Burning in the Growing Season

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Growing-season prescribed fire is defined as prescribed burns conducted when warm-season herbaceous plants are actively growing, which is summer to early fall in the Southern Great Plains. While prescribed fire is a common management practice on many private and public lands, it is primarily used during the dormant season, particularly just before spring green-up, because it is often used to promote livestock production,[1] and growing-season burns are often viewed as consuming forage that could be grazed by livestock.[2] However, growing-season fire can be used in livestock operations to extend highly palatable forage later into the year. Additionally, there is a misconception that growing-season burns are not possible due to green vegetation or insufficient fuel[2]. Yet, with sufficient litter, fires can carry even during the summer months. Another reason land managers do not consider growing-season burns is due to the belief that burning during this period will damage key plants and negatively alter vegetation composition. However, this is been dispelled by research.[3] For more information see Oklahoma Cooperative Extension Publication NREM-2877 *Fire Effects in Native Plant Communities*.

Historically, fires have occurred throughout the year and even today they continue to ignite at varying times of the year throughout Oklahoma and North America. Historical fire accounts show that lightning-set fires in many regions of the U.S. occurred during the growing season, and Native Americans ignited fires in nearly all months with a majority in the late summer. [4,5,6,7,8] This extension circular will address reasons for conducting growing-season fire, effects of these fires, when they might be appropriate, and how to conduct them.

Why Burn During the Growing Season?

One of the primary reasons to burn during the growing season is to provide more opportunities to complete a planned burn. Fire managers find themselves with several burns to conduct during the dormant season, and with inadequate days available, those burns are not conducted that year.[9,10] Burns that are not conducted are usually postponed until the following year, which adds even more burns and burn days to an already limited schedule in the upcoming year. For the long-term, burn units are not burned on a regular basis, which alters management of livestock forage, timber and wildlife habitat. Limiting the burning window to a few days in the dormant season may result in fire mangers burning when conditions are marginal, so fires are less effective, or when the escape risk is greater. If burning was conducted year-round or in more than one season, more days would be available for burning and the most optimum days for achieving goals and minimizing risk could be utilized (Figure 1). For more information about burn dates see Oklahoma Cooperative Extension Publication NREM-2885 *The Best Time of Year to Conduct Prescribed Burns.*

Due to the large impact weather has on prescribed burning and fire behavior, the number of days available to burn each year is largely constrained by temperature, wind speed and relative humidity.[11,12,13,14,15,16,17] Finding the proper set of weather conditions to conduct a burn during a particular time of the year has always been a dilemma faced by fire managers. High wind speed is often a major constraint to conducting prescribed burns, and in the Southern Great Plains, the late dormant season is typically the windiest period of the year.[18]

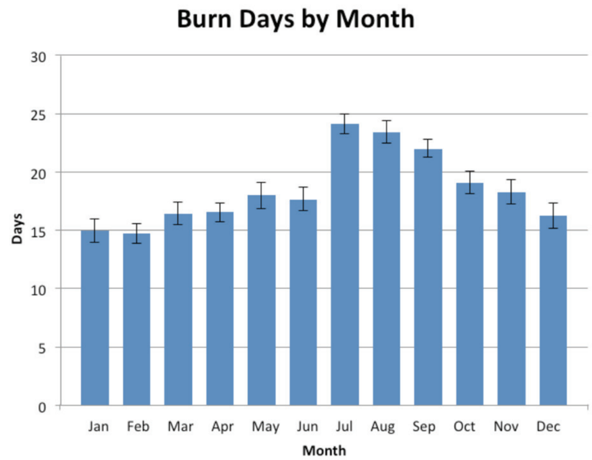

Figure 1. Average number of days from 1994 to 2007 available to conduct prescribed burns by month in Oklahoma. Note that the traditional burn period of February, March, and April had fewer available burn days compared to July, August, and September. If burning was conducted year-around or in more than one season, more days would be available for burning and the most optimum days for achieving goals and minimizing risk could be utilized. For more information about burn times see Oklahoma Cooperative Extension Publication NREM-2885 *The Best Time of Year to Conduct Prescribed Burns.*

It is also during the late dormant season in the Southern Great Plains when conditions are most favorable for wildfires, and county and state burn bans are most often imposed, which can limit the number of burn opportunities. March has the greatest number of wildfires and the greatest number of county and statewide burn bans in Oklahoma.[19] For example, during March of 2009, 44 of the 77 counties in Oklahoma were under a burn ban, but from May to December of that same year no county burn ban was in place.

