Greater sage-grouse

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The **greater sage-grouse** (*Centrocercus urophasianus*) is the largest grouse in North America. Its range is sagebrush country in the western United States and southern Alberta and Saskatchewan, Canada. It was known as simply the **Sage Grouse** until the Gunnison Sage-Grouse was recognized as a separate species in 2000.[3] The Mono Basin population of Sage Grouse may also be distinct.

Adults have a long, pointed tail and legs with feathers to the toes. Adult males have a yellow patch over the eye, are grayish on top with a white breast, a dark brown throat and a black belly; two yellowish sacs on the neck are inflated during courtship display. Adult females are mottled gray-brown with a light brown throat and dark belly.

Their historic range spanned 16 American states and Alberta, British Columbia and Saskatchewan in Canada. Between 1988 and 2012, the population declined by 98%.[4] By 2012 they were extirpated from British Columbia and left with only remnant populations in Alberta with 40 to 60 adult birds, and in Saskatchewan with only 55 to 80 adult birds. By 2013 Sage-Grouse were also extirpated from five U.S. states.[4] In 2013 the Canadian Governor in Council (GIC) on behalf of the Minister of the Environment, under the Species at Risk Act, annexed an Emergency Order for the Protection of the Greater Sage-Grouse.[4]

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Ecology

This species is a permanent resident. Some move short distances to lower elevations for winter. These birds forage on the ground. They mainly eat sagebrush, but also insects and other plants. Greater Sage-Grouse do not have a muscular crop and are not able to digest hard seeds like other grouse. They nest on the ground under sagebrush or grass patches.

Greater sage-grouse

Male in USA

Conservation status

Near Threatened (IUCN 3.1)[1]

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Aves
Subclass:	Neornithes
Infraclass:	Neognatha
Superorder:	Galloanserae
Order:	Galliformes
Family:	Phasianidae
Subfamily:	Tetraoninae
Genus:	*Centrocercus*
Species:	***C. urophasianus***

Binomial name

Centrocercus urophasianus

(Bonaparte, 1827)

Subspecies

- *Centrocercus urophasianus phaios*
- *Centrocercus urophasianus urophasianus*

Greater Sage-Grouse are notable for their elaborate courtship rituals. Each spring males congregate in leks and perform a "strutting display". Groups of females observe these displays and select the most attractive males to mate with. The dominant male located in the center of the lek typically copulates with around 80% of the females on the lek. Males perform in leks for several hours in the early morning and evening during the spring months.

Plant communities

Greater Sage-Grouse are obligate residents of the sagebrush (*Artemisia* spp.) ecosystem, usually inhabiting sagebrush-grassland or juniper (*Juniperus* spp.) sagebrush-grassland communities. Meadows surrounded by sagebrush may be used as feeding grounds.[5] Use of meadows with a crown cover of silver sagebrush (*A. cana*) is especially important in Nevada during the summer.[6]

Greater Sage-Grouse occur throughout the range of big sagebrush (*A. tridentata*), except on the periphery of big sagebrush distribution or in areas where it has been eliminated.[7] Greater Sage-Grouse prefer mountain big sagebrush (*A. t.* ssp. *vaseyana*) and Wyoming big sagebrush (*A. t.* ssp. *wyomingensis*) communities to basin big sagebrush (*A. t.* ssp. *tridentata*) communities.

Sagebrush cover types other than big sagebrush can fulfill Greater Sage-Grouse habitat requirements; in fact, the grouse may prefer other sagebrush cover types to big sagebrush. Greater Sage-Grouse in Antelope Valley, California, for example, use black sagebrush (*A. nova*) cover types more often than the more common big sagebrush cover types.[8] Drut and others found hens with broods on the National Antelope Refuge in Oregon were most frequently found (54–67% of observations) in low sagebrush (*A. arbuscula*) cover.[9] Desert shrub habitat may also be utilized by Greater Sage-Grouse.[10]

Sagebrush communities supporting Greater Sage-Grouse include silver sagebrush and fringed sagebrush (*A. frigida*).[11]

