Ecology and Management of the Greater Prairie-Chicken

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Ecology and Management of the Greater Prairie-Chicken in Oklahoma

Contributors in Alphabetical Order:

Dr. Terry Bidwell, Editor
Professor and Extension Specialist
Rangeland Ecology and Management
Department of Plant and Soil Sciences
Oklahoma State University

Dr. Sam Fuhlendorf
Associate Professor
Rangeland Ecology and Management
Department of Plant and Soil Sciences
Oklahoma State University

Stephanie Harmon
Wildlife Biologist
U.S. Fish and Wildlife Service, Ecological Services
Tulsa, OK

Russ Horton
Biologist
Oklahoma Department of Wildlife Conservation
Norman, OK

Rob Manes
Midwest Regional Representative
Wildlife Management Institute
Pratt, KS

Randy Rodgers
Biologist
Kansas Wildlife and Parks
Hays, KS

Dr. Steve Sherrod
Executive Director of the Sutton Avian Research Center
Oklahoma Biological Survey, University of Oklahoma
President of the North American Grouse Partnership
Bartlesville, OK

Don Wolfe
Research Biologist
Sutton Avian Research Center
Oklahoma Biological Survey, University of Oklahoma
Bartlesville, OK

Cover Photo: The Greater Prairie-Chicken by Joel Satore.

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Introduction

Historically, prairie-chickens were common throughout Oklahoma, except in the extreme southeastern corner of the state. Their habitat was comprised of extensive prairie with few trees, and was subjected to periodic disturbance from fire and grazing. Since the land run and the ensuing settlement by Europeans, large quantities of high-quality prairie-chicken habitat have been steadily lost. Native plant communities were converted to cropland, introduced forages, and urban development, which supported fire suppression and tree planting. In the absence of fire, trees invaded (e.g., eastern redcedar, osage orange, elms, and many other woody species) and created poor Greater Prairie-Chicken (GPC) (Tympanuchus cupido) habitat. Poor grazing management has also contributed to the loss of habitat quantity and quality, but is easily reversed. Herbicides used to kill native broad-leaved herbaceous plants (forbs) have caused a decline in food production (insects and seeds) for adult prairie-chickens and their broods. Insecticides, although used less extensively on rangelands, also suppress insects that are critical for GPC chick nutrition. Additionally, in the GPC's current range, burning extensive areas in late spring reduces nesting, loafing, and roosting cover. With the reduction in cover, the probability of predation increases.

Status

The Greater Prairie-Chicken is currently found in seven north central and northeastern Oklahoma counties , but historically was common on the prairies throughout most of eastern Oklahoma and to the Texas border. However, its range decreased by 42% in Oklahoma from 1943-80, with a 90% decrease in numbers. Although the species is still classified as a game bird, there has been no general hunting season in Oklahoma since 1997.

Life History

Adult Greater Prairie-Chickens are 16 to 18 inches in length and weigh about 1,000 grams for males and 900 grams for females (approximately 2 pounds). The GPC has a barred feather pattern of brown, buff, blackish, and white colorations. Elongated feathers called pinnae or "ear feathers," which are erected during sexual displays, are located on the back of the neck. Underneath the pinnae are featherless areas of skin called typannm or "air sacs." These yellow-orange air sacs are inflated during sexual displays. The GPC also has a yellow-orange comb above the eye, which is more conspicuous on males than females.

Sexual displays of male GPCs occur on traditional display grounds called leks or booming grounds. Leks are typically located on elevated, open areas where grassland vegetation is short, visibility is good, and calls (booming) can be heard for great distances. Leks are often not far from taller grasses into which males can escape if threatened. Males concentrate on these communal display grounds and establish individual territories. The most advantageous territories are in the central region of the lek and are usually held by dominant males. Young males typically establish peripheral territories. Most females visiting the booming ground mate with dominant males that hold central territories. Thus, one or two males perform as much as 90 percent of the copulations on one lek.