Burning is often limited to a single season by policy, tradition or a misunderstanding of fire effects on plant communities. Fire managers should be aware of the benefits and downfalls of burning during various times of the year. If the goals and objectives of the land manager are specific, and if safety for everyone involved with the fire is maintained, then a wide range for temperature, relative humidity and wind speed can be used to safely and effectively conduct the fire.[20]

Growing Season Fire Effects

Native Plants

In grassland landscapes, fire promotes productivity by increasing light availability.[21,22,23] Fire also limits woody plant encroachment.[24,25,26] Growing-season fire in grasslands enables land managers to extend the traditional dormant-fire season and actively burn throughout the year with minor or no negative impact on grass survival. Pre-fire and post-fire environmental conditions influence individual plant and plant community response.[27,28] Soil moisture has been identified as the single most critical factor affecting plant recovery following fire in the southern mixed prairie.[29] Drought following fire, regardless of season, can intensify fire effects in semi-arid grasslands, but in the Kansas tallgrass prairie no reduction in productivity followed annual late-spring burning (dormant-season) even in dry years.[24,29,30] Drought can also delay recovery beyond three years in some instances.[28] Even when drought follows fire, vegetation will recover, but it may take longer than if the post-fire period is accompanied by normal or above normal rainfall.

A study conducted in Oklahoma[31] revealed the plant community was unaffected by fire season and little bluestem (*Schizachyrium scoparium*), a presumed fire-sensitive grass species, was strongly influenced by precipitation, and unaffected by season-of-fire even when followed by grazing (Figure 2). The results of the study indicate the previous year's precipitation influenced plant composition more than season of fire.

These results are supported by data from a greenhouse study that found that little bluestem seedling survival was strongly dependent on plant age, and the effect of burning followed by clipping (simulated grazing) was similar to multiple clipping events.[31] Burning also increased aboveground biomass and belowground root biomass of clipped and non-clipped plants, yet burning had less negative effect on little bluestem than clipping (Figure 3). These results strongly suggest little bluestem is highly adapted to growing-season fire.

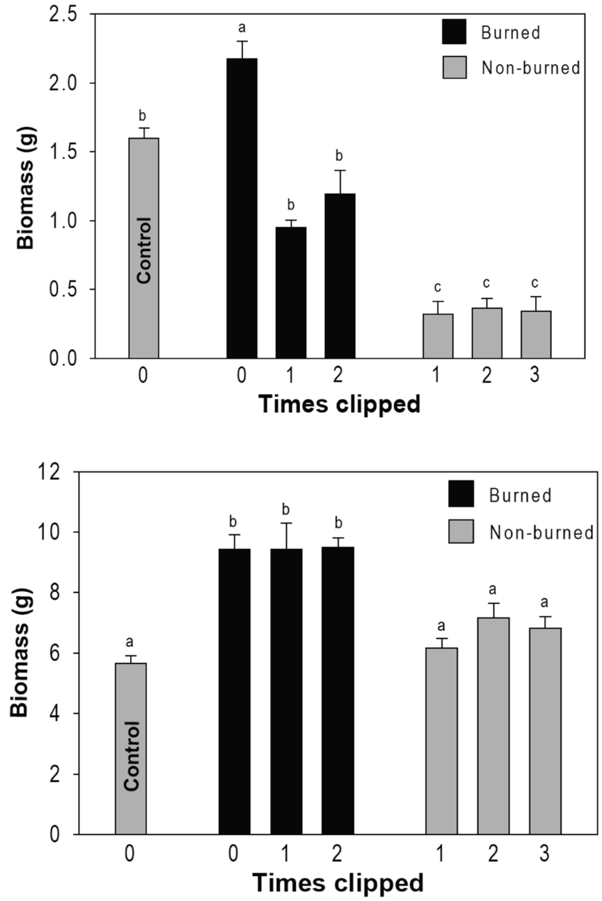

Figure 3. Aboveground biomass (top graph) and belowground root biomass (bottom graph) harvested from little bluestem plants subjected to burning and clipping, and clipping only, at 18 weeks post germination. Burning increased aboveground biomass and belowground biomass of clipped and non-clipped plants, yet burning had less negative effect on little bluestem than clipping. These results strongly suggest little bluestem is highly adapted to growing-season fire.[31]