Timing of major life events

Males gather in leks to court, usually in late February to April. Only a few dominant males, usually two, breed. Sage-grouse mating behaviors, which are complex, are summarized by Johnsgard.[5] After mating, the hen leaves the lek for the nesting grounds. Clutch size ranges from 6 to 8 eggs; incubation time is 25 to 27 days. Greater Sage-Grouse apparently have high rates of nest desertion and nest predation.[5][14] Summarizing data from several sage grouse studies, Gill found a range of nesting success from 23.7 to 60.3%, with predation accounting for 26 to 76% of lost nests.[15]

Chicks fly by two weeks of age, although their movements are limited until they are two to three weeks old.[16] They can sustain flight by five to six weeks of age. Juveniles are relatively independent by the time they have completed their first molt at ten to twelve weeks of age.[17]

Fall movements to wintering areas are driven by weather conditions and usually occur gradually. After late winter or spring lekking activity, Greater Sage-Grouse may move to higher elevations or down to irrigated valleys for nesting and feeding. Brooding ranges may be a considerable distance from winter ranges or spring nesting grounds. Schlatterer [18] reported that in southern Idaho, brooding grounds were 13 to 27 miles (21–43 km) from the nesting grounds. Males may also move long distances over the seasons. During winter in Wyoming, Patterson recovered a male Greater Sage-Grouse 75 air miles (120 km) from where he had banded it the previous summer.[19]

Preferred habitat

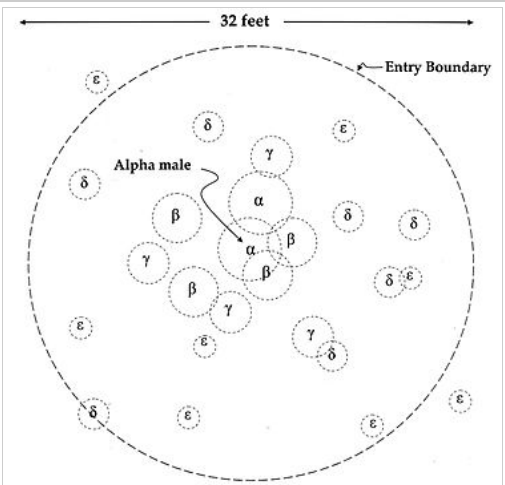
Greater Sage-Grouse are totally dependent on sagebrush-dominated habitats. Sagebrush is a crucial component of their diet year-round, and Greater Sage-Grouse select sagebrush almost exclusively for cover.[19] Because their habitat and cover requirements are inseparably tied to sagebrush, they will be discussed together.

Breeding: Open areas such as swales, irrigated fields, meadows, burns, roadsides, and areas with low, sparse sagebrush cover are used as leks.[20] Of 45 leks, Patterson [19] reported that 11 were on windswept ridges or exposed knolls, 10 were in flat sagebrush, 7 were in bare openings, and the remaining 17 were on various other site types. Leks are usually surrounded by areas with 20 to 50% sagebrush cover, with sagebrush no more than 1 foot (30.5 cm) tall.

When not in leks, Greater Sage-Grouse disperse to the surrounding areas.[16] Wallestad and Schladweiler[21] studied habitat selection of male greater sage grouse in central Montana during breeding season and recorded sagebrush height and canopy cover at 110 daytime feeding and loafing sites of cocks. Eighty percent of the locations occurred in sagebrush with a canopy cover of 20–50%. In another Montana study,[22] sagebrush cover averaged 30% on a cock-use area, and no cocks were observed in areas of less than 10% canopy cover.

Some females probably travel between leks. In Mono County, California, the home range of marked female Greater Sage-Grouse during one month of the breeding season was 750 to 875 acres (300–350 ha), enough area to include several active leks.[23]

Nesting: Within a week to ten days following breeding, the hen builds a nest in the vicinity of the lek. Hens usually nest near the lekking grounds,[18] but some hens have been noted to fly as far as 12 to 20 miles (19–32 km) to favorable nesting sites.[15][24]



Lek mating arena of the Greater Sage-Grouse, in which each male, alpha-male (highest ranking), beta-male, gamma-male, etc., guards a territory of a few meters in size on average, and in which the dominant males may each attract up to eight or more females.[12] In addition, each individual is shown with variations in personal space (bubbles), whereby higher-ranking individuals have larger personal space bubbles.[13] Common bird leks typically have 25–30 individuals. A strict hierarchy accords the most desirable top-ranking males the most prestigious central territory, with ungraded and lesser aspirants ranged outside. Females come to these arenas to choose mates when the males' hierarchy has become established, and preferentially mate with the dominants in the centre.

