

Lorreen Ryan
8120 Libby Road Northeast
Olympia, Washington 98506

Ecology of the Western Gray Squirrel in the South Puget Sound

Lorreen A. Ryan

Abstract

The western gray squirrel, *Sciurus griseus*, was one of the most common mammals in the Northwest. Recently it has become rare and been accorded a “threatened species” by the State of Washington. The western gray squirrel occurs in California, Oregon and Washington, with its distribution in the Puget Trough centered at Fort Lewis and McChord Air Base. The western gray squirrel uses the ecotone of Oregon White Oak and Douglas-fir. It requires continuous canopy of these trees since it prefers arboreal travel. Food sources are varied and include truffles, mushrooms, acorns, and other seeds and nuts. Western gray squirrels scatter hoard, burying individual acorns in the soil and relocating them through smell. Tree cavities and stick nests are used over winter, to rear young and rest to rest during the day, especially summer days. Predators are varied, including domestic dogs and cats. Automobiles may affect squirrel numbers, especially during peaks of juvenile dispersal. Potential management activities include increased monitoring to determine locations of squirrels, public awareness and education and controlling introduced squirrel species.

Status and Distribution

The western gray squirrel was one of the most commonly seen mammals in the northwest (Bowles 1921). Recently, however, the state of Washington accorded a “threatened species” status to the western gray squirrel, *Sciurus griseus* due to loss of oak habitat, fluctuating food supplies, disease, and illegal hunting (Washington Department of Wildlife 1993). Their range in Washington now consists of small, scattered populations that primarily follow the range of Oregon white oak *Quercus garryana*. There are three major subpopulations in Washington (Rodrick 1986): one in Klickitat County, along the southern Columbia River, a second in Okanogan and Chelan Counties along the northern Columbia River basin, and a third in Thurston and Pierce Counties in the Puget Trough. The later population seems to be centered on Fort Lewis, an 86,000-acre military reservation.

Description

The western gray squirrel is the largest native tree squirrel in Washington. It is silver gray with dark flanks and creamy white underparts. Adults may weigh 17.6 to 33.4 ounces (Asserson 1974, Barnum 1975, Gilman 1986) with total body lengths (including tail) ranging from 19.7 to 23.6 inches (Barnum 1975). There is no apparent sexual dimorphism.

The western gray squirrel resembles the eastern gray squirrel, a common squirrel of the Eastern United States that has been introduced into the range of the western gray (including the Puget Trough). The two squirrels are similar in appearance, but the eastern grays are smaller, have less prominent tails, and have rufous (reddish-brown) coloration on the head, back, flanks, and underparts. The eastern and western gray squirrel differ markedly in their evolutionary relationships. The eastern gray

is in the subgenus *Neosciurus* (Hall 1981) and is related to the fox squirrel of the Eastern United States and the red squirrel of Europe. The western gray squirrel is in the subgenus *Hesperosciurus* and is related to Abert's squirrel of the Rocky Mountain west and southwest (Wade and Gilbert 1940).

Life History

Breeding occurs from January to September in western Washington. A litter of two to five young is born after 44 days' gestation (Ingles 1965). Most researchers believe that females produce only one litter per year. Young may be seen outside the nest starting in mid-March (Ingles 1965). Males reach sexual maturity by 1 year of age, females at 10 to 11 months of age.

Activity

Western gray squirrels are active throughout the day. They are most active in the morning, alternate resting and activity throughout the day, and decrease or cease activity late in the day. No nocturnal activity has been observed. Activity periods are influenced by food availability, competition, disturbance, and weather conditions (Cross 1969). Squirrels are active all year long but are most visible in August and September when they are collecting acorns (Ryan and Carey 1995b).

Habitat

In most of Washington, western gray squirrels inhabit conifer-hardwood forests with Oregon white oak (Cross 1969). In the Puget Trough, squirrels inhabit Douglas-fir-Oregon white oak woodlands. Dominant understory vegetation includes Scot's broom, snowberry, California hazel, indian plum, and swordfern. Oak stands are most commonly located on the edges of Douglas-fir stands, prairies, ponds, and wetlands.

Characteristics of Oak Woodlands Important to Western Gray Squirrels.

Squirrels use oaks for food, seasonal cover, arboreal travel, and escape routes. Conifers provide cone seed, truffles (Luoma 1991), nest sites, and year-round escape cover. In the Puget Trough, squirrels are seen most often in the ecotonal (transitional) areas between Oregon white oak and Douglas-fir stands and in stands where oak and Douglas-fir are interspersed with other species of hardwoods and conifers (Ryan and Carey 1995a). Tree and shrub species common in oak stands with western gray squirrels include bigleaf maple, vine maple, Oregon ash, indian plum, and California hazel. These stands had connected tree canopies that allow for arboreal travel and patchy understory with a variety of food-producing trees and shrubs. Foster (1992) found that an important feature of western gray squirrel habitat is a continuous tree canopy that allows for arboreal travel for at least 66 yards around nest sites. Squirrels generally do not cross open prairies to use isolated trees (Barnum 1975).

