

COSEWIC
Assessment and Status Report

on the

Greater Prairie-Chicken
Tympanuchus cupido pinnatus

in Canada



EXTIRPATED
2009

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada



COSEPAC
Comité sur la situation
des espèces en péril
au Canada

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COSEWIC Assessment Summary

Assessment Summary – November 2009

Common name

Greater Prairie-Chicken

Scientific name

Tympanuchus cupido pinnatus

Status

Extirpated

Reason for designation

This species was once an abundant breeder in prairie habitats of Alberta, Saskatchewan, Manitoba and Ontario. New genetic evidence indicates that the species was a native of Canada for the past 9000 years and did not colonize the prairies habitat with European settlement as previously thought. Habitat loss and degradation and hybridization with the Sharp-tailed Grouse contributed to its extirpation from Canada.

Occurrence

Alberta, Saskatchewan, Manitoba, Ontario

Status history

Last reported in 1987. Designated Endangered in April 1978. Status re-examined and designated Extirpated in April 1990. Status re-examined and confirmed in May 2000 and in November 2009.



COSEWIC
Executive Summary

Greater Prairie-Chicken
Tympanuchus cupido pinnatus

Species information

The Greater Prairie-Chicken is a medium-sized grouse closely related to the Sharp-tailed Grouse. The Greater Prairie-Chicken is slightly larger than the Sharp-tailed Grouse and differs from the latter by barred underparts, rounded tail, presence of elongated dark neck feathers, and golden neck sacs in males.

Distribution

The Greater Prairie-Chicken formerly occurred in Alberta, Saskatchewan, Manitoba, and Ontario, but was extirpated from most of its Canadian range by the mid-20th century. Disjunct populations of this species still occur in the United States (North Dakota, Minnesota and Wisconsin, south to Kansas, Oklahoma and Missouri, west to Colorado and east to Wisconsin and Illinois).

Habitat

The Greater Prairie-Chicken was originally common in native prairie. In the United States, its habitat is now composed of remnant prairie, often mixed with cropland, in the tall-grass prairie and the mixed-grass prairie biomes where land-use changes have supplemented food and cover. This species is highly area-sensitive, and is consistently absent from small fragments of otherwise suitable habitat. At least 5000–6000 ha of suitable habitat are required to support a minimum viable population. The primary cause of habitat loss for the Greater Prairie-Chicken in Canada was the conversion of native prairie for crop cultivation and pasture.

Biology

In early spring, males congregate on relatively small display sites or leks, and actively defend territories from other males. Females attend leks and usually mate with the dominant male, and then disperse to nesting sites. Nests are built on the ground under cover of grass, and the clutch size is on average 11-12 eggs. Incubation lasts 23–25 days. The young are precocious, and leave the nest shortly after hatching. A portion of the population is resident while others move 12-170 km between breeding and wintering areas during October-November. The species possesses high annual mortality.

Population sizes and trends

The global population estimate for this species ranges from 200,000 to 690,000 individuals. The Greater Prairie-Chicken is considered extirpated from Canada. It is also extirpated from seven states in the U.S. and has decreased in eight other states over the last third of the 20th century. Breeding Bird Survey (BBS) data from the U.S. show a non-significant decline across the U.S. range from 1966-2007, but the trend estimates are of questionable validity because of the small sample sizes.

Limiting factors and threats

Threats to the Greater Prairie-Chicken include habitat fragmentation, resulting in population isolation and loss of genetic variability, competition and hybridization with Sharp-tailed Grouse, nest parasitism by exotic Ring-necked Pheasants, and predation. The main limiting factor for the recovery of the Greater Prairie-Chicken in Canada appears to be a shortage of extensive, lightly grazed blocks of grassland.

Special significance of the species

The Greater Prairie-Chicken is a flagship species for prairie conservation. It is enjoyed by hunters and bird-watchers, and it has cultural significance to some First Nations, including the Blackfoot Nation.

Existing protection

The Greater Prairie-Chicken is given status and protection under Saskatchewan's *Wildlife Act* 1998 and is protected as an extirpated species under Ontario's *Endangered Species Act*, 2007. In 1993, a National Recovery Plan for the Greater Prairie-Chicken was prepared under the Recovery of Nationally Endangered Wildlife (RENEW) program, which recommended that no recovery actions for the species be undertaken. COSEWIC assessed this species as Extirpated in May 2000. In June 2003, the Greater Prairie-Chicken was listed as Extirpated under the *Species at Risk Act* (SARA). BirdLife International classifies this species as "vulnerable", the National Audubon Society lists the Greater Prairie-Chicken on its 2002 watch list, and Partners in Flight has listed it on the 2004 watch list of extremely high priority species.



COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2009)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.



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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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SPECIES INFORMATION

Name and classification

The English name for the species *Tympanuchus cupido* (Linnaeus 1758) is the Greater Prairie-Chicken. The French name is Tétrás des prairies. Its taxonomy is as follows:

Class: Aves
Order: Galliformes
Family: Phasianidae
Genus: *Tympanuchus*
Species: *Tympanuchus cupido*
Subspecies: *pinnatus*

Two to three species of prairie grouse of the genus *Tympanuchus* occur in North America: Greater Prairie-Chicken, Lesser Prairie-Chicken (*T. pallidicinctus*) and Sharp-tailed Grouse (*T. phasianellus*; American Ornithologists' Union 1998). The Greater and Lesser Prairie-Chicken constitute a superspecies, and are considered to be conspecific by some authors (e.g., Johnsgard 1983), but are treated as separate species by others (e.g., Schroeder and Robb 1993, Johnson 2008). The Lesser Prairie-Chicken does not occur in Canada (Hagen and Giesen 2005). Genetic differentiation between these three species is among the lowest in closely related species of birds, and they hybridize where ranges overlap (Johnsgard and Wood 1968, Lumsden 2005a).

