Conservation Assessment for Sharp-tailed Grouse *(Tympanuchus phasianellus)* in the Great Lakes Region

USDA Forest Service, Eastern Region
April 11, 2006

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Executive Summary

This Conservation Assessment (CA) provides a summary of readily available information regarding the distribution, ecology, and population biology of the Sharp-tailed Grouse (*Tympanuchus phasianellus)*. Special attention is placed on issues pertinent to the conservation of this species in Region 9 of the United States Department of Agriculture, Forest Service.

Sharp-tailed Grouse occupy large patches of early successional habitats including grasslands, shrublands, wetlands and early stages of forest-land throughout much of central and northern North America; collectively these areas are knows as openlands. Within Region 9, sharptail populations are found in Michigan, Minnesota and Wisconsin; populations in the Upper Peninsula of Michigan represent the most easterly distribution of the species in the United States.

In recent years, Sharp-tailed Grouse populations have declined and their historic range has been reduced as early successional ecosystems have undergone substantial alternations in amount and extent. The loss and fragmentation of large blocks of quality habitat through barren conversion and degradation, wetland drainage and degradation, intensive agricultural practices, reforestation, fire suppression, and natural succession, threatens this species. Management for this and other area sensitive openland bird species requires a large-scale ecosystem perspective. Low intensity farming, prescribed fire, barrens restoration and even-aged timber management can provide important habitat for sharptails and associated early successional species.

Within the current range of the Sharp-tailed Grouse, there are 6 National Forests in Region 9. All list the sharptail as a Region 9 Regional Forester Sensitive Species (R9 sensitive), except the Ottawa. Two National Forests (Hiawatha and Chequamegon-Nicolet) list sharptail as a Management Indicator Species (MIS). All of the Forest Plans in Region 9 provide conservation guidelines for R9 sensitive species, but there are few goals, objectives or guidelines, specific to Sharp-tailed Grouse.

Future sharptail research should investigate the effects of weather, fire and agricultural practices on habitat use, predation rates, and reproductive output. Research is needed to develop accurate and efficient methods to estimate population size, and understand genetic implications. More work is also needed to provide parameters for assessing minimum viable populations and determine the historical status of this species in different parts of its range. Sharptails are a well studied species with good documentation. For a more comprehensive account of this species, the reader is directed to Ammann (1957), Connelly et al. (1998) and others (references section).

Acknowledgements

Information was provided by the following individuals: Bill Berg, Minnesota Department of Natural Resources; Terry Minzey, Michigan DNR; Chris Clampitt, The Nature Conservancy; Natasha W. Lapinski and Kevin Doran, Hiawatha National Forest; Michael Fashoway and Jeff Cooper, Michigan Natural Features Inventory; Phil Huber Huron-Manistee NF; Jerry Edde and Bob Johnson, Ottawa National Forest; Ed Lindquist, Mary Shedd, Tim Catton and Wayne Russ, Superior National Forest; Al Williamson Chippewa NF; Dan Eklund, Chequamegon-Nicolet NF; Mike Tansy, Seney National Wildlife Refuge.

Early drafts of this document were reviewed by various people within and external to the Forest Service. The final draft was reviewed by the Forest Service Eastern Regional Office wildlife staff.

Nomenclature and Taxonomy

Order: Galliformes
Family: Phasianidae
Genus: *Tympanuchus* (formerly *Pediocetes*)
Binomial name: *Tympanuchus phasianellus*
Subspecies:

- *T. p. campestris* (prairie subspecies)
- *T. p. caurus*
- *T. p. columbianus*
- *T. p. hueyi* (extinct)
- *T. p. jamesi*
- *T. p. kennicotti*
- *T. p. phasinellus* (northern subspecies)

Common name: Sharp-tailed Grouse
Synonyms: sharptail
American Ornithologist's Union Code: STGR

Description of Species

The Sharp-tailed Grouse is a medium-sized grouse measuring 41-47 cm in length, with a body mass of approximately 1 kg. Females are slightly smaller than males. Both sexes are characterized by heavily barred, dark brown head, neck, back and wings; white breast feathers, with tawny drab margins; white upper-belly feathers with small, dark, olive brown sub-terminal V-shaped marks; white under tail-coverts; and protruding central tail feather (retrices) that give the species its name. Males have pinkish air sacs on each side of their neck (exposed and inflated during displays) and have linearly-marked central retrices (Figure 1). The female is marked by central retrices that are more transversely barred and less vertically striped (Figure 1), and crown feathers that are lighter and more barred than the male (Figure 2). Each sex has a crescent-shaped, yellowish-orange comb over each eye. This species is further characterized by having tarsi feathered to the base of the toes (Edminster 1954, Connelly et al. 1998).

Precocious hatchlings are completely covered with down and prejuvenile molt is complete (Connelly et al. 1998). Juvenile body plumage is visible within a few days after hatching and young sharptails are fully feathered by 6 weeks. Juveniles resemble adult females but are grayer in color with white instead of buff throats (Connelly et al. 1998).

Male sharptails produce 6 vocalizations:
1) a "cackle" given during agonistic interactions such as fighting or attacking (Sparling 1981);
2) a "chilk," or sharp bark-like sound used possibly for mate-attraction (Kermott and Oring 1975);
3) a "coo";
4) a "cork" or popping sound, given most frequently when females are on leks;
5) a "gobble," also associated with agonistic interactions (Kermott and Oring 1975); and
6) a "whine" which is a lingering vocalization given during agonistic interactions.

Other audible recognition queues for the sharptail include tail rattling and foot-stomping by the males. Tail rattling is a sound produced by the lateral movement of upturned rectrices (Kermott and Oring 1975). The rapid stomping of feet during the mating ritual occurs as agonistic behavior, increasing in rate when females are on leks (Sparling 1983). Female vocalizations are not well known, however they may gobble during aggressive female-female interactions on a lek and clucking is common during brood rearing (Sparling 1981).

Figure 1. Tail pattern of female (left) and male (right) sharptail (adapted from Bihrle 1993)

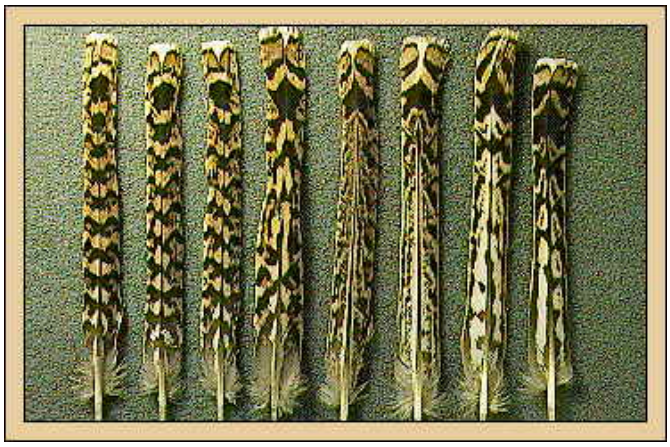


Figure 2. Head feather pattern of female (left) and male (right) sharptail (adapted from Bihrle 1993)

Life History

Sexual Behavior and Courtship

Sexual behavior and courtship in Sharp-tailed Grouse is well documented (Connelly et al. 1998). During the spring both sexes congregate at localized breeding areas referred to as arenas, dancing grounds or leks. The lek is a communal display arena where males congregate for the purpose of attracting and mating with females. Leks are most often situated on areas elevated from the general surroundings and are usually located in the same place from year to year (Ammann 1957, Connelly et al. 1998). Leks can consist of anywhere from 2-57 males, each defending a territory that may vary in size from 0.46-2.6 ha (Connelly et al. 1998). Males can be observed displaying from dawn to several hours after sunrise, even on snow covered fields. However, rain, snow, wind and other factors can inhibit sharptail breeding activity, especially early in the season (Ammann 1957, Drummer et al. 2005.).

The primary courtship display by the male sharptail consists of animated phases of foot-stomping, clicking, tail rattling, with many intricate vocalizations (Connelly et al. 1998). This behavior is often interspersed by a relaxing phase (Gratson 1992).

Although leks are predominately used during the spring breeding season, male sharptails may defend territories on leks during their first fall, winter or the following spring. However, some males may not gain permanent territories in their first year (Hammerstrom and Hamerstrom 1960, Tsuji et al. 1994). Bergerud and Gratson (1988) speculate that dominant males show the greatest lek fidelity while sub-dominant males or males not affiliated with a lek are more likely to disperse. Male-dominated polygyny often results in many mature males not acquiring a female for mating (Tsuji et al. 1994). Temple (1991) reported that approximately 10% of the males actually breed in Wisconsin and dominant males at a given lek monopolize breeding. Age at first breeding is typically 1 year for females, but is unknown for males, and the maximum known life span is 7.5 years (Connelly et al. 1998).

Females invite copulation from males by exhibiting white shoulder spots and extending wings slightly outward and down to the ground, and squatting (Connelly et al. 1998). Females may visit the lek 1-10 times during a breeding season (April and May in Region 9) and nearly all females attempt to nest (Ammann 1957, Connelly et al. 1998). However, it is assumed that female sharptails mate only once during a breeding season (Tsuji 1996).

