BEGINNER'S GUIDE TO GREATER SAGE-GROUSE

Notes from the Lek

Greater Sage-grouse Conservation Primer Series Primer # 1

A detailed description of seasonal habitats, sage-grouse natural history and population trend analyses can be found in the Fish and Wildlife Service's March 2010 status review (http://www.fws.gov/wyominges/PDFs/Findings/SageGrouse/FR03052010.pdf). This following abbreviated discussion provides key points for a basic understanding of the species and its habitats.

Life History

Greater sage-grouse (*Centrocercus urophasianus*) are members of the Phasianidae family. They are one of two species; the other species in the genus is the Gunnison sage-grouse (*Centrocercus minimus*). The Greater sage-grouse is the largest North American grouse species. Adult male greater sage-grouse range in length from 26 to 30 inches and weigh between 4 and 7 pounds. Adult females are smaller, ranging in length from 19 to 23 inches and weighing between 2 and 4 pounds.

During the spring breeding season, male sage-grouse gather together to perform courtship displays on areas called leks. Areas of bare soil, short-grass steppe, windswept ridges, exposed knolls, or other relatively open sites typically serve as leks, which are often surrounded by denser shrub-steppe cover, which is used for escape, thermal and feeding cover. The proximity, configuration, and abundance of nesting habitat are key factors influencing lek location. Leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat. Therefore, lek habitat availability is not considered to be a limiting factor for sage-grouse. Leks are indicative of nesting habitat.

Productive nesting areas are typically characterized by sagebrush with an understory of native grasses and forbs, with horizontal and vertical structural diversity that provides an insect prey base, herbaceous forage for pre-laying and nesting hens, and cover for the hen while she is incubating. Shrub canopy and grass cover provide concealment for sage-grouse nests and young, and are critical for reproductive success. The average distance between a female's nest and the lek on which she was first observed ranged from 2.1 mi to 4.8 mi in five studies examining 301 nest locations, but actual distances can be highly variable. Male sage-grouse do not participate in nesting or rearing of the chicks.

Overall, the average nest success for sage-grouse in habitats where sagebrush has not been disturbed is higher than for sage-grouse nesting in disturbed habitats. Re-nesting only occurs if the original nest is lost, and even then re-nesting rates are low. Unlike other exotic game bird species, such as ring-necked pheasants, there is little evidence that populations of sage-grouse produce large annual surpluses. This is due to low nesting rates, small clutch sizes, low sage-grouse chick survival and limited re-nesting. This low rate of productivity slows recovery from population losses and limits population irruptions.

During the spring and summer sage-grouse will primarily eat insects and forbs, but they rarely stray from the edge of sagebrush, which provides cover year round. In the fall, sage-grouse shift their diet entirely to sagebrush, depending on the shrub for both food and cover. Sage-grouse obtain their water from the food they eat. However, they will drink water if available.

Many populations of sage-grouse migrate between seasonal ranges in response to habitat distribution. Migration can occur between winter and breeding and summer areas, between breeding, summer and winter areas, or not at all, making habitat management for the species challenging at best. Migration distances of up to 100 miles have

been recorded; however, distances vary depending on the locations of seasonal habitats. Almost no information is available regarding the distribution and characteristics of migration corridors for sage-grouse. Sage-grouse dispersal (permanent moves to other areas) is poorly understood and appears to be sporadic. Estimating an "average" home range for sage-grouse is difficult due to the large variation in sage-grouse movements both within and among populations. Annual recorded home ranges have varied from 1.5 to 237.5 square miles (mi^2).

Sage-grouse typically live between 3 and 6 years, but individuals up to 9 years of age have been recorded in the wild. Hens typically survive longer due to a disproportionate impact of predation on leks to males. Although seasonal patterns of mortality have not been thoroughly examined, over-winter mortality appears to be low. Juvenile survival (from hatch to first breeding season) is affected by food availability, habitat quality, harvest, and weather. While both males and females are capable of breeding the first spring after hatch, young males are rarely successful due to the dominance of older males on the lek. Nesting rates of yearling females are 25 percent less than adult females.

Habitat

Greater sage-grouse depend on a variety of shrub-steppe habitats throughout their life cycle, and are considered obligate users of several species of sagebrush (e.g. Wyoming, mountain and basin big sagebrush). Thus, sage-grouse distribution is strongly correlated with the distribution of sagebrush habitats. Sage-grouse exhibit strong site fidelity (loyalty to a particular area even when the area is no longer of value) to seasonal habitats, which includes breeding, nesting, brood rearing, and wintering areas. Adult sage-grouse rarely switch between these habitats once they have been selected, limiting their adaptability to changes and movement into unfamiliar areas or restored habitats.