Booming displays are most common in spring, but less active displays can occur in the fall and winter. Because the lek is central to the social structure of local GPCs year round, it is likely to find GPC's around booming grounds during every month of the year, although not always in display. Displays increase in February and decline by May. The number of males and females on courtship grounds peaks in early to mid-April in Oklahoma. Females may attend the leks at any time when the males are displaying, but their attendance is greatest in spring, and peaks during the first two weeks of April. During the display, the male erects the pinnae above his head, inflates the air sacs on the sides of his neck, lowers his wings, rapidly stamps his feet, and calls. In addition to booming, a series of crows, caws, and cackles can be heard from males throughout the display ground. Short vertical flights called flutter-jumps often occur in conjunction with booming. When in the presence of a female, the male may perform a nuptial bow with wings spread, pinnae erect, and bill lowered to the ground. The hen might visit two or three different booming grounds before she finally mates. After mating, the hen selects a nest site usually within one-half mile of a booming ground. Most nests (75%) occur within 1 mile of a lek. Nests are in areas of dense grass cover located near areas of shorter vegetation with high forb cover.

Normal clutch size is 11 to 14 eggs. The eggs are grayish-olive, buffy-plain, or spotted. Nests are located in slight excavations in well-drained areas and are lined with grasses and feathers. The incubation period can range from 23 to 28 days with an average of 25 days. A hen will usually lead the brood away from the nest within hours after the last chick has hatched. The hen will then move the brood into an area comprised of early stages of plant succession. Such areas have abundant forbs that supply the high insect densities needed as a protein food base for growing chicks and escape/loafing cover (tall forbs and grasses). The brood usually remains with the hen for 8 to 10 weeks. During that period broods often intermix with juveniles dispersing after about 10 weeks.

Habitat Requirements

Required habitat elements for Greater Prairie-Chickens are leks, nesting cover, brood rearing cover, food, escape cover, and loafing/roosting cover. The minimum land area to maintain a healthy breeding population is estimated to be 10,000 to 20,000 acres of unfragmented native prairie. The combined home ranges for all individuals using a single lek may be as much as 50 square miles (33,000 acres). However, management efforts on smaller areas are still valuable, especially if adjacent land and management provide quality habitat. Within a management unit, maintaining appropriate vegetation structure (height and density of grasses and forbs) and plant species composition is essential for sustaining a viable GPC population. The appropriate vegetation structure is maintained by a combination of fire and grazing by large herbivores. Trees are detrimental to GPC and other wildlife native to prairies and shrublands, thus no trees should be planted or allowed to invade.

GPC have been described as metapopulations or source-sink populations because of fragmentation. An important effect of fragmentation is isolated populations, which leads to dispersal limitations, genetic bottlenecks, and failure to recolonize after local extinctions.

Leks

Greater Prairie-Chickens typically use the same leks each year, although some leks tend to move about within general areas. Vegetation less than 6 inches high is preferred on booming grounds. Concentrated grazing, patch burning, or mowing a booming ground that is limited in size, may improve its attractiveness if the vegetation has become too tall. An area 50 to 100 yards in diameter is usually sufficient.

Nesting Cover and Brood Rearing Habitat

Nesting cover and brood-rearing habitat are the primary keys to prairie-chicken management. Concerns about food during the winter are irrelevant if nests and broods are not successful. At least 40 to 60 percent of the landscape should support native grasses that have grown 18 to 20 inches in height (last year's residual dead growth) in order to completely conceal nesting hens and foraging chicks. Grazing impacts prairie-chicken habitat through the amount and kind of forage removed and by the pattern of removal. Uneven grazing patterns under season- and year-long continuous grazing can create

an interspersion of short grass with tall forbs, bare ground, and tall, lightly grazed bunches of grass when stocking rates are moderate. This structural diversity provides easy travel lanes for broods, abundant access to seeds and insects, and close escape cover. Patch burning and the resulting patch grazing also provide this requirement. Prairies with light to moderate stocking rates and spot grazing produce more food (seeds and insects) and habitat diversity than ungrazed, rotationally grazed, or heavily grazed areas.