It is apparent that breeding sharptail populations include non-territorial males that are not attending leks, and that these younger birds move onto leks after dominant males are removed (Rippen and Boag 1974). Generally, mature males occupy the inside or central locations on the dancing grounds while juvenile males are relegated to the peripheral territories on the lek (Rippen and Boag 1974). Males occupying outer lek territories experienced greater spring to autumn mortality compared to those in central territories (Moyles and Boag 1981). Young birds may provide a buffer around the reproductively more important, centrally located older birds thus increasing survival of the older birds. Lek carrying capacity may be a factor in stimulating emigration and colonization of new courtship areas. Availability of breeding males does not generally limit population growth since the normal population structure provides for an excess of males ready to assume breeding roles.

Nest and Brood Characteristics

Sharptails nest under or near shrubs, small trees, or thick residual cover (Peterle 1954, Ammann 1957). Peterle (1954) found nesting areas in Upper Michigan to be 43% shrub cover (1-2 m in height) in a primarily openland area. Nest composition can include moss, grass, sedge, ferns, herbaceous plants, leaves and breast feathers from the female (Connelly et al. 1998). Nest sites were located far from dancing grounds in Wisconsin, perhaps as a strategy for females to avoid conspicuous, dancing cocks and associated predators (Bergerud and Gratson 1988). Nests are also located near leks, in Michigan (*pers obs*).

Sharp-tailed Grouse hens lay approximately 1 egg per day (1.3 average) in the spring with a total average clutch size of 12.1 eggs per nest (Amman 1957). Incubation takes about 24-25 days and only the female participates. The average hatching date reported for Michigan is June 18

(Ammann 1957). Approximately 86% of hens that lost their first nest attempted to renest (Beregrud and Gratson 1988). However, Ammann (1957) reports that sharptails in Michigan are not persistent renesters due to the low proportion of chicks hatching after mid-June.

Approximately 54% of Sharp-tailed Grouse nests in Wisconsin were successful at hatching at least 1 chick (Bergerud and Gratson 1988). Ammann (1957) reports a slightly lower success rate for Upper Michigan of 44% successful nests. Mature sharptails are more successful nesters, compared to yearlings. Bergerud and Gratson (1988) report that approximately 61% of adult nests hatch at least one chick while only 43% of yearling hens hatch a chick. Of the nests that failed in this study, the primary cause was predation (79%), followed by nest desertion, then fire, flood, and agricultural practices.

Range-wide the average brood size at hatching is 8.7 birds based on average clutch sizes and hatch rates (Johnsgard 1983). Young sharptails are precocial and can not thermoregulate. They are born downy, with well-developed legs, open eyes, and the ability to feed themselves while following the adult female (Connelly et al. 1998). As with incubation, the male is absent from all nest attendance and parental care. Broods will typically experience about 47% mortality with the majority of the mortality within the first month (Johnsgard 1983). Causes of chick mortality include weather chill, predation and starvation (Bergerud and Gratson 1988). Berry producing shrubs are especially valuable as high quality food for chicks (Johnsgard 1983). Throughout the summer, the young remain close to the hen and the nesting area (Marks and Marks 1987). Ammann (1957) reports an average May-August brood size of 7.7 chicks per hen based on 451 broods monitored in Upper Michigan. Brood bond breaks starting in mid to late September.

Diet

Feeding habits of sharptails vary by season and locality. During the spring and summer months, sharptails may consume clover (*Trifolium repens*), goldenrod (*Solidago* spp.), hawkweed (*Hieracium canadense*), grass seed, rose, dandelion (*Taraxacum officinale*), corn (*Zea mays*), alfalfa, wheat, goatsbeard (*Tragopodon dubius*), yarrow (*Achillea millefolium*), smartweed (*Polygonum* spp.) as well as ants (Hymenoptera: Formicidae), crickets (Orthoptera: Gryllidae), moths (Lepidoptera), grasshoppers (Orthoptera: Locustidae), and beetles (Coleoptera) (Peterle 1954, Ammann 1957, Connelly et al. 1998). Newly hatched and developing young sharptails are especially dependent upon insects at and around the nest site (Marshall and Jensen 1937, Schneider 1994). In Michigan, blueberries (*Vaccinium* spp.) are a principal summer food for sharptails occupying barrens, savannas and xeric habitats (Ammann 1957).

During the fall and winter paper birch (*Betula papyrifera*) buds and catkins are favored. Other common winter food includes acorns, aspen (*populus spp*.), tamarack (*Larix laricina*) leaf buds, sunflower (*Helianthus* spp.), cherry (*Pinus* spp.) buds, sumac (*Rhus* spp.), Russian olive (*Eleagnus angustifolia*) fruits, and serviceberry (*Amalanchier* spp., (Peterle 1954, Ammann 1957, Connelly et al. 1998).

Predation

Sharp-tailed Grouse are vulnerable to nest and brood predation due to large clutch size and habit of nesting on the ground (Lindstrom et al. 1994, Connelly et al. 1998). Sharptail predators include both birds and mammals. Examples include raptors, American Crow (*Corvus brachyrhynchos*), Common Raven (*C. corax*), Coyote (*Canis latrans*), Red Fox (*Vulpes vulpes*), Striped Skunk (*Mephitis mephitis*), American Badger (*Taxidea taxus*), and Raccoon (*Procyon lotor*). Causes of mortality from predators in Wisconsin included 50% mammal, 4% raptor, and 46% unknown (Bergerud and Gratson 1988).

Predator success may increase as nesting hens become more concentrated either through habitat reduction or grouse population expansion resulting in a density dependent predator/prey relationship relative to nest density (Bergerud and Gratson 1988).

Life History Summary

Table 1. General population and life history parameters for Sharp-tailed Grouse in Region 9 (multiple sources).

Population Parameter	Value
Egg Fertility	90%
Mean Clutch Size	12.1 eggs/clutch
Incubation Period	25 days
Nest Success Rate (% of nests with 1 or more eggs hatching)	44%
Mean Brood Size at Hatching	8.7
Mean Fall Brood Size	4.6
Ratio Breeding Male to Total Male	1:10
Ratio Breeding Male to Breeding Female	1:10
Ratio of Male to Female at Hatching	50:50
Ratio Fall Adult Male to Adult Female	150:100
Ratio Fall Juvenile Male to Female	125:100
Ratio Fall Total Male to Female	140:100
Juvenile (4-10 months) Survival Rate	89%
Adult (10+ months) Monthly Survival Rate	95%
Probability of Female Survival to 1 Year	26%
Probability of Male Survival to 2 Years	13.5%
Mean Annual Male Home Range Size	617 ha
Mean Annual Female Home Range Size	464 ha
Maximum Likely Emigration/Immigration Distance	21 miles
Population Density in Occupied Habitat	5-24 birds/square mile
Minimum Sub-Population Size	280
Possible Maximum Fall Harvest Levels	30-40%

Migration and Dispersal

The sharptail is non-migratory but individual birds or groups may move short distances on a seasonal basis. In the wetland-dominated habitat at the Seney National Wildlife Refuge, and elsewhere in Upper Michigan, sharptails are commonly found outside of typical upland openland habitat, especially in the Fall and Winter (*pers obs*.). In particular, during the fall, adults and juveniles often form flocks that move back and forth between food sources and cover (Ammann

1957, Marks and Marks 1987). Many of these birds in Upper Michigan then winter in and near wetlands and forested areas (Ammann 1957, Sjogren and Robinson 1997).

Existing occupied sharptail habitat in Region 9 consists of large, but disjunct, openland patches within a forested matrix. Populations in these habitat fragments require new breeders to avoid inbreeding problems and to maintain genetic diversity. Forests surrounding isolated patches of habitat can be barriers to sharptail movement, dispersal and genetic exchange. Banding studies in Michigan show 79% of banded birds were recovered within 4.8 km of the trap site, several were recovered up to 16 km from the trap site, and the longest movement recorded at 34 km (Hamerstrom and Hamerstrom 1951). Based on this limited band recovery information, very little immigration or emigration would affect population growth rate for populations separated by >34 km. Interchange of individuals between breeding populations would increase, as the distance between leks decreases, and young birds move around seeking new territories for breeding and nesting.

In general, openland bird species should be considered native to a region unless there is historical evidence of a range expansion into eastern forests after forest clearing by Europeans (Askins 2001). Evidence for an eastward range expansion exists for a few species but not for most shrubland and grassland species. Disturbance dependent species, such as the sharptail have probably always shifted their distributions in response to the availability of ephemeral disturbance habitat. For practical conservation purposes these species should be considered native, and thus warrant conservation concern (Askins 2001).

Habitat

Presettlement habitat for Sharp-tailed Grouse in Region 9 included pine barrens, burned forest areas and non-forested wetlands. It is likely that sharptails existed in the burns and wetlands of the upper Midwest before European settlement, and that their populations expanded and contracted depending on the effects of natural disturbances such as fire (Ammann 1957, Peterle pers. com.). For example, in eastern Upper Michigan, during the mid-1800's, burned areas covered approximately 32,375 ha, and averaged over 1000 ha in size (Comer et al. 1995). Such large disturbances could have provided the necessary large patches of openland habitat required for pre-settlement populations of sharptails.