The three recognized subspecies of *T. cupido* are the Greater Prairie-Chicken (*T. c. pinnatus*), Attwater's Prairie-Chicken (*T. c. attwateri*), and the Heath Hen (*T. c. cupido*). *T. c. pinnatus* occupies most of the species' range. Attwater's Prairie-Chicken is endangered, and survives in the wild at only two locations in coastal Texas, and the Heath Hen is extinct (Schroeder and Robb 1993).

Morphological description

The Greater Prairie-Chicken is a medium-sized grouse predominantly olive-brown with cross-bars of buffy brown and white on back, wings, breast, belly, and tail. Males have crown and tail feathers that are not barred, and females have alternating cross-bars on crown and tail feathers. Males also have orange superciliary combs (Ridgway and Friedmann 1946). The Greater Prairie-Chicken is slightly larger than the Sharp-tailed Grouse and differs from the latter based on its barred underparts, rounded tail, the presence of elongated dark neck feathers, and golden neck sacs in males (Schroeder and Robb 1993).

Genetic description

Analysis of mitochondrial DNA sequences from 10 to 20 Greater Prairie-Chickens each from Nebraska, Kansas, Oklahoma and South Dakota indicate that these populations diverged very recently (since recession of the Pleistocene glaciers), and undergo female-mediated gene flow (Johnson 2008). In contrast, mitochondrial DNA sequences of 100 birds in the United States versus Canada differ slightly but significantly (Ross *et al.* 2006).

Ross *et al.* (2006) used DNA sequence data in combination with provenance data from 238 museum specimens and historical records to argue that Greater Prairie-Chickens are native to the northern prairies, extending from central Minnesota to Alberta since ca. 9000 years before present. This finding contrasts with the hypothesis that the species expanded into Canada with European settlement, but is supported by several lines of evidence. First, historical records report Greater Prairie-Chickens in Canada in the early to mid-1800s. The rates of range expansion and population growth needed to explain the provenance of museum specimens if Greater Prairie-Chickens expanded into Canada since European settlement seem incompatible with realistic estimates of dispersal distances and population growth rates for this species. Also, the variation in mitochondrial DNA suggests population expansion before European settlement, ~9000 years ago. Finally, mitochondrial DNA sequences differ weakly but significantly between birds in Canada versus the United States, suggesting that these populations have been relatively isolated since before European occupation of Canada (Ross *et al.* 2006; Johnson 2008).

Analyses of mitochondrial DNA sequences using methods based on coalescent theory suggest that the Greater Prairie-Chicken, Attwater's Prairie-Chicken, and the Heath Hen are as genetically different from each other as they are from the Lesser Prairie-Chicken and the Sharp-tailed Grouse, and that these taxa diverged in the late Pleistocene, between 10,000 and 80,000 years ago (Johnson 2008). Johnson's results also indicate that little female-mediated gene flow occurs among these taxa, whereas female-mediated gene flow occurs among populations of Greater Prairie-Chicken in Oklahoma, Kansas, Nebraska and South Dakota.

Designatable units

There is one subspecies of Greater Prairie-Chicken in Canada and no known distinctions between populations within that subspecies that would warrant consideration of designatable units beyond this level. This report is based on a single designatable unit.

DISTRIBUTION

Global range

The historic range of the Greater Prairie-Chicken was thought to include the original extent of the tall-grass prairie, except at its northern limit where it was near the southern edge of Minnesota and the eastern edge of South Dakota. It was assumed that the species expanded its range into the mixed-grass prairies following European colonization of the U.S. mid-west and the Canadian prairie provinces (Hamerstrom and Hamerstrom 1973, Schroeder and Robb 1993, Environment Canada 2007). However, recent genetic studies of museum specimens (Ross *et al.* 2006) suggest that this species was also native to the northern prairies, and extended from central Minnesota to Alberta for at least 9000 years.

Thus, the historic range of the Greater Prairie-Chicken included the mixed-grass and tall-grass prairies of southern Alberta, Saskatchewan, Manitoba, and western Ontario (Lake of the Woods area), south to eastern Wyoming, northern Texas, and Arkansas, and east to Michigan, extreme southern Ontario, western Pennsylvania, Kentucky, and Tennessee (Lumsden 1966, Schroeder and Robb 1993, Westemeier and Gough 1999, Svedarsky *et al.* 2003, NatureServe 2008). Presently, *T. c. pinnatus* occurs from eastern North Dakota and western Minnesota, south through central South Dakota, central and southeastern Nebraska, to northeastern Colorado, northern and eastern Kansas, southern Iowa, northern and west-central Missouri, northeastern Oklahoma, and east to central Wisconsin and southern Illinois (Johnsgard 1983, Schroeder and Robb 1993, Svedarsky *et al.* 2003, Alleger 2008). The core of the Greater Prairie-Chicken population is now found in parts of Kansas, Nebraska, and South Dakota (Svedarsky *et al.* 2000). Its current range consists of disjunct populations primarily in the tall-grass prairie biome, but also in the mixed-grass prairie where land-use changes have supplemented food and cover (Figure 1).