Food

Production of native, annual forbs is key to seed and insect availability and is achieved by disturbing the soil with animal action, mechanical action, or fire. During winter, seeds from native and cultivated plants, fruits, and flowers are consumed, but insects (primarily grasshoppers) are a major portion of the summer diet. Greater Prairie-Chickens eat green leafy material, insects, and seeds throughout the year, depending on availability.

The relative importance of cultivated food plots depends upon the abundance of native food sources. Food plots smaller than 10 acres have little effect on survival in winter and may encourage concentrated predation. Food plots do not provide the degree of natural diversity needed by the GPC, although they can be important in regions where prairies and shrublands have been degraded or converted to introduced forages. Food plots may sustain GPC populations until quality habitat can be restored. Where varied stages of plant succession in the prairie are present within a significant area (10,000 acres), cultivated food plots are not necessary.

Escape/Loafing/Roosting Cover

Native tall grasses, perennial forbs, annual forbs greater than 20 inches, and a shrub component such as blackberry or sand plum provide escape cover from ground and aerial predators. Tall herbaceous vegetation also provides thermal protection from heat and cold.

Water

Water requirements are met by the consumption of succulent vegetation, insects, and dew, except in periods of drought when water from stock ponds and prairie streams may become important.

Causes of Mortality and Competition

Greater Prairie-Chickens have a short life expectancy, with about 50 to 60 percent mortality each year. Mortality of adults results from predators including coyotes, bobcats, raccoons, foxes, hawks, and owls. In addition, a significant number of birds may be killed through collisions with fences and power lines. Chicks in broods are taken by the same suite of predators, but may also be depleted by crows and smaller predators such as snakes and rats. Hay harvesting before the chicks can fly can also cause significant mortality.

Nests are destroyed by a variety of predators, including coyotes, raccoons, opossums, skunks, snakes, and rodents. Although cattle or other large grazing animals may trample nests, this is unusual under normal grazing management or patch burning/grazing. However, in the case of rotational grazing (e.g. cell grazing, management intensive grazing), intensive early stocking (IES), or triple stocking, nest damage may increase. Harvesting or cultivating during late April, May, or June will destroy nests in hay or cultivated fields.

Wind Power Generation

Generating electricity from wind power is promoted as an environmentally friendly technology, but embracing such claims without a thorough examination of all related issues may pose serious threats to some grassland bird populations. Presently, much is unknown about how wind power development affects prairie-chickens, but there exists sufficient information to demand a cautious approach to the issue.

Concerns about direct mortality resulting from bird collisions with wind turbines, towers, power lines, and other infrastructure generally proved limited or unwarranted. With few exceptions, the number of birds likely to be killed by striking a wind power facility lacks potential to be significant on a population level. Exceptions would include turbine complexes that are established where they could affect large portions of very rare species' populations. More significant concerns focus on habitat fragmentation effects associated with grassland birds' avoidance of vertical structures and human disturbances that wind turbine complexes entail.

The species richness among grassland birds at a southwest Minnesota wind generator site, was four times less within 180 meters of each wind turbine, regardless of whether the turbines were running. Sage grouse avoid areas near roads, power lines, and other artificial structures; and use of leks diminishes with increased proximity to such disturbances.

The life cycles of prairie-chickens, require vast areas of relatively unfragmented grassland habitat. More than 90 percent of North America's historic prairies have been destroyed or seriously altered. Thus, the effect of each additional fragmentation influence is magnified. Many other factors diminish existing unfragmented habitats, including oil and gas production, road construction, housing development, crop production, excessive livestock grazing, and woody plant invasion.

An example in a similar species is the Lesser Prairie-Chicken. It avoids even high-quality habitat within 200 meters of a single oil or gas well pump, and they avoid the area within 600 meters of an improved road, and within 1,000 meters of an elevated power line, regardless of whether avian predators are present. This means that each wind turbine complex has the potential to void habitat benefits over thousands of acres. Much of the Greater Prairie-Chicken's existing range is suitable for wind power development. While little research has been conducted on GPC avoidance of vertical structures, it is reasonable to expect them to exhibit habitat abandonment tendencies similar to Lesser Prairie-Chickens.

