THE STATUS OF SAGE GROUSE *(Centrocercus urophasianus urophasianus)* IN CANADA

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Abstract: The sage grouse (*Crentrocercus urophasianus*) is the largest North American grouse and depends on sagebrush (*Artemisia spp*.) for diet and protective cover. The association with sagebrush limits the range of sage grouse to the range of sagebrush. As a result of the loss of native sagebrush-grasslands, the range of sage grouse has decreased by over 50% since the turn of the century. Sage grouse are considered a "threatened" species in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

In Canada, sage grouse are at the northern edge of the species' range, occurring only in extreme southeastern Alberta and southwestern Saskatchewan. Population trends based on spring lek surveys indicate that populations have experienced an 80% decrease from numbers in the early 1980s in Alberta, or from the late 1980s in Saskatchewan. The decline occurring in the rest of the range, although thought to be less severe, is most often attributed to the loss of habitat. Degradation of sagebrush habitat has resulted from human agricultural developments, oil and gas exploration, vehicular traffic, and the drought of the early 1980s. Sage grouse have been extirpated from British Columbia and three of at least 15 U.S. states known to previously support populations. In 1997, the Canadian sage grouse population was estimated at between 513 and 849 individuals (Aldridge 1998), which may not be high enough to sustain a viable population.

INTRODUCTION

Sage grouse (*Centrocercus urophasianus*) are found almost exclusively where sagebrush-grasslands occur. The range of the native sagebrush habitat has been decreased by approximately two and a half million ha, which ultimately reduced the range of the sage grouse (Braun 1995). The eastern subspecies (*C. u. urophasianus*) occurs in Canada at the northern edge of its range, in extreme southeastern Alberta and southwestern Saskatchewan. In Canada, sage grouse were officially listed as a "threatened" species in 1997 by the Committee on the Status of Endangered Wildlife In Canada (COSEWIC) due to their limited range, specific habitat requirements, and decline in numbers over the past 30 years. This paper is adapted from the Alberta Wildlife Status Report on the Sage Grouse in Alberta (Aldridge 1998).

HABITAT

In Canada, sage grouse are found within the range of silver sagebrush (*Artemisia cana*) on the semi-arid mixed-grass prairie. In this area, the mean annual precipitation is about 310 mm, and temperatures for July and January average 19.1 and -14.5° C, respectively (McAdam 1997). Essentially flat, the prairie contains small knolls or hills and is often interrupted by vast coulees that lead to numerous creeks and river tributaries. Although the sage grouse have a close association with sagebrush habitats, specific habitat requirements vary throughout the year. It is important that areas contain habitats which satisfy requirements for strutting grounds, nesting areas, feeding and loafing sites, brood rearing sites, and possibly wintering grounds (Beck 1977, Eng and Schladweiler 1972, Klebenow 1969, Wallestad and Pyrah 1974).

Strutting Grounds

Areas in which displaying males are highly visible to females during the spring mating season are used as strutting grounds (leks). Leks range in size from 0.04 ha to as large as 4 ha, and are very traditional, with some remaining active for upwards of 100 years (Dalke et al. 1963). These are typically flat, open areas, such as dried mud flats or valley bottoms (Dalke et al. 1963, Patterson 1952, Peterson 1970, Scott 1944) that are often slightly lower than surrounding areas and are usually located near small creeks (pers. obs., W. Harris pers. comm.). Leks themselves typically have little vegetation, but are surrounded by sagebrush flats that are important as feeding and roosting sites (Clark and Dube 1984, Patterson 1952, Peterson 1970, Scott 1944). Spring daytime roosting sites of males have a canopy coverage of 20 to 50%, and consist of plants that are <30 cm tall (Wallestad and Schladweiler 1974, Wallestad 1975).

