[Oral Presentation]

The Role and Expectations of the Federal Fisher Science Team

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Various federal and state resource management agencies have agreed to cooperate in the preparation of a Fisher Conservation Assessment and Strategy (FCAS) for the western U.S. This document will provide a science-based assessment of current conservation concerns, and management recommendations for reducing or eliminating risks to population persistence and species recovery. There are 3 non-overlapping groups participating in this effort: a Fisher Steering Committee, Fisher Biology Team, and Fisher Science Team. The Steering Committee will be responsible for establishing priorities for fisher conservation and helping to secure required resources, including both funding and key personnel. The Biology Team will be responsible for drafting the FCAS, which will include a synthesis of available literature, an assessment of conservation risks, and recommendations for management. Once the FCAS is completed, the Biology Team will also assist public agencies with its interpretation and implementation. The Science Team will provide scientific support to the Steering Committee and Biology Team, as needed, and will also oversee peer review of the draft FCAS. The Science Team's initial contribution to this process is a document that briefly discusses the following 4 conservation issues for fisher in the western U.S. (1) Where are the critical gaps in fisher survey efforts? (2) How can we increase the effectiveness of survey, monitoring, and research efforts for fishers? (3) What are the critical information gaps for developing a Fisher Conservation Assessment and Strategy? and (4) How can we do a better job of integrating science and management for fishers? The report also includes an annotated bibliography of relevant fisher literature, with emphasis on studies conducted in western North America. The primary findings of this assessment will be presented.

[Oral Presentation]

Current Fisher and Marten Conservation Efforts: How Did We Get Here?

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I briefly review the history of research and management of marten and fisher in California to provide a backdrop for a discussion of current events. The fisher in particular, but also the marten are central players in the ongoing events driving forest management decisions, especially in the Sierra Nevada.

[Oral Presentation]

Research and Management Needs for Fisher and Marten: A Perspective from the Environmental Community

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Environmental organizations have played a lead role in advocating for increased protection for fisher and marten in the Sierra Nevada and the western United States. Our goal has been to bring the best available science to bear on management decisions, particularly affecting national forest lands. Towards this end, we have petitioned the U.S. Fish and Wildlife Service to protect the Pacific fisher under the Endangered Species Act, and have commented on, appealed, and litigated numerous Forest Service projects and plans that may adversely affect the fisher and marten and their habitat.

To better inform land management decisions, we suggest that the scientific community address the following issues for fisher and/or marten:

- Development of less expensive methods (e.g. other than radio telemetry) to identify individuals and monitor habitat use
- Development of models or other tools to estimate the likelihood of specific marten or fisher populations persisting
- Increased refinement of habitat models that address requirements at small and large scales
- Research on movement and dispersal
- Characterizations of nearest neighbor distances necessary to support an interbreeding population
- Evaluation of disease or parasite load and an assessment of the effect of this load on population health and persistence
- Additional evaluation of the apparent gap in the marten's distribution and development of strategies to facilitate recolonization of such areas

Conservation of fisher and marten depends on an increased commitment from land managers to monitor the impacts of management – specifically logging – on these species. Further, it is vital that the widespread application of management approaches that increase risk to forest carnivores, such as implementation of the 2004 Sierra Nevada Framework and the Quincy Library Group Project, be delayed until these research questions are addressed.

[Oral Presentation]

A Conservation Strategy for Fishers in California, Including the Feasibility of Reintroduction

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The status of fisher populations in California has been of concern to the California Department of Fish and Game (Department) since the 1940s. The trapping season for fishers was closed in 1946 to protect dwindling populations. In 1977, intensive field work on fisher home range size and habitat relationships was initiated in California. In 1986, fishers were designated as a species of special concern in California. Population declines were attributed primarily to reduction in habitat quality. In 1987, the Department determined that a substantial reduction in fisher distribution had occurred in California since the early 1900s and management action was needed to restore populations and reduce distribution gaps. Since that time, no statewide management or recovery plan has been completed for the fisher in California, though many planning and management actions have occurred on U.S. Forest Service lands. With the recent (2004) "warranted but precluded" listing determination by U.S. Fish and Wildlife Service on fisher populations in Washington, Oregon, and California, there is renewed interest in this species. A statewide conservation strategy document is needed for fishers in California to identify interim actions, provide management guidance, and promote long term population viability. Management and research priorities also need to be determined, and cooperative efforts should be promoted. Following the recent (2004) example from Washington, a feasibility assessment for reintroducing fisher in California should also be prepared and include habitat and landscape requirements for ensuring a sustainable California population. Securing adequate funding for all program phases is also vital.

[Oral Presentation]

The Relevance of Regional-Scale Habitat Models to Fisher Conservation

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Because wide-ranging species such as the fisher occupy relatively large home ranges, their population dynamics at any particular site will be strongly influenced by the regional distribution of suitable habitat. Regional models of habitat suitability are therefore key tools for fisher conservation. However, empirical models of species distribution that use variables such as vegetation type that are surrogates for proximal limiting factors may be difficult to extrapolate between ecoregions. I tested the generality of the model of Carroll et al. (1999) using newly available data from the redwood zone. I created new models based on combined redwood data and interior zone surveys to identify commonalities in fisher habitat relationships between regions and produced preliminary predictions of habitat suitability in the Sierra Nevada. The redwood zone data fit the Carroll et al. (1999) model well, implying that variables such as canopy closure are biologically-relevant limiting factors whose correlation with fisher distribution has some generality across forest types and ecoregions. However, strong geographic patterns in the residuals between predicted and observed occurrence suggest that the 1999 model could be updated using new modeling techniques that better mimic the underlying biological processes causing spatial dependence in the data. In newly developed models, terrain ruggedness was also strongly correlated with fisher distribution in northern California. A model including canopy closure and terrain ruggedness successfully identified areas of known fisher distribution when extrapolated to the Sierra Nevada. Although this model is too preliminary for use in isolation for mapping fisher conservation areas within the Sierra Nevada, when compared with other models it may facilitate development of hypotheses concerning habitat factors influencing fisher distribution. Delineation of suitable habitat using such regional-scale models is a key step in operationalizing Endangered Species Act's language directing restoration of threatened species to a "significant portion of range".