Forage Quality

Fire removes old, standing dead plant material that is coarse and low in forage quality. After a fire, plant regrowth is young, green and considerably higher in quality than dead plant material or older live plant tissue. Grazing animals attracted to this palatable, nutritious regrowth will preferentially graze recently burned areas. This attraction is one of many mechanisms that demonstrate how fire and grazing interact with each other.

While it is commonly known that burning increases forage quality, the practice is often applied in the spring when vegetation is dormant. Forage quality is increased after the fire, but declines as the season progresses. Burning during the growing season will have similar effects. This increase in forage quality can be valuable for livestock or wildlife, as it is at a time when forage quality declines. Fire may be necessary for optimum productivity of grazing animals. Burning during the growing season may also prolong the availability of high quality forage; quality of burned areas may be twice as good as unburned areas through November (Figure 4).

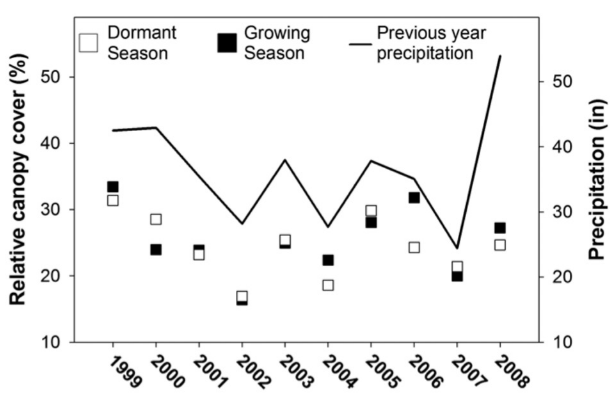

Figure 2. Little bluestem relative canopy cover within tallgrass prairie at the Oklahoma State University Research Range, Stillwater burned in the dormant season or growing-season and annual precipitation from 1999 to 2008. The results of the study indicate that the previous year's precipitation influenced plant composition more than season of fire.[31]

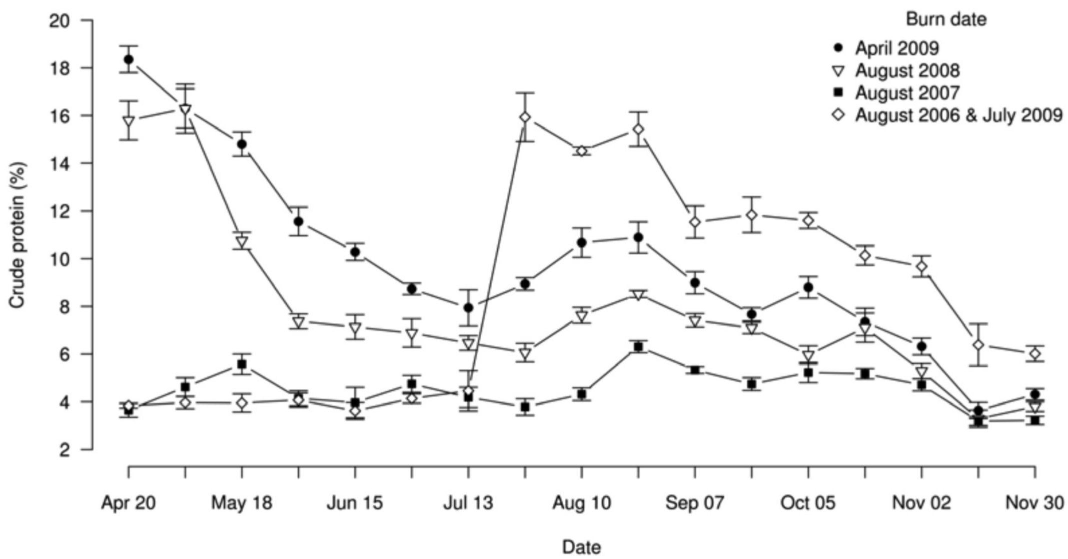

Figure 4. The effects of fire on forage quality (% crude protein) throughout the growing-season of 2009. Data were collected from pastures managed with patch burning. Different symbols represent areas that vary in the time since burned. Recently burn areas (less than one year since fire) contain higher forage quality. A prescribed fire in mid-July increases quality of forage, raising it significantly higher than other areas. This increase remains through the end of the growing-season.