Lorimer (2001) described the estimated amount of early successional habitat available on the presettlement landscape, including various sharptail areas in Region 9. Before settlement, approximately 7.5% of eastern Upper Michigan consisted of burned land, barrens and recent blow downs. Similarly, 7.8% of northern Lower Michigan and 13.2% of northern Wisconsin would have been early successional habitat at the time of settlement. At one time, nearly 270,000 acres of pine barrens were present in Michigan, while today there are fewer than a few hundred acres, although many more acres are likely restorable (Comer 1996).

In the pre-settlement era, pine dominated patches of very well drained soil exhibited a fire frequency as high as one fire every 21.8 years in Upper Michigan (Loope 1991). In the Mack Lake area of the Huron-Manistee National Forest it is estimated that fires occurred every 13-41

years in the presettlement period (Simard and Black 1982) and pine barrens likely occurred on the most frequently burned portion of that landscape (Comer 1996).

Fire is the key natural-history disturbance process for creating and maintaining sharptail habitat. Wildfires create a mosaic of burned and unburned patches of habitat depending on local fire intensity and weather patterns (Niemi and Probst 1989), and is instrumental in the creation and maintenance of early successional habitat used by Sharp-tailed Grouse and other open-land species (Figure 3).

Figure 3. Typical occupied sharptail habitat on the Hiawatha near Raco, MI.

Sharptail home range size has been measured in Michigan and Wisconsin at approximately 600 ha and varies depending on season, location, habitat quality and other factors (Table 2).

Table 2. Mean seasonal and annual home ranges for sharptails from telemetry studies in Michigan (Sjogren and Robinson 1997) and Wisconsin (Gratson 1983).

Season	Michigan Area (ha)	Wisconsin Area (ha)
Spring	40	348
Summer	60	82
Fall	209	388
Winter	380	400
All Year	**641**	**593**

For mating and lek attendance, openings of at least 16 ha are preferred (Ammann 1957). Typically, the lek vicinity includes areas of low, sparse vegetation that provides good visibility and unrestricted movement (Peterle 1954, Ammann 1957), although sharptail leks are also found in young stands of trees and areas with more cover (John Ries 2006, *pers comm*). Leks have been

observed on mowed wet meadows, cattle trampled areas, low ridges, knolls and recent burns (Tesky 1994). An open space near and around the lek is usually needed to allow sharptails to detect most predators from a longer distance and give them a chance to seek cover or quickly flush (Ammann 1957). Woody plants near the lek are often used by sharptails as hiding cover when flushed off the lek, and when they are not engaged in courtship (Ammann 1957). Broods depend on areas abundant with forbs and insects, often with a high diversity of shrubs and an interspersion of cover types (Ammann 1957, Connelly et al. 1998). In Michigan, adult sharptails preferred recently burned upland grass-openings with abundant blueberries and scattered shrubs during the summer months (Sjogren and Robinson 1997).

During the winter months sharptails use jack pine forests and wetlands in Michigan (Ammann 1957, Sjogren and Robinson 1997), although in wetland-dominated landscapes such as Seney NWR in Upper Michigan sharptails can be observed in wetlands throughout the year. Conservation Reserve Program (CRP) lands and grain fields are utilized by sharptails during mild winters (Berg 1997). Sharp-tailed Grouse use both wetlands and uplands for snow burrowing (Figure 4). Snow roosting may be used as a tactic to avoid predation and cope with cold weather or food shortages (Bergerud and Gratson 1988). Paper birch and aspen groves are important winter food resources and sharptails expend considerable energy as they search larger areas for food during this season.

Figure 4. Sharptail snow-burrow

The National Forests in Region 9 manage early successional habitat both through the timber sale program, as well as with permanent opening management programs. The amount of permanent openland habitat on each Forest is summarized (Table 3).

Table 3. Early successional habitat on National Forests in Region 9 (from Trani et al. 1999)

Forest	% upland opening	% lowland opening
Chequamegon-Nicolet	2	10
Chippewa	<1	<1
Hiawatha	8	5
Huron-manistee	<1	<1
Ottawa	<1	<1
Superior	<1	<1

Distribution and Abundance

Sharp-tailed Grouse once occurred in at least 29 provinces and states of Canada and the United States (Miller and Graul 1980). More recently, the distribution of the species has become more restricted and sharptails now breed from central Alaska and central Yukon to northern Ontario and west-central Quebec, south to eastern Oregon, central Utah, Montana, Colorado, Nebraska, North Dakota, South Dakota, Minnesota, Wisconsin, northern Michigan and southern Ontario (Figure 5).

Upper Michigan is the eastern limit of the prairie race of sharptail and lies south of the range of the northern strain. Prairie sharptails historically occupied a geographical range from Ontario and Manitoba in Canada, to Michigan, Wisconsin, Minnesota and as far south as Illinois in the U.S. The current range of the prairie race is considerably smaller and more disjunct than during pre-settlement times, with small isolated populations in the Upper Midwest, as well as populations in southwestern Ontario and southeastern Manitoba. (Johnsgard 1983).

Figure 5. Distribution of Sharp-tailed Grouse (adapted from Connelly et.al 1998).

Where found in the United States, Sharp-tailed Grouse numbers have been decreasing in most areas due to habitat changes. The Lake States populations have also been declining in numbers and range in recent years. Fire suppression, wetland degradation, forest succession, the decline in low-intensity agriculture, and reforestation since the 1930's have resulted in the fragmentation and reduction of sharptail distribution and abundance throughout the Lake States.

The Sharp-tailed Grouse is an area-sensitive habitat specialist and isolated patches of their habitat must be relatively large to support viable populations (Temple 1991). The Sharp-tailed Grouse population is not continuous across its range. Sharptail habitat in the Lake States consists of semi-open patches or habitat fragments within a primarily forested matrix, requiring dispersal to re-colonize patches in which extinction has occurred. Small, isolated sharptail subpopulations occupy relatively small patches of open-land habitat in the upper Midwest. Dispersal patterns, barriers, genetic factors, and habitat characteristics influence colonization of new habitats by Sharp-tailed Grouse.

Existing sharptail population indices as measured by spring lek counts are displayed in Table 4. Actual spring populations would be somewhat higher since lek counts do not typically include females or non-breeding juvenile males.

Table 4. Current sharptail population as measured by spring lek counts of dancing males

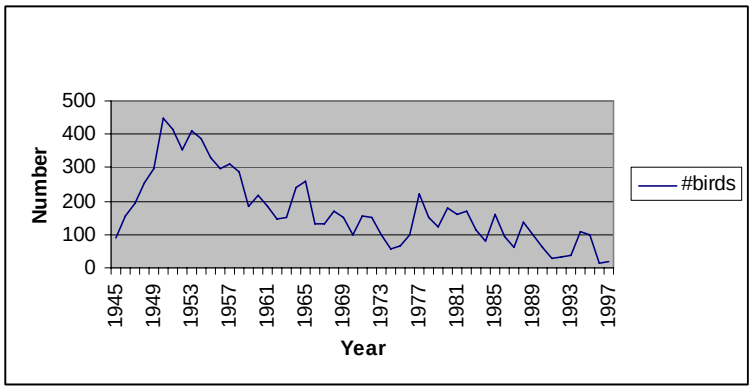
State	2005 Sharptail Population
Michigan	332
Minnesota	1,824
Wisconsin	215

Michigan

Peripheral populations are often genetically and morphologically divergent from central populations, and the long term conservation of a species may depend on the protection of these genetically distinct populations (Lescia & Allendorf 1995). Consequently, in Michigan, sharptails may exhibit behavioral and habitat use patterns that are different from birds in more central parts of their range. Michigan lies geographically near the eastern edge of the prairie race of sharptails and south of the northern race. While prairie sharptails are generally thought of as upland species, Hanson (1953) found the northern race breeding in extensive open muskeg wetlands. Sharptails in Michigan are found in both wetland and upland habitats.

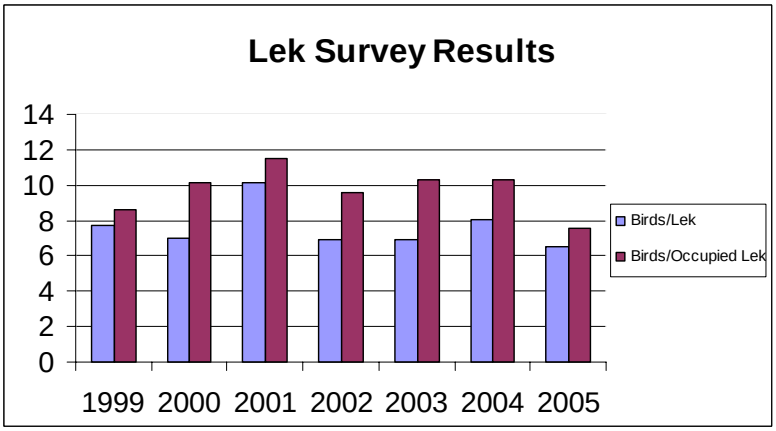
Sharptails likely existed in the burned areas, barrens and wetlands of Michigan until turn-of-the-century logging and subsequent slash fires created much larger areas of openalnd. Portions of Gogebic and Ontonagon counties in western Upper Michigan, for instance burned in excess of 18,000 ha annually between 1923 and 1927 (Peterle 1954). This magnitude of disturbance undoubtedly improved conditions for the species and caused significant population growth. In the late 20th Century, forest maturation and conversion of natural prairies to other uses has reduced habitat resulting in isolated subpopulations of Sharp-tailed Grouse across northern Michigan. The available Michigan Department of Natural Resources (MDNR) long-term population trend is displayed (Figure 6).

