

Fire in Restoration of Oregon White Oak Woodlands

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Fire has influenced both the morphology of species and their distribution for millions of years. Prescribed fire may be necessary to meet ecological restoration objectives, but reintroducing fire is a complex task. Fire may have undesirable effects if it is reintroduced outside of its "historical range of variability," or where the ecosystem has undergone major shifts in species composition or structure due to fire exclusion. Oregon white oak or Garry oak (*Quercus garryana*) woodlands and their associated prairies are a good example of this problem (Griffin 1977).

Oak woodlands and prairies in the Pacific Northwest were burned frequently by Native Americans. Almost all the early travelers to this region (1820-1850) described the prairie areas as having been burned. The oaks, with relatively thick corky bark and the ability to crown sprout, were well adapted to these fires. Visitors in the 19th century remarked "...Country undulating...with beautiful solitary oaks and pines interspersed through it...but being all burned" (Davies 1980), and extensive fires that "...destroyed all the vegetation, except the oak trees, which appear to be uninjured" (Wilkes 1845). The intensity of these fires must have been low, considering that a fire-sensitive species, Idaho fescue (*Festuca idahoensis*), was a dominant grass in the understory of the oak savannas and adjacent prairies.

A question arises as to how regeneration of the oaks survived in the face of frequent fires. Without a clear adaptation to regenerate, oaks might disappear over time if burned annually. First, regeneration is not a primary concern with a tree species that lives 400 years and also sprouts from rhizomes. If the main stem is killed, many suckers may emerge from an oak root system, which may encompass an area exceeding 250 m². Seedling regeneration is not common. The effect of fire on the relative importance of seedlings in comparison with sprout regeneration for Oregon white oak is not well understood.

In 1989, the Washington Department of Natural Resources (WDNR) conducted a prescribed fire at Oak Patch Natural Area Preserve, which was established to preserve a Oregon white oak/snowberry (*Symphoricarpos albus*) community in western Washington. After the fire, oak seedlings were observed in the area. They were associated with corridors where logs had burned at relatively high intensity, consuming much of the soil organic matter. A comparison of microsites where seedlings became established to sites where vegetative sprouts had emerged showed soil and floristic

differences. (Agee, unpublished data). Seedlings are found on more heavily disturbed microsites. Soil carbon and soil nitrogen are significantly lower around seedling locations. Both carbon and nitrogen are volatilized by fire, and the amount lost is an index to fire severity. The plant species around oak seedlings are typical of very disturbed sites: tansy ragwort (*Senecio jacobea*), velvetgrass (*Holcus lanatus*), and fireweed (*Epilobium angustifolium*). Most of the sprouting shrubs at the site are more common around oak sprouts: woodland rose (*Rosa gymnocarpa*), serviceberry (*Amelanchier alnifolia*), salal (*Gaultheria shallon*), and Cascara buckthorn (*Rhamnus purshiana*). In this low severity fire regime, seedling regeneration may depend on the presence of high severity microsites.

A critical constraint to using fire in oak woodlands and prairies is the presence of alien species. Shrubby aliens such as Scotch broom (*Cytisus scoparius*) and Himalayan blackberry (*Rubus discolor*) have invaded these open communities. Fire can be used to reduce the spread of these invaders, but must be used very carefully. A single intense fire can reduce Scotch broom cover, but may encourage germination of the seed bank of Scotch broom, and at least temporarily reduce cover of native perennials such as Idaho fescue. A second fire, which will be much less intense, is necessary in 2-3 years, before the new Scotch broom plants are mature enough to flower. This double fire treatment can greatly reduce Scotch broom, but it is often difficult to get fire to spread through these fuel-limited microsites. Spot treatments, such as using a flamethrower in the winter when grasses are green and fire will not spread, can remove any residual Scotch broom plants missed by the double-fire treatment, but is labor-intensive.

Native plants such as camas (*Camassia quamash*), which Native Americans harvested as bulbs for their flour, seem to flourish after burning, based on observations at The Nature Conservancy's Yellow Island Preserve and at the WDNR's Mima Mounds Natural Area Preserve. Endangered plants such as Curtus aster (*Aster curtus*) appear to increase after burning, so that fire may be an essential element in prairie restoration. Idaho fescue is more sensitive, at least after the initial more intense fire. At the Mima Mounds Natural Area Preserve, managers have collected fescue seed at the site, grown it as nursery plugs, and outplanted the fescue in heavily burned microsites. The first planting in 1994 has shown quite vigorous growth after the first season, suggesting that restoration and preservation of fescue prairie may be possible in the face of Scotch broom infestations. The prairie has been divided into blocks so that not all the area is burned in one fire. Sensitive and rare butterflies which depend on Idaho fescue during their larval stages may then be preserved at the local scale while other portions of the prairie are treated.

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In oak woodlands and prairies, we will not be able to eliminate alien species, although we can recreate the appearance of the historic plant communities. We may, then, be restricted to creating from more than function in woodland and prairie restoration where alien species already have a foothold.

Fire can be an important element of conservation biology plans, and fire is being used along with removal of competing conifers to restore some of the remaining Oregon oak woodlands (Cook 1996). But just because fire was historically present as a natural process in ecosystems is insufficient guidance for its use in the future. We may not understand fully the significant effects of fire: for example, the concentration of oak seedlings in severely burned microsites within a low severity fire regime. Alien species may create new competitive environments for native species, even though the reintroduced fire regime may mimic the historical fire regime. The structure of the system may have changed, so that the effect of a natural process like fire may be different now than in the past. These constraints may not preclude the use of fire, but they may require a comprehensive analysis of the ecological costs and benefits associated with the proposed fire regime: its frequency, intensity, extent, timing, and synergism with other disturbance factors. Agee (1993)

provides a more detailed account of the role of fire in the Oregon oak type.

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