Wildlife

It is well established that disturbances such as prescribed fire can be used to manage habitat for many species of wildlife.[32,33,34] Fire effects both plant composition (species of plants) and structure (height, stems per area, litter depth, etc). Various wildlife species have differing habitat requirements, so fire can be used to alter the plant community in ways to favor specific species or groups of species. While many land managers recognize the role fire has on wildlife, traditionally most prescribed fires are conducted during the dormant season, even those conducted primarily for wildlife objectives. There are several customary reasons why fire is used during this time of year, such as avoiding disturbance of ground nesting birds, minimizing mortality of reptiles, amphibians, and young mammals as well as tradition. While all of these reasons can be valid, it is difficult to achieve some management objectives for wildlife during dormant season burns and burning at the same time of year every time may benefit certain plants more than others.

Further, land managers often struggle to burn enough land to keep the plant community in the appropriate condition to meet their objectives. For example, in the Southern Great Plains, thousands of acres of rangeland are being encroached by eastern redcedar (*Juniperus virginiana*). This has significantly changed the plant species composition of these grasslands,[35,36] which directly impacts the wildlife species present. Landowners constrained to only burning during one season of the year will often lose acres of prairie to eastern redcedar woodland, which becomes increasingly difficult to control with fire by itself.

The primary consideration regarding the use of fire should be the appropriate fire frequency (how often you burn) to maintain the desired plant community. This often entails burning during different seasons of the year. It is important to note that all other considerations (i.e. season of burn) should be secondary to fire frequency. Therefore, the primary reason to use growing-season fire is to extend the burn window to maintain the desired plant community to meet wildlife management objectives. With that in mind, there are some differences in plant and animal responses that should be understood.

Impacts to Wildlife Habitat Structure and Composition

Growing-season fires behave quite differently from dormant-season fires, and more often than not, they tend to burn less complete and are often patchy in nature (Figure 5). Factors such as fuel load, fuel type, moisture, slope, soils and grazing will contribute to this patchy burn pattern. This patchy distribution of burned and unburned areas can be beneficial to some species of wildlife that require diverse plant communities in close proximity.

Bobwhite quail (*Colinus virginianus*) is a classic example. This species requires dense nesting cover, usually in the form of residual grass from the previous growing season and forb rich areas with adequate amounts of bare ground for their broods.[37] These areas need to be in close proximity to each other. While conducting small burns (less than 50 acres) may be beneficial to quail, many times this is not logistically or economically feasible for land managers. Thus, burn units tend to be larger in size and if conducted during the dormant season, most of the vegetation in the burn unit will be consumed by the fire, resulting in fairly uniform plant structure across the unit in the short term. However, if that same unit burned

Figure 5. Growing-season fires behave quite differently from dormant-season fires and, more often than not, growing-season fire burns less complete and often patchy in nature. The resulting mosaic burn can create ideal habitat for bobwhite quail. Notice the woody cover and grass cover not consumed by fire. (Photo D. Elmore)

during the growing season, it will often exhibit a high percentage of unconsumed and unburned vegetation and these patches provide a higher amount of variation within the unit that can benefit quail (Figure 6). Having this habitat variation within the burn unit also provides habitat for other wildlife species.

It should be noted this will not always be beneficial to all species, especially if the patch (burned or unburned) size is smaller than a particular wildlife species responds to. Prairie-chickens (*Tympanuchus spp.*) for instance, require large tracts of treeless prairie. Conducting a patchy fire that only removed a portion of the eastern redcedar in a burn unit would not be appropriate for prairie-chickens. However, once all the eastern redcedar were removed, then a patchy fire within the grassland could provide both nesting and brood cover similar to what the bobwhite quail require. Thus, depending on the initial conditions of the site, wildlife species of interest, and scale of patches, a non uniform burn may or may not be warranted.