[Oral Presentation]

Science as it Relates to Fisher and Marten Management: Private Lands

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Information concerning the distribution and status of fisher (*Martes pennanti*) and marten (*M. americana*) on private lands has been obtained primarily through general meso-carnivore track-plate and camera-based surveys on commercial timberlands. In north coastal California, four large timber companies (combined over one million acres) have done track-plate or camera surveys that have the potential to document the occurrence of fisher or marten. Fisher and marten were not detected on private commercial timberlands in northern Sonoma or Mendocino Counties, but fishers were detected throughout Humboldt and Del Norte Counties. Generally, more fishers were detected in northern Humboldt and Del Norte Counties, and detections increased from coastal low elevation redwood forests to more interior higher elevation Douglas fir-hardwood forests. No marten were detected on any coastal private timberlands, except for one location at higher elevations on and adjacent to commercial timberlands in Del Norte County.

In interior regions, four large timber companies (combined over two million acres) have done track-plate or camera surveys for carnivores that have the potential to document the occurrence of fisher or marten. Fishers were detected throughout the Siskiyou Mountains (including southern Oregon) and northern Sierras on commercial timberlands, but fishers were not detected in the central Sierras. Marten were detected at higher elevations on commercial timberlands in scattered locations in the Sierras, but survey effort was low in this region.

To date there have been no published studies of fisher or marten exclusively on private lands in California. However, there have been several master's theses and in-house reports documenting habitat associations and selected population parameters of fisher, and one in-house report on marten. In general, studies done on commercial timberlands indicated that the structures used for rest and den sites on commercial timberlands were similar to those used by fisher on public lands. From these studies, and the widespread distribution of fisher on commercial timberlands, it appears that fisher will occur on managed lands where suitable structure exists to provide rest and den sites. Studies done in other portions of its range suggests the same may be true for marten, but there has not been sufficient work done in this region to draw any conclusions. The long term viability of these meso-carnivores on managed timberlands is not known, but the primary determinant will likely be the extent to which suitable rest and den structures are maintained and recruited for the future. Although the majority of fisher and marten habitat may be on public lands, opportunities for experimental studies that will greatly increase our ability to effectively manage these species may exist primarily on private timberlands. This dilemma calls for collaborative studies with a strong partnership between private and public land managers and the scientific community.

[Oral Presentation]

Using Collaboration in Resolving Critical Issues for Fisher Conservation;

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In April 2004, the U.S. Fish and Wildlife Service determined that the West Coast Distinct Population Segment of the Fisher (*Martes pennanti*), was warranted for listing under the Endangered Species Act. This determination then led to the identification of the fisher as a candidate species in California, Oregon, and Washington. Candidate status for the fisher has increased the awareness of land managers and regulatory agencies to the threats and conservation needs of fishers. This increased awareness has been integral to the availability of funds, supporting a number of collaborative research projects and the development of multi-agency and private landowner conservation plans. This presentation will provide an overview of completed and current collaborative and cooperative partnerships and suggest some ideas for increasing the effectiveness of future conservation efforts. Cooperation, collaboration and implementation of conservation plans are key strategies for securing future funding and for attaining the ultimate goal of minimizing and removing current and future threats to the West Coast population of fishers.

[Oral Presentation]

Food Habits of Fisher in California

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Fisher diet is important to biologists and land managers in order to understand the relationship between fisher and key elements of habitat, effects of habitat alteration, energy available to fisher populations, potential effects on prey and other predators, and to assess restoration plans. Early investigations of fisher diet reported many different foods. Outside California, important food includes snowshoe hare and porcupine, which represent a positive energy return for foraging effort. In California, fisher distribution is not sympatric snowshoe hare. Porcupine are reported to be absent at the southern end of fisher range, but coincide with fisher in northern California. Contrary to expectation, no porcupine was detected in an analysis of 382 fisher scat from four disparate locations in northern California. Sciurids consistently were the most frequent prey across all sites and seasons in northern California, and were common in the southern Sierras. Sciurids may be associated with mast production and be an efficient energy source for fisher. Some rodents become unavailable in winter, but fisher can utilize other prey. Larger food items (more calories gained per capture effort) frequently included mustelids at all sites, and canids (eg: grey fox) at northern California sites. Cervids (deer) were also prevalent across seasons and sites (it was presumed that their presence represented scavenging). Lagomorphs occurred in the diet at low frequency. Many small mammals, birds, reptiles and amphibians also occurred regularly in the diet, which implies that fisher feed opportunistically. Thus, fisher may differentially use larger food types, but consume whatever they find while hunting. In California, no single food-type has been associated with fisher or their abundance, although productivity of a site (eg: mast that supports sciurids) may increase energy availability or efficiency of acquisition. Fisher may directly consume other similar sized carnivores, as well as overlap the diet with other predators. Fisher restoration efforts should recognize the diet overlap with sympatric carnivores, as well as potential change to carnivore communities through direct consumption of other carnivores.

