BUILDING WITH FIRE

ARTICLE BY DAN STROUD, DOUG McWHIRTER, NORM MERZ, AND DIANE ABENDROTH • PHOTOGRAPHY BY JEFF VANUGA, LURAY PARKER, AND CHRIS MADSON

Fires have burned across most of the Intermountain West over and over again since the last ice ages. Our climate seasonally dries the forests and range lands, then brings routine lightning storms to ignite them. Native Americans set fires by accident and on purpose to improve range and send long-distance communications. Western vegetation has adapted to fire's inevitable disturbance, and the animals have evolved along with the plants. Now our habitats are actually dependent on fire—a natural and needed process in western ecosystems.

In our modern world with expanding permanent settlements and resource-based markets, we have come into conflict with wild-land fire. Many people think of forest fires only as a tragic and destructive force. For instance, the media coverage of the Yellowstone fires of 1988 focused on the devastation of Yellowstone but failed to mention the benefits or the reasons behind the fires. Smoky Bear, a famous persona among children and adults alike, has promoted a negative image of fire. On the other hand, fire can be viewed as a benefit to ecosystem health. One ecologist has written that "Fire is a 'destroying angel' whose ecological missions to cleanse...."

Our society has suppressed fire for over a century in the West. Modern technology has allowed us to control this force of nature to a great extent. However, as earthquakes, floods, and hurricanes teach us, natural processes eventually have their way. We have upset many of the natural patterns of fire, but we have not, and cannot, ever suppress them completely. To manage our fire-dependent ecosystems safely and productively, we need to understand fire ecology.

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Plant succession and the fire cycle

After a fire moves through an area, the vegetation starts to reestablish through a process called succession. Depending on the soil type, the growing conditions, and the intensity of the burn, plants soon begin to colonize the site. In some cases, a hot fire will burn off the organic soil and delay regrowth for many years. Most fires, however, leave fertile soil and plenty of sunlight for plants to begin growing right away.

Usually the first plant to colonize the ground after a fire are very aggressive and tolerant of dry bare soils and bright sun. Often these include fireweed, geranium, and other annual forbs. As time goes on, these pioneers make the site more favorable for other plants. Perineal grasses and forbs begin to move in. These in turn provide good growing conditions for woody shrubs and trees, which eventually dominate the site. In some cases, conifers will sprout in this shade and grow to become a dense forest. Each of the plant communities in this progression is called a *sere* or *seral stage*. The last sere in the succession is called the *climax*.

Competition for nutrients, water, and sunlight drives succession. Each sere has unique adaptations that allow it to "succeed" better than the previous plant community. As these new plants take over, they change the microclimate, which allows the next sere to become established.

Without disturbance, succession would not occur, and homogenous climax communities would be found everywhere. Plants adapted to grow in early seral stages would not be able to compete and would soon disappear.

In the West, fire is the most common disturbance, and for this reason, early seres in the West are said to be fire dependent.

Succession cases a fire cycle that perpetuates disturbance so that the process is repeated over and over again. After a fire, the early seral plants are lush and there is little dry fuel to carry a fire. This acts as a natural barrier preventing fire's spread. But over time, dead wood and litter accumulate in most plant communities providing the opportunity for a fire to spread. Lightning eventually strikes, and the resulting fire sets back plant succession once again. Research shows that these natural fire intervals are fairly predictive for certain kinds of vegetation. For example, sagebrush, aspen, and lodgepole communities have an average fire frequency of forty, eighty and 200 years, respectively.

When settlers began to suppress fire in the West, they unwittingly disrupted the fire regime. Now a hundred years later, the landscape has an unnatural acreage of older, even climax plant communities. Some of these climax communities have become so different due to advanced succession that, when they finally burn, then whole successional pattern is altered. They may not return to the early seral patterns that were common before we interfered.

Another consequence of fire suppression over the last hundred years is extensive accumulation of fuel. With so many acres of climax forest and shrub communities, the danger of larger, out-of-control fires has increased. This isn't to say that big forest fires are a new phenomenon in the West. The northern Rockies have had intense fires at intervals of several hundred years over the millennia. These fires have claimed entire strands of timber. Even fires on the scale of the 1988 season in Yellowstone occurred during presettlement time. But these fires were the exception.