Habitat Management Tools

Fire, Stocking Rate, and Grazing

Fire, stocking rate, and type of grazing system are the main habitat management tools that affect landscape structure and pattern on native prairies. The frequency, size, and pattern of the burn or the grazing event, and their relationship (fire-grazing interaction) must be considered and managed to meet the year-round habitat requirements of the Greater Prairie-Chicken. Since GPCs occur on prairies typically grazed by cattle or other herbivores, grazing management is necessary to restore landscapes for the GPC. Experienced ranchers recognize that light to moderate stocking rates provide the best long-term economic return as well as reduced economic risk in times of economic uncertainty or drought. Research supports their experience that the optimum-stocking rate for beef cattle is moderate, not heavy (Figure 1).

Grazing systems vary from continuous year-round stocking to multiple-paddock rotations with many moves during the grazing season. Different grazing systems produce different landscape patterns, plant composition, and habitat structure. Uneven grazing patterns under season- and year-long continuous grazing create an interspersion of short grass, bare ground, and tall grasses and forbs. Research has shown that continuous grazing at a light to moderate stocking rate provides a moderate level of habitat diversity. Continuous grazing at a light to moderate stocking rate also provides the desired habitat structure and composition needed for the GPC.

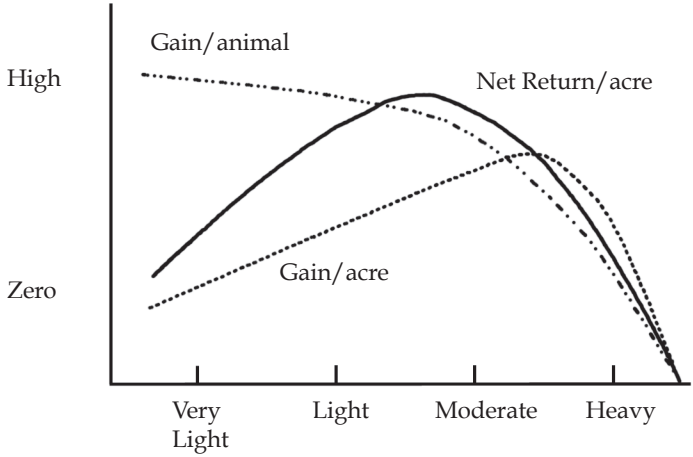

Figure 1. Relationship of stocking rate to various production and economic factors for beef cattle.

Rotational grazing has been promoted with very little scientific evidence, some anecdotal testimony, and many unsupported claims. Proponents have suggested that moving cattle controlled by fencing from grazed to ungrazed areas mimics historical grazing patterns by large herbivores such as bison and elk. However, this idea is unlikely, since there were historically no fences, and animals moved freely to graze the highest quality forage.

Another stated goal for using rotational grazing is to reduce spot grazing and increase uniformity of grazing distribution, which is often accomplished. However, if this goal is attained, structural and compositional habitat diversity will decline and reduce habitat quality for the GPC. Research has shown that rotational grazing as it is normally applied with small paddocks, high stock density, and rapid rotations does not provide the landscape pattern, habitat structure, or plant community composition necessary for the GPC. Slower movements with lower stock densities and larger paddocks might mitigate some of the impacts. However, a much better system is rotational grazing without fences, which is also known as patch burning.

Fire can be used to alter the structure and composition of the native plant community depending on the season and scale of the burn and its interaction with grazing animals. The application of the fire/grazing integration at the landscape level should reverse the decline of some prairie and shrubland dependent wildlife species (Table 1) by increasing the heterogeniety in vegetation structure and composition. This variability is required by GPC to meet its habitat requirements.

Table 1. Spatial variability of management units under typical rangeland management practices and alternative management practices.