[Poster]

Distribution and Habitat Associations of American Marten and Fisher in Sequoia and Kings Canyon National Parks

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Historic trapping and alteration of forested habitats during the last century have contributed to the decline of American marten (*Martes americana*) and fisher (*Martes pennanti*) in California's Sierra Nevada. Concern for the conservation of these species was the impetus for surveys to determine their current status within Sequoia and Kings Canyon National Parks. Between 2002 and 2004, 79 sites were surveyed using track plates and remote cameras in elevations from 600 to 3,500 m, and patterns of distribution for both species exhibited similarities to available historic records. Martens were detected at 36.7% of sites surveyed in elevations between 1,800 and 3,340 m across a relatively broad geographic area, while fishers were detected at only 11.4% of sites from 1,000 to 2,870 m in the western half of the Parks. Martens occurred most frequently in Sierran mixed conifer and red fir forests with ≥ 24" diameter trees and ≥ 60% canopy cover, although detections also occurred in other forest types and high elevation areas dominated by rock cover such as boulders and talus. Fishers occurred most frequently in Sierran mixed conifer and montane hardwood-conifer forests with ≥ 24" diameter trees and ≥ 60% canopy cover. Presence-absence data from these surveys was used to evaluate the California Wildlife Habitat Relationship (CWHR) model for American marten. This evaluation yielded moderate to poor measures of correct classification (37 to 68%), which varied with cut-point and method used to calculate suitability values, but revealed a positive association between frequency of marten occupancy and CWHR suitability values (r_s = 0.52, P = 0.06). Future conservation of marten and particularly fisher in the southern Sierra Nevada could be promoted by maintaining a connected network of suitable mature forest on the west slope of the mountains through cooperative efforts of national parks, national forests, and other regional landowners.

[Oral Presentation]

Science, Management and Cultural Significance of Fisher and Marten on Tribal Lands

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California currently has the second highest population of Native Americans in the United States behind only Oklahoma. Historically there were approximately 60 tribal territories and six language groups represented in California. The native population was over 300,000 prior to first contact with Europeans in 1542 and plummeted to 16,500 by 1900. There are currently 96 Federally recognized tribes in California with approximately 25 within the historic range of the fisher. However most of the tribes have no significant land base and only four tribes have appreciable land within the historic range of the fisher (Hoopa, Round Valley, Tule River and Yurok). These four tribes have just over 200,000 acres of land within the historic range of the fisher with approximately 125,000 acres of land supporting potential fisher habitat. Fisher are still known to be present on Hoopa, Tule River and Yurok lands and marten are also present at Tule River. Fisher hides are used for regalia by the Hoopa, Karuk, Yurok and possibly other Tribes in northwestern California but were apparently not used by members of the Tule River Tribe in the southern Sierra. The status of the fisher as a candidate for Federal protection under the Endangered Species Act has already impacted the Tule River Tribes ability to accomplish forest management objectives aimed at protecting their forest from catastrophic fire. Federal listing of the fisher will also likely affect the Hoopa, Karuk, Round Valley and Yurok Tribes ability to manage their forests, mostly through an increase in the bureaucracy associated with obtaining project approvals due to the need for Consultation with the U.S. Fish and Wildlife Service.

[Poster]

New Microsatellite Markers for Population Genetic Studies of Fishers

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We have developed new microsatellite markers from fishers in the Kings River population in the southern Sierra Nevada. Using ear tissue samples, we screened 42 new microsatellite markers in fishers from this region. Of these, 37 loci (88%) amplified, and 6 (14%) were polymorphic. Five of the polymorphic loci have 4 base pair repeats, while the other locus has a 2 base pair repeat motif. The low level of polymorphism among screened loci in our samples corroborates other studies that have found low levels of genetic diversity in Sierra Nevada fisher populations. These new genetic markers will be useful for a variety of population genetic studies of fishers, such as population monitoring using genetic tagging.

[Oral Presentation]

Federal Land Managers and Biologists - Information Needs

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There are six National Forests, one National Park, and two BLM Districts within the range of the Pacific fisher in California. Each federal unit has a different approach to determining distribution and managing fisher habitat . This presentation summarizes responses from biologists regarding status and distribution of fishers and their habitats on those units. We offer examples of mitigation and project planning criteria related to fishers. We identify the questions that challenge federal land managers related to secretive, rare forest carnivore management.

[Poster]

Multiple-Scale Habitat Modeling for the American Marten in Northeastern California

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The American marten (*Martes americana*) has experienced an apparent loss of occupied range over the last century in northeastern California. Studies conducted elsewhere in North America indicate martens respond to thresholds in landscape characteristics. We used survey data to evaluate landscape habitat associations of martens in a study area that included four national forests (Shasta-Trinity, Lassen, Plumas, Tahoe) and Lassen Volcanic National Park; an area encompassing 28,000 km^2. Systematic surveys were conducted from 1999 – 2002 using sample units comprised of track plate and camera stations. Martens were detected at 11% of sample units, with detections clustered in three distinct areas. The California Wildlife-Habitat Relationships (CWHR) system was used to describe marten reproductive habitat, but was modified based on regional knowledge of marten associations. This new model was implemented in GIS across the region using the California Department of Forestry's Fire and Resource Assessment Program vegetation data. Landscape pattern analysis focused on forest characteristics and was conducted using the spatial analysis program FRAGSTATS. Forest composition, configuration, and fragmentation levels were evaluated at 184 sample units, where circular 'landscapes' were created at three spatial extents (1, 2.5, and 5 km radii) to gain insight into marten habitat selection. Land cover, land ownership, landscape metrics, elevation, stream density, road density, and nearby marten detection data were used in logistic regression analyses to predict marten occurrence. Models developed at larger spatial extents outperformed others and included the following predictor variables: amount of habitat, number of habitat patches, and land ownership. Marten detection sites had on average three times the amount of 'reproductive' habitat and core area habitat as non-detection sites. Late-successional forests located at higher elevations appear important for marten population persistence and maintenance of large forest patches may benefit marten. Trends in marten distribution in this region indicate proactive conservation actions are needed and the results of this study may help address this need. We suggest, however, that this model be tested with new data to evaluate its accuracy.