Figure 6. Growing-season burns will often exhibit a high percentage of unconsumed and unburned vegetation and these patches provide a higher amount of variation within the unit that can benefit wildlife such as quail. Notice in this photo the area left unburned due to sparse fine fuels. These patches of unburned blackberry and bluestem not only serves as winter cover for birds such as quail, but can provide nesting habitat the following spring for some ground nesting birds. (Photo D. Elmore)

Besides changing the overall composition of plant functional groups (such as grass, forb and woody), season of burn also can impact individual plant species. For example, certain forbs may be at an advantage when growing-season burns are conducted rather than dormant season burns, while other plant species will be at a disadvantage. Many of these relationships take years to become evident for some species (particularly perennial plants). Others, such as annuals, are immediately impacted, but the results are highly variable depending on the precipitation during that year. Thus, a growing-season fire may yield abundant common broomweed (*Gutierrezia dracunculoides*), which is a valuable quail plant, in one year, and almost no response following the next growing-season burn. As precipitation is impossible to predict, it becomes problematic to anticipate individual plant species responses at small scales. From a large landscape perspective, this may be irrelevant, assuming not all the landscape is managed the same way. Thus, it becomes important to not manage all the land the same way year after year.

Growing-season Burns as Food Plots

Land managers often wish to plant food plots to increase forage or serve as an attractant for certain species of wildlife such as waterfowl, dove, turkey and deer. At times this may be a beneficial practice, particularly as an attractant for hunting. However, there are problems associated with this practice such as: cost, erosion, introduction of invasive plants, compaction of soil, and difficulty of establishment. An alternative is to use prescribed fire to stimulate food-producing native plants. Growing-season fires can be very effective at this. For example, in the Southern Great Plains, summer fires often create patches of snow-on-the-mountain (*Euphorbia marginata*) and various species of croton or dove weed (*Croton spp.*), which are highly desirable to mourning doves (*Zenaida macroura*). The seeds from these plants, coupled with the lack of grass litter following the fire, make these burned areas key areas for dove hunting in September. Additionally, late summer or early fall fires reduce grass litter going into the dormant season which can make certain important cool season plants more accessible. Scribner's panicum (*Dichanthelium oligosanthes*), which is important winter deer forage, is a good example. This plant is commonly foraged on by white-tailed deer during the winter in areas burned during the previous growing season (Figure 7).

While, these native "food plots" may not produce the quantity of forage per acre that a cultivated plot would, the cost is much less per acre, thus many more acres can be treated, maximizing the benefit to wildlife. Land managers will not see the same results from year

Figure 7. Growing-season fires can create natural food plots at little cost to the landowner. These white-tailed deer are concentrated on a fire conducted in July, the photo was taken the following January. The deer are feeding on the winter rosettes of Scribner's panicum which is a native cool season perennial grass. (Photo D. Elmore)

to year or place to place, as weather and soil differences will influence the outcomes. Experimentation with various seasons of burns on a particular property will provide the manager guidance as to how to increase the attractiveness of a site to target wildlife. The important thing to remember is that you can successfully manage for wildlife without planting anything on your property. This requires an understanding of how to manipulate native plants with disturbances such as fire. Additionally, you will need to learn the plants in your area. A good reference is *Field Guide to Oklahoma Plants* available at Natural Resource Ecology and Management, 008C Ag Hall, Oklahoma State University, Stillwater, OK, 74078 or 405-744-5437.

Other Considerations for Wildlife

While growing-season fires can assist in meeting wildlife management objectives, there are some other items to consider. Many people have concerns about wildlife mortality during any prescribed fire. The vast majority of wildlife are able to avoid the fire by leaving the burn unit or going underground, but some young wildlife can be particularly vulnerable.[38] Research suggests growing-season fire mortality is minimal in areas where fire historically occurred.[39,40] It has long been recognized that ground nesting birds are susceptible to fire,[41] however limited research suggests that losses to ground nesting birds from growing-season fires is minimal.[42] But avoiding the primarily nesting period is advisable especially in areas with species of concern. For our region, the primary nesting season for most grassland birds is May-July. While there is still reproduction taking place during August and September, the vast majority of nests are complete by this time. Therefore, waiting until late July or August will avoid most chick mortality on ground nesting birds. Additionally, many bird species will renest if their first nest is lost.

