature spreadsheet to see if new info and summaries are available for your subject. Google spreadsheet called: ***FisherLitigationUpdatedScienceCompilationSummary_SEyes_***
    b. Look at the "NewInfo" Tab in the Comments spreadsheet to see if there is any new information received from the 2019 Open Comment period that needs to be addressed for your threat.
    c. Conduct a short search on internet for subject to determine if any other new literature available
3. Review the 2014 pL rule threat section for your subject threat, as well as both the draft and final Species Reports write-ups for your threat
4. If applicable, review new information files compiled by Betty (i.e., wildfire, popsize/trends, ARs)
5. Revise/update text in the "FRdocDraftText" file based on your evaluation of above information.
    a. Use blue font for all significantly revised or new text. All other text should remain black font.
6. Review the existing Regulatory Mechanisms Folder/file and edit any text relevant to your subject threat that needs updating (e.g., new mechanisms, completed HCP that was draft before, revised/updated management plan).
    a. Use blue font for all significantly revised or new text. All other text should remain black font.
7. Email Heidi when you are done with each assigned threat.

THREAT SUBJECT	**ASSIGNED**
*Wildfire/Fire Suppression *(incl. new evaluation info from Betty's work)*	Laura (Elizabeth assist)
*Climate Change	Heidi
*Vegetation Management	Sue
Development (incl. Linear Infrastructure)	Elizabeth
Forest Insect & Tree Diseases	Madeline
Trapping and Incidental Capture	Elizabeth
Research	Heidi

Disease or Predation	Elizabeth
Collision with Vehicles	Elizabeth
*Exposure to Toxicants *(incl. new evaluation info from Betty's work)*	Laura
*Small Population Size and Isolation *(incl. new evaluation info from Betty's work)*	Madeline
*Cumulative Effects	Dan



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CARLSBAD FIELD OFFICE
GIS CONTACT: ED TURNER
BIOLOGY CONTACT: BETTY GRIZZLE
(760) 431-9440
DATA SOURCE: USFWS
IMAGE SOURCE: ESRI Online Mapper
Dec 04, 2018
S:\stem\edstemp\Fisher\MXDs\Fisher_Populations_Update_2018.mxd

