

The Status and Conservation of Mesocarnivores in the Sierra Nevada¹

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Carnivores play important roles in structuring communities, and their populations are useful indicators of ecosystem condition (Wennergren and others 1995, Buskirk 1999, Crooks and Soulé 1999, Terborgh and others 2001). As many as 4 of 20 native mammalian carnivore species have been extirpated from the southern Cascade Mountains and Sierra Nevada, with unmeasured effects on ecological communities. Given the loss of a number of significant carnivores from the system, understanding the status and ecological roles of the remaining species has assumed new urgency. Mesocarnivores (intermediate body-size mammalian carnivores; Buskirk and Zielinski (2003) are of particular importance because of their diversity and variety of ecological roles, and unlike the more conspicuous large carnivores, their populations can decrease with little notice.

Status

An essential step in assessing the status of wildlife populations is comparing current and historical distributions (Zielinski and others [In press]). Although site-specific autecological or demographic studies are important, they often lack the extensive spatial context to identify the effects of human activities on population size, trend, and distribution (for example, Kareiva and others 1997, Ceballos and Ehrlich 2002). Recent extensive mesocarnivore surveys in California, using baited track plates and cameras (Zielinski and Kucera 1995), provide an opportunity to evaluate changes in population distributions. Comparing the results of these surveys with historical distributions from the work of Grinnell and his colleagues in the early 1900s (Grinnell and Storer 1924, Grinnell and others 1930, Grinnell and others 1937) provides an opportunity to evaluate changes in carnivore distributions during a period of dramatic human influences on California forests.

Systematic surveys were conducted throughout the central portion of the Sierra Nevada Ecosystem Project area (Sierra Nevada Ecosystem Project 1996). A total of 334 sample units (six track plates and one camera station) were distributed at approximately 10-kilometer intervals from 1996 through 2002, and the species that made the tracks and visited these baited sites were identified. These surveys and other recent information indicate that two native mesocarnivores, the wolverine (*Gulo gulo*) and the Sierra Nevada red fox (*Vulpes vulpes necator*), have not been verified to occur in the Sierra Nevada for more than 60 years. Red foxes occur in the region of Lassen National Park (Kucera 1995; J. Perrine, pers. comm.), but they have not been genetically distinguished from the more common and exotic subspecies (Lewis and others 1995, J. Perrine, pers. comm.). Wolverines and Sierra Nevada red foxes were vulnerable to historical trapping; however, they are also described as being extremely sensitive to the presence of people (Grinnell and others 1937, Carroll and others 2001, Rowland and others 2003). Most of the native generalist mesocarnivores (gray fox

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[*Urocyon cinereoargentus*], striped skunk [*Mephitis mephitis*], spotted skunk [*Spilogale gracilis*], and ringtail [*Bassariscus astutus*]), and one large carnivore (black bear, *Ursus americanus*) appear to occupy regions today that were also occupied in the early 1900s (Zielinski and others [in press]). Over the same period of time, the distribution of two exotic and generalist species, the lowland red fox (*V. vulpes*; Lewis and others 1995) and the opossum (*Didelphis virginianus*; a non-carnivoran that is detected regularly at track-plate stations), have increased.

The regions currently occupied by two forest specialists, the fisher (*Martes pennanti*) and the marten (*M. americana*), appear to have decreased compared with their historical distributions (figs. 1 and 2). Fishers are apparently absent from the region from Mt. Shasta south to Yosemite, and martens are distributed patchily in the southern Cascades and northern Sierra Nevada. Fishers and martens are among the most habitat-specific mammals