The typical forest fire before settlement was small. Small patches of the landscape burned every few years, but the fires were contained by a lack of fuel in adjacent areas that had burned recently.

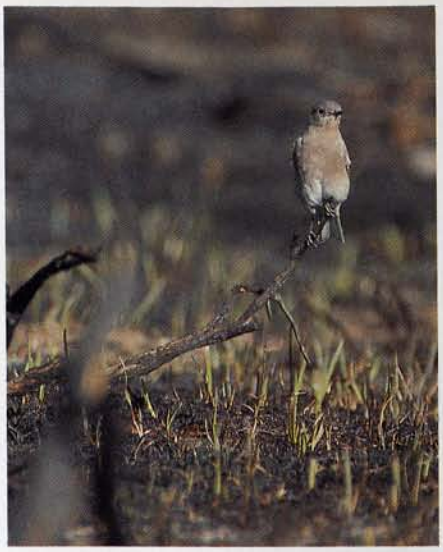
Settlement has indirectly suppressed fires through fuel breaks such as roads. In addition, the annual removal of forage by livestock removes fine fuels like dried grasses and fobs thus reducing the spread of light to moderate wildfires.

Fireweed (opposite page) and lodgepole pine (above) thrive after a fire. The roots of plants like this marsh marigold (left) often survive intense fire and sprout the following spring. (fireweed by Jeff Vanuga; pines by Chris Madson; marigold by LuRay Parker).

Wildlife and the fire cycle

Wildlife has coexisted with fires for as long as there have been both wildlife and fire. How an animal species is affected by fire depends on its intensity as well as the animal's mobility and habitat requirements. From fire-dependent to fire-intolerant, there is a whole range of animal responses. In the big picture, however, animals are adapted for certain habitats, and most of these habitats depend on the fire cycle in order to persist. Fire encourages plant diversity, which, in turn, is necessary for wildlife diversity.

Fire is highly beneficial for ungulates, including mule deer, moose, elk, and bighorn sheep. Early seral stages following a fire provide abundant, available forage with high nutrient value. Forest openings created by fire enable these prey species to spot predators more easily. A patchwork of burning over the landscape supplies vegetation of different sizes, ages, and species. This variety assures both food and cover . Increases in animal numbers such as moose and elk have been documented following large fires in Idaho and Alaska. Even small burns are known to attract both ungulates and livestock due to enhanced forage quality and earlier spring green-up.



Populations of mammals and birds often decline immediately following a fire, but, in most cases, they exceed pre-fire numbers three to ten years after the burn. The increased diversity and edge created will usually increase the numbers of wildlife species using the area as well as the number of each species. Species that depend on climax habitats such as old-growth forests don't benefit from fire. Fire rarely occurs in these areas, however.

Unfortunately, fire suppression has favored late-successional vegetation in the older age classes. Habitat diversity has been lost, and our wildlife resources are threatened as a result. In order to manage wildlife, we must create and/or maintain a landscape of diversified habitat types. Fire, both prescribed and natural, is needed to rejuvenate our landscape and our wildlife diversity.

Western wildlife has learned to coexist with fire. Most ungulates, including these moose and bison (lower left and below), seek out forage on recently burned ground for its high nutrition. Even the ash of the fire itself can be nutritious (bull elk, right). Recent burns may also attract other species, like the mountain bluebird at left. (Bull elk eating ash by Jeff Vanuga; others by LuRay Parker).

Prescribed fire

Allowing natural fires to burn is not always an option. Wildfires can be dangerous in some areas and some seasons. Lightning doesn't always strike where and when land managers want it, so prescribed burning can be an extremely useful tool.

Habitat managers burn range and timber to mimic the natural landscape mosaic. The Wyoming Game and Fish Department, U.S. Forest Service, Bureau of Land Management, National Park Service, as well as some private landowners, are actively involved in prescribed burning. Before igniting a prescribed fire, managers develop a plan. They decide on the weather they want, identify the kind of fuel they are dealing with, set a target for the moisture content of the fuel, and arrange for the equipment they'll need to control the fire. The plan sets objectives for the right mix of fire intensity, too. The managers figure out how they want to start the fire, by hand torch or helitorch, and they may

recommend a year's rest from livestock grazing so that there are sufficient fine fuels to carry a fire. For best results in important wildlife habitat, the burn should be as large as possible— if it's too small, big game herds may overgraze the vegetation before it fully recovers from the fire. Additionally, burns should receive rest from livestock use for several years following the fire to allow for plant re-establishment. As part of planning for a burn, managers may consider a prescribed natural fire. In this approach, managers allow lightning-caused fires to burn as long as certain fuels and weather conditions ensure that it is safe. Instead of suppressing the fire, they carefully monitor its spread. This policy is primarily reserved for wilderness areas.