Figure 6. Sharp-tailed Grouse lek count population trend data for Upper Michigan (1946-1997).



Sharptails are now concentrated in the eastern portion of Upper Michigan and found occasionally in suitable habitat in western Upper Michigan. They were previously known to breed in Lower Michigan (Brewer et al. 1991). In eastern Upper Michigan, populations began to increase in the Eastern U.P. in the late 1990's and have recently stabilized. In 2005, 332 birds were observed on 51 leks (Minzey 2005). This compares to 620 birds on 77 leks in 2003. The occupancy rate on surveyed leks increased from 78% in 2004 to 86% in 2005. However, this increase may be a product of surveyors selecting which leks to survey rather than an actual increase in lek occupancy. The average number of sharptails observed/lek decreased from 8.0 (2004) to 6.5 (2005). The number of sharptails per occupied lek also decreased from 10.3 to 7.5 from 2004 to 2005 respectively. The average number of birds/lek as well as birds/occupied lek in 2005 were the lowest recorded in seven years (Figure 7). Using the total number of observed birds as a minimum population count is probably the most appropriate use of this data (Minzey 2005).

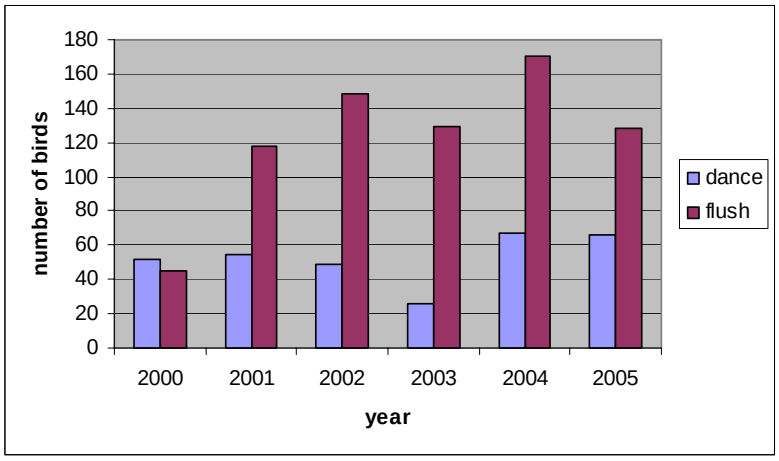
Figure 7. MDNR lek survey results 1999-2005 (birds/lek)



Chippewa and Schoolcraft counties in eastern Upper Michigan routinely rank number 1 and 2 respectively in terms of survey effort and birds observed. The same pattern held true in 2005 as 50% of the birds observed were in Chippewa County. Schoolcraft County contained 33% of the observed birds. For the fifth year in a row, no Sharp-tailed Grouse were observed in Delta County (Minzey 2005).

Of the 3 National Forests in Michigan, only the Hiawatha is known to currently support a breeding population (Figure 8). The Huron-Manistee and Ottawa have likely had breeding sharptails in the past and still have occasional reports of individuals. There are sharptails breeding adjacent to the Ottawa on private land, but habitat on the Forest is limited (Edde 2005, *pers comm*). The Huron-Manistee National Forest would like to re-establish a breeding population to compliment their barrens restoration and Endangered Kirtland's Warbler (*Dendroica kirtlandii*) management programs (Huber 2005, *pers comm*).

Figure 8. Spring lek count survey trend on the Hiawatha NF (2000-2005).



Minnesota

In Minnesota, sharptail population trends suggest a decline in the number of birds since lek surveys began in 1975 (Table 5). Between 1981 and 1995 there was a net loss of 77% of the sharptail population in Minnesota (Berg 1997).

Table 5. Percent change in total number of Sharp-tailed Grouse counted in comparable leks in northwestern and east-central Minnesota, 1981-1996 (from Berg 1997)

Year	Northwest (% Change)	East-Central (%Change)
1981	-20	Stable
1982	Stable	-34
1983	-22	-24
1984	-29	-20
1985	-18	-24
1986	+3	-28
1987	+8	+4
1988	+11	+21
1989	+4	Stable
1990	+10	+25
1991	-8	-3
1992	-21	-41
1993	-26	-23
1994	Stable	-9
1995	-11	-4
1996	-24	+15

Sharptails occur in less than one-third of their historical range in Minnesota (Berg 1997). Viable populations exist in two disjunct ranges in the northwest and east-central portions of the state. Population estimates in Minnesota are based on hunter harvests since 1949 and annual dancing ground counts. Between 1964 and 1980, male sharptail densities were estimated at 1.5 males/km^2 for a township-sized ($94km^2$) area in typical Minnesota sharptail range (Berg 1997). In 2000, a total of 168 leks were checked, and 130 active leks had 1,222 males present (9.4 males/ active lek, Berg 2000). Counts of the east-central leks resulted in 44% of the leks having more birds than the previous year, 45% had fewer and 11% were the same as 1999. Counts on 118 comparable leks in the northwest declined 9% from 1999 (Berg 2000).

During the spring 2005 survey 1,824 Sharp-tailed Grouse were observed at 193 dancing grounds. The mean number of Sharp-tailed Grouse per dancing ground was 7.6 (6.3–8.9) in the East Central range, 11.4 (9.6–13.2) in the Northwest range, and 9.5 (8.3–10.6) statewide. Counts of Sharp-tailed Grouse at dancing grounds in Minnesota during 2005 were very similar to counts during 2004 (Larson 2005). Furthermore, sources of temporal variation that are not related to the abundance of Sharp-tailed Grouse, such as the timing and duration of surveys, could cause minor changes in bird counts and index values. Although index values from different years are not necessarily comparable, the mean number of Sharp-tailed Grouse counted per dancing ground has fluctuated in a pattern consistent with an apparent long-term population cycle similar to that of ruffed grouse. During the last 20 years values of the Sharp-tailed Grouse index have been between approximately 7 and 11 birds counted per dancing ground. The 2005 statewide mean of 9.5 (8.3–10.6) birds counted per dancing ground was in the middle of that range (Larson 2005).

In the Superior National Forest, sharptails are not monitored (Ed Lindquist *pers. comm.*). The National Forests in Wisconsin and Minnesota (Chippewa, Superior, and Chequamegon-Nicolet) conducted a species population viability assessment for sharptail. They concluded that sharptails are declining region-wide and population trends are not well known for these National Forests, presumably due to very low numbers (Statement of Purpose and Reason Draft Species Data Records 2000).

Wisconsin

Overall, sharptail populations in Wisconsin have experienced dramatic declines, although management within certain areas like Crex Meadows show promise (Evrard et al. 2000, Gregg and Niemuth 2000). Within managed wildlife areas and recently disturbed sites, 748 dancing males were counted in 1998 compared to 215 in 2005 (Table 6).

The total number of dancing males on the 9 managed tracts in Wisconsin decreased from 148 in 2004 to114 in 2005, indicating a 23% decline in the sharptail population. The overall population has been on a gradual decline that started in 1999. Survey efforts by the Wisconsin Sharp-tailed Grouse Society in unmanaged habitats resulted in locating less sharptails in 2005, with a total of 215 birds found this spring compared to 243 last year (WDNR website, 2005). The State of Wisconsin is considering reintroductions of sharptails to the Ashland area (Eklund 2006, *pers comm.*)

Table 6. Sharp-tailed Grouse populations on managed wildlife areas (first 9 locations) and recently disturbed sites in Wisconsin (adapted from Gregg and Niemuth 2000).

	Number of Dancing Males by Year											
Location	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Crex Meadows	42	67	81	103	126	47	53	59	83	110	117	132
Douglas Co.	>10	>10	7	3	5	4	2	8	12	9	9	18
Kimberly-Clark	13	15	25	40	56	32	20	20	28	20	15	25
Moquah Barrens	2	2	-	3	6	9	6	7	21	14	17	34
Namekagon Barrens	15	15	<15	33	37	25	16	25	44	48	55	74
Pershing	30	39	43	23	37	34	24	16	26	30	43	34
Riley Lake	25	30	<20	20	25	8	5	7	18	17	19	19
Wood Co.	42	-	32	-	54	13	11	16	19	18	10	17
Dike Seventeen	-	-	-	-	16	10	9	9	8	7	3	18
SE Douglas Co.	-	-	-	-	-	-	-	-	153	-	213	377
Total (Reserves)	**-**	**-**	**-**	**--**	**362**	**182**	**146**	**167**	**259**	**273**	**288**	**371**
Total (All Sites)	**-**	**-**	**-**	**-**	**362**	**182**	**146**	**167**	**412**	**273**	**501**	**748**

There are 2 primary sharptail population centers on Wisconsin's Chequamegon-Nicolet National Forest (Riley Lake and Moquah Barrens). Both population areas appear stable, however Riley Lake (15-30 birds/year) may be slightly increasing, while Moquah barrens (5-30 birds/year) may have a slightly decreasing trend (Dan Eklund, *pers comm*. 2006).

