CONSERVATION OF FISHERS (*Martes pennanti*) IN SOUTH-CENTRAL BRITISH COLUMBIA, WESTERN WASHINGTON, WESTERN OREGON, AND CALIFORNIA–VOLUME IV: CONSERVATION STRATEGY

2011

Interagency Fisher Biology Team

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EXECUTIVE SUMMARY

Fishers (*Martes pennanti*) were once widely distributed in montane forests of western North America (Hagmeier 1956, Gibilisco 1994). Following European settlement, fisher distribution and abundance declined primarily due to anthropogenic stressors including direct and indirect mortality and habitat loss (USDI Fish and Wildlife Service 2004). In western North America, extant fisher populations with varying status occur in parts of British Columbia, Oregon, California, Idaho, and Montana. Breeding populations of fishers are currently believed to be absent in the Cascade, Hozameen and Okanagan Ranges, and the Thompson Plateau of south-central British Columbia (Lofroth 2004).

We organized the conservation assessment in 3 parts. In Volume I (Lofroth et al. 2010) we synthesized information on fisher biology and ecology from studies conducted within the Assessment Area (current known and historical range of fishers in south-central British Columbia [Thompson Plateau, Western Okanagan Upland, Hozameen and Okanagan Ranges, and Cascade Range], western Washington [Cascade Range, Olympic Mountains, and Coast Range], western Oregon [Cascade Range, Coast Range, and Klamath-Siskiyou Mountains], and California [Klamath-Siskiyou Mountains, North Coast Ranges, and Sierra Nevada]) as well as from studies conducted in adjacent regions (north-central and south-eastern British Columbia, Idaho, and Montana). We also summarized all habitat studies in the same region. Although the distance from study areas in adjacent regions to the boundary of the Assessment Area varies from 125–310 mi (200–500 km), these study areas occur in regions with similar ecological conditions to portions of the Assessment Area and, historically, there was likely some connectivity and genetic linkages to fisher populations in portions of the Assessment Area. We also draw upon results from studies conducted elsewhere in North America to demonstrate relevant similarities or differences in fisher biology and ecology, or when no information on a particular topic was available for the Assessment Area. The one exception is fisher habitat associations. Because of major differences in ecosystems (including climate, plant communities, natural disturbance regimes, and human land use patterns and management) between western coniferous forests and forests elsewhere in North America, and how these differences may influence fisher habitat relations, we only synthesized information from studies conducted in coniferous forests in the Assessment Area and adjacent regions.

In Volume II (Lofroth et al. 2011) we have tried to identify all available information on fisher habitat ecology (i.e., documented in a progress or final report, thesis, dissertation, peer-reviewed paper, etc.) from fisher habitat studies conducted in and west of the Rocky Mountains. We considered all literature available prior to 1 July 2008 in our review of habitat studies.

In Volume III (Naney et al. 2011) we identified, reviewed and assessed presumed threats to fishers and fisher habitat within the Assessment Area. We referenced literature through 2009 to complete this volume.

In the conservation strategy (Volume IV) we applied information contained in the conservation assessment on fisher biology, ecology, and threats to develop a regional management approach to habitat and species conservation. We developed the Strategy to apply to the same geographic areas as the Assessment. We provide a consistent yet flexible approach that resource managers can readily use to conserve fishers and fisher habitat and address other resource issues, such as vegetation management. Addressing a wide-ranging species influenced by broad-scale issues inherently involves large landscapes, often with multiple land owners and land managers. Accommodating different ownerships and management priorities requires developing a suite of conservation measures that can be implemented based on local conditions, site potential, and other considerations. Active management, implemented purposefully over space and time, will be necessary for the conservation strategy to succeed. For a conservation strategy to remain current and effective, it must also be reviewed and updated periodically to incorporate relevant new information.

A significant challenge to fisher conservation within the Strategy Area is that fishers occur in relatively small, isolated populations and are absent from significant portions of their historical range. We developed a vision statement for the Strategy that was approved by the Fisher Steering Committee in 2008:

"**The Fisher Conservation Strategy provides an integrated, regional approach to achieve self-sustaining, interacting populations of fishers within the Strategy Area**."

We developed the vision of self-sustaining populations with the assumption that fishers historically occurred in low densities but were widely distributed throughout the Strategy Area. There were likely areas within the range where fishers were rarely present while other areas were consistently occupied, and discontinuities in the distribution were possible. However, due to the lack of extant breeding populations of fishers in much of the Strategy Area reintroductions will be needed to re-establish fishers in parts of the Strategy Area, and make progress towards realizing the fisher vision within the next 20 years.

We used the following guiding principles to develop the Strategy:

1. *We used the best and most current scientific information available on fishers.* We used the results of fisher studies conducted within the Assessment Area and adjacent regions (Volume I and II) as our primary sources of information. We also used reports and published literature available since July 1, 2008 when they were within the scope of the strategy. When information was limited, we applied relevant research conducted throughout the fisher's North American range. We also used information derived from the collective knowledge, experience, and professional judgments of Fisher Biology Team members (Volume III) and other scientists.

2. *We used principles of conservation biology, landscape ecology, and forest ecology to develop the foundation for the Strategy* (Thomas et al. 1990, Meffe and Carroll 1997, Franklin et al. 2002, Lindenmayer et al. 2008*)*.

3. *We considered and integrated variation in fisher ecology, ecological processes, landscape patterns, and threats because* a *blending of natural ecological*

processes and species-specific management approaches has a higher likelihood of retaining natural diversity, preserving species viability, and promoting resource sustainability (Glick et al. 2011).

4. *We considered and integrated multiple spatial scales because fishers use habitats at different spatial scales for different behaviors and activities (Powell 1994, Weir and Harestad 2003, Volume I).*

We developed Strategy goals to:

1. Protect extant populations and promote expansion into areas presumably occupied in the past;
2. Maintain or restore connectivity within fisher populations;
3. Restore populations of fishers to areas from where they have been extirpated, considering native genetic diversity and recommending selecting appropriate genetic lineages;
4. Develop landscapes that are resilient to natural disturbances and restore or maintain habitat conditions that can support fishers; and
5. Review and incorporate relevant new information into the Strategy to maintain its effectiveness for conservation of fishers.

We developed Strategy objectives to (not in priority order):

1. Provide an approach to fisher conservation that ameliorates threats to extant populations, facilitates expansion of existing populations, and prepares areas where fishers are to be re-introduced;
2. Identify areas for re-introductions to establish populations in areas where they have been extirpated and to restore the species' ecological role;
3. Provide an approach to fisher conservation that will maintain, restore, and develop resilient landscapes that supports fishers;
4. Provide a framework for the application of various types and scales of spatial tools needed to facilitate, support, and implement a regional conservation strategy;
5. Develop an approach that facilitates integrating other conservation efforts (e.g., British Columbia: Forest and Range Practices Act Identified Wildlife Management Strategy, Fisher Forestry Guidelines Conservation Framework; United States: The Northwest Forest Plan, Sierra Nevada Forest Plan Amendment, Northern Spotted Owl Recovery Plan) at local and regional scales;
6. Provide framework to assist in developing Candidate Conservation Agreements, memoranda of understanding, jurisdictional recovery plans or conservation strategies, feasibility assessments for reintroductions, and land management plan revisions;
7. Establish performance measures to assess long-term efficacy of the Strategy; and
8. Identify high-priority research, inventory, and monitoring needs.

The Strategy is not a federal action requiring analysis under the National Environmental Policy Act. Any future projects and activities proposed in response to this strategy or guided by this strategy will require, as appropriate, NEPA analysis including scoping and public comments. The Strategy is a science based guidance document for use by local managers and biologists within the Strategy Area and provides a framework to promote cooperation between and among agencies and stakeholders to implement conservation actions needed to meet fisher life history requirements at multiple spatial scales.

We developed an approach to identify specific areas that protect extant populations and suitable habitat. This approach encourages areas for restoration activities to develop fisher habitat and to develop resilient landscapes. We used a scale-based approach that conceptually moves from large scales, regional (approximately 4,000 sq. mi.) or landscape (1500 to 2000 sq. mi.), to small scales (the individual female home range) or forest stands scale (a group of trees that are more or less homogenous in species composition and size).

Our highest priority is to protect extant populations. While active vegetation management will be needed to restore resilient landscapes in some habitats that support extant populations, specific areas meeting our contemporary understanding of fisher habitat suitability are identified for protection. Some of these areas may be vulnerable to disturbance, such as fire or insects and diseases, but the emphasis on fisher population protection and habitat restoration is a deliberate tradeoff to distribute risk in a manner compatible with population persistence and growth.

We define several spatial designations to identify fisher population status: Extant Population Areas, Population Re-establishment Areas, habitat quality: high and low habitat suitability and non-capable habitat; and for management emphasis: Fisher Emphasis Areas, and Restoration Landscape. There are 3 extant population areas and 11 Population Re-establishment Areas, which includes 2 recently reintroduced populations. The locations and administrative units responsible for species and habitat management are defined for each. Fisher Emphasis Areas (FEA) are selected within the Strategy Area to protect specific areas in Extant Populations Areas, or to protect High Suitability Habitat in Population Re-establishment Areas. FEAs are selected based on our current understanding of occupancy or the presence of suitable habitat and will represent our contemporary understanding of fisher biology, ecology and habitat needs. In Extant Population Areas, FEAs will be large enough to support $\geq$ 20 hypothetical female fisher home ranges; there will be multiple FEAs in each Extant Population Area. In each Population Re-establishment Area, one FEA will contain habitat that can support at least 60 hypothetical female fisher home ranges. Conservation models that provide a rigorous, repeatable method for aggregating habitat values will be used to help design a set of networks used to identify FEAs. An iterative process with field units will be used to validate vegetation and habitat suitability maps and identify the best areas for FEAs.

In FEAs, in areas of high habitat suitability, vegetation management actions could occur, but would not be expected to reduce habitat quality such that a female fisher would need to increase her home range size to meet life requirements and reproduce and raise young. In areas of low habitat suitability proposed management actions should be designed to reduce the risk of disturbances that could further degrade habitat. Management actions should be designed to maintain and improve fisher habitat suitability while restoring the landscape to a resilient condition.

In Restoration Landscapes management flexibility will emphasize processes to restore a more resilient landscape. In Extant Fisher Population Areas fishers may be present and management actions may affect individual fishers, but are not expected to result in a trend toward a decreasing population. In Re-establishment Fisher Population Areas, management actions in the Restoration Landscape should be designed to move the landscape toward a more resilient condition while developing higher suitability fisher habitat.

We developed Conservation Measures based on the best available science to ameliorate threats to fishers and fisher habitat at multiple spatial scales. Implications for Conservation from Volumes I and III were used as the basis for development of the Conservation Measures. The Conservation Measures have also been designed to encourage development of landscapes over time that are resilient to disturbance events and blend together natural ecological processes and species-specific management approaches.

We developed the Strategy using the most current science and best available information on fishers on the west coast. During development of the Strategy there were aspects of fisher ecology, biology, distribution, and some habitat components that were poorly understood or had not been fully investigated. With better information to inform development of conservation measures fisher conservation could be furthered. The final section of the strategy identifies areas we felt were of most immediate need.

PREFACE

This interagency conservation effort began in late 2005 in response to a 12-month status review and subsequent finding by the USDI Fish and Wildlife Service (2004) for the West Coast (Washington, Oregon, and California) Distinct Population Segment (DPS) of the fisher (*Martes pennanti*) stating that a listing was "…warranted but precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants." Following this finding, federal and state agency leadership recognized the need for and potential benefits of developing a conservation assessment and strategy for the West Coast DPS. Agency leaders subsequently formed a steering committee to oversee the development of a Conservation Assessment (Assessment) and Conservation Strategy (Strategy) by the Interagency Fisher Biology Team. Because the range of the West Coast DPS is contiguous with historical range in British Columbia, fishers will benefit from a coordinated conservation approach that includes both countries. The geographic scope of this conservation effort thus includes south-central British Columbia. The vision for the Assessment and Strategy is to provide an effective, integrated regional approach to achieve self-sustaining, interacting populations of fishers within their historical west coast range.

The steering committee was chaired by the Natural Resources Director of the USDA Forest Service (Dave Gibbons, Pacific Southwest Region [2005]; Cal Joyner, Pacific Northwest Region [2006–2007]; Jose Linares, Pacific Northwest Region [2008–2010]; Debbie Hollen, Pacific Northwest Region [2010–Present]). Representatives were from the USDA Forest Service, Northern (Cindy Swanson) and Pacific Southwest (Art Gaffery, Chris Knopp, and Deborah Whitman) Regions; USDI Fish and Wildlife Service, Pacific (Theresa Rabot) and Pacific Southwest (Darrin Thome) Regions; USDI National Park Service, Pacific West Region (Kathy Jope and Steve Gibbons); USDI Bureau of Indian Affairs, Pacific Region (David Wooten); USDI Bureau of Land Management in Oregon (Mike Haske and Lee Folliard) and California (Paul Roush, Tom Pogacnik, and Amy Fesnock); Washington Department of Fish and Wildlife (Dave Brittell); Oregon Department of Fish and Wildlife (Don Whittaker); California Department of Fish and Game (Dale Steele); and British Columbia Ministry of Environment (John Metcalfe).

A Fisher Science Team was also formed: Keith Aubry (Lead, USDA Forest Service, Pacific Northwest Research Station), Steve Buskirk (University of Wyoming), Michael Schwartz (USDA Forest Service, Rocky Mountain Research Station), and Bill Zielinski (USDA Forest Service, Pacific Southwest Research Station). The Fisher Science Team was available for scientific consultation and orchestrated an independent peer-review of the Assessment.

The Interagency Fisher Biology Team (members identified here in front matter) produced 4 documents (Volumes I through IV) during this process. Volume I is a comprehensive review of best available information on fisher biology and habitat ecology based primarily on research conducted in south-central British Columbia, western Washington, western Oregon, and California (Assessment Area) and adjacent regions. Volume I (Lofroth et al. 2010) describes the current status of fisher populations and provides a broad overview of the physical and human environments in the Assessment Area. It references source material produced and available prior to 1 July 2008.Volume II (Key Findings from Fisher Habitat Studies in British Columbia, Montana, Idaho, Oregon, and California; Lofroth et al. 2011) provides a detailed summary of results from 27 habitat study areas west of the Rocky Mountains within the Assessment Area and adjacent regions. Volume II was developed as a supporting document for the primary syntheses of habitat associations presented in Volume I, as well as a general reference to help orient practitioners to the body of available information for their geographic area of interest. Practitioners are strongly encouraged to reference the original literature pertinent to their area rather than rely exclusively on Volume II. Volume III (Threat Assessment; Naney et al. 2011) is an assessment of threats pertinent to fishers and fisher habitat within the Assessment Area. Volume IV (Conservation Strategy) was developed based on the information and syntheses in Volumes I through III to achieve the goal of "self-sustaining, interacting populations of fishers within their historical west coast range."

ACKNOWLEDGEMENTS

We thank the many agencies and individuals that supported this multi-year effort to develop a fisher conservation strategy for south-central British Columbia, western

Washington, western Oregon, and California. We thank the Fisher Steering Committee for support and guidance. Bruce Marcot (USDA Forest Service, Pacific Northwest Research Station) and Steve Morey (USDI Fish and Wildlife Service, Pacific Region) provided insights and expertise in structured decision making and developing a framework for the strategy. Jo Ellen Richards documented discussions and Cindy Donegan facilitated many Fisher Biology Team meetings. This volume has benefited greatly from comments and suggestions for improvement provided by the Sarah Madsen and Elaine Rybak, Threatened, Endangered and Sensitive Species program managers in the Portland Regional Forest Service and Rob Huff, Bureau of Land Management, Portland State Office. We conducted 2 tests of earlier drafts of the strategy and the comments and recommendations received from biologists and managers were very useful to improve the strategy. To them we are very grateful. We are grateful to the many fisher researchers and other scientists who generously provided their photographs for use in this volume. The federal, provincial, and state agencies associated with members of the Interagency Fisher Biology Team provided support including time and travel for individuals to attend meetings. The USDI Fish and Wildlife Service (Pacific and Pacific Southwest Regions), and the Interagency Special Status and Sensitive Species Program (USDA Forest Service, Pacific Northwest Region and USDI Bureau of Land Management Oregon/Washington) provided additional funding to assist with costs. The map-based figure was expertly produced by Dave LaPlante (Natural Resources Geospatial). Janine Koselak (USDI Bureau of Land Management, National Operations Center) capably managed the layout and publication process.