N

0 25 50 100 Miles

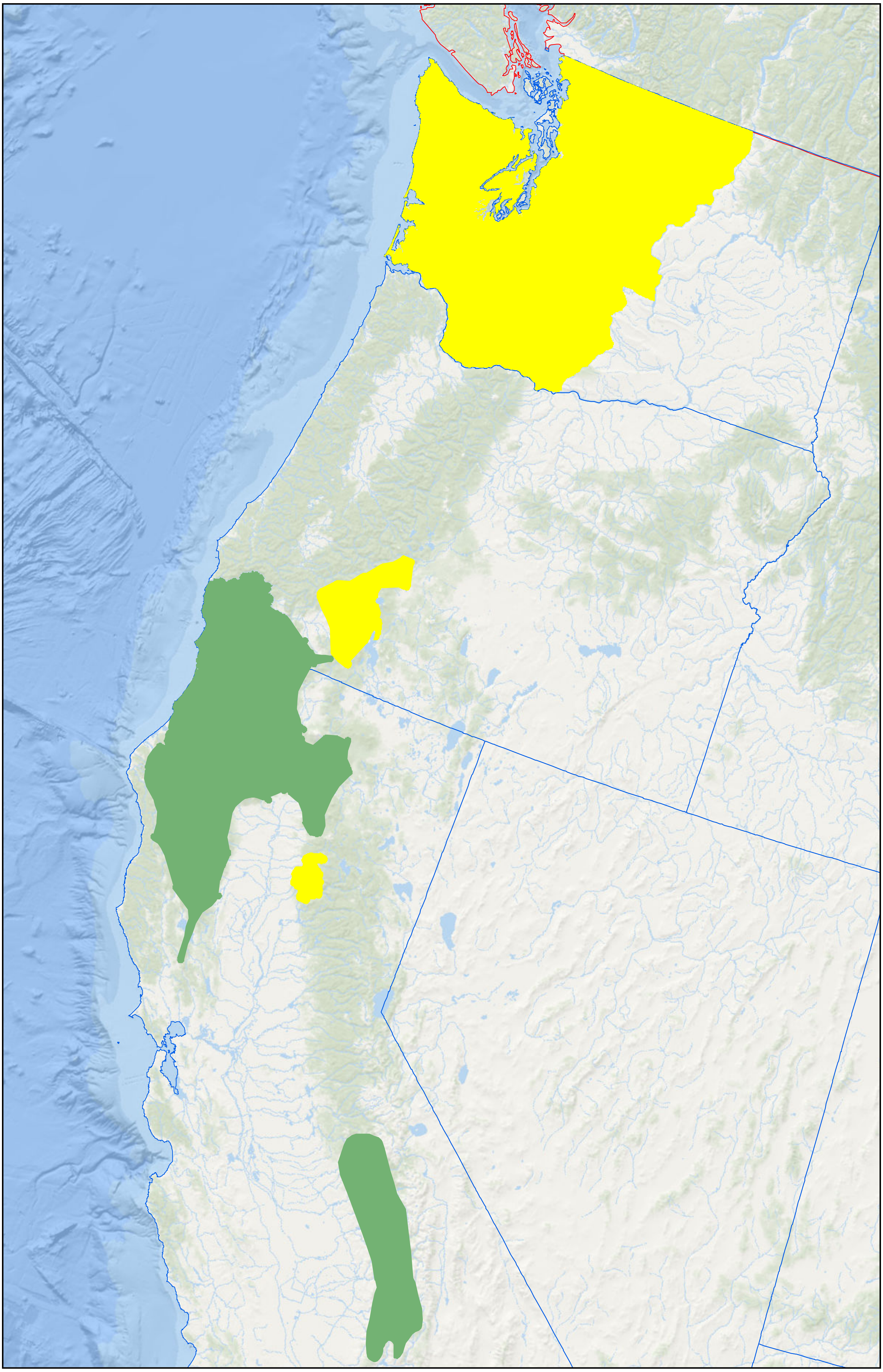
0 30 60 120 Kilometers

Legend

Native West Coast Fisher Populations

Reintroduced West Coast Fisher Populations

Information displayed is DELIBERATIVE and should be considered DRAFT for internal discussion.