Nesting Areas

Nesting habitat is associated with sagebrush flats surrounding strutting grounds. Despite the apparent association of nests with leks, Wakkinen et al. (1992) found that nest distribution with respect to leks was random, even though 92% of nests in the southeastern Idaho study area occurred within 3 km of a lek. Nests are almost exclusively placed under sagebrush (Braun et al. 1976, Gates 1985, Patterson 1952, Wallestad and Pyrah 1974) which typically has fairly dense canopy coverage (20 to 50%; Klebenow 1969, Patterson 1952, Wallestad and Pyrah 1974).

Brood Rearing

In early summer, broods concentrate in areas that have sparse sagebrush cover and are more open and moist (Drut et al. 1994b, Klebenow 1969, Patterson 1952, Wallestad 1971). During late brood rearing and breakup, hens and broods searching for succulent forbs move further into moist areas (wetlands and wet meadows), often near open water (Drut et al. 1994b, Klebenow 1969, Patterson 1952, Wallestad 1971). Birds return to dense sagebrush in late summer and fall before moving to wintering grounds (Drut et al. 1994a, Patterson 1952, Wallestad 1971).

Wintering Habitat

During the winter, sagebrush is extremely important as it makes up 100% of the diet of sage grouse and provides cover from inclement weather (Johnsgard 1973, 1983, Patterson 1952, Remington and Braun 1985, Wallestad et al. 1975). Winter locations are usually at lower elevations such as drainage basins (Hupp and Braun 1989b, Patterson 1952), where sagebrush is dense enough and tall enough to remain above snow cover (Johnsgard 1973, Eng and Schladweiler 1972).

CONSERVATION BIOLOGY

General Biology

Sage grouse are the largest North American grouse (Beck and Braun 1978) and exhibit extreme sexual dimorphism, with females and males weighing about 1080 and 2410 grams, respectively (Johnsgard 1973, 1983, Nelson and Martin 1953). Weight fluctuates throughout the year, with the maximum being attained during the breeding season (April to May; Beck and Braun 1978, Hupp and Braun 1991, Patterson 1952). Beck and Braun (1978) suggest that the overwinter weight gain is necessary to meet the high energy demands of breeding rather than for overwinter survival. Male sage grouse in Alberta are larger than throughout the rest of their range (breeding weight estimated at 3290 grams; Aldridge 1998), which may be an adaptation to the longer, more extreme weather conditions at the northern edge of the species' range.

Lek Behaviour

Males begin returning to lek sites in late winter, and begin displaying and establishing territories as soon as snow disappears. Older cocks arrive first, and obtain the most central territories (Patterson 1952). If yearling males manage to obtain a territory (mid April in Idaho and Montana, Dalke et al. 1963, Eng 1963; late April to early May in Alberta, Aldridge 1997), it is usually after the period of peak female attendance, and they are usually displaced to the periphery. During population lows, smaller dancing grounds tend to be abandoned (Dalke et al. 1963). Males will attend and display at leks at both dusk and dawn, but activity peaks during the hour surrounding sunrise (Johnsgard 1983, Patterson 1952). The male display is used both to attract females and defend a territory from other males (see Johnsgard 1983 or Patterson 1952 for detailed description). Both males and females show a strong tendency to return to the same strutting ground each year (Berry and Eng 1985, Dalke et al. 1963, Emmons and Braun 1984.

Nesting

After mating, females move to nest sites located in close proximity to leks, and typically near previous years' nest sites (Fischer et al. 1993, Patterson 1952). Mean clutch size is usually 7 to 9 eggs (Anonymous 1997), and in Alberta, peak hatching occurs in early June (Clewes 1968). In Idaho, Connelly et al. (1993) found that 78% of all adult females and 55% of yearlings initiated a nest; 52% of both age groups produced a clutch. Reproductive success in Alberta has declined in recent years. Mean brood size from 1967 to 1976 gradually decreased from 4.4 to 3 chicks per hen (both n=20; Windberg 1976) and in 1985, brood size was 3.4 (n=29; Banasch 1985). Crawford and Lutz (1985) reported similar trends in Idaho, with brood sizes decreasing from 4.5 chicks per hen in the late 1950s, to 3.3 in the early 1980s. They also reported that the percentage of adults with broods declined from 55% to only 9% over the same time period. Patterson (1952) found that 20% of eggs hatched and produced chicks that survived to the age of four months.