Canadian range

In Ontario, the Greater Prairie-Chicken inhabited the tall-grass prairie and oak savannah of extreme southern Ontario in the current Essex, Chatham-Kent and Lambton counties, and expanded its range northeastward to Toronto (ca. 1840–1858), and the Holland Marsh area of southern Lake Simcoe (ca. 1832–1889) (Baillie 1947, Lumsden 1966). By 1900, much of the land had been cleared for agriculture, and the species' range subsequently retracted. The last population in extreme southern Ontario occurred at Walpole Island until the mid- to late 1920s (Lumsden 1966, Environment Canada 2007). Around 1925, the Greater Prairie-Chicken was recorded on St. Joseph's Island and the adjacent mainland in the Sault Ste. Marie area, and by 1942 they had colonized Manitoulin Island (Baillie 1947, Lumsden 1966, 2003, Houston 2002). Subsequently, Manitoulin Island was colonized by two different waves of Sharp-tailed Grouse, and the two species readily hybridized. By 1948, 58–60% of the Manitoulin Island birds already were hybrids (Lumsden 2003), and by the 1970s, Greater Prairie-Chickens were extirpated from Manitoulin Island, likely as a result of hybridization

(Lumsden 2005a, b). The Greater Prairie-Chicken also occurred in northwestern Ontario (northwest of Lake Superior in Rainy River and southern Kenora districts) until 1959 (Houston 2002).

In Manitoba, the Greater Prairie-Chicken was abundant during the 1870s, and reached its northernmost range at Swan River and Grand Rapids (Godfrey 1966, Environment Canada 2007), but began declining by 1920, and mostly disappeared from that province by 1950, although occasional sightings were reported during the 1960s to the 1980s (Houston 2002).

In Saskatchewan, the species occurred north to Lloydminster, Montreal Lake, and Prince Albert National Park, and was common to at least 1920, after which it declined. The species was observed infrequently in the province through to the 1960s, and rarely in the 1970s and 1980s (Houston 2002), with the last unverified sightings in 1991 and 1992 (Koes and Taylor 1991, 1992).

In Alberta, this species ranged north to Lac la Biche and west as far as Calgary. It also occurred just outside Waterton National Park, along the U.S.–Canadian boundary (Salt and Salt 1976, Houston 2002). The Greater Prairie-Chicken apparently was never common in Alberta (Hamerstrom *et al.* 1957), and it virtually disappeared from that province after the mid-1950s (Salt and Salt 1976).

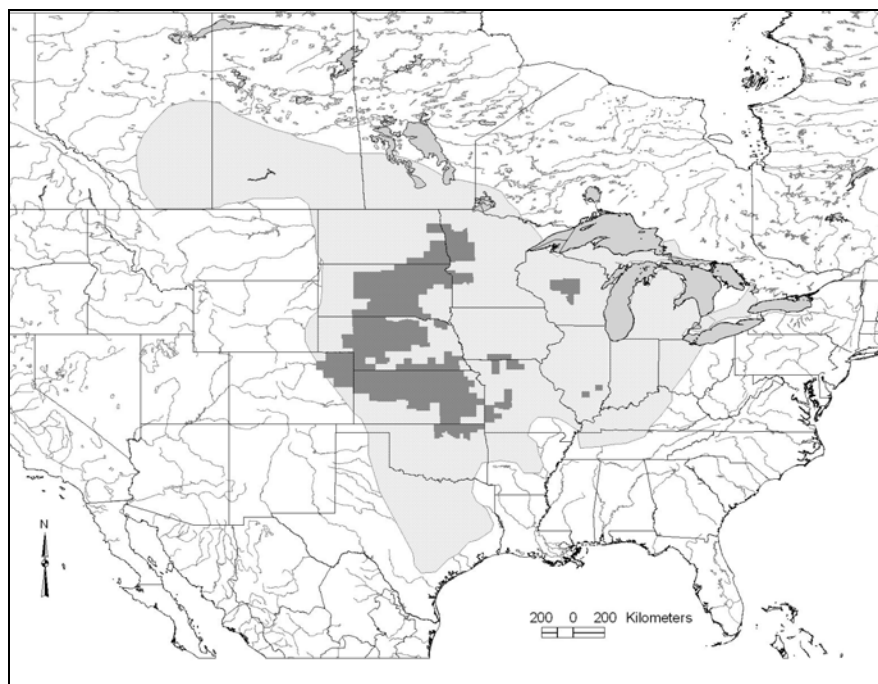


Figure 1. Past (light grey area) and current (dark grey areas) distribution of the Greater Prairie-Chicken in North America (based on maps provided by Schroeder and Robb 1993, Westemeier and Gough 1999, NatureServe 2008, Svedarsky *et al.* 2003, Environment Canada 2007 and Allegor 2008).