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0 25 50 100 Miles

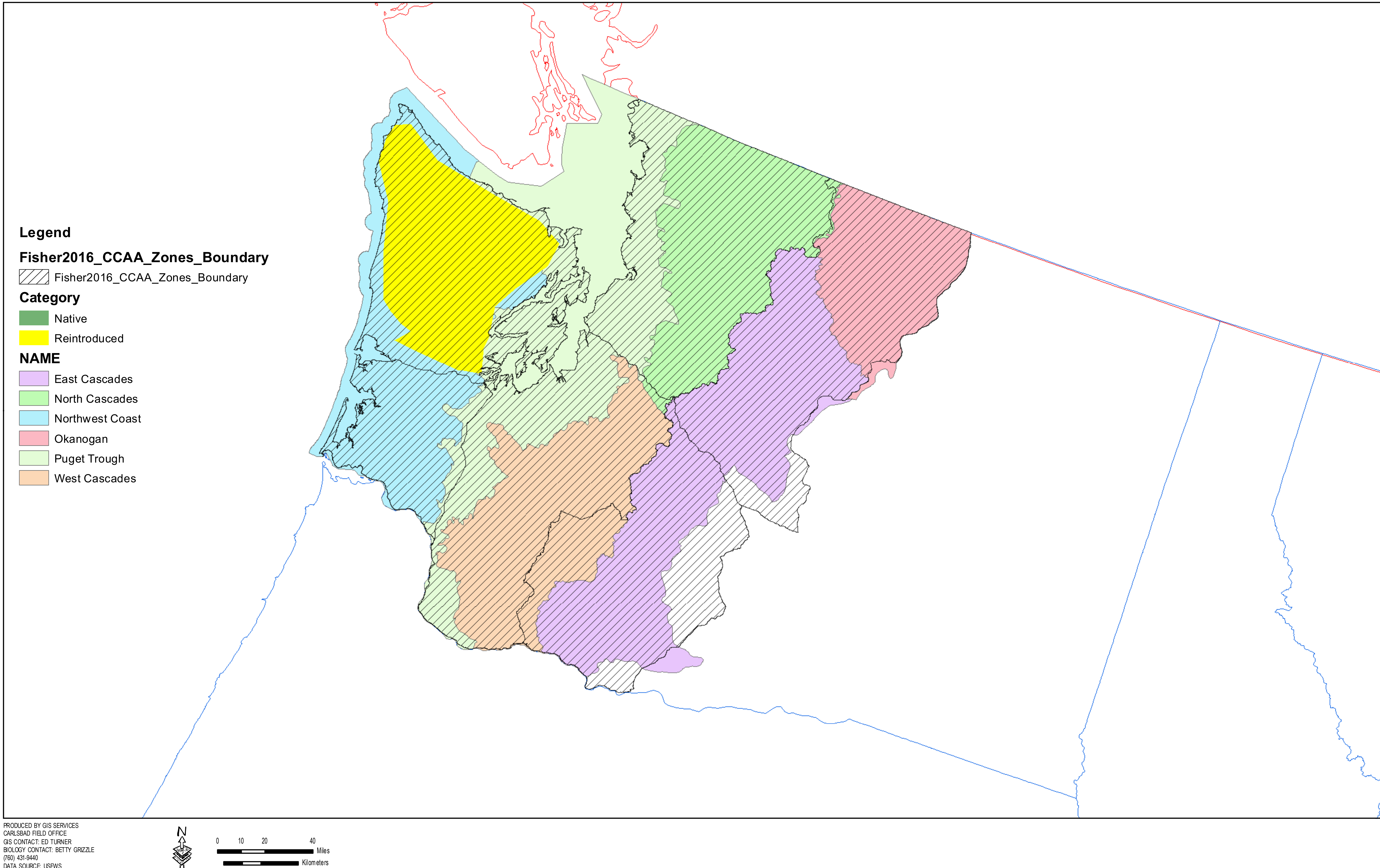
0 30 60 120 Kilometers

Legend

Native West Coast Fisher Populations

Reintroduced West Coast Fisher Populations

Information displayed is DELIBERATIVE and should be considered DRAFT for internal discussion.



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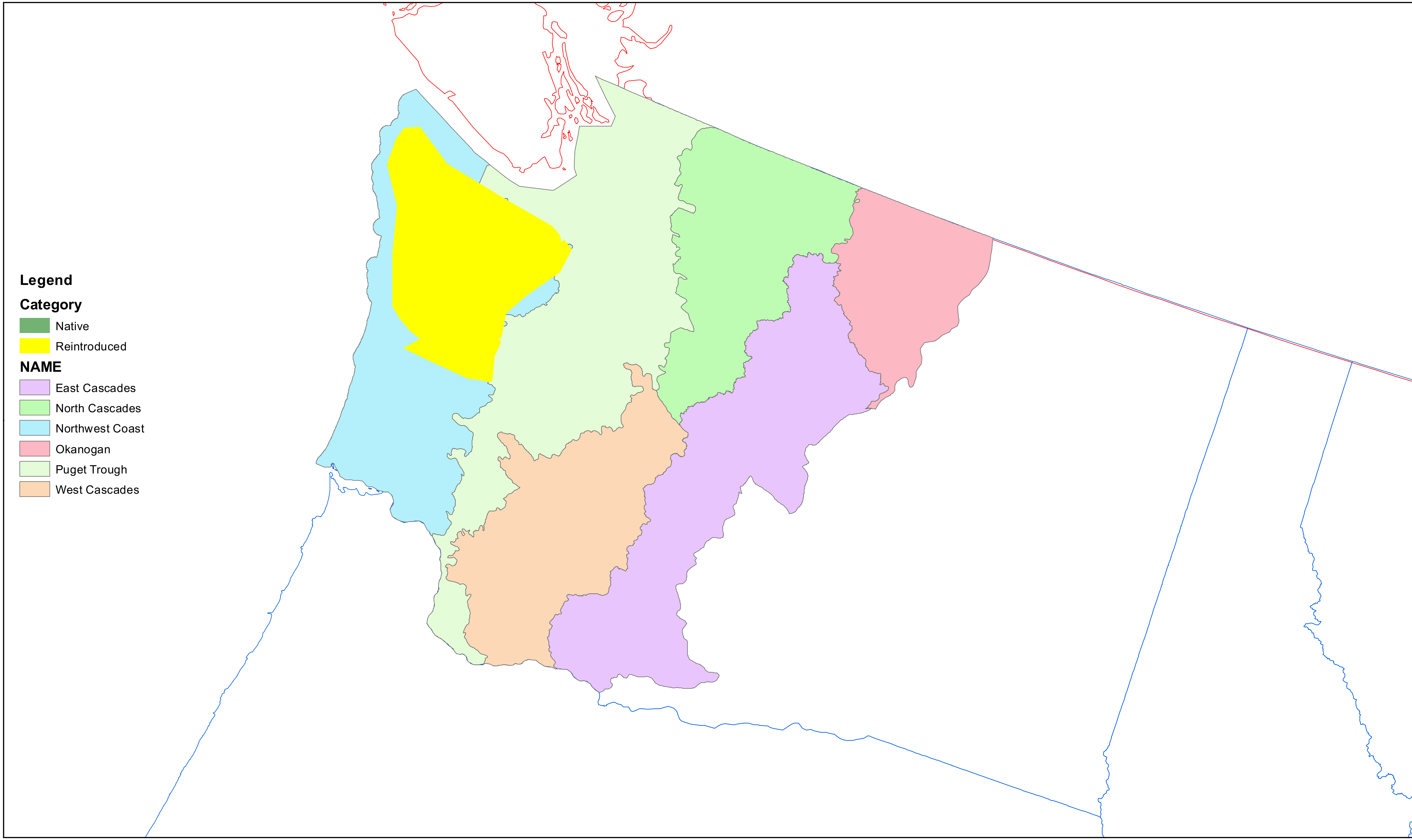

