

Status of the Sage Grouse
(Centrocercus urophasianus urophasianus)
in Alberta

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PREFACE

Every five years, the Wildlife Management Division of Alberta Natural Resources Service reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991 and 1996, assign individual species to “colour” lists which reflect the perceived level of risk to populations which occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily-available sources of population data. A primary objective of these reviews is to identify species which may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the 1996 *Status of Alberta Wildlife* review process, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province (Red or Blue listed), that are of uncertain status (Status Undetermined), or which are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Wildlife Management Division of Alberta Environmental Protection, and are intended to provide detailed and up-to-date information which will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information which will assist the proposed Alberta Endangered Species Conservation Committee to identify species that may be formally designated as endangered or threatened under the Alberta Wildlife Act. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

EXECUTIVE SUMMARY

The Sage Grouse (Centrocercus urophasianus) is the largest of all North American grouse and depends on sagebrush for diet and protective cover. This association with sagebrush has limited the range of the Sage Grouse to the range of sagebrush. As a result of the loss of the native sagebrush grasslands, the range of the Sage Grouse in North America has decreased by over 50 % during this century. Sage Grouse are currently included on the “Blue List” of species which may be at risk in Alberta because of their decreasing population numbers, limited distribution and specific habitat requirements. Nationally, they are considered to be a “threatened” species in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Alberta lies at the northern edge of the range of the eastern subspecies of the Sage Grouse (C. u. urophasianus), and the (sub)species is found only in the extreme southeastern corner of the province. Population trends determined through spring lek surveys indicate that the Alberta population has experienced an 80 % decline over the past few decades. A similar but less severe decline has been observed throughout the species’ range in North America. Declines are most often attributed to the loss of habitat resulting from human encroachment on native prairie. These disturbances include agricultural developments, oil and gas exploration and vehicular traffic. Current information suggests that the population in Alberta and adjacent areas of Saskatchewan may be near levels that are nonviable.

Sage Grouse in Alberta are probably non-migratory, wintering within or near their summer range in the province, except in the most extreme conditions when some southward movement may occur. The possibility that Sage Grouse use sagebrush plains in Alberta year round increases the importance of the currently available habitat in the province. Long-term studies are needed to understand habitat requirements and population trends, assess the impact of various land uses, address the effects of human disturbances, and ultimately to develop management strategies necessary to sustain a viable Sage Grouse population in Alberta.

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INTRODUCTION

The Sage Grouse (Centrocercus urophasianus) is the largest of all North American grouse and is found almost exclusively where sagebrush-grasslands occur. The eastern subspecies (C. u. urophasianus), which occurs in Alberta, is found at the northern edge of its range in the extreme southeastern corner of province.

The range of the Sage Grouse has been greatly reduced in recent decades, likely because of a drastic reduction in availability of native sagebrush habitat (Braun 1995). In 1997, the Committee on the Status of Endangered Wildlife in Canada listed the Sage Grouse as a “threatened*” species (McAdam 1997). The species is also included on the “Blue List” of wildlife that may be at risk in Alberta (Alberta Wildlife Management Division 1996).

This report reviews and summarizes current information on the Sage Grouse in Alberta, to develop a better understanding of the species and its status in this province.

HABITAT

Sage Grouse are found almost exclusively within the North American range of sagebrush (Artemisia spp.), and maintain a close association with sagebrush habitats throughout the year (Braun 1995, Braun et al. 1977, Crawford and Lutz 1985, Eng and Schladweiler 1972, Patterson 1952, Swenson et al. 1987, Wallestad et al.

1975). This is also true in Alberta, where the species is found within the range of sagebrush on the semi-arid mixed-grass prairie. In this area the mean annual precipitation is 310 mm, and mean July and January temperatures are 19.1°C and -14.5°C, respectively (McAdam 1997). The prairie in this area is essentially flat, but contains small knolls or hills and is often interrupted by vast coulees that lead to numerous creeks and river tributaries. Silver Sage (A. cana) is the main species of sagebrush on Alberta prairies and is most frequently associated with grasses such as June Grass (Koeleria macrantha), Blue Grama (Bouteloua gracilis), Speargrass (Stipa comata), and Western Wheatgrass (Agropyron smithii). Pasture Sage (A. frigida) is the dominant forb in these areas (Dickinson 1969, Nietfield et al. 1984, Madsen 1995a).

Sage Grouse are probably non-migratory in Alberta (see “Conservation Biology” section), and individual birds confine most of their breeding activities to relatively small areas. Although the species has a close association with sagebrush habitat, the specific habitat requirements vary at different times in the annual cycle. This stresses the importance of areas that contain habitats which satisfy requirements for dancing 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).

1. Dancing Grounds. - Areas where displaying males are highly visible to females during the spring mating season are used as dancing grounds (leks). Leks range in size from 0.04 ha to as large as

* See Appendix 1 for definitions of selected status designations

4 ha, and are very traditional, with some remaining active for upwards of 100 years (Dalke et al. 1963). Leks are typically flat, open sites such as dried mud flats or valley bottoms (Dalke et al. 1963, Patterson 1952, Peterson 1970, Scott 1944) that are slightly lower than surrounding areas and usually near small creeks (pers. obs., W. Harris, pers. comm.). Patterson (1952) also found some leks in Wyoming located on slight knolls and ridges. The leks themselves contain 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 roosts of males have a sagebrush canopy coverage of 20 to 50 %, and consist of plants that are <30 cm tall (Wallestad and Schladweiler 1974, Wallestad 1975 in Johnsgard 1983).

