Wisconsin Sharp-tailed Grouse Management Plan 2023-2033

Wisconsin Department Of Natural Resources

Sharp-tailed Grouse Management Team

Photo by Ryan Brady, Wisconsin DNR

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I.

Working Group Tours

Department staff met with working group members to tour properties in the Northwest Sands Ecological Landscape and discuss different habitat management approaches and priorities for the plan. These tours included internal representatives from the Plan Writing Team and staff from Wildlife Management, Forestry, Office of Applied Science, and the Natural Heritage Conservation program. External working group organizations included: US Forest Service, Pheasants Forever Farm Bill Biologists, American Bird Conservancy, Ruffed Grouse Society, Wisconsin Sharp-tailed Grouse Society, area Friends Groups, Brule River LLC, and Bayfield, Burnett, and Douglas County Forests.

II. Plan Timeline & Public/Partner Input Process

Wisconsin Sharp-tailed Grouse Management Plan	
Date of Approval	March 2022
Contact Address	Wisconsin Department of Natural Resources 101 S. Webster St. Madison, WI 53707
Sources of Support	Wisconsin DNR Bureau of Wildlife Management and Bureau of Science Services, Wisconsin Sharp-tailed Grouse Society, Friends of Crex Meadows, Friends of the Namekagon Barrens, Central Michigan University
Plan Public Involvement	
Advisory Committee Meeting, Issues and Goals Identified for the Plan	*Date: June 14, 2022* *Location: Spooner Fish Hatchery*
Open House, Public Comments to Kick-off Plan Update	*DATE: May 24, 2022* *Location: Douglas County Wildlife Area*
Dog Trainer Intercept Interviews, Field Qualitative Conversations for Plan Content	*DATE: Aug. 2022* *Location: Namekagon Barrens, Crex Meadows, Douglas County Wildlife Areas*
Expert Field Tour, Fine Tune Habitat Requirements	*DATE: Aug. 8, 2022* *Location: Crex Meadows*
Working Group Field Tour, Partnering Land Managers, Content for Implementation	*Date: Aug. 9,2022* *Location: Burnett County Forest, Namekagon Barrens WA, and Douglas County Forest*
Working Group Field Tour, Partnering Land Managers, Content for Implementation	*Date: Sept. 21, 2022* *Location: Brule River LLC, Brule River State Forest, Bayfield County Forest*
Working Group Field Tour, Partnering Land Managers, Content for Implementation	*Date: Sept. 26, 2022* *Location: Moquah Barrens (USFS), Private Lands, Bass Lake and Barnes Barrens - Bayfield County Forest*
Advisory Committee Meeting,	*Date: Oct. 7, 2022* *Spooner Service Center and Teams*

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Acknowledgements

We would like to thank members of the Wisconsin Department of Natural Resources Sharp-tailed Grouse Advisory Committee and the Sharp-tailed Grouse Management Plan Partner Working Groups who have committed their efforts over the years to this important endeavor. We would also like to thank the following partner agencies and organizations who have supported the sharp-tailed grouse/barrens cause for decades in Wisconsin: Wisconsin Sharp-tailed Grouse Society, Wisconsin Ruffed Grouse Society, United States Forest Service, Friends of Crex Meadows Wildlife Area, Friends of the Namekagon Barrens Wildlife area, Friends of the Bird Sanctuary, Wild Rivers Conservancy, the Great Lakes Indian Fish and Wildlife Commission, Wisconsin County Forest Association, Wisconsin Conservation Congress, and the Wisconsin Wildlife Federation.

Many divisions and bureaus within the Wisconsin DNR provided funding and/or assistance in the development of this plan including the Bureaus of Wildlife Management, Natural Heritage Conservation, Office of Applied Science, and the Division of Forestry. In addition, several partner groups provided valuable feedback during the plan development, including Audubon, American Bird Conservancy, and the Nature Conservancy.

Executive Summary

The sharp-tailed grouse (prairie subspecies, *Tympanuchus phasianellus campestris*) is a year-round resident of Wisconsin. Once found throughout the state, sharp-tailed grouse distribution retreated northward as Wisconsin's barrens, savannas and grasslands were converted to agriculture or fire dependent barrens and grasslands transitioned into forests due to wildland fire suppression and land use changes. Range contractions in Wisconsin mirror those found in Michigan and eastern Minnesota.