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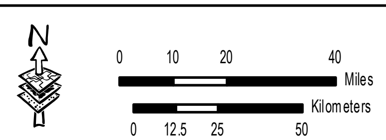

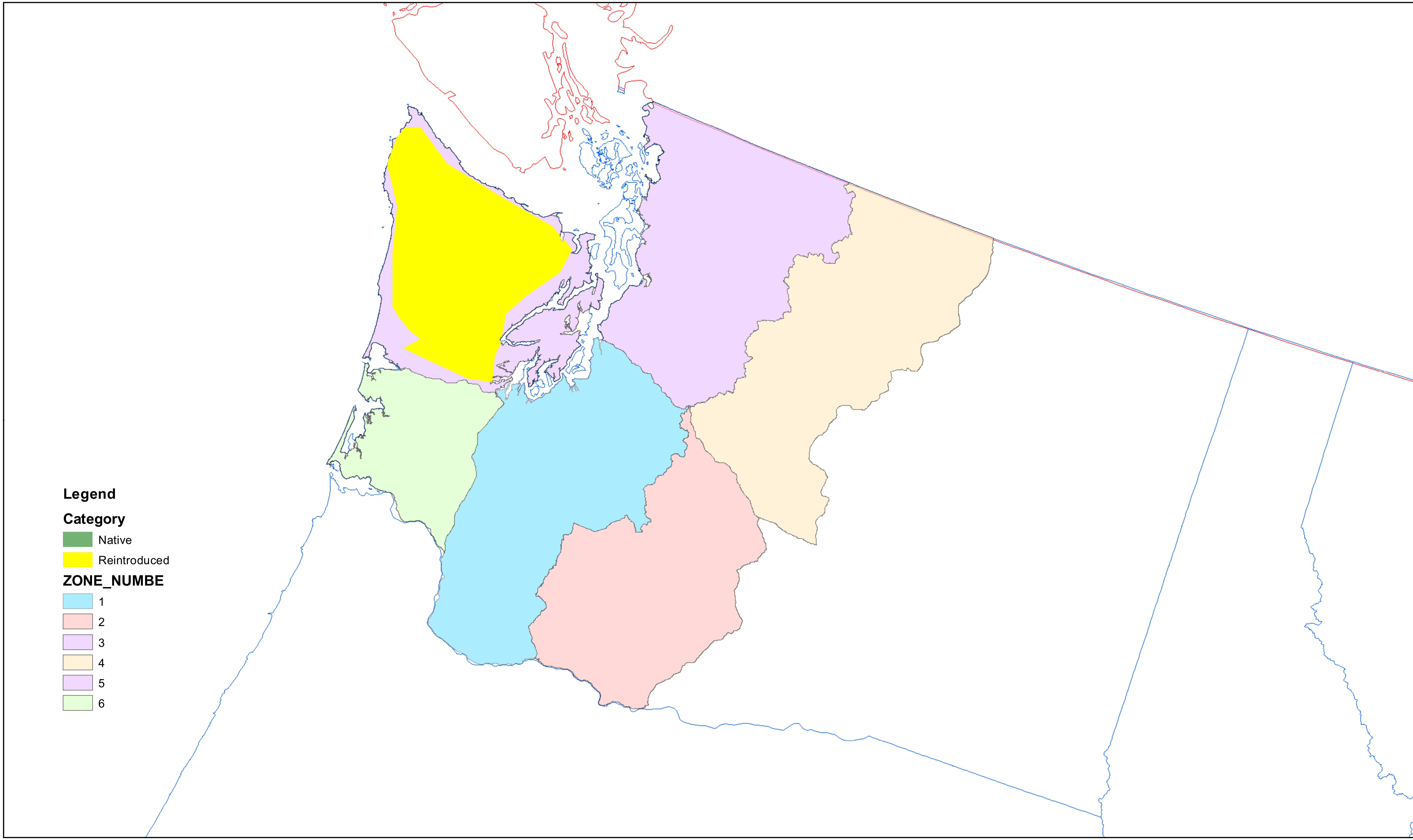

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