

Status of the Sharp-tailed Grouse
***columbianus* subspecies**
(*Tympanuchus phasianellus columbianus*)
in British Columbia

by

E.E. Leupin
and
M.J. Chutter



Ecosystems Branch
Victoria, BC

Wildlife Bulletin No. B-125
March 2007

Wildlife Bulletins can contain preliminary data, so conclusions based on these may be subject to change. Bulletins receive technical review and may be cited in publications.

Library and Archives Canada Cataloguing in Publication Data

Leupin, Ernest E. (Ernest Eric), 1967-

Status of the Sharp-tailed Grouse, *columbianus* subspecies (*Tympanuchus phasianellus columbianus*) in British Columbia [electronic resource]

(Wildlife bulletin [British Columbia. Ecosystems Branch]; no. B-125)

Cover title.

Funded by Ministry of Environment, and Habitat Conservation Trust Fund.

Available on the Internet.

Includes bibliographical references: p.

ISBN 978-0-7726-5828-9

1. Columbian sharp-tailed grouse – British Columbia. 2. Columbian sharp-tailed grouse – Habitat – British Columbia. 3. Birds – Conservation – British Columbia. 4. Upland game bird management – British Columbia. 5. Endangered species – Government policy – British Columbia. I. Chutter, M. J. II. British Columbia. Ecosystems Branch. III. Title.

QL696G285L48 2007

333.95'86378

C2007-960176-6

This publication is available at through our e-library at

<http://www.env.gov.bc.ca/eirs/bdp/>

Citation

Leupin, E.E., and M.J. Chutter. 2007. Status of Sharp-tailed Grouse, *columbianus* subspecies (*Tympanuchus phasianellus columbianus*) in British Columbia. B.C. Minist. Environ., Victoria, BC. Wildl. Bull. No. B-125.

ACKNOWLEDGEMENTS

The authors wish to thank all who provided valuable information to make this report as complete as possible, including all the friends and professional associates listed in the Authorities Consulted section. From this group, we would especially like to acknowledge Dave Fraser and Doug Jury, who also provided extensive input, inexhaustible effort, patience, and valuable comments on earlier versions of the manuscript. In addition, we also wish to thank Robert Wagner (EBA Engineering Consultants) and Graham McGregor (Grasslands Conservation Council) for the production of the detailed distribution map.

Funding for this report was kindly provided by the Habitat Conservation Trust Fund and the Ministry of the Environment.

EXECUTIVE SUMMARY

Species Information and Distribution

The Sharp-tailed Grouse, *columbianus* subspecies (*Tympanuchus phasianellus columbianus*) occurs in the south-central interior of British Columbia and portions of Washington, Oregon, Idaho, Montana, Utah, Nevada, and Colorado. It is a medium-sized grouse. The upper body is heavily barred with dark brown, black, and buff, while the underside is typically white with tawny margins.

Habitat and Biology

The Sharp-tailed Grouse, *columbianus* subspecies is considered an open grassland/shrub-steppe species. However, in British Columbia, the subspecies can be divided into two ecotypes: populations that inhabit climax grasslands (grassland ecotype) and populations that occur in large openings in forested systems such as sedge meadow complexes, major burns, and large clearcuts (forest ecotype). The grassland ecotype occurs in grasslands south of Williams Lake and the forest ecotype occurs from 70 Mile House north to Prince George. This subspecies has a relatively large home range and requires a wide range of habitats for the various stages of its life history. Males congregate in the spring on traditional dancing grounds (leks) and engage in elaborate displays to attract receptive females. Females create a shallow depression in a densely vegetated area where they lay 10 to 12 eggs. After the eggs hatch, females and broods move away from the nest into areas where insects are abundant. In winter, males and females will use riparian and upland shrub communities that provide adequate cover and food in the form of buds and fruits.

Population Size and Trends

The Sharp-tailed Grouse, *columbianus* subspecies was once considered the most abundant upland game bird in western North America's grasslands. Today, it occupies less than 10% of its former range. In British Columbia, the grassland ecotype has been extirpated from climax grasslands in the Okanagan Valley and the East Kootenay Trench, effectively isolating British Columbia's populations from those south of the border. In the remaining grasslands of south-central British Columbia, populations have shown consistent declines; they now appear to have stabilized, albeit at levels significantly lower than those observed 13 years ago. Incidental observations indicate that the forest ecotype populations have expanded in the last 15 years and are likely to continue to increase as a result of mountain pine beetle (*Dendroctonus ponderosae*) infestations.

Limiting Factors and Threats

Many factors have been implicated in the decline of the Sharp-tailed Grouse, *columbianus* subspecies. Foremost is the loss and degradation of its grassland habitat due to conversion of native grasslands to croplands, certain grazing practices, land

development, invasion of non-native plants, forest encroachment, and damage to upland shrub and riparian areas. These factors continue to pose a significant threat to the grassland ecotype of the *columbianus* subspecies in British Columbia.

Habitat for forest ecotype populations has benefited from large-scale clearcut harvesting in the central and northern part of the subspecies' range, but the climax grassland habitat has suffered significant declines. The Sharp-tailed Grouse, *columbianus* subspecies has been extirpated from the Okanagan and the Rocky Mountain Trench in the Kootenays and from low-elevation grassland habitats between Kamloops and 70 Mile House. Populations of both forest and grassland ecotypes are isolated from each other and from other populations in the Pacific Northwest. In the Kootenays, important wintering riparian habitat has been lost to flooding. In the remaining grasslands, grazing practices have been implicated in the degradation of nesting and winter cover. These factors continue to threaten grassland ecotype populations and, since there is currently no possibility of "rescue" effect from outside sources, populations could continue to decline below a viable population threshold.

Special Significance of the Species

In Canada, the *columbianus* subspecies occurs only in British Columbia. From a broader conservation perspective, British Columbia supports one of the largest remaining populations in the current North American range of the subspecies. As such, B.C.'s populations have become an important source of birds for recovery efforts elsewhere in the range; for example, translocations to Montana and Washington have been approved and conducted in recent years. The "Columbian" sharptail is considered an indicator of grassland ecosystem health. It is a favoured game bird in British Columbia because it is the only native species that provides opportunities for open grassland bird hunting. This subspecies is also sought after by birders, bird dog trainers, and naturalists.

Historically, the Okanagan First Nations people hunted the Sharp-tailed Grouse, *columbianus* subspecies for sustenance, but it was not considered a staple or critical for survival.

Existing Protection or Other Status Designations

Provincially, the Sharp-tailed Grouse, *columbianus* subspecies is ranked by the B.C. Conservation Data Centre (CDC) as G4T3S2S3, placing it on the British Columbia Blue list and indicating it is considered a taxon at risk at the "vulnerable" or "sensitive" level. Adult birds, their young, eggs, and active nests are protected under Section 34 of the B.C. *Wildlife Act*. Hunting closures have been imposed throughout the range of the grassland ecotype, but hunting remains open in areas where the forest ecotype occurs. In terms of habitat, climax grassland habitats have some degree of protection. Several populations occur in provincial parks and in private landholdings that have stewardship agreements with the provincial government, although intensive grazing, an identified threat to this subspecies, continues. Forested habitats have minimal protection, but large-scale

openings created through forest practices in previous decades appear to have inadvertently benefited forest ecotype populations.

Nationally, the Sharp-tailed Grouse is not covered by the federal *Migratory Birds Convention Act* and is not currently listed as being at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) at either the species or subspecies level.

Summary of Status Report

Limited knowledge about population status and habitat data from forested areas, the continued threats to remaining grassland habitats, and known historical extirpations point to the importance of evaluating the status of both grassland and forest ecotypes of the Sharp-tailed Grouse, *columbianus* subspecies in British Columbia.

The distribution of grassland ecotype populations has declined significantly over time and is now confined to middle- and upper-elevation grasslands in the Kamloops and Merritt areas. However, within these areas, urban and suburban expansion coupled with instances of land uses detrimental to the grassland ecosystem (e.g., grazing) continue to reduce the quantity and quality of grassland habitats.

Forest ecotype populations, however, have benefited from large-scale clearcutting. Although the benefit is merely coincidental, it is likely to continue as forests infested with mountain pine beetles undergo large-scale harvesting.

Although the forest and grassland ecotypes currently exhibit opposite population trends, rescue events or movements between the two habitat types would have been likely in the past. Currently, the condition of lower elevation grasslands that divide the ecotypes has been severely degraded with little or no chance of recovery under existing land uses. As a result, populations that inhabited these grasslands have disappeared and the areas are no longer used by the Sharp-tailed Grouse, *columbianus* subspecies, reducing the likelihood of rescue events or movements between habitat types.

The continued perseverance of this subspecies in Canada is highly dependent on management practices (related to both forest and grassland habitats) that address and mitigate identified impacts on its populations. Current management practices in grasslands are likely inadequate to recover populations and thus declines below viable population thresholds could occur.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iii
EXECUTIVE SUMMARY	iv
SPECIES INFORMATION	9
Name and Classification	9
Description	9
Nationally Significant Populations	9
DISTRIBUTION	11
Global Range	11
Canadian Range	11
HABITAT	13
Habitat Requirements	13
Habitat Trends	16
Habitat Protection / Ownership	17
BIOLOGY	18
Reproduction	18
Survival	20
Physiology	20
Movements / Dispersal	20
Nutrition and Interspecific Interactions	21
Behaviour / Adaptability	22
POPULATION SIZES AND TRENDS	23
Population Sizes	23
Population Trends	23
LIMITING FACTORS AND THREATS	26
Factors Limiting Population	28
Factors Limiting Habitat	30
SPECIAL SIGNIFICANCE OF THE SPECIES	33
EXISTING PROTECTION OR OTHER STATUS	34
SUMMARY OF STATUS REPORT	36
TECHNICAL SUMMARY	38
BIOGRAPHICAL SUMMARY OF AUTHORS	45
AUTHORITIES CONSULTED	46

LIST OF TABLES

Table 1. First clutch sizes of Sharp-tailed Grouse, <i>columbianus</i> subspecies in various areas.	19
Table 2. Summary of Sharp-tailed Grouse, <i>columbianus</i> subspecies transplants from B.C. population sources.	32
Table 3. Global, provincial, and state status of the Sharp-tailed Grouse, <i>columbianus</i> subspecies.	33

LIST OF FIGURES

Figure 1. Male Sharp-tailed Grouse, <i>columbianus</i> subspecies in breeding display. Female in background.....	10
Figure 2. Current and historical distribution of Sharp-tailed Grouse, <i>columbianus</i> subspecies in British Columbia.....	12
Figure 3. Winter habitats used by Sharp-tailed Grouse, <i>columbianus</i> subspecies relative to habitat availability and snow depth in climax grassland systems near Kamloops, BC.....	16
Figure 4. Mean number of male Sharp-tailed Grouse, <i>columbianus</i> subspecies attending leks in grasslands of the Thompson-Nicola region.	24
Figure 5. Average number of males Sharp-tailed Grouse, <i>columbianus</i> subspecies attending three leks in grasslands of the Cariboo region.	25
Figure 6. Number of male Sharp-tailed Grouse, <i>columbianus</i> subspecies attending leks in grassland habitats in the Cariboo region where the surrounding area is primarily forested. (Source: Pat Dielman, Ministry of Environment, Williams Lake).	26
Figure 7. Number of hunters (solid line) and total Sharp-tailed Grouse, <i>columbianus</i> subspecies harvest estimates (dashed line) in Region 5 (Cariboo).....	27

SPECIES INFORMATION

Name and Classification

Sharp-tailed Grouse belong to the order Galliformes, commonly referred to as upland game birds. They were first described by Lewis and Clark in 1805. In 1815, they were classified by Ord in the pheasant genus as *Phasianus tympanuchus* because they closely resembled female pheasants. They are currently in the family Phasianidae, the genus *Tympanuchus*, and the species *phasianellus* (Johnsgard 1973; Cannings 1998).

The Sharp-tailed Grouse, *columbianus* subspecies (Tétras à queue fine columbienne; *Tympanuchus phasianellus columbianus*) is one of six subspecies of Sharp-tailed Grouse recognized in North America.

Description

Sharp-tailed Grouse are medium-sized (40–48 cm long, 500–1000 g) birds. Both sexes are cryptically coloured. The upper body is heavily barred with dark brown, black, and buff (Hjorth 1970). The underside is typically white with tawny margins (Connelly et al. 1998). Plumage of adult male and female sharptails is nearly identical. Males can be distinguished from females by their darker crown feathers and dark longitudinal bars along both sides of the central rectrices (Henderson et al. 1967). Males also have yellow-orange superciliary combs and pale violet airsacs (apteria). Both the airsac and the superciliary combs are enlarged and exposed during breeding displays (Figure 1). “Columbian” sharptails are lighter in colour and smaller than other subspecies of sharptails (Johnsgard 1973).

Similar subspecies and species include the “Plains” Sharp-tailed Grouse (*T. p. jamesi*), the “Alaskan” Sharp-tailed Grouse (*T. p. caurus*), the Greater Prairie-Chicken (*T. cupido*), and the Lesser Prairie-Chicken (*T. pallidicinctus*), although their ranges do not overlap with the Sharp-tailed Grouse, *columbianus* subspecies. Other grouse that share the “Columbian” sharptail’s range include Dusky Grouse (*Dendragapus obscurus*), Spruce Grouse (*Falcapennis canadensis*), and Ruffed Grouse (*Bonasa umbellus*). Sharptails are lighter in colour than these species, vocalize during flight, and have a characteristic wedge-shaped tail resulting from elongated central rectrices (Hjorth 1970; Tirhi and Hays 1997).

Nationally Significant Populations

British Columbia contains the only populations of the *columbianus* subspecies in Canada. This subspecies now occupies less than 10% of its former North American range. At present it exists only in isolated, remnant populations, with the largest number (50–70% of the total population) in southeastern Idaho and northern Utah (Ohanjanian 2006). Despite the drastic declines (including among British Columbia populations), British Columbia supports a significant proportion of the total population and still maintains

more than 60% of the remaining North American breeding habitat (Connelly et al. 1998). However, extirpation of viable populations in the southern portions of British Columbia has effectively isolated this subspecies from remnant and highly disjunct populations in adjacent jurisdictions (i.e., Washington, Idaho, and Montana).



Figure 1. Male Sharp-tailed Grouse, *columbianus* subspecies in breeding display. Female in background. (Photo by Ernest Leupin)

DISTRIBUTION

Global Range

The Sharp-tailed Grouse, *columbianus* subspecies occurs only in North America. Historically, this subspecies inhabited the intermountain region from central British Columbia (Figure 2) through Washington, Idaho, Montana, and Oregon, south to Northern California, Nevada, and New Mexico, and east into Wyoming, Utah, and Colorado (Aldrich 1963; Miller and Graul 1980).