Population Biology and Viability

Factors that may influence Sharp-tailed Grouse population growth rates are often interrelated and include; 1) quality of the habitat patch, size of habitat patch, and distribution of habitat patches across the landscape, 2) predator population levels, 3) hunting regulations and translocations, 4) female nest success and nest density, 5) spring weather prior to thermoregulation of chicks. Population densities can vary widely based on habitat quality. The magnitude of the carrying capacity for a habitat patch is determined by habitat quality and environmental factors which can fluctuate yearly. Generally mature populations reach an annual peak in early fall when the population consists of adults and fully grown juveniles.

Temple (1991) conducted a population viability analysis for sharptails in Wisconsin to achieve a 95% probability of population persistence for 50-years. He concluded that a viable sharptail population would require a spring breeding populations of at least 280 breeding birds in each of 5 sub-populations (1,400 total birds). Each subpopulation would require a 4000+ ha patch of appropriate habitat (20,000 ha total habitat). He calculated that 280 breeding birds would include a spring population of 140 females, all breeders, and 140 males, of which only 10% are breeding birds. This spring breeding population would, on average result in 628 individuals by October 1. According to Temple (1991) a minimum effective population size is needed to avoid inbreeding depression, or negative effects of genetic stochasticity, especially important for relatively isolated

sharptail subpopulations.

Conservation Status

Although sharptails can be found throughout portions of north-central North America many regional populations have shown long-term declines (Miller and Graul 1980, Marks and Marks 1987, Berg 1997, Raymond 1999, Gregg and Niemuth 2000). Several organizations use ranking systems to assign sharptail status to facilitate prioritization of management and conservation (Table 7). In Minnesota, sharptails are presently hunted, while in Wisconsin and Michigan sharptails have not been hunted since 1997.

Table 7. Sharptail status summary

Agency/Management Unit/Affiliation	Status	Comments
TNC/Natureserv Global Rank	G4	Apparently Secure
TNC/Natureserv National Rank	N4	Apparently Secure
TNC/Natureserv Michigan Rank	S3	Vulnerable
TNC/Natureserv Wisconsin Rank	S2	Imperiled
TNC/Natureserv Minnesota Rank	NR	Not Ranked
TNC/Natureserv Illinois	NR	Apparently Extirpated
State Michigan	SC	Special Concern
State Wisconsin	SC	Special Concern
State Minnesota	Game	Open hunting season
Chequamegon-Nicolet NF	R9/MIS	2 population centers (Riley lake, Moquah barrens)
Chippewa NF	R9	Historical leks possible, no recent leks
Hiawatha NF	R9/MIS	Approximately 15-20 leks, most on east unit (Raco)
Huron-Manistee NF	R9	Occasional reports
Ottawa NF	none	Occasional reports
Superior NF	R9	Possibility of leks in proclamation boundary, but not currently known on FS land

The sharptail is a Management Indicator Species (MIS) for the Hiawatha and Chequamegon-Nicolet National Forests. As an indicator species, sharptail population levels theoretically provide an index to population levels of other species associated with similar habitats. Species associated with sharptails would include area-sensitive, obligate openland species such as short-eared owl, black-backed woodpecker, northern harrier, sand-hill crane, field-sparrow, prairie warbler, badger, etc. While these species may use similar habitat as sharptails, the MIS process provides only a coarse-filter approach, since all species have individual, unique niches. Individual species management and conservation requirements must also be assessed at a fine scale.

Potential Threats

Present or Threatened Risks to Habitat or Range

Various threats to sharptails have been documented and most are a primary consequence of human activity (Connelly et al. 1998). Albeit over hunting, disease, and other factors may influence some populations, in general it is believed that regional and local declines and extirpations can be attributed primarily to loss and fragmentation of suitable habitat throughout the species range (Miller and Graul 1980, Marks and Marks 1987, Berg 1997, Raymond 1999, Gregg and Niemuth

2000, Hanowski et al. 2000). Major land use changes that have proven to be detrimental to sharptails include the loss of native barrens, intensive agriculture, fire suppression, reforestation, natural succession, and urban sprawl. The National Forests in Wisconsin and Minnesota Statement of Purpose and Reason Draft Species Data Records (2000) states that the highest potential threats to sharptail population viability include 1) Decline in habitat quality, 2) Changes in vegetation composition, 3) Genetic homogeneity, and 4) Interactions among threats.

The Michigan Wildlife Action Plan (Eagle et al. 2005) identifies the following threats to sharptails; **c**onversion to agriculture lands; altered fire regime; fragmentation; grazing & mowing patterns; incompatible natural resource mgmt; industrial/residential/recreational development; forestry practices; non-consumptive recreation; other biological interactions (predation by birds and mammals); pesticides & herbicides; removal of wildlife; social attitudes.

The State of Wisconsin Wildlife Action Plan (Wisconsin Department of Natural Resources. 2005) identifies the following threats and issues for sharptails in Wisconsin;

- Need to restore large blocks of open barrens through harvest or fire.
- Housing development reduces opportunities for large-scale management through timber harvest and/or fire.
- Conversion of barrens/jack pine forest to red pine plantations is a significant long-term threat.
- Since we have low population sizes in Wisconsin, care should continue to be taken to ensure over harvest does not occur.
- It is not clear how invasives such as spotted knapweed will affect Sharp-tailed Grouse.
- Remaining populations are somewhat isolated and genetic drift could become a serious issue.

The sharptail decline in Minnesota in the last 50 years has been caused by drastic changes in land use and fire suppression technology and these problems can be categorized as: 1) natural succession, 2) conversion to intensive agriculture, and 3) conversion to conifer plantations (Berg 1997). There is concern that hybrid poplar, grown for fiber in Minnesota could reduce sharptail habitat, especially on private lands and fallow agricultural land (Minnesota Wildlife Society 2002, Furtman 2005).

Fire Suppression

In Michigan, current fire rotations were found to be an order of magnitude longer than historic rotations, resulting in important implications for forest health and ecological processes (Cleland et. al, 2004). Fire suppression minimizes the amount of post-fire habitat available to wildlife (Niemi and Probst 1990). The heterogeneity produced by fire can produce a mosaic of openland, down coarse-woody-debris, un-burned islands, many den and snag trees, blueberries and diverse under story vegetation. This mosaic is difficult to simulate with silvicultural and habitat management treatments.

Springtime is the most likely period of wildfire occurrence in upland habitat with most fires occurring before leaf-out in mid-April through mid-June. This spring burning window coincides

with sharptail breeding and nesting and some egg/chick mortality could be expected from this disturbance. However, this mortality has not been quantified and is offset by the positive effects of habitat creation. Summer fires, often resulting from lightning strikes on ridges in wetlands, can also burn extensive areas, especially in drought years. At Seney National Wildlife Refuge prescribed fire is being used during the growing season (late July to early September) to emulate natural ignition patterns and control succession of woody plants (Figure 9).

Figure 9. Prescribed fire can be used to mitigate the effects of fire suppression.

Habitat Loss and Conversion

Grassland, wetland, savanna, barren and shrubland ecosystems have declined in amount, extent and quality in eastern north America resulting in habitat problems for species of early successional ecosystems (Askins 2001). These species are in trouble not only because of more intense farming practices and the decline in acreage of pastures, hay fields and abandoned fields, but also because of the suppression of natural disturbances like fire. While the loss of old growth and the fragmentation of second growth forest are major concerns, so too is the decline of early successional habitats dominated by grass, shrub and young trees (Askins 2001).

Converting barrens and jack pine sites to red pine (*Pinus resinosa*) plantation reduces habitat suitability for openland species, including sharptails, because red pine plantations typically lack the under story development and habitat diversity of jack pine stands (Niemi and Probst 1990). Typically, two jack pine rotations could be grown in the same time period as one red pine rotation, with significantly more temporary openings, snags, understory plant diversity and young jack pine habitat available.

Habitat Succession

The continued maturation of forestland in Region 9 of the Forest Service and subsequent decline in early successional forest conditions could contribute to the decline and potential loss of early successional bird species of conservation concern (Trani et al. 2001). Birds found in early serial

stage forests of Great Lakes National Forests are experiencing declining amount and quality of habitat (Edde 2005). Trend data also indicate that the proportion of seedlings and saplings in forest land in Wisconsin, Michigan and Minnesota have declined by between 5% and 12% since the mid 1950's. Considering all ownerships, the current seedling and sapling proportion of the forested land base is approximately 24% in Michigan, 30% in Minnesota and 31% in Wisconsin Forestland (Trani et al. 2001).