2. Nesting Areas. - Nesting habitat is primarily associated with sagebrush flats surrounding dancing grounds. Martin (1970) found that 80 % of nests in southwestern Montana were within 3.2 km of a lek, and similarly, Wallestad and Pyrah (1974) found that 68 % of nests in central Montana occurred within 2.5 km of a lek. 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 their study area in southeastern Idaho occurred within 3 km of a lek.

Nests are almost invariably placed under sagebrush (Braun et al. 1977, Gates 1985, Patterson 1952, Wallestad and Pyrah 1974). Connelly et al. (1991) found that yearling females in southeastern Idaho placed their nests

under sagebrush more often than did older individuals (95 % versus 79 %). Sagebrush used for nesting has a fairly dense canopy coverage (20 to 50 %) and taller plants are preferred, with heights ranging from 17 to 79 cm (Klebenow 1969, Patterson 1952, Wallestad and Pyrah 1974).

3. Brood Rearing. - In early summer, broods concentrate in more open and moist sagebrush where important foods such as succulent forbs occur (Drut et al. 1994b, Klebenow 1969, Patterson 1952, Wallestad 1971). During late brood rearing and breakup, hens and broods searching for forbs move further into moist areas (wetlands and wet meadows) away from sagebrush flats, and are often found 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). Dunn and Braun (1986b) found that females and juveniles in Colorado selected habitat during the fall that was more homogenous in size and density of shrubs, and had the greatest horizontal and vertical vegetational cover.

4. Wintering Habitat. - During winter, sagebrush makes up nearly 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 in drainage basins (Hupp and Braun 1989b, Patterson 1952), where sagebrush is dense and tall enough to remain above snow cover (Eng and Schladweiler 1972, Johnsgard 1973). Southwest-facing slopes with a

gradient of less than 5 % are important attributes of wintering areas, as these sites are wind-swept and relatively snow free, which allows for the exposure of sagebrush (Beck 1977, Eng and Schladweiler 1972). Eng and Schladweiler (1972) found that 82 % of all Sage Grouse winter locations in central Montana were in sagebrush stands that exceeded 20 % canopy cover. Beck (1977) found that Sage Grouse wintering areas in northern Colorado composed only 7 % of the available sagebrush habitat, suggesting that winter habitat may be the most limiting resource (Beck 1977, Eng and Schladweiler 1972, Patterson 1952, Remington and Braun 1985).

CONSERVATION BIOLOGY

1. General Biology. - Sage Grouse are the largest of all North American grouse (Beck and Braun 1978). The species exhibits extreme sexual dimorphism, with females and males averaging 48 to 58 cm and 65 to 75 cm in length, and weighing about 1078 and 2411 grams, respectively (Johnsgard 1973, 1983, Nelson and Martin 1953). Weights of Sage Grouse fluctuate throughout the year, with the largest weight gain occurring from January to March. This results in maximum weights 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.

In October 1968, adult male and female Sage Grouse weighed at hunter check stations in Alberta averaged 2469 and

1617 grams, respectively (Armstrong 1969). These values are difficult to compare with weights from other parts of the species' range, as data are usually gathered during the breeding season when individuals are at their heaviest. Assuming that seasonal weight loss (late spring to early fall) of adult males in Alberta is similar to the 25 % loss observed in Wyoming (Patterson 1952) and Colorado (Beck and Braun 1978) populations, then an average breeding weight of male Sage Grouse in Alberta would be about 3292 grams. This is heavier than weights recorded in Colorado (3190 grams; Beck and Braun 1978), eastern Idaho (2450 grams; Dalke et al. 1963), central Montana (2900 grams; Eng 1963) and Wyoming (2700 grams; Patterson 1952). The greater weights of Sage Grouse at the northern edge of the species' range may be an adaptation to longer, more extreme weather conditions at higher latitudes.

2. Lek Behaviour. - Males begin returning to strutting grounds in late winter, and begin displaying and establishing territories on leks as soon as snow begins to disappear. Older cocks arrive first, and obtain the most central territories (Patterson 1952). After the period of peak female attendance, yearling males begin to visit leks (mid-April in Idaho and Montana, Dalke et al. 1963, Eng 1963; late April to early May in Alberta, Aldridge 1997). If yearling males manage to obtain a territory, they are usually located near the periphery of the lek. Each female attends a lek for a period of two to three days each spring, mating only once (Gibson and Bradbury 1986), and usually with one of the dominant cocks (Gibson 1996). During years of low population size, smaller

dancing grounds tend to be abandoned (Dalke et al. 1963).

Males attend and display at leks at both dusk and dawn (Johnsgard 1983, Patterson 1952), but activity peaks during the hour surrounding sunrise. The male display is used both to attract females and to defend a territory from other males (Johnsgard 1983, Patterson 1952). The display itself consists of a series of "struts", in which the male fans his tail feathers, inflates his esophageal bag, and puffs his white chest feathers while displaying his olive green-yellow gular sacs. He then flaps his drawn wings and produces a brushing sound, which finishes with a characteristic "plopping" noise that is produced from the release of air from the esophageal bag (see Johnsgard 1983, Patterson 1952 for detailed description). Displays are most intense when females are in attendance (pers. obs.).