HABITAT

Habitat requirements

One of the most important habitat components for this species is a large area of grassland with substantial residual cover (Niemuth 2000). Suitable habitat for the Greater Prairie-Chicken generally consists of grassland, especially patches of tall- or mixed-grass prairie, or actively restored rangelands (Toepfer *et al.* 1990), and includes lek, nesting, brood-rearing, and wintering habitat (Hamerstrom *et al.* 1957). All of these habitat types need to be within the home range of the birds to ensure that their annual requirements are met. Most Greater Prairie-Chicken activities occur within a range of 3–5 km, and almost all activities occur within 8 km (Hamerstrom and Hamerstrom 1973). Half of the current Greater Prairie-Chicken range in the U.S. lies within the tall-grass prairie biome, with the remaining populations located within the mixed-grass prairie biome (Environment Canada 2007).

Greater Prairie-Chickens are highly area sensitive and are consistently absent from small fragments of otherwise suitable habitat (Winter and Faaborg 1999). Westemeier and Gough (1999) suggest that a minimum of 5000–6000 ha of suitable grasslands are required to support a viable population of this species. However, this is likely an underestimate: the smallest isolated population that has still maintained its genetic integrity occupies 516,800 ha (Svedarsky *et al.* 2003). The minimum area for a viable population would also be dependent on the quality, composition, and spatial arrangement of the habitat (Niemuth 2003). The proximity to other Greater Prairie-Chicken populations is also important because isolation can lead to low genetic diversity and decreased fitness, ultimately resulting in low survival probability or extinction of the population (Westemeier *et al.* 1998). Maintaining connective habitat or corridors between patches of suitable habitat is critical in maintaining the movement of individuals among patches and populations (Hamerstrom and Hamerstrom 1973, Johnson *et al.* 2003, 2004, Niemuth 2003).

Breeding habitat

Leks are traditional sites where males gather to display and compete for breeding opportunities. They need to be in the vicinity of good nesting cover (Svedarsky *et al.* 2003) and are generally located on small rises or knolls prominently exposed by flat surrounding topography and/or lack of vegetation (Schroeder and Robb 1993). They require low (<15 cm) vegetative cover (e.g., grazed, mowed or ploughed fields) on level or slightly rolling land with a clear vision of the horizon. Leks tend to occur in areas with a greater amount of grassland in the landscape and less forest cover (Merrill *et al.* 1999, Niemuth 2003) and fewer residences or farmsteads (Merrill *et al.* 1999).

Nest sites need substantial vegetative cover for concealment from predators and to provide protection from the elements. Svedarsky *et al.* (2003) recommended that residual nesting cover have a 100% visual obstruction reading at 25 cm and that this should comprise 30% of the management area. The highest vegetation should not

exceed 80 cm. Nest success is greater in areas with less litter cover. This is because excessive litter may decrease grass and forbs, which are important food sources, and attract predators by enhancing small mammal or arthropod habitat (Svedarsky *et al.* 2003). The presence of woody vegetation in nesting areas can create an edge effect that attracts mammalian predators and may provide perches for avian predators (Svedarsky *et al.* 2003). Broods commonly use more mesic lowlands, possibly because they provide taller cover (Svedarsky *et al.* 2003). Brood cover must accommodate chick movement, provide adequate amounts and types of insects, provide concealment from predators and protection from weather, be accessible from the nest site and function as secure roosting cover (Svedarsky *et al.* 2003).

Wintering habitat

Escape, roosting and wintering habitat consists of tall (>60 cm) dense grass stands and brush cover (Eng *et al.* 1988, Toepfer *et al.* 1990). Roost sites should be near adequate winter food resources such as weed seeds and small cereal grains (e.g., wheat, corn and sorghum) (Svedarsky *et al.* 2003). Westemeier and Gough (1999) have suggested that 20–30% of the landscape should be crop (especially corn) to meet winter food requirements, especially in areas with snow cover.

Habitat trends

Breeding and wintering habitat

In the late 1800s, the extirpation of the plains bison (*Bison bison*), higher than normal precipitation, and fire suppression all resulted in taller denser prairie grasses and thus favourable habitat for Greater Prairie-Chickens (Christisen 1969, Johnston and Smoliak 1976). Historical peaks in populations of this species in Iowa and Missouri occurred during the transition from native prairie to cropland, but populations declined as the proportion of cropland increased (Stempel and Rodgers 1961, Christisen 1985). Extensive cattle grazing and large-scale conversion of native grasslands to crops in the western prairies, combined with the drought of the 1930s, eliminated the tall-grass vegetation on which the Greater Prairie-Chicken depended for nesting (Christisen 1969, Johnston and Smoliak 1976, Houston 2002). Continued fire suppression allowed the invasion of trees and shrubs and thereby further fragmented the grassland (Houston 2002).

The extent of the former Greater Prairie-Chicken range in Canada is not known, but has been estimated at a minimum of 200,000 km² (calculated from the estimated pre-European settlement range, Figure 1). The tall-grass prairie, the preferred habitat type for this species, has been reduced to approximately 1% of its original extent. The remaining fragments are usually very small and are often surrounded by heavily wooded areas (Environment Canada 2007). In the United States, the remaining range of the Greater Prairie-Chicken is estimated at between 378,000 (BirdLife International 2008) and 566,000 km² (B. Young, NatureServe, pers. comm.).