Similarly, during May and June there are high numbers of deer fawns and young mammals, but there is limited information reported about the impact of growing-season fires on these species. Reptiles can also be at risk during the early growing season when temperatures are cooler, which makes them less mobile than birds and mammals. Some reptile species have shown high mortality rates such as glass lizards (*Ophisaurus spp.*).[43] However, growing-season burns often leave a refuge of unburned areas that reptiles may be able to escape into.[44] While some reptile mortality will occur, providing diversity in habitats with fire is beneficial in the long-term to the reptile community as a whole. In fact, a review of research concluded that a landscape with a mixture of burned and unburned areas has a higher diversity of reptile species.[40]

There are techniques that can be used to reduce impacts to wildlife, such as the use of backfires, spot ignition, or strip headfires. These ignition techniques create slower moving fires or only burn small areas of the unit at one time, which allow most wildlife time to avoid the fire. Avoid using ring fire techniques that can possibly entrap wildlife within the fire. If necessary, only burn patches (burning only small areas at a time), avoiding large broadcast burns. For more information about ignition techniques see Oklahoma Cooperative Extension Publication E-927 *Using Prescribed Fire in Oklahoma* or Video VT-112 *Using Prescribed Fire in Oklahoma*.

While it is impossible to avoid all wildlife mortality from prescribed fire, steps can be taken to reduce the incidence. However, as mentioned earlier, maintaining the appropriate plant community for a species is much more critical than concern about an individual incidental mortality. Along with additional burn days, the positive effects for wildlife and native plants are important issues to consider when contemplating growing-season fires. Land managers need to consider all of the possible options available to achieve their land management goals and objectives before applying any management practice.

Conducting Growing-Season Burns

To conduct a growing-season burn, adequate dead plant residue (litter) from the previous year's growth is required. This litter is needed to ignite the fire and create the heat to remove the moisture from the current year's growth so the fire will continue to carry through the fuelbed (Figure 8). Therefore, for a growing-season burn to be successful, an appropriate stocking rate of livestock is necessary to provide sufficient litter from the previous year's forage production. Research at OSU has found that litter accumulation in patch burning provides exceptional fuel loading in the form of dead plant litter.[45] For more information about patch burning see Oklahoma Cooperative Extension publication E-998 *Patch Burning: Integrating Fire and Grazing to Promote Heterogeneity*.

Due to the high moisture content of actively growing plants, expect some unburned residue after most growing-season burns. Rather than being a concern, patchy burns can meet specific goals (e.g. wildlife habitat) difficult to achieve with dormant-season burns. The higher

Figure 8. To conduct a growing-season burn, adequate dead plant residue (litter) from the previous year's growth is required. This litter is needed to ignite the fire and create the heat to remove the moisture from the current year's growth, so the fire will continue to carry through the fuelbed. (Photo Stephen Winter)

Figure 9. With increased fuel moisture (green vegetation) there is a greater amount of smoke produced. On the positive side, most burn days during the growing-season are favorable for proper smoke dispersion. While a growing-season burn may increase the amount of smoke produced on an individual burn, it can help spread the total smoke load out over an entire year. (Photo Stephen Winter)

the moisture level, the more heat energy required to remove the water from the live plant tissue before it is consumed by the fire. Do not assume that because a plant is green and growing that it will not burn very well. Many plants burn extremely well during the growing season; this can be attributed to plant chemistry (volatile oils) and many live plants also have dead leaves.

Personal Safety

A potential problem from conducting growing-season burns is the increased risk of heat stress related problems to members of the burn crew. Always make sure everyone is ready for the additional heat of burning during the summer time. Have plenty of water and sports drinks available so everyone on the fire crew can stay hydrated. Be sure personnel drink ample amounts of fluids before, during and after the burn to keep their body hydrated.[46] Also, everyone should learn to recognize the symptoms of heat-related problems such as heat stress or heat stroke and know how to treat them.

Personnel should wear clothing that allows for adequate ventilation and cooling, but is safety appropriate, such as all cotton. Another way to reduce heat-related problems is to make sure everyone on the burn crew rides in some type of vehicle if at all possible. Also, certain tasks involve being around greater amounts of heat than others on growing-season burns, so make sure personnel switch tasks often to reduce the chance of heat related injuries. If everyone on the burn crew will watch out for each other, and crew members learn to know their limits, there should be no heat related problems encountered while conducting growing-season burns even on the warmest of summer days.