Both males and females show a strong tendency to return to the same dancing ground each year (Berry and Eng 1985, Dalke et al. 1963, Emmons and Braun 1984, Eng 1963, Fischer et al. 1993), and >50 % of yearlings return to the dancing ground at which they were conceived (Dunn and Braun 1986b). Inter-lek movements by adult cocks during a breeding season are uncommon (Dalke et al. 1963, Wallestad and Schladweiler 1974), but may occur with females and juvenile cocks (Emmons and Braun 1984).

3. Nesting. - After mating, females move to nesting areas located in close proximity to leks, and typically near the previous years' nest site (Fischer et al. 1993). Egg laying is initiated within a

few days (Patterson 1952). Laying and incubation together last about 37 days, with 1.3 days elapsing between the laying of successive eggs (Dalke et al. 1963, Patterson 1952). Average clutch size is usually seven to nine eggs (Anonymous 1997), and in Alberta, peak hatching occurs in early June (Clewes 1968). Wallestad and Pyrah (1974) found that adult hens in central Montana were more successful in bringing off a clutch than were yearlings (77 % versus 44 %). In Idaho, Connelly et al. (1993) found that 78 % of adult females and only 55 % of yearlings initiated a nest, yet 52 % of both age groups produced a clutch. Males also remain near leks during the nesting season, with one study reporting that 76 % of all movements during this season were within one kilometer of the dancing grounds (Wallestad and Schladweiler 1974).

Breeding production in Sage Grouse has declined in recent years. In Alberta, mean brood size from 1967 to 1976 gradually decreased from 4.4 to three chicks per hen (both n=20; Windberg 1976) and in 1985, brood size was 3.4 (n=29; Banasch 1985). Limited brood surveys conducted in 1995 revealed that only 21 % of hens (n=19) had broods, with an average of 1.5 chicks per brood (n=4; Madsen 1995a). 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 as high as 55 % to only nine percent over the same time period. Patterson (1952) found that only 20 % of eggs hatched and survived to the age of four months.

Shortly after hatching, broods move to areas with dense forbs (see "Habitat" section). In Alberta, Banasch (1985) found that 85 % of broods located were in wet meadows. Broods still remained relatively close to leks, with an average brood-lek distance of 2.6 km.

4. Non-breeding Season. - In late summer and fall, Sage Grouse of all ages congregate in flocks that are sexually segregated, although some flocks contain both females and immature males (Beck 1977, Eng and Schladweiler 1972). Movements to wintering grounds begin at this time (September to November) and may last until December (Connelly et al. 1988). Distances moved from breeding to wintering ranges averaged 7.9 to 11.6 km for Sage Grouse in northern Colorado (Beck 1977), 28 to 30 km in Colorado (Schoenberg 1982 in Dunn and Braun 1986a) and 11.3 km for adults in southeastern Idaho (Connelly et al. 1988). However, one-way migrations of 80 km are not uncommon (Connelly et al. 1988, Dalke et al. 1963, Patterson 1952) and distances up to 160 km have been recorded (Patterson 1952). Movements of juveniles in Colorado are sporadic and tend to follow corridors of sagebrush (Dunn and Braun 1986a). Similarly, fall movements of adults in Idaho were found to be slow and meandering (Connelly et al. 1988). 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 due to the overlap of habitats (Eng and

Schladweiler 1972). Wintering grounds in southeastern Idaho also overlap with spring and summer ranges (Connelly et al. 1988). Topographic relief (or lack thereof) in Alberta, is similar to that of Montana, and thus, Sage Grouse populations in Alberta are probably non-migratory. This suggestion is supported by a report of a wintering flock of >50 Sage Grouse observed in March 1997 in the Lodge Creek area near the Alberta-Saskatchewan border (J. Taggart, pers. comm.). Sage Grouse have also been observed at dancing grounds in this general area during spring surveys (Aldridge 1997), suggesting that this region provides valuable year-round habitat. Aside from this observation, winter habitat use in Alberta has not been documented and needs further investigation.

Sage Grouse have adapted to the extreme temperatures associated with winters on the plains, and may increase overwinter survival through the use of snow burrows. As with some other Tetraonidae (Grouse), Sage Grouse will actively excavate burrows in the snow and completely immerse their body, where the temperature can be as much as 23°C warmer than the ambient air temperature (Back et al. 1987).

5. Diet. - Sage Grouse lack a muscular gizzard that is necessary for grinding seeds and other hard materials (Patterson 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). Sage Grouse are

capable of digging through snow to reach sagebrush leaves in winter (Beck 1977).

All Sage Grouse shift their diet to include lush forbs in late summer, but this food also appears to be particularly important to pre-laying hens (20 to 40 % of diet; Barnett and Crawford 1994). Forbs also make up 75 % of the diet of juvenile Sage Grouse that are <12 weeks of age (Peterson 1970). The large majority of forbs consumed are leaves and flower buds of Common Dandelion (Taraxacum officinale), Common Salsify (Tragopogon dubius), and Prickly Lettuce (Lactuca serriola; Klebenow and Gray 1968, 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). In feeding trials with captive-reared Sage Grouse chicks, Johnson and Boyce (1990) found that increasing amounts of insects in the diet increased both growth and survival. In the wild, insects may make up as much as 60 % of the diet of chicks less than one week old, but this value decreases to as little as five percent by 12 weeks of age (Peterson 1970). The most commonly consumed insects include grasshoppers, beetles, and ants, all of which have also been found in small amounts in the diets of adults (Patterson 1952, Wallestad et al. 1975).

