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EFFECTS OF FIRE ON WILDLIFE

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The belief that fire on Texas rangelands is detrimental to wildlife is a misconception. Despite the images that fire prevention programs use to promote their message, rangeland fire has a critical and positive role to play for humans and animals. Native Americans understood that fire enhances the propagation of early successional plants, which attract game such as white-tailed and mule deer, antelope, and bison. Fire plays such a crucial role in our ecosystems that nearly all native wildlife have adapted to the direct and indirect effects of fire. The absence of fire on rangelands has consistently been cited as a primary cause of woody encroachment, decreased rangeland condition, and diminished ecological resiliency. Over time, fire suppression* actually degrades habitat for many wildlife species—the direct effect of range burning on wildlife is far outweighed by its indirect benefits (Fig. 1).

Many fear that fire is destructive to wildlife. However, even in large fires, animal mortality as a direct result of the fire is rare. When it does occur, it is usually the result of escape routes being blocked by fencing or other obstructions. The beneficial effects of fire typically compensate for any losses, and once vegetation responds, wildlife populations quickly recover, often better than before.

Figure 1. 1,000-acre summer prescribed burn in Kimble County (2015). Burn plan objectives included cedar management, pricklypear management, and increased productivity and vigor of native perennial grasses. *Photo by Dr. Morgan Russell*

Wildlife habitat is not static—it changes constantly. Therefore, landowners must manage habitat in order to maintain stable populations of desired wildlife species. Prescribed burning for wildlife must take into account the wildlife species that are present, vegetation types, stages of plant succession, weather patterns, life histories of wildlife, and intensity of burn. Using a series of fires to create a mosaic pattern of vegetation over large areas will create interspersed habitat types that can support the maximum diversity of plant and wildlife species. In this scheme, burned areas promote edge effects between habitat types that can be used for feeding, escape, loafing coverts, and sites for ground-nesting birds (Fig. 2).

Figure 2. A 30-acre summer prescribed burn actively burns as part of a patch-burn in a larger 100-acre pasture in San Saba County. Patch-burning allows for enhanced edge effect that provides a variety of fire frequencies and fire effects that enhance wildlife habitat. *Photo by Dr. Morgan Russell*

On the next pages are explanations of the specific effects of fire on various species. These will provide some general rules and context and help you develop an understanding of the effects of fire on wildlife.

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*Underlined terms are in the glossary on page 5.

SMALL MAMMALS

The direct effect on small mammals (rabbits, squirrels, mice, rats, etc.) is minimal since most escape ahead of the fire front. The indirect effect of fire on small mammals is greater and includes the temporary loss of shelter and food, increased surface exposure, and increased predation. However, research suggests that the numbers and diversity in small mammal populations are maintained for 1 to 3 years or longer after a fire and positive food chain effects are present for many years after the fire. Also, some small mammals can tolerate temperatures of 120ºF for short periods if the relative humidity is above 60 percent. Death typically occurs when fires burn for longer periods at sustained temperatures of 145ºF with a relative humidity below 22 percent. Survival increases when fires involve interspersed low-density fuels and high moisture content.

BIRDS

The effect of fire on birds depends on the species, the season, and the intensity of a fire. For example, a cool-season dormant burn increases food sources and provides residual nesting sites for ground- and brush-foraging birds. A more intense cool-season fire produces the same effect but creates more openness by reducing the brush canopy. The greatest advantage to varying frequencies of fire is that they create relatively small burns of different ages that are interspersed with areas that have not been burned for several years. Birds may use a recently burned area for foraging within seconds of burning (Fig. 3).

Habitat for endangered bird species such as the golden-cheeked warblers and black-capped vireos can be managed through appropriate burns—these birds evolved in a system dominated by fire. The black-capped vireo (listed in 1987) breeds in fire-maintained juniper and scrub-oak habitats. To nest successfully, black-capped vireos require a patchy structure of mixed shrublands, mature, woodlands, and open cover. This diverse habitat type is achieved by varying fire frequencies and seasons to optimize plant diversity and structure.

In some ways, northern bobwhites (*Colinus virginianus*) could be considered a firebird. Quail will take the opportunity to feast on newly available insects and seeds in the edge habitat of burns even before the vegetation stops smoking. A true grassland species, bobwhites thrive in areas characterized by frequent fires that reduce woody cover. In addition, the more efficiently quail feed, the less vulnerable they are to predation—especially following mosaic-type burns that

Figure 3. A northern bobwhite female in a recently burned area foraging for food immediately after a 500-acre prescribed burn in Edwards County. *Photo by Dr. Morgan Russell*

leave residual cover. You can produce quality quail habitat by using a fire regime that intersperses areas burned more frequently than every 2 years with areas burned 2 to 6 years apart. This balance of burn frequencies provides summer fruits and insects that are critical for young birds and laying hens as well as isolated clumps of grass that are desirable nesting habitat (Fig. 4). These isolated clumps of grass, such as little bluestem [*Schizachyrium scoparium* (Michx.) Nash] typically decrease after 3 years due to litter buildup.