Non-breeding Season

In late summer and fall, sage grouse congregate in sexually segregated flocks for movements to wintering grounds (September to December) (Beck 1977, Connelly et al. 1988, Eng and Schladweiler 1972). Distances moved from breeding to wintering ranges

average 7.9 to 30 km for sage grouse in southern populations (Beck 1977, Schoenberg 1982). However, one-way migrations of 80 to 160 km have been recorded (Connelly et al. 1988, Dalke et al. 1963, Patterson 1952). The longest reported migration movements are usually of birds moving to lower elevations (see Connelly et al. 1988, Patterson 1952).

In Montana, sage grouse populations are considered non-migratory, with minimal movements occurring between winter and summer ranges (Eng and Schladweiler 1972). Wintering grounds in southeastern Idaho also overlap with spring and summer ranges (Connelly et al. 1988). Landscape features in Alberta and Saskatchewan are similar to Montana, and thus, sage grouse in Canada are probably non-migratory. Beck (1977) found that sage grouse wintering areas composed only 7% of sagebrush habitat, suggesting that winter habitat may be the most limited resource (Beck 1977, Eng and Schladweiler 1972, Patterson 1952, Remington and Braun 1985).

Diet

Sage grouse lack the muscular gizzard necessary for the grinding of seeds and other hard materials (Paterson 1952, Remington and Braun 1985). Consequently, their diet is limited to soft vegetation such as sagebrush leaves and buds. Sagebrush constitutes 62% of the year round diet (Wallestad et al. 1975) and makes up 100% of the diet in winter (Patterson 1952). All sage grouse shift their diet to include some lush forbs in the summer (Barnett and Crawford 1994). Forbs make up 75% of the diet of juvenile sage grouse that are <12 weeks of age (Peterson 1970). Insects are also an important component of the diet of juveniles (Drut et al. 1994b, Klebenow and Gray 1968, Patterson 1952, Peterson 1970), and make up as much as 60% of the diet of one week old chicks in the wild (Peterson 1970).

Survival

Annual adult survival has been estimated at 30 to 60% (see Johnsgard 1973, Beck and Braun 1978). Adult males often have lower survival rates than do yearlings (33.7 versus 56.1%), and it is thought to be related to weight losses incurred by adults during courtship (Beck and Braun 1978). Juvenile mortality may be high, with large numbers succumbing to disease and predation (Patterson 1952). The major predators of adult birds are hawks, eagles, coyotes (*Canis latrans*) and badgers (*Taxidea taxus*), while ground squirrels, striped skunks (*Mephitis mephitis*), magpies (*Pica pica*), American crows (*Corvus brachyrhynchos*) and coyotes are known to take eggs (Patterson 1952, McAdam 1997).

DISTRIBUTION

Canada

Sage grouse presently occur in a 6,000 km^2 area in southeastern Alberta and Saskatchewan (see 1997 range; Figure 1). This distribution is based on known locations of active strutting grounds. Sage grouse in Canada probably represent a continuous population