[Oral Presentation]

Freel Redux: Updating Fisher Habitat Guidelines for USDA Forest Service Lands in California

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Freel (1991) presented guidelines for assessing fisher habitat on national forests in California. Based on published and unpublished literature, habitat models developed by the USDI Fish and Wildlife Service and USDA Forest Service, and the professional opinions of numerous biologists, these guidelines have assisted forest managers in the design of, and analysis of the effects of, forest management projects throughout the range of the fisher in California. Supported by the Forest Service, I have reviewed relevant research on the fisher conducted since Freel (1991) and where possible have updated suggested parameters for managing fisher habitat. I recommend changes in habitat parameters for fishers only where they are supported by recent scientific research. In keeping with the spirit of the original, I will solicit the professional opinions of biologists familiar with fisher ecology in California and include them in the final document.

[Poster]

The Current Distribution of the Fisher and the Humboldt Marten in California

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Based on recent, empirical survey data collected by the USDA Forest Service and others, these maps show the current distribution of the fisher and the Humboldt marten in California. The maps also indicate the species' historical distributions as shown by Grinnell and colleagues.

[Oral Presentation]

The Science of Fisher Reintroductions: Planning, Implementation, and Monitoring

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Following an extensive decline via overtrapping and habitat loss, reintroduction efforts have successfully reestablished fishers throughout much of their range. Among 32 known fisher reintroductions, 23 (72%) were considered successful. These efforts were undertaken for three reasons: to reestablish the fisher, to reestablish a valuable furbearer, or to control porcupines. Reintroductions can be more easily supported after a status review, recovery plan, and a reintroduction feasibility assessment have been completed. A fisher reintroduction should be preceded by a feasibility assessment to determine (1) if the causes of decline or extirpation have been reduced or eliminated, (2) if there is an adequate amount and configuration of suitable habitat for a reintroduced population, (3) if there is an adequate prey base, and (4) if there is a suitable and available source population. These factors are critical to biological feasibility but do not address the social or economic aspects of reintroduction, which are also important to evaluate. If a reintroduction is deemed feasible, an implementation plan could be built from many of the pieces of the feasibility assessment such as reintroduction areas and release sites, suitable source populations and necessary cooperators. While the characteristics of fisher reintroductions vary greatly, successful fisher reintroductions frequently involved: the most closely related (or nearest) source population, the release of >50 fishers, a female-biased (54%) founding population, the release of fishers in > 2 consecutive years, late fall or early winter releases, hard releases, and protection from commercial harvest but not from incidental capture. Implementation must involve the approval for use of the source population; capture, housing and transport of individuals; release protocols; monitoring; and contingency planning ability. The success of the reintroduction was frequently based on the documentation of survival, reproduction, or continued persistence or expansion of the reintroduced population. These population measures can be actively monitored via telemetry, mark-recapture, genetic sampling, track-plate and camera detections, or track surveys. Reintroductions are also important opportunities to conduct important research on population demography, multi-scale habitat use and selection, behavior, and food habits.

[Poster]

Feasibility Assessment for Reintroducing Fishers (*Martes pennanti*) to Washington

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Historical over-trapping, loss and fragmentation of low to mid-elevation late-successional forests (i.e., suitable habitat), predator and pest control campaigns, and incidental capture were the main causes of decline of the fisher population in Washington. Protection from trapping since 1934 has not resulted in the recovery of the population, which is now extirpated in Washington. Similar declines occurred throughout the fisher's range in North America. Reintroductions have reestablished fishers throughout much of their range. In 2002, a feasibility study was initiated to determine if a fisher reintroduction could be successful in Washington. A science team was assembled to design the study and provide oversight. A habitat assessment investigated the amount and distribution of suitable habitat, its connectivity via travel cover, and ability of large blocks of connected suitable habitat to support fisher populations. A genetics study evaluated the suitability of fishers throughout their range for reintroduction in Washington. A literature review evaluated the suitability of the existing prey base for a reintroduced population. The Olympic Peninsula was identified as the most suitable fisher reintroduction area based on amounts of suitable habitat and estimated carrying capacity. Fishers from British Columbia, California and Alberta are suitable for reintroduction; however fishers are available only from Alberta and possibly from British Columbia. An adequate prey base exists for a reintroduced population. Legal aspects, potential reintroductions scenarios, and potential stakeholders and cooperators were also investigated. A successful reintroduction appears feasible and a NEPA analysis for a proposed reintroduction on the Olympic Peninsula is currently underway.

[Oral Presentation]

California Department of Fish and Game: Roles and Information Needs in Forest Mustelid Conservation

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To fulfill its mission of managing California's biological resources, Department of Fish and Game staff work on several fronts; for fisher and marten, these include the following four general areas: (1) Information on the status of species is collected throughout the species' range and is collated by the Species Conservation and Recovery Program. To assess species' status, information is needed on the abundance and distribution of fisher and marten, and whether populations are currently self-sustaining, declining, or at risk of extinction. We also need information on the factors limiting populations, as well as information on unique populations (in terms of genetic structure, geographic range, behavior, etc.) that require special conservation efforts. (2) Department projects involving direct management of populations or individuals are carried out by the Wildlife Programs Branch or their regional counterparts. The most obvious project for fisher or marten would be the translocation of individuals to reestablish populations in areas no longer occupied by the species. This topic is covered in the presentation by Esther Burkett. (3) Review of projects on private or State lands for their potential to adversely impact species is conducted by the CESA/CEQA Permitting Program or their regional counterparts. In the case of fisher and marten, project review mostly involves private timber harvesting plans. For timber harvest plans, mitigations may be developed for projects with the potential for significant adverse effects on the environment. Thresholds of significance for fisher and marten have not been defined, but could be based on the known habitat requirements for these species. (4) Opportunities also exist for landscape, regional, or State-wide planning efforts for fisher and marten. Such planning efforts should focus on the maintenance of healthy, self-sustaining populations to preclude the need for listing as threatened or endangered. Information needed in this arena tends to be of the "How much is enough?" type. For example, what quantities should we manage for in terms of seral stage distribution and for resting/denning site density within a planning area?