A female Sage Grouse

A male strutting at a lek

Quality of nesting habitat surrounding the lek is the single most important factor in population success. Adequacy of cover is critical for nesting. There can be too little: where 13% was the average percent total crown cover on Idaho range, nests were located where average cover was 17%. No Greater Sage-Grouse hens nested in the most arid, open areas with less than 10% total shrub cover. There can be too much: average shrub cover at 87 nest sites was 18.4%, and in more dense cover, Greater Sage-Grouse did not nest where total shrub cover was greater than 25%.[25] In Utah no nests occurred where threetip sagebrush cover exceeded 35%.[11]

Sagebrush forms the nesting cover for most Greater Sage-Grouse nests throughout the West with concealment being the basic requirement.[26] Rabbitbrush (*Chrysothamnus* spp.) is occasionally used for nesting cover with greasewood (*Sarcobatus vermiculatus*) and shadscale (*Atriplex canescens*) being rarely used.[19]

Greater Sage-Grouse prefer relatively tall sagebrush with an open canopy for nesting. In Utah, 33% of 161 nests were under silver sagebrush that was 14 to 25 inches (36–63.5 cm) tall, while big sagebrush of the same height accounted for 24% of nests.[11] In a threetip sagebrush (*A. tripartata*) habitat averaging 8 inches (20 cm) in height, hens selected the tallest plants for nesting cover. Similarly, Patterson [19] reported that in Wyoming, 92% of Greater Sage-Grouse nests in Wyoming big sagebrush were in areas where vegetation was 10 to 20 inches (25–51 cm) tall and cover did not exceed 50%.

In Montana, Wallestad and Pyrah [27] compared sagebrush characteristics around 31 successful and 10 unsuccessful nests. Successful nests had greater than average sagebrush cover surrounding the nest and were located in stands with a higher average canopy cover (27%) than unsuccessful nests (20%). Difference was significant at the 0.005 level. They also found the average height of sagebrush cover over all nests was 15.9 inches (40.4 cm) as compared to an average height of 9.2 inches (23.4) cm in adjacent areas (significant at 0.005 level).

During the nesting season, cocks and hens without nests use "relatively open" areas for feeding, and roost in "dense" patches of sagebrush.[20][25]

Brood rearing: Sagebrush is an essential part of Greater Sage-Grouse brood habitat. An interspersion of sagebrush densities, from scattered to dense, are utilized by broods throughout the summer. Broods can be grouped into two categories: those that remain in sagebrush types through the summer and those that shift from sagebrush types in mid-summer and later return to sagebrush.

Throughout the summers of 1968–1969 in a study in Montana, areas that received the greatest amount of utilization by Greater Sage-Grouse broods were areas of sagebrush density characterized as scattered (1–10%) and common (10–25%). Scattered sagebrush received heaviest utilization in June. "Common" sagebrush was utilized heavily throughout the summer. "Dense" sagebrush had greatest use during late August and early September; "rare" sagebrush cover received greatest use in July and August.

Combined data for both years of the study at brood sites showed an average sagebrush cover of 14% during June, 12% during July, 10% during August and 21% during September, which reflects the vegetational types utilized by broods during the summer. Height of sagebrush at brood sites ranged mainly between 6 to 18 inches (15.2–45.7 cm).[10] In 158 Montana locations, young Greater Sage-Grouse broods used areas of low plant height 9 to 15 inches (23–38 cm)) and density, while older broods and adults used areas where plants were taller (7 to 25 inches (18–63.5 cm).[28]

Early in summer the size of the area used by Greater Sage-Grouse hens with broods in Idaho seemed to depend upon the interspersion of sagebrush types that provided an adequate amount of food and cover. Areas with sagebrush in scattered densities, with occasional clumps in the common to dense categories, appeared to be preferred. In their daily activity, broods tended to use more open sites for feeding and to seek more dense clumps of sagebrush for roosting.

Cover types used by hens with broods typically had greater availability of forbs during periods of high use, but differences in availability between areas influenced use of cover types, movements, and diets.