Fire's diverse patchwork on the landscape

Over the millennia, fires have changed vegetation in a sporadic, patchy pattern again and again. Different fire intensities, sizes of burns, and stages of succession caused complex mixtures of community types.

This arrangement is often referred to as a "mosaic" because overlapping burned and unburned areas on the landscape gave it a complex pattern not unlike a design made of tiles.

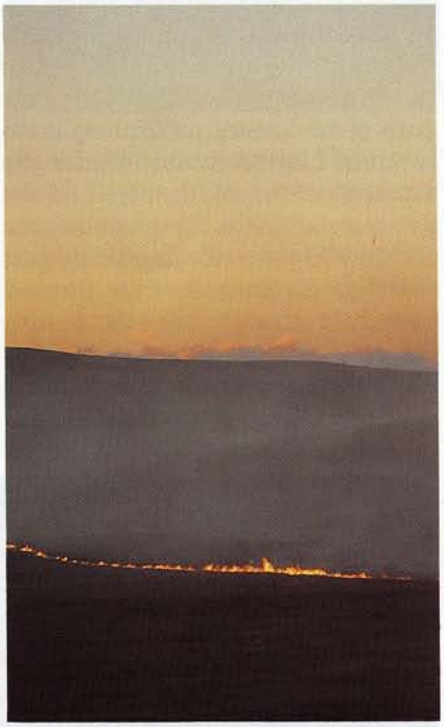
Before fire suppression by European settlers, this diverse array of forests, meadow, and shrub-grasslands tended to perpetuate itself. The variation in accumulation of fuel meant that fires were often naturally curtailed. When fire ran into previously burned areas where there was little fuel, it tended to burn out. Therefore, many fires were fairly small. Under some conditions, however, very large fires still occurred.

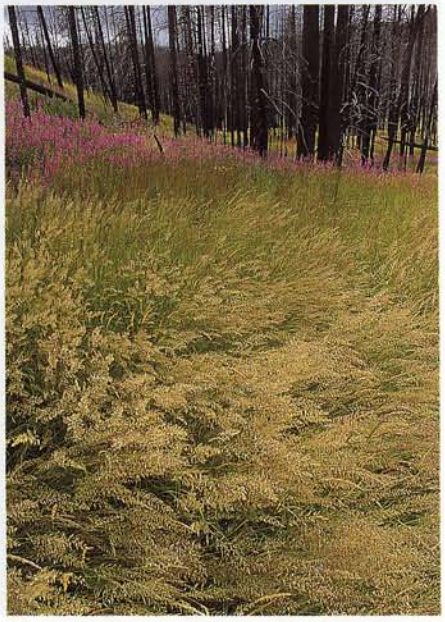
Our wildlife is adapted to the diversity of habitats that resulted from naturally spreading fires. These habitats had a lot of variety and "edge." The edge or ecotone where two habitat types come together allows wild animals to take advantage of both. For example, sage grouse nest and hide in dense, unburned older sagebrush and forage for insects in the abundant grasses of a nearby recent burn. The more edge there is, the more habitat for many species.

Fire suppression has unfortunately led to a landscape dominated by late successional, relatively consistent vegetation. As a result, the amount of edge has been decreased, and habitat quality has been changed, in many ways for the worse. It also has removed the former diversity in fuels, which increases the danger of larger and less controllable wildfires.

Prescribed fire can be used to create the sort of "mosaic" that is desirable for wildlife and fuels management. Burn plans generally call for only a percentage of land, perhaps thirty to seventy percent, to be actually blackened. This provides for edge and variety for the plant communities and age classes because there are both burned and unburned areas.

Fire kills many woody plants and encourages grass (below) for big game like the bighorn sheep (opposite page). (Grass by Jeff Vanuga).





Fire ecology in major habitat types

Aspen

In Wyoming, aspens are found in mountain foothills between the dry sagebrush lowlands and mountain conifers. Aspen communities are extremely important for wildlife habitat and are second only to riparian areas in the numbers of different plants and animals found within them.