Today, sharp-tailed grouse are managed as a game species and are listed as a Species of Greatest Conservation Need in Wisconsin due to habitat loss, and other factors that may threaten the persistence of the species. Regionally, habitat loss is considered the greatest threat. Fragmentation of large blocks of open landscape, ecological succession, and conversion of habitats to other uses are the main factors contributing to this decline. In Wisconsin, sharp-tailed grouse exist primarily on a core group of six public properties managed for barrens and scattered private lands. This has resulted in two distinct subpopulations in the Northwest Sands Ecological Landscape and a small remnant in the North Central Forest Ecological Landscape.

Just as the sharp-tailed grouse population in Wisconsin is not contiguous, suitable habitat currently exists in scattered patches within a primarily forested matrix. As the sharp-tailed grouse is an area-sensitive species many of the remaining habitat patches are not large enough to sustain a long-term viable population. Additionally, the scattered distribution of remaining suitable habitat limits the dispersal and movement of sharp-tailed grouse among habitat patches. As a result, sharp-tailed grouse dispersal appears to be limited by significant habitat barriers. This limited dispersal likely minimizes any genetic exchange among subpopulations. Dispersal among habitat patches and colonization of new habitat is likely necessary to maintain a sustainable population and genetic viability in the long-term. Given that there are multiple public landowners across the landscape, there is a significant opportunity to collaborate with conservation partners when managing for sharp-tailed grouse habitat on the landscape scale. The Northwest Sands Habitat Corridor Plan was developed to support the previous Sharp-tailed Grouse Management Plan (DNR 2011) and provides prescriptions to address the issue of reconnecting this landscape for sharp-tailed grouse (Reetz et al. 2013).

A Need For A Plan

Long-term population declines and range contractions provide the greatest evidence of need for an updated conservation and management plan for sharp-tailed grouse. Conservation genetics research demonstrating that Wisconsin sharp-tailed grouse have significantly reduced genetic diversity, high levels of inbreeding, and genetic isolation provide additional urgency. In addition, recent research completed by the University of Wisconsin-Madison and University of Wisconsin-Stevens Point showed that the scale and approach of managing for sharp-tailed grouse on core public properties may not be enough to sustain this species indefinitely. The Northwest Sands Habitat Corridor Plan

has brought a collaborative group of partners together to implement sharp-tailed grouse habitat management at a landscape level in the Northwest Focus Area. This state plan will provide this partnership the tools to be more successful working to manage and reconnect the barrens landscape for sharp-tailed grouse and associated species.

Therefore, the Wisconsin Department of Natural Resources Sharp-tailed Grouse Working Group and Advisory Committee was charged with revising and updating the 2011 Wisconsin Sharp-tailed Grouse Management Plan. Membership of both the working group and committee is comprised of DNR representatives as well as other state, county, federal, tribal and non-governmental agencies and partners.

Structure Of The Plan

The plan has two primary components. The first explains the natural history and background of sharp-tailed grouse in Wisconsin and contains subchapters focusing on: taxonomy, natural history, population demographics, habitat requirements, population status and distribution, conservation issues and opportunities, and a review of the current management plan. The second component focuses on the management plan goals and strategies for implementation, and contains our plan goals, focus areas, plan objectives and strategies. The plan also includes several appendices with supporting documentation for specific plan goals and action items.

Plan Approach, Goals & Action Items

This management plan follows an adaptive management or conservation action planning approach. That is, the plan has set goals based on the best available information and has identified a number of information needs and gaps and a series of actions to address them. When new information becomes available and information gaps are filled, we will adapt the plan management actions as necessary to reach the plan goals.

The overarching goal of this plan is to ensure a managed sustainable population of sharp-tailed grouse in Wisconsin, by implementing landscape level habitat strategies within the Northwest Focus Area. We plan to accomplish this goal by focusing our management and research efforts on the existing core range of sharp-tailed grouse in northern Wisconsin, specifically the Northwest Focus Area. Further, our vision for this overall management effort is to develop and facilitate a voluntary and cooperative partnership among public and private organizations to ensure the long-term viability of sharp-tailed grouse populations in Wisconsin through an ecological landscape approach.