In Oregon, the Greater Sage-Grouse hens at Jackass Creek selectively used sites with forb cover greater than typically found there and similar to that generally available to broods at Hart Mountain National Antelope Refuge. This amount of forb cover (12–14%) may represent the minimum needed for Greater Sage-Grouse brood habitat in Oregon.[9]

Succulence of their favored foods appears to be a key to Greater Sage-Grouse movements.[25] As plants mature and dry, the grouse move to areas still supporting succulent vegetation. A delay in maturing of forbs has a noticeable effect on bird movements.[20]

Broodless: A study by Gregg and others [29] in Oregon revealed differences in chronology of summer movements and cover types used between broodless hens and hens with broods. Broodless hens gathered in flocks and remained separate from but in the vicinity of hens with broods during early summer. However, broodless hens moved to meadows earlier in summer and used a greater diversity of cover types than hens with broods perhaps because dietary needs of broodless hens might be less specific than those of hens with broods.

A winter-use area appears to be both a key habitat segment and a major factor in Greater Sage-Grouse distribution over a large area.[22] The best winter habitat is below snowline, where sagebrush is available all winter.[24] Dalke and others [30] reported wintering grounds of Greater Sage-Grouse in Idaho were usually where snow accumulation was less than 6 inches (15 cm). In areas of deep snow, Greater Sage-Grouse winter where sagebrush has grown above the snow level.[31]

Greater Sage-Grouse appear to select areas of little or no slope. In a Colorado study, nearly 80% of Gunnison Sage-Grouse winter use of 500 square miles (1,252 km²) of sagebrush was on less than 35 square miles (87 km²): on flat areas where sagebrush projected above the snow, or on south- or west-facing sites of less than 5% slope, where sagebrush was sometimes quite short but still accessible.[17] In Montana, prime wintering areas were flat, large expanses of dense sagebrush; winter home ranges of 5 Greater Sage-Grouse females in Montana varied from 2,615 to 7,760 acres (1,050–3,100 ha) during 2 different years.[22]

Winter-use areas are determined by amount of snow rather than affinity to a particular site. Majority of winter observations are in sagebrush with more than 20% canopy coverage. Species and subspecies of sagebrush that seem to be preferred by grouse in the winter are black sagebrush, low sagebrush, and some subspecies of big sagebrush.[32]

Food habits

Adults: The importance of sagebrush in the diet of adult Greater Sage-Grouse is impossible to overestimate. Numerous studies have documented its year-round use by Greater Sage-Grouse.[7][8][16][19][20][26] A Montana study, based on 299 crop samples, showed that 62% of total food volume of the year was sagebrush. Between December and February it was the only food item found in all crops. Only between June and September did sagebrush constitute less than 60% of the Greater Sage-Grouse diet.[16] Sage-grouse select sagebrush species differentially. Greater Sage-Grouse in Antelope Valley, California, browsed black sagebrush more frequently than the more common big sagebrush.[8] Young and Palmquist[33] state the browse of black sagebrush is highly preferred by Greater Sage-Grouse in Nevada. In southeastern Idaho, black sagebrush was preferred as forage.[32]

Among the big sagebrush subspecies, basin big sagebrush is less nutritious and higher in terpenes than either mountain or Wyoming big sagebrush. Sage-grouse prefer the other two subspecies to basin big sagebrush.[31] In a common garden study done in Utah, Welch, Wagstaff and Robertson [34] found Greater Sage-Grouse preferred mountain big sagebrush over Wyoming and basin big sagebrush. However, when leaves and buds of the preferred species became limited, the birds shifted to the lesser-liked plants. The authors concluded the birds, while expressing preference, are capable of shifting their eating habits.