Aspen is the most widely distributed native tree in North America, but it is declining in many parts of the country, particularly in the western United States. Under the current rate of decline, half of the aspen stands in the West will be gone within 400 years. Ecologists suspect that fire suppression over the last century is largely responsible for this trend.

Aspen is generally regarded as a seral species and is very well adapted for periodic disturbance, such as wildfire. Aspens evolved with fire and actually require it in order to maintain vigor and compete with invading conifers and sagebrush.

Aspens rarely reproduce by seed—the majority of new aspens sprout from roots of mature trees, a process called root suckering. The new trees are genetically identical clones of the parent tree. As a result, aspens in clones covering several acres tend to change color simultaneously in the fall. Suckers are produced each year by aspen trees, but the limbs and leaves of mature aspens produce chemicals that suppress sucker development. When the overstory tree dies, the chemical levels decrease and suckers are produced in droves. Botanists have counted more than a million aspen suckers in a single acre.

Aspens have a short life span, and trees tend to die off at eighty to 100 years of age. But old and decadent aspens continue to suppress suckering. This can lead to a gradual weakening of the clone to the point that even if the overstory is killed, there are not sufficient root reserves for suckers to replace the stand.

Moderately hot fires which kill overstory trees and eliminate part of the litter and duff are most effective at stimulating suckering and thus rejuvenating aspen stands. Fires also kill conifers and sagebrush which threaten to take over aspen stands through succession. After a fire, a vigorous aspen stand usually sends up a huge number of suckers. This eventually produces more aspen trees, often up to five times as many as existed in the old grove. Fires provide a more varied distribution of aspen age classes, which translates into greater diversity of both flora and fauna.

After a fire, ungulates are attracted to the suckers. Overbrowsing by livestock and big game can potentially prevent the aspen from ever reaching tree height. Over time, the clone may be weakened by this to the point that it dies out. Therefore, rest from livestock grazing is particularly important when aspens are burned. To reduce localized overbrowsing by wildlife, prescribed burns in aspen communities should include large acreages so that animal use is well distributed.

The bottom line is that fire is very much a natural part of aspen ecosystems in the western United States. If we expect to maintain aspens in our western forests, we will have to allow fire to exert its influence.

The part of an aspen clone that lives above ground is easily killed by fire, but when the stems are killed by flame, the roots send up thousands of new sprouts to take their place. (Photo by LuRay Parker).

Sagebrush-grassland

Sagebrush/grasslands are the most common habitat type in Wyoming, occupying 58,000 square miles (fifty-nine percent) of the state. Botanists have identified sixteen species, eighteen subspecies, and two varieties of sagebrush in Wyoming. Each of these is adapted to different soil types and climates. This habitat supports at least eighty-seven mammal species, 297 birds, and sixty-three reptiles and amphibians. Species such as sage grouse, pronghorn antelope, and mule deer rely heavily on sagebrush communities for their survival.

Additionally, the sagebrush habitat types support a majority of the livestock grazed in this state.

Historically, sagebrush communities burned every twenty to seventy years, depending on the species of sage and where it grew. Mountain big sagebrush, which occupies productive sites in the western mountains of Wyoming, burned every twenty to thirty years. Conversely, low sage, which occupies dry, unproductive sites, burned at much longer intervals, if at all.

In most cases, sagebrush is considered the climax species on a site. Most species of sage are easily killed by fire and few resprout. Fire causes significant changes in these plant communities. The sagebrush overstory is removed and replaced by abundant forbs and grasses. Associated shrubs, such as rubber rabbitbrush and bitterbrush, resprout from the roots of burned plants following a fire and can temporarily increase their dominance on a site. Grasses like bluebunch wheatgrass, Sandberg bluegrass, and Nelson's needle-and-thread will resprout and recover within one to three years after a fire. Others, such as Idaho fescue, can be severely damaged by fire, thus reducing their presence on a site for up to thirty years. Mat-forming forbs, such as buckwheat, phlox, and pussytoes, are severely damaged by fire, allowing more productive plants to take their place. Forbs with large taproots, including arrowleaf balsamroot, longleaf phlox, and arnica, remain undamaged by fire. The severity of burns, the season, and soil moisture all determine how these plant communities respond to fire.

