old-growth cover and the presence of coastal redwood were the strongest predictors of murrelet presence.

Nests have been located in forested areas dominated by coastal redwood, Douglas-fir (*Pseudotsuga menziesii*), mountain hemlock (*Tsuga mertensiana*), Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), and western redcedar (*Thuja plicata*) (Binford *et al.* 1975; Quinlan and Hughes 1990; Hamer and Cummins 1991; Singer *et al.* 1991, 1992; Hamer and Nelson 1995b). Individual nests in Washington, Oregon, and California have been located in Douglas-fir, coastal redwood, western hemlock, western redcedar, and Sitka spruce trees.

For nesting habitat to be accessible to marbled murrelets, it must occur at a distance from the marine environment consistent with the flight and energetic capabilities of the species. The farthest inland distance for a known occupied site is 84 kilometers (52 miles) in Washington. The farthest known inland occupied sites in Oregon and California are 61 and 56 kilometers (38 and 35 miles), respectively. Occupied sites are defined as forest stands where marbled murrelets have been observed exhibiting behaviors generally associated with nesting. Additionally, detections (not occupied sites) have been documented farther inland in Oregon (K. Nelson, pers. comm. 1995).

Marbled murrelet nests are difficult to locate for several reasons—(1) nests are generally located high in the canopy; (2) adults and juveniles have cryptic plumage during most of the nesting season; (3) adults can be extremely quiet in the vicinity of nests; and (4) adults may show activity near the nest only once per day, usually under low light conditions. Therefore, identification of occupied sites and suitable nesting habitat are the best indicators of potential nest sites. Indicators of occupied habitat include active nests; egg shell fragments; young found on the forest floor; marbled murrelets seen flying through the forest beneath the canopy, landing in trees, circling above the canopy, and calling from a stationary perch; or large numbers of murrelets heard calling from in and around a stand.

Inland, marbled murrelets are generally easier to detect at high-use sites during the spring and late summer when breeding activities peak (Paton and Ralph 1988; Nelson 1989). Inland detections of the species are less frequent during the early fall when murrelets have presumably completed breeding and are undergoing a flightless molt at sea. Similarly, detections are more difficult in areas that support low numbers of reproducing pairs.

Marbled murrelets spend most of their lives in the marine environment where they consume a diverse group of prey. Maintaining areas that support populations of prey species juxtaposed with nesting areas are essential to maintaining successfully reproducing marbled murrelet populations (Burkett 1995). Murrelets often aggregate near local food concentrations, resulting in a clumped distribution in the marine environment (Sealy and Carter 1984). Prey breeding areas (e.g., near-shore kelp beds, sand or gravel beaches, sand banks, etc.) and areas where prey may concentrate (e.g., near-shore upwellings, waters at the mouths of bays and coastal rivers, eddies in the vicinity of headlands, river mouths and associated plumes, and tidal rips, etc.) are likely the most important features determining murrelet foraging opportunities (Ainley et al. 1995; Hunt 1995). Human-caused disturbances (e.g., intense commercial or recreational fishing) may affect prey density or accessibility.

Most of the information available about prey species of marbled murrelets is from the Gulf of Alaska and British Columbia, and is summarized by Burkett (1995). Marbled murrelets generally forage in near-shore marine waters at distances of 0.3 to 2 kilometers (0.2 to 1.2 miles) from shore; however, they occur at distances up to 24 kilometers (14 miles) from shore in reduced numbers. Marine systems producing sufficient prey to support marbled murrelets provide suitable foraging habitat for the species.

Marbled murrelets have been reported feeding on a wide variety of small fish and invertebrates, indicating their flexibility and capability to use alternative prey sources. Prey include Pacific sandlance (Ammodytes hexapterus), Pacific herring (Clupea harengus), northern anchovy (Engraulis mordax), osmerids, sea perch (Cymatogaster aggregata), euphausiids (Euphausia pacifica and Thysanoessa spinifera), mysids (Neomysis spp.), and amphipods, among others (Sealy 1975; Sanger 1987; Sanger and Jones 1981; Carter and Sealy 1990; Strong et al. 1993; Burkett 1995). Fish are an important component of the diet during the summer, which coincides with the nestling and fledgling periods, while euphausiids, mysids, and amphipods seem to be more important in the winter and spring in some areas (Munro and Clemens 1931; Sealy 1975; Krasnow and Sanger 1982; Sanger 1983, 1987; Carter 1984; Carter and Sealy 1990; Vermeer 1992; Burkett 1995).

Prior to euroamerican settlement, nesting habitat for the marbled murrelet was well-distributed, particularly in the wetter portions of its range in Washington, Oregon, and California. This habitat was generally found in large, contiguous blocks as described under the Management Considerations section of this proposed rule. The Recovery Team considered the loss of habitat to be one of the primary factors limiting current population size from British Columbia to California.

Currently, breeding populations of marbled murrelets are not distributed continuously throughout the species' range. Little habitat remains at low elevations in Washington's Puget Trough. Lands surrounding the Puget Trough, particularly to the east and south, are highly urbanized, developed for agricultural use, or contain young forests, forcing marbled murrelets to fly up to 42 kilometers (25 miles) inland to reach the first-available suitable nesting habitat.

Off the Oregon and California coasts, three areas where marbled murrelets are concentrated at sea correspond to the four largest remaining blocks of coastal older forest inland. These blocks of older forest are separated by areas of little or no habitat that correspond to areas where few marbled murrelets are found at sea (Strong *et al.* 1995; Varoujean and Williams 1995; Ralph and Miller 1995; Ralph *et al.* 1995b).

The area between the Olympic Peninsula in Washington and Tillamook County in Oregon (160 kilometers (100 miles)) contains few occupied sites or sightings of marbled murrelets. In California, approximately 480 kilometers (300 miles) separate the large breeding populations to the north in Humboldt and Del Norte Counties from the southern breeding population in San Mateo and Santa Cruz Counties. Currently this reach contains few marbled murrelets; however, the area likely contained significant numbers of marbled murrelets before extensive logging (Paton and Ralph 1988, Larsen 1991). The degree of interaction that occurs across these areas containing few murrelets is unknown.

Marbled murrelets are affected by impacts to their nesting habitat, marine foraging habitat, and food supply, as well as direct mortality from human activities such as oil spills and gill nets. Based on analyzing likely ranges of fecundity and survivorship of this species, Beissinger (1995) estimated that marbled murrelets in Washington, Oregon, and California are most likely declining at a rate between 4 and 6 percent per year.