1. INTRODUCTION

We developed the Fisher Conservation Assessment (hereafter the "Assessment"; Lofroth et al. 2010, 2011, Naney et al. 2011), to provide the foundation for development of the Fisher Conservation Strategy (Strategy). The Strategy applies information contained in the Assessment on fisher biology, ecology, and threats to regional management approaches for habitat and species conservation. We developed the Strategy to apply to the same geographic areas as the Assessment Area, which encompasses the West Coast DPS and south-central British Columbia Cascades and Thompson Okanogan Plateau (henceforth the Strategy Area; Fig. 1). The range of the fisher in the northern Rocky Mountains (southeast British Columbia, northeastern Washington, Idaho and Montana), northern British Columbia, and portions of eastern Washington and Oregon was not included in the Strategy.

We developed the Strategy using the most current science and principles of conservation biology, landscape and forest ecology. The Strategy is a guidance document for use by local managers and biologists within the Strategy Area and provides a framework to promote cooperation between and among agencies and stakeholders to implement conservation actions needed to meet fisher life history requirements at multiple spatial scales. This Strategy is not a federal action requiring analysis under the National Environmental Policy Act. Any future projects and activities proposed in response to this strategy or guided by this strategy will require appropriate NEPA analysis including scoping and public comments.

We provide a consistent yet flexible approach that resource managers can readily use to conserve fishers and fisher habitat and address other resource issues, such as vegetation management. The success of the Strategy will depend on a high level of interagency coordination and collaboration, guided by the continued oversight of an interagency fisher steering committee. An interagency fisher biology team will be needed to assist field managers and staff in application of the strategy, and for its long-term maintenance.

The ecological context for the Strategy is based on 9 geographic areas (Appendix A), derived from Ecological Subregion Sections of the United States (McNab and Avers 1994) and Ecoregions of British Columbia (Demarchi 1996, 2007a, b, c).

To support fisher population maintenance and expansion in extant fisher populations the Strategy promotes the protection of high suitability habitat, the development of resilient landscapes, and amelioration of non-habitat threats. In areas that do not currently support fishers the Strategy is designed to re-establish self-sustaining fisher populations and develop and maintain resilient landscapes.

The Strategy was developed primarily for use on federal (United States) and crown (British Columbia) lands, but the approach and conservation measures would be applicable to any lands within the Strategy Area that have the potential to support fisher populations.

1.1. Guiding Principles

Addressing a wide-ranging species influenced by broad-scale issues inherently involves large landscapes, often with multiple land owners and land managers (Fig. 2). Accommodating different ownerships and management priorities requires developing a suite of conservation measures that can be implemented based on local conditions, site potential, and other ecological and management considerations. Active management, implemented purposefully over space and time, will be necessary for the conservation strategy to succeed. For a conservation strategy to remain current and effective, it must also be reviewed and updated periodically to incorporate relevant new information.

Conservation of a species is best accomplished by maintaining multiple, robust populations and restoring resilient and representative landscapes that support them. Population resiliency allows populations to withstand and recover from periodic natural disturbances. Representative populations retain genetic diversity and unique local adaptations that allow response to environmental change (Lacy 1997, Tear et al. 2005).

The following guiding principles were used to develop the Strategy:

1. *We used the best and most current scientific information available on fishers.* We used the results of fisher studies conducted within the Assessment Area and

adjacent regions (Volume I and II) as our primary sources of information. We also used reports and published literature available since July 1, 2008 when they were within the scope of the strategy. When information was limited, we applied relevant research conducted throughout the fisher's North American range. We also used information derived from the collective knowledge, experience, and professional judgments of Fisher Biology Team members (Volume III) and other scientists.

2. *We used principles of conservation biology, landscape ecology, and forest ecology to develop the foundation for the Strategy* (Thomas et al. 1990, Meffe and Carroll 1997, Franklin et al. 2002, Lindenmayer et al. 2008).

3. *We considered and integrated variation in fisher ecology, ecological processes, landscape patterns, and threats because* a *blending of natural ecological processes and species-specific management approaches has a higher likelihood of retaining natural diversity, preserving species viability, and promoting resource sustainability* (Glick et al. 2011).

4. *We considered and integrated multiple spatial scales because fishers use habitats at different spatial scales for different behaviors and activities (Powell 1994, Weir and Harestad 2003, Volume I).*

1.2. Fisher Vision Statement

"**The Fisher Conservation Strategy provides an integrated, regional approach to achieve self-snstaining, interacting popnlations of fishers within the Strategy Area**."

We developed the vision of self-sustaining populations with the assumption that fishers historically occurred in low densities but were widely distributed throughout the Strategy Area. There were likely areas within the range where fishers were rarely present while other areas were consistently occupied, and discontinuities in the distribution were possible. Our vision uses McCullough's (1996) definition of a population: an interacting collection of individuals occupying a defined geographic area, the boundary of which can be determined in various ways including a geographic unit in which movement and interaction of animals are greater within than between adjacent units.

Reintroductions will be needed to re-establish fishers in parts of the Strategy Area, to make progress in realizing the fisher vision within the next 20 years. When reintroductions are planned, careful consideration must be given to genetics lineages of source populations. Recent information indicates the southern Sierra Nevada fishers have a genetic structure unique to that population (Knaus et al. 2011). In the future, as populations are restored, translocations of individuals may be necessary where barriers limit genetic exchange.

1.3. Goals

We developed Strategy goals to:

1. Protect extant populations and promote expansion into areas presumably occupied in the past;
2. Maintain or restore connectivity within fisher populations;
3. Restore populations of fishers to areas from where they have been extirpated, considering native genetic diversity and recommending selecting appropriate genetic lineages;
4. Develop landscapes that are resilient to natural disturbances and restore or maintain habitat conditions that can support fishers; and
5. Review and incorporate relevant new information into the Strategy to maintain its effectiveness for conservation of fishers.

1.4. Objectives

We developed Strategy objectives to (not in priority order):

1. Provide an approach to fisher conservation that ameliorates threats to extant populations, facilitates expansion of existing populations, and prepares areas where fishers are to be re-introduced;
2. Identify areas for re-introductions to establish populations in areas where they have been extirpated and to restore the species' ecological role;
3. Provide an approach to fisher conservation that will maintain, restore, and develop resilient landscapes that supports fishers;
4. Provide a framework for the application of various types and scales of spatial tools needed to facilitate, support, and implement a regional conservation strategy;
5. Develop an approach that facilitates integrating other conservation efforts (e.g., British Columbia: Forest and Range Practices Act Identified Wildlife Management Strategy, Fisher Forestry Guidelines Conservation Framework; United States: The Northwest Forest Plan, Sierra Nevada Forest Plan Amendment, Northern Spotted Owl Recovery Plan) at local and regional scales;
6. Provide framework to assist in developing Candidate Conservation Agreements, memoranda of understanding, jurisdictional recovery plans or conservation strategies, feasibility assessments for reintroductions, and land management plan revisions;
7. Establish performance measures to assess long-term efficacy of the Strategy; and
8. Identify high-priority research, inventory, and monitoring needs.

2. CONSERVATION STRATEGY TERMINOLOGY AND DESIGN

2.1. Introduction

A significant challenge to fisher conservation within the Strategy Area is that fishers occur in relatively small, isolated populations and are absent from significant portions of their historical range (Fig. 1). We developed an approach to identify specific areas that protect extant populations and suitable habitat. This approach encourages areas for restoration activities to develop fisher habitat and to develop resilient landscapes. We used a scale-based approach that conceptually moves from large scales, regional (approximately 4,000 sq. mi.) or landscape (1500 to 2000 sq. mi.), to small scales (the individual female home range) or forest stands scale (a group of trees that are more or less homogenous in species composition and size). Regional-level coordination and planning are integral to the application of the Strategy. We developed conservation measures for multiple spatial scales, designed them to provide actions that can be applied to protect fishers or fisher habitat, restore habitat components, and reduce threats to both animals and habitat, and develop and promote resilient landscapes (North et al. 2009, USDA Forest Service 2010). By protecting and encouraging expansion of extant populations and re-establishing fishers in unoccupied portions of their historical range, fisher populations should increase in size and geographic distribution and achieve the overarching goal of self-sustaining populations.

2.2. Approach

This Strategy is a guidance document for use by local managers and biologists within the Strategy Area (Fig. 1). The Strategy framework promotes cooperation between and among agencies and stakeholders to implement conservation actions needed to meet fisher life history requirements at multiple spatial scales. To successfully apply this Strategy, it is critical that wildlife and fisher experts and other resource specialists use the information compiled in Volumes I, II, and III, and new information as it becomes available, supplemented with local knowledge. The Strategy provides a logical conservation approach to address threats (Volume III) in each of the 9 geographic areas in the Strategy Area (Appendix A). Appendix B provides information on selected habitat variables important to fishers in each geographic area within the Strategy Area. To apply the Strategy, it is critical to use Appendix B in addition to local knowledge of the geographic area to use apply appropriate conservation actions. The Strategy describes a process that will facilitate inter- and intra-agency coordination. We use maps of suitable and potential fisher habitat which provide the foundation for identifying locations where specific conservation actions should be applied. We developed the Strategy so managers could respond to new information and adjust guidance based on adaptive management principles.

The highest priority of this Strategy is to protect extant populations. While active vegetation management will be needed to restore resilient landscapes in habitats that support extant populations, specific areas meeting our contemporary understanding of fisher habitat suitability are identified for protection. Some of these areas may be vulnerable to disturbance, such as fire or insects and diseases, but the emphasis on population protection and habitat restoration is a deliberate tradeoff to distribute risk in a manner compatible with fisher population persistence and growth. Some management may occur in these areas, but will be a "light touch" and designed to protect or buffer important habitats. Protection of extant populations combined with implementation of conservation measures that allow expansion of extant populations into suitable, but unoccupied areas will assist in achieving the fisher vision.

2.3. General Terminology

The following terms are used regularly in this document.

Resilient landscape – Walker et al. (2004) defined resilience as "…the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks." We refer to resilient landscapes as systems dominated by forested plant communities capable of withstanding natural disturbances, such as low to moderate intensity fires, wind events, and insect and disease outbreaks. These landscapes typically include patches of non-forested habitats (e.g., shrub dominated, meadows, rock outcrops) resulting either from site (e.g., soils) limitations or succession following disturbance). We considered these landscapes resilient when they remain in a forest dominated condition that retains inherent structural characteristics, and ecosystem processes following a disturbance event. The landscape retains or quickly recruits native species and structural diversity of vegetation adapted to the site following disturbance.

Conservation Measure – a strategy or action that will reduce or eliminate (ameliorate) a defined threat to fishers or fisher habitat, or will provide opportunities to improve the condition of fisher habitat, when implemented as part of a management activity.

Hypothetical female fisher home range – the area required to support a female fisher. In the majority of the Strategy Area we do not know where female fishers are located or the extent of their home ranges without telemetry. The use of this term allows conservation efforts to be applied to areas large enough to support females when they occupy the area. The size of the home range may vary by geographic area and quality of habitat. Where research has not been conducted or where extant populations do not occur, female home range sizes will be estimated based on habitat conditions that are similar to areas where known home range sizes have been determined (Volume I, Chapter 6; Appendix B).

2.4. Spatial designation terminology within the Strategy Area

The Strategy relies on several spatial designations to identify fisher population status, habitat quality, and management emphasis.

Population Status

Extant Population Areas – Extant Population Areas include the known distribution of fisher populations in the Cascade Range, Oregon, Northern California –Southwestern Oregon, and Southern Sierra Nevada, plus areas of capable habitat around each population extending approximately 30 miles (50 km; Fig. 1). Detailed descriptions of the geographic bounds of these populations are provided in section 3.

Population Re-establishment Areas – Within the Strategy Area, 11 Population Re-Establishment Areas have been identified to meet the overall objectives of the Strategy. Re-establishment Population Areas have the inherent capability to support fisher populations. These areas are where fisher population re-establishment is necessary to create a network of interconnected populations. Fisher Population Re-establishment Areas have been identified using broad geographic and administrative boundaries (section 3). Population re-establishment areas will be prioritized based on the current and future ability to support fisher populations, and their strategic location to meet long term fisher conservation goals. These areas may require reduction of non-habitat threats (e.g., high quality habitat bisected by a major highway is connected by providing wildlife crossings). Re-establishment may occur by dispersal from Extant Population Areas or re-introduction. The intent of the Strategy is to apply management actions for habitat maintenance and restoration so that fisher populations could be established in the next 10 – 20 years.

Habitat Quality

High Suitability Habitat –Areas identified as high suitability represent habitat that has a high probability of fisher occurrence and presumably provide a higher likelihood of supporting reproductive females. This habitat is based on our current understanding of contemporary fisher habitat associations and is tailored specifically to each geographical area.

Low Suitability Habitat – Areas of Low Suitability Habitat have a lower probability of fisher occurrence, but may be capable of meeting certain fisher life requisites. Low Suitability Habitat also includes areas that are of value to fishers but may not support fisher reproduction (e. g., patches of shrub habitats that support prey and may be available for foraging fishers.)

Non-capable habitat – Plant communities or landscape features (e.g., high elevation alpine habitats, dry, warm, open forests and grasslands, large bodies of water) that do not contain elements that support fishers. This category also includes other areas that have been permanently altered by anthropogenic (e.g., agricultural areas and urban areas) actions.

Management Emphasis

Fisher Emphasis Areas – Fisher Emphasis Areas (FEA) are selected within the Strategy Area and to protect specific areas in Extant Populations Areas, or to protect High Suitability Habitat in Population Re-establishment Areas. In Extant Population Areas, FEAs will be selected using habitat suitability and fisher occurrence information when available. FEAs will provide for fisher reproduction and will be large enough to support $\geq$ 20 hypothetical female fisher home ranges (Thomas et al. 1990). In each Population Re-establishment Area, an FEA will be selected based on habitat suitability and contain habitat that can support at least 60 hypothetical female fisher home ranges (Hayes and Lewis 2004, Lewis 2006, Powell et al. in Press).

Restoration Landscape –That portion of the Strategy Area excluding Fisher Emphasis Areas. To assure the success of this strategy, the Restoration Landscape provides environmental conditions capable of supporting foraging, resting, and denning habitat, and security cover in amounts and distribution that facilitates survival, reproduction, and successful dispersal and breeding season movements.

2.5. Reaching the Vision

The long term goal is to have landscapes resilient to environmental events, such as fire and insect and disease outbreaks and is flexible to adapt to climate change. As the Restoration Landscape undergoes active management moving it towards a more resilient condition, low risk actions are emphasized in occupied FEAs to ensure persistence of fishers and habitat on the landscape. When research and monitoring validate fishers have re-occupied the Restoration Landscape and are present in self-sustaining populations, active management maybe warranted in High Suitability Habitat in FEAs to develop more resilient landscapes.

3. POPULATION AREAS.

3.1. Extant Population Areas

3.1.1. Cascade Range, Oregon Population Area

The Cascade Range, Oregon Population Area includes the Upper Rogue River Drainage Basin on the west slope of the Cascade Range in Douglas and Jackson counties, and occupies forests between 2,000 and 5,000 ft (610 and 1,525 m) in elevation. The population extends north and west to the divide between the Rogue and Umpqua rivers, south to Mt. McLoughlin, and east across the Cascade crest to approximately the western boundaries of the Wood River Valley and Upper Klamath Lake in Klamath County. Fishers have been infrequently detected further north near Lemolo and Crescent Lakes on the Umpqua and Deschutes National Forests and further south near Hyatt Reservoir (Volume I, Chapter 5).

The administrative units responsible for land or species management for the Cascade Range, Oregon Population Area are: Umpqua, Rogue River-Siskiyou, and Fremont-

Winema national forests; Oregon Field office, Region 1 and Klamath Falls office, Region 8, U. S. Fish and Wildlife Service; Roseburg, Medford, and Klamath Falls Resource Areas, Lakeview District, Bureau of Land Management; Crater Lake National Park; and Oregon Department of Fish and Wildlife.

3.1.2. Northern California – Southwestern Oregon Population Area

The Northern California – Southwestern Oregon population includes southwestern Oregon south of the Rogue River to the Oregon-California border and west of Interstate 5 to the coast (Jackson, Josephine, and Curry counties; Aubry and Lewis 2003); northern California from the Oregon-California border in Del Norte and Siskiyou counties east to Interstate 5; east and west of Interstate 5 in Shasta County; and west of Interstate 5 in forested areas in Trinity, Tehama, Glenn, Lake, Humboldt, and Mendocino counties (Zielinski et al. 1995, Slauson and Zielinski 2007; see Volume I, Chapter 5).