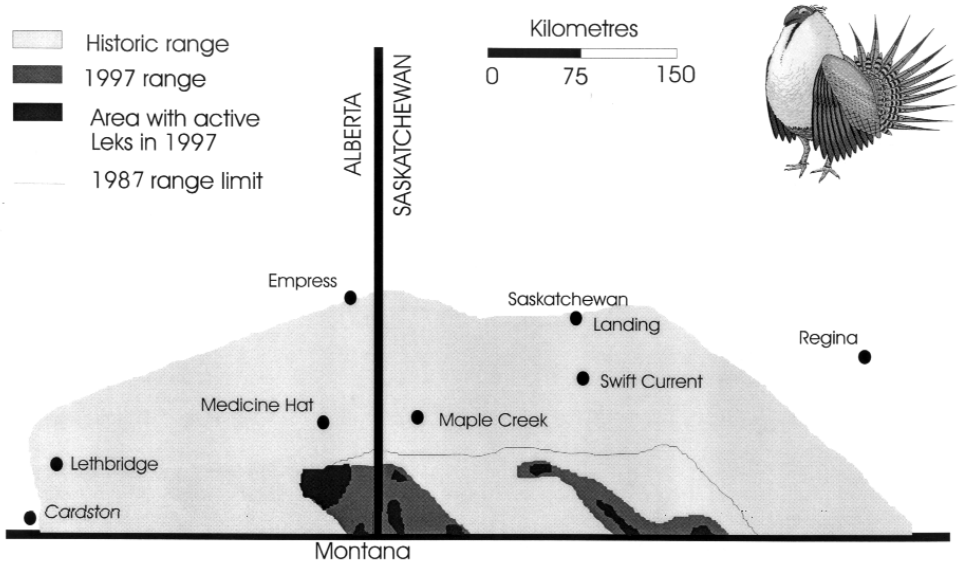

Figure 1. Range of sage grouse in Canada. The historical range is based on anecdotal sightings of sage grouse prior to the commencement of lek surveys. The 1997 range limit is based on the locations of active leks that year. The 1987 range limit is shown to illustrate the range contraction.

Figure 2. Current (solid line) and known historic (dashed line) distribution of the eastern (E) and western (W) subspecies of the sage grouse (adapted from Johnsgard 1983). The current distribution is not continuous and is more fragmented than indicated.

which likely extends into Montana to the south (see Figure 2). It is not known where Canadian birds winter, but it is suspected that they are non-migratory. Historically, the range of the sage grouse in Canada was much greater (about 100,000 km^2; see Figure 1), with the species likely occurring over the historic range of sagebrush.

Other Areas

The eastern subspecies (*C. u. urophasianus*) which occurs in Canada, is the most common and widespread. The western subspecies (*C. u. phaios*) is present in smaller numbers from eastern Washington to southeastern Oregon, and historically occurred in the southern Okanagan valley of British Columbia (Figure 2). Today, sage grouse are considered extirpated from British Columbia and at least three of 15 U.S. states (Nebraska, New Mexico and Oklahoma; see Figure 2) (Anonymous 1997, Johnsgard 1973, 1983). Range contractions have also occurred in other parts of the species' range, where available habitat continues to disappear (Braun 1995, Eng and Schladweiler 1972, Swenson et al. 1987, Wallestad et al. 1975).

POPULATION SIZE AND TRENDS

The most cost effective and time efficient method of obtaining data on sage grouse to estimate population size is through lek surveys. These represent the maximum count of all male sage grouse displaying on a strutting ground during the spring mating season (Beck and Braun 1980).