Sagebrush begins to seed in and recolonize a site three to five years following a fire. These plants will continue to mature and reproduce and eventually crowd out the understory grasses and forbs. When a sagebrush community reaches greater than twenty percent canopy cover, it will burn readily.

Production of herbaceous forage peaks several years after a burn and persists approximately twenty to seventy years, depending on the site, climate, and management. The rate at which sagebrush begins to dominate a site may be greatly accelerated by overgrazing. For example, one range scientist studied a piece of sagebrush pasture that had been burned, then overgrazed and found that sage covered more than forty percent of the area only fourteen years after the burn.

With fire suppression across the state, sagebrush communities have become old and dense. Most sagebrush communities in Wyoming exceed twenty percent canopy cover and consist of mature to decadent plants. This is not as useful for wildlife and livestock as a mixture of sagebrush densities and age classes would be.

A mosaic of different age classes and densities covered the landscape before settlement changed the role of fire. Prescribed fire is very effective in sagebrush, but it is important that a portion of the older, denser stands is left to provide hiding cover for antelope and deer fawns, habitat for sage grouse, and nesting sites for several bird species. A variety of different aged stands will provide habitat for a variety of wildlife species.

Sage grouse (left)need more than sage—a variety of grasses, forbs, and other shrubs like rabbitbrush (above) makes the best sage grouse habitat. (Both photos by LuRay Parker).

Mountain shrub communities

Mountain shrub communities are usually found in the foothills with sagebrush flats along their lower edges and conifer-covered slopes above. In some cases, these shrubs may be intermixed in sagebrush stands. They may also be found in aspen communities. The shrubs found in this community include serviceberry, mountain mahogany, snowberry, bitterbrush, currant, elderberry, mountain ash, Rocky Mountain maple, chokecherry, spirea, honeysuckle, rose, and gooseberry.

From the wildlife perspective, these communities are extremely important. In many cases, they comprise crucial winter range which is the limiting factor for most big game populations in Wyoming. Most of these shrubs are very palatable and nutritious. In the case of mule deer, they provide variety in areas where the winter diet is primarily sagebrush. Deer have trouble digesting an exclusive diet of sagebrush because of some of the chemicals it contains. If deer can mix sage with other shrubs in their diet, they can digest the sagebrush more completely.

As a food source, mountain shrubs are important to many species, including moose, elk, mule deer, beaver, porcupine, rabbits and hares, and numerous other small mammals. The leaves, buds, fruits, and seeds provide food for songbirds, sage grouse, and blue grouse.

Mountain shrub communities also provide important cover for wildlife— shade in the summer, shelter from the elements in the winter, a place to hide from predators, and a nursery where calves or fawns can be born safely and hidden from predators. These shrubs also provide nesting areas for birds, both in the shrubs themselves and on the ground under the canopy.

Fire frequencies in these communities are similar to those in sagebrush communities. Fires historically burned every twenty to sixty years when woody and dead material accumulated and stands became dense enough to carry fire. Without fire to periodically "turn over" these communities, they get old and lose diversity as plant species die out. In some cases, they become unavailable to browsing game species because they grow too tall to reach. Without fire, other plants may take over these communities. Conifers tend to move in and shade out the understory shrubs. Lack of fire may also cause these communities to become monotypic stands of sagebrush.

Many mountain shrubs— particularly western serviceberry, snowbush ceonothus, chokecherry, and common snowberry— sprout profusely after fires and usually increase in coverage. Other species like antelope bitterbrush and mountain mahogany may not sprout, but more intense burns provide a good seedbed for seeds from nearby seed sources. Often the intensity or heat of the fire determines whether or not the shrubs resprout or reseed and how quickly. A cooler burn with high soil moisture will usually preserve enough of the roots for many species to resprout which would not do so under hotter conditions. Periodic burning generally provides more diverse shrub communities. Fire also tends to increase the palatability, production, and nutrient content of many of these shrubs, especially for the first few years following burning.

In winter, mule deer depend on healthy stands of mountain shrubs for food and shelter. Fire encourages most of these shrub species to produce more forage with higher nutrition. For that reason, controlled fire in mountain shrub communities can be good for deer. (Mule deer by LuRay Parker).