“Columbian” sharptails have undergone significant regional and local range reductions and extirpations; their geographic distribution has contracted by more than 90% overall in Idaho, Montana, Utah, Wyoming, Nevada, and Washington (Tirhi and Hays 1997), and they have been extirpated from California, Nevada, and Oregon (Hoffman 2001). Recent reintroductions into formerly occupied ranges in Oregon, Idaho, Montana, and Washington have been attempted, although success is limited (Schroeder, pers. comm.).

Canadian Range

In Canada, the range of the “Columbian” sharptail is restricted to British Columbia (Figure 2). The subspecies still occurs from the Fraser Basin Ecoregion near Vanderhoof, south to Merritt in the Southern Thompson Upland Ecoregion (Ritcey 1995). Breeding populations have been extirpated from grassland systems in the Pavillion Range, the East Kootenays (north and south of Cranbrook), and the Okanagan Valley (Ritcey 1995). Recent confirmed sightings of lone adults (and an additional unconfirmed breeding record of a hen with chicks) from the East Kootenays (Fraser and Antifeau, pers. comm.) suggest that peripheral individuals may still persist, or possibly that they have migrated northward from reintroduction attempts on the Tobacco Plains in Montana (Cope 1992).

Nevertheless, the core of the Canadian (British Columbian) population has become isolated from populations in adjacent jurisdictions and is now confined to two disjunct areas in the south-central interior of British Columbia. These populations are separated by approximately 100 km and are associated with different habitat types. Populations in the southern part of their distribution (Thompson-Nicola region) are associated primarily with climax grassland ecosystems, whereas populations in the northern part of their distribution are associated primarily with sedge meadow complexes and large openings created by stand-replacing fires or harvesting, and to a lesser extent with climax grasslands adjacent to forested areas (Figure 2).

The fragmentation of the once-continuous B.C. population is believed to have coincided with historical changes in habitat quality of grasslands between Kamloops and 70 Mile House (Jury, pers. comm.). Changes in habitat quality include higher densities of sagebrush (*Artemisia* spp.), decreases in bunchgrass cover, and changes in vegetation composition associated with fire suppression and grazing pressure.

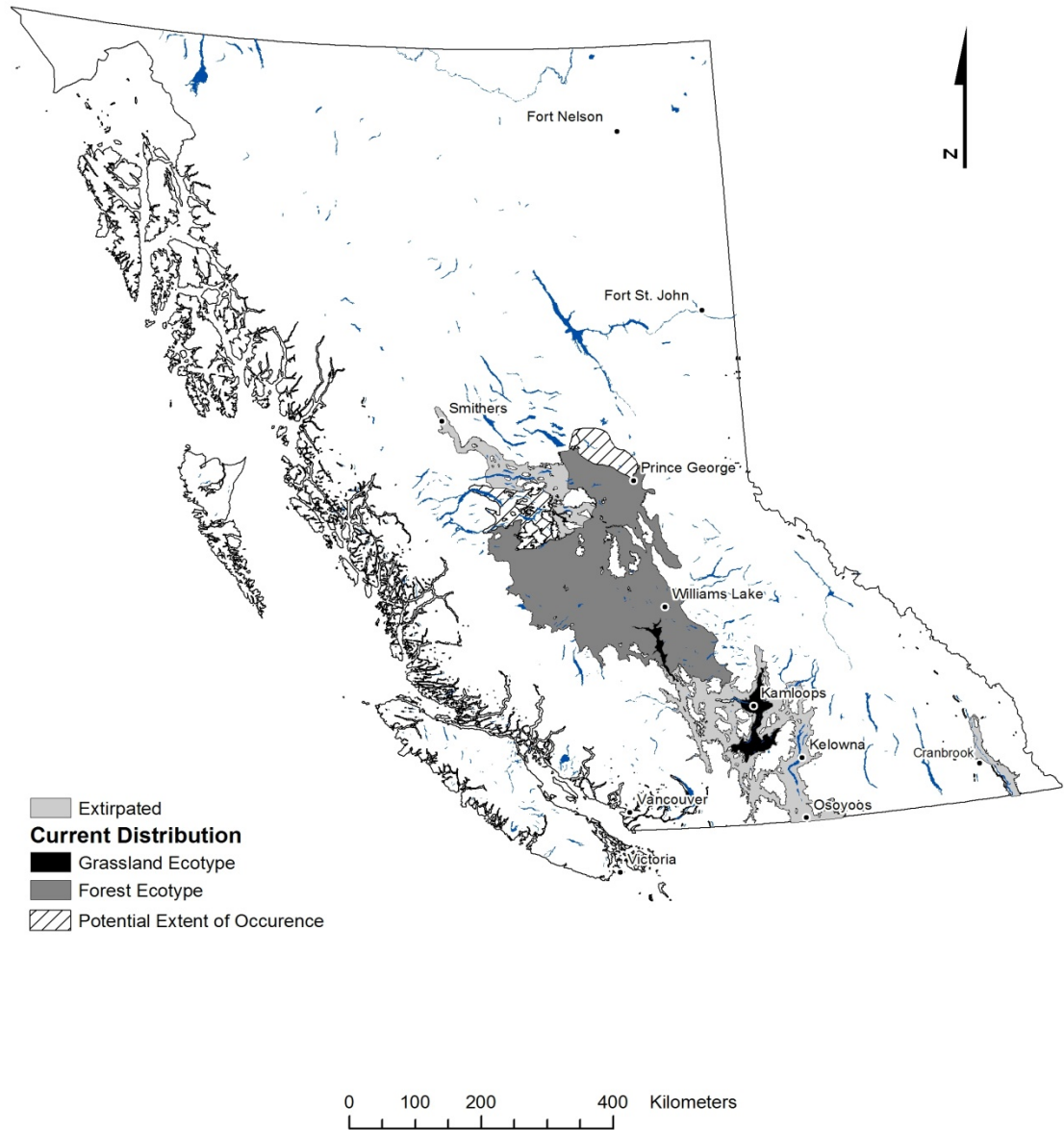


Figure 2. Current and historical distribution of Sharp-tailed Grouse, *columbianus* subspecies in British Columbia. (Prepared by Robert Wagner, EBA Engineering Consultants, and Graham McGregor, Grasslands Conservation Council.)

HABITAT

Habitat Requirements

The habitat requirements described in this section are largely those of populations inhabiting climax grasslands. Because we lack studies of forest ecotype populations, little information is available on their habitat requirements. Any information presented below on forest ecotypes is based on incidental observations by local Ministry of Environment biologists experienced with “Columbian” sharptail conservation and management (Jury and Dielman, pers. comm.), and by the senior author.

General — Sharp-tailed Grouse use a variety of habitats, although the presence of open areas juxtaposed with shrubby and/or open parkland is common to all occupied areas. In British Columbia, sharptails have been found at elevations from 275 to 2135 m (Campbell et al. 1990).

Elsewhere in North America, the Sharp-tailed Grouse, particularly the *columbianus* subspecies, is commonly associated with sagebrush communities (Saab and Marks 1992; Ritcey 1995; Schroeder, pers. comm.). In British Columbia, the *columbianus* subspecies occurs as two populations occupying two distinct habitat types. Given the physical separation of the two populations, they can be divided into two ecotypes: the grassland ecotype, which is associated with middle- and upper-elevation climax grasslands with little or no sagebrush in the Bunchgrass, Ponderosa Pine, and Interior Douglas-fir biogeoclimatic zones; and the forest ecotype, which is associated with sedge meadow/riparian complexes and seral grasslands resulting from large-scale harvesting or fires in lodgepole pine (*Pinus contorta* var. *latifolia*) forests in the Interior Douglas-fir, Sub-boreal Pine–Spruce, and Sub-boreal Spruce biogeoclimatic zones (Ritcey 1995).

It is not known if there is significant movement of individuals or genes between the two habitat types. Recent genetic work suggests that differences between grassland and forest ecotypes were not significant (Mock, pers. comm.). However, the lack of genetic differences is similar to that observed between “Prairie” and “Columbian” sharptails, which suggests a relatively recent (in geological time) subspeciation event among sharptail subspecies (Mock, pers. comm.). Despite a lack of evidence of genetic and/or morphological differentiation between the ecotypes, the two populations appear to be isolated, which in turn may preclude the ecotypes from readily intermixing. The authors hypothesize that the absence of movement is related to the quality of the grassland habitat separating the two populations. These grasslands have been, and continue to be, intensely grazed and managed for fire suppression. As a result, little or no grass cover remains and species composition has shifted to dominance by grazing-tolerant grass species (e.g., Kentucky bluegrass, *Poa pratensis*) and increases in sagebrush densities. Leks have been identified in degraded grasslands peripheral to forested habitats, and results from recent translocations of forest ecotype birds to climax grassland areas in British Columbia (2003) and Washington (2005) indicate that the forest birds can colonize grassland environments (although an affinity for forested areas was evident in the translocation

efforts; Leupin, pers. obs.; Hays, pers. comm.). Recovery of the grasslands separating the two populations is unlikely under the current use intensity and fire suppression mandate; if management objectives change to favour Sharp-tailed Grouse, recovery of these grasslands will require significant restoration efforts over a significant period of time.

Breeding habitat — Leks, or dancing grounds, are the focal area during the breeding season. Leks may be located on knolls, drumlins and benches, sand dunes, forest clearcuts, meadows, or recent burns (Mossop 1979; Ritcey 1995). For *columbianus* populations inhabiting climax grasslands, leks are typically located on sites that are higher than the surrounding area (Giesen and Connelly 1993; Ritcey 1995). In forested habitats, leks are generally located in large openings (usually the result of stand-replacing burns or large-scale logging after insect/beetle outbreaks, or sedge meadow complexes) at least 100 m from the mature forest edge (Leupin 2003; McKenzie, pers. comm.).

The vegetation associated with leks consists of reduced grass and forb layers that provide some cover, but also afford good visibility. The degree of “openness” varies greatly between lek sites. In forested habitats, “Columbian” sharptails usually select recently harvested areas, but a few leks occur in areas where tree regeneration exceeds 4 m in height (Leupin 2003). Furthermore, in a recent inventory of leks in forested areas, Leupin, pers.obs. (2004) noted that 85% of all known leks of the forest ecotype populations were located adjacent to trembling aspen (*Populus tremuloides*) copses.

In climax grassland communities, established leks may be used for more than 40 years, although their exact location may shift over time. Smaller satellite leks often form in the vicinity of historic leks (Schroeder et al. 2000; Leupin, pers. obs.). In forested areas, leks may persist for more than 20 years, but longevity of these sites is likely dictated by natural succession, silvicultural treatments, fire frequency, and other factors that affect forest regrowth.

Nesting habitat — Females nest soon after mating (April–June). Nests are located on the ground, and are typically situated in open grassy areas with dense cover (Ritcey 1995). Females nest within 2.4 km of the lek (Cope 1992; Schroeder 1996; Leupin 2001).

Availability of suitable nesting sites is considered a limiting factor for sharptails (Hays et al. 1998). The grassland ecotype prefers climax grasslands in excellent condition for nesting. A lack of abundant cover (especially residual vegetation from the previous year’s growth) has been identified as a major factor contributing to poor nesting success (Meints 1991). In a study of Sharp-tailed Grouse, *columbianus* subspecies habitat selection in grasslands near Kamloops (Jury, unpublished data), five nests of radio-collared sharptails were located. Four nests were on gentle slopes under residual clumps of bluebunch wheatgrass (*Pseudoroegneria spicata*); one nest was in a dense stand of Kentucky bluegrass. Leupin (2001) described six nests in the same area. Five nests were in dense stands of climax grasses and herbs, which included rough fescue (*Festuca campestris*), bluebunch wheatgrass, and arrowleaf balsamroot (*Balsamorhiza sagittata*). The sixth nest was in a dense stand of Kentucky bluegrass. Mean nest cover for all six nests was 60%

(range, 30–90%). Mean vegetation height at all nest sites was 36 cm (range, 27–45 cm). Nest site selection for the forest ecotype is largely unknown.

Campbell et al. (1990) reported on 30 nests found in British Columbia: 15 were in grassy openings, the remainder were under sparse canopies of lodgepole pine, ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), and trembling aspen. All nests were concealed under branches or clumps of grass. Elsewhere in North America, Sharp-tailed Grouse nest in areas where shrubs are abundant. Nests are built between or under shrubs (Tirhi 1995). In Idaho, shrub density in nesting habitat was 11 000 shrubs/ha (Meints et al. 1992); in Colorado, it was 32 500 shrubs/ha (Giesen 1987).

Brood-rearing habitat — Sharp-tailed Grouse are precocial. Young move away from the nest site with the female soon after hatching. Insect availability is critical for the young during the first few weeks after hatching (Kobriger 1995).

Adequate brood habitat for “Columbian” sharptails includes open and shrub habitats with abundant insects and sufficient cover (Meints 1991; Ritcey 1995). Leupin (2001) found that radio-collared females and their broods in climax grasslands of south-central B.C. spent the pre-fledging stage in or near seepage areas and swales that supported shrubs (mean height, 150 cm), and tall grasses and herbs (mean height, 60 cm). During this period, broods also used aspen copses with a dense understorey of shrubs and tall grasses. After fledging, broods used open grasslands most frequently; however, aspen copses were also used for security cover. Elsewhere in the subspecies’ range, brood habitat is also associated with higher cover of shrubs and broadleaf trees. Cope (1992) found that females with broods used areas with the highest vegetative cover and height (Schroeder 1996).

Winter habitat — Sharp-tailed Grouse habitat requirements are more restricted during the winter months (Meints 1991; Ritcey 1995). Habitats used for foraging and thermal cover include upland shrub communities, aspen complexes, forest edges, and riparian habitats (Moyle 1981; Marks and Marks 1987).

“Columbian” sharptail winter habitat in Idaho consisted of shrub patches on hillsides (Marks and Marks 1987). In Washington, they relied on stands of water birch (*Betula occidentalis*), choke cherry (*Prunus virginiana*), and big sagebrush (*Artemisia tridentata*) (Hays et al. 1998). In grasslands near Merritt, Van Rossum (1992) found that they selected habitats other than open grassland when snow was present. Similarly, Leupin (2000b) reported that Sharp-tailed Grouse, *columbianus* subspecies near Kamloops showed a preference for habitat types other than open grassland and open forest in winter (Figure 3), and that use of these habitats was strongly related to presence/absence of snow. Mean distances to shrub/riparian cover were 10 m and 139 m during snow and snow-free periods, respectively (Leupin 2000b).