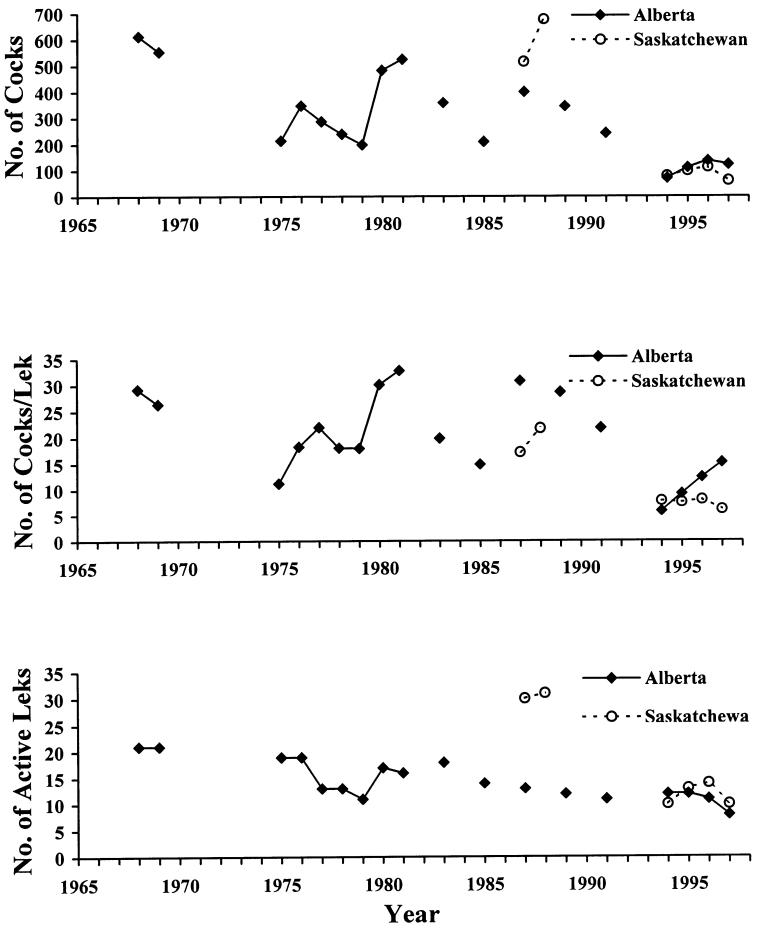

Figure 3. Population trends for sage grouse in Canada over the past 30 years based on the number of cocks, number of cocks per lek, and number of active leks. Years with sampling effort of less than eight surveyed leks are not included.

Canada

Sage grouse lek surveys have been performed independently in both Alberta and Saskatchewan, and for this reason population trends are analyzed as separate data (Figure 3). In Alberta, surveys have been performed on average every two years since 1968, although gaps as long as five years have occurred (Figure 3). During the first two years (1968-69) and in the early 1980s, sage grouse numbers peaked, and approached 600 males on about 20 leks, with greater than 25 cocks/lek on average (Figure 3). In Saskatchewan, the first surveys performed in 1987 and 1988 peaked at about 600 males, but there were 30 active leks with about 20 cocks/lek (Figure 3). Since the surveys began, there has been a general decline in numbers, such that in 1997, there were only eight, and 10 active leks supporting 122 and 61 males, in Alberta and Saskatchewan respectively (Figure 3).

Lek surveys suggest that the overall Canadian sage grouse population has declined by about 80% from known maximum levels. However, the exact rate of decline is difficult to determine, as sampling effort has been inconsistent among years (Aldridge 1997, Madsen 1995, McAdam 1997). It is also difficult to determine from some reports whether leks that apparently contained no birds were actually located and surveyed. The determination of trends is further complicated by population cycles which last from five to ten years (Figure 3; see also Aldridge 1998, McAdam 1997, Patterson 1952). Based on 1997 lek surveys, the total spring population of sage grouse in Canada has been estimated at between 549 and 813 individuals (see Aldridge 1998). It has been suggested that 500-5000 individuals may be required to sustain a viable population (Anonymous 1997, Braun 1995).

Other Areas

Declines in sage grouse populations have also been reported in the United States. By 1983, sage grouse in Oregon had declined by approximately 60% from levels in 1940 (Crawford and Lutz 1985). Similarly, sage grouse numbers in Colorado have decreased by over 50% since the early 1900s (Braun 1995). Overall, the continental decline in sage grouse abundance mirrors the loss of sagebrush habitat (Braun 1995, Braun et al. 1977, Eng and Schladweiler 1972, Swenson et al. 1987, Wallestad et al. 1975).

LIMITING FACTORS

Population declines of sage grouse on the Great Plains have been attributed primarily to loss of sagebrush habitat. However, a number of more localized disturbances, such as industrial development, have contributed to the loss of suitable habitat, and declines are likely due to a combination of factors (outlined below).