Food Habits

The western gray squirrel diet may include hypogeous fungi (truffles and false truffles), epigeous fungi (mushrooms), acorns, seeds and nuts of trees and shrubs, fleshy fruits, and green vegetation. Acorns and conifer seed are important in summer, fall, and winter. Western gray squirrels, like many tree squirrels, cache food for use over the winter, but instead of collecting acorns and cones in a central location like red squirrels and Douglas squirrels, they bury them individually in holes 1.5 to 2.0 inches underground (scatter hoard) and relocate them by smell (Gurnell 1983). Stienecker and Browning (1970) concluded that acorn and pine seed may be more critical in the diet than fungi because acorns and seeds are high-energy foods that prepare squirrels for

overwintering. Fungi cannot be stored for winter use, but can provide seasonal food, especially when the mast (seed and nut) crop is low. Squirrels, being food opportunists also will eat buds, forb foliage, stems, and shoots all year, especially when mast is in short supply (Gurnell 1983, Stienecker 1977, Stienecker and Browning 1970). Western gray squirrels have been observed stripping bark from upper sections of redwoods (Ingles 1947), and ponderosa pine (Cross 1969) to eat the cambium layer inside the bark. Ryan and Carey (1995a) observed one incident of several young squirrels stripping bark off of young Douglas-fir trees in summer.

In general, the diet of western gray squirrels in the Puget Trough consists of acorns from late summer through early spring; mushrooms and truffles mostly in the spring and fall; Douglas-fir seed from late summer through fall; and succulent vegetation from late spring through early summer. Most foraging occurs on the ground except in the fall when squirrels are in trees gathering acorns or cones for winter storage (Foster 1992). Squirrels may drink from permanent and intermittent water sources such as lakes, marshes, rivers, streams, or puddles.

Den sites

Western gray squirrels use both tree cavities and stick nests. They use tree cavities created by other species and “natural” cavities formed by decay (Brown 1985). Squirrels may use tree cavities in the winter and for rearing young (Cross 1969, Maser and others 1981).

Stick nests are of two general types: large, round, twig-and-leaf nests, constructed with a thick roof for winter use and rearing of young; and, loosely constructed platforms of leaves, used as temporary, summer, or alternative, nests (Foster 1992). Platform nests are used for resting during the day, especially in summer (Cross 1969). Nests

are made with sticks, twigs with leaves, mosses, and lichens, and are lined inside with mosses, lichens, and shredded bark (Maser and others 1981).

Stick nests usually are occupied by only one squirrel at a time (Gilman 1986). Cross (1969) notes several incidents of two young squirrels staying in the same nest. Squirrels commonly use many stick nests (Cross 1969, Foster 1992). A squirrel may use one nest during the day and another at night (Gilman 1986).

In the Puget Trough region, western gray squirrels, Douglas’ squirrels, and northern flying squirrels use similar nests. Most are found in Douglas-fir trees in forks of branches.

Mortality Factors

Predators. Potential predators in the Puget Trough include the red-tailed hawk, great horned owl, coyote, gray fox, and domestic dogs and cats. Automobiles are a serious threat to squirrels in the Puget prairie region. Ryan and Carey (1995b) found 13 squirrels dead on roads on Fort Lewis. Automobiles could affect squirrel numbers, especially during peaks of gestation and juvenile dispersal. Of the thirteen dead squirrels, eleven were found from April through August: two were pregnant females, a third was lactating, and four were juveniles.

Disease. Diseases and parasites of western gray squirrels include notoedric mange (scabies), coccidiosis, western equine encephalitis virus, fleas, ticks, mites, intestinal roundworms, and ringworm. Mange reached epidemic proportions in 1917 and in the late 1930s and is still present at low levels today. Ryan and Carey (1995b) found no signs of disease in Fort Lewis squirrels.

Competition

Competitors for food and nest sites in the Puget Trough include eastern gray squirrels, Townsend's chipmunks, Douglas' squirrels, northern flying squirrels, black-tailed deer, Stellar's and scrub jays, common crows, and northern flickers.

Eastern gray squirrels were introduced into Washington for sentimental and aesthetic reasons. They evolved in the extensive deciduous forests of the Eastern United States but have been able to proliferate in areas of the West, including western Washington. Eastern gray squirrels survive in natural wildland communities but are most common in human-dominated areas such as orchards, parks, college campuses, and suburbs. Because the eastern gray squirrel is more ecologically more flexible than the western gray squirrel, it has moved into areas that were occupied by western gray squirrels prior to human disturbance. They may produce two litters of young per year, whereas western grays generally produce only one litter per year. They may compete with western grays for acorns, conifer seeds, and fungi.

