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Research and Extension

Fire and Grasslands

Prairies need fire to remain healthy (photo: Tom Gross).

Without fire, grasslands would not exist. The frequently dry, fine fuels ignite easily, allowing fires to travel at the speed of the wind for hundreds of miles under wildfire conditions. The interplay between vegetation, fire, climate, humans, and grazing shaped the ecosystems of the North American Great Plains.[1] Individual responses of various species of wildlife and plants native to this region can vary, but overall the grassland systems are well-adapted to frequent fire, and for many grassland species, fire is essential for their persistence.

By intentionally lighting fires, humans have been the main source of fire in this region for thousands of years.[2] Native Americans deliberately and carefully planned burns to achieve management objectives such as directing animal movements, clearing land for travel and farming, or reducing snake populations. A description of an Illinois fire in 1761 tells how a chief planned a fire for hunting bison. *"He organized three separate crews, and at midnight on the designated day, directed the crews out onto the prairie to surround the bison. As dawn approached, the circle would be completed and once the morning sun had dried the dew from the grass, it was set on fire and the hunt began."*[3]

Today, ranchers and wildlife managers carry on the tradition of maintaining healthy Great Plains grasslands by mimicking natural fire through the use of prescribed burns. These burns are not conducted randomly or without care, but according to a detailed and well-thought-out plan that gives the best chance of achieving the desired results. Thus a goal-oriented 'prescription' or plan is developed to ensure the best chance of success. Grasslands require a myriad of disturbances to maintain health and productivity; a prescribed fire implementation plan is only part of an overall grassland management plan and should be considered in conjunction with other livestock, wildlife, vegetation, and wildfire mitigation objectives.

Perhaps the most interesting interaction between disturbance processes is that of fire and grazing. Whether native grazing animals such as bison are present or domestic livestock such as cattle or sheep, fire influences grazing behavior and vice versa. Fire not only removes litter and standing dead grasses, but it also stimulates new regrowth of nutritious grasses and some forbs that are sought out by both wildlife and livestock.

Grazing behavior also can dramatically influence fire effects. Areas that have been heavily grazed are less likely to burn as there is less fuel. Conversely, ungrazed areas with plenty of grass are more likely to burn with varying degrees of intensity depending on environmental and fuel conditions during the fire. Managing grazing to either increase or decrease fuel loads can be an important part of a prescribed fire and overall grassland management plan.

Benefits of Prescribed Burning

Prescribed burning can benefit native grasslands, hay meadows, parks, and reseeded native grass plantings. Some of the benefits include:

Maintain open grassland. Woody plant encroachment threatens prairie ecosystems both in the Great Plains as well as globally. Without fire, woody plant species outcompete grasses and may convert grassland to closed-canopy forest or dense shrubland in a matter of decades. The transition of prairie to woodland or shrubland is more rapid in areas of greater precipitation. As woody plant abundance increases in a grassland system, there is a subsequent decrease in forage quality and availability, as well as the habitat available for livestock and for prairie wildlife and plants. A higher abundance of heavy woody fuels not only decreases abundance of fine grassy fuels, but also decreases the likelihood that low-intensity burns will occur and increases the probability than infrequent and potentially more intense and severe fires will occur.

Enhance biological diversity. Fire maintains and enhances biological diversity in native grassland systems. Fire helps to 'reset' the clock, allowing early successional plants to grow while also stimulating root development, nectar production, and seed germination for many grassland plants. Overall, fire can preserve biological diversity and can positively interact with grazing to promote increased prairie plant and wildlife diversity.

Improve plant growth and vigor. Great Plains range plants are well-adapted to fire. Fire removes litter, promoting native warm-season grass growth. Desirable grasses such as big bluestem grow more vigorously when recently burned. Seeded stands, such as CRP (USDA Conservation Reserve Program), can be thickened with the use of fire and grazing. Healthy plants that comprise a dense stand of vegetation generally provide plenty of forage and little opportunity for weed establishment. Appropriately timed fire also can stimulate growth of native wildflowers and other broadleaf plants.

Growing season prescribed burns may be beneficial for woody plant control (photo: Carol Baldwin).

Improve soil health. Fire causes soil organisms to become active earlier in the spring as the blackened soil surface is heated by the sun. By enhancing plant and microbial growth, soil health is improved and maintained with fire. Rangeland soils in the Great Plains are generally fertile, and fire can play a key role in establishing and maintaining prairie grasses that hold the soil against erosion. Prairie soil organisms weave together a complex matrix of microbial life, fecal material, roots, mineral particles, and decaying vegetation while fixing nitrogen from the atmosphere and regulating water movement.