[Poster]

Seasonal Distribution of Marten Detections in the Lassen Peak Region

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Biologists with the USFS Pacific Southwest Research Station (PSW) recently completed a systematic trackplate and TrailMaster camera survey of carnivores in California's Sierra Nevada ecoregion. One important finding was that in Lassen Volcanic National Park and the surrounding Lassen National Forest, marten were detected only within wilderness areas. This would represent a significant reduction of their distribution in this region. To verify these results, we collected and reviewed the data from other TrailMaster and trackplate surveys in the Lassen area. One systematic camera survey was conducted there in the summers of 2000 through 2002, roughly coincident with the PSW surveys. In addition, local agency biologists conducted opportunistic camera surveys for marten and other carnivores from 1992 through 2002. Unlike the systematic surveys, the opportunistic surveys were conducted in winter as well as summer, but their sampling effort was uneven temporally and spatially. These surveys totaled 998 baited camera stations distributed throughout much of the Lassen region. Marten were detected at 132 of these 998 cameras. The results from camera stations operated in summer supported the conclusions of the PSW survey, with all marten detections occurring within wilderness. In contrast, winter cameras routinely detected marten in several non-wilderness areas. It is unclear whether this difference is due to seasonal changes in marten distribution, unequal seasonal detectability by camera stations, or other sampling issues. Also unclear is whether other carnivores in the Lassen area show a similar seasonal pattern. We present several hypotheses and suggest future research to resolve these issues.

[Oral Presentation]

Evaluating the Demographic Factors that Affect the Success of Reintroducing Fishers (*Martes pennanti*) and the Effect of Removals on a Source Population

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In California, fishers persist only in northwestern California and in the southern Sierra Nevada. The population in the southern Sierra Nevada is assumed to be small and its ability to maintain itself is uncertain. That population could potentially benefit if supplemented by dispersal of fishers re-established in the northern Sierra Nevada. We modeled the northwestern and southern Sierra Nevada populations using Vortex to gain insight whether 1) re-establishing a fisher population in the northern Sierra Nevada Mountains feasible, 2) the fisher population in northwestern California can remain viable if fishers are removed for release elsewhere and 3) if fishers dispersing from a re-established
population in the northern Sierra Nevada reach the presently-isolated population in the southern Sierra Nevada would such dispersers benefit the southern population. We used probability of extinction as an index of population viability, not as a dependable estimate of that probability. Removal of up to 20 fishers per year for as long as 8 years from the northwestern California population is predicted to have little effect on the viability of that population. The probability of a successful reintroduction of fishers to the northern Sierra Nevada Mountains increases with the number of years that fishers are released and with the number of females released. Allowing dispersing fishers from a re-established population in the northern Sierra Nevada to reach the southern Sierra Nevada population reduced the probability of extinction for that Southern population. If reintroduction is to proceed, the next steps would be: (1) a more critical examination of the characteristics of the northwestern population to validate our modeling assumptions, (2) a thorough investigation of the distribution and abundance of habitat and prey in potential reintroduction areas, and (3) an evaluation of the genetic implications of transplantation.

[Oral Presentation]

Challenges to Designing Studies to Address Wildlife Response to Forest Management: Preliminary Results from a Study Examining the Effects of Fuels Treatments on Fishers

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Managing forest fuels and reducing the risk of wildfire is a priority for land management agencies, not only to reintroduce fire as an ecological process after decades of fire suppression, but to protect human communities within the forest matrix. Fishers are typically associated with structurally complex, dense-canopied forests with large trees, snags, and logs—habitat elements that are likely to be altered by fuels management. Designing studies to address fisher response to habitat alteration poses a challenge for researchers because fishers are secretive, have large home ranges, and are found at low densities. Traditional experimental approaches involving classical experimental designs are difficult or impossible to implement and may be cost prohibitive. We discuss problems such as the inability to randomly assign treatment and control groups, the lack of true controls, and difficulties in defining the treatment studied. We discuss one approach to addressing these problems that used a BACI (Before-After-Control-Impact) design that was implemented as a pilot study in 2005. We collected data on fisher use in three areas scheduled for treatment in the range of fishers in the southern Sierra Nevada and three control sites. We placed baited track plates at 50 randomly-selected points on each site and monitored them for 10 days, in both late spring and fall. Our response variable was the proportion of sample units with a detection and we wished to test whether changes in this proportion differed in treated areas compared to control areas. We found large variability in detection rates among the sites and there were no detections on some sites even though fishers had been detected there previously. Results indicate that implementing such a study on a large enough scale to detect a reasonable effect size with adequate statistical power would be challenging. We discuss alternatives to the approach we are using (i.e., telemetry-based methods, use of scat detector dogs) and contrast their advantages and disadvantages. We measured key habitat variables at each track plate and relate fisher presence/absence to habitat characteristics. These results help to further refine our knowledge of fisher foraging habitat.

[Poster]

Efficacy of Two New Hair-Snaring Devices to Survey and Identify Mesocarnivores Using DNA Analysis

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Commonly used methods to survey for forest carnivores – sooted track plates, remotely-triggered cameras and snow tracking – are useful to determine the presence of these species but do not provide information about density, abundance or relatedness. Genetic analysis of DNA from hair samples can furnish this information, including unambiguous identification to species, sex, and individual. We modified baited track plate enclosures so that they would snare hair by fitting them with either barbed wire strands or a glue pad. Enclosures also contained sooted track plates, which allowed us to independently verify the species of individuals that visited them. We compared the efficacy of the wire and glue snare methods at 3 locations chosen to maximize mesocarnivore detections, particularly fishers and American martens. Five species of carnivores were detected by both tracks and DNA analysis. Fishers and martens entered boxes with barbed wire snares more often (100% wire, 85% glue). Snare type did not significantly affect hair snaring rate for fishers, but wire was ineffective for martens. Track identification and genetic identification agreed in all cases where only 1 species had visited the enclosure. Glue snares appear to be the most effective method for collecting genetic material from both fishers and martens.