Sage-grouse lack a muscular gizzard and cannot grind and digest seeds; they must consume soft-tissue foods.[16] Apart from sagebrush, the adult Greater Sage-Grouse diet consists largely of herbaceous leaves, which are utilized primarily in late spring and summer. Additionally, Greater Sage-Grouse use perennial bunchgrasses for food.[35]

Sage-grouse are highly selective grazers, choosing only a few plant genera. Dandelion (*Taraxacum* spp.), legumes (Fabaceae), yarrow (*Achillea* spp.) and wild lettuce (*Lactuca* spp.) account for most of their forb intake.[31] Martin [28] found that from July to September, dandelion comprised 45% of Greater Sage-Grouse intake; sagebrush comprised 34%. Collectively, dandelion, sagebrush, and two legume genera (*Trifolium* and *Astragalus*) contributed more than 90% of the Greater Sage-Grouse diet. Insects are a minor diet item for adult Greater Sage-Grouse. Martin and others reported insects comprised 2% of the adult Greater Sage-Grouse diet in spring and fall and 9% in summer. Sagebrush made up 71% of the year-round diet.[36]

Prelaying females: Herbaceous dicots are used heavily by females before egg laying and may be essential for Greater Sage-Grouse nutrition because of their high protein and nutrient content.[35]

Favored foods of prelaying and brood-rearing Greater Sage-Grouse hens in Oregon are common dandelion (*Taraxacum officinale*), goatsbeard (*Tragopogon dubius*), western yarrow (*Achillea millefolium*), prickly lettuce (*Lactuca serriola*) and sego lily (*Calochortus macrocarpus*).[37]

Juveniles: In their first week of life, Greater Sage-Grouse chicks consume primarily insects, especially ants and beetles.[19] Their diet then switches to forbs, with sagebrush gradually assuming primary importance. In a Utah study, forbs composed 54 to 60% of the summer diet of juvenile Greater Sage-Grouse, while the diet of adult birds was 39 to 47% forbs.[38]

A Wyoming study evaluated effects of eliminating insects from the diet of newly hatched Greater Sage-Grouse chicks. All chicks hatched in captivity and not provided insects died between the ages of 4 and 10 days, whereas all chicks fed insects survived the first ten days. Captive Greater Sage-Grouse chicks required insects for survival until they were at least three weeks old. Chicks more than three weeks old survived without insects, but their growth rates were lowered significantly, indicating insects were still required for normal growth after three weeks of age. As quantity of insects in the diet increased, survival and growth rates also increased up to 45 days, the length of the experiment.[39]

In a study conducted in Idaho, Klebenow and Gray measured food items for juvenile Greater Sage-Grouse for each age class, classes being defined by weeks since birth. In the first week insects were very important – 52% of the total diet. Beetles, primarily family Scarabaeidae, were the main food item. Beetles were taken by all other age classes of chicks, but in smaller amounts. All ages fed upon ants and while the volume was generally low, ants were found in most of the crops. After week 3, insect volume dropped and stayed at a lower level throughout all the age classes, fluctuating but always under 25%.[40]

Forbs were the major plant food of the chicks. Harkness gilia (*Leptosiphon harknessii*) was the main forb species in the 1st week and then steadily decreased. It was not found in the diet after 6 weeks. Loco (*Arabis convallarius*) and common dandelion were important food items for most of the collection period and occurred with generally high frequencies. Common dandelion was the most abundant food item and the mainstay of the chicks. At 6 weeks of age, goatsbeard reached its peak in the diet and sego lily was found in greatest volume a week later. These 5 species were the most important forbs.

With plants like common dandelion and goatsbeard, all aboveground parts of the plant were sometimes eaten. The stems, however, were not of main importance. The reproductive parts, mainly buds, flowers, and capsules, were the only parts taken from some of the other species. Conversely, leaves were the only parts of sagebrush found in the crops. Leaves and flowers of the species listed above and other dicots contained higher amounts of crude protein, calcium, and phosphorus than sagebrush and may be important in Greater Sage-Grouse diets for these reasons.[35]

Water: Greater Sage-Grouse apparently do not require open water for day-to-day survival if succulent vegetation is available. They utilize free water if it is available, however. Sage-grouse distribution is apparently seasonally limited by water in some areas. In summer, Greater Sage-Grouse in desert regions occur only near streams, springs, and water holes. In winter in Eden Valley, Wyoming, they have been observed regularly visiting partially frozen streams to drink from holes in the ice.[26]

Status

Residential building and energy development have caused the Greater Sage-Grouse population to decline from 16 million 100 years ago to between 200,000 and 500,000 today.[41]