Increase livestock performance. Herbivores from livestock to grasshoppers to bison prefer to graze the regrowth after a fire. Regrowth has high levels of nutrients and is easily accessible due to the removal of dead and decaying vegetation. Appropriately timed burning can improve livestock weight gains by stockers in certain areas of the Great Plains.

Improve wildlife habitat. Prairie wildlife depends on fire to create desirable habitat. Food, shelter, and breeding bird habitat availability and quality are influenced by fire. Some wildlife species are most often found in recently burned prairie (fresh regrowth), some in less-recently burned prairie, while others require a mix of recently and less-recently burned prairie.

Weed control. Some less-desirable plants can be controlled or prevented from establishing by the use of prescribed fire at times when the individual plant or species is most vulnerable to damage by fire. Prescribed fire is oftentimes less expensive than other forms of weed control (i.e. herbicide application or mechanical removal), and less damaging to nontarget species.

Grazing and habitat distribution. Because livestock prefer recently burned areas, they can be manipulated to use various parts of a pasture through planned burning. This concept is used in various patch-burn grazing strategies, where a single pasture provides a variety of grazing options and multiple wildlife habitats due to the interaction of fire and grazing and the subsequent uneven regeneration of forage, vegetation structure, and plant composition. Conversely, after a wildfire, grazing distribution can be evened out by burning the parts of the pasture not touched by wildfire.

Wildfire risk reduction. Grassland fuel loads are highly dependent on fire history, grazing, and precipitation; annual growth can replace the fuel load each year. The greatest reduction in wildfire risk is

achieved by removing woody species, such as junipers species, with prescribed burning. Nonsprouting juniper like eastern redcedar and ashe juniper are easily killed with fire. Lofted embers from burning junipers can start spot fires well ahead of the main fire front, greatly increasing the difficulty of controlling a fire.

Planning for a prescribed burning begins with identifying clear management objectives. The best time to burn depends on when the burn objectives are most likely to be achieved, resources for burning are available, and safe burning conditions exist. It may take several years of planning to create and wait for the conditions needed to achieve a particular burn objective. Examples of multi-year strategies include deferring grazing to allow fuel to accumulate, developing or acquiring appropriate human or equipment resources, and patiently waiting for weather and fuel conditions to align to produce a fire that achieves the primary objectives.

Woody plant control is often an objective when prescribed burning in grasslands (photo: Eva Horne).

A single burn can often achieve more than one management objective, such as reducing woody plants while improving forage quality. Management objectives determine the fire intensity, timing, size, and duration needed. Fuel and environmental conditions that play a large role in determining fire effects include seasonality, vegetation structure and composition, time since the last burn, and fuel properties such as fuel amount, continuity, and moisture content. Weather, soil moisture, and topography directly affect fire intensity and also need careful consideration.

Short-term management objectives can often be achieved with a single successful fire event; however, fire use should be considered to be an ongoing land management tool. Long-term goals, such as woody plant reduction or creating a desired shift in a plant community, may require multiple fires over time and space. Depending on objectives, grazing, and rainfall, the time until the next burn is needed will vary. For example, a return interval of three years or less may be recommended in tallgrass prairie to keep woody species under control prior to their establishment. In shortgrass prairie, a fire interval of 10 years or more may be adequate to maintain an intact and functioning ecosystem.

Some fire effects are short-lived. The increased nutritional value of regrowth after burning declines rapidly in tallgrass prairie.

Some fire effects last for years. Where junipers are killed by a prescribed fire, re-treatment may not be needed for five or more years in areas that are semi-arid.

Some desired objectives can only be met with multiple fires over a sustained period of time. Pastures with dense brush encroachment may take years of prescribed burning to manage problematic species, and chemical and mechanical treatments may also be needed as initial or follow-up treatments.

Where there are grasslands, there will be fire. Prescribed fires can mimic the rejuvenating effects of wildfires on prairie while minimizing risk and controlling the timing and intensity of the fire. Living in a landscape shaped by fire, prescribed burning engages us in an ongoing collaboration with nature. There is no substitute for fire.

Endnotes

1 Axelrod, D.I. 1985. *Rise of the grassland biome, Central North America*. Botanical Review 51(2):163-201.

2 Kay, C.E. 2007. *Are lightning fires unnatural? A comparison of aboriginal and lightning ignition rates in the United States.* Pages 16–28 in R.E. Masters and K.E.M. Galley (eds.). Proceedings of the 23rd Tall Timbers Fire Ecology Conference: Fire in Grassland and Shrubland Ecosystems. Tall Timbers Research Station, Tallahassee,FL

3 W.E. McClain and S.L. Elzinga, 1994, *The occurrence of prairie and forest fires in Illinois and other Midwestern states*, 1679-1854. Erigenia 13: 80

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