Sage Grouse generally obtain enough moisture from the foods they eat, but in dry years they have been observed drinking from water sources (Patterson 1952).

6. Survival. - Annual survival has been estimated at 30 to 60 % (Beck and Braun

1978, Johnsgard 1973, C. Braun, pers. comm.), and at least in Idaho, has been relatively constant over several decades (1941 to 1983; Crawford and Lutz 1985). Dalke et al. (1963) reported seeing a female that had been banded seven years earlier. Adult males often have lower survival rates than do yearlings (33.7 versus 56.1 %), which is thought to be related to weight loss incurred by adults during courtship (Beck and Braun 1978). Juvenile mortality may be high, with most losses being attributed to disease and predation (Patterson 1952). The major predators of Sage Grouse are hawks, eagles, Coyotes (Canis latrans) and Badgers (Taxidea taxus), with ground squirrels, Striped Skunks (Mephitis mephitis), Black-billed Magpies (Pica pica), American Crows (Corvus brachyrhynchos) and Coyotes preying upon nests (Patterson 1952, McAdam 1997). Both the Red Fox (Vulpes vulpes) and Raccoon (Procyon lotor) have increased on the Canadian prairies and may also be prevalent nest predators of Sage Grouse (W. Harris, pers. comm.).

DISTRIBUTION

1. Alberta. - In Alberta, Sage Grouse are at the northernmost edge the species' range. Historically, the range of the Sage Grouse, and of sagebrush habitat, in Alberta was much larger than it is today. In the 1950s, Mitchell (1959) reported sightings of Sage Grouse south of Magrath, west of Milk River, and east of Champion. Banasch (1985) cites anecdotal reports of Sage Grouse south of the Milk River, in the Walsh Flats area east of Medicine Hat, and as far north as Brooks. During the 1967 Sage Grouse

hunting season, birds were shot as far northeast as Elkwater (Armstrong 1968). The historical range enclosed by these records encompassed an area of approximately 49,000 km² in the province (Figure 1).

Surveys for Sage Grouse in the province have been conducted on an intermittent basis since 1968 (see "Population Size and Trends section"). Since the inception of these surveys, 33 leks have been discovered within a 4,000 km² area centered south and east of Manyberries in extreme southeastern Alberta (Figure 1). This area is likely contiguous with Sage Grouse populations in Saskatchewan to the east, and possibly with Montana to the south. As of 1997, only eight of these leks were known to be active. These sites are located in the western and southern portion of the range occupied over the past 30 years (Figure 1). Detailed information on these sites is omitted from this report in order to protect dancing grounds from potential human disturbance.

There is an recent but unconfirmed sighting of two female Sage Grouse several kilometers north of the Canadian Forces Base Suffield. This is approximately 150 km north of the presently known range. This record suggests that more extensive surveys may be needed to confirm the species' current distribution within Alberta.

It is not known exactly where the Alberta population winters, but Sage Grouse populations in relatively flat areas are usually non-migratory (Connelly et al. 1988, Dalke et al. 1963, Eng and Schladweiler 1972). It is therefore suspected that Sage Grouse in Alberta

are non-migratory, and winter in the southeastern corner of the province.

2. Other Areas. - The eastern subspecies of the Sage Grouse (C. u. urophasianus) is the most common and widespread, and is also the subspecies that occurs in Canada. The western subspecies (C. u. phaios) is present in smaller numbers from eastern Washington to southeastern Oregon (see Figure 2). DNA analyses have indicated that the Gunnison Sage Grouse of Colorado is a distinct species that was geographically isolated in the Pleistocene (C. Braun, pers. comm.). Within the next year, the Gunnison Sage Grouse will be officially named C. minimus (C. Braun, pers. comm.).

Historically, Sage Grouse occurred in British Columbia (southern Okanagan valley), Alberta, Saskatchewan, and at least 15 U.S. states. During this century, the species' range has contracted in most areas, and Sage Grouse are considered to be extirpated from British Columbia, Nebraska, New Mexico, and Oklahoma (see Figure 2; Anonymous 1997, Johnsgard 1973, 1983). The species now inhabits as little as 50 % of the area it occupied in Oregon (Crawford and Lutz 1985) and Colorado (Braun 1995) at the turn of the century. Range contractions of similar magnitude have occurred elsewhere in the species' range, as available habitat disappears (Braun 1995, Braun et al. 1977, Crawford and Lutz 1985, Eng and Schladweiler 1972, Patterson 1952, Swenson et al. 1987, Wallestad et al. 1975). The distribution of Sage Grouse is also becoming more fragmented.