This species is in decline due to loss of habitat; the bird's range has shrunk in historical times, having been extirpated from British Columbia, Kansas, Nebraska, Oklahoma, Arizona and New Mexico. Though the Greater Sage-Grouse as a whole is not considered endangered by the IUCN, local populations may be in serious danger of extinction. In May 2000, the Canadian Species at Risk Act listed the *Centrocercus urophasianus phaios*, formerly found in British Columbia, as being extirpated in Canada.[42] The presence of subfossil bones at Conkling Cave and Shelter Cave in southern New Mexico show that the species was present south of its current range at the end of the last ice age, leading some experts to project that the species could become increasingly vulnerable as global climate change increases the humidity in semiarid regions.[43]

In the United States, the species is a candidate for listing under the Endangered Species Act [44][45]

A petition was signed by American Lands Alliance, Biodiversity Conservation Alliance, Center for Biological Diversity, Center for Native Ecosystems, Forest Guardians, The Fund for Animals, Gallatin Wildlife Association, Great Old Broads for Wilderness, Hells Canyon Preservation Council, The Larch Company, The Northwest Coalition for Alternatives to Pesticides, Northwest Ecosystem Alliance, Oregon Natural Desert Association, Oregon Natural Resources Council, Predator Defense Institute, Sierra Club, Sinapu, Western Fire Ecology Center, Western Watersheds Project, Wild Utah Project, and Wildlands CPR.[41]

In 2010, after a second review, the Department of the Interior assigned the Greater Sage-Grouse a status known as "warranted but precluded," essentially putting it on a waiting list (behind more critically threatened species) for federal protection.

In April 2014 the Sage-Grouse and Endangered Species Conservation and Protection Act (H.R.4419)[46] was introduced in the U.S. House of Representatives to prohibit the federal government from listing sage grouse under the Endangered Species Act for 10 years, as long as states prepare and carry out plans to protect the species within their borders.[47][48]

In 2013 the Canadian Governor in Council (GIC) on behalf of the Minister of the Environment, under the Species at Risk Act, annexed an Emergency Order for the Protection of the Greater Sage-Grouse.[4][49][50] This order, among other things, prohibits killing of sagebrush plants, native grasses or native forbs, the building of fences and other structures in certain areas. Emergency Order for the Protection is implemented "to protect a listed wildlife species on both federal and non-federal lands when the competent Minister is of the opinion that the species faces imminent threats to its survival or recovery."[4]

> "Over the past several decades, Canada's Sage-Grouse population has been reduced to remnant populations in Alberta and Saskatchewan. Historically, Sage-Grouse occurred in at least 16 states within the western U.S. and three provinces in Canada (Alberta, British Columbia and Saskatchewan). Sage-Grouse are now extirpated from British Columbia and five U.S. states. The Sage-Grouse population has continued to decline despite the provincial recovery strategies produced in 2001, 2006, and 2008. According to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), between 1988 and 2012, the total Canadian population of the Sage-Grouse declined by 98%. Current provincial population estimates from 2012 in Alberta are 40 to 60 adult birds and 55 to 80 adult birds in Saskatchewan."
>
> —Emergency Order for the Protection of the Greater Sage-Grouse 2013

Predators

Predators are commonly believed to reduce Greater Sage-Grouse populations and of most importance is timing of death. Nest loss to predators is most important when potential production of young and recruitment are seriously impacted.[51] Lack of adequate nesting and brooding cover may account for high juvenile losses in many regions.[52] Nest success is related to herbaceous cover near the nest site.[14][53] Taller, more dense herbaceous cover apparently reduces nest predation and likely increases early brood survival.[51] Although predators were the proximate factor influencing nest loss, the ultimate cause may relate to the vegetation available to nesting Greater Sage-Grouse.[14] Tall dense vegetation may provide visual, scent, and physical barriers between predators and nests of ground-nesting birds. Greater amounts of both tall grass and medium-height shrub cover were associated collectively with a lower probability of nest predation.[53] In a series of Nevada studies, artificial nest predation experiments were conducted. Artificial nests experienced 100% mortality with the loss of 1,400 eggs in 200 simulated nests in two weeks in one study, 84% of the nests were destroyed in three days in another study, while just 3% of the nests were destroyed in ten days in an area of significantly better cover (t test, $P < 0.05$).[54]