Sage-grouse require large areas of contiguous sagebrush. Sagebrush species and subspecies occurrence in an area is dictated by local soil type, soil moisture, and climatic conditions. The degree of dominance by sagebrush varies with local site conditions and disturbance history. Plant associations, typically defined by perennial grasses, further define distinctive sagebrush communities and are influenced by topography, elevation, precipitation and soil type. These ecological conditions influence the response and resiliency of sagebrush and their associated understories to natural and human-caused changes.

Sagebrush is long-lived, with plants of some species surviving up to 150 years. Sagebrush has resistance to environmental extremes, with the exception of fire and occasionally defoliating insects (e.g., webworm (*Aroga* spp). Most species of sagebrush are killed by fire and historic fire-return intervals were as long as 350 years, depending on sagebrush type and environmental conditions. Natural sagebrush recolonization in burned areas depends on the presence of adjacent live plants for a seed source or on the seed bank, if present, and requires decades for full recovery. Sagebrush seeds, depending on the species, remain viable for 1 to 3 years. In years of drought, sagebrush may not flower.

Habitat Restoration

Very little sagebrush within its extant range is undisturbed or unaltered from its condition prior to EuroAmerican settlement in the late 1800s. Due to the disruption of primary patterns, processes and components of sagebrush ecosystems since EuroAmerican settlement the large range of abiotic variation, the minimal short-lived seed banks, and the long generation time of sagebrush, restoration of disturbed areas is very difficult. Not all areas previously dominated by sagebrush can be restored because alteration of vegetation, nutrient cycles, topsoil, and living (cryptobiotic) soil crusts has exceeded recovery thresholds. Additionally, processes to restore sagebrush

ecology are relatively unknown. Active restoration activities are often limited by financial and logistic resources and lack of motivation and may require decades or centuries. Meaningful restoration for greater sage-grouse requires landscape, watershed, or eco-regional scale context rather than individual, unconnected efforts. Landscape restoration efforts require a broad range of partnerships (private, State, and Federal) due to landownership patterns.

There is little information available regarding minimum sagebrush patch sizes required to support populations of sage-grouse. This is due in part to the migratory nature of some, but not all sage-grouse populations, the lack of juxtaposition of seasonal habitats, and differences in local, regional and range-wide ecological conditions which influence the distribution of sagebrush and associated understories. Where home ranges have been reported they are extremely variable. Occupancy of a home range also is based on multiple variables associated with both local vegetation characteristics and landscape characteristics. Large seasonal and annual movements emphasize the landscape nature of the greater sage-grouse.

Range and Distribution

Prior to settlement of western North America by European immigrants in the 19th century, greater sage-grouse occurred in 13 States and 3 Canadian provinces—Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, South Dakota, North Dakota, Nebraska, British Columbia, Alberta, and Saskatchewan. Sagebrush habitats that potentially supported sage-grouse occurred over approximately 463,509 mi^2 before 1800.

Currently, greater sage-grouse occur in 11 States (Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, South Dakota, and North Dakota), and 2 Canadian provinces (Alberta and Saskatchewan), occupying approximately 56 percent of their historical range. Approximately 2 percent of the total range of the greater sage-grouse occurs in Canada, with the remainder in the United States. Sage-grouse have been extirpated from Nebraska, British Columbia, and possibly Arizona. Current distribution of the greater sage-grouse is estimated at 258,075 mi^2. Changes in distribution are the result of sagebrush alteration and degradation. Land ownership patterns within the Greater sage-grouse range can be found in Table 1.

TABLE 1. Percent surface ownership of total sagebrush area (km^2 (mi^2)) within the sage-grouse range. Other Federal agencies include the Service, BOR, NPS, DOD, and DOE.

		Sagebrush Management and Ownership					
		BLM	Private	USFS	State	BIA	Other Federal
km^2	mi^2	Percent					
480,570	185,549	52	31	8	5	3	1

Population numbers and trends

Estimates of greater sage-grouse abundance were mostly anecdotal prior to the implementation of systematic surveys in the 1950s. Early reports suggested the birds were abundant, with estimates of historical populations ranging from 1,600,000 to 16,000,000 birds. However, concerns about extinction were raised in early literature due

to market hunting and habitat alteration. Based on a review of published literature and anecdotal reports the abundance of sage-grouse has declined from pre-settlement (defined as 1800) numbers.