The administrative units responsible for land or species management for the Northern California – Southwestern Oregon Population Area are: Six Rivers, Klamath, Shasta-Trinity, Mendocino, Rogue River-Siskiyou national forests; Oregon Field Office, Region 1 and the Arcata, Yreka and Red Bluff Fish and Wildlife Offices, Region 8, U. S. Fish and Wildlife Service; Arcata, Coos Bay, Medford, Redding, and Ukiah districts, Bureau of Land Management; Oregon Caves National Monument, Crater Lake National Park, Redwood National and State Parks, Whiskeytown National Recreation Area; and Oregon Department of Fish and Wildlife and California Department of Fish and Game.

3.1.3. Southern Sierra Nevada Population Area

The Southern Sierra Nevada population includes the west slope of the southern Sierra Nevada and is generally encompasses mid-elevation forests between 3,950 and 9,200 ft (1,200 and 2,800 m; USDA Forest Service 2006). Fishers occupy the area from the Merced River drainage in Yosemite National Park south through the Greenhorn Mountains at the southern end of the Sierra Nevada, and the Kern Plateau in the eastern Sierra Nevada (Zielinski et al 1995, 2005; see Volume I, Chapter 5).

The administrative units responsible for land or species management for the Southern Sierra Nevada Population Area: Sierra, Stanislaus, Inyo, and Sequoia national forests; Sacramento Fish and Wildlife Office, Region 8, U.S. Fish and Wildlife Service; Folsom and Bakersfield districts, Bureau of Land Management; Yosemite and Sequoia-Kings Canyon national parks; and California Department of Fish and Game.

3.2. Population Re-establishment Areas

Integral to the success of the Strategy is re-establishing fisher populations in areas where they have been extirpated. Feasibility studies (Lewis and Hayes, 2004, Callas and Figura, 2008, Powell et al. in Press) that evaluate and develop the best approaches for successful reintroductions must be completed prior to translocations. We recommend that the priorities for reintroductions should consider proximity to native fishers and unique genetic characteristics within fisher populations. State wildlife agencies have the responsibility for initiating fisher reintroductions and should participate in identifying and delineating suitable areas.

The 11 Population Re-establishment Areas (Fig. 3, 4) have the long-term capability to support fisher populations, but all are not currently considered occupied. Population Re-establishment Areas F and J have had recent reintroductions to establish fisher populations.

3.2.1. Thompson Okanagan Plateau
Population Re-establishment Area A (Fig. 3). The administrative unit responsible for land or species management for Region A is the Thompson-Okanagan Region of the Ministry of Forests, Lands, and Natural Resource Operations.

3.2.2. Cascades of Washington and British Columbia
Population Re-establishment Area B (Fig. 3). The administrative units responsible for land or species management for Region B are the South Coast region of the Ministry of Forests, Lands, and Natural Resource Operations; Manning and Skagit, British Columbia Provincial Parks, BC Ministry of Environment; Mt. Baker-Snoqualmie National Forest; North Cascades National Park; Washington Department of Fish and Wildlife; and Washington Field Office, U. S. Fish and Wildlife Service.

Population Re-establishment Area C (Fig 3). The administrative units responsible for land or species management for Area C are Okanagan and Thompson-Nicola districts, Thompson-Okanagan Region of the Ministry of Forests, Lands, and Natural Resource Operations; Manning, Cathedral, and Skagit British Columbia Provincial Parks; Okanogan-Wenatchee National Forest; North Cascades National Park; Washington Department of Fish and Wildlife; and Washington Field Office, U. S. Fish and Wildlife Service.

Population Re-establishment Area D (Fig 3). The administrative units responsible for land or species management for Area D are Mt. Baker-Snoqualmie, Okanogan-Wenatchee, and Gifford Pinchot national forests; Mt Rainier National Park; Washington Department of Fish and Wildlife; and Washington Field Office, U. S. Fish and Wildlife Service.

Population Re-establishment Area E (Fig 3). The administrative units responsible for land or species management for Area E are Gifford Pinchot National Forest (inc. Mt. St. Helens National Monument); Washington Department of Fish and Wildlife; and Washington Field Office, U. S. Fish and Wildlife Service.

3.2.3. Oregon and Washington Coast Ranges
Population Re-establishment Area F (Fig. 3). A fisher reintroduction was initiated in 2008 and completed in 2010 (Lewis et al. 2011). Monitoring has resulted in confirmed reproduction by translocated fishers. Monitoring criteria have been established to help determine when this population becomes self-sustaining. The administrative units responsible for land or species management for Area F are Olympic National Forest;

Olympic National Park; Washington Department of Fish and Wildlife; Washington Department of Natural Resources; and Washington Field Office, U. S. Fish and Wildlife Service.

Population Re-establishment Area G (Fig. 3). The administrative units responsible for land or species management for Area G are Siuslaw National Forest; Oregon Department of Fish and Wildlife; Oregon Field Office, U. S. Fish and Wildlife Service; and Coos Bay District, Bureau of Land Management.

3.2.4. Cascades of Oregon

Population Re-establishment Area H (Fig. 3). The administrative units responsible for land or species management for Area H are Mt. Hood National Forest; Oregon Department of Fish and Wildlife; Oregon Field Office, U. S. Fish and Wildlife Service; and Salem District, Bureau of Land Management.

Population Re-establishment Area I (Fig. 3). The administrative units responsible for land or species management for Area I are Deschutes and Willamette national forests; Oregon Department of Fish and Wildlife; Oregon Field Office, U. S. Fish and Wildlife Service; and Eugene District, Bureau of Land Management.

3.2.5. Southern Cascades and Sierra Nevada

Population Re-establishment Area J (Fig. 4). A fisher reintroduction was initiated in 2009, with releases in 2009, 2010, and 2011. Monitoring has confirmed reproduction by translocated fisher. The administrative units responsible for land or species management for Area J are Shasta-Trinity, Lassen, and Plumas national forests; Lassen National Park; California Department of Fish and Game; Yreka, Red Bluff, and Sacramento Field Offices, U. S. Fish and Wildlife Service; and Redding District, Bureau of Land Management.

Population Re-establishment Area K (Fig. 4). The administrative units responsible for land or species management for Area K are Tahoe, El Dorado, and Stanislaus national forests; California Department of Fish and Game; and Sacramento Field Office, U. S. Fish and Wildlife Service.

4. DELINEATING FISHER EMPHASIS AREAS

4.1. Introduction

Regional landscape habitat models have been or will be developed to guide selection of Fisher Emphasis Areas (FEAs; Fig. 5). Regional landscape habitat models have been developed to identify fisher habitat suitability in parts of the Strategy Area (e.g., Lewis and Hayes 2004, Carroll et al. 1999, Davis et al. 2007, Carroll et al. 2010, Zielinski et al. 2010, Spencer et al. 2011). In areas with extant fisher populations, models were based on the relationships between vegetation, environmental variables, and the probability of fisher occurrence or occupancy. In areas where models predict higher probability of occurrence we presumed they indicate areas of higher habitat suitability. In areas without extant fisher populations models have been or will be developed by selecting vegetation variables (e.g., tree species, canopy complexity, structure) and other landscape attributes determined important to fishers in extant population areas (Volume I, Chapter 7, Buskirk et al. 2010). Habitat suitability "maps" are used for the initial identification of FEAs based on the concepts of reserve planning using a hierarchical ranking of the conservation value of habitat across the landscape (Thomas et al. 1990, Lamberson et al. 1994, Doak 1995).

4.2. Regional Habitat Models

Southcentral British Columbia/Washington—being developed by lewis/iredale
Northwest Forest Plan Area—contract to Conservation Biology Institute informed by existing models (including NSO model)
Sierra Nevada Framework—Spencer et al. (2011) and possibly Davis (2007) and Carroll (2011)

4.3. Fisher Emphasis Areas

FEAs will be located throughout the Strategy Area. Within the extant population areas, each FEA will contain habitat that supports at least 20 hypothetical female fisher home ranges (Thomas et al. 1990) and will be selected based on higher suitability habitat, and if available, information pertaining to current occupancy of fishers. Size of FEAs will be based on the hypothetical female fisher home ranges relevant to habitat type and area (Appendix B). In the Fisher Re-establish Population Areas each FEA will contain habitat that supports at least 60 hypothetical female fisher home ranges (Lewis and Hayes 2004, Lewis 2006, Powell et al. in Press) and will be selected based on the presence of high suitability habitat.

We will use conservation models that provide a rigorous, repeatable method for aggregating habitat values into FEAs to help design a set of networks used to identify habitat conservation areas (Fig. 5; e.g. Moilanen and Kujala 2006). We will map a series of alternative FEA conservation network scenarios based on a series of rule-sets (e.g., varying land ownership categories, inclusion of existing reserves, identifying a specific amount of "habitat value" to include). The primary output of this conservation planning analysis of the landscape is a "hierarchical ranking" of conservation priorities in the landscape. The maps produced by the conservation planning models will be used to evaluate and compare alternate scenarios; and will not represent decisions about the size or distribution of FEAs.

4.4. Iterative Process for Delineating Fisher Emphasis Areas

1. *Fisher Biology Team* provides regional fisher habitat suitability map applicable to the geographic area to the administrative units.
2. *Management agency, administrative units* evaluate at a coarse scale how well the fisher habitat suitability map represents potential fisher habitat (e.g., are areas, such as non-forest, alpine, and subalpine areas, incorrectly included as potential fisher habitat?) and have activities (natural disturbance or management) altered habitat suitability displayed on the maps. This process

should be informed by local fisher research results, Volumes I and II, and local knowledge of landscapes.

3. *Fisher Biology Team* applies conservation modeling tools to map products completed in step 2 for initial identification of areas with the highest current value of fisher habitat suitability (draft FEAs). In Extant Population Areas draft FEAs that can support $\geq$ 20 hypothetical female fisher home ranges will be identified. In each Population Re-establishment Area a draft FEA that can support $\geq$60 hypothetical female fisher home ranges will be identified.
4. *Fisher Biology Team* provides draft FEA maps to administrative units displaying outlines of FEAs and the amount and arrangement of high and low suitability habitat and non-capable habitat. Additional FEAs in excess of the number estimated to meet the Fisher Vision may be identified. This will give all the Administrative Unit greater flexibility in designating FEAs.
5. *Administrative Units* evaluate areas identified in step 4 considering and including existing project actions, fires, vegetation conditions, etc. that may affect the habitat suitability value as identified. Document changes and modify map as appropriate.
6. *Administrative Units* identify and document the risk of substantial loss of fisher habitat on a relative scale between 1–10 from lowest to highest, based in part on the following:
    a. Fire risk models to assess risks to fisher habitat.
    b. Results from insect and disease surveys and insect and disease risk models will be used to assess risks to suitable fisher habitat.
    c. The Threat Assessment (Volume III) and local expert knowledge to identify areas with the potential for reduction in fitness or increases in mortality (e.g. proximity to existing or planned developments, vehicle caused mortality).
    d. Identify, using Volume III and local knowledge, site specificity of any threats that affect connectivity within FEAs in Population Re-establishment Areas and within and between FEAs in Extant Population Areas.
7. *Administrative Units* identify and document existing land allocations and management priorities that may influence placement of FEAs.
    a. Management priorities may be compatible with fisher and fisher habitat conservation goals (e.g. U. S. Congressionally Withdrawn Areas, U. S. Critical Habitat Designations, Giant Sequoia Groves, regional/local species conservation strategies, British Columbia Identified Wildlife Management Strategy areas [Wildlife Habitat Areas]) and can or should overlap FEAs where appropriate.

   b. Management priorities that may conflict with fisher and fisher habitat conservation goals (e.g., Wildland Urban Interface, high use recreation sites) should be excluded, or if included will not be considered as contributing habitat to female fisher home ranges.

8. *Administrative Units* determine if steps 4-7 result in FEAs that currently contain enough high suitability fisher habitat at low risk to support $\geq$ 20 hypothetical female fisher home ranges. If they do not then include habitat of higher risk and consider:
   a. In Extant Population Areas expanding the FEA to assure that $\geq$ 20 hypothetical female fisher home ranges could be sustained over time with the loss/modification of habitat;
   b. In Re-establishment Fisher Population Areas, where habitat is not currently available to support $\geq$ 60 hypothetical female fisher home ranges, habitat to support a reintroduction of a minimum of $\geq$ 20 female fishers will be identified;
9. *Administrative Units* may modify size and location of FEAs
   a. Where appropriately scaled climate change models exist that indicate how habitat suitability may be altered, adjust FEA locations and boundaries to accommodate these vegetation changes (e.g. higher elevation habitats);
   b. Where inclusion of regional plans for wildlife connectivity are available (e.g. WA, OR, CA transportation department projects, Conservation Biology Institute's conservation strategy for carnivores in the Sierra Nevada Mountains and California Cascades [in Prep]);
   c. Where physiographic (e.g., watershed boundaries), land ownership, and planning unit boundaries can be used to adjust FEAs for ease of implementation. Maintain the integrity the FEA by providing habitat for the appropriate number of female fisher home ranges.
10. *Administrative Units* provide any additional analysis that may be needed for rationale to support the selection of the FEAs anticipated ability to provide for conservation of fishers in a manner that supports the Strategy's objectives.
11. *Fisher Biology Team* will review final draft FEAs delineated by the administrative units to assure the goals of this strategy will be met.

4.5. Distribution of FEAs in the Strategy Area

A population modeling tool will incorporate a maximum distance between FEAs to accommodate connectivity in Extant Population Areas.

4.5.1. Extant Population Areas

Cascade Range, Oregon. The abundance of the Cascade Range, Oregon population is unknown and the distribution is presumed to be small and as depicted by Aubry and Raley (2006). Because of the increased risk of extirpation due to the small size of this population, we anticipate delineation of FEAs to cover areas of greatest likelihood of including female home ranges. One FEA will be delineated to include the existing population as depicted by Aubry and Raley (2006). Two additional FEAs will be delineated to provide for the expansion of this population.

Northern California – Southwestern Oregon. The population in northern California – southwestern Oregon is the largest population in the Strategy Area. Because of the relatively large size and dispersed nature of this population and habitat, FEAs will be well-distributed throughout this extant population area. To facilitate expansion of this population, however, FEAs are anticipated to be identified in each of the following counties: Curry and Josephine, Del Norte, Shasta, and Mendocino.

Southern Sierra Nevada. Fisher population distribution in this area reflects the peninsular nature of habitat, which is distributed in a narrow band, necessitating establishment of FEAs in a north to south manner on the west slope of the Sierra Nevada Mountains. Location of these FEAs will be influenced by the presence of populated areas and needs to be associated with vegetation management in the wildland urban interface. Because of the increased risk of extirpation due to the relatively small size and linear nature of this population, we estimate the delineation of 7 FEAs throughout the range of this population from Kern County in the south to Toulumne and Mariposa counties in the north. At least 1 FEA should be located in the southernmost portion of fisher distribution in suitable habitat that extends east to the Kern Plateau.

4.4.2. Establishment of FEAs in Population Re-establishment Areas

Within each Population Re-establishment Area (A-K; Fig. 3, 4), one FEA that can support ≥60 hypothetical female fisher home ranges will be identified. This FEA may be divided into 2 or 3 FEAs as long as the total area contains sufficient habitat to support ≥60 hypothetical female fisher home ranges and they are close enough to allow fishers to interact. Within the FEA, habitat that is currently suitable to support approximately 20 female fishers will be identified for potential reintroduction. In Population Re-establishment Areas F and J, reintroduction programs have been initiated. These reintroduced fishers will be a high priority for the establishment of a FEA in these Population Re-establishment Areas.

5. MANAGEMENT REGIMES

5.1. Introduction

A key component of the Strategy is the development of resilient landscapes. We have provided a process to define areas to target fisher conservation: protect extant populations, and develop a network that supports re-establishing and reconnecting fisher populations within the Strategy Area. Extant and Re-establishment Fisher Population Areas will each have FEAs within the larger Restoration Landscape. The focus of the FEA is to protect current, high suitability fisher habitat. The focus of the Restoration Landscape will be to apply management that moves vegetation to a condition that is more resilient to environmental disturbances and climate change and supports fisher populations. Some fisher habitat components, such as structural elements (Volumes I and

III), require many decades to develop tree size, forest complexity, and for ecological processes of decay to create cavities. Other habitat elements, such as overstory canopy, can be recovered in a decade or two where a portion of the dominant, co-dominant, and intermediate tree component is retained.

5.2. Fisher Emphasis Area Management

Three habitat conditions can occur within each FEA: high suitability, low suitability, and non-capable fisher habitat. There may be other land management priorities that occur as well, e.g., protection zones for communities or other structures, priority management areas for other species, administrative sites. Management actions within the FEA will generally enhance conditions for fishers by ameliorating threats and reducing the risk of a large scale disturbance that could reduce habitat suitability.