Eastern gray squirrels are common on Fort Lewis, particularly in the housing areas. They also were trapped in several areas occupied by western gray squirrels (Ryan and Carey 1995a)

Douglas' squirrels, northern flying squirrels, Stellar's jays, and Townsend's chipmunks are also common on Fort Lewis. Douglas' squirrels use similar nest sites and eat many of the same foods as western gray squirrels, including acorns, maple samara, and Douglas-fir seed. They can be aggressive towards western grays and were seen chasing western grays on Fort Lewis (Ryan and Carey 1995a). Northern flying squirrels use similar nest sites and fungi but probably provide little direct competition. Stellar's jays compete for acorns and will aggressively dive and strike at western gray

squirrels. Townsend's chipmunks compete for acorns, fungi, and conifer seed.

Limiting Factors

Factors that limit the abundance of western gray squirrels include 1) availability of oak-conifer habitat, 2) year-round food supply, 3) dispersal and mortality, and, 4) competition from introduced species.

Western gray squirrels prefer to use oak stands that are greater than five acres in area and within 430 yards of a water source (Ryan and Carey 1995b). Gurnell (1983) found that the density and diversity of mast-bearing trees influence the long-term densities of western gray squirrels and that dispersal is the main factor regulating population size. Dispersal of squirrels during spring and summer may force them into marginal or inadequate habitat or increase their chances of getting killed by automobiles or predators.

Mortality factors are various. In the past, local extirpations by mange have seriously affected populations of western gray squirrels in many parts of its range in Washington. Recovery from disease outbreaks may be difficult when populations are small. Competition from introduced tree squirrels also may limit western gray squirrel numbers. Eastern gray squirrels are invasive and ecologically flexible. They are able to survive in a wide range of habitat types whereas the western gray squirrel seems more limited in its choice of habitat.

Management

Management for the western gray squirrel should involve protecting both the squirrel and its habitat. The greatest threats to western gray squirrels in the Puget Trough appear to be habitat loss, the over-dispersion of oak woodlands, and automobile traffic. Habitat loss is due to two factors; the

clearing of trees for development and succession and invasion of Douglas-fir.

Oak conifer forests are transitional communities that require continued management for their maintenance. On Fort Lewis, the succession to Douglas-fir is evident in most oak stands except for those that are isolated from conifers and have little value for western gray squirrels (Ryan and Carey 1995b). Western gray squirrels prefer large oak stands near water. Therefore, management should emphasize preserving oak stands that are larger than 5 acres and within 430 yards of water. Small stands, near water and adjacent to coniferous forests, are high-priority candidates for management to increase the area of oaks. Mature, acorn-producing oaks can be maintained by killing overtopping conifers by girdling or felling. Growth of smaller oaks can be encouraged by releasing them from competition with conifers.

Reducing competition with young Douglas-fir, oak seedlings, Scot's broom, and invading grasses may be important both in allowing oaks to regenerate and in preserving native prairies. Management may include prescribed burning on prairie edges to control the invasion of Scot's broom and retain native plant species. Once oak stands are maintained, the next management priority would be to protect habitat corridors between oak patches to facilitate travel by squirrels.

Maintaining a mix and juxtaposition of habitat conditions is necessary to maintain western gray squirrel populations. Fort Lewis is an important area for western gray squirrel management because it holds the largest publicly managed area of Oregon white oak in the Puget Sound region. Fort Lewis foresters currently manage for the maintenance of prairies, wetlands, oak woodlands, and continuous cover variable-age conifer forests. All these habitat conditions are beneficial to western gray squirrels.

Both the western gray squirrel and oak woodlands are listed in the Washington Department of Fish and Wildlife's (WDFW) Priority and Species Program.

Management Activities

1) Monitoring. Surveys of oak woodlands are necessary to determine locations of squirrels and to monitor the effects of management activities.

2) Public awareness and education. Few people know the western gray squirrel as a separate species of tree squirrel. They may confuse it with the eastern gray and wonder how such a common squirrel could be considered "threatened." Informational brochures (available at the WDFW) that describe the squirrel's appearance and explain its status in the area may help to increase public awareness and concern. Signs posted along major roads through western gray squirrel habitat will alert drivers to important squirrel crossing areas and may reduce squirrel deaths.

3) Monitoring and controlling introduced squirrel species. Because eastern gray squirrels seem to be more tolerant and adaptable to changing habitats than western grays, eastern gray populations within western gray habitats should be monitored. Eastern gray squirrels were readily trapped on Fort Lewis (Ryan and Carey 1995b).

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