[Oral Presentation]

Conservation Genetics of Fisher and Marten: What We Know and What We Need To Learn

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Molecular genetics has provided a series of new tools to help understand the status of fisher (*Martes pennanti*) and marten (*Martes americana*). These tools are especially effective at understanding fisher and marten taxonomic designations, movement patterns, distributions, and abundances. Three sub-species of marten exist in California (*M. a. humboldtensis, M. a. caurina,* and *M. a. sierrae*), with the largest conservation concern occurring with the coastal species, *M. a. humboltensis*. Ongoing population genetic studies are characterizing the genetics of the recently discovered marten population in coastal California and its relationship to other populations. Otherwise, little work has been conducted on the use of molecular genetics or DNA-based surveys to evaluate marten status in California. This is in stark contrast to other sensitive marten populations (e.g., Newfoundland marten, *M. a. atrata*) and fisher (*Martes pennanti pacifica*) populations in California. Fisher have been the target of both systematic and non-invasive genetic sampling efforts to understand their sub-species designations, geographic range, abundance, movements, and patterns of genetic variation. These studies have shown not only the unique genetic signature of California fisher, but have also demonstrated the lack of genetic variation in some southern California fisher populations, suggesting isolation. Furthermore, ongoing research is actively deploying non-invasive genetic sampling devices to monitor fisher abundance and shifts in range. In this talk, I review the current state of knowledge about the conservation genetics of both California marten and fisher and discuss relevant finding from fisher genetics work in the Rocky Mountains. Furthermore, I describe a series of state-of-the-art molecular tools that can be used to gain a better understanding of marten and fisher genetic patterns and understand if these patterns have an ecological and evolutionary basis.

[Poster]

Regional and landscape habitat factors predict fisher distribution in California

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Using Generalized Additive Modeling, we analyzed field survey data and mapped environmental variables to predict the distribution of fisher (*Martes pennanti*) habitat in California, USA. We divided the study area, which spanned the recent historical range of fisher in the state, into Klamath/Cascades, northern Sierra Nevada and southern Sierra subregions. Fishers were not detected in the northern Sierra Nevada. For the other subregions, fisher occurrence was related to topography, forest structure and roads. Including a spatial autoregressive term significantly improved model performance for the statewide and Klamath/Cascades models. For statewide data, terrain ruggedness, tree canopy closure and distance from roads are positively associated with fisher occurrence. In the Klamath subregion elevation, relief, tree canopy closure and maximum tree size are significant predictors, compared to elevation, tree canopy closure, precipitation and distance from roads in the southern Sierra Nevada. Forest characteristics mapped from Thematic Mapper imagery performed as well or better than field vegetation data to predict fisher occurrence, reflecting the tradeoff between higher accuracy and precision of local-scale ground plots versus less accurate but broader landscape-scale characterization afforded by satellite remote sensing. The complete absence of fisher in the northern Sierra could be related to high road density, limited extent of late seral forest structure, and perhaps limited access to available habitat in the subregion due to the fragmenting effects of development, major roads and forest cutting.

[Oral Presentation]

New Habitat Models for American Martens in California

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Our understanding of the distribution and ecology of martens in California began with the expeditions of Joseph Grinnell and his colleagues in the early 1900s to collect specimens, interview trappers, and chronicle their and other's observations. A new phase of investigation of marten ecology began in the 1970s with the advent of radio telemetry which allowed researchers to intensively study individuals and the fine scale details of their ecology (e.g., activity patterns, diet, foraging areas, types of structures used as rest sites). Although these studies revealed new details about marten ecology, their cost and intensity prohibited large sample sizes or large study areas and they only occurred in a few habitat types. With the conclusion of commercial trapping and the growing awareness that sightings were an unreliable index to status, new efforts were needed to determine the distribution, habitat associations, and the effects of forest management. A century later we have returned to the extensive approach of Grinnell and colleagues, however with new tools, multi-species detection devices, and large-scale systematic sampling designs that allow us to contrast locations where martens do and do not occur, using environmental and species co-occurrence information. We present three studies that use large-scale systematic sampling with track plates to gather detection/non-detection data for martens across different regions of their range: 500 km^2 of mid-high elevation habitat (1,800-3,350 m) in Sequoia-Kings Canyon National Parks (SEKI) in the southern Sierra, 28,000 km^2 of low-high elevation (300-2,750 m) habitats of the northern Sierra and southern Cascade region (NSSC), and 800 km^2 of low elevation (<1300 m) coastal forests in northwestern California (NWCF). These efforts provide new insights at multiple spatial scales, such as the importance of dense spatially extensive shrub cover to martens in coastal forests, use of talus slope-sparsely forested complexes at high elevations, and the importance of large patches of old forest to the persistence of marten populations in California.

[Poster]

Genetic Differentiation of Martens (*Martes americana*) in Oregon and California – Does the Humboldt Marten Exist?

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The Humboldt marten (*Martes americana humboldtensis*) is endemic to the redwood region of California and southern Oregon and was common in the late nineteenth and early twentieth centuries. The subspecies dramatically declined due to intense trapping and was feared potentially extinct. In 1996 a population in Del Norte County, California was discovered inhabiting an area representing less than 5% of the historical range of the subspecies. Although this population occurs within the historical range of the Humboldt subspecies, these individuals could represent dispersers from adjacent populations of *M. a. caurina* or *M. a. sierrae* to the north and east, respectively. To address this problem we compared the mitochondrial DNA sequence diversity (1428 base pairs of the cytochrome b gene and control region) of martens from: (a) a contemporary sample of individuals from within the historical ranges of *M. a. humboldtensis* (N=14), *M. a. caurina* (N=5) and *M. a. sierrae* (N=5), and (b) a sample from a historical museum specimen of *M. a. humboldtensis* collected in 1927. The results indicated little genetic differentiation between *M. a. humboldtensis* and *M. a. caurina* (contemporary and historical samples). However, individuals representing these two subspecies were distinct from *M. a. sierrae*. These data suggest that contemporary martens in Del Norte County, California either represent individuals of a remnant population of *M. a. humboldtensis* or are dispersers from adjacent populations of *M. a. caurina* to the north. Martens from the adjacent population to the east (*M. a. sierrae*) do not appear to be dispersing into the population found in Del Norte County, California. Because there is little to no differentiation among individuals of *M. a. humboldtensis* and *M. a. caurina* (contemporary and historical samples), the taxonomic validity of these two subspecies will be discussed.