Agriculture and Land Use Patterns

Sharptail habitat is also threatened by the decline in small family farms and the associated control of natural secondary succession via low-intensity land use practices. In much of the best sharptail habitat in the Upper Peninsula of Michigan, urban sprawl is a threat as agricultural lands are converted to housing and other structures (Corace et al. *In Review*).

Commercial, Recreational, Scientific, or Educational Over utilization

Sharptails are a popular game species and their spectacular spring courtship ritual is popular with photographers and bird-watching enthusiasts alike. Historically a game species, fewer than 500 birds were historically harvested annually in Michigan (Ammann 1957) with many more harvested in Minnesota. However, there are far fewer sharptail hunters in Minnesota today than in the past as a consequence of population declines (Berg 1997). For example, in 1949, approximately 154,000 sharptails were harvested in Minnesota, whereas in 1993 approximately 9,000 birds were harvested, 6,000 in 1994, and 5,000 in 1995 (Berg 1997). Recent declines in populations have resulted in reduced bag limits and reduced open hunting areas across the range, and a ban on hunting in Michigan and Wisconsin starting in 1997.

Hunting activities may adversely impact small, isolated and declining populations (Ammann 1957, Connelly et al. 1998). From an 11-year study on Drummond Island, Ammann (1957) concluded that: 1) 40-50% of the fall sharptail population can safely be harvested without jeopardizing the bird's future, in large areas of optimum habitat, while bird populations are rising; 2) in isolated areas of sub-optimal or poor quality habitat hunting may significantly impact populations and contribute to declines; 3) population trends are important in establishment of season timing and bag limits. Temple (1991) suggests that up to 30% hunter harvest is compensatory, based on models he has developed, meaning that in an average year hunting probably would not affect spring survivor numbers. However a string of poor survival years could result in an additive hunting mortality.

Wildlife observation, surveys and research can also have a negative impact on the species. Males appear to be less tolerant of human presence than females (Connelly et al. 1998). Disturbance at leks may limit reproductive opportunities and may result in regional reproductive declines (Baydack and Hein 1987).

Snowmobiles are becoming a larger threat as they are now commonly used off roads and trails, due to new technology that permits the machines to run on deeper snow. Large openlands are especially attractive for this activity. This has the potential to affect sharptail viability since sharptails live in the same, limited large openland, habitat that is targeted for this recreational

activity. Snowmobiles forced birds to flush from snow burrows and tree roosts during a season where energy conservation is critical. Young tree plantations are frequently posted as off-limits to snowmobiles due to potential damage to young trees. It may be necessary to also post large openland habitats to prevent damage to sharptail populations.

Disease and Predation

Disease does not appear to be a major threat to sharptail populations, however ulcerative enteritis and tularemia have been documented and populations of closely related galliformes have been shown to be adversely affected by parasites (Connelly et al. 1998).

Predation is suspected to cause a large number of nest losses. Over a 5-year period, Giesen (1987) found yearly survival rates for females varied from 17-42% and most mortality was due to predation. Broods will typically experience a 47% mortality rate with the majority occurring during the first month (Johnsgard 1983).

Inadequacy of Existing Regulatory Mechanisms

There is a common misconception that many disturbance dependent species moved into the east, from the west following turn-of-the-century exploitation of forests (Hunter et al 2001). Robbins (1996) suggests that it is more likely that these species were native to natural openings in the presettlement landscape and increased in number and spatial distribution following disturbance. The original status of sharptails near the eastern edge of their range is not clear (Maples et al. 1996). For example, in Michigan, it has been argued that sharptails moved into the state due to human processes (e.g., timber harvest, slash fire and translocation) and as such are a "non-native" species, and not of great conservation concern. Others think the species existed in burns, wetlands and barrens prior to settlement (Amman 1957, Peterle 1954) and is a "native" species, worthy of conservation concern. This issue has complicated efforts to conserve the species.

Sharptails are non-migratory and are still considered primarily a game species. Hunting regulations and associated surveys of hunted populations are generally the responsibility of the State Natural Resource Management organizations and game species generally receive a higher priority for survey/census compared to non-game species. Difficulties in assessing sharptail numbers exist because, populations are disjunct, birds often inhabit private agricultural lands, often exist at relatively low density, surveys require repeat visits, and the census period coincides with other established spring-time survey periods. At present, existing broad-scale survey programs (e.g., Breeding Bird Survey) are inadequate for monitoring sharptails (Robbins et al. 1996, Sample and Mossman 1997, Sauer et al. 2000).

Since sharptails are no longer hunted in Michigan and Wisconsin, they do not currently hold "game" status in these States. However, they are not necessarily considered a "non-game" species either. Thus, there is the potential for sharptail conservation to miss funding and public support opportunities, since they are not recognized as either a "game" or "non-game" species.

All 3 States with sharptails have active sharptail conservation groups that serve as advocates and provide critical labor, funding, assistance with State-wide surveys, facilitate public discussion, and generate interest in sharptail management. Current momentum for sharptail conservation depends

a great deal on the financial and political support these groups provide. Without this support sharptail conservation would likely have considerably less emphasis in the Region.

The Minnesota Sharp-tailed Grouse society (MSGS) is a group of conservation minded citizens determined to help reverse the decline of Minnesota's native Sharp-tailed Grouse population. Their objectives are to; 1) educate natural resource managers and the public about Sharp-tailed Grouse and their habitat, 2) influence the management of habitat through contacts with elected officials, and through cooperation with natural resource agencies, land-owners, and private organizations, and 3) raise funds to support education, legislation, and management.

The Michigan Sharp-tailed Grouse Association (MSGA) was formed in 1990 by concerned biologists and private individuals, with the stated purpose of "the restoration of grassland ecosystems". The MSGA annually provides volunteers to conduct the annual spring census of leks. The MSGA's main goal is that of working towards a grassland management plan for Michigan.

Other Natural or Human Factors Affecting Continued Existence of Species

Collision with wire, fences and vehicles may prove to be an underestimated mortality factor and is relatively little studied. Nest parasitism by other bird species may impact sharptail populations (Westermeier et al. 1998).

Summary of Land Ownership and Existing Conservation and Management Activities

Sharptail habitat protection within Region 9 requires consideration of existing and potential openland habitat on private and public lands (Berg 1997, Gregg and Niemuth 2000, Corace et al. *In Review*). State and Federal resources are committed to maintaining openland habitat in Michigan, Minnesota, and Wisconsin (Gregg and Niemuth 2000) through prescribed fire and even-aged timber management. State Wildlife Action Plans are in place with conservation recommendations for sharptails or their habitat.

National Forest Plans

The sharptail is a R9 Sensitive species for 6 of the 7 National Forests covered by this assessment (all except the Ottawa). Forest Plan direction provides general conservation objectives for R9 Sensitive Species. For example, the Chippewa has a Sensitive Species objective to; maintain, protect, or improve habitat for sensitive species using both a landscape level (or coarse filter) management strategy, and a site-level (or fine filter) management strategy, and addressing species' needs by managing specifically for high quality potential habitat or known locations of sensitive species. Most Forest Plans include language so that if negative impacts to sensitive species cannot be avoided, management activities must not result in a loss of species viability forest-wide or create significant trends toward federal listing. The Hiawatha has a goal that the Forest will contribute to the conservation of Regional Forester Sensitive Species and work cooperatively with State and Federal agencies to complete and implement conservation assessments and strategies. The Huron-Manistee and the Hiawatha have goals to create large areas of regenerating jack pine to manage Kirtland's Warbler habitat. During the early serial stages of jack pine ecosystems, these temporary openlands provide suitable sharptail habitat. Specific Forest Plan direction for sharptails is summarized in Table 8.

Table 8. Summary of sharptail protection in National Forest Plans in the Region.

Forest	Occupied	Forest Plan Direction	Comment
Chequamegon-Nicolet	Yes	Goals are to maintain and enhance these populations through habitat restoration and maintenance (Eklund pers com. 2006)	2 populations. Sharptail is MIS for Forest.
Chippewa	Historic	None specific for sharptail.	
Hiawatha	Yes	Objective; In this planning period, maintain permanent openings within vegetation goals for habitat suitable for Sharp-tailed Grouse. Wildlife Vegetation Management Guideline: The maximum size of temporary openings for Sharp-tailed Grouse and Kirtland's warbler management should not exceed 1,100 acres. In KW management areas the 1,100-acre temporary opening guideline may be exceeded by harvesting adjacent blocks after the appropriate stocking density is achieved, and after the third-year stocking review.	Managed in conjunction with KW habitat. Prescribe burn large barrens openings for barrens restoration, sharptail habitat and associated species. Sharptail is MIS for Forest.
Huron-Manistee	Occasional	None specific for sharptail. Plan allows barren creation and provides vary large areas of potentially suitable sharptail habitat via KW management program.	Interested in establishment of new breeding population in barrens restoration areas and KW management areas. Planning for 2006 sharptail survey (Huber pers. com. 2005)
Ottawa	Occasional	None specific for sharptail	Private land in "hole in doughnut" between Bergland and Bruces Crossing holds sharptails. Some potential on Baraga plains. Pburn planned for Baraga could benefit sharptails. Unlikely that sharptails will remain for more than a few decades in western U.P. (Edde 2005 pers comm)
Superior	Historic	None specific for sharptail.	Coarse filter/fine filter approach

Existing Management Activities

Management for an area-sensitive species, such as sharptail, requires a large-scale ecosystem perspective by which large tracts of openland are maintained through even-aged timber management, wildfire or burning, grazing, cutting or mowing. Low intensity farming and the restoration of pine barren ecosystems utilizing prescribed fire and even-aged timber management will provide important, if not critical, habitat for this and other openland bird species of conservation concern. Because public lands cannot be expected to provide habitat for all openland species (Probst and Crow 1991), partnerships involving private lands (e.g., agriculture, timber industry, state and federal, etc.) would help to maintain sharptail habitat.