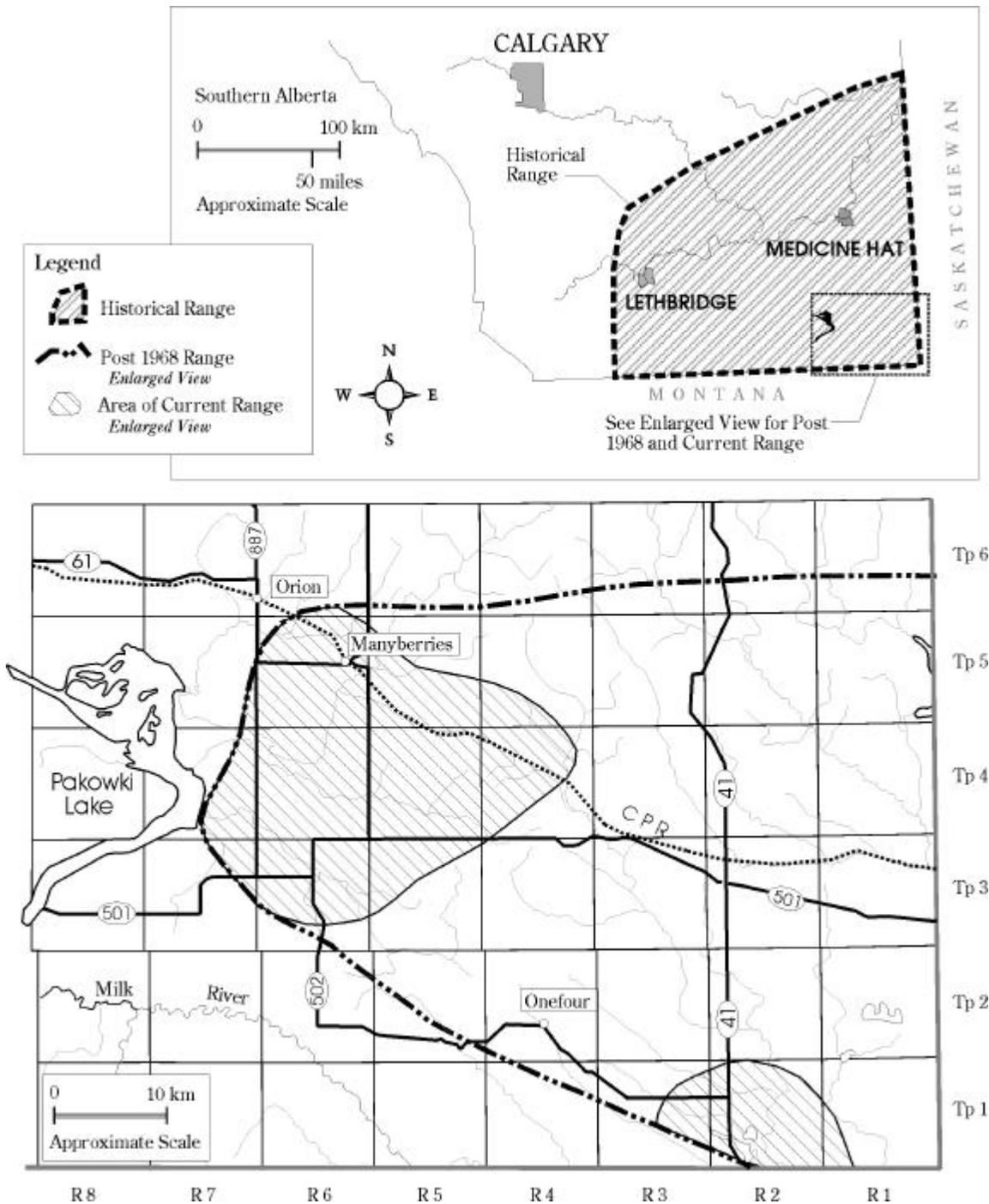


Figure 1. Range of the Sage Grouse in Alberta. Limits of the historical range are from Armstrong (1968), Banasch (1985), and Mitchell (1959). The post-1968 range is constructed from locations of 33 leks discovered since that date. The current range of leks encloses eight leks known to be active in 1997. (see Figure 2; Hupp and Braun 1991).