Figure 4. A covey of northern bobwhite hang out during a summer prescribed burn in McCulloch County. The bobwhite are headed to the recently burned black to forage for new food resources produced from the prescribed burn. *Photo by Brian Treadwell, Conservation Fire Team*

Figure 5. This 100-acre prescribed burn in Tom Green County was conducted to remove decadent litter from perennial grasses. The burn will produce healthier stands of grass and greatly enhance the wildlife habitat of this pasture. *Photo by Dr. Morgan Russell*

This buildup inhibits quail movement, especially for chicks. The problem of vegetation becoming too rank for chicks is most common in high-rainfall grasslands such as the Texas coastal prairies. Patch burning in these areas, at varied return and season intervals, offers a desirable mosaic habitat effect (Fig. 5).

Lesser prairie chickens (*Tympanuchus pallidicinctus*) are best served by burns every 3 years. This frequency maintains proper cover conditions and promotes desirable forb species and seed-producing grasses. Further, most desirable food items for this species increase after fire. Frequently burned areas maintain appropriate grass height for nesting and concealment.

Wild turkeys (*Meleagris gallopavo* spp.) frequently congregate and feed on freshly burned areas. Turkeys require an open understory as well as mature trees. They use mixed low brush with ample grasses for nesting and the tree canopy for roosting. Therefore, intense burns that kill woody species are not as good for turkey habitat as are cooler, maintenance-type fires conducted during the dormant season. Turkeys benefit from a mosaic of burned and non-burned areas, which provide nesting cover, herbaceous-rich brood-rearing areas, and large roost trees with open understories.

Most adult birds are highly mobile and can easily escape fire. Fires in fine fuels burn rapidly in a narrow band of flame. These conditions keep the maximum temperature, flame length, and fire intensity low and brief, thereby allowing animals to escape more easily. Early season fires may cause some direct mortality of young birds, particularly for ground-nesting species, but the ultimate impact on bird populations requires a longer-term view. When nests are lost, many species will re-nest. Bird populations can respond rapidly and will even increase once they are not limited by food availability and negative habitat changes. This provides further evidence of the positive impacts of mosaic-type burns. Less-intense burns decrease the short-term impact on food availability or cover following a fire. If you want an intense, hot-season burn, later summer months may be preferable—most ground-nesting birds have hatched out and are near adult size by that time.

AMPHIBIANS AND REPTILES

In Texas mesquite savanna research, dormant-season fire had no effect on the diversity and abundance of amphibians and reptiles, whereas their diversity and abundance tended to be slightly greater in plots managed with growing-season fires. One species of lizard was 10 times more abundant in plots burned during the growing season than in the unburned control plot. Burning season overall had few short-term effects on the amphibian and reptile community. A fire regime with burns in varying areas and seasons creates greater mosaic patterns and promotes multiple habitats for wildlife species, including amphibians and reptiles.

LARGE MAMMALS

One of the most common public concerns regarding fire on Texas rangelands is its effect on white-tailed deer (*Odocoileus virginianus*). This concern arises because deer, especially fawns, need screening cover for protection from predators as well as from harmful heat. For white-tailed deer, woody cover should comprise 40 to 60 percent of the landscape. Leaving irregular-shaped patches of woody cover is best, as this maximizes edge. Most often, fire is underutilized on landscapes managed for deer due to the perceived loss of screening and fawning cover. Historically however, fire in Texas burned ¾ of the state every 6 to 10 years. This burning created a habitat in which native populations of white-tailed deer thrived. In the past, much of Texas was covered by prairie, and though deer might not have been as abundant as they are today, healthy populations were maintained due, in part, to the edges fire created between grasslands and woodlands. Again, it is critical that at least 40 percent woody cover remain after a burn to provide for other habitat needs. Within one growing season after fire, preferred browse plants experience significant resprouting of basal and lateral buds—this makes them more abundant, accessible, and palatable. The young, tender shoots are more

succulent and plentiful than older plant material and can potentially alter populations. Grasses and forbs also typically increase following fire. Though increases in nutrient content also occur, these increases do not generally last beyond 6 months following fire.

Most large mammal species have already produced their young by the peak fire season in late summer to early fall. There has been concern that prescribed fires conducted outside the summer season, when historical fires were common, might do more harm to wildlife populations—especially concentrated populations. For example, young large mammals may be more vulnerable to early season fire because they are still immature and lack mobility. However, many of these species have high reproductive rates and recover rapidly. In the long term, large mammals respond more strongly to habitat conditions, including those created by the fires, than they do to short-term effects created by a single burning season. Isolated populations caught in a wildfire could be destroyed, but a dense volatile habitat that could fuel this lethal kind of fire is already unfavorable to their survival.

