Resource Bulletin

Fire Ecology

Cyclic Disturbance

Fire is often thought of as a catastrophic event. In actuality, the occurrence of fire in a wildland setting is an essential part of the natural cycle. Many North American ecosystems evolved under the influence of fire. In fact, fire is the most prevalent natural disturbance mechanism in the Northern Rockies, where fires have been occurring for thousands of years.

Fire ecology describes the important role that fire plays in plant and animal communities. Fire's natural cycles maintain and restore a wide diversity of conditions needed by various flora and fauna. Over time, certain fire-adapted species and fire-dependent relationships develop.

A fire-adapted ecosystem is one in which flora and fauna have developed adaptations to help them survive periodic fires. An example is ponderosa pine, which has very thick bark that protects it from low intensity fires. A fire-dependent species is one that has adapted to fire so much that it requires fire to complete an essential part of its life cycle. As an example, some of the cones of the lodgepole pine are serotinous, requiring heat from fire to open and drop their seeds.

Renewal by Fire

It is not difficult to see that fire changes an ecosystem. While some species are absent after a fire, many others are regenerated and become more plentiful. Fires perform not just one, but many different functions, because any given change has far-reaching effects throughout the rest of the system. Fires affect plants which impact herbivores and then carnivores.

Burned trees of the Robert Fire fall to a new forest floor.

One major effect is that a fire clears out a great deal of vegetation, leaving behind vegetation that is burned or partially burned. On the surface this can appear to be a loss, but it actually provides new habitat by opening up space for young and different plants to grow. Fire also opens up the canopy so more sunlight reaches the forest floor. In addition, some plants thrive in the nutrient-filled, ashy soil. For example, western larch can become established rapidly on mineral soil exposed by fire. Larch also responds to the space created by fire as it requires full sun or nearly full sun for best development.

Wildland fire plays a major role in forest succession in the Northern Rocky Mountains. The distribution of lodgepole pine, ponderosa pine, western larch, western white pine, and whitebark pine is the result of past fires. For example, without fire, Douglas-fir would dominate areas where ponderosa pine now occurs. Periodic fire also allows western larch and western white pine to persist on many sites.

Fire is critically important for some species with limited ranges. In subalpine forests, the perpetuation of whitebark pine depends upon occasional disturbances, especially fire. Without fire, forest succession would lead to dominance by subalpine fir and spruce.

Relative fire resistance varies among tree species found in the Northern Rockies. Because of its thick bark, deep roots, very little resin in old bark, very open branches, and foliage that has low flammability, western larch is the tree

Fireweed thrives among snags from a fire.

species that is the most resistant to fire. Ponderosa pine and Douglas-fir share many of these characteristics and are also very resistant to fire. Engelmann spruce, western hemlock, and subalpine fir are the least resistant to fire.

The response of understory plants to fire also varies. Nearly all native forest shrubs are capable of surviving fires. A majority of forest herbaceous species, especially those with underground stems or rootcrowns, survive fires, too. These survivors regrow from surviving plant parts after fire. Herbaceous plants that do not survive must re-colonize from adjacent unburned areas. In fact, the more severe the disturbance, the more favorable the site for colonizers.

Many times, when a fire moves through an area, not all of the existing vegetation is burned. The result is a mosaic pattern of burned and unburned patches across the landscape which results in a mixed diversity of species, some not present before the fire.

A forest that has a mosaic pattern of growth can support a wider variety of animal species than a homogeneous forest. Young plants growing in recently burned areas provide food for many animals. Many shrubs, including huckleberry, are rejuvenated by fire, and are a food source for a variety of animals, including deer, moose, bears, and birds. Insects invade standing dead trees after a fire. Many of these insects are eaten by birds, such as Black-backed, Three-toed, and Hairy Woodpeckers. Dead trees, or snags, also provide sites for denning, roosting, and nesting by various species.

Glacier's Management Strategy

In Glacier National Park, the Fire Management Plan takes into account the known fire ecology, fire history, and fire behavior of the region. While many fires must be suppressed to avoid endangering people and structures, fires that can be managed with minimal suppression activity are allowed to burn, within certain parameters, for the benefit of the resource.

Glacier's managers and researchers have studied the park's fire history and the expected fire return intervals for different areas of the park. Knowing how often a certain kind of habitat has burned in the past gives managers insight into when another fire is likely. Now that the value of fire is realized, if an area is overdue for a fire, a prescribed burn may be started to help perpetuate a vegetative cover type (e.g., ponderosa pine). Prescribed burns can also reduce the buildup of fuel that could cause a natural fire later on to be more severe than it would have been historically. The hope is that these policies, based on sound ecological research, will guide fire managers to perpetuate diverse and dynamic landscapes.

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Resources for More Information

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Documents and web sites:

Glacier National Park Fire Management Plan and Environmental Assessment, March 2003:
www.nps.gov/glac/pdf/2003fireea.pdf

Forest Fire in the U.S. Northern Rockies: A Primer:
www.northernrockiesfire.org/history.htm#hlist1

Glacier National Park Wildland Fire Management webpage:
www.nps.gov/glac/resources/fires.htm

USDA Forest Service Fire Effects Information System:
www.fs.fed.us/database/feis/

A Scouler's Willow begins the regeneration of a burned forest.