	Spatial Variability of Management Units		
	Homogeneous	Heterogeneous	Shifting Mosaic
Typical Range Practices			
Continuous Grazing		X	
Rotational Grazing	X		
Herbicide Application	X		
Multi-species Grazing	X		
Area Burns	X		
Improved Water Distribution	X		
Alternative Practices			
Patch Burning			X
Patch Herbicide Application			X
Patch Fertilization			X
Focused grazing disturbances			X
Shifting attractants			X

The fire-grazing interaction, also known as patch burning or rotational grazing without fences, provides the diversity of habitat pattern, structure, and plant composition that the GPC requires. The spatial scale and shape of patches are also important elements of GPC habitat restoration, but are less clearly understood. In Oklahoma, patch burning has been used for over 20 years in different configurations to benefit bobwhite quail, mourning dove, bison, and elk on relatively small areas (less than 10,000 acres). Patch burning has not been applied at the landscape level to meet the needs of the GPC or to native plant communities to measure its affects on beef cattle performance until recently.

Currently, patch burning research is being conducted by the Rangeland Ecology and Management Program at Oklahoma State University. This work provides some insight into how patch burning may be used for wildlife habitat restoration. Patch burns were applied by annually burning one-third of a management unit and allowing cattle access to burned and unburned patches. The one-third burn area can further be divided into summer and winter burns to add additional diversity. Studies conducted since 1999 indicate that patch burning does not reduce livestock gains when compared to unburned prairies. Since 2000, researchers have compared patch burning to intensive early stocking where the entire unit is burned. Both treatments were intensively early stocked (see OSU Fact Sheet F-2875) from April 1 until July 15. These studies indicate that patch burning increases landscape heterogeneity, structural diversity, and diversity of grassland birds without affecting livestock performance. It also demonstrates that once the patch system is implemented, burning becomes easier because recently burned/grazed patches become firebreaks. Patch burning has also reduced the spread of sericea lespedeza (*Lespedeza cuneata*) a noxious weed (see OSU Fact Sheet F-2874).

The timing of the patch burn is also important in terms of its effects on the GPC, which are well known, but its effects on plant community response are much less predictable. Late summer, fall, and winter burns usually allow for a higher proportion of forbs and less disturbance to nesting sites than do spring burns. For example, burning alters habitat by removing the plant litter and increasing bare ground, thus improving seed availability and insect foraging efficiency for the GPC. A recently published synthesis paper that summarizes the burning research done in the Southern Great Plains concludes that plant community responses to timing or season of burn are highly variable because of environmental variation from year to year. Thus, burning during periods other than late spring (e.g. winter, early spring) can provide equally good livestock gains. This research indicates that it not necessary to apply the same type of management to the same land unit each and every year.

Large-scale burns that uniformly cover thousands of acres and grazing systems that use additional fencing are detrimental to the GPC. Thus, patch burning provides an alternative to traditional fire and grazing programs and a practical way to restore the GPC habitat.

Herbicides

The use of herbicides should be minimized in order to maintain cover as well as food-producing plants such as forbs, and invertebrates such as insects and spiders. If grazing management (i.e. stocking rate) is properly adjusted for the productive capabilities of the land, herbicides should only be necessary to control invasive plants such as sericea lespedeza, Bermuda grass, tall fescue, and Old World bluestem.

Haying

Cutting native hay meadows too early or too late is detrimental to Greater Prairie-Chicken nesting habitat and winter survival. Haying before July 1 can destroy nests or kill chicks. Cutting native prairie later than July 10 misses the optimum combination of forage protein and production for livestock and does not allow for sufficient regrowth to maintain plant vigor for next year's growth. The relationship of forage quality and production is controlled by photoperiod (day length). The physiology of the plant changes during this period and is not dependent on air temperature or precipitation. Thus the recommendation for hay cutting does not vary from year to year. The regrowth of prairie hay cut between July 1 and no later than July 10 can provide adequate winter cover for GPCs.

Cultivation

Croplands within a management area may benefit the Greater Prairie-Chicken under certain conditions, particularly if prairies have inadequate forbs. Cropland with annual seed producing plants such as grain sorghum can partially compensate for inadequate forb availability. However, cropland lacks plant diversity and thus lacks essential amino acids (protein building blocks) that are required for a balanced diet. The most suitable landscape composition for prairie chickens is 10 to 25 percent cropland if availability of annual native forbs is insufficient. Cropland stubble should be greater than 14 inches tall to provide cover while feeding. Generally speaking, at a landscape level, GPC numbers decline sharply when cultivated land (milo, corn, soybeans, or wheat) cover more than 40 percent of the landscape relative to native prairie.