Conifer communities

Pines, spruces, and firs are found at higher elevations where deep snow provides plenty of summer soil moisture. Distribution of these species depends on the successional stage, soil type, and elevation on a site. In mountain foothills, they often occupy shaded north-facing slopes while sagebrush communities dominate dry, south-facing aspects. Conifers may seem to be a climax community, but these species actually prefer different successional stages. Shade-tolerant conifers such as spruce establish beneath pioneering forests of lodgepole pine, subalpine fire, and Douglas fir, which may have been previously occupied by aspen and/or shrub communities. Near treeline, hardy whitebark pine trees create a shelter for spruces to grow.

Evergreen forests are important wildlife habitat for many species. Trees provide thermal shelter for deer, moose, and elk by acting as windbreaks in the winter months and shade in the summer. Conifers offer critical hiding cover and give many animals a sense of security .

For many bird species, dead conifer "snags" provide food and nesting sites. Many of the understory plants in a conifer forest are berry producers. Birds, rodents, and bears eat the berries. Most of these shrubs are resprouters and are stimulated by fire.

The effects of fire can vary considerably in conifer forests. A low-intensity fire may burn only the understory surface fuels. A moderate fire will also consume litter and duff on the ground and kill smaller trees. If fuel "ladders" of dead branches exist up the trunks of mature trees, fire can move into the forest crowns. In this case, a severe fire may burn through the overstory and kill the majority of trees. Often the heat from these fires damages much of the organic soil.

Different species of pine, spruce, and fir play different roles in the fire cycle, and fire suppression has affected conifer forests in many ways. When succession is allowed to continue unchecked, conifers tend to encroach on aspen, sagebrush, and mountain shrub habitats which reduces the plant diversity and forage production of winter, summer, and transition ranges. In the case of bighorn sheep, conifer encroachment is significant because sheep prefer open spaces where predators can be easily seen, allowing them to escape to cliff bands. When conifers cover these open spaces, sheep cannot detect approaching predators, so they will avoid the area.

Large-scale conifer encroachment in watersheds can deplete to the

All western forests burn easily, and ecological research has shown that they burned regularly before European settlement. While lumbering can mimic some of the effects of burning, there is nothing as effective as fire when it comes to improving large stands of conifers for big game and many other wildlife species. (Photo by LuRay Parker).

ground water since the evergreens absorb more water than sagebrush or mountain shrubs. This can lead to reduced stream flow and loss of springs. After a fire, springs and streams will often have greater flow. This can temporarily scour stream beds; however, when equilibrium is restored, research shows that the riparian habitat benefits and fish grow to be larger.

Accumulation of dry, downed logs is another serious concern resulting from fire suppression in conifers. This presents a major threat if there is a hot, dry summer with many lightning strikes. Prescribed burns are one way to reduce these fuels. However, this is not always easy. Burns in extensive conifer stands require dry and/or windy weather. There's always a chance that the fire will "escape."

Forest fires improve and expand winter range for deer, elk, and moose. Burning increases diversity within conifer forests by creating more edge between dense timber and meadows, stands of shrubs, or thinner stands of trees with grassy understories. These patchworks of conifers and other cover types improve habitat for big game, grouse, bears, mice, squirrels, and chipmunks. When trees are killed, insects move into the burn to eat the wood. Woodpeckers drill holes in the trees to catch and eat insects. These holes act as homes for cavity nesters such as bluebirds, flickers, and swallows. As songbirds and small mammals take up residency, birds of prey move in to hunt.

Prescribed fire in conifer communities should mimic the fire frequency that historically occurred under natural conditions. This schedule for fire will depend on the location and the types of trees present. Taking natural cycles into account will promote optimum regeneration of diverse habitat types.

Subalpine fire is the conifer least tolerant to fire in the Intermountain West. It's a small tree with many branches near the ground, pockets of flammable resin on its thin bark, and a tendency to grow in dense stands, a perfect arrangement for a hot fire. Like spruce, subalpine fir is shade tolerant. Without disturbance, fir will eventually dominate lodgepole pine stands.

Mature Douglas fir is relatively resistant to fire because of its thick bark, but saplings that have thin bark are vulnerable. Fire-resistant bark takes about forty years to develop on moist sites.

Lodgepole pine is moderately tolerant of surface fires even though it has thin bark. It can be a seral community, as seedlings establish rapidly and abundantly after a fire.