Habitat protection/ownership

In the past, this species occurred in Prince Albert National Park ca. 1939–1940 (Houston 2002), Cypress Hills Provincial Park, last nesting in 1966 (Houston 2002), just outside Waterton National Park in 1939 (Houston 2002), and also possibly in Grasslands National Park (P. Nantel, pers. comm.). While there are remaining large tracts of mixed-grass prairie (e.g., Grasslands National Park, Suffield National Wildlife Area, Prairie Farm Rehabilitation Administration pastures), many are on the periphery of the Greater Prairie-Chicken's historical range, and do not have the requisite vegetation height or density for the Greater Prairie-Chicken (Environment Canada 2007).

In the U.S., only 0.4 to 0.5% of the range is protected in state parks, national wildlife refuges and national grasslands (calculated from World Database on Protected Areas 2008).

BIOLOGY

Reproduction

The Greater Prairie-Chicken is a polygynous species. During the breeding season 7 to 20 males (Christisen 1985) congregate on relatively small display sites or leks, which are generally located in areas accessible to numerous females (Kobriger 1965, Robel *et al.* 1970, Schroeder and Braun 1992). Males actively defend territories on leks from intruding males. During aggressive encounters with other males, males lower their pinnae feathers, deflate their air sacs, leap into the air, and strike their opponent with feet, wings, and/or beak. Most intense aggressive interactions between males on leks occur when females are present (Schroeder and Robb 1993). Lek attendance peaks in early to mid-April (Svedarsky 1988, Schroeder and Braun 1992). Seventy-one percent to 89% of copulations are performed by 1–2 males (Robel 1970).

Females build nests in grassland with thick horizontal and vertical vegetative cover. Nests are bowl-shaped depressions in the substrate, lined with feathers, dried grass, leaves, and small twigs; vegetation is usually 25–70 cm high (Hamerstrom *et al.* 1957, Jones 1963, Svedarsky 1988, Schroeder and Braun 1991). There is one brood per season and nests are initiated from mid-April to early-June and the average clutch size is 11-12 eggs. Incubation lasts 23–25 days and peak hatch generally occurs from mid-May to late June (Gross 1930, Hamerstrom 1939, Robel 1970, Svedarsky 1988, Schroeder and Braun 1991). The chicks are precocial and leave the nest with the hen shortly after hatching (Schroeder and Robb 1993). Broods move to areas that have abundant insects, a mixture of grassland-agriculture or lightly grazed areas (Jones 1963, Schroeder and Braun 1991). The young remain with hens until they are 80–84 days old (Bowman and Robel 1977).

Survival

The average life span for Greater Prairie-Chickens is 1.6 years (Robel and Ballard 1974), and the annual survival rate is about 48% for yearling males, 45% for adult males, 41% for yearling females, and 49% for adult females (Hamerstrom and Hamerstrom 1973). If the first clutch is depredated or abandoned, females may lay a replacement clutch (Robel 1970, Svedarsky 1988). Nest success rate varies from 73 to 93%, and is highest in habitats with thick vegetation and few predators (Svedarsky 1988, Schroeder and Robb 1993). Early nesting attempts are more successful than nesting attempts later in the season (Robel 1970).

Predators of adults and chicks include diurnal and nocturnal raptors, and a variety of mammals, including feral cats and dogs (Grange 1948, Bowman and Robel 1977, Svedarsky 1988, Schroeder and Robb 1993). Predators of eggs include snakes, corvids, and a variety of mammals (Bowman and Robel 1977, Svedarsky 1988, Schroeder and Robb 1993). Other causes of mortality include farm machinery, moving vehicles, electric wires, fences, pesticides, fire, and exposure (Gross 1930, Hamerstrom 1939, Svedarsky 1988).

Dispersal/migration

Some Greater Prairie-Chickens will remain resident in the same area throughout the year while others will move 12–170 km between wintering and breeding areas (Hamerstrom and Hamerstrom 1949, Svedarsky 1988, Schroeder and Braun 1993). The species has no clear migration routes (Schroeder and Braun 1993). Habitat and weather conditions do not adequately explain current movement patterns, and historical migrations may have consisted of little more than local movements (< 10 km) in response to habitat availability (Schroeder and Braun 1993). Unsuccessful females tend to leave nesting grounds during June, but most birds move in October and November (Svedarsky 1988, Schroeder and Braun 1993). Females are more likely to migrate between breeding and wintering areas than males (Hamerstrom and Hamerstrom 1949, Toepfer and Eng 1988, Schroeder and Braun 1993). Seven percent of 369 juvenile males and 47% of 125 juvenile females moved > 8 km between their first wintering and first breeding areas (Hamerstrom and Hamerstrom 1973).

Diet and foraging

The Greater Prairie-Chicken eats a wide variety of foods, and its diet reflects the abundance of local foods (Jones 1963). Seasonally available foods such as insects (especially for young), green leaves/buds and green grass are eaten in spring and summer (Minish 1990). Leaves and greens are a common food source in fall as well as in winter, when not covered by snow. Weed seeds and small cereal grains (e.g., wheat, corn and sorghum) are used throughout the year but are especially important in winter, particularly in the northern parts of their range (Svedarsky *et al.* 2003). Sunflowers are a preferred winter food (Svedarsky *et al.* 2003). Feeding trials indicated that grain is more important to this species than buds for winter nutrition (Hamerstrom *et al.* 1941).