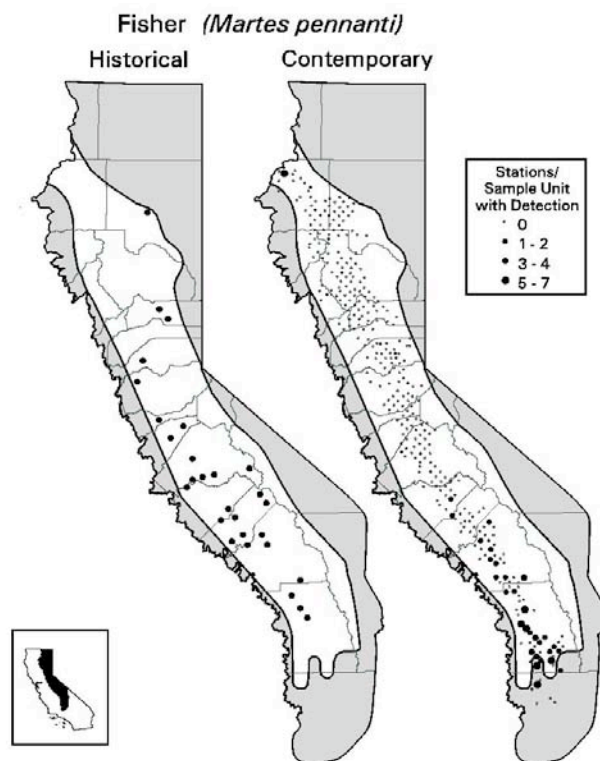


Figure 1— Historical and contemporary distributions of fishers within the Sierra Nevada Ecosystem Project (1996) planning boundary in California. The historical distribution is a combination of results derived from Grinnell and others (1937) and Grinnell and others (1930). Black circles in the historical map represent a single record (specimen or location of trapped animal) reported for the period of approximately 1919–1925. The contemporary distribution is the result of track-plate and camera surveys conducted from 1996 to 2002. Circles indicate sample units where six track plates and one camera were baited, scented with carnivore lure, and deployed for 16 days (112 sample days/sample unit). Small open circles indicate locations where fishers were not detected, and larger black circles indicate where fishers were detected at one or more stations (see key). Undulating lines indicate the distributional limits identified by Grinnell and others (1937); gray-scale areas are outside the distribution.

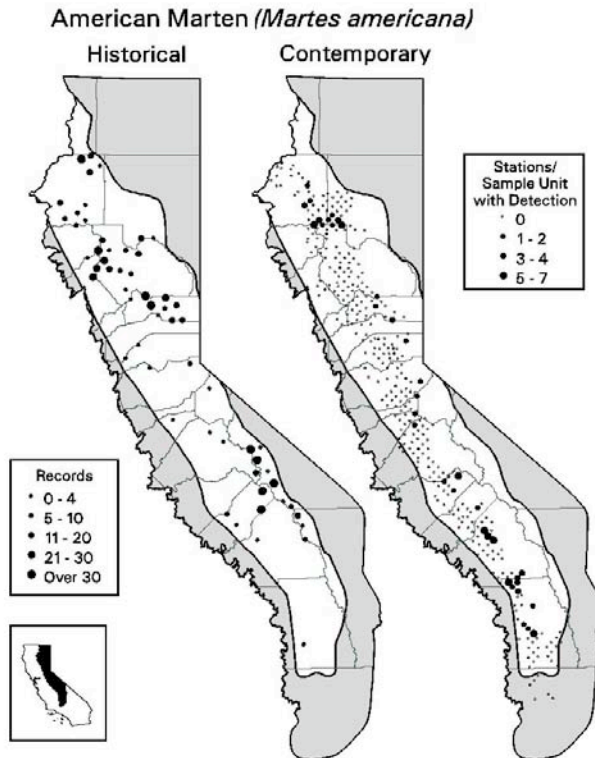


Figure 2— Historical and contemporary distributions of martens within the Sierra Nevada Ecosystem Project (1996) planning boundary in California. The historical distribution is derived from Grinnell and others (1937). Black circles in the historical map represent marten records (specimen or location of trapped animal) reported for the period of approximately 1919–1925 (see legend). The size of the circle reflects the number of individuals reported for that location. The contemporary distribution is the result of track-plate and camera surveys conducted from 1996 to 2002. Circles indicate sample units where six track plates and one camera were baited, scented with carnivore lure, and deployed for 16 days (112 sample days/sample unit). Small open circles indicate locations where martens were not detected, and larger black circles indicate where martens were detected at one or more stations (see key). Undulating lines indicate the distributional limits identified by Grinnell and others (1937); gray-scale areas are outside the distribution.

in North America, occurring primarily in contiguous mature forests in the western United States (Buskirk and Powell 1994, Powell and Zielinski 1994, Bissonette and others 1997, Powell and others 2003). In California, they are associated with mature forest conditions in the mixed conifer (fisher) and the true fir (marten) zones (Zielinski and others 1997). Each species predominantly uses large trees, snags, and logs as their daily resting sites (Spencer 1987, Zielinski and others 2004).

A comparison of the historical and contemporary distributions of martens indicates that they are currently absent, or at low densities, outside parks or other reserves in the northern part of the surveyed area (fig. 3). Martens are especially sensitive to forest fragmentation (Bissonette and others 1997), so this pattern may be due to the loss of old-growth and mature forests in the Sierra Nevada (Franklin and Fites-Kaufman 1996, Beardsley and others 1999), especially in the northern portion of the region (McKelvey and Johnson 1992). This assumption, however, needs to be validated by direct studies of marten habitat ecology in this area.

