

# The Relationship Between the Understory Shrub Component of Coastal Forests and the Conservation of Forest Carnivores<sup>1</sup>

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The physical structure of vegetation is an important predictor of habitat for wildlife species. The coastal forests of the Redwood region are highly productive, supporting structurally-diverse forest habitats. The major elements of structural diversity in these forests include trees, shrubs, and herbaceous plants, which together create three-dimensional complexity. In the forests of the northern Redwood region, dense, continuous shrub layers were common understory structural elements in mature forests (Sawyer and others 2000). However, within the last 60 to 80 years, most of these forests have been logged and subsequently managed on short rotations (for example, 60 years) to maximize the production of wood. This has resulted in a reduction in the complexity of shrub and herb layers in these forests due to a combination of detrimental factors (for example, mechanical damage, burning, herbiciding, competition for light with densely stocked stands, fragmentation by roads). We investigated the importance of shrub cover to three species of mesocarnivores, the American marten (*Martes americana*), fisher (*M. pennanti*), and gray fox (*Urocyon cinereoargenteus*).

To determine whether the distributions of mesocarnivores have changed since large scale changes in forest structure have occurred in the Redwood region, we compared the historical distributions of each of the three mesocarnivore species to their contemporary distributions in Northwestern California. For historical information we used the records from Grinnell and others (1937), which covered the period from 1919 to 1924 in California. To determine contemporary distribution we conducted surveys using two, five, and 10 km systematic grids, with two track plates at each two km grid point and six track plates at each five and 10 km grid point; each station was surveyed for 16 consecutive days (see Zielinski and others 2000). From 1995 to 2002, we sampled 493 sample units, composed of 1,920 individual stations, representing 30,720 survey days.

American martens were historically found within coastal forests (redwood and Douglas-fir types) from near the Oregon border to northwestern Sonoma county; most records (20 of 24) occur within  $\leq 25$  km of the coast. Contemporary detections of martens were limited to a single population, occupying an area equivalent to less than five percent of its historical range. Fishers were historically found in more interior forests with nearly all records (50 of 51) occurring  $\geq 25$  km from the coast. However contemporary detections of fishers occurred commonly in both interior and near coast forests with 30 of 76 (39 percent) stations  $< 25$  km and 68 of 377 (18

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percent) >25 km detecting fishers. Most historical records of gray foxes occurred in interior forests (78 of 100), but clusters of records occurred in near coast areas with naturally mixed habitats (for example, forest and oak woodland or forest and estuarine) such as the Humboldt bay vicinity. Contemporary detections of gray foxes also occurred commonly in both coastal and interior forests, with 14 of 50 (28 percent) sites <25 km and 38 of 177 (21 percent) >25 km detecting gray foxes. Thus, by comparing historical and contemporary information, the distribution of the marten has dramatically declined in near coast forests while the fisher and gray fox have maintained their interior distributions and now appear to have expanded their distributions in coastal forests.

In an investigation of habitat use by the remnant population of martens, Slauson (2003) found that stands of old growth conifers with dense, spatially extensive shrub cover were most often selected. This population occupies the largest remnant area of late-successional dominated coastal forest within its historical range. Fishers and gray foxes were rarely detected within this region, despite being commonly detected in adjacent areas that are either more interior, or in logged coastal forest landscapes. Martens show the strongest selection for stands with >80 percent shrub cover and select against stands with <60 percent shrub cover. Both fishers and gray foxes show selection against stands with shrub cover >80 percent and use sites with <60 percent in proportion to availability.

The shrub layers used by martens in coastal forests are typically dominated by salal (*Gautheria shallon*), rhododendron (*Rhododendron macrophyllum*), evergreen huckleberry (*Vaccinium ovatum*), and huckleberry oak (*Quercus vaccinifolia*). Overall in unlogged sites, mean shrub cover naturally declines with increasing distance from the coast (table 1). At 20 km from the coast shrub cover is at the lower end of shrub cover used by martens and begins to enter the range used more by the fisher and gray fox. However, in logged sites shrub cover is significantly reduced in the five to 20 km region that naturally supports denser shrub cover. This has created conditions in the near coast region that now appear more suitable for use by the fisher and gray fox and less unsuitable for the marten.

**Table 1**—Mean shrub cover (SE) for unlogged and logged stands and their distance from the coast.

	Distance from coast (km)							
	5	10	15	20	25	30	35	>35
Percent unlogged (n = 584)	92 (1.7)	86 (2.0)	77 (2.6)	59 (3.8)	66 (3.2)	53 (3.2)	54 (7.0)	34 (1.9)
Percent logged (n = 218)	55 (6.1)	57 (5.0)	50 (5.3)	46 (4.4)	60 (6.6)	72 (6.8)	34 (13.9)	44 (7.4)

The distributions of several mesocarnivore species have changed over the last 80 years, perhaps in response to the changes in understory forest structure we have described here. Two species, the fisher and the gray fox, now appear more common in redwood forest types than in the early 1900s. Both of these species typically occupy forest types interior to the redwood region where understory shrub densities are naturally lower and are absent or rarely detected within coastal forest habitats with dense, spatially-extensive shrub cover. The American marten has disappeared

from >95 percent of its historical range within the redwood region, in part due to over-trapping (Zielinski and others 2001). It currently only occurs in coastal forest habitats with dense, spatially-extensive shrub cover. The smaller-bodied marten may be able to more effectively forage within the dense shrub layers than fishers or gray foxes. Dense, spatially-extensive understory shrub cover may play an important role in structuring the mesocarnivore community in coastal forests of the Redwood region. The cover of mature shrub communities may be critical to the restoration of the American marten across this region. Strategic restoration and management efforts will be necessary to return this natural structural element where it has been lost.

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