Interspecific interactions

The Greater Prairie-Chicken is often observed on leks with the Sharp-tailed Grouse, and males of each species respond to each other's territorial behaviours (Schroeder and Robb 1993). Hybridization with the Sharp-tailed Grouse is cited as the main cause of the disappearance of the Greater Prairie-Chicken from Manitoulin Island, Ontario (Lumsden 1966, 2005a). Aggression by male Ring-necked Pheasants (*Phasianus colchicus*) on leks can temporarily disrupt Greater Prairie-Chicken courtship displays and lek boundaries, which can negatively affect reproduction (Zewadski 1977, Vance and Westemeier 1979). Nest parasitism by Ring-necked Pheasants has also been reported (Vance and Westemeier 1979).

Territory

Territories of displaying males consist of a core area where other males are rarely encountered, and a boundary area in which aggressive interactions with other males occur. Average territory size is ca. 500 m² (Robel 1966). Centrally located and/or large territories are usually occupied by dominant males (Hamerstrom and Hamerstrom 1973, Robel 1970, Robel and Ballard 1974). Territories are smaller during the breeding season than during winter because birds roost and feed close to leks (Hamerstrom and Hamerstrom 1949, Schroeder and Braun 1991). During winter, home range size increases as birds move greater distances between feeding and roosting areas (Drobney and Sparrowe 1977).

Adaptability

The Greater Prairie-Chicken has demonstrated some amount of adaptation to different habitat conditions, considering its current and historic range. The current range is mostly composed of remnant prairie, often used as pasture, and interspersed with cropland. This species is able to tolerate low levels of human activity and was able to adapt to new food sources e.g., small grains, corn and sorghum (Svedarsky *et al.* 2003).

POPULATION SIZES AND TRENDS

Search effort

Wildlife management agencies in the U.S. use densities of male Greater Prairie-Chickens and/or leks, and harvest data to evaluate the status of populations (Hamerstrom and Hamerstrom 1973, Horak 1985, Svedarsky 1988, Robb and Schroeder 2005). Accurate estimates of numbers of females are difficult to obtain. Although lek density is used to predict total population density, assumptions about male attendance at leks and male-female sex ratio have been difficult to evaluate (Schroeder and Braun 1992). No specific survey efforts have been made by federal or provincial agencies to locate this species in Canada in the last two decades, and there are no

verified records with provincial ornithological records/rare bird committees. The volunteer-based Breeding Bird Survey (BBS) provides some limited information on population sizes and trends in the U.S. (Sauer *et al.* 1994, 1999, U.S. Geological Survey 2008).

Abundance

The global population estimate for this species has been reported from 200,000-250,000 (Johnsgard 2002) to 459,000 (BirdLife International 2008) to as high as 690,000 individuals (Rocky Mountains Bird Observatory 2008), with the bulk of the population in Nebraska, Kansas, and South Dakota (Johnsgard 2002). Localized density estimates for males may be as high as 8 to 36/km² (Hamerstrom *et al.* 1957, Westemeier and Gough 1999, Westemeier *et al.* 1999), though typical density estimates are 0.3 to 2.5 males/km² (Kobriger *et al.* 1988, Anderson and Toepfer 1999, Fredrickson *et al.* 1999).

The species was considered Endangered in Canada by 1978 (Saskatchewan Department of Tourism and Renewable Resources 1978) and Extirpated in Canada by 1990 (COSEWIC status report). Wildlife authorities from Alberta, Manitoba, and Ontario have considered the Greater Prairie-Chicken extirpated in their respective provinces (Minish 1990).

Fluctuations and trends

In the early 1900s, populations of the Greater Prairie-Chicken in the Canadian prairies peaked at an estimated one million or more breeding birds (Johnston and Smoliak 1976). At this time, Greater Prairie-Chickens were shot and shipped to the eastern cities, and in Manitoba it was common to bag from 60 to 150 in one day (Environment Canada 2007). From 1910 to at least the 1920s, Greater Prairie-Chickens were as common as the Sharp-tailed Grouse in parts of Saskatchewan and Manitoba, although they were never common in Alberta (Houston 2002). Their numbers declined drastically by the 1930s, and by the 1980s, the Greater Prairie-Chicken was gone from the Canadian prairies (Godfrey 1966, Johnsgard and Wood 1968, Lumsden 1966, 2003, Houston 2002).

In the U.S., historical densities for the Greater Prairie-Chicken may have approached 250 birds/km² in optimal habitats (Schroeder and Robb 1993). The total population was estimated at about 1 million in 1970s, 500,000 in 1980s, and 200,000-250,000 in the late 1990s (Johnsgard 2002). Declines have been most precipitous in Oklahoma (130,000 birds in 1968 to 1,500 birds in 1997), Kansas (530,000 in 1989 to 160,000 by 1997) (Robb and Schroeder 2005) and Illinois (several million in the mid-19th century to 46 by 1994) (Westemeier *et al.* 1998).

BBS data show a decline of 2.4%/year ($p = 0.37$, $n = 56$ routes) for the Greater Prairie-Chicken population in the U.S. between 1966 and 2007 (U.S. Geological Survey 2008).