Shrub/tree habitats used during winter in climax grassland communities in the southern interior of B.C. are dominated by trembling aspen, black cottonwood (*Populus*

balsamifera), and Douglas-fir in the canopy. Shrub habitats are dominated by water birch, choke cherry, common snowberry (*Symphoricarpos albus*), saskatoon (*Amelanchier alnifolia*), red-osier dogwood (*Cornus stolonifera*), and prickly rose (*Rosa acicularis* spp. *sayi*).

Important forage species for wintering “Columbian” sharptails in British Columbia include water birch, scrub birch (*Betula nana*), willow (*Salix* spp.), saskatoon, rose, and aspen (Ritcey 1995; Leupin 2000b; Jury, pers. comm.).

Habitat Trends

Cannings (2002) states that the distribution of the Sharp-tailed Grouse *columbianus* subspecies in British Columbia has seen marked declines over the past hundred years. The estimated overall range of viable populations of this subspecies in the province, based on minimum convex polygon calculations, is 60 000 km² (Cannings 2002). Although this estimate takes into account realistic amounts of suitable habitats resulting

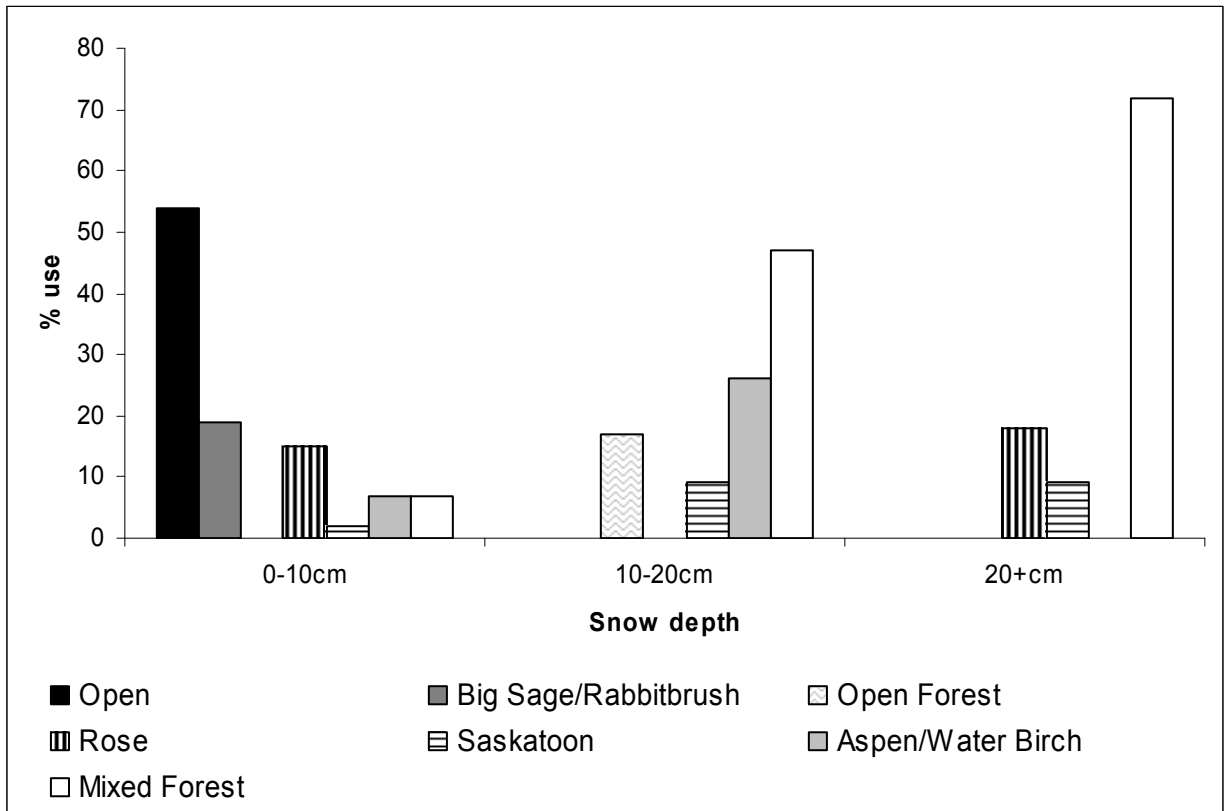


Figure 3. Winter habitats used by Sharp-tailed Grouse, *columbianus* subspecies relative to habitat availability and snow depth in climax grassland systems near Kamloops, BC. (Adapted from Leupin 2000b.)

from forest harvesting cycles (approx. 20%), it does not account for unsuitable habitats (e.g., forested habitat) within the range (Ritcey 1995). Actual suitable habitat is estimated at 15 000 km² (Jury, pers. comm.). When ecosection areas of occurrence are combined, they show that the *columbianus* subspecies has been extirpated from 22% of its original range in British Columbia, and is declining in 19% of its remaining range (MWLAP 2001).

The extent of loss and degradation of “Columbian” sharptail habitat in British Columbia has not been well documented. Some studies have investigated the extent of forest ingrowth and encroachment in climax grasslands and open forests in areas occupied by the grassland ecotype. In the southern Rocky Mountain Trench, Gayton et al. (1995) estimated yearly forest encroachment and ingrowth rates of 1% and 3%, respectively, over a 30-year period. In a similar study conducted in grasslands of the Cariboo region, Ross (1997) reported a 30–40% decrease in grassland area and up to 30% ingrowth of grasslands and open forests over the same period. Forest encroachment in grasslands of the Kamloops Timber Supply Area over the past 30 years has resulted in the loss of approximately 17 715 ha (approx. 15%) (MoF 1999a).

Habitat trends for the forest ecotype are more difficult to discern. Under natural circumstances, openings that created suitable habitat for “Columbian” sharptails consisted mostly of sedge meadow complexes that provided reliable long-term habitat, with temporary expansion of habitats resulting from large-scale stand-replacing fires. However, in the last three decades, large-scale clearcuts created to control mountain pine beetle (*Dendroctonus ponderosae*) infestations have provided additional habitat for this ecotype.

In adjacent jurisdictions, reliable habitat trend information for the “Columbian” sharptail is available only from Washington. Schroeder et al. (2000) estimated that the subspecies’ historic range in Washington was 79 865 km². The current range is estimated at less than 3% (approx. 2234 km²) of the original, and consists of eight disjunct areas that range from 61 to 513 km² (Schroeder et al. 2000).

Habitat Protection / Ownership

Protection of existing habitat within the range of the Sharp-tailed Grouse, *columbianus* subspecies is limited.

Habitat protection for the grassland ecotype is limited. Approximately 47% of all grasslands in the Kamloops, Merritt, 100 Mile, and Williams Lake districts fall under private ownership. Crown grasslands make up 43%, with 93% of the total Crown land area falling under long-term grazing tenure. The remainder (10%) falls under Indian Reserve status (Holmes 2002). Protected areas encompass 8.9% of the total grassland area, and include Lac du Bois Grasslands Protected Area and Churn Creek Provincial Park. However, protection is partial because grazing is allowed in both areas. Additional

management for the grassland ecotype includes stewardship agreements with several landowners.

Most of the forested area where “Columbian” sharptails occur is Crown land. Protected areas include Itcha-Ilgachuz Provincial Park and Chilanko Marsh Wildlife Management Area.

BIOLOGY

Reproduction

Mating behaviour — The Sharp-tailed Grouse is the only extant species of grouse in British Columbia that exhibits lekking behaviour. During spring, and to a lesser extent in fall, males congregate and defend territories in traditional areas known as dancing grounds or leks. Common display behaviours at leks include rapid foot stomping with outstretched wings (“dancing”), squatting and facing other males at territory boundaries, and quick runs along territory boundaries or toward other males. Dominant males occupy territories near the centre of the lek while subdominant and juvenile males defend territories at its periphery. Males that successfully maintain a territory near the centre of the lek mate more often and are less likely to be predated (Gratson et al. 1991). Females visit the lek during the breeding season (March–June) (Cannings 1998). In British Columbia’s southern interior grasslands, peak visits by females occur in mid to late April (Jury, pers. comm.). Later visits by females may represent second mating attempts after an initial nest failure (Meints 1991).

Nesting and incubation — After copulation, females leave to find suitable nest sites. Sharp-tailed Grouse nests consist of small depressions, which are loosely lined with residual grass, leaves, mosses, and feathers (Campbell et al. 1990; Leupin 2001). Incubation typically begins after the last egg has been laid and lasts 21 to 23 days (Campbell et al. 1990); only the female incubates the eggs (Connelly et al. 1998). Nesting, oviposition, and hatching dates vary with weather and latitude. In general, dates for these activities are later during cold springs and in northern areas (Connelly et al. 1998).

“Columbian” sharptail nests are usually located within 2 km of the lek, and often in areas where vegetation density is greatest (Giesen and Connelly 1993; Schroeder et al. 2000). Average distance between nests and leks is 1.6 km (Giesen and Connelly 1993; Schroeder 1996). In British Columbia, information on nest location relative to leks is available only for climax grasslands of the Thompson-Nicola region. Jury (unpublished data) found four nests within 1600 m of the lek. A fifth nest was located 2400 m from the lek. Leupin (2001) reported that four radio-collared females nested, on average, 1199 m (range, 296–1801 m) from the lek during the first nesting attempt. Re-nesting attempts averaged 1517 m (range, 463–2663 m) from the lek. Distances between first and second nesting attempts were 91 m, 169 m, and 2880 m.

Table 1. First clutch sizes of Sharp-tailed Grouse, *columbianus* subspecies in various areas.

Location	Mean clutch size (range)	Source
British Columbia	11.2 (8–13)	Leupin 2001
British Columbia	7.9 (5–13)	Campbell et al. 1990*
Washington	10.5	Schroeder 1996
Idaho	11	Marks and Marks 1987
Montana	11.5 (11–12)	Cope 1992

* Campbell et al. 1990 includes pooled data for all three subspecies that occur in B.C. (*T. p. columbianus*, *T. p. caurus*, *T. p. jamesi*).

Recorded dates for 19 clutches in British Columbia fell between April 22 and July 11, with 52% occurring between May 7 and June 21 (Campbell et al. 1990). In the province's southern interior, incubation initiation dates of first clutches ranged from May 5 to 10, and peak hatch dates ranged from May 20 to June 11 (Leupin 2001; Jury, unpublished data).

The average number of eggs in the first clutch ranges from 7.9 to 12.3 (Table 1). Meints (1991) reported lower numbers of eggs in re-nesting attempts. In British Columbia's southern interior, the average number of eggs for the *columbianus* subspecies in two re-nesting attempts was 11 (Leupin 2001).

Nesting success for sharptails ("Columbian" and "Plains" subspecies combined) ranges from 50 to 72% (Hamerstrom 1939; Marks and Marks 1987; Meints 1991). In B.C., nesting success rates for the *columbianus* subspecies is not well documented. However, Leupin (2001) and Jury (unpublished data) reported identical nesting success rates of 75% ($n = 4$) and 75% ($n = 4$), respectively, for radio-collared females in grasslands near Kamloops.

Brood rearing — One brood is produced annually. Campbell et al. (1990) stated that 56 broods found in British Columbia ranged in size from 1 to 14 young and averaged 5.6 young (all subspecies combined). In climax grasslands near Kamloops, Leupin (2001) reported two broods (*columbianus* subspecies) of six and five young 35 days after hatching.

Young can walk soon after hatching and are capable of flight when they are 7 to 10 days old. In his study near Kamloops, Leupin (2001) found that one female and her brood remained within 680 m of the nest in the first 35 days after the chicks hatched. A second female and her brood moved 1036 m within the first five days after hatching. After 35 days, they had moved 2084 m from the nest. Movements by both females and their broods were toward the lek of origin.

Survival

No mortality estimates are available for “Columbian” sharptails in British Columbia (Ritcey 1995). In Washington, Schroeder (1994) reported mortality rates of 47% for radio-collared birds (*columbianus* subspecies). Bergerud (1988) reported mortality rates of 60% and 75% for all subspecies of sharptails combined. Robel et al. (1972) estimated mortality rates of “Plains” sharptails of 70.4–71.5% in two study areas in North Dakota.

Higher mortality rates of “Columbian” sharptails appear to coincide with spring and fall dancing periods and with increased winter severity. Marks and Marks (1988) reported that 94% of their radio-collared birds were killed during the spring and fall dancing periods. In Idaho, Ulliman (1995) reported mortality rates of 14% and 71% for a small sample of birds during mild and severe winters, respectively, which suggests a strong correlation between winter severity and survival. Late, wet springs may also contribute to mortality of chicks, but the extent of the impact on this subspecies is not well documented.

Sharp-tailed Grouse have high reproductive potential; therefore, chick survival may influence population dynamics significantly (Hays et al. 1998). Bergerud (1988) summarized results from eight studies of several subspecies and determined that chick mortality until fall was less than 40%. Giesen (1987) and Marks and Marks (1987) reported “Columbian” sharptail chick mortality rates until fall of 34% and 50% in Colorado and Idaho, respectively. Mortality rates are unknown in British Columbia.

Physiology

Sharp-tail Grouse are non-migratory; therefore, they must be able to withstand harsh environmental conditions during winter snows and summer droughts. They thermoregulate by selecting suitable habitats and postures that regulate heat balance (e.g., snow roosting) (Evans and Moen 1975). The importance of water sources to Sharp-tailed Grouse is poorly documented. Oedekoven (1985) believes their water requirements are satisfied by the foods they consume. However, during winter, they may also eat snow (Aldous 1943 *in* Connelly et al. 1998).

Marks and Marks (1987) did not observe “Columbian” sharptails near open water. In grasslands near Kamloops, birds were consistently flushed from the shore of a small pond during the breeding season, but were likely using the riparian vegetation for cover (Leupin, pers. obs.).

Movements / Dispersal

Migration — Although Sharp-tailed Grouse, *columbianus* subspecies are not considered migratory, some populations regularly move significant distances between wintering and breeding areas (Hays et al. 1998). In Washington, “Columbian” sharptails moved 14 km to wintering grounds (Schroeder 1994). Meints (1991) reported movements of 20 km to

wintering grounds. These long-distance movements may indicate poor winter habitat quality (Meints 1991). In grasslands near Kamloops, a small sample ($n = 7$) of radio-collared “Columbian” sharptail males remained within 600 m of the lek of capture throughout the winter (Leupin 2000b). However, a similar study by Jury (unpublished data) noted that one male moved 12 km from the lek of capture during the winter period.

Although dispersal does occur, as evidenced in British Columbia by colonization of newly created clearcuts or burns in grassland and forest habitats, detailed information regarding timing, distance, and sexual differences of Sharp-tailed Grouse, *columbianus* subspecies dispersal mechanisms is largely unknown (Jury, pers. comm.). However, during the breeding season, movements of males and females between nearby leks are not uncommon (Schroeder, pers. comm.).