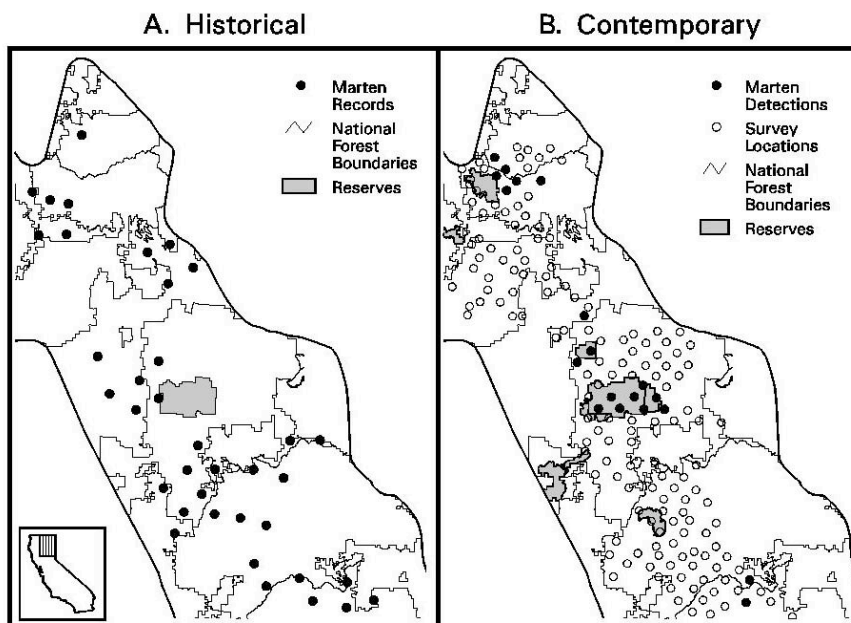


Figure 3— Exploded view of the historical boundary of the distribution of martens (Grinnell and others 1937) in the southern Cascades and northern Sierra Nevada region. Black circles in the historical map represent one or more record (specimen or location of trapped animal) at the location reported for the period of approximately 1919–1925 (Grinnell and others 1937). The contemporary distribution is the result of track-plate and camera surveys conducted from 1996 to 2002. Circles indicate sample units where six track plates and one camera were baited, scented with carnivore lure, and deployed for 16 days (112 sample days/sample unit). Open circles indicate locations where martens were not detected, and black circles indicate where martens were detected at one or more stations. Reserves are indicated in gray and indicate the boundaries of the national parks and wildernesses that were designated during the time period that each map reflects.

Fishers appear to be absent from an approximately 400-kilometer-long region of their historical range in the northern and central Sierra Nevada, producing a significant gap in their distribution in California (Zielinski and others 1995). The creation and maintenance of this gap are likely related to a combination of factors, which may include historical patterns of logging, trapping, and porcupine (*Erethizon dorsatum*) poisoning; deeper snows in the northern Sierra Nevada (Krohn and others 1997); greater density of human development and roads in northern portions of the range (Duane 1996); and the current distribution of other generalist carnivores (Campbell 2003). The current pattern may also be attributed, in part, to the constraints on movements—current and historical—imposed by the long, peninsular distribution of montane forests in the Pacific states (Wisely and others 2004). Historical and current distributions of fishers are not strongly associated with parks and wildernesses (*fig. 4*), unlike that described for the contemporary distribution of martens in the north. This is probably because fisher habitat occurs in mid-elevation forests in the Sierra Nevada (Grinnell and others 1937, Zielinski and others 1997), largely below the elevations of national parks and wilderness areas.

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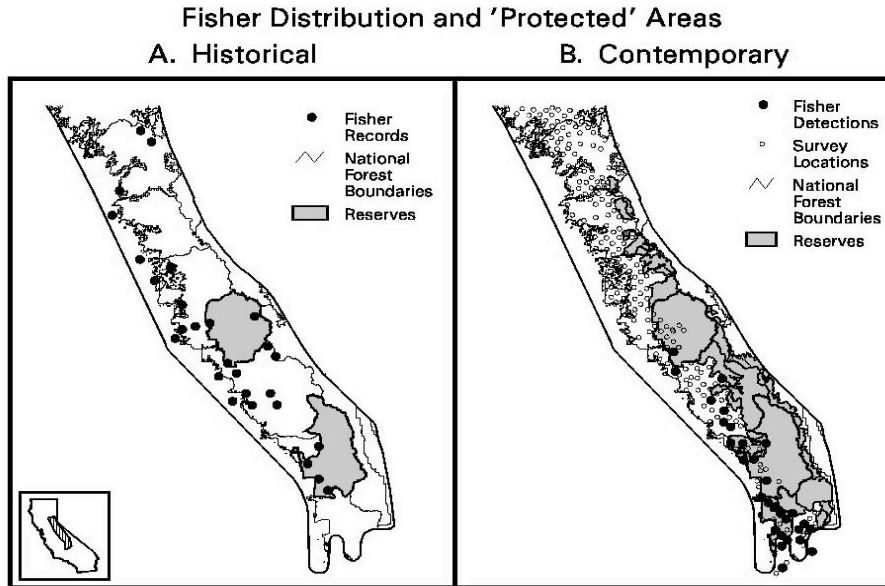