[Poster]

The Abundance and Density of Fisher (*Martes pennanti*) on Managed Timberlands in North Coastal California.

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A mark-sight technique was used to quantify the abundance and density of fisher on two 100-km^2 study sites in north coastal California. During late winter and early spring of 2002 and 2003, 36 fishers (19 females, 17 males) were live-trapped and marked with uniquely colored ear-tags. Trap success (fishers captured/trap night) was 1.9% and 2.6% in 2002 and 2003 respectively. Twenty-five individuals (19 females, 6 males) were equipped with radio transmitters. Twenty-nine of 36 fishers captured were adults, with 10 females lactating at the time of capture. Following each capture period, 22 remotely triggered cameras were monitored for 3-4 months on each study site. During the 2002 camera season, 153 fisher detections were documented. The detections included 43 marked and 110 unmarked fishers. During the 2003 season, there were 225 fisher detections, consisting of 154 marked and 71 unmarked fishers. Sighting success was high with all 10 males known to be using the sites detected at least once each season. Of the marked females known to be using the sites, 7 of 8 were sighted in 2002 and 12 of 13 in 2003. Because telemetry data on males was insufficient, density estimates were calculated only for females. Using a modified Bowden estimator, multiple estimates of female density were calculated for each site each year using three or four 4-week sighting periods and an annual estimate with all sighting periods combined. Annual estimates ranged from 8.43/100km^2 on the Korbel site in 2003 to 17.05/100km^2 on the Bald Hills site in 2002. Home range size was estimated using program CALHOME and the 100% MCP method for 15 fishers (11 females, 4 males) having 10 or more point locations. Male home range sizes varied from 357-2036 ha (mean=882 ha), while female home range size varied from 387-849 ha (mean=602 ha).

[Oral Presentation]

Short-Term Effects of Fire and Fire Surrogate Treatments on Fisher Habitat in the Sierra Nevada

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We examined the short-term effects of Fire and Fire Surrogate (FFS) treatments on fisher (*Martes pennanti*) habitat at 2 FFS sites in California's Sierra Nevada. Potential resource conflicts exist between maintaining habitat to support viable fisher populations in the Sierra Nevada and meeting fuels reduction and vegetation management objectives needed to protect mountain communities and reduce the likelihood of catastrophic fires. Blodgett Forest Research Station (BFRS) was the primary FFS site, and compared the effects of mechanical treatment, prescribed fire, and mechanical treatment followed by prescribed fire on various resources. The second FFS site was located at Sequoia-Kings Canyon National Park (SEKI) and focused on the timing of prescribed fire, comparing early season burns to late season burns. At each site, three replicates of each treatment and 3 control replicates were randomly assigned to treatment units ranging in size from ~15 – 30 ha. Within each treatment unit we collected habitat data at 10 plots prior to and following treatment implementation to assess effects on fisher habitat suitability. We assessed habitat suitability using Resource Selection Functions developed from radio-telemetry research and track plate surveys conducted in California from 1993-1997. By comparing differences in predicted probability of resource use before and after treatment implementation, we concluded that (1) FFS treatments resulted in significant short-term reduction in resting habitat suitability and on average canopy closure and (2) effects on foraging habitat were generally not significant. At BFRS the mechanical and mechanical plus fire treatments had the greatest effect on habitat suitability, while at SEKI late season burns had significantly greater impact on fisher habitat suitability than did early season burns. We provide suggestions to mitigate short-term effects on resting habitat suitability for fisher resulting from fuels management projects. Future resampling at the FFS sites will provide the opportunity to assess potential habitat improvement following the initial, short-term reduction in habitat quality.

[Oral Presentation]

Monitoring Fisher and Marten Populations and Habitat: I

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Assessing the status of fishers and martens calls for monitoring populations and habitats and, eventually, reconciling the results of both components. We present a framework for monitoring fisher populations in the western U.S. using the USDA Forest Service's ongoing Sierra Nevada monitoring program to illustrate the development and implementation of a bioregional monitoring effort. Fisher currently appear to be limited in distribution from Yosemite National Park south through Sequoia National Forest. During 2002 the Forest Service initiated a long-term fisher population monitoring program. The objectives of this program are to (1) detect a 20% decline in relative abundance of the southern Sierra population with 80% statistical power and (2) detect fisher population expansion to the central and northern Sierra should it occur. The index of relative abundance estimated annually is the proportion of sample units detecting fisher ($\hat{P}$). Each sample unit is centered on a Forest Inventory and Analysis (FIA) point and includes 6 baited track plate stations surveyed for 10 days; sample units are established at 5-10 km intervals across the region. Detecting population expansion into the central and northern Sierra uses identical survey methods, but relies on establishing sample units in areas assumed to be of high habitat quality. Preliminary results from 2002-2005 indicate that (1) fishers are well distributed in portions of the southern Sierra Nevada, (2) the fisher population has not expanded north of Yosemite NP, and (3) estimates of $\hat{P}$ range from 0.25 to 0.27. Recent advances in genetic sampling methods have encouraged us to incorporate genetic sampling into the existing monitoring program. This modification will allow us to estimate and monitor absolute abundance rather than an index of abundance, and may facilitate relating habitat conditions to population status. The framework we present can easily be modified for and implemented in other extant fisher and marten populations in the western US, though implementation requires considerable monetary commitment.