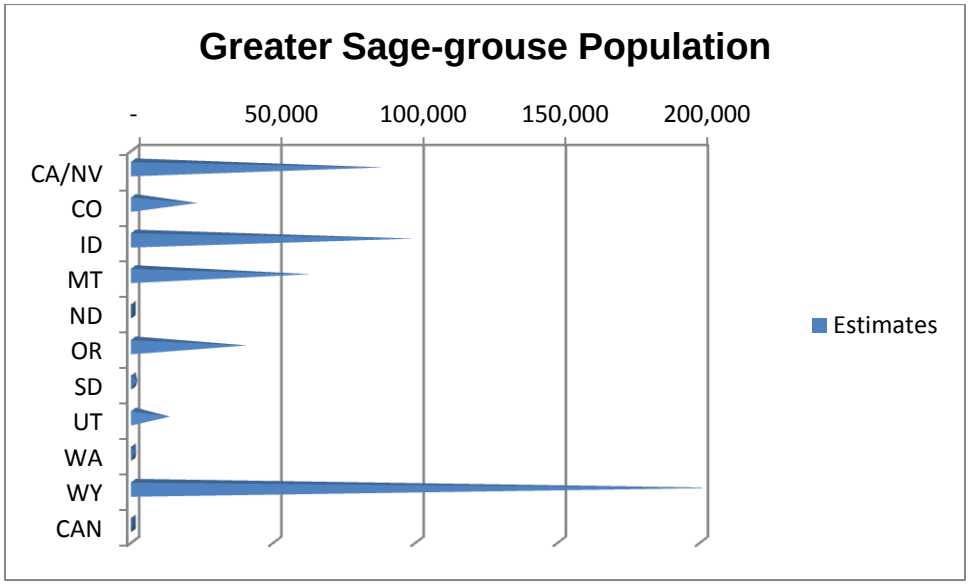

Figure 1. Population Estimates by State.

Population numbers are difficult to estimate due to the large range of the species, physical difficulty in accessing some areas of habitat, and past inconsistent sampling of leks across states. Additionally, estimating population sizes using lek data is difficult as the relationship of those data to actual population size (e.g., ratio of males to females,) is unknown. Males may also attend multiple leks in a morning. The use of harvest data for estimating population numbers also is of limited value since both harvest and the population size on which harvest is based are estimates.

A 1998 minimum spring population estimates ranged from about 157,000 to 515,000 sage-grouse. In 2000, the FWS estimated the range-wide abundance of sage-grouse was between a minimum of 100,000 up to 500,000 birds. In 2007 an estimated range-wide minimum of 88,816 males were counted on leks.

Population Trends

Although population numbers are difficult to estimate, the long-term data collected from counting males on leks provides insight to population trends. Periods of historical decline in sage-grouse abundance occurred from the late 1800s to the early-1900s. Other noticeable declines in sage-grouse populations occurred in the 1920s and 1930s, and then again in the 1960s and 1970s. Declines in the 1920s and 1930s were attributed to hunting, and declines in the 1960s and 1970s were primarily as a result of loss of habitat quality and quantity.

Using lek counts as an index for abundance there were range-wide declines from 1965 through 2003. Declines averaged 2 percent per year from 1965 to 2003. The rate of decline range-wide slowed to 0.37 percent annually during 1986 to 2003 and some populations increased. Based on these analyses, estimated that sage-grouse population numbers in the late 1960s and early 1970s were likely two to three times greater than current numbers.

While the average annual rate of decline has lessened since 1985 (3.1 to 1.4 percent), population declines continue and populations are now at much lower levels than in the early 1980's. Therefore, these continuing negative trends at such low relative numbers are concerning regarding long-term population persistence. Similarly, short-term increases or stable trends, while on the surface seem encouraging, do not indicate that populations are recovering but may instead be a function of losing leks and not increases in numbers on the remaining leks. Population stability may also be compromised if cycles in sage-grouse populations are lost, which current analyses suggest, minimizing the opportunities for population recovery if habitat were available.

In summary, since neither pre-settlement nor current numbers of sage-grouse are accurately known, the actual rate and magnitude of decline since pre-settlement times is uncertain. However, independent analyses have concluded that range-wide greater sage-grouse have experienced long-term population declines in the past 43 years, with that decline lessening in the past 22 years. Many of these declines are the result of loss of leks, indicating either a direct loss of habitat or habitat function. There is also a delayed response of sage-grouse to changes in carrying capacity, meaning that sage-grouse numbers counted on leks may not reflect current habitat conditions, but rather conditions up to 7 years previous.