The core sharp-tailed grouse population currently occurs in northern Wisconsin within the Northwest Sands and Superior Coastal Plains Ecological Landscapes. Another smaller population persists in the North Central Forest. To ensure the highest probability of maintaining a viable sharp-tailed grouse population in Wisconsin and retain sharp-tailed grouse genetic diversity, it is recommended that we focus effort on implementing the Northwest Sands Habitat Corridor Plan. The corridor plan restores barrens

connectivity at the landscape level. Barrens are a globally rare natural community that occurs on dry sandy soils and are fire-dependent, mostly open, habitats composed of prairie grasses, shrubs, and scattered young oak and pine trees. Through habitat restoration sharp-tailed grouse on existing barrens will serve as source populations for new habitats. Beyond sharp-tailed grouse, this plan will enhance and increase connectivity between existing, globally imperiled, barrens to benefit at-risk wildlife and plant species, strengthen ecosystem resilience, and support tribal conservation priorities. This plan calls for existing core barrens properties to be managed and expanded, increase landscape connectivity through working forest rolling barrens partnerships, and foster new partnerships following the strategies and priorities set by the Northwest Sands Habitat Corridor Plan to benefit sharp-tailed grouse, and barrens associated species. This conservation area was chosen because it encompasses over 90% of the current sharp-tailed grouse population's range and has the highest landscape level restoration potential.

Plan Objectives will further evaluate necessary monitoring and research priorities to develop biologically defensible and adaptive best management practices for long-term persistence of the species, develop adaptive and sustainable harvest frameworks, and create measures of success.

HISTORY AND BACKGROUND

Introduction / Taxonomy / Description

The sharp-tailed grouse (*Tympanuchus phasianellus*) is one of five species of North American grouse that inhabit a broad range of plant communities dominated by grasses and shrubs. Historically the species was found in steppe, grassland, and mixed-shrub habitat throughout much of central and northern North America. Although it still ranges from the Great Lake states west to Alaska and south to Colorado (Figure 1), sharp-tailed grouse numbers have greatly declined across portions of its historical range, including Wisconsin.

Sharp-tailed grouse are classified in the order Galliformes, family Phasianidae, and sub-family Tetraoninae. Linnaeus originally described sharp-tailed grouse as *Tetrao phasianellus* in 1758, but the species was later placed in the monotypic genus *Pedioecetes* by Baird in 1858 (Connelly et al. 2020). *Pedioecetes* was later merged with *Tympanuchus*, due to the similarities between sharp-tailed grouse and prairie-chickens (Hudson et al. 1966, Short 1967). There are six recognized subspecies of sharp-tailed grouse, as well as one extinct subspecies; only one subspecies is a year-round resident of Wisconsin: the prairie sharp-tailed grouse (*T. p. campestris*; Connelly et al. 2020). This subspecies current range extends from southeastern Manitoba, southwestern Ontario, and across the Upper Peninsula of Michigan, northern Minnesota, and northern Wisconsin.

Sharp-tailed grouse are a medium-sized grouse measuring 41–47 cm (16–18.5 in) in length and a body mass of 569–1,031 grams (1.25–2.25 lbs); mass varies with season and sex, with females being slightly smaller than males (Sjogren and Corace 2006, Connelly et al. 2020). Overall, both sexes are cryptically colored and 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 subterminal V-shaped marks; white undertail-coverts; and two protruding central tail feathers (retrices) extending beyond the other tail feathers about 5 cm that give the species its name (Sjogren and Corace 2006). Males have pinkish to pale-violet air sacs on each side of their neck that become exposed and inflated during breeding displays and have linear markings on central retrices (Figure 2). Females are marked by central retrices that are more transversely barred and less vertically striped (Figure 2), and crown feathers that are lighter and more barred than males (Figure 3; Henderson et al. 1967, Sjogren and Corace 2006, Connelly et al. 2020). Both sexes have a crescent-shaped, yellowish-orange comb over each eye; and the species is further characterized by tarsi feathers extending to the base of the toes (Connelly et al. 2020).