Figure 4— Exploded view of the historical boundary of the distribution of fishers (Grinnell and others 1937) in the central and southern Sierra Nevada. Black circles in the historical map represent one or more record (specimen or location of trapped animal) at the location reported for the period of approximately 1919–1925 (Grinnell and others 1930, Grinnell and others 1937). The contemporary distribution is the result of track-plate and camera surveys conducted from 1996 to 2002. Circles indicate sample units where six track plates and one camera were baited, scented with carnivore lure, and deployed for 16 days (112 sample days/sample unit). Open circles indicate locations where fishers were not detected, and black circles indicate where fishers were detected at one or more stations. Reserves are indicated in gray and indicate the boundaries of the national parks, national monuments, and wildernesses that were designated during the time period that each map reflects.

Conservation

Despite the extensive size of the Sierra Nevada, the conservation needs of wide-ranging carnivores (including the fisher and marten, which have disproportionately large home ranges for their sizes) should be considered over even larger bioregions (Noss and others 1996, Aubry and Lewis 2003). For example, only two native fisher populations occur in the Pacific states: one in the southern Sierra Nevada, and the other in the western California/Oregon border region (Aubry and Lewis 2003). Fishers are extirpated from Washington and most of Oregon, and populations are sparse in southern British Columbia (Proulx and others 2004). Studies have revealed genetic patterns that appear to be affected by the disjunct nature of fisher population distributions in the Pacific states and indicate reduced diversity in the southern Sierra Nevada population (Drew and others 2002, Wisely and others 2004). Population genetic data from fishers in the Pacific states (Wiley and others [unpublished draft]) suggest that dispersal is limited and that conservation strategies may need to encourage connectivity among the few remaining populations. The maintenance of

the southern Sierra Nevadan fisher population is important for its own sake, but it may also be critical to the conservation of fisher populations in the western United States.

Martens appear to be well distributed throughout most of their historical range in the interior western United States (Gibilisco 1994, Proulx and others 2004), and genetic studies have not reported results that indicate that marten populations are at risk there (Koepef 1998, Kyle and others 2000). However, the pattern of isolated groupings of detections in the Cascades and northern Sierra Nevada resembles that in other interior regions where local populations have been affected by fragmentation of mature forests (for example, in Utah: Hargis and others 1999).

A number of new research activities are under way to assist managers in evaluating the effects of land management practices on fishers and martens in California. These include (1) creating spatially explicit descriptions of suitable habitat for fishers and martens (Carroll and others 1999, Truex [in preparation], Campbell 2003) (2) developing an understanding of the role of other carnivores on the distribution of fishers (Campbell 2003), and (3) evaluating alternative designs for monitoring change in population status and habitat (Zielinski and Mori 2001). In 2002, the USDA Forest Service began implementing a plan to monitor the distribution of fishers and martens in the Sierra Nevada. This plan will provide annual estimates of the area occupied by each species and an index of population change. Although this program is an important precaution for assessing the unintended effects of land management on the habitats of these species, many questions about the effects of human activities on fishers and martens can be resolved only by initiating long-term studies on their demography and the relationship of population growth rates to the distribution and quality of habitat. These studies could also help identify natal and maternal den structures and document the dispersal routes used by juveniles to establish home ranges. This knowledge would allow managers to (1) protect the special habitat elements that these species require for reproduction and (2) create forest landscapes that facilitate the movements of dispersing juveniles. Both needs are critical to maintaining late-seral associated species on landscapes managed for multiple purposes.

Fishers and martens are important predators in dense, mature forests that have abundant, large standing and down woody material. Thus, providing habitat and restoring populations for these species are challenges in the face of growing human demands for timber, fuel reduction, and increased protection from the threat of wildfire. New studies, some of which are under way, will be necessary to understand the vulnerability of martens in the northern portion of the region to vegetation management activities and effects of fuels treatments on fisher habitat and catastrophic wildfire. The latter issue, in particular, will be difficult to resolve because fishers select dense stands as habitat in mid-elevation forests, where fire is a frequent threat to rural communities. Balancing the need to protect fishers and their habitat from the short-term effects of fuels treatments with the need to address the threat of wildfire will be a significant challenge.

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