Multi-scale approaches will best meet the needs of sharptails and associated early successional species because some characteristics of sustainability are best viewed from a regional perspective, while others should be evaluated at the landscape or stand/patch scales (Probst and Crow, 1991). Management objectives should be directed towards providing the mix of habitat conditions to

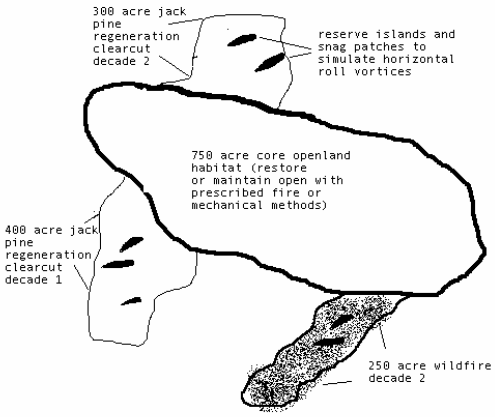
which species have become adapted. Conservation of biological diversity in forests will require management plans that mimic, to some extent, the long-term historical and natural disturbance regime (Lorimer 2001).

The Sharp-tailed Grouse is an important component of the native biological diversity of fire-regulated ecosystems. Efforts directed at maintaining Sharp-tailed Grouse are focused on restoring quality habitat at existing subpopulation centers and on other potentially occupied habitats such as historic pine barrens wetlands and other fire-regulated ecosystems. Sharptail populations respond rapidly to improved habitat conditions, such as timber harvest in large blocks (that mimic wildfire disturbance patterns), and controlled burning of suitable habitat.

Many of the habitat patches inhabited by sharptails are imbedded within a matrix of forested habitat in the upper Great Lakes. This forested matrix also provides habitat for many regionally important bird species that use forested ecosystems. Therefore, openland habitat management should be accomplished within the context of conserving patterns and processes of native ecosystems. Management of openlands requires coordination between wildlife biologists, ecologists, silviculturalists and fire staff. Timing and location of clear-cuts, size of clear-cuts, site preparation, reforestation, prescribed burn plans, preparation and implementation decisions all have an impact on openlands habitat.

Maintaining a system of large openland habitat can provide a "coarse filter" approach to species protection. The highest conservation priority species are those in which ecological conditions (e.g., soil and hydrologic characteristics) sustain openland vegetation. Openland habitat management has been implemented on state and federal lands within Region 9 in conjunction with silviculture practices. For example, on the Hiawatha, pine barrens complexes are managed for timber production and prescribed burning to restore native plant and animal communities. Establishment of large opening complexes is accomplished using jack pine harvests adjacent to large permanent openland habitat (Figure 10). This interdisciplinary approach provides timber products, creates and maintains fuel breaks, and provides habitat for area sensitive openland species like sharptails.

Figure 10. Example of an interdisciplinary management scenario providing multiple outputs.



In Upper Michigan, sharptails may use large areas of recently burned openland habitat (Baumgartner 1939, Sjogren and Robinson 1997). Fire can substantially increase the quality and quantity of blueberries and other native plants that function as food or cover resources for sharptails (Ammann 1957, Niemi and Probst 1990). However, prescribed burning, requires interdisciplinary coordination, long-range planning, suitable weather, and public acceptance. In combination with even-aged timber management, fire provides a suitable and integrated approach to openland habitat management. Next to wildfire, prescribed fire is the best method to restore and maintain large patches of high quality habitat and simulate conditions historically found in xeric and wetland portions of the range. The application of fire should be designed to establish a mosaic of grasses, shrubs, snags and blueberries over large areas (Figure 11).

Figure 11. Prescribed burn operation to maintain and restore barrens habitat.

Another option for control of tree succession is the use of hand tools or mechanical brush cutters. Chainsaw or hand-saw cutting of encroaching vegetation, while labor intensive, provides an excellent method to maintain land in an open condition. Hand cutting has the advantages that it can be done at any time of the year, the manager can be very selective in designation of tree or shrub species to remove, and work can be completed using relatively cheap labor sources like prison crews and volunteers. Mechanical brush cutters have similar advantages as hand cutting but they can treat an area much quicker if the site is suitable. If the site is stump and slash free, is relatively flat, and encroaching vegetation is relatively small (<5 cm DBH), a brushog pulled behind a farm tractor or dozer is an efficient method to maintain openland (Figure 12).

Ground disturbing equipment should not introduce or spread non-native or exotic vegetation. Non-native vegetation can colonize a site and replace native vegetation which can displace animals adapted to the native vegetation. In addition exotic plants can out-compete or displace habitat for native and possibly rare plant species. Equipment may be washed prior to moving onto the site to remove and prevent the accidental spread of weeds.

Figure 12. Tractor and brushog operation used to simulate a light surface fire and restore barrens habitat

Silvicultural techniques have an important role is creating and maintaining early successional habitats across the landscape (Thompson et al. 2001). Natural disturbance regimes in the jack pine ecosystem have historically resulted in very large tracts of even-aged trees. Silvicultural techniques that mimic this structure and condition should be employed when managing for open-land habitat. In historic barrens areas, tree harvest may be used with fire to restore elements of the original land cover condition. For example, on the Hiawatha, Kirtland's Warbler and sharptails are successfully managed together since large stands of young jack pine (i.e., 0-9 years of age) adjacent to managed barrens openings provides excellent sharptail habitat, before it becomes suitable for KW.

At the time of timber sale layout, considerations should be given to simulating wild-fire structure, for visual management, and other habitat considerations. For example, leaving large oaks or red pines or narrow islands or fingers of live trees to resemble skip areas in burns. These strips will simulate horizontal roll vortices or green islands frequently found after stand replacing wildfires in jack pine. These strips provide habitat diversity as feeding, cover and nesting areas for many open-land associated species. The habitat value remains as the strips die and fall over or blow over. Consider providing areas of red pine savanna where open-land habitat or jack pine regeneration is established under a stand of lightly stocked (i.e. <40 basal area) but large red pine trees.

The jack pine budworm *(Choristoneura pinus pinus)* is an important consideration in the management of jack pine and sharptail resources. Jack pine, fire and budworm are interrelated in the ecological system of barrens and xeric pine plains. Jack pine salvage operations following a budworm outbreak replace fire as the stand regenerating disturbance agent. Fire and budworm are natural components of the ecological function of this system. In general, budworm outbreaks will be minimized by providing decreased edge, fully stocked stands and few open grown trees. The probability of wildfires will be reduced by maintaining large openings, surrounded by large temporary clear-cuts, providing large rotating fire break complexes.

Sample and Mossman (1997) have provided guidelines for management of grassland birds, including sharptails, for Wisconsin. These guidelines are generally applicable across the sharptail range in Region 9, and include excellent recommendations on management techniques, disturbance ecology, vegetation height, priority landscapes, and more using a multi-species landscape ecosystem approach.

The State of Wisconsin Wildlife Action Plan (Wisconsin Department of Natural Resources. 2005) identifies the following priority conservation actions;

- Since this species requires large areas of grassland/barrens, the best management and preservation opportunities are on public land.
- Continue to build barrens partnerships in appropriate landscapes.
- Create habitat corridors and consider translocations to restore genetic variability within isolated populations.
- Create financial incentives to incorporate large aggregated clearcuts in and around managed core areas. This will require sound long-term planning. This strategy could be used in conjunction with management for Kirtland's Warbler and Connecticut Warbler, as well as the other barrens species.

The following priorities were recommended for openland habitat and sharptail management in a draft Openland Conservation Strategy (2000) for land in eastern Upper Michigan. These have been used to guide management of State and Federal lands in Michigan:

1. Maintain a system of large open-land habitat across the eastern U.P. that will provide a "coarse filter" approach to species protection. The highest priority are areas where ecological conditions will sustain open-land vegetation.

2. Pine barrens and wetland complexes are extremely important areas to prioritize the use of prescription burning for restoration of native plant and animal communities.

3. When contemplating jack pine harvest, establishment of very large blocks of temporary openings, or clearcuts, should be a priority, especially when they are located near large areas of permanent open-land habitat, or where needed to meet specific wildlife population goals.