Introduced Forages

Introduced forages provide little value for the Greater Prairie-Chicken. Introduced forages lack the appropriate structure (growth form, stature, and spacing) for cover and diversity, also they have no food value. In some cases introduced forages are toxic to gallanacious birds. For example, research has shown that tall fescue inhibits reproduction in Northern Bobwhite Quail, which raises concern for GPC in areas with tall fescue. This is not surprising when considering the well researched physiological effects of endophyte infected tall fescue on beef cattle.

Summary of Management Practices

1. Keep livestock grazing patchy to maintain leks (short grass), nesting cover (tall grass – 18 inches), brood cover (tall forbs with sparse grass – 18 inches), food (forbs and sparse grass), and protective cover (thermal and escape – tall forbs and grass – 18 inches). Avoid uniform grazing except on leks. Do not install electric fencing or additional watering facilities that contribute to uniform grazing. Electric or other fences can also be lethal to Greater Prairie-Chickens in flight.

2. Implement patch burning to provide the structural, compositional, and spatial diversity required above.

3. Eliminate the regular use of broadcast herbicides. Herbicides reduce annual and perennial food sources (seeds and insects).

4. Convert tall fescue, Bermuda grass, Old World Bluestem, smooth brome grass, or other introduced forages or trees into native warm season grasses and forbs. Consult the USDA Natural Resources Conservation Service's (NRCS) Ecological Site Guide (located in NRCS county offices) to select the appropriate plant composition for the land area of interest. Once a Conservation Reserve Program (CRP) contract has expired, restore the native plant community based on the Ecological Site Guide.

5. Native forbs need not be protected by fencing and are preferred to cultivated crops. However, in much of the Greater Prairie-Chicken's range, native forb cover has been reduced by intensive cattle grazing, late spring burning, and herbicides. Plant food plots with crops such as grain sorghum or alfalfa if native forbs are inadequate. Prepare a good seedbed and fertilize according to a soil test. Plots should be no less than 10 to 15 acres in size, oblong in shape, surrounded by protective cover with no trees, and preferably planted on the contour. Exclude domestic livestock from food plots. Leave 14 inches or more of wheat, grain or forage sorghum, or forb (weeds) stubble in cultivated fields that are harvested in agricultural operations. Do not use insecticides on cultivated crops.

6. Cut native hay meadows between July 1 and July 10. Never cut twice. Cutting twice or cutting late has negative impacts on forage quality, plant species composition, and residual winter cover.

7. Remove all trees from the area including field windbreaks and living snow fences. Greater Prairie-Chickens and other prairie wildlife do not require trees and strongly avoid them. Trees also provide perches for predatory birds and encourage habitat generalists such as raccoons to invade. All trees are invasive plants in the prairie ecoystem.

8. Muffle all pumpjacks or other sources of noise. Do not allow structural fragmentation from wind farms, coal bed methane development, roads, powerlines, etc. to fragment remaining habitat.

Conclusion

Oklahoma is fortunate to have Greater Prairie-Chickens and the prairies that support them. However, the range and numbers of this landmark prairie grouse have decreased significantly from historical levels and continue to decline. To survive and reproduce, the GPC needs native prairies in different stages of plant succession. Hopefully, populations of GPCs can be maintained and even increased if prairies are restored and the proper use of fire and grazing are allowed to drive the ecosystem.

The GPCs in Oklahoma and elsewhere occur almost exclusively on private property and thus depend on the stewardship of private landowners. Programs that promote conversion of native prairie to non-native vegetation such an introduced forages or trees are not beneficial to the GPC or other prairie wildlife. Government and private programs that encourage restoration and management of native plant communities are needed. The GPC is a species that reflects the health of the tallgrass prairie ecosystem, and this icon of the plains is at a critical threshold for its long-term survival. Oklahoma and many other central and western states still have large tracts of land and the opportunity to reclaim and restore millions of acres of native plant communities for the GPC and other prairie species. Adequate funding, public support, competent consultants, and landowner cooperation are needed to accomplish this goal.

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