5.2.1. FEA Vegetation Management

Management actions that are proposed in high suitability habitat in an FEA, will present a thorough description of the anticipated effects to fisher habitat and the need for the action. These management actions will represent a "light touch" at both spatial and temporal scales. "Light touch" management (North et al. 2009, Weir and Almuedo 2010, Weir and Corbould 2010, Thompson et al. 2011) actions should not reduce the suitability of the habitat to fishers such that individual female fisher home range size would increase or their productivity would decrease.

Within areas of low suitability fisher habitat, proposed management actions should be designed to reduce the risk of disturbances that could further degrade habitat. Management actions should be designed to retain and improve habitat conditions for fishers and restore the landscape to a resilient condition.

Forested plant communities in a FEA that are capable, but not currently providing fisher habitat will be managed to develop conditions that support fisher populations and resilient landscapes. Management actions would not be limited in these areas except to retain structural elements and provide cover for security and dispersal and breeding season movements.

Vegetation that is not capable of supporting reproducing fishers may provide elements for fisher dispersal and movements. In these plant communities management actions should consider retaining habitat components needed for movements.

5.2.2. FEA Non-Vegetation Management

In Extant Fisher Population Areas, threats (Volume III) that are not related to vegetation management, such as open water containers, which can trap fishers or impediments to movements, or multi-lane highways should be ameliorated as quickly as feasible. Some can be as simple as covering an open container or providing escape ramps. Others, such as highway crossings will require interagency coordination and funding.

In Re-establishment Fisher Population Areas, non-vegetation threats may not be as important for immediate amelioration since fishers are not present. However, some threats take considerable time to address, e.g., installation of highway crossings and modifications to trapping regulations, and these actions should be initiated early so areas can support fishers when reintroductions occur.

5.3. Restoration Landscape Management

The long term goal is to have landscapes resilient to environmental events, such as fire and insect and disease outbreaks and is flexible to adapt to climate change. When research and monitoring validate fishers have re-occupied the Restoration Landscape and are present in self-sustaining populations, active management in High Suitability Habitat in FEAs can occur to develop more resilient landscapes.

In Restoration Landscapes management flexibility will increase to restore more resilient landscape conditions (North et al. 2009). In Extant Fisher Population Areas fishers may be present and management actions may affect individual fishers, but are not expected to result in a trend toward a decreasing population. Actions should be designed to reduce the risk of large scale disturbances that could result in loss of extensive amounts of high suitability habitat, either in the Restoration Landscape or the FEAs. Other priorities include increasing vegetation diversity by favoring desirable native species, such as oaks in appropriate geographic areas. Other options include stem density reduction that results in increased tree diameter while retaining ecological processes that aid in the development of structural elements.

In Re-establishment Fisher Population Areas, Restoration Landscapes management actions should be designed to move the landscape toward a more resilient condition while maintaining or developing fisher habitat (North et al. 2009). Since fishers are not present, actions should be designed to improve conditions by retaining and developing native vegetation diversity, structural elements, and ecological processes that result in den trees and rest sites. Unless surveys provide new information on fisher occupancy, fishers are not expected to be present in these areas until a reintroduction occurs or fishers disperse from adjacent extant populations.

6. CONSERVATION MEASURES

6.1. Introduction

We have developed Conservation Measures to apply primarily in FEAs and are based on the best available science to ameliorate threats to fishers and fisher habitat at multiple spatial scales. Implications for Conservation from Volumes I and III were used as the basis for development of the Conservation Measures. In the Restoration Landscape, the Conservation Measures should be considered for application in Extant Population Areas to allow for expansion into adjacent areas. In the Restoration Landscape in Population Re-establishment Areas, adaptive management to develop resilient vegetation and fisher habitat should use appropriate Conservation Measures (habitat components that take a long time to develop). We have organized the Conservation Measures to address the highest priority threats (Volume III) first.

To understand and effectively apply these Conservation Measures, Volumes I, II, and III of the Fisher Conservation Assessment (including the Implications for Conservation) and recent literature should be referenced.

These Conservation Measures address 3 of the goals identified for the Strategy:

1. Protect extant populations and promote expansion into areas presumably occupied in the past;
2. Develop landscapes that are resilient to natural disturbances and restore or maintain habitat conditions that can support fishers; and
3. Maintain or restore connectivity within fisher populations;

These Conservation Measures are designed for application at multiple spatial scales. At the regional and landscape scales, described desired conditions will provide for self-sustaining fisher populations. Landscape scale defines an area capable of supporting multiple female fisher home ranges (1500 – 2000 sq. mi.). The home range and stand scales were used to develop measures to either protect or restore fishers and fisher habitat.

The diversity and complexity of habitats within the Strategy Area make it challenging to design "one size fits all" conservation measures that complement the variety of potential restoration management actions. Additionally, existing management directions for U. S. federal agencies and British Columbia provincial governments (e.g., sensitive species, listed species recovery plans, Fisher Wildlife habitat decision guide) are expected to provide elements important to fishers and fisher habitat. The desired conditions are described in a manner that reflect development of more resilient landscapes while restoring key habitat elements important to fishers that may be limited or absent.

6.2. Loss of Structural Elements

The desired condition provides rest and den sites that are well distributed and abundant enough to meet fisher survival, reproduction, and recruitment needs. Endemic levels of pathogens that create decay, deformities (e.g., epicormic branching, mistletoe and rust brooms) and mortality in trees through natural ecological processes are present. Tree age, size, and species diversity of structural elements occur consistent with habitat descriptions by geographic area in Appendices A and B.

Implications for Conservation that apply to the loss of Structural Elements are: Volume I, Chapter 7, Numbers 1, 2, 3, 4, 5, 9, and 11; Chapter 8, Numbers 1, 2, 3, and 4; Volume III, Numbers 5 and 7.

Because of the time necessary to develop structural elements, the following evaluation methods and conservation measures (6.2.1 and 6.2.2) apply to FEAs and Restoration Landscapes.

6.2.1. Regional and Landscape Scales

Evaluation Method

Use the landscape scale to determine the abundance and distribution of structural elements. In some areas within the Strategy Area modeling tools are available to predict the abundance and distribution of structural elements (large live trees and snags; e.g., gnn, BC/S.Sierra). The presence, amount, and distribution of old and mature forest can be used as a surrogate to represent structural elements; forests that contain large old trees and large snags, and decadence. Where old and mature forest conditions are used as a surrogate to estimate adequate structural elements, at least 50% of that condition is necessary to meet adequate numbers and distribution. If old and mature forest represents < 50% of the landscape, additional information such as plot data, harvest history with large structure retention standards, or remote sensing data that can reliably assess the availability of structural elements (Thompson et al. 2011) at the landscape scale can be used.

Where modeling tools or other information are used to estimate the abundance and distribution of structural elements, Thompson et al. (2011) provides information on the numbers of structural elements needed to support a female fisher.

Conservation Measures

1. If the landscape does not meet the desired condition, project planning should not include project prescriptions that remove existing structural elements (Appendix B). Additionally, project development and implementation should incorporate home range and stand scale conservation measures to ensure maintenance and recruitment of structural elements.

2. If the landscape does not meet the desired condition and higher suitability fisher habitat is at risk from wildfire, management activities outside of higher suitability fisher habitat should be designed to increase stand resiliency to protect structural elements from catastrophic loss (North et al. 2009, Weir and Corbould 2010, USDA Forest Service 2010, Thompson et al. 2011).

6.2.2. Home Range and Stand Scales

Evaluation Method

Use the appropriate models and landscape evaluation area methods from the landscape scale (above) at the home range scale.

Conservation Measures

1. Retain or maintain an adequate distribution and abundance of trees (see evaluation methods) that have the characteristics of Structural Elements identified as providing potential den and rest structures (see Appendix B) and that are not safety hazards.
2. Retain or recruit tree growth forms such a large limbs, epicormic branching and forked tops (Weir and Almuedo 2010).
3. Where the evaluation determines Structural Elements are deficient, silvicultural treatments to increase growth and individual tree structure complexity are warranted.
4. Where large down logs are less than the range of variation for the vegetation community, pile brush and retain some slash piles for fisher escape cover and prey habitat (these piles have less value than large logs; Weir and Almuedo 2010).
5. In home ranges with adequate distribution of live trees the size of potential structures, but a deficiency in the distribution of micro-structures such as cavities, brooms, broken tops, etc. consider actions to create micro-structures (e.g., inoculating trees with heart rot fungi native to the area, bole damage). Other methods for cavity creation may be effective.
6. Reintroduce fire to stands at the scale and intensity expected for the site, to allow for snag and cavity creating processes associated with fire to occur.
7. Retain and protect from prescribed fire large down wood, especially those in the earliest stages of decay (amounts consistent with the vegetation community)
8. Retain a minimum of 1 large snag and 5 of the larger green trees per 2 acre and all snags (Appendix B; Thompson et al. 2011). These can be conifers or hardwoods or a combination.
    a. Retain trees in strategic locations, e.g. seeps, cold air drainage, and in clumps.
    b. Retain canopy and understory cover adjacent to retained snags and large green trees.
9. Retain intermediate sized trees (conifers and hardwoods consistent with vegetation type and site capability) to recruit structure into size classes capable of providing cavities and rest sites.

6.3. Overstory and Understory Reduction and Loss of Vegetation Diversity
The desired condition is a landscape supporting forests with vertical and horizontal diversity provided by overstory and intermediate trees, saplings, and shrubs that represent the full array of native vegetation species (complex forest structure; Volume I)) in amounts and locations consistent with ecological subregions and ecoregions (Appendix A). Dominant and co-dominant trees contribute to the vertical diversity (forest canopy) and provide current and future structural elements. Canopy cover is the best predictor of fisher occupancy at the landscape scale (Volume I, Chapter 7). It is important that landscape conditions contain well distributed forested stands with dominant and co-dominant trees providing dense canopy cover suitable for rest and den sites.

The desired condition for understory and vegetation diversity is vegetation that provides habitat needs of fisher prey species appropriate to the geographic area (e.g., snowshoe hares, woodrats, and other small mammals). Desired condition for vegetation diversity provides tree species, shrub, and herbaceous vegetation to support den and rest sites, prey habitat, security cover, and resiliency to natural disturbances. It is important that a mosaic of understory densities be well distributed, to provide for foraging and movement within individual home ranges.

Implications for Conservation that apply to Overstory and Understory Reduction and Loss of Vegetation Diversity are: Volume I, Chapter 7, Numbers 5, 6, 9, 10, and 11; Volume III, Numbers 6, 7, and 8.

6.3.1. Regional and Landscape Scales

Evaluation Method

For canopy estimation use measurement methods and processes as consistently as possible across all ownerships in the landscape. Remote sensing, Forest Inventory Analysis (or its equivalent) plot data, and vegetation treatment history are all good sources for analysis. Use predictive models (Zielinski et al. 2006, 2010) or other modeling tools, where available, at the landscape scale to estimate habitat (e.g., resting habitat) that is dependent on overstory and understory vegetation conditions. As appropriate indirect methods of assessing vegetation conditions may need to be augmented with aerial photography, field reconnaissance, or other evaluation methods. Refer to Appendix B for elements specific to each geographic area.

Conservation Measures

1. If the evaluation area does not meet the desired condition and higher suitability fisher habitat is at risk from wildfire, management activities should be designed to increase stand resiliency to protect overstory trees and vegetation diversity from catastrophic loss (North et al. 2009, USDA Forest Service 2010).
2. During vegetation management (including reforestation and restoration projects) retain and promote native species diversity in the landscape (Weir and Almuedo 2010).

6.3.2. Home Range and Stand Scales

Evaluation Method

Use an area equivalent to the estimated size of a female fisher home range for the analysis. Use remote sensing data, stand exam or other plot data, vegetation treatment history. Other evaluation tools, such as field reconnaissance or aerial photography to estimate understory and vegetation diversity may be necessary. Refer to Appendix B for important habitat components at the home range scale.

Conservation Measures

1. Where the availability of complex forest structure (e.g., old and mature forest) is <50%, manage to accelerate development of complex forest structure.
2. In the immediate vicinity of potential rest and den structures maintain areas of moderate to dense canopy cover (Volume I).
3. In stands where overstory cover is sparse (e.g., seed tree units, regeneration treatments, post fire landscapes), manage for higher densities of shrub and smaller vegetation to provide total cover as overstory trees develop.

4. If a reduction in overstory canopy cover is required to protect higher suitability habitat from uncharacteristically severe wildfire, management actions should be directed to areas where overstory cover would naturally be moderate or sparse (e.g., ridge tops, southwest facing slopes) and move landscapes toward a more resilient condition (North et al. 2009).
5. During vegetation treatments such as fuels reduction and prescribed burning, patches of dense understory vegetation, and diversity of shrubs and hardwoods should be retained and promoted as representative of the vegetation community.
6. Where understory and vegetation diversity is no longer representative of the potential vegetation type restore natural processes or actively manage to create small openings for understory development and promote vegetation diversity.
   a. The highest priorities for treatment are areas with extensive monotypic stand types; prioritize the restoration of species that are known or suspected to provide key fisher habitat values (e.g., cottonwoods in British Columbia, tan oaks in California).
   b. Prioritize areas most divergent from the natural range of variation and promote under represented species
   c. Use silvicultural treatments, such as variable density thinning and prescribed burning, in closed stem exclusion stages (Hessburg et al. 2000) to accelerate development of multiple layers and horizontal stand structure.
7. Do not implement management actions that will disrupt or reduce natural processes (e.g., root rot, insects and disease, wind throw) that create small openings (appropriate to vegetation type) which will allow for understory diversity.
8. Control or remove invasive non-native plant species that reduce habitat quality for fishers and fisher prey, or interfere with ecosystem processes (e.g., increase threat of uncharacteristic wildfire or insect and disease)

6.4. Climate Change, Uncharacteristically Severe Wildfire and Fire Suppression, and Uncharacteristically Severe Insects and Disease

Uncertainty exists in the potential effects of climate change on fisher habitat. Climate change will be variable across the Strategy Area, resulting in some geographic areas being warmer and wetter and others warmer and drier. Changes in climate are likely to result in an increase in the frequency and severity of extreme weather events such as heat waves, droughts, and floods. The degree of effects of climatic factors such as temperature, precipitation, and wind patterns are uncertain and are among the many factors that influence vegetation structure and composition, insect and forest disease outbreaks, and fire behavior.

Fire is an important large-scale disturbance agent and fire regimes and their relative importance vary from north to south and west to east and with increasing moisture and elevation. The desired landscape contains forests that are composed of various age classes of fire-resistant trees, including large old trees and multi-layered canopies. Endemic levels of insects are on the landscape and contribute to the development of key fisher habitat components. Disease agents would typically affect the forest at a small scale, (e.g., individual stems or small patches). Vegetation diversity contributes to a resilient landscape since many insect species are host specific.

Wildfire suppression efforts in these landscapes would generally be restricted to fires that would require control within the wildland urban interface or to protect capital investments or improvements.

Implications for Conservation that apply to Climate Change, Uncharacteristically Severe Wildfire and Fire Suppression, and Uncharacteristically Severe Insects and Disease are: Volume I, Chapter 3, Numbers 2, 3, and 4; Chapter 4, Number 4; Chapter 8, Number 3 and 4; Volume III, Number 7 and 9.

6.4.1. Regional and Landscape Scales
Evaluation Method

Define the reference conditions for the landscape evaluation based on the landscape's ecological sub-region (e.g., Hessburg et al. 1999, Blackwell et al. 2003, Gray and Daniels 2006) and an appropriate climate scenario based on the climate model that most represents the area. There are two types of reference conditions, the historical range of variability and the future range of variability. The historical range of variability could be derived from landscape reconstructions (e.g. Hessburg et al. 1999, Blackwell et al. 2003, Gray and Daniels 2006).The future range of variability is used to address the potential effects of climate on vegetation (e.g. the approach described by Gärtner et al.2008).

Use local fire risk models to determine the areas most at risk to uncharacteristically severe wildfire. Determine where areas of high risk are adjacent to high suitability fisher habitat and identify priorities for treatment to protect existing habitat (Spencer et al. 2011). Use annual survey information to identify areas of insect concentrations and recommendations on potential insect spread to determine areas of highest risk to fisher habitat.

Conservation Measures.

1. When designating FEAs in geographic areas expected to be significantly affected by climate change, consider locating or expanding FEAs to accommodate anticipated changes in plant communities.
2. Where uncharacteristically severe wildfire has been identified as a threat to fisher population persistence (e.g., large blocks of fisher habitat are at risk from stand replacing fire) management actions should include fuels treatments to protect high suitability fisher habitat (Spencer et al. 2011, Thompson et al. 2011).
3. Fisher conservation planning objectives should be incorporated into fire management plans and address wildland fire use, suppression, and prescribed natural fire.
4. During the implementation of fire management plans (British Columbia), wildland fire plans (United States), fire resource advisors, (United States), Forest District staff or Ministry of Environment staff (British Columbia) will be briefed on the status of fishers and fisher habitat in the area and when possible, suppression activities will be designed to minimize detrimental effects to fisher habitat.
5. To protect Structural Elements during fire suppression efforts, retain as many large trees, snags, large down logs as safely possible.