4. Agricultural lands in the eastern U.P. currently provide important habitat for open-land species and some of these lands should be a priority for open-land conservation.

5. Restore natural hydrology to wetland habitats.

6. Consider open-lands and early successional wildlife habitat requirements in rehabilitation and management of areas burned by wildfire.

7. Prevent the spread and colonization of non-native and exotic or invasive plants.

Research and Monitoring

Existing Monitoring, and Research

Sharp-tailed Grouse surveys are being conducted in Michigan, Minnesota, and Wisconsin. The standard method uses spring time lek counts. Some states are experimenting with late summer and fall field searches of broods using dogs. Sharptail lek surveys should not be used as absolute estimates of population size, but rather as indices of population trends (Applegate 2000).

On the Hiawatha and Chequamegon-Nicolet National Forests the sharptail is a Management Indicator Species (MIS) and as such will likely receive more intensive monitoring, compared to Forests where it is not a MIS.

Drummer et al. (2005) are conducting sharptail research in Upper Michigan and have completed the first year of a planned 3-year study. The objective of the study is to develop a monitoring method and an unbiased abundance estimator for the regions Sharp-tailed Grouse population. They have captured, radio-collared, and tracked Sharp-tailed Grouse at three sites indicative of three broad openland landscape types in the eastern Upper Peninsula of Michigan: the Clay Lake Plain of Chippewa County (low intensity agricultural land). Seney National Wildlife Refuge (open wetlands), and Raco Plains of the Hiawatha National Forest (pine barrens). Available data indicated a peak in lek visitation lasting about two weeks wherein the probability of birds visiting leks was > 80%. Lek count data indicated different trends in number of flushed birds across sites, with respect to date and time of day. Collared birds residing on or near Seney National Wildlife Refuge were not observed on >1 lek, but some birds at the Raco Plains and Clay Lake Plain sites did move between leks during the breeding season.

Survey Protocol

Spring census of dancing males counts only a portion of the total population due to the 50:50 sex ratio, and an unknown proportion (estimates of 50%-90%) of non-dancing or non-territorial males (Rippen and Boag 1974, Temple 1991).

Michigan

Sharp-tailed Grouse are the most intensively surveyed species in Upper Michigan (Minzey 2005). Since 1999, Michigan DNR has been working cooperatively with the Hiawatha Forest, Seney National Wildlife Refuge, and volunteers to conduct surveys on known Sharp-tailed Grouse leks. Generally, surveyors will visit each lek at least two times during the months of April and May using standard survey protocol (appendix 1). After getting a count on the dancing males, the surveyor then walks into the lek and flushes the birds to gain a total count present at the lek.

Wisconsin

Sharptail numbers in Wisconsin are assessed using a variant of Grange's "hooting ground surveys" with observers listening and looking from roads every 0.8 km where suitable habitat exists. Flush counts are also used. Sharptail populations on managed properties are monitored by counting

displaying males on dancing grounds. Male birds were identified by observations from blinds placed on dancing grounds with the aid of field glasses after approaching the dancing ground afoot or by vehicle. Complete census of display grounds was attempted on those properties designated as sharptail management tracts. Sharptail surveys on private lands generally involved selecting one or more blocks of the best available habitat and then conducting listening routes along roads transecting those blocks. Those dancing grounds found within wild land habitat blocks were approached and all birds flushed from each site were counted, no attempt being made to distinguish sexes. Sharptail surveys on unmanaged lands were concentrated within a portion of northwestern Wisconsin. These surveys are a cooperative effort between DNR, USFS, GLIFWC, Northland College, members of the Wisconsin Sharp-tailed Grouse Society, and volunteers.

Minnesota

The purpose of surveys of grouse populations in Minnesota is to monitor changes in the densities of grouse over time. Estimates of density, however, are difficult and expensive to obtain. Simple counts of animals, on the other hand, are convenient and, assuming that changes in density are the major source of variation in counts among years, they can provide a reasonable index to long-term trends in populations. Weather, habitat conditions, observer ability, and grouse behavior, vary over time and affect simple counts of animals. These factors make it difficult to make inferences about potential changes in wildlife populations over short periods of time. Over longer periods of time assumptions upon which grouse surveys in Minnesota depend are more likely to be valid, thereby making inferences about grouse populations more valid (Larson 2005).

Known and accessible dancing grounds were surveyed by Wildlife Managers and their volunteers between sunrise and 2.5 hours after sunrise during April to count Sharp-tailed Grouse. When possible, surveys were conducted when the sky was clear and the wind was <16 km/hr (10 mph). Attempts were made to conduct surveys on >1 day to account for variation in the attendance of male grouse at the dancing ground. Survey data consist of the maximum of daily counts of Sharp-tailed Grouse at each dancing ground (Larson (2005).

The index value of interest was the mean number of Sharp-tailed Grouse per dancing ground, averaged across dancing grounds. It was not valid to compare the survey data results from different years because survey effort and success in detecting and observing Sharp-tailed Grouse was different between years. Many factors can affect the number of birds counted, so inferences based upon comparisons of survey data between years are tenuous. Larson (2005) used the data set to calculate the difference in the mean number of birds counted per dancing ground between 2004 and 2005 and the percent difference in the total number of birds counted on the comparable dancing grounds.

Research Priorities

In 2005, several Upper Michigan leks surveyed were visited four or more times. In most cases, the number of birds counted per visit was not consistent. In some cases, there was as much as a 22 birds/lek difference between dates on the same lek. There is also some anecdotal evidence that some of the surveyed leks are transitory. Observers have reported cases in which Sharp-tailed Grouse dance at a given location, lift up and move a few hundred yards and begin dancing again at

a new location. This pattern may be repeated three or four times over the course of a given morning. The noted behavioral patterns and inconsistent data gained from the survey of individual leks highlight the need for a more reliable process of indexing Sharp-tailed Grouse abundance (Minzey 2005)

Genetic study could be used to evaluate the effects that isolation of small sharptail sub-populations may have on genetic health, diversity, inbreeding and effective population size. Genetic work could also assess potential hybridization issues. In addition, genetic study could be used to evaluate Michigan sharptails in relation to *T.P. campestrus* the prairie race, and *T.p. phasinellus*. This work could shed light on the origin, and subspecies of sharp-tails that inhabit Upper Michigan. Genetic study could help explain physiological habitat adaptations at range edge, or where races overlap. For example, the northern race of sharptails breeds in extensive muskeg wetland habitat (Hanson 1953) and the prairie race is typically found breeding in upland grass/shrub habitats. Michigan sharptails breed in both of these habitat types.

More study of the mechanisms regulating population trends and bird movement is needed. Future sharptail research should investigate the effects of weather, fire, and agricultural practices on habitat use, predation rates, and breeding behavior. More work is also needed in a regional context to provide parameters for assessing minimum viable populations and minimum habitat area requirements.

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Appendix 1: Michigan Sharp-tailed Grouse Survey protocol

Sharptail Dancing Ground (Lek) Survey guidelines

1. Attempt to survey each Lek at least twice during the season, at least 1 week apart.
2. Begin surveys as soon as the birds become active on the dancing ground. Usually about April 1 to May 15.
3. The best counts are obtained shortly after dawn, but birds may still be on the dancing grounds until about 10:00 a.m.
4. Avoid doing the survey during periods of heavy rain or high winds.
5. The best technique is to observe the dancing ground from a distance with binoculars and attempt to count all dancing males. Only the males display but females may be present. When confident that the males have been counted, approach the dancing ground and count all flushed birds.
6. A successful method for locating new leks is to stop and listen for dancing males at about ? mile intervals in suitable habitat between dawn and 10:00 a.m. New Leks should be surveyed on another day if found later in the morning and you believe that all birds may not have been counted.

Local Lek name	Use the historical name for the Lek if known.
Date	Be sure to include the year
Time	Record time of observation
Weather	Record temperature, wind, and sky conditions
Birds observed	M=number of males, F=number of females, ?=number of unidentified birds, add all birds sighted and enter in total column
County	Write in County on the upper line, record legal Town, Range, Section, and ``40" below. For example: Luce; T47N, R10W, Sec. 31, SENW
Comments	Any other information. For example: 3 birds seen in trees, no dancing observed; GPS location if taken; birds flushed before could count males, etc.
Observer(s)	Enter the name(s) of people who did the survey.
Completed forms	Send a copy of all completed forms at the end of the survey period to: Terry R Minzey DNR Wildlife Division P.O. Box 67 Shingleton, MI 49884

Sharptail Dancing Ground Record

Michigan Department of Natural Resources
Wildlife Division
Route 4, Box 796
Newberry, MI 49868

Local Lek name	***Date***	***Time***	***Weather***	***Birds observed***				***County***				***Comments***	***Observer***
				M	**F**	**?**	**Tot.**	**T.**	**R.**	**Sec**	**``40''**		
								Chippewa					
Example	*5/1/03*	*0600*	*Clear, 5mph wind 55 degrees*	*9*	*4*	*5*	*18*	*45N*	*5W*	*30*	*nwnw*	Very active, etc	*name*