Historically in British Columbia, suitable habitat for both ecotypes would have existed close to each other and movements/dispersal of individuals between them likely occurred. Currently, birds from the two ecotypes are separated by approximately 100 km. Although the habitats that separate them are grasslands, current and historical management has resulted in habitat degradation and “Columbian” sharptails have subsequently disappeared from those areas, resulting in less likelihood of migration/dispersal between the two ecotypes.

Home range — Sharp-tailed Grouse have small annual home ranges. In Idaho, “Columbian” sharptail home ranges averaged 1.87 km^2 (Meints 1991). In Montana, average male and female home ranges for transplanted birds were 1.7 km^2 ($n = 6$) and 3.6 km^2 ($n = 2$), respectively (Cope 1992). In British Columbia’s climax grasslands, radio-collared “Columbian” sharptails (male and female) have been located within 2.8 km of the lek of capture (Van Rossum 1992; Leupin 2001; Jury, unpublished data.). One collared female, however, moved 8 km from the lek during winter and one male moved 12 km during the same time (Jury, unpublished data.). The estimated winter home range for two males was 2.1 km^2 and 3.8 km^2 (Leupin 2000b).

Nutrition and Interspecific Interactions

Diet — Adult Sharp-tailed Grouse, *columbianus* subspecies feed primarily on native vegetation throughout the year, although cultivated grains and insects supplement their diet (Marks and Marks 1987; Giesen and Connelly 1993; Hays et al. 1998). Chicks depend on insects as a food source during the first five weeks after hatching (Johnsgard 1983). In spring and summer, the bulk of the diet consists of greens, buds, and fruits from grasses, herbs, and shrubs (Tirhi 1995; see Connelly et al. 1998 for a detailed list of food items).

Summer dietary habits of “Columbian” sharptails in B.C. are poorly documented. Winter foods include buds, seeds, herbs, and fruits (Hays et al. 1998). In the southern interior of B.C., buds of water birch are an important winter food item (Ritcey 1995; Leupin 2000b; Van Rossum 1992). Other important forage species include wild rose (*Rosa* spp.),

saskatoon, choke cherry, and willow. In forested habitats in B.C., winter foods include buds of scrub birch, trembling aspen, and buds and fruits from other deciduous trees and shrubs (Ritcey 1995). Studies elsewhere have documented reliance on grain as a winter food source (Connelly et al. 1998). In British Columbia, grain fields within the “Columbian” sharptail’s range are uncommon and thus do not provide a critical food source.

Interspecific interactions — Interspecific interactions are poorly documented (Hays et al. 1998). Nest parasitism by Ring-necked Pheasants (*Phasianus colchicus*) on “Plains” sharptails has been reported (Vance and Westeneier 1979 in Hays et al. 1998). In British Columbia, “Columbian” sharptails may have interacted with Ring-necked Pheasants in the southern portion of their range, but nest parasitism has not been documented there. In B.C., releases of pheasants (and other non-native upland game birds) are prohibited on Crown land (Fraser, pers. comm.), but releases of non-native upland game birds on private property are allowed and do occur within the range of the *columbianus* subspecies (Jury, pers. comm.). Additional interaction may occur between the grassland ecotype and wild turkeys (*Meleagris gallopavo*). Turkeys are expanding rapidly from the south and now inhabit parts of the sharptail’s historic range. There is no evidence to suggest that turkeys have had a negative impact on B.C.’s grassland ecotype “Columbian” sharptails because at present their ranges do not overlap. However, interactions may become apparent as turkeys colonize habitats where sharptails occur.

Sharp-tailed Grouse have been reported to hybridize with Greater Prairie-Chickens and Dusky Grouse (Connelly 1998). In British Columbia, hybridization has not been reported. The range of the *columbianus* subspecies in British Columbia overlaps that of the Dusky Grouse, Ruffed Grouse, Chukar (*Alectoris chukar*), and Spruce Grouse. Historically, the “Columbian” sharptail’s range in the south Okanagan would have overlapped that of the Greater Sage-Grouse (*Centrocercus urophasianus*), but the latter species is now extirpated from the province.

Behaviour / Adaptability

Sharp-tailed Grouse are highly social and flocks composed exclusively of males or broods gather in fall and winter (Connelly et al. 1998). In Idaho, winter flock sizes ranged from 5 to 22 birds (Meints 1991), whereas in British Columbia, flocks of up to 72 birds have been reported (Leupin 2000b; Ritcey 1995).

Sharp-tailed Grouse dancing grounds are traditional; however, displaying males may move short distances to alternate display areas if the original dancing grounds are altered (Sexton and Gillespie 1979; Tirhi 1995).

Males (adults and juveniles) also congregate on the dancing grounds during fall (non-breeding), presumably to establish their position in the hierarchy or as a response to photoperiods similar to those of the breeding season (Connelly et al. 1998; Gratson 1988; Hays et al. 1998; Moyles and Boag 1981). Females may also visit dancing grounds at this

time (Lumsden 1965). Rippin (1970) reported two females (“Plains” subspecies) among 14 birds shot near a dancing ground during fall in Alberta.

POPULATION SIZES AND TRENDS

Population Sizes

Population sizes of Sharp-tailed Grouse, *columbianus* subspecies in British Columbia have been derived largely from density estimates in the various regions and from localized long-term counts of males attending leks. The provincial population of the *columbianus* subspecies in 1993 was estimated to be between 4600 and more than 10 000 birds (Ritcey 1995). In 2002, a further attempt to quantify the population, based on extrapolation of estimated densities across all potentially suitable habitats in the Thompson-Nicola and Cariboo regions, resulted in a provincial estimate of 5500–11,500 breeding birds (Jury and Dielman, pers. comm.). An inventory of forest ecotype populations in 2004 estimated that portion of the provincial population to be 7000–11,500 breeding birds (Leupin and Hawes 2005); added to the grassland ecotype’s 1500–2500 breeding birds, this increases the 2002 estimate of the provincial population (including both ecotypes) to 8500–14,000 birds.

Population Trends

Populations of Sharp-tailed Grouse, *columbianus* subspecies have declined markedly since the advent of large-scale agricultural practices (Buss and Dziedzic 1955). This is especially true for all birds that inhabit climax grasslands in the United States and southern Canada. In Washington, Schroeder et al. (2000) estimated a 92% population decline of “Columbian” sharptails since 1954.

In British Columbia, populations of the *columbianus* subspecies are estimated to have declined by as much as 70% since the early 1900s (Cannings, pers. comm.). Populations in climax grasslands (grassland ecotype) of the south-central interior have been affected most, and thus now constitute a small proportion of the total population in British Columbia (Ritcey 1995). Although earlier reports of Sharp-tailed Grouse in the southern Rocky Mountain Trench suggested that remnant individuals were persisting, or moving back into the area from reintroduced populations in the Tobacco Plains, Montana, recent inventories within historical habitats have not resulted in any sightings (Antifeau and Ohanjanian, pers. comm.).

Assuming lek attendance is an indicator of population trends, regional Ministry of Environment survey data since 1986 show a steady decline in grassland ecotype Sharp-tailed Grouse lek attendance in the Thompson-Nicola region from 1990 to 1998, after which populations appeared to stabilize. From a peak in 1990 through to 1995, there was a 28% decline in male attendance at leks in the Thompson-Nicola grasslands (Figure 4). Furthermore, 23% of the known lek sites in this area became inactive between 1986 and 2002, and despite searches in the general area, no new leks have been located in the

vicinity. However, the latest 10-year trend (Figure 4) suggests that populations in the Thompson-Nicola region have been stable or increasing slightly since 1995.

Ministry of Environment population data for the grassland ecotype in the Cariboo region are highly variable (Dielman, pers. comm.). They do, however, suggest a slight increase in male attendance at lek sites between 1995 and 2006 (Figure 5). In one specific example, 46 grouse were found at a grassland lek site in the Cariboo region in 1989, but only six birds were recorded at the site in 1993 (Ritcey 1995).

In forest-grassland matrices within areas of the Cariboo region where forested habitats make up a larger proportion of the habitats surrounding the lek, numbers of males attending leks in grassland openings show no change over time (Figure 6).

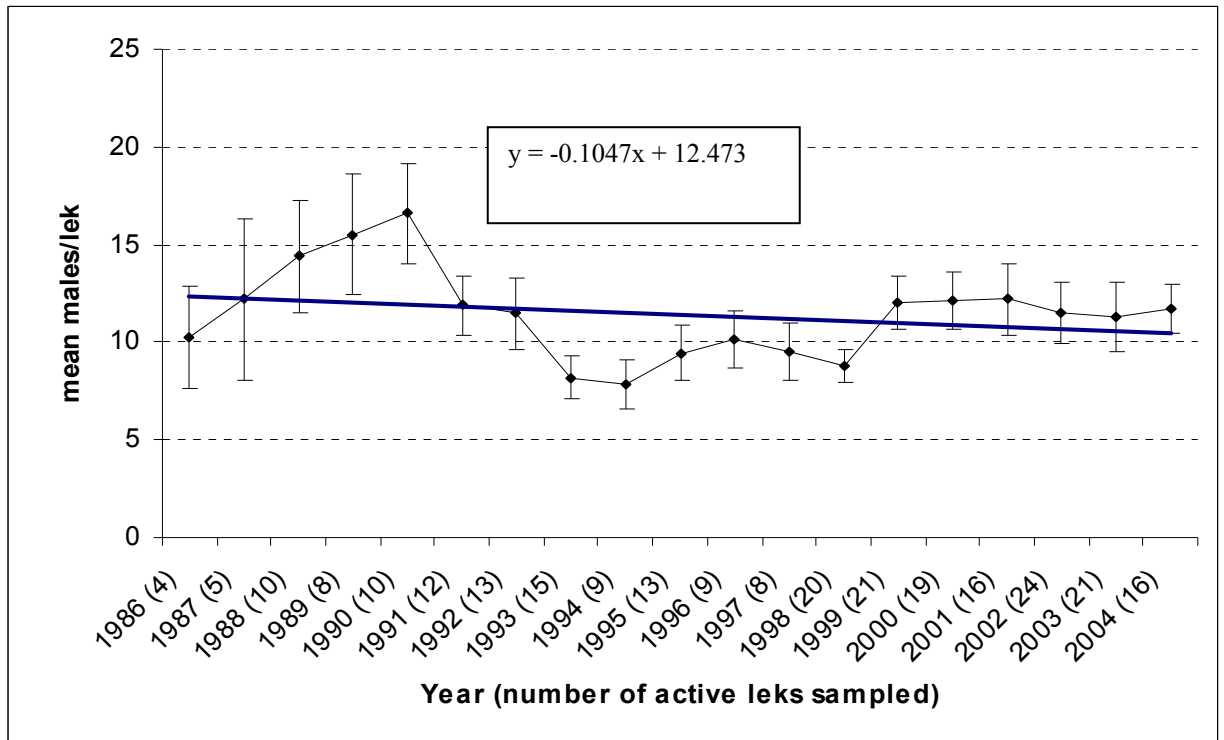


Figure 4. Mean number of male Sharp-tailed Grouse, *columbianus* subspecies attending leks in grasslands of the Thompson-Nicola region. (Source: Ministry of Environment, Kamloops). Error bars indicate 1 standard error.

In contrast to climax grassland populations, forest ecotype “Columbian” sharpetails in the Central Interior Ecoprovince are believed to have expanded in range and increased in numbers in the past decade (Ritcey 1995; Dielman, pers. comm.). This is believed to be due to increased habitat availability resulting from large-scale timber harvesting of mountain pine beetle-infested stands in 1987 (Cannings 2002; McKenzie, pers. comm.). This apparent increase in sharptail numbers is supported by higher hunter harvest in the years after logging (Figure 7). However, it can be argued that these populations are unlikely to persist over time because their existence depends on the distribution, size, and age of the harvested blocks. From 1988 to 1998, the average cutblock size in the Cariboo and Prince George regions, where most of the forest ecotype occurs, declined from 84 and 71 ha to 31 and 40 ha, respectively (MoF 1999b). Similarly, from 1992 to 2002, the provincial average cutblock size decreased from 35 to 22 ha, a reduction of 37%. As forests regenerate and cutblock size decreases, habitat suitability and availability, and populations of Sharp-tailed Grouse may also decrease (Dielman and McKenzie, pers. comm.). However, areas where the forest ecotype occurs are currently experiencing

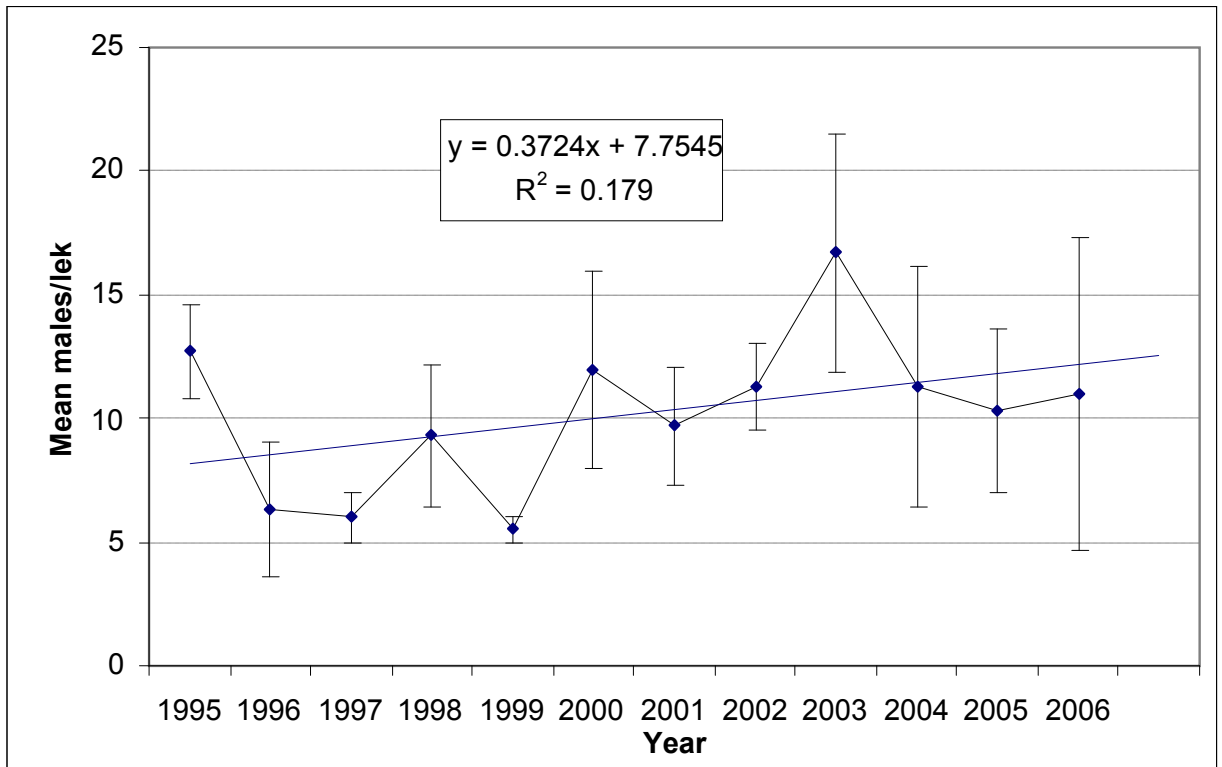


Figure 5. Average number of males Sharp-tailed Grouse, *columbianus* subspecies attending three leks in grasslands of the Cariboo region. (Source: Pat Dielman, Ministry of Environment, Williams Lake). Error bars indicate 1 standard error.

a mountain pine beetle epidemic, which is projected to affect 80% of B.C.'s pine inventory (MoFR 2004). As a result, B.C. is increasing the allowable annual cut (AAC) to salvage impacted pine (in 2005, the AAC was forecast to increase by 27%, MoFR 2004, and did so). This will result in the creation of new clearcuts that will likely be large enough to ultimately provide long-term habitat availability and secure habitat for sharptails for several decades.