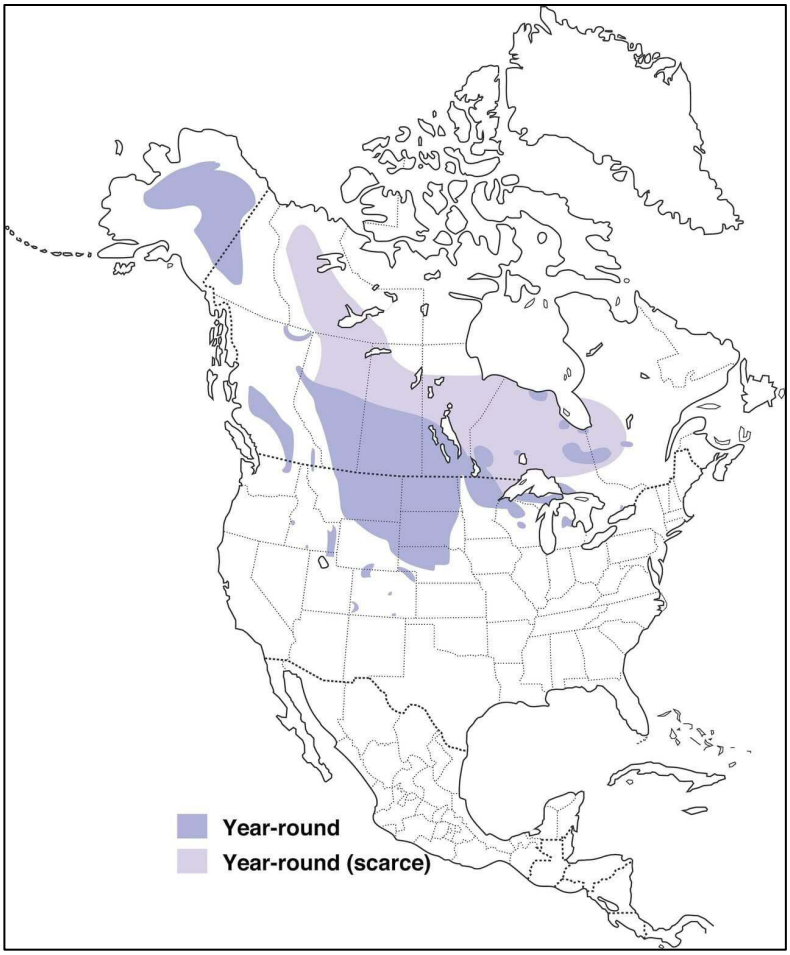


Figure 1. *Distribution of the sharp-tailed grouse (Connelly et al. 2020).*

Sharp-tailed grouse are similar in size, shape, and coloration to the greater prairie-chicken (*T. cupido*), which occur near or within the range of sharp-tailed grouse in central regions of North America. Sharp-tailed grouse are generally distinguished from greater prairie-chicken by bold V-shaped markings on underparts, elongated central retrices, by the color of the air sacs on the neck of males (pinkish-violet versus orange or yellow in prairie-chickens), and lack pinnae found on the neck of prairie-chickens. Where ranges overlap, hybridization between sharp-tailed grouse and greater prairie-chickens can occur (Connelly et al. 2020).

Figure 2. *Central tail feathers from female and male sharp-tailed grouse. The coloration of these feathers is an indicator of sex. The four feathers on the left came from females; note the alternating buff-black horizontal striping. The four feathers on the right are from a male and are whiter in color, and the striping pattern is more vertical and not as consistent as on female feathers (North Dakota Game and Fish Department 2022).*

Figure 3. *Head feathers of sharp-tailed grouse. Female feathers (left) exhibit an alternating buff-black striping pattern. Feathers from a male (right) are all black with a buff-colored border (North Dakota Game and Fish Department 2022).*

Natural History

Behavior – Social System, Territoriality, Sexual Behavior, etc.