Rescue effect

Two factors affect the likelihood of rescue from the U.S. The first is the state of Greater Prairie-Chicken populations in the U.S. and, in particular, in states adjacent to the Canadian border. Overall, the Greater Prairie-Chicken has been extirpated from seven states, has decreased in eight and is still considered healthy enough to be hunted in four states. In terms of border states, in North Dakota, counts of males fell from 407 in 1980 to 84 in 1994 (McCarthy *et al.* 2008). However, more than 300 wild-caught birds from Minnesota, South Dakota and Nebraska were introduced into North Dakota between 1992 and 1998 and by 2004 abundance was estimated at 1,200 birds. In Minnesota, the number of displaying males increased from 1,258 in 1980 to 3,294 in 2008 (M. Larson, pers. comm.). Thus, rescue could occur from these populations, although numbers are relatively low. The second factor that might affect the probability of rescue is the distance between populations in the U.S. and suitable habitat in Canada. Stable populations in adjacent states are some distance (>100 km) from the Canadian border, thus reducing the chance that rescue could occur.

LIMITING FACTORS AND THREATS

Threats to the Greater Prairie-Chicken include fragmentation and modification of suitable habitat that results in population isolation and loss of genetic variation, competition and hybridization with Sharp-tailed Grouse, nest parasitism by Ring-necked Pheasants and hunting. These are discussed in more detail below.

Habitat loss and degradation

In the 19th to early 20th century extensive cattle grazing and large-scale conversion of native grasslands to crops, combined with the drought of the 1930s, eliminated the prairie vegetation on which the Greater Prairie-Chicken depended for nesting (Lumsden 1966, Christisen 1969, Johnston and Smoliak 1976, Houston 2002). The Greater Prairie-Chicken apparently tolerated some conversion of native grassland into crops, and initially increased when the proportion of cropland and grassland reached 50:50, but then declined when the ratio of cropland far exceeded the remaining grassland (Stempel and Rodgers 1961, Environment Canada 2007). By the end of the 19th century, the remaining prairie-chickens in southern Ontario were associated with large marsh areas because much of the original prairies had been ploughed and little suitable habitat remained for the birds (Lumsden 1966). The invasion of trees and shrubs into already fragmented grassland as a result of fire suppression also contributed to the decline (Houston 2002). The tall-grass prairie, the most suitable habitat type for this species, dwindled to only ca. 1% of its original extent in Canada. The remaining fragments are small and are often surrounded by heavily wooded areas (Environment

Canada 2007). While there are remaining large tracts of mixed-grass prairie (e.g., Grasslands National Park, Suffield National Wildlife Area, Prairie Farm Rehabilitation Administration pastures), many lie on the periphery of this species' range and do not have the requisite vegetation height or density for the Greater Prairie-Chicken (Environment Canada 2007).

Loss of genetic variation

The fragmentation and isolation of Greater Prairie-Chicken populations can have serious implications for their survival and persistence. Maintaining connections between local populations of Greater Prairie-Chickens has been identified as one of the primary challenges for conserving this species (Johnson *et al.* 2004). Isolation of Greater Prairie-Chicken populations in Wisconsin and Illinois has resulted in reduced levels of genetic variability (Westemeier *et al.* 1998, Johnson *et al.* 2003, Toepfer 2003).

Hybridization and competition with the Sharp-tailed Grouse

The Greater Prairie-Chicken and the Sharp-tailed Grouse have similar habitat preferences, with the latter using a wider range of habitats (Connelly *et al.* 1998). In areas of sympatry, the Sharp-tailed Grouse displaces the Greater Prairie-Chicken from feeding areas. Once the Sharp-tailed Grouse becomes more abundant than the Greater Prairie-Chicken, the latter usually disappear in 5 to 6 years (Toepfer 2003, Environment Canada 2007).

Hybridization between the Greater Prairie-Chicken and the Sharp-tailed Grouse in areas of sympatry can also have profound effects on prairie-chicken populations. In Canada, hybrids of these two species were reported from Alberta, Saskatchewan, and Ontario (Houston 2002, Lumsden 2003a, b). The Sharp-tailed Grouse interbred with, and ultimately displaced, the Greater Prairie-Chicken in Manitoulin Island, Ontario (Lumsden 1966, 2003a, b).

Competition and nest parasitism with/by Ring-necked Pheasants

Exotic Ring-necked Pheasants can compete with Greater Prairie-Chickens for lek and feeding sites (Zewadski 1977, Vance and Westemeier 1979). They can also parasitize prairie-chicken nests (Vance and Westemeier 1979, Westemeier *et al.* 1998). The Ring-necked Pheasant's eggs have a shorter incubation period and hatch earlier, resulting in Greater Prairie-Chicken hens leaving their nests prematurely with the pheasant chicks. The nest success rate for 17 parasitized nests was 24%, and for 480 non-parasitized nests it was 51% (Vance and Westemeier 1979).