Fire history

Different habitats have different fire frequencies. Land managers predict how often areas are likely to burn by studying the history of wild fires and forests before fire suppression. Fire history shows how human activities are affecting plant communities. It also allows land managers to use prescribed fire to mimic nature's patterns.

Determining the history of fire in a given forest involves detective work. Trees lend themselves to the study of the past because tree rings accurately record the passage of time. Douglas fir with its thick bark, and to a lesser extent, lodgepole pine and even aspen will survive fire even though their trunks have been scarred by flames. Often very old trees will have multiple scars that date back hundreds of years. Counting the rings between scars can tell the actual dates the site was burned.

Since a dense new generation of lodgepole pine seedlings often follows a fire, the age of a uniform lodgepole forest often dates the last major burn as well. Sagebrush can also be aged by counting the annual rings. If enough plants are aged, the date of the last fire can be closely estimated.

Additional fire history information can be found in old newspapers, trappers' diaries, and interviews. Old photographs of landscapes compared with contemporary retakes show evidence of past fires. Many of these pictures show an increase in conifer forest cover since the 1800s. This gives an excellent illustration of the ways the landscape has changed due to fire suppression.

Decades of fire suppression in Yellowstone Park allowed dead timber to build up. In the summer of 1988, this accumulation of fuel exploded (opposite page). (Photo by Jeff Vanuga).

This species can't persist on a site without fire. Lodgepole's key to fire survival is its serotinous cones. The heat from a forest fire melts a resin that glues the cone shut, and seeds are deposited on the ground within hours after the flames pass. Most stands produce both serotinous and non-serotinous cones so that seeds are also released in the absence of fire.

Mature Englemann spruce are very vulnerable to fire because they have dry, dead lower limbs, a low canopy, and thin bark. The spruce is shade tolerant which allows it to grow under lodgepole pines. Spruce eventually dominates the landscapes where it grows, but this takes hundreds or thousands of years to occur.

Whitebark pine is semi-tolerant of fire and has been observed as a pioneer establishing in recently burned sites. It has a large, wingless seed that does not disperse by wind. Regeneration on burned sites is usually a result of seed germination from bird and squirrel seed caches, especially those of Clark's nutcracker, a common seed-eating bird in the Rockies.

Historical evidence indicates that fires have always been an ecological force in ponderosa pine communities, regardless of whether they were seral or climax. Fires thin the stands, eliminating young pines, spruce, and fir in the understories and keeping the ponderosa pine forests open and park-like.

Rocky Mountain juniper is easily killed as a young tree but as it matures, it develops thicker, more resistant bark. Fire has long been recognized as a way to control juniper. Juniper produces chemicals which exclude other plants from the understory. As a result, in the absence of fire, juniper areas tend to lose their grass and forbs and become less attractive to most wildlife.

Riparian areas

Riparian areas include wetlands, streamside and shoreline plant communities. They are the most diverse, productive habitat types in the Intermountain West. Ecologists know relatively little about the impact of fire on riparian areas. The moist vegetation and patches of open water in these areas resist fire except during occasional drought, but when the weather is dry and windy, the accumulation of fuel here can support high-intensity fires. Because of the moist, fertile soils in riparian zones, vegetation here recovers quickly after a fire. Many riparian plants tend to resprout after fires. Willows, alder, dogwood, cottonwoods, aspen, and sedges come up quickly from their underground root systems. Many of these species also have abundant, airborne seeds that allow rapid colonization of bare areas.

Wetlands come in many different types, from lowland "cattail-and-mosquito-infested swamps" to high alpine wet meadows. They provide crucial habitat for migratory waterfowl, amphibians, beavers, and numerous other aquatic and terrestrial birds and mammals.

Prescribed fire has been used to improve wetlands by reducing dense stands of old plants, removing encroaching cattails, and encouraging more productive and palatable regrowth. This benefits wildlife, particularly waterfowl, by improving

forage for grazers like Canada geese and seed eaters such as swans and dabbling ducks. Burn-killed trees provide nest holes for wood ducks, goldeneye, mergansers, and raccoons. The vigorous and abundant regrowth of grasses following a fire improves nesting cover and attracts breeding ducks including teal, mallards, and wigeons. Burning around wetlands also increases the amount of open water and in some cases actually raises the water table. As in all fire-influenced habitats, fire in wetlands creates additional diversity and edges between age groups of vegetation.