Because of inconsistent lek counts, trends in lek attendance in forest ecotype habitat are not known.

LIMITING FACTORS AND THREATS

The persistence of viable populations in a given area depends primarily on the availability of suitable habitat to breed, nest, rear young, and overwinter. Historical declines in Sharp-tailed Grouse populations have been attributed mainly to loss and degradation of suitable habitat. Additional factors are winter severity, predation, hunting, and human disturbance.

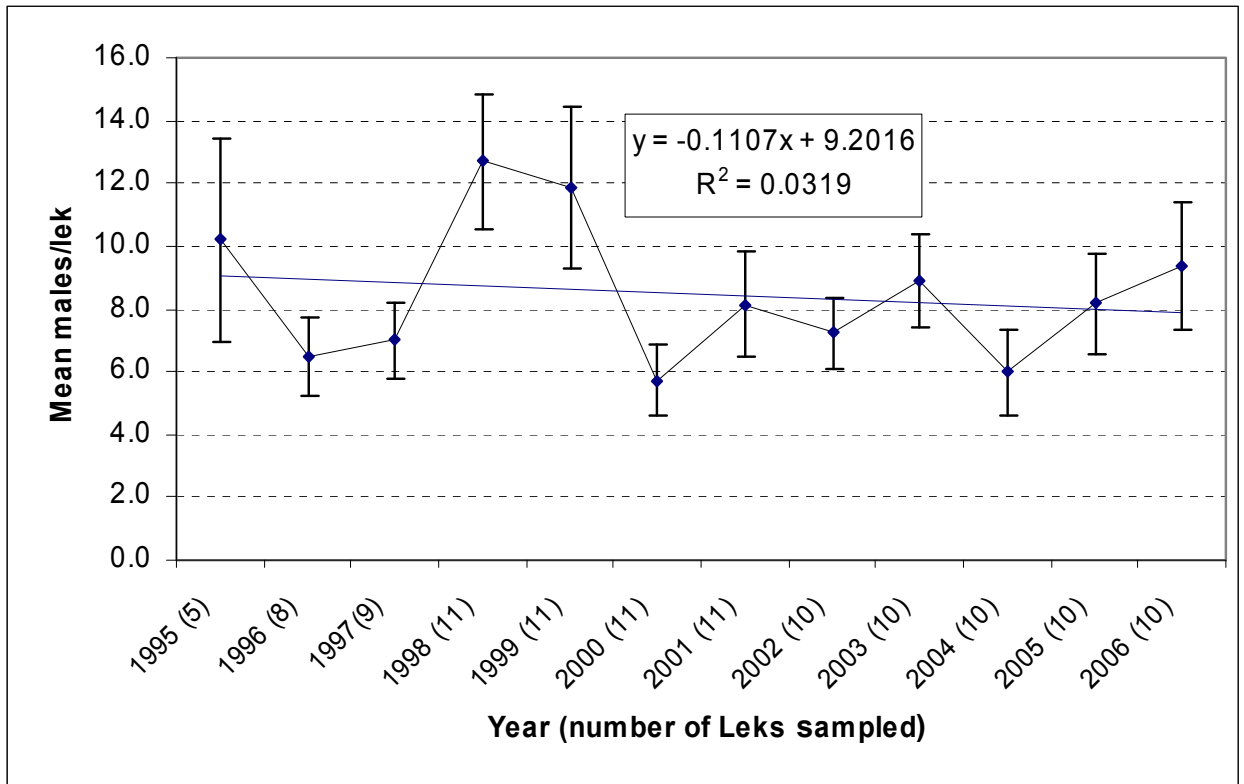


Figure 6. Number of male Sharp-tailed Grouse, *columbianus* subspecies attending leks in grassland habitats in the Cariboo region where the surrounding area is primarily forested. (Source: Pat Dielman, Ministry of Environment, Williams Lake). Error bars indicate 1 standard error.

Disturbance — At leks, male Sharp-tailed Grouse tolerate a variety of disturbances, but are displaced by human presence. Disturbance of leks appears to limit reproductive opportunities and may result in regional population declines (Baydeck and Hein 1987).

Females appear to be more susceptible to various anthropomorphic disturbances (Connelly et al. 1998). Females will avoid leks that are subject to frequent disturbances (Baydeck and Hein 1987). Similarly, if females are flushed frequently during the early stages of oviposition, they may abandon the nest (Dickinson, pers. comm.).

Excessive disturbance of wintering birds may impair their ability to cope with unfavourable winter conditions (Connelly et al. 1998; Jury, pers. comm.).

In British Columbia, potential sources of human-caused disturbance for the grassland ecotype include all-terrain vehicles (ATVs), hunting dog training and trials, mowing, and domestic grazing during the breeding season. For the forest ecotype, additional sources of disturbance include silvicultural activities such as spacing and brushing.

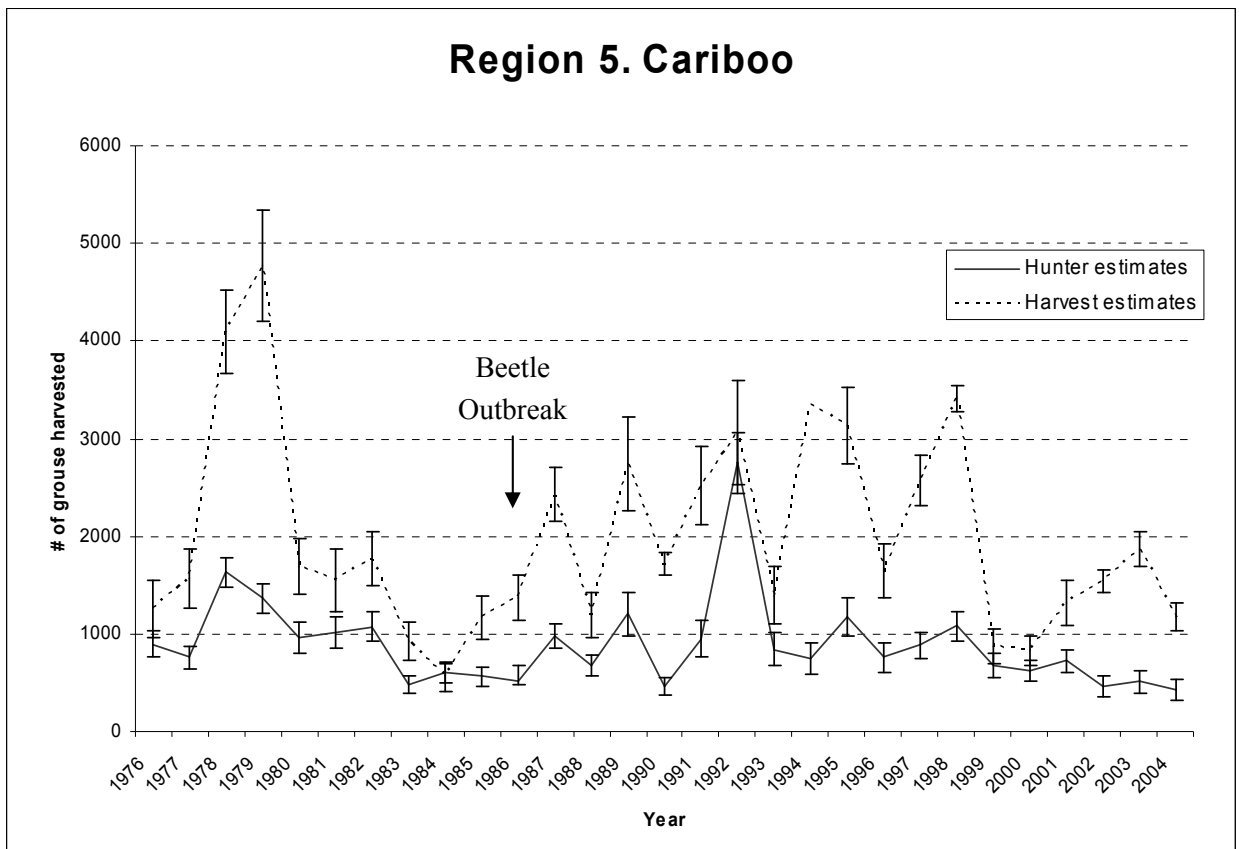


Figure 7. Number of hunters (solid line) and total Sharp-tailed Grouse, *columbianus* subspecies harvest estimates (dashed line) in Region 5 (Cariboo). Error bars represent 95% confidence intervals.

Factors Limiting Population

Predation mortality — Predation is commonly cited as the greatest source of direct mortality for Sharp-tailed Grouse (Cope 1992; Tirhi 1995; Marks and Marks 1987; Ritcey 1995; Connelly et al. 1998). Grouse are prone to predation because of their ground-nesting habits, large clutch sizes (Hays et al. 1998), and lekking behaviour during the breeding season. Hays et al. (1998) also noted that predation rates depend partially on habitat quality.

Raptors, corvids (*Corvus* spp.), and canids (*Canis* spp.) are the major predators of Sharp-tailed Grouse, *columbianus* subspecies. Marks and Marks (1987) reported that avian predators were responsible for 19 of 22 deaths of radio-collared Sharp-tailed Grouse in Idaho. Incidental observations of predation of grassland ecotype birds suggest that the main predators in British Columbia are Coyote (*Canis latrans*), Northern Goshawk (*Accipiter gentilis*), Short-eared Owl (*Asio flammeus*), Great Horned Owl (*Bubo virginianus*), corvids, and Red-tailed Hawk (*Buteo jamaicensis*) (Ritcey 1995; Jury, pers. comm.; Leupin, pers. obs.).

Main predators of forest ecotype birds include Northern Goshawk and Coyote (Leupin, pers. obs.; Jury, pers. comm.).

Periods of high adult predation for both ecotypes appear to coincide with the breeding season, when birds congregate at dancing grounds. During aerial searches in the spring of 1998, Coyotes were frequently spotted stalking Sharp-tailed Grouse at lek sites (Leupin, pers. obs.).

Hunting mortality — Sharp-tailed Grouse are a popular game bird where they occur in sufficient numbers to support hunting (Ritcey 1995; Connelly et al. 1998). The effects of hunting on populations are poorly understood because of a lack of empirical data (Connelly et al. 1998).

Bergerud (1988) summarized hunting information from 10 studies of various subspecies and concluded that hunting increased annual mortality rather than compensating for natural mortality during winter. However, these studies reported harvests in excess of 30% of the population, which is extremely high. Conversely, indirect evidence suggests that hunting may not have an additive effect on mortality. In areas of Washington, Utah, and British Columbia, “Columbian” sharptail populations continued to decline despite hunting closures (Hart et al. 1950; Schroeder 1996; Leupin 2000a). Hunting at any harvest level, however, may impact small, isolated populations (Marks and Marks 1987).

Timing of the hunting season may also affect local populations. For example, male “Columbian” sharptails congregating at dancing grounds during the fall could potentially be decimated or eradicated with repeated hunting visits to the lek location (Ritcey 1995). Ritcey (1995) reported that at least two dancing grounds in climax grasslands of British Columbia were abandoned due to heavy hunting pressure the previous fall. Local

extirpation could also occur if females visit lek locations at this time. However, the degree to which females visit leks during fall congregations is unclear, although fall visits by females have been reported for the “Plains” and “Prairie” subspecies (Lumsden 1965; Rippin 1970).

“Columbian” sharptails have traditionally been hunted in British Columbia, but over the past decades, hunting has been severely curtailed in response to population declines and the subsequent provincial Blue-listing of the subspecies. The B.C. Provincial Wildlife Harvest Strategy (MELP 1996) states that Red-listed species and subspecies (those considered threatened or endangered) will not normally be harvested. If further declines warrant upgrading the Sharp-tailed Grouse, *columbianus* subspecies to the Red list, full range-wide closure may result. As of 2002, all grassland ecotype populations in B.C. have been closed to hunting. Hunting remains open only for the forest ecotype birds because they are more numerous, appear to be stable or increasing at present, and occupy what are considered ephemeral habitats. Daily bag and possession limits for this ecotype remain at 5 and 10, respectively. Despite hunting restrictions, accidental shooting of Sharp-tailed Grouse in closed areas may occur. In 2001, a hunter returned a band from a “Columbian” sharptail shot in a closed area near the city of Kamloops, claiming he was unaware of any hunting closures on the species (Jury, pers. comm.).

Pesticide mortality — Ritcey (1995) provides anecdotal reports of mortalities of “Columbian” sharptails caused by insecticides and surface applications of rodenticides. Other authors have suggested insecticide use can lead to population declines by causing both direct mortality and loss of critical insect food resources (Bown 1980). Pesticides and rodenticides have been used extensively in B.C. in the past and may have contributed to Sharp-tailed Grouse, *columbianus* subspecies mortalities in the province (Ritcey 1995). However, the use of these products is now highly restricted and regulated and is limited primarily to a few private holdings (Ritcey 1995).

In forested ecosystems of British Columbia, monosodium methanearsonate (MSMA) has been used to control mountain pine beetle (Dost 1995). Stands treated with MSMA are first pheromone-baited to attract the mountain pine beetle. Recent research has shown that the resultant increase in insects in and on the trees can attract woodpeckers and other gleaners, which can in turn be negatively affected by increased arsenic intakes (Elliott, pers. comm.). However, because MSMA is either injected or applied directly to cuts in the bark at the base of selected trees in a stand (Dost 1995), it is not directly accessible to Sharp-tailed Grouse. Similarly, mountain pine beetles and their larvae impacted by MSMA die and remain under the bark of the treated tree, which makes them unavailable to feeding grouse (Morrissey, pers. comm.). In addition, MSMA is no longer being used and the B.C. Ministry of Forests is not applying for a renewed Pesticide Use Permit for it (Eng, pers. comm.). Therefore, MSMA likely has not had, and will not have, any negative impacts on Sharp-tailed Grouse.