6. To protect fisher habitat resource advisors should use local information to help direct burnout (e.g., ignition point) activities.
7. To restore habitat conditions:
   a. Close and restore firelines, helicopter landing zones, staging areas.
   b. Guide Burned Area Emergency Rehabilitation (BAER; United States only) activities by following recommendations in vegetation management section for habitat attributes to restore fisher habitat.
8. BAER teams will ensure that a member of the team is familiar with fisher biology or has access to the Strategy, Appendices A and B. Fisher conservation measures will be contained in wildfire-associated plans.
9. Identify specific tree species that may be important in a given region (e.g., black oak [Appendix B]) and monitor the effects of insects or disease to determine if a large scale decline is occurring. When a target tree species important in a geographic area is declining below the historical range of variability as a result of insects or disease, determine if control of insects and diseases is necessary and feasible to retain the species.
10. To protect fisher habitat allow natural ecological processes to occur at endemic disturbance levels to create gaps by killing one or a small patch of canopy trees. These key ecological processes are necessary for the development and maintenance of the forest structure used by fishers (Volume I, Chapter 8).

6.4.2. Home Range and Stand Scales
Evaluation Method

Refer to Evaluation Method, Landscape and apply at the home range scale.

Conservation Measures

1. To retain important fisher habitat components:
   a. Unaffected green trees and selected dead trees in areas of uncharacteristic insect and disease episodes should be retained
   b. Salvage logging should not reduce future potential fisher habitat to provide adequate structural elements (den and rest sites).
2. Restore stand resiliency by moving toward a heterogeneous landscape.
   a. Evaluate and use fire where appropriate as a tool to control insects.
   b. Use silvicultural methods (e.g., thinning to reduce competition) to prevent and isolate uncharacteristically large scale eruptions.
   c. Use timber harvest to remove insect and disease infected trees when epidemic levels occur and removal could reduce the infestations.

6.5. Fragmentation, Linear Features, and Development

The desired condition is a landscape that provides large, connected patches of forested habitat and allows population connectivity and facilitates dispersal and breeding season movements.

Implications for Conservation that apply to Fragmentation, Linear Features, and Development are: Volume I, Chapter 4, Numbers 1, 2, 3, and 5; Chapter 5, Number 3 and 4; Chapter 6, Number 6; Chapter 7, Number 11; Volume III, Numbers 1, 3, and 10.

6.5.1. Regional and Landscape Scales
Evaluation Method

Compare the current landscape, including developments, reservoirs, large (uncharacteristically severe wildfires), multi-lane highways, and other linear features to the reference landscape and determine if connected patches of forested cover provide for fisher movements. Define the reference conditions for the landscape vegetation evaluation based on the landscape's ecological sub-region (e.g., Hessburg et al. 1999, Blackwell et al. 2003, Gray and Daniels 2006) and an appropriate climate scenario based on the climate model that most represents the area. Use both of the landscape assessment tools described above to assess the current and future range of conditions that may affect fisher population connectivity.

Conservation Measures

1. Regional (county and provincial) planning efforts will ensure that fishers are considered early in the planning process for development of recreation and residential proposals, and the construction and reconstruction of highways,
    a. Connectivity models for each state or province should be reviewed to assure the important fisher habitat linkages are met.
    b. Emphasis on interagency coordination to record and report to appropriate agency personnel fisher road kill locations.
2. To maintain connectivity, evaluate filters and barriers to movement and avoid building paved highways, where feasible through FEAs. When this is not possible, mitigate for the loss of habitat and connectivity by developing wildlife crossings, increasing overhead cover, creating gaps in Jersey barriers, etc.
3. Implement actions that enhance habitat continuity e.g., conservation agreements, carbon credits and mitigation banking.
4. Where populations are separated by impermeable barriers, consider regional translocation of males to facilitate genetic exchange.

6.5.2. Home Range and Stand Scales
Evaluation Method
Refer to Landscape Evaluation and apply the results to an area equivalent to the estimated size of a female fisher home range.

Conservation Measures

1. To reduce the effects of fragmentation manage a hypothetical female fisher home range in various seral stages to retain 80% of the area in fisher habitat. See evaluation methods for 6.2.2 and 6.3.2.

2. Evaluate physical barriers created by linear features, and mitigate where possible to allow safe crossing.
3. Coordinate with state department of highways to locate areas to deposit road-killed animals that could be scavenged by fishers at least ¼ mile from highway corridors.
4. Re-vegetate utility corridors with native plants which provide overhead cover for fishers, but don't affect the function of the utility corridor.
5. Identify and create landscape linkage areas to facilitate dispersal of fishers (adequate cover, rest sites, prey) through or around developed and agricultural lands (e.g., vineyards, orchards).
6. Protect fisher habitat by discouraging new recreation area developments (large developed campgrounds, intensive motorized trail networks, ski areas, etc.) in FEAs or favor expansion of existing recreational developments in FEAs over the development of new ones to reduce fragmentation.

6.6. Human Caused Mortality and Reduction in Fitness
The desired condition is a landscape where actions that reduce an individual fisher's life span (survival) and/or reduce reproduction and recruitment are minimized.

Implications for Conservation that apply to Human Caused Mortality and Reduction in Fitness are: Volume I, Chapter 4, Numbers 1; Chapter 5, Numbers 3 and 6; Chapter 6, Number 2 and 3; Volume III, Number1 and 10.

6.6.1. Regional and Landscape Scales
Evaluation Method
Identify the potential causes of fisher mortality in the landscape. For example, are body gripping traps legal for any species? Identify the interface of residential development and paved highways with high suitability fisher habitat.
Conservation Measures
1. Promote public awareness to build broad base support for fisher conservation.
    a. Develop and deliver public education programs to inform the public of factors that contribute to fisher mortality and loss of fitness.
    b. Inform the public living in and around fisher habitat about threats associated with entrapment structures (e.g., open water tanks, trash dumpsters), conditioning fishers to human associated foods (e.g., open garbage cans, pet food), and domestic dogs.
    c. Inform the public regarding use of lethal poisons and their effects to fishers and fisher prey through education and provide suggestions of alternate management techniques.
2. Maintain or intensify enforcement activities within populations to reduce fisher mortality from poaching.
3. Modify trapping regulations and practices by developing and implementing techniques or trap modifications in areas where body gripping traps are legal to prevent incidental captures of fishers in areas where harvest for other furbearers occurs.

4. Reduce threats to fishers from mortality or reduced fitness associated with non-target poisoning by restricting use of lethal poisons for pest control (gophers, non-native rats, etc.).

6.6.2. Home Range and Stand Scales.
Evaluation Method
Refer to Landscape Evaluation and apply the results to an area equivalent to the estimated size of a female fisher home range.

Conservation Measures

1. Reduce the threat of fisher mortalities associated with anthropogenic structures.
   a. Permanently cover, disable or dismantle potential entrapment structures (e.g. cisterns/ water tanks) or provide escape structures.
   b. Install bat gates on mines that will restrict fishers but not bats.
2. Minimize actions (e.g., trapping, poisoning) that affect population numbers of important fisher prey species (e.g., mountain beaver, porcupine, snowshoe hares, woodrats).

7. RESEARCH, INVENTORY, AND MONITORING NEEDS

7.1. Introduction.

We developed the Strategy using the most current science and best available information on fishers on the west coast. During development of the Strategy there were aspects of fisher ecology, biology, and distribution that were poorly understood or had not been fully investigated. With better information to inform development of conservation measures fisher conservation could be furthered. The following section identifies areas we felt were of most immediate need. The list is ranked in priority order as funds become available.

7.2. Inventory.

Review all previous survey efforts; identify those that were conducted following established protocols, and review all verifiable records to determine the extent of extant populations. Use non-invasive genetic survey techniques whenever possible to continue refining phylogenies and establish range limits of extant populations. All survey data and verifiable detections of fishers and other carnivores obtained from standardized surveys should be permanently archived in the "Forest Carnivore Surveys in the Pacific States" website database <http://maps.fs.fed.us/carnivore//Modules/application/home.html>. Highest priority areas for survey are adjacent to extant populations are British Columbia (Assessment Area portion), areas around the southern Oregon Cascades, NW California/SW Oregon, and southern Sierra Nevada extant populations.

7.3. Monitoring.

7.3.1. Establish and maintain long-term demographic monitoring programs in the southern Oregon Cascades and NW California/SW Oregon extant populations (similar to monitoring in the Southern Sierra) to describe distribution and habitat use in each area.

7.3.2. Extant populations in the Strategy Area do not appear to be expanding. Multiple factors could be contributing to the lack of expansion. Fishers could be dispersing into adjacent habitats, but monitoring is not detecting them. Fishers could be dispersing, but adjacent habitat is not suitable to support reproduction; e. g., lack of suitable den or rest sites. Barriers/filters could be preventing successful dispersal. Reproduction and recruitment in the extant populations may not be adequate to support juvenile dispersal into adjacent habitats or there is still unoccupied habitat within the extant population area. A monitoring strategy should be developed following existing protocols to monitor areas within 50 miles of extant populations to determine if fishers are expanding and establishing territories in adjacent habitat.

7.3.3. Implementation monitoring to assure Fisher Emphasis Areas are properly recorded in GIS systems for use by all affected agencies and units. Update all Fisher Emphasis Areas annually (includes project activities and natural disturbances).

7.3.4. Develop a monitoring strategy for assessing the success of this strategy to conserve fishers. Were threats eliminated or reduced, what changes are needed to improve habitat conditions, reduce mortality factors, etc, were surrogates for habitat elements appropriate to meet fisher requirements.

7.4. Research.

7.4.1. Demography and vital rates (fitness) in relation to habitat.

Develop long term studies to compare habitat (e.g., abundance and distribution of structural elements, prey) in home ranges of successful females (those that annually produce young that survive to dispersal) and how those habitats are used with home ranges of less successful females. Develop studies the focus on males and their use of habitat in home ranges.

7.4.2. Information on fisher foraging habitat and foraging behavior in different Geographic Regions is lacking.

Develop studies to investigate relationships between prey size (e.g. snowshoe hare vs. microtus sp.), prey abundance, and catchability of prey to survival and female fitness.

7.4.3. A comprehensive phylogeographic analysis is needed to understand the phylogenic relationships of extant populations within the Strategy Area.

7.4.4. Fishers in the eastern United States have recovered quickly and have expanded into many areas.

A study to compare habitats (including prey availability, habitat fragmentation, denning and resting sites and structures, mortality factors) in the eastern United States with those in the west might shed some light on why fishers in the east appear to be more successful.

7.4.5. We have identified anthropogenic factors that may influence fisher distribution, dispersal, and survival (Volumes I and III).

There are many reports of fishers killed during highway crossing attempts. Investigations on the sex and age of individuals killed might provide some insight into lack of dispersal into adjacent habitats, especially where these incidents occur at the edges of extant populations.

Recent reports have indicated fisher have been exposed to and tested positive to rodenticides, however, the effects on fitness are not known. As residential and agricultural developments expand into fisher habitat, increases in the use of the pesticides may increase. A better understanding of the effects of these pesticides and development of an educational program for users may be necessary.

There is also little information on the effects of disease on fishers. It has been speculated that diseases transmitted from domestic animals may have effects on fishers. A better understanding of this relationship will help in the development of environmental education of pet owners as they recreate in fisher habitat.

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Appendix A. GEOGRAPHIC AREA DESCRIPTIONS

The geographic areas described in this document are based primarily on Ecological Subregion Sections of the United States (McNab and Avers 1994) and Ecoregions of British Columbia (Demarchi 1996, 2007). Subregion sections (McNab and Avers 1994) and ecosections (Demarchi 1996, 2007) are comparable units from these two hierarchical frameworks that are founded on ecological principles and provide a standardized method for classifying areas with similar biological and physical potentials at a variety of geographic scales. They describe relatively broad areas of similar sub-regional climate, geomorphic processes, topography, geologic origin, and potential natural vegetation communities (Demarchi 1996, 2007, Cleland et al. 1997). With few exceptions, we used boundaries of sections and ecosections to define geographic areas within the Strategy Area. In California, we combined the Northern California Coast Ranges and the Northern California Coast Sections into a single geographic area. We combined the Sierra Nevada Foothills and the Sierra Nevada Sections into a single geographic area. We extended the boundaries of the Western Cascades and Eastern Cascades Sections to the north to include the Cascades in British Columbia. We identified 9 resultant geographic areas (Fig. 1) within the Strategy Area.

Thompson Okanagan Plateau

Geographic Extent – This area encompasses the landscapes of the Thompson and Okanagan Plateaus. It includes the Guichon Upland, Nicola Basin and Western Okanagan Upland ecosections (Demarchi 1996, 2007). It is approximately 90 mi (140 km) from north to south and 85 mi (130 km) from west to east. This area is bounded by the Thompson River basin in the north, the Okanagan Basin in the east and the Cascade Ranges on the south and west perimeter. The Nicola River is the major watercourse within this area. Elevation varies within this area from 1,950–5,820 ft (600–1,800 m).

Geomorphology and Soils – This area is primarily a broad rolling plateau dissected by low elevation dry warm steppes. It contains granitic plutonic, volcanic, and sedimentary rocks, some of which lie buried under deep glacial drift (Demarchi 2007). It was subjected to heavy glaciation resulting in severe sculpting and rounding, and the formation of hundreds of small lakes as well as a number of larger lakes surrounded by lacustrine deposits. Soils vary from calcareous and rich in organic matter in grasslands, to weathered calcareous forest soils in lower elevation forests, to weak to moderately leached and acidic forest soils in forests at highest elevations (Meidinger and Pojar 1991, Demarchi 2007). Forest litter increases with increasing elevation and bedrock outcroppings are common at highest elevations.

Climate – Climate of this area varies from very hot and dry, to cool and moist (Meidinger and Pojar 1991). Climate is influenced by moist Pacific air from the northwest and in the winter by cold Arctic air incursions (Demarchi 2007). Precipitation ranges from 8–36 in (20–90 cm), 15–70% of which falls as snow. Mean annual temperatures vary from 28–50° F (2–10° C; Meidinger and Pojar 1991). Variation in climate is largely correlated with elevation with the hottest driest areas occurring in major valley bottoms and basins.

Potential Natural Vegetation – Vegetation varies on an elevation/moisture gradient. Grasslands are extensive in lowest elevations, particularly within the Nicola Basin. Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) forests are found upslope (Meidinger and Pojar 1991, Demarchi 2007). Higher elevations are dominated by lodgepole pine (*Pinus contorta*) and white spruce (*Picea glauca*) forests in the Montane Spruce zone with Engelmann spruce (*Picea engelmanni*) and subalpine fir (*Abies lasiocarpa*) forests at highest elevations (Meidinger and Pojar 1991). Seral stands in riparian areas and some slopes include black cottonwood (*Populus trichocarpa*) and trembling aspen (*Populus tremuloides*; Meidinger and Pojar 1991).

Disturbance Ecology – Disturbance agents and regimes vary by ecological condition. Lower elevation Ponderosa pine forests are subject to low to mid-severity fires that are often not stand-replacing (Wong et al. 2003). Reported mean fire return intervals range from 9–28 years (Wong et al. 2003). Insects, root rots, dwarf mistletoe, stem rusts and needle casts are other disturbance agents in these forests (Wong et al. 2003). A recent mountain pine beetle (*Dendroctonus ponderosae*) epidemic has resulted in considerable stem mortality in this zone. Within the Interior Douglas-fir zone fire, insect defoliators and root rots are predominant natural disturbance agents (Wong et al. 2003). Mean fire return intervals are 5–50 years. Stand-replacing fire frequencies are difficult to evaluate and may vary from 125–250 years (Wong et al. 2003). Stand-replacing fire and mountain pine beetles are the dominant disturbance agents of the Montane Spruce zone (Wong et al. 2003). Stand-replacing fire intervals vary from 25–130 years (Wong et al. 2003). Recent mountain pine beetle infestations in this zone have reached epidemic proportions and have resulted in mortality of up to 80% of *Pinus* species (Walton et al. 2007). Forests at highest elevations within this area (Engelmann Spruce – Subalpine fir zone) are affected primarily by fire, insects, decay fungi and root rot. Stand-replacing fire return intervals vary from 45–800 years (Wong et al. 2003).