Periodic fire has been an integral component of the long-term stability of streamside communities. The effects of burning appear to be somewhat detrimental in the short term. After the first few years, however, long-term benefits of a fire become apparent, which outweigh the initial drawbacks.

Streamside communities respond to fire in about the same way wetlands do. However, the effects of fires on the streams themselves may be more significant than the response of vegetation on either bank. Short-term impacts may include temporary removal of shading trees and shrubs, resulting in the sun warming the water and increasing the incidence of fish disease. When a large area in a watershed is burned, increased flow scours channels and deposits silt downstream. This can clog trout spawning beds. Run-off from burns carries high concentrations of nutrients, causing an increase in algae which, when it decomposes, removes oxygen.

Long-term effects of fire on aquatic habitat, however, appear to be beneficial. Burning of forests along streams sets back succession encouraging deciduous plants which attract terrestrial insects, an important fish food. Research in Yellowstone following the 1988 fires showed that, after an initial two-year decrease, there was a post-fire increase in aquatic insects. Reports speculate that insect abundance will continue to increase in coming years. The loss of heavy conifer forests means more run-off and ground water, adding to stream flows during late summer and improving the survival of fish. Studies in Yellowstone found no extensive effects on fish after 1988. This is notable, considering the severity and magnitude of the fires, which many considered to be devastating.

Beavers definitely prosper when aspen in riparian areas is stimulated by fire. Aspen provides beavers with a source of both food and quality building materials. With fewer fires, aspen has declined in many areas, and beavers have had to make do with willows. Unfortunately, willow is inferior as both a food source and dam-building material and may result in frequent blow-outs of dams and subsequent lack of stability for the beaver system. With fewer beavers, there are also fewer wetlands, fewer moose, waterfowl, song birds, even grizzlies.

How do you burn a wetland? With a little help from drought. Many Yellowstone wetlands burned in the summer of 1988 (left). In the aftermath of the fire, these areas offered more open water to wading birds and more nutritious food for a variety of wetland animals. (Photo by LuRay Parker).

Rising from the ashes

Animals depend on plants. To have diversity and abundance of wildlife, we must have diverse, productive plant communities to provide habitat. Habitat diversity depends on a number of natural processes, one of which is disturbance.

Fire is perhaps the most important natural disturbance on the western landscape. The West's timber and grasslands have been visited by fire for thousands of years. The plants of this area have evolved with fire. As the examples here have explained, seral species are quick to colonize burned areas, and over time, succession returns the plant community to a climax stage, with woody species and accumulated fuels, ready to carry a fire again.

The animal populations of the West are adapted to the plant communities, so they are also well suited to the presence of fires. They like the new growth that follows a burn because it is nutritious and palatable. A mosaic of burns of different ages provides them with a good combination of forage, cover, and open terrain.

Fire suppression since settlement has put a stop to regular, natural fire disturbance. As a result, the vegetation in huge areas of the West has changed. Early seral plants are less and less abundant. The natural mixture of old-growth and new colonizers distributed over the landscape has been lost and, with it, wildlife habitat. Animals that are adapted to foraging in seral communities like aspen, open grassland, mountain meadows, and stands of shrubs must make do with climax communities.

We understand the dangers wildfire poses, especially to our permanent settlements. Our society has fought hard to control fire and has developed valuable tools and technology for this purpose. But now, for biodiversity's sake and for wildlife, we need fire's disturbance on the land.

Fortunately, we can use our fire suppression technology to manage fire as a tool to "treat" the landscape. Prescribed fire and policies that let some remote wildfires burn will help bring back the fire-adapted ecosystems that support the rich wildlife resource we enjoy.

Land managers and residents of the West recognize the role of fire in nature's balance. However, until fire is fully accepted as a part of the ecosystem, prescribed burning will be difficult and expensive. Letting a natural fire burn will be politically risky and therefore infrequent. Our wild lands will continue to decline in productivity, lose diversity, and accumulate fuels that pose the risk of huge, uncontrollable wild fires.

Scientific research has shown the benefits of fire. Now it is time for land managers to help us reap those benefits. As we gain greater understanding of fire and experience with using it as a management tool, we will improve wildlife habitat and maintain a healthy, balanced ecosystem for future generations.