

western gray squirrels were detected in WDFW surveys in Thurston County (D. Brittell, *in litt.* 2002). Isolated occurrences have been reported in the past in Grays Harbor and Lewis Counties (WDFW 2002), and more recently in Clark County (Tracy Fleming, National Air and Stream Improvement Council, pers. comm. 2003). In 2002, fewer than a dozen sightings of western gray squirrels were reported (Dave Clouse, Fort Lewis, pers. comm. 2003).

Although the western gray squirrel was once common on the partially wooded prairies adjacent to Puget Sound, the surviving Puget Trough population is now centered on Fort Lewis in southern Pierce and northern Thurston Counties where the largest area of oak woodlands remains. From 1992 to 1993, 156 western gray squirrel observations were documented on 169 sites on Fort Lewis. These observations were estimated to represent 81 individual western gray squirrels on 44 oak-conifer sites (Ryan and Carey 1995b). During intensive surveys in 1998 to 1999, only 6 western gray squirrels in only 4 percent (5 of 133) suitable habitat stands were detected in over 4,000 hours of survey effort. The researchers concluded that the low western gray squirrel population on Fort Lewis is at a high risk of extirpation (Bayrakçi *et al.* 2001). Subsequent western gray squirrel sightings included 3 (including 1 road kill) in 2000 and 11 (including 1 road kill) in 2002 (D. Clouse, pers. comm. 2003). Factors that may have influenced the decline of western gray squirrels on Fort Lewis include (1) poor acorn crops or undependable food resources; (2) drought and unavailability of water in many oak ecotones; (3) road kills; (4) competition with eastern gray squirrel and Douglas' squirrels (*Tamiasciurus douglasii*); (5) reduction in quality and quantity of oak habitat; (6) diseases and parasites; and (7) predation (Carey and Harrington 2001).

From 1993 to 1995, The Nature Conservancy of Washington conducted surveys, analyzed nest trees, and trapped western gray squirrels on McChord Air Force Base (McChord AFB) adjacent to Fort Lewis. Fifteen observations of western gray squirrels occurred at 6 different locations on McChord AFB. Most of these observations (13) occurred in 1993, with the remaining two observations occurring in 1995; none were observed in 1994 (The Nature Conservancy of Washington and Washington Natural Heritage Program 1996). They hypothesized that western gray squirrels were dispersing from Fort Lewis to

McChord AFB to use acorns and other food resources when available, but only when environmental conditions were favorable (e.g., when water sources are available in wet years). In the mid-1990s, a western gray squirrel occupied a nest box erected for American kestrels (*Falco sparverius*) on McChord AFB. Two or three western gray squirrels were seen in 1995, and possible western gray squirrel nests were found in 1996 (McChord AFB 2002). Although western gray squirrels were previously found on private lands, the last observation of western gray squirrels on private lands adjacent to the military bases was in 1990 (WDFW 2002).

The western gray squirrel in the Puget Trough of western Washington persists in a transitional ecological setting, in comparison with the subspecies' populations elsewhere in its range. Western gray squirrels in the Puget Trough occupy an ecotone (transitional) habitat composed of Oregon white oak woodlands situated between upland Douglas-fir forests and prairies (Ryan and Carey 1995; Bayrakçi *et al.* 2001). Here, scattered woodlands of Oregon white oak and Douglas-fir encircle the prairies (WDW 1993).

This western gray squirrel population, located at the northwestern limits of the subspecies' range, occur in habitat that closely conforms to the distributional range of the Oregon white oak. The western gray squirrel ranges only as far north in the Puget Trough as the northern limit of the continuous distribution of Oregon white oak on the gravelly prairies just south of Tacoma (Dalquest 1948; Larrison 1970; Stein 1990; WDW 1993). While the Puget Trough area is essentially the northwestern limit of the continuous range of the Oregon white oak, it does occur in discontinuous patches further north on the islands of Puget Sound and, in British Columbia, Canada, on Vancouver Island and in two disjunct stands on the mainland (Stein 1990).

Geologic and floristic evidence indicates that Oregon white oak associations have evolved through successive eras as components of relatively arid pine forest that repeatedly advanced northward from a locus in the southwestern U.S. and northwestern Mexico as climates warmed and retreated as climates cooled. The most recent northward expansion ended about 6,000 years ago (Stein 1990). Pollen spectra samples show that oak communities were common around Puget Sound during the warm, dry post-glacial period 10,000 years ago. Subsequent trends toward cooler and moister conditions have influenced the replacement of Oregon

white oaks by conifers (Stein 1990; Agee 1993; WDW 1993).

Prehistorically, the "Tacoma prairies" once occupied the lowland areas of Pierce and Thurston Counties in the Puget Sound region of the Puget Trough, with a southward finger into Lewis County; prairies intermittently reappeared in Clark County down to the Columbia River (Kruckeberg 1991). This landscape feature of the Puget Trough consists of a mosaic of prairie, oak woodland, and open forest called a "gravelly outwash plain." The gravelly outwash prairies coincide with the southern terminus of the last continental ice sheet during the Vashon glaciation, which ended 15,000 years ago (Kruckeberg 1991).

Although the Puget Trough of western Washington has a wetter climate than occurs in much of the Oregon white oak range, the Puget Sound area is near sea-level and has a warm, relatively dry climate because of the Puget Sound and the surrounding mountain ranges (Thyssel and Carey 2001). The Puget Sound region is included in the *Tsuga heterophylla* (western hemlock) Zone, with many of the same plant communities. Large areas in this region, however, differ from the surrounding plant community types in that prairie, oak woodland, and pine forest are encountered. These plant-community type differences, related to both climate and soil, include Oregon white oak stands and prairies being invaded by Douglas-fir and the occurrence of species rarely or never found in western Washington or northwestern Oregon (Franklin and Dyrness 1988).

As previously discussed, western gray squirrels depend primarily on acorns and pine seeds (Sumner and Dixon 1953; Kruckeberg 1991; Carraway and Verts 1994). Because of the wetter climate and flatter topography of the Puget Trough in comparison with the rest of the western gray squirrel range, the habitat is more homogeneous, and there are fewer mast-producing trees (C. Maser, pers. comm. 2003). Consequently, in this region, the success of the western gray squirrel is probably more intimately tied to the success of Oregon white oak because it provides an essential winter food item for this squirrel.

Elsewhere in the subspecies' range, Oregon white oaks occur in communities that include a wider range of mast-producing tree species. In western Washington, the western gray squirrel depends primarily on Oregon white oak, Douglas-fir, and where available, ponderosa pine (*Pinus ponderosa*). In Oregon, the western gray squirrel diet includes seeds from a