Sexual behavior and courtship in sharp-tailed grouse are well-documented (Connelly et al. 2020). During the spring both sexes congregate at localized breeding areas called leks or dancing grounds. The lek is a communal display area where males gather to attract and mate with females. Leks are often located on slightly elevated sites and in a similar location every year (Ammann 1957, Sjogren and Corace 2006, Connelly et al. 2020). When lek locations are unpredictable day-to-day and year-to-year, local populations may be unstable or habitat conditions at lek sites may have changed. Lek movement may also occur temporarily as a population grows. Males can be observed displaying from just before dawn to just after sunrise (Sjogren and Corace 2006).

Courtship displays of the male sharp-tailed grouse consist of stages of foot-stomping, tail- rattling, and various vocalizations, with a relaxation phase between display bouts. Male grouse use several displays to show aggression toward other males and will fight to defend their lek territory. Dancing displays consist of a series of rapid stepping motions performed with the tail erect, the head held forward and the wings outstretched. After assuming this stiff posture, the male dances in a small circle or arc. While dancing, he vibrates his tail feathers, which makes a clicking or rattling sound. Male sharp-tailed grouse often perform this tail-rattling in synchrony and frequently stop to pose before the females. Males produce six main vocalizations in addition to tail-rattling and foot-stomping displays. Female vocalizations are not well-known (Sjogren and Corace 2006).

Home Range

Mean annual home range size varies between males and females and among seasons. Males, on average, tend to have a larger annual home range size than females, 617 ha vs. 464 ha, respectively (Sjogren and Corace 2006, Connelly et al. 2020). Home range size tends to be smallest during spring and summer, coinciding with the breeding and nesting season. On average, summer home range size is approximately 65 ha for males and 55 ha for females (Artmann 1971, Gratson 1988). Home range size expands considerably during fall when dispersal occurs and can be well over 1,300 ha (Gratson 1988). In Wisconsin, average winter home range is 259 ha for males and 149 ha for females (Gratson 1983, Connelly et al. 2020). Habitat and food quality and availability may affect home range size (Giesen 1987).

Diet – Food & Water

Throughout the year, sharp-tailed grouse feed on a wide variety of foods. During spring and summer months, birds select forbs, grasses, insects, berries, and flowers. Foods include goldenrod, clover, hawkweed, goatsbeard, yarrow, smartweed, grass seed, alfalfa, wheat, moths, ants, grasshoppers, crickets, and beetles (Peterle 1954, Ammann 1957, Connelly et al. 2020). Insects are especially important for young sharp-tailed

grouse development (Marshall and Jensen 1937, Schneider 1994). During this time, birds actively feed in early morning and late evening (Connelly et al. 2020).

Fall and winter months provide buds, seeds, herbaceous matter, and fruit. If not covered in snow, sharp-tailed grouse feed on the berries of snowberry, winterberry, and cranberry, as well as the leaves of strawberry goldenrod, clovers, and sheep sorrel (Schmidt 1936). Where available, fall grain crops such as oats, buckwheat, soybeans, and corn are consumed (Schmidt 1936). However, during winter months when snow reduces food availability, browse makes up the primary diet of sharp-tailed grouse, consisting of the buds, catkins, and twigs of poplar, aspen, white birch, balsam fir, willow, bog birch, and leather leaf (Schmidt 1936). Birds will feed throughout the day, storing food in their crop for later digestion (Hart et al. 1950). Sharp-tailed grouse primarily forage on the ground, except in winter when they frequently feed in shrubs and small trees (Grange 1948, Hart et al. 1950).

There is no direct evidence that sharp-tailed grouse need open water to meet their nutritional needs. However, mesic areas may provide a source of water during warm summer months (Kobriger 1965).

Seasonal & Daily Movements

The sharp-tailed grouse is a year-round resident of Wisconsin and does not regularly migrate long distances. Longer distance seasonal migration was documented prior to the early 1900s, but there is little information on distance or direction of travel (Hamerstrom and Hamerstrom 1951). Recent historical habitat changes coinciding with agricultural and silvicultural developments are thought to have eliminated longer migrations as open continuous habitats have become fragmented across the landscape (Connelly et al. 2020). Seasonal shifts are less prevalent in Wisconsin as birds lack available habitat.