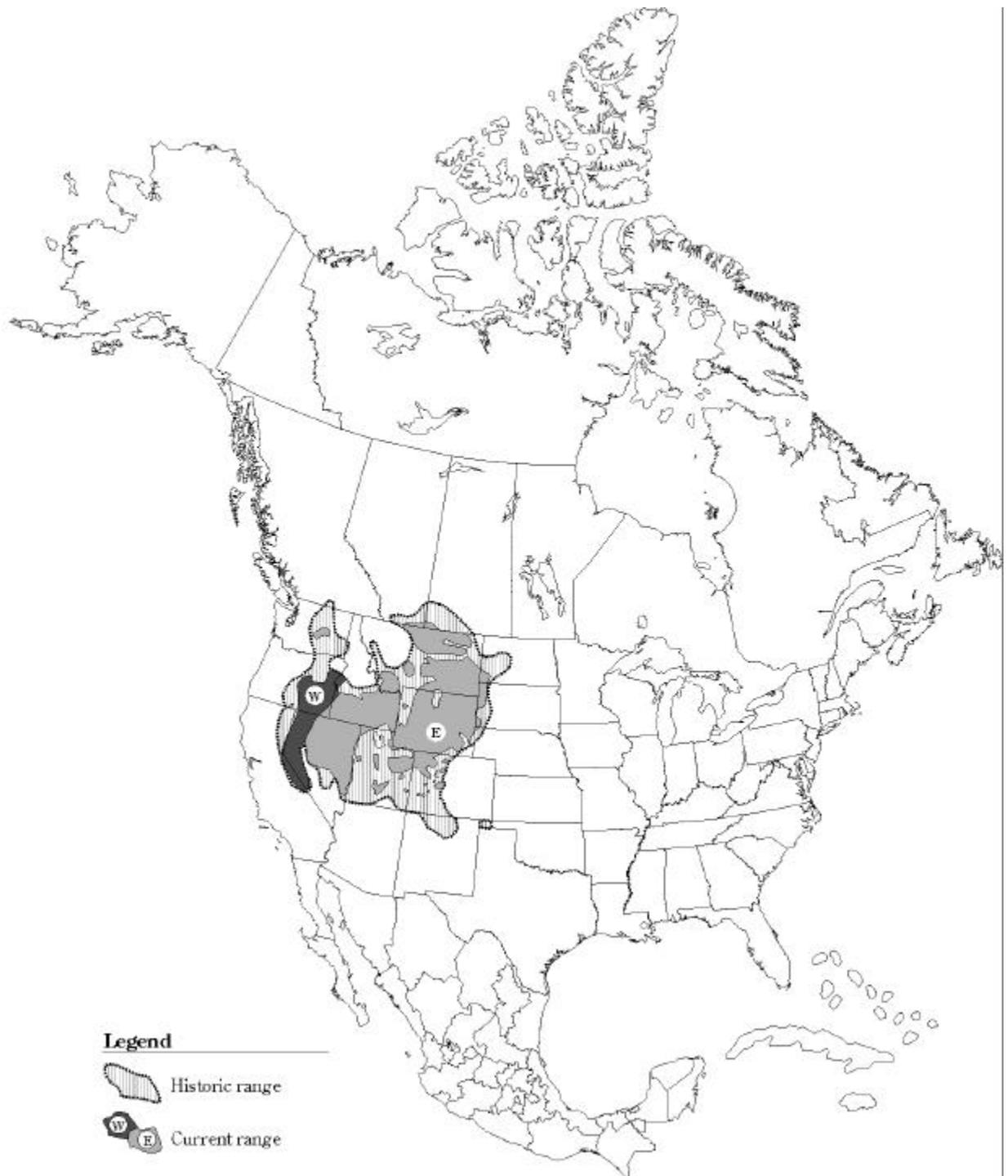


Figure 2. Current (solid line) and known historic (dashed line) distribution of the eastern (E) and western (W) subspecies of the Sage Grouse (adapted from Johnsgard 1983). The current distribution is not continuous and is more fragmented than indicated.

In Saskatchewan, Sage Grouse may have once occurred as far north as the South Saskatchewan River (Weichel and Hjertaas 1992), but presently are confined to three disjunct concentrations (totalling approximately 4,300 km²) within a 15,000 km² area in the southwestern corner of the province (Weichel and Hjertaas 1992, W. Harris, pers. comm.). The westernmost of these populations, if not all three, is probably continuous with the Alberta population.

POPULATION SIZE AND TRENDS

The most cost-effective and time-efficient method of obtaining Sage Grouse population estimates and trends is through lek surveys. These surveys are simply the enumeration of all male Sage Grouse displaying on a dancing ground during the spring mating season. The maximum number of males observed at each lek is then used as an index of population status (Beck and Braun 1980). Lek counts began in North America in the early 1950s and have attained a “mythical” status in that they are uncritically accepted by all (Beck and Braun 1980). Today, lek counts are used as population estimates and indicators of trends for all Sage Grouse populations.

1. Alberta. - Sage Grouse lek surveys in Alberta have been performed on an average of every two years since 1968, although gaps as long five years have occurred (Figure 3). In the first two years of such surveys (1968-69), the total number of cocks in the province approached 600 birds on 21 active leks, with the average number of cocks/lek exceeding 25. Since that time, the Sage Grouse population in the province has

experienced a general decline, such that in 1997, there were only eight active leks known in the province, and the total number of cocks was estimated to be 122. By 1994, the number of cocks/lek had fallen to less than six, although this number has rebounded to over 15 cocks/lek in 1997.

Surveys over the last four years have been the most intensive, and concerted effort has been made to locate most, if not all, of the leks in the province. Over this period, it appears that the number of cocks per lek is increasing, suggesting that the population may be rebounding. However, the overall total population remains relatively constant, while the number of active leks each year decreases (Figure 3). This would seem to indicate that Sage Grouse are abandoning some traditional dancing grounds, which is not uncommon in lekking species during low points in the population cycle (Dalke et al. 1963).

The numbers suggest that the overall population of Sage Grouse in the province has declined by about 80 % for levels observed in the late 1960s and early 1980s (Aldridge 1997). However, the exact rate of decline is difficult to quantify because survey effort has been inconsistent among years (Aldridge 1997, Madsen 1995b). It is also difficult to determine from some reports whether leks that apparently contained no birds were actually located and surveyed. Furthermore, the determination of trends is complicated by the apparent population cycles in this species. Specifically, population size in Alberta over the last 30 years appears to cycle over a five to 10-year period (Figure 3; see also McAdam 1997, Patterson 1952).

Figure 3. Population trends for Sage Grouse in Alberta 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. Solid lines are drawn where data were collected in consecutive years; dashed lines are extrapolations for periods when consecutive annual surveys were not done.

In such cases, the rate of population decline is best measured from start and end points at the same stage in the cycle. Because data prior to 1968 are unavailable, it is possible that populations in the late 1960s represent extraordinary high values, and that the estimated 80 % decline in numbers since that time is an overestimate. Nevertheless, there has been a dramatic decline from the population size observed in the 1980s, and the number of active leks and number of cocks attending those leks are presently at their lowest recorded values (Figure 3).