Western Cascades

Geographic Extent – This area encompasses the southeast portion of the Eastern Pacific Ranges in British Columbia (Pacific Ranges Ecoregion; Demarchi 1996, 2007), and the west slope of the Cascade Ranges in British Columbia (Northwest Cascade Ranges Ecosection; Demarchi 1996, 2007), Washington, and Oregon (Western Cascades Ecological Subregion Section; McNab and Avers 1994). It is approximately 500 mi (800 km) north to south and 20–60 mi (30–100 km) west to east. In British Columbia the Western Cascades include a block of rugged mountains just north of the U.S. – Canadian border and east of the Georgia Depression Ecoprovince and the Fraser River (Demarchi 1996). In Washington this area is bordered by the Puget Trough to the west, in Oregon by the Willamette Valley to the west. It extends south to the South Fork of the Upper Rogue River near Prospect. The Columbia River divides the Western Cascades into a northern and southern section. This area is dissected by many rivers which flow to the west. Elevation varies from near sea level at the Columbia River to 14,000 ft (4,300 m), but the majority of the west slope is between 2,000–7,000 ft (600–2,135 m).

Geomorphology and Soils – Mountains of the Eastern Pacific Ranges Ecosection in British Columbia are characteristically high, rugged coastal granite. The Cascades are an uplifted sequence of extrusive volcanic rocks dissected by large river systems (McNab and Avers 1994). Geomorphology varies from primarily metasediments, U-shaped valleys, and cirques in the north to more andesite and basalt bedrock materials in southern Washington and Oregon. Active mountain building occurred from the early Pliocene to present (McNab and Avers 1994). Soils are extremely variable in this area ranging from cryic at higher elevations to warmer mesic soils at lower elevations (Franklin and Dyrness 1988, McNab and Avers 1994). Soils in the Eastern Pacific Ranges Ecosection are strongly weathered and acidic. Soils are very complex in the northern Cascades due to variability in parent materials, large amounts of glaciation and rugged terrain. The latter two conditions restrict soil formation over large areas (Franklin and Dyrness 1988). Soils are less complex and more well-developed are more common in the Western Cascades of southern Washington because the terrain is less rugged and there was less glaciation (Franklin and Dyrness 1988). In the western Cascades of Oregon, most soils are derived from basic igneous rocks of basalt and andesite and are relatively well developed, well drained, and stable (Franklin and Dyrness 1988).

Climate – Rainfall is lowest in the northern extreme of this area in British Columbia, as the Eastern Pacific Ranges Ecosection has a transitional wet, mild coast to dry cold interior climate including some rain shadow effects. The northwest Cascades are affected by heavy fall and winter rains that bring extreme rainfall events during October to February. Precipitation varies from 5–150 in (13–380 cm) annually, falling as rain or snow primarily from October-June, while the summer months are relatively dry (Meidinger and Pojar 1991, McNab and Avers 1994). Mean annual temperature varies from 30–52° F (-1–11° C; Meidinger and Pojar 1991, McNab and Avers 1994). In the Cascades, elevation has a profound effect on local climate causing precipitation and snow fall to increase, and temperature to decrease rapidly with increasing elevation (Franklin and Dyrness 1988). Lower elevations may see as little as 15% of precipitation fall as snow while as much as 70% may fall as snow at higher elevations (Meidinger and Pojar 1991). Overall, temperatures are cooler and precipitation is greater in British Columbia and Washington than in Oregon (Franklin and Dyrness 1988, Meidinger and Pojar 1991).

Potential Natural Vegetation – The dominant potential natural vegetation type in this area is silver fir – Douglas-fir forest followed by fir – hemlock forest at higher elevations near the crest, and some cedar – hemlock – Douglas-fir forest along the low elevation slopes and drainages (Kuchler 1964, McNab and Avers 1994). On the west slopes of the North Cascades and in the Eastern Pacific Ranges Ecosection the dominant potential vegetation types are western hemlock (*Tsuga heterophylla*) and Douglas-fir forests at lower elevations, and mountain hemlock (*Tsuga mertensiana*) forests at higher elevations (Kuchler 1964, Meidinger and Pojar 1991).

Disturbance Ecology – Fire, insects and diseases, flooding and erosion, and localized wind throw events influence vegetation patterns and ecosystems in the Western Cascades (McNab and Avers 1994, Wong et al. 2003). In British Columbia, at lower elevations, pathogens such as hemlock dwarf mistletoe (*Arceuthobium tsugense*) in association with wind throw are the primary means of disturbance across the landscape (Wong et al. 2003). At higher elevations gap dynamics involving the death of one to a few trees are common (Wong et al. 2003). Fire frequency and severity in this area vary from north to south and low to high elevation. In British Columbia, stand-replacing fires vary in frequency from approximately 100–1000+ years, depending on locality (Wong et al. 2003). Fires resulting in partial stand-replacement can be more frequent and are often associated with other disturbance agents (Wong et al. 2003). Fire regime analyses for the Northwest Forest Plan indicate that most of the Western Cascades have a fire frequency rate of 35–100+ yr with mixed severity (moderate effects on overstory trees and mixed mortality; Moeur et al. 2005). However, much of the northern Cascades and small pockets along the entire crest of the west slope fall into a 200+ year fire-frequency interval with stand-replacement severity (fire consumes >90% of the overstory canopy cover; Moeur et al. 2005). Most of the northern Cascades are within the historic range of conditions (low risk of losing key ecosystem components; Moeur et al. 2005). The west slope in central and southern Washington iss a mix of within historic range and moderately altered conditions (moderate risk of losing key ecosystem components) and the west slope in Oregon is mostly moderately altered except along the crest where it is within the range of historic conditions (Moeur et al. 2005).

Compared to the Eastern Cascades, incidence of extensive insect or disease outbreaks in the western Cascades is relatively low. Laminated root rot appears to be one of the more serious diseases affecting Douglas-fir, true firs, and mountain hemlock (USDA Forest Service 2006). Western hemlock looper (*Lambdina* fiscellaria lugubrosa) can cause significant mortality especially in old-growth stands, and in the 1960's and 1970's the introduced Balsam wooly adelgid (*Adelges piceae*) caused extensive mortality of true firs, but now occurs at chronic low levels (USDA Forest Service 2006). Although other diseases and insects occur in the western Cascades, outbreaks are typically localized.

Wind throw is common and affects localized areas. Rain-on-snow events at low and mid-elevations are relatively common and cause frequent flooding and erosion. Periodic volcanic eruptions alter the physical and biological environments (McNab and Avers 1994). In British Columbia, particularly susceptible portions of the landscape are subject to frequent stand-replacing events as a result of geomorphic processes such as landslides (Wong et al. 2003).

Eastern Cascades

Geographic Extent – This area encompasses the east slope of the Cascades from the extreme southeast portion of the Pavillion Ranges Ecosection (Interior Transition Ranges Ecoregion; Demarchi 1996, 2007), and the Hozameen and Okanagan Ranges Ecosections in southern British Columbia (Northern Cascade Ranges Ecoregion; Demarchi 1996, 2007) south to Upper Klamath Lake in Oregon (Eastern Cascades Ecological Subregion Section; McNab and Avers 1994). It is approximately 600 mi (900 km) north to south and 20–90 mi (30–145 km) west to east. It is bordered on the north by the Thompson River basin, on the west by the crest of the Eastern Pacific Ranges and the Western Cascades, and on the east by the Thompson Okanagan plateau, the Columbia River

Basin, and the Great Basin. Elevation ranges from near sea level at the Columbia River to (10,000 ft >3,050 m), but most of the area is between 3,000–7,000 ft (900 – 2,150 m).

Geomorphology and Soils – Much of the Eastern Cascades are steeper than the Western Cascades with more glaciation of volcanic peaks. This topographic difference decreases from south to north and in British Columbia the situation is reversed with the eastern slopes gentler than the western ones (Demarchi 2007). Many volcanic peaks are still active with an eruption occurring about every 25 years (McNab and Avers 1994). The Okanagan and Hozameen Ranges in British Columbia are composed of metamorphic and sedimentary rocks with granite batholith intrusions and have been subject to folding and intense glaciation. U-shaped valleys and cirques are common in the northern part of this area, whereas the effects of glaciation become less severe and eventually diminish to the south (McNab and Avers 1994). The soils in the eastern Cascades are extremely variable. Due to the rain shadow effect of the west slope, soils are more xeric and dry for long periods during the summer (Franklin and Dyrness 1988, McNab and Avers 1994). Soils in the north are primarily weathered forest soils, with increasing leaching and acidity with elevation (Demarchi 2007). Most of the soils along the east slope in Washington and Oregon are influenced to some extent by volcanic and glacial parent materials (Franklin and Dyrness 1988, McNab and Avers 1994).

Climate – The east slope of the Cascades is in the rain shadow of the west slope and overall winters are colder, summers are hotter, and the growing season is shorter (Franklin and Dyrness 1988, Meidinger and Pojar 1991, Demarchi 2007). However, as in the Western Cascades, elevation has a profound effect on local climate causing precipitation and snow fall to increase and temperature to decrease rapidly with increasing elevation (Franklin and Dyrness 1988). Latitude also influences climate. From north to south winter temperatures get warmer, summer temperatures hotter, and precipitation decreases (Franklin and Dyrness 1988). In British Columbia, most of this area is in rain shadow, but climate is transitional and moist Pacific air often dominates the western portion and the low mountain passes. Average annual temperature varies from30–52° F (-1–11° C), and precipitation from 8–120 in (20–305 cm), 20–70% of which falls as snow (Meidinger and Pojar 1991, McNab and Avers 1994).

Potential Natural Vegetation – Vegetation is extremely diverse and varies north to south. The dominant cover is coniferous forest. Ponderosa pine forests are common in the warm dry valley bottoms in the far north and south along the east slope eventually becoming the dominant type along with fir-hemlock at higher elevations (Kuchler 1964, Meidinger and Pojar 1991). In British Columbia, higher elevations are dominated by Engelmann spruce-subalpine fir, montane spruce, and lodgepole pine forests (Meidinger and Pojar 1991). In northern Washington potential vegetation includes western spruce-fir, western ponderosa, fir-hemlock, and grand fir (*Abies grandis*)-Douglas-fir types (Kuchler 1964). Western spruce-fir, Douglas-fir, and grand fir-Douglas-fir forest types become less prevalent along the east slope further south in Washington and in Oregon.

Disturbance Ecology – Fire, insect, and disease events are common and are the major disturbances that shape ecosystems in the Eastern Cascades. Historical patterns of fire periodicity and severity are extremely variable in this area. Fire regimes at the higher elevations are typically greater than 200-year intervals of stand-replacement severity within which a 35–100 year interval of mixed severity fires may occur (Wong et al. 2003, Moeur et al. 2005). Fires occur at lower elevations in ponderosa pine forests at 0–35 year intervals with low severity (>90% of the canopy cover survives; McNab and Avers 1994, Moeur et al. 2005). Unlike the western Cascades, historic fire regimes for much of the eastern Cascades are significantly altered and the risk of losing key ecosystem components is high (Moeur et al. 2005). Limited areas in the north and higher elevations near the crest are within historical fire conditions or only moderately altered.

Incidences of disease and insect epidemics are much greater in the Eastern Cascades than in the Western Cascades. Douglas-fir beetle (*Dendroctonus pseudotsugae*), fir engraver beetle (*Scolytus ventralis*), mountain pine beetle, spruce beetle (*Dendroctonus rufipennis*), western spruce budworm (*Choristoneura occidentalis*), and pine engraver beetle (*Ips pini*) outbreaks occur in the Eastern Cascades. Mountain pine beetle has caused extensive mortality across large areas (USDA Forest Service 2006). Recent mountain pine beetle infestations in British Columbia have reached epidemic proportions and have resulted in mortality of up to 80% of *Pinus* species (Walton et al. 2007). Armillaria is the most common root disease in eastern Washington and Oregon and causes significant mortality in mixed-conifer stands (USDA Forest Service 2006). Wind events may impact very localized areas but do not appear to be a major disturbance factor in this area.

Oregon and Washington Coast Ranges

Geographic Extent – The Oregon and Washington Coast Ranges are considered a section of the Cascade Mixed Forest-Coniferous Forest-Alpine Meadow Province (McNab and Avers 1994). In Washington, this encompasses those areas west of the Puget Trough, including the western two-thirds of the Olympic Peninsula and southwestern Washington. In Oregon, it includes the coastal areas and Coast Range from northwestern Oregon to the northernmost extent of the Klamath-Siskiyou Mountains. This area is approximately 403 mi (650 km) north to south and as much as 62 mi (100 km) west to east. Elevations range from sea level to 7,923 ft (2,415 m), with most of the area below 1,800 ft (545 m).

Geomorphology and Soils – The Oregon and Washington Coast Ranges are characterized by highly dissected, lower elevation mountains with incised valleys and coastal lowlands (McNab and Avers 1994). The Olympic Mountains are higher in elevation and have experienced periods of glaciation. Coastal lowlands were formed by erosion from the mountain ranges and include dunes, bogs and numerous headlands. Soils in the Oregon and Washington Coast Ranges vary with climate and elevation (McNab and Avers 1994). Moister soil types occur in the coastal and western portions of the section, and drier soil types occur in the rain shadow of the Olympic Mountains. Colder soil types occur at the higher elevations and some of these soils are characterized by a cemented layer that impedes water and roots. On the low mountains that dominate this section, typical soils are moderately deep or deeper, and have dark, humus-rich topsoil.

Climate – The Oregon and Washington Coast Ranges are characterized by wet, cool winters and warm, relatively dry summers (McNab and Avers 1994). Precipitation ranges from 60–240 in (150–610 cm) as rain November to April. The 240 in (610 cm) of precipitation at Mt. Olympus, 7,923 ft elevation (2,415 m), is mostly snow. There is typically <20 in (<50 cm) of precipitation in the rain shadow of the Olympic Mountains. Annual temperatures average 32–53° F (0–12° C).

Potential Natural Vegetation – Spruce-cedar-hemlock forests dominate the coastal and lower western slopes. Cedar, hemlock and Douglas-fir dominate mid-elevation forests and the drier sites in the eastern side of this area. Subalpine fir, Pacific silver fir (*Abies amagilis*) and mountain hemlock dominate subalpine forests of the Olympic Peninsula. Alpine meadows and barrens occur in the alpine areas of the Olympic Mountains (Kuchler 1964, McNab and Avers 1994).

Disturbance Ecology – Winter storms of 25–100 year intervals resulted in wind throw and landslides (McNab and Avers 1994). Stand-replacement fires occurred at intervals of 9–250 years and may have been more frequent on upper slopes and ridges and near the coast (McNab and Avers 1994).

Willamette Valley Puget Trough Fraser Lowland

Geographic Extent – This area, located in Washington and Oregon and British Columbia, is approximately 390 mi (625 km) from north to south (Demarchi 2007, McNab and Avers 1994). The Fraser Lowlands occur south of the Coast Ranges in the south-western Fraser Valley between the Pacific Ocean and the West Cascades. The Puget Trough runs the length of Washington, between the Cascade Mountains on the east and the Olympic Mountains (eastern one third of the Olympic Peninsula) and Willapa Hills on the west. In Oregon, this area includes the Willamette Valley and adjacent foothills, extending south to the community of Drain, and is bordered on the west by the Coast Range and on the east by the Cascade Mountains and (ODFW 2005). Elevations range from sea level to approximately 2,000 ft (610 m; McNab and Avers 1994).

Geomorphology and Soils – In the south, cyclic flood deposits laid down during the Spokane flood events formed the smooth floor of the Willamette Basin (McNab and Avers 1994). The southern trough's basement is composed of volcanically formed basalts. To the north, glaciers have deposited and eroded morainal debris and sedimentary rocks. These are overlaid by river deposits of sands, silt, and clay of which the upper 2–100 ft (0.6–31 m) may be flood-deposited silts. Below the glacial limit, a zone of branching drainages and low divides is sculpted in soft rocks where isolated basalt-capped mesas occur in islands of bedrock (McNab and Avers 1994). In the Fraser Lowlands soils are primarily river deposits over glacial materials (Demarchi 1996). Soils are characterized by mesic temperature and xeric moisture regimes (McNab and Avers 1994). On the floor of the Willamette Valley, soils formed in the Willamette silts that were deposited by the great Pleistocene Missoula floods, and deposits from the Coast Range and Cascade Mountain drainages. On forested foothills and uplands, soils are clay-enriched and have dark, organic topsoils. Soils on upland terraces are mostly dark topsoil and are well to poorly drained. In the Puget lowlands and foothills, soils are underlain by a silica-cemented hardpan that impedes drainage and root penetration, and which occurs on gravelly till deposits. Valley floor soils are poorly drained and have accumulations of organic matter (McNab and Avers 1994). In the Fraser valley soils are mostly delta silts with rock outcrops, glacial gravel and debris at the base of the Coast Ranges (Demarchi 1996).