Hunting

Market hunting and poaching in the late 19th-early 20th centuries severely reduced populations of Greater Prairie-Chickens across North America (Schroeder and Robb 1993, see population size and trends section).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Greater Prairie-Chicken is a flagship species for prairie conservation. It is enjoyed by hunters, and bird-watchers, and it has cultural significance to some First Nations, including the Blackfoot Nation. Their Prairie Chicken Dance (Kitokipaaskaan) mimics the mating dance of the Greater Prairie-Chicken (Blackfoot Crossing Historic Park 2008).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The Greater Prairie-Chicken is given status and protection under Saskatchewan's *Wildlife Act* 1998 and is protected as an extirpated species under Ontario's *Endangered Species Act*, 2007. The 1978 COSEWIC status report on the Greater Prairie-Chicken (Saskatchewan Department of Tourism and Renewable Resources 1978) concluded that this species was Endangered in Canada. The status was re-examined in April 1990 and it was designated Extirpated. The subsequent COSEWIC (2000) review upheld the extirpated status and in June 2003, the Greater Prairie-Chicken was listed as extirpated under the *Species at Risk Act* (SARA). In 1993, a National Recovery Plan for the Greater Prairie-Chicken was prepared under the Recovery of Nationally Endangered Wildlife (RENEW) program, which recommended that no recovery actions for the species be undertaken (Hjertaas *et al.* 1993).

BirdLife International (2008) classifies this species as "vulnerable", National Audubon Society lists the Greater Prairie-Chicken on its 2002 watchlist, and Partners in Flight has listed it on the 2004 watchlist of extremely high priority species (Pashley *et al.* 2000, Rich *et al.* 2004). The status of the Greater Prairie-Chicken by jurisdiction is summarized in Table 1.

Table 1. Conservation status ranks for the Greater Prairie-Chicken *Tympanuchus cupido pinnatus* in North America according to NatureServe (2008).

Province/State	Rank	Definition
Global rank (Nature Serve)	G4	Apparently secure
IUCN Red List	VU	Vulnerable
World Rank (BirdLife International)	VU	Vulnerable
Canada	NX	Presumed Extirpated
USA	N4	Apparently secure
Alberta	SX	Presumed Extirpated
Manitoba	SX	Presumed Extirpated
Ontario	SX	Presumed Extirpated
Saskatchewan	SX	Presumed Extirpated
Arkansas	SX	Presumed Extirpated
Colorado	S3	Vulnerable
Illinois	S1	Critically Imperiled
Indiana	SX	Presumed Extirpated
Iowa	S1B	Critically Imperiled
Kansas	S4	Apparently Secure
Kentucky	SX	Presumed Extirpated
Michigan	SX	Presumed Extirpated
Minnesota	S3	Vulnerable
Missouri	S1	Critically Imperiled
Montana	SX	Presumed Extirpated
Nebraska	S5	Secure
North Dakota	SNR	Unranked
Ohio	SX	Presumed Extirpated
Oklahoma	S3	Vulnerable
Pennsylvania	SX	Presumed Extirpated
South Dakota	S4	Apparently Secure
Tennessee	SX	Presumed Extirpated
Texas	SX (<i>pinnatus</i>)	Presumed Extirpated
Wisconsin	S1B, S2N	Critically Imperiled (breeding) to Imperiled (non-breeding)

TECHNICAL SUMMARY

Tympanuchus cupido

Greater Prairie-Chicken

Tétras des prairies

Range of Occurrence in Canada: Extirpated (formerly in Alberta, Manitoba, Ontario and Saskatchewan)

Demographic Information

Generation time Assuming 50% survival of adults	1.78 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	N/A
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	N/A
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	N/A
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	N/A
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	N/A
Are the causes of the decline clearly reversible and understood and ceased?	N/A
Are there extreme fluctuations in number of mature individuals?	N/A

Extent and Occupancy Information

Estimated extent of occurrence	N/A
Index of area of occupancy (IAO) (Always report 2x2 grid value; other values may also be listed if they are clearly indicated (e.g., 1x1 grid, biological AO)).	N/A
Is the total population severely fragmented?	N/A
Number of "locations*"	N/A
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	N/A
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	N/A
Is there an [observed, inferred, or projected] continuing decline in number of populations?	N/A
Is there an [observed, inferred, or projected] continuing decline in number of locations?	N/A
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Likely a decline
Are there extreme fluctuations in number of populations?	N/A
Are there extreme fluctuations in number of locations*?	N/A
Are there extreme fluctuations in extent of occurrence?	N/A
Are there extreme fluctuations in index of area of occupancy?	N/A

* See definition of location.

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Total	0

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	No analysis conducted
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Threats (actual or imminent, to populations or habitats)

<ul style="list-style-type: none"> - Habitat loss and degradation - Loss of genetic variation - Hybridization and competition with Sharp-tailed Grouse - Competition and nest parasitism from Ring-necked Pheasants

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? adjacent populations in the U.S. stable or increasing; however, overall a decline in the U.S.	
Is immigration known or possible?	Yes
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes, but highly localized
Is rescue from outside populations likely?	Unlikely because of distance between source populations and available habitat

Current Status

COSEWIC: Extirpated (November 2009)

Status and Reasons for Designation

Status: Extirpated	Alpha-numeric code: Not applicable
Reasons for designation: This species was once an abundant breeder in prairie habitats of Alberta, Saskatchewan, Manitoba and Ontario. New genetic evidence indicates that the species was a native of Canada for the past 9000 years and did not colonize the prairies habitat with European settlement as previously thought. Habitat loss and degradation and hybridization with the Sharp-tailed Grouse contributed to its extirpation from Canada.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Does not meet criterion.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. Does not meet criterion.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Does not meet criterion.
Criterion D (Very Small or Restricted Total Population): Not applicable. Does not meet criterion.
Criterion E (Quantitative Analysis): None available

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