Generally, quantity and quality of habitats used by Greater Sage-Grouse control the degree of predation. Thus, predation would be expected to be most important as habitat size and herbaceous cover within sagebrush decreases.[51]

A decline in preferred prey may also result in increased predation on Greater Sage-Grouse. Kindschy suggested that in southeastern Oregon, a decline in black-tailed jackrabbit (*Lepus californicus*) numbers may have caused predators to switch to Greater Sage-Grouse as their primary prey.[52]

Predator species include coyote (*Canis latrans*),[52] bobcat (*Lynx rufus*), American badger (*Taxidea taxus*),[55] falcons (Falconidae),[56] and hawks and eagles (Accipitridae)[57] prey on adult and juvenile Greater Sage-Grouse. Crows and ravens (*Corvus* spp.) and magpies (*Pica* spp.) consume juvenile birds.[52] Coyote, ground squirrels (Sciuridae spp.), and badger are the most important mammalian nest predators. Among bird species, magpies and ravens commonly prey on Greater Sage-Grouse nests.[16][17]

Greater Sage-Grouse are a popular game bird. Mortality due to hunting is generally considered to be compensatory[30][51] and replacive,[51] where until mortality reaches a "threshold value" it has no effect on population levels. Autenrieth and others [31] state data are not available to suggest that closed or restricted hunting seasons will materially affect overall Greater Sage-Grouse population levels on their primary range.

In a study on hunting in a low density Greater Sage-Grouse population in Nevada, Stigar concluded low populations may be a result of factors other than hunting. Protecting one Greater Sage-Grouse population from hunting while doubling the birds harvested in a four-year period on another population showed that despite low recruitment, both populations increased to nearly the same density.[58] In an Oregon study, no relationship was found between the rate of summer recruitment (chicks/adult) and harvest by hunters. Nor was any significant relationship found between the size of the fall harvest and population trends during the subsequent spring.[59]

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Further reading

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- Manier, D.J. (2013). *Summary of Science, Activities, Programs, and Policies that Influence the Rangewide Conservation of Greater Sage-Grouse (Centrocercus urophasianus). (http://purl.fdlp.gov/GPO/gpo41773)* Reston, Va.: U.S. Department of the Interior, U.S. Geological Survey.
- *Western Watersheds Project v. U.S. Fish and Wildlife Service* – Summary Judgement PDF fulltext (http://www.westernwatersheds.org/legal/07/sagegrouse/greater_sage-grouse_sj_decision.pdf)

External links

- Cornell Lab of Ornithology – Greater Sage Grouse (http://www.allaboutbirds.org/guide/Greater_Sage-Grouse/id)
- USGS Patuxent Bird Identification InfoCenter – Greater Sage Grouse (http://www.mbr-pwrc.usgs.gov/id/framlst/i3090id.html)
- eNature.com: Greater Sage Grouse (http://enature.com/fieldguides/detail.asp?allSpecies=y&searchText=greater%20sage%20grouse&curGroupID=1&lgfromWhere=&curPageNum=1)

Wikimedia Commons has media related to ***Greater sage-grouse***.

- High-resolution sage-grouse photos, range maps, broadcast-quality b-roll, and fact sheets (http://wayback.archive.org/web/20120220092041/http://nativeecosystems.org/newsroom/greater-sage-grouse-decision-expected)
- "Greater Sage-Grouse" photo gallery (http://vireo.acnatsci.org/search.html?Form=Search&SEARCHBY=Common&KEYWORDS=Sage-grouse&showwhat=images&AGE=All&SEX=All&ACT=All&Search=Search&VIEW=All&ORIENTATION=All&RESULTS=24) VIREO
- Western Watersheds Project: Greater Sage Grouse (http://www.westernwatersheds.org/issues/species/sage-grouse/)
- Sage Grouse Protection (http://www.voiceforthewild.org/general/sage_grouse_protection.html) Biodiversity Conservation Alliance
- Studies in Avian Biology Monograph: Ecology and Conservation of Greater Sage-Grouse: A Landscape Species and Its Habitats (http://sagemap.wr.usgs.gov/monograph.aspx) Biodiversity Conservation Alliance

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Categories: IUCN Red List near threatened species | Centrocercus | Birds of the United States | Native birds of the Western United States | Fauna of the Great Basin | Grouse

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