Conversely, herbicides that are broadcast sprayed (e.g., glyphosate) are applied directly to habitats that forest ecotype sharptails occupy. Herbicides are used to reduce

competition between deciduous and coniferous vegetation and may reduce cover availability for forest ecotype populations, potentially making them more vulnerable to predation and/or hunting pressures.

Factors Limiting Habitat

Urban and suburban sprawl — Urban and suburban growth near cities and towns located within grassland habitat has increased dramatically in the last 10 years. Large holdings of grasslands are currently being subdivided and developed as small-acreage hobby farms and ranchettes. In general, ranchettes tend to use and develop a greater extent of the grassland habitat, which can result in the displacement of Sharp-tailed Grouse. This is particularly evident on the outskirts of major cities in the central interior. In the North and Central Okanagan and Thompson-Nicola regional districts, projected population growth from 2001 to 2031 is 33, 58, and 21%, respectively (B.C. Stats 2001). The full extent of Sharp-tailed Grouse habitat that will be lost or degraded due to human population growth is not known (Grassland Conservation Council of B.C. 2004). A preliminary analysis of grassland habitat loss near the city of Kamloops showed that 801 ha were lost to urban and commercial resort developments between 1995 and 2004 (McGregor, pers. comm.). Within the same time span, subdivision of grassland parcels into ranchettes, hobby farms, and lakeshore summer residences resulted in the loss of 389 ha and 194 ha of grasslands in the Nicola Valley and Stump Lake areas, respectively (McGregor, pers. comm.). In addition, since 2004 at least three leks have been or will be impacted by subdivisions in the Kamloops and Stump Lake areas (Leupin, pers. obs.; Jury, pers. comm.). Similarly, Ohanjanian (2006) reported impacts to Sharp-tailed Grouse and their habitat in the East Kootenays caused by increased rural residential development in the Cranbrook to Kimberley area—including a subdivision built within 100 m of three dancing grounds and a trailer park built directly atop another one.

The extent of habitat loss for the forest ecotype caused by urban and suburban expansion is not known, but the loss is likely insignificant because most of these areas are remote and in townships that have experienced little growth in the past 20 years.

Agriculture — Agricultural sprawl has been considered a significant factor contributing to the decline of Sharp-tailed Grouse, *columbianus* subspecies. In Washington, Buss and Dziedzic (1955) attributed the extirpation of Sharp-tailed Grouse from southeastern Washington to the rapid growth in agricultural activities. In British Columbia, the extent of the effects of agricultural sprawl on “Columbian” sharptail populations is not clearly known. However, the conversion of climax grasslands to orchards and vineyards in the Okanagan Valley undoubtedly contributed to their extirpation. In grassland habitats where “Columbian” sharptails still occur, the areas under cultivation have not increased since 1995 (McGregor, pers. comm.).

In forested areas, the extent of the impacts on habitat loss from agricultural practices is unknown. It should be noted, however, that areas allocated for timber harvest typically occur on Crown land and therefore no agricultural practices take place.

Grazing — Grazing by domestic livestock is considered to be the primary threat to Sharp-tailed Grouse populations in the United States and southern Canada (Hays et al. 1998). Continued heavy grazing changes the vegetation community, and results in the loss of residual and live grass and forb cover required for nesting (Marks and Marks 1987; Ritcey 1995). Cattle can also have severe impacts on riparian areas, which provide critical foraging, roosting, and wintering areas for this species. Riparian areas with gentle topography often receive heavy use by cattle since they provide easy access to water and shade (Gillen et al. 1985; Medin and Clary 1990). Browsing, rubbing, and trampling by cattle can cause loss of cover and vegetation structure in riparian habitats (Szaro and Pase 1983).

Certain grazing regimes and high stocking rates can be detrimental to Sharp-tailed Grouse habitat (Klott and Lindzey 1990). For example, spring–fall rest rotation regimes provide adequate nesting cover in only one of three years (Hays et al. 1998). Additionally, high cattle stocking rates during the nesting season can cause physical damage to roosting and nest sites and may contribute to nest abandonment and/or destruction (Hays et al. 1998). In Idaho, Marks and Marks (1987) noted that “Columbian” sharptails selected areas least impacted by cattle. Pepper (1972) noted similar behaviour by the “Plains” subspecies in Alberta. In British Columbia, grazing occurs over much of the range of “Columbian” sharptails. Lek abandonment, damage to important roosting/wintering areas, and nest damage have been reported in climax grasslands in the Thompson-Nicola region (Ritcey 1995; Leupin 2001; Jury, pers. comm.). Furthermore, the proliferation of fences on rangelands may negatively impact Sharp-tailed Grouse populations by providing convenient perch sites for raptors (Pepper 1972; Tirhi 1995).

Nevertheless, the persistence of “Columbian” sharptails in British Columbia’s grasslands is closely tied to the continued operation of cattle ranches. Without them, these areas would likely be converted to small-acreage hobby farms, ranchettes, or subdivisions, which would effectively eliminate habitat for this subspecies. Although livestock operations might remove resources required by “Columbian” sharptails, adaptive management of livestock can be used as a management tool to enhance or maintain sharptail habitat.

In forested areas, domestic livestock grazing in cutover areas occurs. Forestry practices dictate that in harvested areas, forest succession must be truncated to achieve a free-growing state. Short-term controlled grazing (in newly planted clearcuts) by sheep removes herbaceous cover and reduces competition with planted seedlings. Cattle grazing is also commonplace, but neither practice is intended to delay forest succession.

Although Sharp-tailed Grouse, *columbianus* subspecies declines have been associated with excessive livestock grazing and conversion of native range to agriculture (Schroeder et al. 2000), Ohanjanian (2006) suggests another factor should also be considered in the East Kootenays. She reports that Sharp-tailed Grouse habitat there overlaps with important ungulate winter ranges and that in these areas, ungulates (largely Elk [*Cervus*

canadensis]) graze the residual vegetation, removing cover that is vital for grouse nesting habitat the next spring. The impact of this type of grazing in the East Kootenays may be exacerbated by the recent proliferation of fencing to keep the ungulates out of ranchlands, resulting in heavier concentrations of Elk on Crown range lands (Antifeau, pers. comm.). Ohanjanian (2006) concludes that, although the degree of impact is not known, the number and distribution of Elk, the timing and intensity of cattle grazing, range condition, and seasonal growing conditions all play a role in the current poor range condition and lack of residual vegetation for Sharp-tailed Grouse in the East Kootenays.

Fire — Fire has been identified as a potential threat to Sharp-tailed Grouse. Hays et al. (1998) reported that Sharp-tailed Grouse declines in shrub–steppe habitats in Washington were attributed to prescribed burning. Hart et al. (1950) reported that a fire at a site in Utah affected Sharp-tailed Grouse nesting and winter habitat and caused the birds to abandon their lek. Marks and Marks (1987) cautioned that severe fires would degrade habitat in a Sharp-tailed Grouse, *columbianus* subspecies management area in Idaho.

Fires can also have a positive impact on Sharp-tailed Grouse habitat. Fires that removed dense sagebrush and wooded areas improved overall habitat conditions in Colorado, Wyoming, and Utah (Hart et al. 1950; Rogers 1969; Oedekoven 1985). In British Columbia, fires maintain climax grassland communities by reducing sagebrush densities, forest encroachment, and ingrowth. Forested areas in British Columbia reach their peak potential to support the forest ecotype only after they have been opened by fire or harvesting. Ritcey (1995) reported that in three areas, “Columbian” sharptails responded positively to stand-replacing fires.

Fire suppression — Fire suppression is common in British Columbia. Statistics indicate that large-scale burns have decreased over the last half century (Ritcey 1995). Most of the habitat used by Sharp-tailed Grouse, *columbianus* subspecies in British Columbia is maintained, primarily, by fire (Ritcey 1995; Webster, pers. comm.). In the absence of fire, habitat quality and quantity is reduced in areas prone to forest encroachment (Gayton 1998). At the landscape level, these vegetation changes can fragment and isolate habitats and populations (Berg 1990; Manley and Wood 1990). Forest encroachment is a significant issue in British Columbia. It has impacted Sharp-tailed Grouse, *columbianus* subspecies negatively (see “Habitat Trends” above), and has been identified as a major contributing factor in the extirpation of the subspecies in the southern Rocky Mountain Trench (Ohanjanian 1990). Encroachment may also increase risks of predation by providing habitat and hunting perches for raptors.

Silvicultural practices — Clearcut harvesting has had a positive impact on forest ecotype populations. Large-scale operations, which were common in previous decades, have helped offset potentially deleterious effects of fire suppression and forest ingrowth. Areas of occupation and the sizes of some populations have increased in response to openings created by large-scale harvesting. These increases, however, are generally short lived, lasting approximately 15 to 25 years. Ritcey (1995) suggested that Sharp-tailed Grouse populations in forested areas would likely benefit indefinitely from logging practices.

However, Cannings (2002) believes that current existing openings are ephemeral in nature and that current harvesting practices do not address local colonization/extinction dynamics and landscape-level issues.

The current mountain pine beetle epidemic in British Columbia has resulted in a 27% increase in the allowable annual cut and is forecast to affect 80% of the pine inventory by 2013. Given that the main areas affected lie within the forest ecotype's distribution, large-scale clearcutting will increase suitable habitat for Sharp-tailed Grouse in these areas

Forestry operations in B.C. truncate forest succession (Bunnell 1997). Activities such as planting, fertilizing, and mechanical site preparation can create obstacles for "Columbian" sharptail broods, and can degrade "Columbian" sharptail habitats and winter forage species (Ritcey 1995).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Sharp-tailed Grouse, *columbianus* subspecies occurs in Canada only in British Columbia. Within British Columbia, stable populations of this subspecies can be found in the northern part of its range in sedge meadow riparian complexes and adjacent cutover areas in forested systems north of Clinton (Dielman, pers. comm.). Conversely, the grassland ecotype has shown significant declines, local extirpations, and has been effectively isolated from populations inhabiting similar habitats in Washington and Montana. These populations are increasingly susceptible to extinction events associated with small isolated populations. It is not known whether forest ecotype populations from the northern part of the range serve, or could serve, as sources of recolonization or "rescue effect" events. However, "Columbian" sharptails have been sighted on recovered grassland habitat near Big Bar, BC, which is located 10 to 14 km from known cutblock populations. Similarly, sightings from the East Kootenays (Antifeau, pers. comm. to Fraser) are either remnant individuals or wanderers from reintroductions on the Tobacco Plains in Montana (Wood and Manley 1993), although recent surveys indicate that no new leks or individuals persist as of 2005 (Ohanjanian, pers. comm.).

As a result of range-wide declines, British Columbia has an increased global responsibility for the perseverance of this subspecies. In recent years, British Columbia's populations have been used as a source of birds for reintroductions into former parts of their North American range. Before 1991, relocations involved capture and transplant of the grassland ecotype. However, declines in grassland populations prompted a shift in source population captures from grasslands to forest cutblock populations. Due to the ephemeral nature of cutblock habitat and the relative health of populations using these areas, the forest ecotype is now exclusively targeted as the source of birds for B.C.'s involvement in any reintroduction/augmentation efforts in North America (Table 2).

Table 2. Summary of Sharp-tailed Grouse, *columbianus* subspecies transplants from B.C. population sources.

Grassland Sources			Forest Sources		
Year	# of birds	Destination	Year	# of birds	Destination
1987	15	Montana	1997	44	Montana
1988	18	Montana	2003	7	Big Bar, BC
1989	13	Montana	2005	40	Washington
1990	15	Montana	2005	8	Big Bar, BC
1996	25	Montana			

The Sharp-tailed Grouse, *columbianus* subspecies is a favoured game bird in B.C. because it is the only native species that provides opportunity for open grassland bird hunting. Its tendency to flush only when a threat is close is also highly valued by owners, breeders, and trainers of pointer-retriever hunting dogs (Ritcey 1995). First Nations people harvested this bird only incidentally because it was not noted as an important food item. Under traditional hunting practices, this subspecies' behaviour made it difficult to harvest and thus it was not a critical food item (Gottfriedson, pers. comm.).

In Washington, historical accounts from Lewis and Clark allude to times when the sky was blackened by flushing Sharp-tailed Grouse. Tribal members watched leks to learn the dance of the male Sharp-tailed Grouse. Dancers would then mimic the elaborate displays in competitive "prairie chicken" dances during local and regional powwows. Other historical information suggests that the wing bones of Sharp-tailed Grouse were used as flutes and the feathers were used as fans and to decorate regalia. Local oral history suggests that Sharp-tailed Grouse were not only abundant, but were used for food (Gerlinger, pers. comm.).

This subspecies is also the only lekking game bird remaining in British Columbia. It exhibits spectacular breeding displays that make it highly sought after by birders and naturalists.

EXISTING PROTECTION OR OTHER STATUS

The Sharp-tailed Grouse is a game species protected under the British Columbia *Wildlife Act* of 1982. Hunting closures for the grassland ecotype of the *columbianus* subspecies have been implemented in the Kootenays and the Okanagan (Ministry of Environment [MoE] Regions 4 and 8) since 1973. Thompson-Nicola region grassland populations (MoE Region 3) have been closed to Sharp-tailed Grouse hunting since 1993. In 2002, a closure came into effect in the southern Cariboo (MoE Region 5) for Provincial Management Units with open grassland populations. Thus, by 2002, all hunting of open grassland ecotype populations of the *columbianus* subspecies was closed in B.C. Hunting

Table 3. Global, provincial, and state status of the Sharp-tailed Grouse, *columbianus* subspecies.

Global (rank)	Canada (rank)	United States (rank)
Nature Conservancy/Conservation Data Centre global rank (G4T3)	British Columbia (S2S3), Blue List (vulnerable, at risk), B.C. <i>Forest and Range Practices Act</i> : listed as Identified Wildlife	California (SX) Colorado (S3) Idaho (S3) Montana (S1) Nevada (S1) Oregon (S1) Utah (S3) Washington (S1) Wyoming (S2)

S = Provincial or state rank.

G = Global rank.

T = Designates a rank associated with a subspecies.

X = Apparently extinct or extirpated, without the expectation that it will be rediscovered.

1 = Critically imperilled because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation or extinction.

2 = Imperilled because of rarity or because of some factor(s) making it vulnerable to extirpation or extinction.

3 = Rare or uncommon, may be susceptible to large-scale disturbances (e.g., may have lost extensive peripheral populations).

of populations of the forest ecotype in less threatened forest clearing and wetland complex habitats in the northern range of the subspecies remains open, with bag and possession limits set at 5 and 10 birds, respectively.