The total population of Sage Grouse in Alberta has been estimated at 320 individuals (Aldridge 1997). A combined population estimate for Sage Grouse in Alberta and Saskatchewan may be of more value, however, as birds from both provinces likely represent one population. Based on 1997 lek survey data from Alberta, (122 cocks; Aldridge 1997) and Saskatchewan (61 cocks; W. Harris, pers. comm.), the Canadian Sage Grouse population in spring is estimated at 549 to 813 individuals (C. Braun, pers. comm.). This estimate is based on the knowledge that there are two hens in the spring population for each male, that counts may represent as few as 75 % of all cocks associated with leks, and that 90 % of leks are located and surveyed (C. Braun, pers. comm.). It has been suggested that 500, and possibly even 5000, individuals may be required to sustain the population (Anonymous 1997, Braun 1995). The Sage Grouse is therefore at risk of declining to nonviable population levels in Alberta.

2. Other Areas. - In Saskatchewan, Sage Grouse populations have experienced an

80 % decline since the late 1980s (McAdam 1997). Similar trends in Sage Grouse population numbers have been seen in the United States. By 1983, the abundance of Sage Grouse in Oregon had declined by approximately 60 % from levels observed in 1940 (Crawford and Lutz 1985). Similarly, Sage Grouse abundance in Colorado has decreased by over 50 % since the early 1900s, and the species has been extirpated from about half of the counties that were previously occupied (Braun 1995). Overall, the continental decline in Sage Grouse abundance mirrors the loss of sagebrush habitat (see "Habitat" section; Braun 1995, Braun et al. 1977, Eng and Schladweiler 1972, Patterson 1952, Swenson et al. 1987, Wallestad et al. 1975). Coincident with these declines is a decrease in breeding productivity in some areas (see "Conservation Biology" section).

LIMITING FACTORS

Population declines of the 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. Such disturbances often result in the abandonment of leks. For example, eight of 33 dancing grounds discovered in Alberta since 1968 have at some time been disturbed by human developments (Aldridge 1997, Dube 1987, 1989, 1991). Of these eight leks, six are no longer active and two have combined to form one smaller dancing ground. Increased predation pressures on Sage Grouse and climatic changes may also individually affect Alberta Sage Grouse;

however, it is more likely that a combination of several factors (outlined below) has resulted in the population decline.

There is concern that the decline in numbers of Sage Grouse in Alberta is at least in part due to the open hunting season in the province from 1967 to 1995. However, Saskatchewan has not supported a Sage Grouse hunting season since the 1930's (W. Harris, pers. comm.), and populations in that province have declined at least as rapidly as in Alberta.

1. Agricultural Practices. - The demand for productive agricultural land in North America since the turn of the century resulted in massive sagebrush eradication programs. This decreased the range of sagebrush by an estimated two and a half million hectares from 1952 to 1977 (Braun et al. 1977). Cultivation of sagebrush-grasslands has contributed to the decrease in available habitat (Dalke et al. 1963, Patterson 1952, Wallestad and Pyrah 1974) and resulted in the desertion of at least one dancing ground in Alberta (Dube 1991), and possibly a second (pers. obs.). The cultivation of 16 % of Sage Grouse habitat in a study area in Montana, including 30 % of the wintering range, reduced Sage Grouse numbers by 73 % (Swenson et al 1987). In addition, Patterson (1952) reported that birds foraging in crop fields can be killed or injured by machines and other farm equipment. Insecticides and herbicides are also potentially lethal to Sage Grouse (Blus et al. 1989). However, most Sage Grouse on the Canadian prairies occur on rangelands, where the use of these chemicals is limited.

Overgrazing has long been suggested as one of the main reasons for the decline in Sage Grouse numbers (Dalke et al. 1963, Johnsgard 1973, 1983), and declines in the Alberta population since 1968 correspond 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 and extreme weather. In addition, cattle disturbance can drive birds from traditional dancing grounds. Windberg (1976) suggests that grazing may simply decrease the carrying capacity of Sage Grouse habitat.

2. Oil and Gas Exploration. - Oil and gas exploration and extraction are major contributors to the Alberta economy, and are very common activities within the Alberta range of Sage Grouse. Hydrocarbon developments are generally localized, and are unlikely to have widespread impacts on Sage Grouse. Nevertheless, the removal of vegetation for well sites, access roads, and associated facilities can fragment and reduce the availability of suitable habitat. Furthermore, human and mechanical disturbance at wells may disrupt breeding activities, and traffic on access roads could cause some fatalities of birds (see below). Even if sites are reclaimed at a later date, birds may fail to return to previously used habitats. This has been the case for at least one dancing ground in Alberta (pers. obs.). In total, six traditional dancing grounds are known to have been disturbed by oil and gas activities in Alberta in recent years. Four of these are no longer active (pers. obs., Dube 1991).

3. Roadways and Traffic. - More heavily used roads and highways result in direct mortalities of Sage Grouse, and contribute to fragmentation of the habitat (Patterson 1952). Sage Grouse travel on the ground to and from leks and foraging sites, and thus many individuals are killed by vehicles (Patterson 1952). Sage Grouse 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 abandonment of dancing grounds if they are continually disturbed by interested onlookers.

4. Climate. - Sage Grouse are fairly robust birds, yet climatic conditions may be more limiting in Alberta, at the northern edge of the species' range, than they are in other areas. Short summers and particularly harsh winters may have drastic effects on 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 also reduce productivity (Weichel and Hjertaas 1992). Drought might also limit the availability of herbaceous vegetation that is important in the diet of Sage Grouse during the summer. The drought of the 1980s may have limited productivity and contributed to the recent population decline.