Smoke

One aspect to burning that should be managed during the growing season or any season of the year is the smoke. Smoke from prescribed fire and wildfires are predominately made up of water vapor. With increased fuel moisture (green vegetation) there is a greater amount of smoke produced.[47] On the positive side, most burn days during the growing season are favorable for proper smoke dispersion (Figure 9). While a growing-season burn may increase the amount of smoke produced on an individual burn, it can help spread the total smoke load out over an entire year. When burning during the growing season, or any time of the year, make smoke management a priority. For more information on smoke management see Oklahoma Cooperative Extension Publication E-1008 *Smoke Management for Prescribed Burning.*

Fire Behavior

Generally flame length and rate of spread are less when conducting growing-season burns (Figure 10). This is due in part to the increased moisture content of the fuels, which has a direct relationship with these fire behavior measurements.[2,48] When conducting growing-season burns, do not expect fast moving fires with tall flames because they will not normally occur. In fact, the flames are rarely taller than the surrounding vegetation and the headfire commonly moves at the rate of a dormant season backfire. This slow rate of fire spread can increase the amount of time it takes to conduct a burn, so plan accordingly.

Growing-season fires still impact woody plants in much the same way dormant-season fires do (Figure 11). While dormant-season fires have taller flame lengths and faster rates of spread, growing-season fires still top kill woody plants. This is due to the residence time, or how long the fire burns in a given area. The intensity of fire may be less, but the duration of heat from the growing-season fire is longer. The temperature at which most vascular plant material dies is around 150 F,[16] so if the outside temperature is already from 90 F to 100 F, then only a small increase in temperature from a fire will top kill most plants. Objectives of cedar control and reducing

Figure 10. When conducting growing-season burns, do not expect fast-moving fires with tall flames because they will normally not occur. In fact, the flames are rarely taller than the surrounding vegetation and the headfire commonly moves at the rate of a dormant season backfire. Example: upper left dormant season backfire, upper right growing-season backfire, lower left dormant season headfire, lower right growing-season headfire. (Photos Stephen Winter-UR, LR J. Weir-UL, LL).

other woody plants can still be met with growing-season fire.

Spotfires and Escapes

Spotfires and escapes are usually not a significant problem while burning in the growing season. This is due impart to the amount of green growing vegetation that reduces the ignition probability of embers and reduces the rate of fire spread. Most of the time in the growing season, the relative humidity is higher because of the transpiration of the growing plants and increased southerly wind flows bringing in moisture from the Gulf of Mexico. The relative humidity is normally higher than it is during most of the dormant season, thus reducing the probability of spotfires.[17] If an escape occurs, it is normally a slow moving fire that can be quickly extinguished, assuming the fire crew is adequately equipped and manned. This is under “normal” growing-season burn conditions, but we can also have extreme fire behavior if the weather has been dry or under drought conditions. Safety and care should be exercised at all times when conducting growing-season burns.

Figure 11. Growing-season fires still impact woody plants in much the same way dormant-season fires do. While dormant season fires have taller flame lengths and faster rates of spread, growing-season fires still top kill woody plants. This is due to the residence time, or how long the fire burns in a given area. The intensity of fire may be less, but the duration of heat from the growing-season fire is longer. (Photo J. Weir)

Management Implications

There are numerous reasons to burn during the growing season, as well as some limitations. Learning how the use of fire in various seasons of the year can increase a land manager's ability to maximize their goals and objectives.

- Fires have historically occurred during the growing season and these burns will not damage or kill most native plants.
- Growing-season burns provide fire managers more days to complete burns and allow for appropriate fire frequencies.
- Burning during the growing season can increase forage quality and extend forage quality later into the year.
- Most growing-season burns do not completely burn up all the vegetation, creating patchy burns, which creates a variety of plant structure and composition for wildlife.
- Understand how growing-season burns can impact various wildlife species.
- Burning during the growing-season is often easier and safer than conducting dormant-season fires.
- Smoke management is not only important for burns conducted in the growing season, but fires conducted at any time of the year.
- Most land management goals and objectives can be achieved with growing-season burns.

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