In 1993, as a result of regional extirpations and declines in grassland populations, the Sharp-tailed Grouse, *columbianus* subspecies was considered to be a vulnerable species-at-risk and therefore Blue-listed by the B.C. Conservation Data Centre (Table 3).

In British Columbia, “Columbian” sharptails occur in several areas that have some degree of protection, including the Junction Sheep Range Provincial Park, Chilanko Marsh Wildlife Management Area, Lac du Bois Grasslands Protected Area, Churn Creek Protected Area, and Itcha-Ilgachuz Provincial Park. However, these areas still allow grazing activities that, if not managed appropriately, can be a threat to Sharp-tailed Grouse and their habitat.

Additional management-related activities include a stewardship program for the *columbianus* subspecies initiated by the Ministry of Environment in Kamloops in 1998. This project’s objectives are to raise awareness of the Sharp-tailed Grouse and to promote stewardship opportunities with landowners, land users, and government bodies to

maintain and restore Sharp-tailed Grouse habitat and populations. To date, four major landowners have signed stewardship agreements to minimize grazing impacts on “Columbian” sharptails.

SUMMARY OF STATUS REPORT

The North American range of the Sharp-tailed Grouse, *columbianus* subspecies has declined by more than 90%. The declines are mostly attributed to loss and degradation of habitat. In British Columbia, where this subspecies occurs, it is currently considered extirpated as a breeding population from the Okanagan Valley and the East Kootenay Trench, which has isolated British Columbia’s populations and effectively precluded natural genetic exchange with remnant populations south of the border. It should be noted that single birds (and an unconfirmed hen with chicks) have been observed in recent years in the East Kootenay Trench; however, it is unlikely that there are sufficient birds present there yet to make up a viable breeding population. Furthermore, a 2005 survey of Sharp-tailed Grouse, *columbianus* subspecies within its historical range in the Kootenays did not result in any sightings (Ohanjanian 2006).

Studies of Sharp-tailed Grouse, *columbianus* subspecies in British Columbia are limited. This is particularly true for the reportedly healthier forest ecotype populations. However, the grassland ecotype population has been studied to some extent in MoE Regions 3 and 5. Long-term lek counts show that these populations have exhibited declines since formal monitoring began in 1986. As in other areas of their range, habitat loss, fragmentation, and degradation continue to occur throughout the grassland systems. Approximately 47% of suitable grassland habitats occur on private property that is routinely grazed and an additional 43% are under long-term grazing leases. Grazing leases refer to leases of Crown land issued for grazing purposes under the *Land Act* for a specified length of time. As a result, regulatory agencies have limited jurisdiction to direct changes to management until leases are up for renewal. Although progress is being made through stewardship efforts, there are currently no tangible monetary incentives for private landowners or lease holders to protect habitat for the Sharp-tailed Grouse, *columbianus* subspecies in the province.

The forest ecotype, which occurs in cutovers and sedge meadows adjacent to forested areas, occupy vast expanses of habitat and, as a result, their demographics and biology are poorly understood. However, because large openings were created by large-scale harvesting in response to past beetle outbreaks, these populations are likely stable or expanding. It is thought that when these large cutovers were created adjacent to sedge meadow habitats, which historically had been occupied by “Columbian” sharptails, these birds acted as a source population that expanded into the cutover habitat. The current mountain pine beetle epidemic will likely result in additional habitat being created and concomitant increases in forest ecotype population numbers. One risk associated with this type of human-caused expansion in habitat is that newly colonized areas (cutovers) are ephemeral in nature and thus populations using them may not be considered part of a stable metapopulation. Conversely, harvesting activities may mimic large-scale stand-

replacing fires typical of the area, to which the birds would have responded by colonizing the burned areas.

Salient points to consider for both ecotypes:

- Grassland populations have been extirpated in the southern portions of their provincial range as a result of urban and agricultural sprawl.
- Existing grassland populations in British Columbia are effectively isolated from populations in adjacent U.S. jurisdictions and may be subject to extinction events associated with isolated populations. Re-establishment of connectivity between U.S. and Canadian populations is unlikely, given the extent of development in the south Okanagan.
- From a North American perspective, core populations occur only in British Columbia and Idaho/Utah.
- Forest and grassland ecotype populations in British Columbia are effectively isolated from each other. Habitat recovery to encourage connectivity between the two populations is unlikely under current land use management.
- Nationally, the Sharp-tailed Grouse, *columbianus* subspecies is represented only in British Columbia. Although B.C. supports nearly 60% of the current continental breeding habitat, the province's grassland populations (i.e., grassland ecotype) have experienced, and will likely continue to experience, declines as a result of habitat loss and degradation.
- Large cutovers and sedge meadow complexes adjacent to or within forested areas likely support stable or expanding populations. It is not clear if these populations represent sink populations; current knowledge of forest ecotype population dynamics is inadequate. Habitats in large-scale harvesting areas may be ephemeral—and accidentally beneficial—but the harvesting may also mimic large-scale stand-replacing fires. In the future, increased harvesting due to the mountain pine beetle epidemic will likely create additional habitat for Sharp-tailed Grouse, but use of the newly created cutblocks by this species will depend on the size and terrain of the area harvested. Generally speaking, cutblock sizes in British Columbia have become smaller and the resulting cutblock matrix may not be suitable for Sharp-tailed Grouse.
- In grassland habitats, Sharp-tailed Grouse are threatened by the subdivision and sale of prime habitat and by grazing practices on private and leased lands that are inappropriate for conserving the birds. Less than 6% of extant locations are in protected areas. However, under the current pressures, maintaining working ranches with stewardship agreements may provide a long-term viable approach to habitat conservation for the Sharp-tailed Grouse, *columbianus* subspecies.

- British Columbia is the last geographic area where most “Columbian” sharptails still depend on native habitat. A large proportion of populations in the United States are found in planted habitats such as restored croplands and mine reclamation areas.

TECHNICAL SUMMARY

Tympanuchus phasianellus columbianus

Sharp-tailed Grouse, *columbianus* subspecies

Tétras à queue fine columbienne

British Columbia

Extent and area information	
Extent of occurrence (EO) (km ²)	60 000 km ²
Specify trend (declining, stable, increasing, unknown)	Grassland Ecotype: declining Forest Ecotype: stable or increasing Subspecies: increasing
Are there extreme fluctuations in EO (>1 order of magnitude)?	No
Area of occupancy (AO) (km ²)	Grassland Ecotype: 2000 km ² Forest Ecotype: 12 000 km ² Subspecies: 14 000 km ²
Specify trend (declining, stable, increasing, unknown)	Grassland Ecotype: declining, due to habitat loss to urban and suburban expansion Forest Ecotype: likely increasing due to increase in timber harvest in response to mountain pine beetle epidemic Subspecies: increasing
Are there extreme fluctuations in AO (>1 order magnitude)?	No
Number of extant locations	Grassland Ecotype: 37 known leks Forest Ecotype: 30 known leks; many more unknown as many areas are unsurveyed Subspecies: 67 known leks
Specify trend in number of locations (declining, stable, increasing, unknown)	Grassland Ecotype: declining; lek abandonment (an estimated 50–100 leks still occur); development has encroached on active leks Forest Ecotype: likely will increase as a result of mountain pine beetle control (number of leks unknown, estimated at 350–600) Subspecies: estimate of 400–700 leks; likely increasing in near future as a result of mountain pine beetle epidemic

Are there extreme fluctuations in number of locations (>1 order of magnitude)?	No
Habitat trend: specify declining, stable, increasing, or unknown trend in area, extent, or quality of habitat	Grassland Ecotype: declining Forest Ecotype: increasing Subspecies: likely increasing in future; increasing as a result of clearcutting to control mountain pine beetle infestations
Population information	
Generation time (average age of parents in the population; indicate years, months, days, etc.)	3–4 years
Number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)	Grassland Ecotype: 1500–2500 Forest Ecotype: 7000–11 500 Subspecies: 8500–14 000
Total population trend: specify declining, stable, increasing, or unknown trend in number of mature individuals	Grassland Ecotype: stable or declining Forest Ecotype: unknown; at least stable, but likely increasing as harvest of mountain pine beetle-infested areas increases Subspecies: stable; may increase with harvesting activities in mountain pine beetle-infested forests
If declining, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)	Grassland Ecotype: 28% decline in males based on lek counts and 23% loss of leks since 1990; stable in last 10 years Forest Ecotype: unknown; likely decreasing in aging clearcuts and increasing in new clearcuts; potential for large increases due to mountain pine beetle management efforts Subspecies: stable; likely to increase as a result of forest ecotype expansion
Are there extreme fluctuations in number of mature individuals (>1 order of magnitude)?	No
Is the total population severely fragmented (most individuals found within small and relatively isolated [geographically or otherwise] populations between which there is little exchange, i.e., <1 successful migrant/year)?	Forest and grassland ecotypes isolated from each other within B.C. Subspecies also isolated from closest U.S. populations in Washington and Montana

List each population and the number of mature individuals in each	Grassland Ecotype: 1500–2500 Forest Ecotype: 7000–11 500 Subspecies: 8500–14 000 Average number per subpopulation: Grassland Ecotype: 20 birds/lek Forest Ecotype: 22 birds/lek Subspecies: 21 birds/lek
Specify trend in number of populations (declining, stable, increasing, unknown)	Grassland Ecotype: declining or stable: surveys from 1990, 1994, 1998, and 2004 averaged 17, 8, 9, and 11 males per lek, respectively Forest Ecotype: unknown; likely declining in ageing clearcuts and increasing in new clearcuts; potential for large increase due to mountain pine beetle management; lek sizes range from 6 to 60 birds Subspecies: stable; no new populations identified
Are there extreme fluctuations in number of populations (>1 order of magnitude)?	No
Threats (actual or imminent threats to populations or habitats)	
Grassland Ecotype: - Habitat loss (agricultural and urban sprawl; forest ingrowth) - Habitat degradation (inappropriate grazing practices; forest ingrowth) - Predation Forest Ecotype: - Habitat loss (intensive silvicultural practices; fire suppression) - Habitat degradation (inappropriate grazing practices; haying of sedge meadows; grazing of sedge meadow/riparian complexes) - Open hunting seasons - Predation - Site preparations (trenching)	
Rescue Effect (immigration from an outside source)	Unlikely
Does species exist elsewhere (in Canada or outside)?	Yes (Washington, Idaho, Montana, Colorado, Nevada)
Status of the outside population(s)?	Declining / Threatened

Is immigration known or possible?	Yes, but colonization by breeding populations unlikely in near future unless reintroductions to U.S. border populations are extremely successful, as all outside Canada sources are declining
Would immigrants be adapted to survive here?	Yes
Is there sufficient habitat for immigrants here?	Yes
Quantitative Analysis	Not Done

Table prepared by Ernest Leupin and Doug Jury, August 2005.

LITERATURE CITED

- Aldous, S.E. 1943. Sharp-tailed Grouse in the sand dune country of north-central North Dakota. *J. Wildl. Manage.* 7:23–31.
- Aldrich, J.W. 1963. Geographic orientation of American Tetraonidae. *J. Wildl. Manage.* 27(4):529-545.
- Baydeck, R.K., and D.A. Hein. 1987. Tolerance of Sharp-tailed Grouse to lek disturbance. *Wildl. Soc. Bull.* 15:535–539.
- B.C. Stats. 2001. 2001 census profiles.
http://www.bcstats.gov.bc.ca/data/cen01/profiles/csd_txt.asp
- Berg, W.E. 1990. Sharp-tailed Grouse management problems in the Great Lakes states: Does the sharp-tail have a future? *Loon* 62:42–45.
- Bergerud, A.T. 1988. Population ecology in North American Grouse. Pages 578–685 in A.T. Bergerud and M.W. Gratson, eds. *Adaptive strategies and population ecology in northern grouse*. Vol. 2. Univ. Minnesota Press, Minneapolis, MN.
- Bown, R.R. 1980. The status of the Columbian Sharp-tailed Grouse in the Tobacco Plains, Eureka, Montana. B.Sc. Thesis. Univ. Montana, Missoula, MT. 42pp.
- Bunnell, F.L. 1997. Operational criteria for sustainable forestry: Focusing on the essence. *For. Chron.* 73:679–684.
- Buss, I.O., and E.S. Dziedzic. 1955. Relation of cultivation to the disappearance of the Columbian Sharp-tailed Grouse from southeastern Washington. *Condor* May 1955.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. *The Birds of British Columbia*. Vol 2. Royal B.C. Museum, Victoria, BC. 636pp.
- Cannings, R.J. 1998. *The birds of British Columbia: A taxonomic catalogue*. B.C. Minist. Environ., Lands and Parks, Victoria, BC. 266pp.
- Cannings, S. 2002. Sharp-tailed Grouse Ranking Report. B.C. Conservation Data Centre. Unpubl. manuscript, Victoria, BC.
- Connelly, J.W., M.W. Gratson, and K.P. Reese. 1998. Sharp-tailed Grouse (*Tympanuchus phasianellus*). in A. Poole and F. Gill, eds. *The Birds of North America*. No. 354. The Birds of North America, Inc., Philadelphia, PA. 20pp.