Climate – Coastal mountains cause rain shadows in the Puget Trough and Willamette Valley. Climate is characterized by mild wet winters and warm dry summers (Campbell et al. 1996, Demarchi 1996, ODFW 2005). Precipitation ranges from 25–60 in (60–165 cm), occurring mostly as rain during October through June. Mean annual temperature is 47–57° F (9–13° C). There is significant local variation in climate due to influences of elevation, proximity to the ocean, north-south mountain ranges, and prevailing storm paths (Campbell et al. 1996).

Potential Natural Vegetation – Differences in dominant vegetation reflect climate differences. Historically, the Willamette Valley was a mosaic of cedar-hemlock-Douglas-fir and the Oregon oak woods forests, the Puget Trough portion was cedar-hemlock-Douglas-fir forest, and the Fraser Valley was riparian lowland Sitka spruce, western redcedar and hemlock forest (Kuchler 1964, Meidinger and Pojar 1991). Alder-ash forest occurs along the Columbia River (Kuchler 1964) and alder, black cottonwood and bigleaf maple forests are common along the Fraser River (Meidinger and Pojar 1991). The Willamette Valley is a mixture of Douglas-fir and white oak (*Quercus garryana*) with local areas of western hemlock and western redcedar (*Thuja plicata*) series on moister sites. A similar pattern occurs in the Puget Trough portion, but with a greater abundance of western hemlock and western redcedar series and less of white oak and Douglas-fir series. Riparian areas, with aquatic conditions, include cottonwood, willow, ash, and alder. Bigleaf maple (*Acer macrophyllum*) occupies mixed sites. Prairies of Idaho fescue (*Festuca idahoensis*) are on droughty, gravelly soils in the Puget Trough. In the Willamette Valley, grasslands of *Danthonia* , bentgrass, orchard grass (*Dactylis glomerata*), needle grass, fescue, and prairie June grass (*Koeleria cristata*) are on drier sites. Tufted hairgrass (*Deschampsia cespitosa*) and shrub thickets are dominant in wetlands (McNab and Avers 1994).

Disturbance Ecology – Natural tree mortality in this area has been, and probably will continue to be, relatively low with occasional local areas of high mortality from disturbances such as flooding, wind storms, fire, and insect outbreaks (Campbell et al. 1996, Wong et al 2003). Forest lands bordering the Willamette Valley are in a combination of moderate and high fire condition classes with regard to departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern (ODFW 2005, USFS 2000).

The most significant mortality agent is root disease. Although not highly visible, root disease causes mortality on 10% of lands in this area and may kill more than 50% of a stand over a period of years (Campbell et al. 1996). Drought in the 1980s and early 1990s resulted in insect outbreaks in the Pacific Northwest (Campbell et al. 1996). Balsam woolly adelgid, introduced to the Pacific Northwest in the 1930s, has damaged grand fir at low elevations in the Willamette Valley to such an extent that most are unable to reproduce (Campbell et al. 1996).

Southern Cascades

Geographic Extent – This geographic area includes the west and east sides of the Cascades from near Prospect, Oregon (eastern Jackson and western Klamath counties) south into California and eastern portions of Siskiyou, Shasta, and Tehama counties, the southwestern corner of Lassen county, and the very northern portions of Plumas and Butte counties (Southern Cascades Ecological Subregion Section; McNab and Avers 1994). This area is roughly 140 mi (225 km) north to south and 45–95 mi (70–150 km) west to east. It is bordered by the Klamath Mountains on the west, the Sierra Nevada to the south, and the Modoc plateau to the east. Elevation ranges from about 1,500 ft (460 m) to high peaks such as Mt. McLoughlin at 9,495 ft (2,894 m) in southern Oregon, Shasta Mountain at 14,162 ft (4,317 m) and Lassen Peak at 10,457 ft (3,187 m) in California.

Geomorphology and Soils – Varying degrees of eroded volcanic mountains make up the southern Cascades but there is no distinct mountain range (McNab and Avers 1994). Soils are derived primarily from volcanic parent materials. Soil temperature regimes are mesic and frigid, and soil moisture regimes are xeric and udic (McNab and Avers 1994).

Climate – Overall, this area is warmer and drier than the Western or Eastern Cascades. Average annual precipitation varies from 20–80 in (50–205 cm). Temperature varies from 42–58° F (5.5–14° C; McNab and Avers 1994). Temperatures are cooler and precipitation is greater at higher elevations.

Potential Natural Vegetation – Vegetation communities in the Southern Cascades are quite different from those of the Western and Eastern Cascades. Sierran montane forest is the dominant component (McNab and Avers 1994). Potential vegetation types in southern Oregon include silver fir-Douglas-fir, mixed conifer, ponderosa pine, and fir-hemlock at higher elevations (Kuchler 1964). In California, the prevalence of ponderosa pine forest diminishes and mixed conifer is the dominant type with red fir forest type at the higher elevations (Kuchler 1964). California mixed evergreen and juniper steppe are also potential vegetation types in localized areas (Kuchler 1964).

Disturbance Ecology – Fire is the primary disturbance factor affecting ecosystems in this area. Historically, fire regimes for low and mid-elevation areas were low severity fires every 0–35 years. Most higher elevation areas had mixed severity fires every 35–100+ years (Moeur et al. 2005). Currently most of this area has significantly altered fire regimes (Moeur et al. 2005). At low and moderate elevations the regime has shifted to infrequent fires that burn with greater intensity and stand-replacing severity. At higher elevations fires are still relatively infrequent but have shifted from low or moderate intensity to higher surface intensity or stand-replacing events (McNab and Avers 1994). Large fluctuations in precipitation and temperature that last for years can cause significant and sometimes catastrophic changes in biological communities of this area. There is also recent history (within 200 years) of active lava flows and ash fall (McNab and Avers 1994). Disease and insect infestations do not appear to be as prevalent as in the Eastern Cascades, but Annosus root disease (*Heterobasidion annosum*) and mountain pine beetles are present in localized areas (USDA Forest Service 2006).

Klamath Mountains

Geographic Extent – The Klamath Mountains' geographic area encompasses the range of the Klamath Mountains, located in southwestern Oregon and northwestern California. The area includes the Siskiyou Mountains, Marble Mountains, Salmon Mountains and the Trinity Alps. It extends south from the northern end of the Klamath Mountains (roughly south of the Coquille and South Umpqua Rivers in Oregon) through the Trinity Mountains to the north end of the Central Valley of California, north of Redding. The area extends east from the southwestern Oregon Coast to the foothills of the southern Cascades in Oregon, and in Northern California east from the coastal mountains to roughly interstate 5 (including Shasta Lake). It is approximately 200 mi (320 km) north to south and 120 mi (200 km) east to west. Elevation ranges from 1,500–8,000 ft (450–2,425 m; McNab and Avers 1994).

Geomorphology and Soils –The Klamath Ranges are an extensive area of old, geologically complex mountains. They consists of an uplifted area with highly dissected, folded mountains, foothills, terraces, and floodplains underlain by igneous sedimentary, and some metamorphic rock (McNab and Avers 1994). Soils range from young soils to older, deeper, more developed soils in combination with mesic and frigid soil temperature regimes and xeric and udic soil moisture regimes (McNab and Avers 1994). Serpentine soils formed by the accretion of rocks onto the continent strongly influence native vegetation (Moeur et al. 2005).

Climate – The mild, sub-humid climate is characterized by moderately cold winters with high snowfall and warm, dry summers with limited rainfall and a lengthy summer drought. Precipitation, primarily rain, ranges from 40–120 in (100–305 cm) per year. Winter precipitation occurs as snow in the mountains (McNab and Avers 1994).

Potential Natural Vegetation – The area supports a mix of northern Californian and Pacific Northwest mixed conifer vegetation. Native vegetation is dominated by mixed-conifer (fir-pine-Douglas-fir) and California mixed evergreen forest (oak-madrone-Douglas-fir; Kuchler 1964).

Disturbance Ecology – Wide fluctuations in precipitation and temperature for periods of years can result in significant or catastrophic changes in biological communities in this area (McNab and Avers 1994). It is characterized by historically high fire frequencies (0–35 years). Historically wildfires played a major role in shaping the forests of the area. In Douglas-fir-hardwood forests, pre-settlement fires had a wide range of fire severity resulting in large, older trees with fire scars and patches absent of conifers and dominated on some sites by hardwoods or shrubs (low severity), and even-aged stands of other conifer species (moderate severity; Agee 1993). At lower and mid-elevations, historic occurrence of fire has changed from frequent, low intensity ground fires to infrequent, high intensity stand-replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity ground fires to infrequent, low, moderate, and high intensity surface or stand-replacing fires (McNab and Avers 1994). Numerous large and destructive fires have occurred in this area in the last few decades (USDA Forest Service and USDI Bureau of Land Management 1994). Changes in fire regime may have made forests more susceptible to large, high severity fires, to epidemic attacks of insects and diseases, and to stress from drought.

Sudden oak death (*Phytophthora ramorum*; SOD) was first identified in oaks in California in 1995 and southwestern Oregon in 2001. Less than 88 acres have been affected in the Klamath Mountains geographic area (USDA Forest Service 2004*a*). SOD causes death in tanoak (*Lithocarpus densiflorus*) and California black oak (*Quercus kelloggii*), which are common in the area (USDA Forest Service 2004*a*). Port Orford cedar root-rot disease (*Phytopthora lateralis*) is throughout many Port Orford cedar (*Chamaecyparis lawsoniana*) stands in the Klamath Mountains. This disease can quickly kill all sizes and ages of Port Orford cedar, which is limited in its natural range to the Klamath Mountains (Zobel 1990).

Northern California Coast Ranges

Geographic Extent – This area parallels the Pacific Coast south from the Oregon Border to San Francisco Bay. The area is roughly350 mi (590 km) north to south and 75 mi (120 km) east to west. It includes the mountains, hills, valleys, and plains of the northern California Coast Ranges and small parts of the Klamath Mountains close enough to the Pacific Ocean for the climate to be modified by maritime influences. It consists of two parallel belts of mountains, one along the coast, the other further inland. The Klamath and Smith Rivers, which drain the Klamath Mountains, cross this geographic area to reach the Pacific Ocean. The mountain ranges are separated by a long valley, the northern portion of which is drained by the Eel River and its tributaries, and the southern area by the Russian River. The eastern slope drains into the California Central Valley. The elevation ranges from sea level to 0–3,000 ft (0–912 m; McNab and Avers 1994).

Geomorphology and Soils– This area was formed by accretion of rocks onto the continent. Stream channels generally follow the northwest/southeast orientation of these rocks. Relatively rapid tectonic uplift has caused hill slopes to become highly dissected and incised by stream channels, creating inner gorges. Weak rocks are highly fractured along numerous faults and contacts, and are weathered to deep soils that are subject to extensive earthflows (USDA Forest Service and USDI Bureau of Land Management 1994). The area is seismically active with strong shaking and ground rupture potential (McNab and Avers 1994). Soils are varied and include those formed in volcanic ash, soils with weakly developed subsurface horizons, and strongly leached soils with a subsurface of clay accumulation. A variety of soil moisture combinations occur, including isomesic, mesic, or thermic soil temperature regimes, and aquic, udic, ustic, or xeric soil regimes (McNab and Avers 1994). Fog contributes to soil moisture.

Climate – This area borders the Pacific Ocean and climate is characterized by mild summer temperatures and wet, cool winters. Summer daytime temperatures are often modified by fog and sea breezes. Annual precipitation ranges from 40–100 in (100–255 cm). Winter precipitation is generally rainfall with snowfall at the highest mountain elevations. Humidity is high and fog partially compensates for the summer drought. Temperature averages range from 50–55° F (10–13° C).

Potential Natural Vegetation – The area includes a coastal fog belt containing redwood vegetation type (Redwood-Douglas-fir*)* which dominates the seaward slopes of the outer California Coast Range and contains the last stands of old-growth redwoods (*Sequoia sempervirens*). California mixed evergreen forest (oak-madrone-Douglas-fir; Kuchler 1964) are also present. Dominant natural vegetative hardwood communities include Pacific madrone , golden chinquapin (*Castanopisis chrysophylla*), tanoak, live oak (*Quercus agrifloria*), and California bay laurel (Kuchler 1964).

Disturbance Ecology – Historically, redwood stands were subject to frequent underburning (USDA Forest Service and USDI Bureau of Land Management 1994). Fire regimes have changed from frequent, low- to high-intensity surface fires, to infrequent, moderate- to high-intensity stand-replacing fires. Fire frequency is generally much lower than in the Klamath Mountains geographic area (USDA Forest Service and USDI Bureau of Land Management 1994). The Northern California Coast geographic area has a low potential risk of tree mortality due to insects and diseases. Sudden oak death is widespread from Monterey County north into Humboldt County and commonly found in two forest types: the understory of coast redwood forests on tanoak, and in coastal evergreen forests on oaks, madrone, California bay laurel, and other species. SOD has caused the death of tens of thousands of trees, in all size classes, and has killed healthy mature trees of tanoaks, coast live oaks, and California black oaks (*Quercus kelloggii*).

Sierra Nevada

Geographic extent – The Sierra Nevada geographic area is mostly within California with a portion extending into Nevada around Lake Tahoe. The mountain range is oriented northwest to southeast and is approximately 400 mi (645 km) north to south and 50 mi (80 km) east to west. It extends from near Susanville in the north to southern Kern County in the south. Elevation ranges from 1,000–14,495 ft (305–4,420 m) with a gradual elevation rise and foothills on the west side, and steep drops on the eastern slope, especially in the southern portion where the Great Basin begins.

Geomorphology and Soils – The block that formed the Sierra Nevada Range tilts west and is comprised of granitic and ultramafic (dark colored igneous) rock, and metamorphosed sedimentary and volcanic rocks. Much of the range has been shaped by repeated glaciation resulting in characteristic 'U' shaped valleys and hanging walls. Westward-flowing rivers run from the crest in deeply incised canyons with bedrock controlled channels to the Central Valley and Pacific Ocean. Rivers flow east from the crest in mostly bedrock-controlled channels terminating in basins in the Mojave Desert, Mono Basin, or Northwestern Basin and Range. There are numerous lakes and wet meadows associated with glaciated areas above 5,000 ft (1,525 m). Both geology and weather contributed to the formation and distribution of soil types which range from younger Mollisols and Alfisols to Inceptisols and Ultisols, with mesic, frigid, and cyric temperatures and xeric, udic and aquic moisture regimes. At higher elevations, soils tend to be thin and less productive than lower elevations of the west slope where alluvial deposits have accumulated.

Climate –The climate is typically characterized as 'Mediterranean' with cool, wet winters and hot, dry summers. Most precipitation, ranging from 10–90 in (25–230 cm), occurs between fall and spring. Precipitation above 6,000 ft (1,830 m) is primarily snow. The Sierra Nevada generally deflects winds from the Coast towards the Great Basin, resulting in winds that are a product of local terrain rather than prevailing circulation. During winter, low-pressure systems approaching from the Pacific meet high-pressure over the Great Basin resulting in locally strong and damaging winds. Storms that move inland travel south-southwest and the greatest velocity winds tend to occur at high elevations.

Potential Natural Vegetation –Vegetation types are Sierran montane forest, upper montane-subalpine forest, northern Jeffrey pine forest, and alpine (Kuchler 1964). Predominant potential natural communities are ponderosa pine, ponderosa pine-mixed conifer, Douglas-fir-mixed conifer, white fir-mixed conifer, red fir (*Abies magnifica*), lodgepole pine, Jeffrey pine (*Pinus jeffreyi*), big sagebrush (*Artemisia tridentate*), canyon live oak, white alder (*Clethra alnifolia*), mountain alder, huckleberry, oak, carex and aspen series (McNab and Avers 1994).

Disturbance Ecology – Fire has played a significant role in the distribution of vegetation. Fire return intervals have generally been shortest at drier, warmer, lower elevations (approx. 8 years). Return intervals increase with increasing elevation and increasing moisture. In red fir forests they range from 11– 26 years. Historic records indicate that fires covered large areas and burned for months at a time at low intensities (USDA Forest Service 2004*b*). Current fire regimes are significantly different from those of the 150 years ago (USDA Forest Service 2004*b*). The frequent, low-intensity ground fires of the past have largely been replaced by high-intensity stand-replacing fires. Insects and disease have also contributed to disturbance events, although less is known about these influences than fire and weather (USDA Forest Service 2004*b*). In the eastern portion extensive die-offs have occurred as a result of bark beetle infestations.