Agricultural Practices

The demand for productive agricultural land in the 1900s in North America resulted in massive sagebrush eradication programs. This decreased the range of sagebrush and thus potential sage grouse habitat by an estimated two and a half million ha from 1952 to 1977 (Braun et al. 1977). Cultivation of sagebrush-grasslands has decreased available habitat (Dalke et al. 1963, Patterson 1952, Wallestad and Pyrah 1974). The ploughing of 16% of sage grouse habitat in Montana, including 30% of the wintering range, reduced sage grouse numbers by 73% (Swenson et al. 1987).

Overgrazing has also been suggested as a main reason why sage grouse populations have declined (Dalke et al. 1963, Johnsgard 1973, 1983). The decline documented in Alberta lek surveys since 1968 corresponds with increased numbers of livestock grazing in the southeastern part of the province (Windberg 1975). The removal of cover by cattle can impact sage grouse populations either by reducing habitat suitability, or by increasing the exposure of birds to predators or extreme weather.

Oil and Gas Exploration

Oil and gas exploration and extraction are very active within the Canadian range of sage grouse. The removal of vegetation for well sites, access roads and associated facilities can reduce and fragment suitable habitat and may disrupt breeding activities. Six traditional strutting grounds in Alberta, four of which are no longer active, are known to have been disturbed by oil and gas exploration activities (pers. obs., Dube 1991).

Roadways and Traffic

More heavily used roads and highways cause sage grouse mortalities and fragmentation of habitat (Patterson 1952). Sage grouse travel on the ground between leks and foraging sites, and some have also been known to form leks on well used roads (Patterson 1952), which has obvious detrimental effects on populations. In addition, roadways may render leks more visible to humans, which could lead to the abandonment of strutting grounds if they are continually disturbed by interested onlookers.

Climate

Sage grouse are fairly robust birds, yet climatic conditions may be limiting in Canada. Short summers and particularly harsh winters may limit the ability of individuals to find enough food in winter months, decreasing lipid reserves necessary for reproduction (Back et al. 1987, Hupp and Braun 1989a) and possibly lowering overwinter survival (Back et al. 1987). Particularly wet and cool conditions during incubation and hatching periods in the spring can drastically reduce productivity (Weichel and Hjertaas 1992). Drought might also limit the availability of lush vegetation important in the diet of all sage grouse during the summer. The drought of the 1980s may have limited productivity and, when combined with consistent cattle stocking rates, a substantial loss of vegetative cover could have resulted in increased predation and lowered overwinter survival (K. Lungle pers. comm.).

STATUS DESIGNATIONS

Canada

Sage grouse were listed as a “threatened” species in 1997 by COSEWIC and are likely to be placed on the endangered species list in Canada if limiting factors are not reversed. In 1996, due to concern over the decline in population numbers, it was decided that the hunting of sage grouse in Alberta would be closed indefinitely for the first time since 1967. In a 1996 review of the status of wildlife in Alberta, sage grouse were included on the “Blue List” of species which are considered to be at risk. Sage grouse have tentatively been classified as an “endangered” species in the province of Saskatchewan (R.M. Brigham Pers. Comm.).

Other Areas

In the United States, status designations vary by state and in some, such as Washington, sage grouse are listed as endangered (C. Braun Pers. Comm.). In the United States, these birds are considered an upland gamebird and are still hunted in most states.

FUTURE WORK IN CANADA

As a follow up to the 1997 COSEWIC listing of sage grouse as a "threatened" species in Canada, it is recommended that a recovery plan be developed. Acting on the advice of COSEWIC, the recovery team will convene a team of biologists and other interested parties in early 1998 to formulate a recovery plan for the management of sage grouse in Canada. Also set to begin in 1998 is a two year study of the behavioural ecology of sage grouse in Canada. The objectives of this work will be to (1) monitor movements of individual females to assess habitat selection and importance throughout different life history stages; (2) determine reproductive success and survival at different life history stages i.e. clutch size, brood size; (3) compare life history strategies of sage grouse in Canada with southern conspecifics. Hopefully, this research will provide the recovery team and wildlife managers with a better understanding of the basic biology and life history strategies of sage grouse in Canada.

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