The effects of other limiting factors may be compounded during drought conditions. For example, consistent

stocking rates during the drought of the 1980s may have resulted a substantial loss of vegetative cover, which may have contributed to the Sage Grouse population decline through lowered nest success, increased predation, and lower winter survival (K. Lungle, pers. comm.). Impacts may have been particularly severe in moister habitats, which supply important herbaceous growth for Sage Grouse during the nesting and brood-rearing periods. The attraction of these areas to cattle was probably increased during drought conditions, which may have reduced brood survival (K. Lungle, pers. comm.).

STATUS DESIGNATIONS

1. Alberta. - Under the Alberta Wildlife Act and its regulations, Sage Grouse are classified as an "upland game bird". However, concerns over the decline in population numbers led to a decision, in late 1995, to close the hunting season on Sage Grouse in Alberta beginning in 1996. Sage Grouse are now protected by law against the capture, killing, or harming of individuals or their nests (K. Lungle, pers. comm.).

In a 1991 review of the status of Alberta wildlife, Sage Grouse in Alberta were given a "Yellow" listing, which means that they were considered a species of concern due to their naturally low populations, and their limited habitat and distribution in the province (Alberta Fish and Wildlife 1991). Five years later, Sage Grouse were included on the "Blue List" of species that may be at risk in the province. This designation was assigned based on the species' limited distribution in Alberta, specific habitat requirements and declining population numbers

(Alberta Wildlife Management Division 1996).

2. Other Areas. - As a result of concern about their population status, Sage Grouse were listed as a “threatened” species in 1997 by the Committee on the Status of Endangered Wildlife In Canada (McAdam 1997). Sage Grouse are likely to be placed on the “endangered” species list in Canada if the current limiting factors are not reversed. In the United States, status designations vary by state, and in some states, such as Washington, Sage Grouse are listed as an “endangered” species (C. Braun, pers. comm.). Federally, Sage Grouse in the United States have yet to be listed as “endangered” or “threatened”, and the species is still considered to be an upland gamebird that is hunted in most states.

RECENT MANAGEMENT IN ALBERTA

Until recently, the Sage Grouse was a game species in Alberta, and populations were managed primarily by the establishment of bag limits determined from periodic surveys. Since the closing of the Sage Grouse hunting season, a number of other management efforts have been initiated.

As a follow up to the 1997 COSEWIC listing of Sage Grouse as a “threatened” species in Canada, it was recommended that a recovery plan be developed. Acting on the advice of COSEWIC, a recovery team met in late 1997 and 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. It is hoped that guidelines can be

established to improve Sage Grouse habitat, and that the long-term decline of Sage Grouse numbers in Alberta can be reversed.

Also set to begin in 1998 is a two year population and behavioural study of Sage Grouse in Canada. The objectives of this work will be to: (1) compare the behavioural ecology of Canadian Sage Grouse with that of southern conspecifics; (2) assess the accuracy of lek surveys; (3) confirm the species’ distribution in Canada; and (4) determine factors responsible for the population decline, and develop management strategies to maintain a viable Sage Grouse population in Canada. Until the past four years, only minimal efforts have been made to locate new or unknown dancing grounds. Hopefully, the use of radiotelemetry in this proposed research will aid in the location of all leks used by Sage Grouse.

SYNTHESIS

Sage Grouse populations have declined in many areas of North America over the past few decades. Declines in Alberta, and in contiguous areas of Saskatchewan, have been amongst the most severe, with numbers now reduced by approximately 80 % of maximum values observed over the last three decades. Although habitat loss appears to be the major reason for range-wide declines, a number of other threats may be influencing populations in this province. A more thorough understanding of the role of such potential impacts is urgently required in order that wildlife managers can implement steps to ensure that the population does not continue its decline

to nonviable levels. Also required is continued monitoring of known leks, and extensive searches for new breeding

grounds, in order that accurate estimates of population size and change over time can be calculated.

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APPENDIX 1. Definitions of selected legal and protective designations.

A. Status of Alberta Wildlife colour lists (after Alberta Wildlife Management Division 1996)

Red	Current knowledge suggests that these species <u>are</u> at risk. These species have declined, or are in immediate danger of declining, to nonviable population size
Blue	Current knowledge suggests that these species <u>may be</u> at risk. These species have undergone non-cyclical declines in population or habitat, or reductions in provincial distribution
Yellow	Species that are not currently at risk, but may require special management to address concerns related to naturally low populations, limited provincial distributions, or demographic/life history features that make them vulnerable to <u>human-related</u> changes in the environment
Green	Species not considered to be at risk. Populations are stable and key habitats are generally secure
Undetermined	Species not known to be at risk, but insufficient information is available to determine status

B. Alberta Wildlife Act

Species designated as “endangered” under the Alberta Wildlife Act include those defined as “endangered” or “threatened” by *A Policy for the Management of Threatened Wildlife in Alberta* (Alberta Fish and Wildlife 1985):

Endangered	A species whose present existence in Alberta is in danger of extinction within the next decade
Threatened	A species that is likely to become endangered if the factors causing its vulnerability are not reversed

C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 1996)

Extirpated	A species no longer existing in the wild in Canada, but occurring elsewhere
Endangered	A species facing imminent extirpation or extinction
Threatened	A species likely to become endangered if limiting factors are not reversed
Vulnerable	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events
Not at Risk	A species that has been evaluated and found to be not at risk
Indeterminate	A species for which there is insufficient scientific information to support status designation

D. United States Endangered Species Act (after National Research Council 1995)

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

APPENDIX 2. Supplemental references on Sage Grouse in Alberta.

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