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Appendix B. Geographic Area specific criteria for evaluating and delineating Fisher Emphasis Areas and for application of Conservation Measures in project planning and implementation.

This appendix provides information on the ecological variation applicable to fishers across the Strategy Area prepared by the Interagency Fisher Biology Team. Conservation of Fishers (*Martes pennanit*) in south-central British Columbia, western Washington, western Oregon, and California, Volumes I and II, and select references available from July 2008 through June 2011 were used as a basis for these recommendations.

It is critical to use results of studies of fishers and fisher habitat, if available, in addition to this Appendix when identifying conservation areas and applying conservation measures. Geographic areas are large and ecological conditions and supporting documentation varies. We encourage the practitioner to reference Volume II and original references to identify study areas with the closest proximity and conditions to their area of interest. For example, the numerous studies conducted in the Klamath Mountains Geographic Area may allow practitioners to identify a subset of the studies that more closely match their ecological conditions of interest, than the summary information presented below.

Where research has not been conducted, or where extant populations do not occur, recommendations for Geographic Areas was estimated from habitat conditions that are similar to areas where studies have been completed. We provide three levels of certainty about the information provided for each geographic area: "Confident" – Studies conducted on extant population and information available; "Moderate" – Populations generally extirpated throughout the area (Vol. 1 pp. 47-49) but contain vegetation communities similar to available studies, values interpolated; "Tentative" – Populations generally extirpated throughout the area, vegetation communities less similar to available studies, values interpolated.

Southern Interior British Columbia

Population Re-establishment Area: A (Fig. X)

Population Area: Fishers generally extirpated throughout this area (Vol. 1, p. 48)

Level of Certainty: Moderate. Variables for this area extrapolated from similar ecological conditions from extant populations studied in British Columbia.

Female HR Size: 18 mi^2 (47 km^2)

Primary Vegetation Communities: montane spruce, interior Douglas-fir, ponderosa pine, lodgepole pine, riparian black cottonwood and trembling aspen.

Forest Canopy and Vegetation Diversity: cite relevant ecosystem restoration literature

Habitat Models: Weir and Corbould 2010.

Prey Items (in declining order of importance): snowshoe hare, red squirrels, northern flying squirrels, redbacked voles, porcupine, grouse, and ungulate carrion.

Den Tree Species and mean dbh: Conifers; Douglas-fir 21 in. dbh, lodgepole pine 13 in. dbh Hardwoods; black cottonwood $\geq$40 in. dbh, aspen 17 in. dbh

Rest Structures (in declining order of importance): tree cavities (live and dead), rust brooms, large log cavities, down wood piles, and other ground structures.

Rest Tree Species and mean dbh: Conifers: Douglas-fir 44 in. dbh; Hardwoods: Hybrid spruce 18in. dbh, black cottonwood 40.5 in. dbh, coarse down wood 31.5 in. dbh

Forest Canopy at the Home Range Scale:

Forest Canopy at the Den and Rest Site Scale:

Amount of open area at the Home Range Scale:

Western Cascades

Population Re-establishment Areas: B, E, F, G, H (Fig. X)

Population Area: Contains a few individuals studied in the Cascade Range, Oregon extant fisher population.

Level of Certainty: Tentative. Variables for this area extrapolated from similar ecological conditions from extant populations studied in the Cascade Range, Oregon and ?.

Female HR Size: 10 mi^2 (26 km^2)

Primary Vegetation Communities: Silver fir-Douglas-fir, fir-hemlock, cedar-hemlock-Douglas-fir, western hemlock, mountain hemlock (Vol 1. p. 90).

Forest Canopy and Vegetation Diversity: cite relevant ecosystem restoration literature

Habitat Models: WA – Lewis and Hayes 2004

Prey Items: Leporidae Sciuridae

Den Tree Species and mean dbh: Black cottonwood –(40 in, 43 in. dbh) Douglas-fir 21 in. dbh Live trees (incense cedar, Douglas-fir, true fir, western white pine, chinquapin)- Natal dens – 36in- Maternal dens – 38 in Snags: natal dens 35 in, maternal den 52 in Logs (maternal den) 41 in snags 52 in.

Rest Structures (in declining order of importance): tree cavities (live and dead), mistletoe and rust brooms, large log cavities, down wood piles, ground structures, large limbs, and rodent nests.

Rest Tree Species and mean dbh: Hybrid spruce 18 in. dbh, Douglas-fir 44 in. dbh, black cottonwood 40.5 in. dbh, CWD 31.5 in,51.5 in. diameter, Douglas-fir, western hemlock, true fir, Cedar, pine, chinquapin, madrone, yew: 30 in. -Snags: 45 in. dbh, -Logs: 41.7 in. large end.

Forest Canopy at the Home Range Scale:

Forest Canopy at the Den and Rest Site Scale:

Amount of open area at the Home Range Scale:

Eastern Cascades

Population Re-establishment Areas: C, E, F, H (Fig. X)

Population Area: Contains a few individuals studied in the Cascade Range, Oregon extant fisher population

Level of Certainty: Tentative. Variables for this area extrapolated from similar ecological conditions from extant populations studied in the Cascade Range, Oregon.

Female HR Size: 10 mi^2 (26 km^2)

Primary Vegetation Communities: Ponderosa pine, fir-hemlock, spruce-fir, montane spruce, lodgepole pine, Douglas-fir, grand fir-Douglas-fir, and mixed conifer.

Forest Canopy and Vegetation Diversity: cite relevant ecosystem restoration literature

Habitat Models: WA – Lewis and Hayes 2004

Prey Items: Leporidae Sciuridae

Den Tree Species and mean dbh: Live trees (incense cedar, Douglas-fir 54 cm dbh lodgepole pine 13 in. dbh Aspen 15 – 18.5 in. dbh Live trees (incense cedar Douglas-fir, true fir, western white pine, chinquapin) -Natal dens – 36 in- Maternal dens – 38 in. Snags: natal dens 35 in, maternal dens 52 in. Logs (maternal den) 41 in. snags 52 in.

Rest Structures: Mistletoe and rust brooms, tree cavities, logs, CWD piles, ground structures, large limbs, rodent nests.

Rest Tree Species and mean dbh: Hybrid spruce 18 in. dbh, Douglas-fir 44 in. dbh, black cottonwood 40.5 in. dbh, coarse down wood 31.5 in., 51.5 in. diameter, -Douglas-fir, western hemlock, true fir, cedar, pine, chinquapin, madrone, yew: 30 in. -Snags: 45 in. dbh, -Logs: 41.7 in. large end.

Forest Canopy at the Home Range Scale:

Forest Canopy at the Den and Rest Site Scale:

Amount of open area at the Home Range Scale:

Oregon and Washington Coast Ranges
Population Re-establishment Areas: D, I (Fig. X)
Population Area: Fishers extirpated throughout this area; reintroduced individuals on Olympic Peninsula, several years are needed yet to determine this an established population
Level of Certainty: Tentative. Variables for this area extrapolated from similar ecological conditions from extant populations studied in.
Female HR Size: 9.6 – 10 mi^2 (25 – 26 km^2)
Primary Vegetation Communities: Spruce-cedar- hemlock, Douglas-fir, Pacific silver fir, mountain hemlock
Forest Canopy and Vegetation Diversity: cite relevant ecosystem restoration literature
Habitat Models: WA – Lewis and Hayes 2004
Prey Items: Leporidae Sciuridae, mice, voles, birds, ungulate carrion
Den Tree Species and mean dbh: Black cottonwood –(40 in, 43 in. dbh) Douglas-fir 21 in. dbh Live trees (incense cedar, Douglas-fir, true fir, western white pine, chinquapin)- Natal dens – 36in- Maternal dens – 38 in. Snags: natal dens 35 in, maternal dens 52 in. Logs (maternal den) 41 in. snags 52 in.
Rest Structures: Mistletoe and rust brooms, tree cavities, logs, CWD piles, ground structures, large limbs, rodent nests, rodent burrows.
Rest Tree Species and mean dbh: Hybrid spruce 18 in. dbh, Douglas-fir 44 in. dbh, black cottonwood 40.5 in. dbh, CWD 31.5 in,51.5 in. diameter, -Douglas-fir, western hemlock, true fir, cedar, pine, chinquapin, madrone, yew: 30 in, -Snags: 45 in. dbh, -Logs: 41.7 in. large end.
Forest Canopy at the Home Range Scale:
Forest Canopy at the Den and Rest Site Scale:
Amount of open area at the Home Range Scale:

Southern Cascades
Population Re-establishment Areas: J (Fig. X)
Population Area: Contains the majority of the individuals studied in the Cascade Range, Oregon extant fisher population (Vol. 1, p. 48).
Level of Certainty: Moderate.
Female HR Size:
Primary Vegetation Communities: Silver fir–Douglas-fir, mixed conifer, ponderosa pine, fir-hemlock, red fir, California mixed evergreen (Vol 1. p. 90).
Forest Canopy and Vegetation Diversity: cite relevant ecosystem restoration literature
Habitat Models:
Prey Items: Rabbits, Sciurids (tree squirrels, ground squirrels, chipmunks), moles, mice, voles, birds, lizards, ungulate carrion
Den Tree Species and mean dbh: Live trees (incense cedar, Douglas-fir, true fir, western white pine, chinquapin)-natal dens – 36 in,- maternal dens – 38 in,snags: natal dens 35 in, maternal den 52 in,logs (maternal den) 41 in. snags 52 in. Douglas-fir, tanoak, chinquapin, red cedar snag (natal den–30 in, maternal–44 in), natal and maternal dens—Douglas-fir average dbh 54 in, Port-Orford cedar 54 in, sugar pine 40 in, black oak 34 in, madrone 34.6 in, tanoak 30 in. black oak 22.4 in, live oak 44.9 in), Douglas-fir 45.6 in. (Vol. 1 pp. 108-109, Vol. 2 pp. XX)
Rest Structures: Mistletoe and rust brooms, , lateral branches, branch clusters, witches brooms, cavities, nests, logs, CWD piles, subnivean ground structures
Rest Tree Species and mean dbh: -CWD 52 in. (diameter) -Douglas-fir, western hemlock, true fir, cedar, pine, chinquapin, madrone, yew: 30 in-snags: 45 in-logs: 42 in. large end Douglas-fir, black oak, ponderosa pine, sugar pine; live trees (76%) (41 in) and snags (47 in), logs (34 in) Douglas-fir, ponderosa pine, sugarpine, black oak, canyon live oak: live tree (76%), snag (14%), mean DBH 38 in; log (9%).
Forest Canopy at the Home Range Scale:
Forest Canopy at the Den and Rest Site Scale:
Amount of open area at the Home Range Scale:

Klamath Mountains
Population Re-establishment Areas: None (Fig. X)
Population Area: Northern California-Southwestern Oregon Population (Vol. 1, p. 48).
Level of Certainty: Confident; Values from studies within the extant Northern California-Southwestern Oregon Population; Study Areas include: Siskiyou National Forest, Sacramento Canyon, Hoopa Valley Indian Reservation, Shasta-Trinity National Forest, Shasta Lake, Big Bar, Pilot Creek, Six Rivers National Forest, Hayfork Summit, Coastal Northwestern California, Northern California Inventory (Vol. II).
Mean Female Home Range Size: 4 mi^2 (10.4 km^2) (Vol. 1, p. 68)
Primary Vegetation Communities: Douglas-fir, Douglas-fir–Ponderosa pine, Douglas-fir –Tanoak, Jeffery Pine, Mixed Conifer, White Fir (Vol 1. p. 90).
Forest Canopy and Vegetation Diversity: cite relevant ecosystem restoration literature
Habitat Models: Carroll et al. 1999, Davis et al. 2007, Zielinski et al. 2010
Prey Items (in declining order of importance): Mammals (rodents [chipmunks, woodrats, tree squirrels, voles, mice, gophers, and ground squirrels], carnivores [skunks, foxes], insectivores [moles, shrews], and ungulate carrion), insects, birds, and reptiles. (Vol. 1, p. 76)
Den Tree Species and mean dbh: Conifers: Douglas-fir 50 in., true fir 41 in., incense cedar 70 in.; Hardwoods: Black oak 34 in., canyon live oak 45 in., tanoak 30 in.
Rest Structures: Dwarf mistletoe, lateral branches, branch clusters, witches brooms, cavities, nests, logs, subnivean
Rest Tree Species and mean dbh: Conifers: Douglas-fir, ponderosa pine, sugar pine, true fir (41 in); Hardwoods: black oak, tanoak (34 in.).
Forest Canopy at the Home Range Scale:
Forest Canopy at the Den and Rest Site Scale:
Amount of open area at the Home Range Scale:

Northern California Coast Ranges
Population Re-establishment Areas: None (Fig. X)
Population Area: Northern California-Southwestern Oregon Population (Vol. 1, p. 48).
Level of Certainty: Confident; Values from studies within the extant Northern California-Southwestern Oregon Population; Study Areas include: Green Diamond Resources Company, Redwood National and State Parks, Pilot Creek Six Rivers national Forest, Coastal Northwestern California, Northern California Inventory, Mendocino National Forest
Female HR Size: 4 mi^2 (10.4 km^2) (Vol. 1, p. 68)
Primary Vegetation Communities: Douglas-fir, Douglas-fir–Tanoak Mixed Conifer, Redwood (Vol 1. p. 90).
Forest Canopy and Vegetation Diversity: cite relevant ecosystem restoration literature
Habitat Models: Carroll 2005, Davis et al. 2007
Prey Items (in declining order of importance): Mammals (rodents [chipmunks, woodrats, tree squirrels, voles, mice, gophers, and ground squirrels], carnivores [skunks, foxes], insectivores [moles, shrews], and ungulate carrion), insects, birds, and reptiles. (Vol. 1, p. 76)
Den Tree Species and mean dbh: Douglas-fir, tanoak, chinquapin, red cedar snag (natal mean=30 in, maternal=44 in), natal and maternal dens—Douglas –fir average dbh 54 in, Port-Orford cedar 54 in, sugar pine 40 in, black oak 34 in, madrone 34.6 in, tanoak 30 in. black oak 22.4 in, live oak 44.9 in, Douglas-fir 45.6 in. (Vol. 1 pp. 108-109, Vol. 2 pp. XX)
Rest Structures: Dwarf mistletoe, lateral branches, branch clusters, witches brooms, cavities, nests, logs, subnivean
Rest Tree Species and mean dbh: Douglas-fir, black oak, ponderosa pine, sugarpine; live trees (76%) (41 in) and snags (47 in), logs (34 in) Douglas-fir, ponderosa pine, sugarpine, black oak, canyon live oak: live tree (76%), snag (14%), mean DBH 38 in; log (9%). (Vol 1. pp. 108-109, Vol. 2 pp. X)
Forest Canopy at the Home Range Scale:
Forest Canopy at the Den and Rest Site Scale:
Amount of open area at the Home Range Scale: X to X pers comm. Higley 2009

Sierra Nevada
Population Re-establishment Areas: J, K (Fig. X)
Population Area: Southern Sierra Nevada Population
Level of Certainty: Confident; Values from studies within the extant Northern California-Southwestern Oregon Population; Study Areas include: Sierra Nevada Fire and Fire Surrogate, Kings River, Sierra National Forest, Sequoia-Kings Canyon, Tule River, Sequoia National Forest Inventory, Sierra Nevada Inventory and Monitoring
Female HR Size: 5 mi^2 (13 km^2)
Primary Vegetation Communities: Sierran mixed conifer, Ponderosa pine, montane hardwood conifer, white fir–mixed conifer, red fir, Jeffrey pine, lodgepole pine, montane hardwood, and giant sequoia.
Forest Canopy and Vegetation Diversity: North et al. 2009, Spencer et al. 2011
Habitat Models: Spencer et al. 2008, 2011, Davis et al. 2007, Zielinski et al. 2006 and 2010.
Prey Items: tree squirrels, ground squirrels, chipmunks, mice, voles, birds, mustelids, lizards, insects, seeds and fruit
Den Tree Species and mean dbh: white fir, ponderosa pine, black oak Mean dbh of natal dens: white fir snag 58 in,. snag 44 in, white fir live tree 32 in, black oak live 40 and 30 in; maternal dens black oak and live– 16 and 20 in; white fir live 57 in.
Rest Structures: Incense cedar, true fir, canyon live oak, black oak, ponderosa pine, sugarpine
Rest Tree Species and mean dbh: Mean dbh 35 in. (range 9 – 69 in)
Forest Canopy at the Home Range Scale: 60% of home range >50% forest canopy
Forest Canopy at the Den and Rest Site Scale: spherical densitometer >70%, FVS >60%
Amount of open area at the female fisher Home Range Scale: Less than 10% of the home range <40% forest canopy.