[Poster]

Distribution and Habitat Suitability for Fishers in the Eastern Klamath and South Cascades Bioregions in Northern California: Progress to Date

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Fishers occur over a large geographic region in California over which tremendous environmental gradients exist. Regional habitat models have been developed for the mesic northwestern Klamath-Siskiyou bioregion and for the southern Sierra Nevada, but we know very little about habitat associations in the unique xeric forest types found in the eastern Klamath and Cascades bioregions of northern California. This is the first regional sampling effort that is deliberately seeking balance between federal and non-federal lands and, thus, incorporates lands with a more complete range of past and current forest management objectives and practices. Our survey protocol is consistent with previous sampling and modeling efforts, and ongoing development of landscape habitat models being conducted at USDA Pacific Southwest Research Station. We are using a robust Primary Survey Unit design (8 visits each to 6 track plate stations) associated with Forest Inventory and Analysis (FIA) grid cells. Results of surveys will be used to develop a landscape suitability model that will identify areas of differential capability for fisher conservation and management. Information from previous survey efforts, which used other protocols, will be used to test our final model. This model will be used to inform regional managers responsible for making conservation planning decisions on federal and private forested landscapes in northern California.

[Oral Presentation]

Science as it Relates to Fisher and Marten Management: Public Lands

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Fishers and martens occur in California within the forested regions of the Klamath-Siskiyou, Northern Coast Range, Cascades and Sierra Nevada bioregions. Fishers occur where deciduous tree species constitute a significant portion of the forest and, thus, usually occur at lower elevations. Both species use large live and dead trees and logs for resting and denning locations. This characteristic, and their association with closed-canopy forests, is probably why these species are associated with late-successional forests. The fisher diet is more diverse than that of martens, but the diets of both species in California are surprisingly varied compared to elsewhere in their ranges. Public land managers have a special responsibility to ensure the persistence of these species. Initially, this responsibility was manifest by funding studies on basic ecology and summarizing professional opinion on the effects of timber harvest on martens and fishers. However, now that their general ecology is well understood, the focus has shifted to understanding the effects of specific management activities on them. Fishers occur at elevations where fire is a threat, so applied studies have begun to focus on the effects of fuels treatments. Martens, conversely, occur at elevations where forests are less prone to fire, but are vulnerable to the effects of recreational activities. Research should also shift to regional conservation planning to assure that populations are connected and that suitable habitat exists on public land to facilitate this goal. However, even the vast areas of public land are an insufficient planning template for these species. Private lands are especially important for martens within the range of the Humboldt subspecies and for fishers throughout their range. A unique consideration for martens is the effect that global warming may have on the distribution of the high-elevation forests. Martens and fishers are ideal focal species for land management planning. A responsible program to assure their persistence should include: (1) a comprehensive framework to monitor the status and trend in populations and habitats, (2) replicated studies on the effects of land management activities, and (3) new research on overlooked aspects of their ecology.

[Oral Presentation]

Monitoring Fisher and Marten Populations and Habitat: II

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Our view of a framework for assessing the status of fishers and martens calls for monitoring populations *and* habitats and, eventually, reconciling the results of both components. Although the most direct method for determining the status of a fisher or marten population is to assess the population itself (which will be discussed in the previous talk), we must also try to understand the *mechanisms* for changes in population status. Habitat, as an important dimension of the niche and the dimension that is affected most by land managers, can be an important predictor of population change. We evaluate various scales and components of habitat selection by fishers in the Sierra Nevada and suggest that, at a minimum, aspects of resting *and* landscape habitat suitability should be included in the habitat monitoring component. Foraging habitat appears to be easily accommodated in the Sierra Nevada, as indicated by habitat selected at track plate stations and the diverse diet of fishers in this bioregion. We propose to monitor resting and landscape habitat using models developed with institutionally available vegetation and topographic data. We will introduce our resting habitat suitability model which uses Forest Inventory and Analysis (FIA) plot data to predict suitability. We will also evaluate options that are being considered for the landscape habitat monitoring component. Neither component alone is a sufficient assessment of the habitat of fishers, so the results of each should be integrated to determine that both resting habitat and the surrounding landscape characteristics are met in any particular watershed. We will close by providing our vision for how the results of the habitat and population monitoring program could be used to affect management decisions at the level of projects and the level of a bioregion. The combined habitat and population monitoring framework we envision should be applicable to other fisher and marten populations in the western United States.

[Oral Presentation]

Interactions between Fishers and Martens in California and Implications for their Conservation

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The literature is replete with references to the potential for negative competitive interactions between the congeneric fisher and marten, usually with martens suffering from the interaction. The disadvantage held by martens in interference competition, however, is mitigated by deep snow which handicaps fisher movements. Previous work indicated that martens, both historically and during recent times, predominately occupied areas with the deepest snow (>23 cm per winter month) compared to fishers (<13 cm) and that the species distributions overlap where snow frequency is intermediate. In fact, snow may be as important a predictor of each species' occurrence as forest type – perhaps because the 2 factors are strongly correlated. The historical and contemporary ranges of fishers and martens appear parapatric in the Sierra Nevada, which is expected based on snow and vegetation associations. In coastal northwestern California, however, the distributions are more complex perhaps because high elevation, deep snow habitats are less common. Recent work suggests that dense shrub understory, rather than snow, may mitigate the competitive interactions between martens and fishers in this region. Reestablishing fishers in the Sierra Nevada has precipitated concern about the potential negative effects of a new population on martens. Although the elevational gradient favors coexistence, we explored the potential overlap using habitat models. Areas with the highest fisher habitat value, but relatively low marten habitat value were considered optimal locations to consider for further assessment. Areas with high fisher value, but near locations with high marten value were considered less ideal. We conclude our presentation by describing the 2 models used as input to this assessment, and then describe how they were integrated to identify 2 general locations that best reconcile the goals of fisher and marten conservation in the northern and central Sierra Nevada.