- Cope, M.G. 1992. Distribution, habitat selection and survival of transplanted Columbian Sharp-tailed Grouse in the Tobacco Valley, Montana. M.Sc. Thesis. Montana State Univ., Bozeman. MT. 60pp.
- Dost, F.N. 1995. Public health and environmental impacts of monosodium methanearsonate as used in bark beetle control in British Columbia. For. Serv. Rep. FS48 HIS 95/2.
- Evans, K.E. and A.N. Moen. 1975. Thermal exchange between Sharp-tailed Grouse (*Pediocetes phasianellus*) and their winter environment. *Condor* 77:160–168.
- Gayton, D. 1998. Preliminary calculation of excess forest in-growth and resulting forage impact in the Rocky Mountain Trench. Unpubl. Draft Rep., B.C. Minist. For., Nelson Region. 6pp.
- Gayton, D., T. Braumandl, and R. Stewart. 1995. EMBER: Ecosystem maintenance burning evaluation and research. Problem analysis and working plans. B.C. For. Serv., Nelson Region. 52pp.
- Giesen, K.M. 1987. Population characteristics and habitat use by Columbian Sharp-tailed Grouse in northwest Colorado. Final Rep., Colorado Div. of Wildl. Fed. Aid Project W-1 52-R.
- Giesen, K.M., and I.W. Connelly. 1993. Guidelines for management of Columbian Sharp-tailed Grouse habitats. *Wildl. Soc. Bull.* 21:325–333.
- Gillen, R.L., W.C. Krueger, and R.F. Miller. 1985. Cattle use of riparian meadows in the Blue Mountains of Northeastern Oregon. *J. Range Manage.* 38:205–210.
- Grasslands Conservation Council of B.C. 2004. B.C. grasslands mapping project: A conservation risk assessment. <<http://www.bcgrasslands.org/library/internal.htm>> [Accessed May 2005]
- Gratson, M.W. 1988. Spatial patterns, movements, and cover selection by Sharp-tailed Grouse. Pages 158–192 in A.T. Bergerud and M.W. Gratson, eds. *Adaptive strategies and population ecology of northern grouse*. Univ. Minnesota Press, Minneapolis, MN.
- Gratson, M.W., G.K. Gratson, and A.T. Bergerud. 1991. Male dominance and copulation disruption do not explain variance in male mating success on Sharp-tailed Grouse (*Tympanuchus phasianellus*) leks. *Behaviour* 118:187–213.
- Hamerstrom, F.N. 1939. A study of Wisconsin's Prairie Chickens and Sharp-tailed Grouse. *Wilson Bull.* 51:105–120.
- Hart, C.M., O.S. Lee, and J.B. Low. 1950. The Sharp-tailed Grouse in Utah: Its life history, status and management. Utah State Dep. Fish and Game, Pub. No. 3.
- Hays, D.W., M.J. Tirhi, and D.W. Stinson. 1998. Washington State status report for the Sharp-tailed Grouse. Wash. Dep. of Fish and Wildl., Olympia, WA. 57pp.
- Henderson, F.R., F.W. Brooks, R.E. Wood, and R.B. Dahlgren. 1967. Sexing of prairie grouse by crown feather patterns. *J. Wildl. Manage.* 31:764–769.
- Hjorth, I. 1970. Reproductive behaviour in Tetraonidae. *Viltrevy* 7:183–596.
- Hoffman, R. W. (Tech. ed.). 2001. Northwest Colorado Columbian Sharp-tailed Grouse conservation plan. Fort Collins, CO.
- Holmes, R. 2002. B.C. grasslands mapping project. Year 3 midterm statistical report. Grasslands Conservation Council Report. Kamloops, BC.

- Johnsgard, P.A. 1973. Grouse and quail of North America. Univ. Nebraska Press, Lincoln, NE.
- Johnsgard, P.A. 1983. Grouse of the world. Univ. Nebraska Press, Lincoln, NE.
- Klott, J.H., and F.G. Lindzey. 1990. Brood habitats of sympatric Sage Grouse and Columbian Sharp-tailed Grouse in Wyoming. *J. Wildl. Manage.* 54:84–88.
- Kobriger, J. 1995. Graph of lek counts 1956–95, Billings Co., North Dakota. *In Proc.*, 21st biennial meeting, Prairie Grouse Technical Council, 28–31 Aug. 1995, Medora, ND.
- Leupin E.E. 2000a. Population trends of the Sharp-Tailed Grouse in the Thompson-Nicola Region. B.C. Minist. Environ., Lands, and Parks, Kamloops, BC. Unpubl. Rep.
- Leupin E.E. 2000b. 1998–2000 Sharp-Tailed Grouse lek inventory project. B.C. Minist. Environ., Lands, and Parks, Kamloops, BC. Unpubl. Rep.
- Leupin E.E. 2001. Columbian Sharp-tailed Grouse nesting and brood-rearing habitat in the Lac du Bois Grassland Provincial Park. B.C. Parks, and Minist. Water, Land and Air Protection, Kamloops, BC. Unpubl. Rep.
- Leupin, E.E. 2003. Status of the Sharp-tailed Grouse (*Tympanuchus phasianellus*) in British Columbia. B.C. Minist. Water, Land and Air Protection, Biodiversity Branch, and B.C. Minist. Sustainable Resour. Manage., Conservation Data Centre, Victoria, BC. *Wildl. Bull.* B-104. 32pp.
- Leupin E.E., and K. Hawes. 2005. Inventory of Columbian Sharp-tailed Grouse in forested habitats of the Cariboo Region. B.C. Minist. Water, Land and Air Protection, Kamloops, BC. Unpubl. Rep.
- Lumsden, H.G. 1965. Displays of the Sharp-tailed Grouse. Ontario Dep. Lands and For., Tech. Ser. Res. Rep. 66.
- Manley, T., and M. Wood. 1990. The status of Columbian Sharp-tailed Grouse on the Tobacco Plain, Eureka, Montana. Montana Dep. Fish and Wildl., Kalispell, MT. Final Rep. 25pp.
- Marks, J.S., and V.S. Marks. 1987. Habitat selection by Columbian Sharp-tailed Grouse in west-central Idaho. U.S. Bur. Land Manage., Boise Dist., Boise, ID.
- Marks, J.S., and V.S. Marks. 1988. Winter habitat use by Columbian Sharp-tailed Grouse in western Idaho. *J. Wildl. Manage.* 52:743–746.
- Medin, D.E., and W.P. Clary. 1990. Bird and small mammal populations in a grazed and ungrazed riparian habitat in Idaho. U.S. Dep. Agric., For. Serv., Ogden, UT. Res. Paper INT-425.
- Meints, D.R. 1991. Seasonal movements, habitat use and productivity of Columbian Sharp-tailed Grouse in southeastern Idaho. M.Sc. Thesis, Univ. Idaho, Moscow, ID. 74pp.
- Meints, D.R., J.W. Connelly, K.P. Reese, A.R. Sands, and T.P. Hemker. 1992. Habitat suitability index procedure for Columbian Sharp-tailed Grouse. Idaho For., Wildl. and Range Exp. Stn, Univ. Idaho, Moscow, ID. *Stat. Bull.* 55. 27pp.
- Miller, G.C., and W.D. Graul. 1980. Status of Sharp-tailed Grouse in North America. Pages 18–28 *in* P.A. Vohs and F.L. Knopf, eds. *Proc. Prairie Grouse Symp.*, Oklahoma State Univ., Stillwater, OK.

- Ministry of Environment, Lands and Parks (MELP). 1996. Wildlife harvest strategy: Improving British Columbia's wildlife harvest regulations. Wildlife Program, Victoria, BC. 73pp.
- Ministry of Forests (MoF). 1999a. Forest in-growth and encroachment: a provincial overview from a range management perspective. Range Section, Forest Practices Branch, Victoria, BC.
- Ministry of Forests (MoF). 1999b. Average cutblock size on Crown land from 1988 to 1998 by region. Range Section, Forest Practices Branch, Victoria, BC.
<www.for.gov.bc.ca/hfp/forsite/jtfacts/1-harv-index.htm> [Accessed March 2005]
- Ministry of Forests and Range (MoFR). 2004. News release: Cut level increased in response to beetle epidemic.
<http://www2.news.gov.bc.ca/nrm_news_releases/2004FOR0040-000707.htm> [Accessed May 2005]
- Ministry of Water, Land and Air Protection (MWLAP). 2001. Has the range of the Columbian Sharp-tailed Grouse changed? [Accessed 2006]
<<http://www.env.gov.bc.ca/soerpt/5wildlife/grouse.html>>
- Mossop, D. 1979. Seral habitat usage by Sharp-tailed Grouse in the Yukon Territory: An hypothesis. Pages 196–199 *in* M. Hoefs and D. Russell, eds. Wildlife and wildfire: Proc. of workshop, 27–28 Nov. 1979, Whitehorse. Yukon Wildl. Branch, Whitehorse, YT.
- Moyles, D.L.J. 1981. Seasonal and daily use of plant communities by Sharp-tailed Grouse (*Pedioecetes phasianellus*) in the parklands of Alberta. *Can. Field-Nat.* 95:287–291.
- Moyles, D.L.J., and D.A. Boag. 1981. Where, when and how male Sharp-tailed Grouse establish territories on arenas. *Can. J. Zool.* 59:1576–1581.
- Oedekoven, O.O. 1985. Columbian Sharp-tailed Grouse population distribution and habitat use in south central Wyoming. M.Sc. Thesis, Univ. Wyoming, Laramie, WY. 58pp.
- Ohanjanian, I.A. 1990. The Columbian Sharp-tailed Grouse in the East Kootenay: A report on their status and options for reintroduction. Bioquest International Consulting, Kimberley, BC. 55pp.
- Ohanjanian, P. 2006. An inventory of Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*) in the East Kootenay. Prepared for Columbia Basin Fish and Wildlife Compensation Program. 27pp.
- Pepper, G.W. 1972. The ecology of Sharp-tailed Grouse during spring and summer in the aspen parklands of Saskatchewan. *Sask. Dep. Nat. Resour., Regina, SK. Wildl. Rep.* 1. 55pp.
- Ritcey, R. 1995. Status of the Sharp-tailed Grouse, *columbianus* subspecies, in British Columbia. *Minist. Environ., Lands and Parks, Victoria, BC. Wildl. Working Rep.* No. WR-70.
- Rippin, A.B. 1970. Social organization and recruitment on the arena of Sharp-tailed Grouse. M.Sc. Thesis, Univ. Alberta, Edmonton, AB.

- Robel, R.J., F.R. Henderson, and W. Jackson. 1972. Some Sharp-tailed Grouse population statistics from South Dakota. *J. Wildl. Manage.* 36:87–98.
- Rogers, G.E. 1969. The Sharp-tailed Grouse in Colorado. Colorado Game, Fish and Parks Dep. Tech. Publ. 23. 94pp.
- Ross, T.J. 1997. Forest in-growth and forest encroachment on Bald Mountain and Bechers Prairie between 1962 and 1993/95. Prep. for B.C. Minist. Agric., Cariboo/Chilcotin Grazing Enhancement Fund. Ross Range and Reclamation Services, Cranbrook, BC. 40pp.
- Saab, V.A., and J.S. Marks. 1992. Summer habitat use by Columbian Sharp-tailed Grouse in western Idaho. *Great Basin Nat.* 52:166–173.
- Schroeder, M.A. 1994. Progress report. Productivity and habitat use of Sharp-tailed Grouse in north-central Washington. Wash. Dep. Fish and Wildl., Olympia, WA. Unpubl. Rep.
- Schroeder, M.A. 1996. Progress report. Productivity and habitat use of Sharp-tailed Grouse in north-central Washington. Wash. Dep. Fish and Wildl., Olympia, WA. Unpubl. Rep.
- Schroeder, M.A., D.W. Hays, M.A. Murphy, and D.J. Pierce. 2000. Changes in the distribution and abundance of Columbian Sharp-tailed Grouse in Washington. Northwest. Nat. 81:95–103.
- Sexton, D.A., and M.M. Gillespie. 1979. Effects of fire on the location of a Sharp-tailed Grouse arena. *Can. Field-Nat.* 93:74–76.
- Szaro, R.C., and C.F. Pase. 1983. Short-term changes in a cottonwood-ash-willow association on a grazed and an ungrazed portion of Little Ash Creek in central Arizona. *J. Range Manage.* 36:382–384.
- Tirhi, M.J. 1995. Washington State management plan for Sharp-tailed Grouse. *Wildl. Manage. Prog.*, Washington Dep. Fish and Wildl, Olympia, WA.
- Tirhi, M.J. and D.W. Hays, 1997. Draft Washington State Status report for the Sage Grouse. Washington Dep. Fish and Wildl., Olympia, WA.
- Ulliman, M.J. 1995. Winter habitat ecology of Columbian Sharp-tailed Grouse in southeastern Idaho. M.Sc. Thesis, Univ. Idaho, Moscow, ID.
- Van Rossum, G. 1992. Habitat of the Columbian Sharp-tailed Grouse in the southern interior of British Columbia. B.C. Minist. Environ., Lands and Parks, Kamloops, BC. Unpubl. Rep.
- Vance D.R., and R.L. Westeneier. 1979. Interactions of pheasants and prairie chickens in Illinois. *Wildl. Soc. Bull.* 7:221–225.
- Wood, M.A. and T. Manley. 1993. Northwest Montana Wildlife Mitigation Habitat Protection: Advanced design appendices G, H, I, J: Final report. Prepared for U.S. Dep. Energy, Bonneville Power Administration, Div. Fish and Wildl., Portland, OR. Project No. 87-060. 57 pp.

BIOGRAPHICAL SUMMARY OF AUTHORS

Ernest Leupin, RPBio, holds an M.Sc. in biology from the University of British Columbia; his thesis work tested the effects of alternative silviculture methods on songbird communities. Ernest has worked extensively with species of grassland

ecosystems in the Thompson-Nicola region. He prepared the status report for Sharp-tailed Grouse in British Columbia and is currently working on a stewardship program and a recovery action plan for the Sharp-tailed Grouse, *columbianus* subspecies.

Michael Chutter, RPBio, is the provincial bird specialist for the B.C. Ministry of Environment, a position he has held since 1991. Michael has worked for the Ministry for 25 years following a four-year stint with D.A. Blood and Associates Environmental Consultants at the start of his career. As the province's senior authority on bird management, he is responsible for overseeing and advising on provincial bird management issues including hunter harvest, policy and regulations, and recovery planning for species at risk. He also represents the province on provincial, national, and international bird committees.

AUTHORITIES CONSULTED

Ted Antifeau. Wildlife Biologist, Ministry of Environment. Nelson, BC.

Syd Cannings. Formerly with B.C. Conservation Data Centre. Victoria, BC.

Pat Dielman. Wildlife Technician, Ministry of Environment. Williams Lake, BC.

Tom Dickinson. Associate Professor, University College of the Cariboo. Kamloops, BC.

John Elliott. Research Scientist, Canadian Wildlife Service. Delta, BC.

Marvin Eng. Landscape Ecologist, Ministry of Forests. Victoria, BC.

David Fraser. Endangered Species Specialist, Ministry of Environment. Victoria, BC.

Rose Gerlinger. Biologist, Colville Tribes, Washington.

Gary Gottfriedson. Tribal Council, Kamloops Indian Band. Kamloops, BC.

Doug Hays. Wildlife Biologist, Department of Fish and Wildlife. Olympia, WA.

Doug Jury. Wildlife Biologist, Ministry of Environment. Kamloops, BC.

Ken MacKenzie. Wildlife Biologist, Iverson and MacKenzie Biological Consulting Ltd. Lac La Hache, BC.

Graham McGregor. GIS Coordinator, Grasslands Conservation Council. Kamloops, BC.

Karen Mock. Associate Professor, Utah State University. Logan, UT.

Christy Morrissey. Canadian Wildlife Service/ University of British Columbia. Delta, BC.

Penny Ohanjanian. Wildlife Biologist. Kimberley, BC.

Michael Schroeder. Upland Bird Research Specialist, Washington Department of Fish and Wildlife. Ephrata, WA.

Bryan Webster. Ecosystem Officer, Ministry of Water, Land and Air Protection. Fort St. John, BC.