White-tailed deer, mule deer (*Odocoileus hermionus*), pronghorn (*Antilocapra americana*), and other native species instinctively flee from fire. Most native animals evolved in the presence of fire and have adapted behaviors for escaping fire. These adaptations along with suitable habitat enable population persistence—many species benefit directly from the habitat modifications that result from fire. However, wildlife's ability to survive fires (prescribed burning and wildfires) can be compromised by human interference, such as high fences that limit escape (Fig. 6). During an extreme wildfire season, unmanaged fuel loads accumulate, and hot, dry conditions persist. Furthermore, if a manager chooses to leave a pasture ungrazed to provide wildlife with cover, the very cover that was intended to protect wildlife could actually fuel a devastating fire. These conditions enable erratic wildfires, where flames are 15 to 50 feet long and can loft firebrands that result in fire spotting. Wildlife mortality increases because of these fire's severity, intensity, and speed—they are very different from the fire conditions under which native wildlife species evolved. Unmanaged fuel loads promote hot, intense wildfires that all animals struggle against, whether by burrowing or escaping.

Bears, which are native to Texas, are expanding back into their historic range, though large-scale fires influence their population by reducing their food supplies in the short term. However, bears will wander across mountain ranges in search of food, and then re-establish in new areas once they find new food sources. This foraging behavior has been a key factor in bear expansion for thousands of years.

Historically, fires were so frequent that fuel buildup seldom occurred and fires burned in cooler mosaic patterns with short flame lengths and head fire behavior almost consistent with today's back-fires. In environments where fire was common, there is little evidence that fires, within historical intensities, cause any direct mortality of wildlife.

Resource management includes promoting diversity of both fauna and flora. Fire will happen on landscapes, and it is up to us to decide what kind will occur and how they will impact wildlife populations. Prescribed burns can be controlled, and they reduce potential wildfire severity and intensity, thus reducing potential for animal mortality.

Figure 6. Two white-tailed bucks on a 1,500-acre summer burn in Mason County. The two bucks wandered the fire lines on the east side of the active burn unit. The Burn Boss met prescribed burn objectives with ignition techniques that allowed wildlife access and escape routes.
Photo by Dr. Morgan Russell

SUMMARY OF FIRE EFFECTS ON WILDLIFE TYPES

- **Small mammals (rabbits, squirrels, mice, rats, etc.)**
  - Direct fire effects on small mammals are minimal.
  - Greater fire effects occur indirectly due to the temporary loss of shelter, food, increased surface exposure, and increased predation.
  - Survival increases when fires are conducted with low fuel-density, variable fuel continuity, and high moisture content.
- **Birds**
  - Birds easily escape the fire front and congregate to recently burned areas within seconds.
  - Adult birds are more mobile and can escape fire more easily than younger birds.
  - Northern bobwhite love to occupy the edges of burns before they stop smoking and feast on newly available insects and seeds.
  - Lesser prairie chickens prefer sites burned every 3 years to maintain—this return period provides appropriate grass height for nesting and concealment.
  - Turkeys require a mosaic of burned and non-burned areas to provide for spring nesting and feeding and winter mast and roosts.
- **Amphibians and reptiles**
  - Dormant-season fire had no effect on their diversity and abundance.
  - Diversity and abundance are slightly greater in plots managed with growing-season fires.
  - Variable fire frequencies and seasons promote greater mosaic patterns ideal for amphibian and reptile species.
- **Large mammals**
  - White-tailed deer require at least 40 percent of landscape to be screening cover.
  - Deer populations increase dramatically following fire, provided 40 percent or more cover remains after the burn.
  - Increases in nutrient content occur; however, these increases do not last for more than 6 months following fire.
  - Large mammal species, such as white-tailed deer, mule deer, and pronghorn flee from fire instinctively.
  - Deer also benefit from increased acorn production and other foods, such as succulents.
  - Fire suppression and landscape fragmentation through high-fencing have created conditions in which large mammal wildlife mortality is more frequent.

For more information

- *https://agrilifelearn.tamu.edu*
- *https://texasrangewebinars.tamu.edu*
- *https://texnat.tamu.edu*
- *https://wildlife.tamu.edu*
- *https://tpwd.texas.gov*
- *https://www.nrcs.usda.gov*

Related publications

- *Wildfire Impacts on Surface Waters*, Texas A&M AgriLife Extension
- *Managing Heat for Wildlife on Texas Rangelands*, Texas A&M AgriLife Extension
- *Fire as a Tool for Managing Wildlife Habitat*, Texas A&M AgriLife Extension
- *Proceedings of the Trans-Pecos Prescribed Fire Symposium*, Texas A&M AgriLife Extension
- *Conducting Prescribed Fires – A Comprehensive Manual,* Oklahoma State University
- *Brush Management Past, Present, Future,* Texas A&M AgriLife Extension

Glossary

- **Cover** – Any structure that provides screening, protection, or insulation against weather events, sunlight, predators, etc.
- **Diversity** – Consisting of different elements and variety
- **Edge habitat** – Areas in the transition between two habitat types (i.e., woodland and grassland)
- **Fine fuels** – Typically 1-hour fuels such as grass and grass-like plants
- **Firebrands** – Flaming or glowing fuel particles that are carried by wind, convective currents, or gravity into non-burned fuels
- **Interspersed** – Mixing of components; in this case, of habitat components
- **Loafing coverts** – Cover that provides protection from sun and predation risk in sufficient structure that animals can move freely, or loaf, underneath it
- **Suppression** – The act of extinguishing any open flame