Sharp-tailed grouse typically use heavier cover between late Nov. and early Jan. depending on snow depth and food availability, before returning to lek sites beginning in March and April (Connelly et al. 2020). Snow roosting is preferred when snow conditions allow. Daily movements of sharp-tailed grouse also vary by season with birds in Wisconsin moving 200–400 m in summer and 800–1200 m in winter (Gratson 1983).

Interspecific Competition & Predation

Interactions at concentrated foraging sites between sharp-tailed grouse and greater prairie- chickens have been documented where ranges overlap (Sharp 1957, Connelly et al. 2020). Lek interference and nesting parasitism by ring-necked pheasants (*Phasianus colchicus*) has been documented across the entire range of prairie grouse populations. The most rigorous studies of pheasant interference have been conducted on endangered greater prairie-chicken populations in Illinois (Walk 2004). As a result of these studies, a pheasant control program was implemented that resulted in lower lek interference and lower brood parasitism. However, prairie-chicken populations in Illinois did not increase markedly after the pheasant removal project, likely because of

additional limiting factors (i.e., low genetic diversity; Walk 2004). Interference at lek sites by ring-necked pheasants has also been observed in Wisconsin (P. Q. Engman, Wisconsin Department of Natural Resources, personal communication), but impacts are unknown at this time.

Nest and egg predation is common since sharp-tailed grouse nest on the ground. Common nest predators include striped skunk (*Mephitis mephitis*), ground squirrel (*Citellus* spp.), raccoon (*Procyon lotor*), American crow (*Corvus brachyrhynchos*), common raven (*C. corax*), mink (*Mustela vison*), and weasels (*Mustela* spp.; Connelly et al. 2020). In addition, coyote (*Canis latrans*), red fox (*Vulpes vulpes*), red-tailed hawk (*Buteo jamaicensis*), northern goshawk (*Accipiter gentiles*), peregrine falcon (*Falco peregrinus*), great horned owl (*Bubo virginianus*), and northern harrier (*Circus cyaneus*) prey on eggs, chicks, and adult sharp-tailed grouse (Connelly et al. 2020).

Population Demographics

Breeding System

From early April to late May, predominately in the early mornings, male sharp -tailed grouse “dance” on a grassy opening, to attract and mate with females. In Wisconsin, six to twenty-six males may gather at a single lek, each defending a small territory, but mating may be limited to one favored male (Connelly et al. 2020).

When the male has successfully attracted a female, they mate, and the female leaves the dancing ground area for her nest site. The nest site is typically within a half mile of the lek in structurally diverse habitat, dominated by dense herbaceous cover and often under or near shrubs or small trees which help protect the nest.

Breeding Season

Sharp-tailed grouse use a lek mating system. Males establish and defend territories on a dancing ground and put on an elaborate display to attract females. Pair bonds are limited to courtship prior to mating and males may breed with several females (Connelly et al. 2020). Dominant males typically receive the majority of breeding opportunities, and it is estimated that approximately 10% of all males actively breed in Wisconsin (Temple 1992). While it has been generally accepted that only a few males within a given prairie grouse population obtain the majority of copulations, courtship and mating away from the lek site has been documented, suggesting that perhaps a greater proportion of males do, in fact, mate (Sexton 1979). Likewise, females may visit an individual lek site several times, mating with multiple males, or may visit more than one lek in a given breeding season (Landel 1989, Gratson et al. 1991).

Lek Site Fidelity

Male sharp-tailed grouse return to the same lek each year. Dominant males likely show the greatest site fidelity whereas males not yet associated with a lek are more likely to disperse (Bergerud and Gratson 1988). As a result, sharp-tailed grouse populations include non-territorial males that are not attending leks. Males can be seen dancing alone for a single female or with only a few other males. Younger birds will often set up territories on the lek periphery and gradually move toward the lek interior as dominant males are removed (Rippen and Boag 1974). Females visit territories of potential mates starting in mid to late April and early May. Nearly all females attempt to nest (Ammann 1957, Connelly et al. 2020).

Nesting & Incubation

Nest sites are typically located 0.4–1.8 km from the nearest lek, with a maximum observed distance of 2.2 km (Connolly 2001, Connelly et al. 2020). The first egg is often laid 1-3 days after copulation (Connelly et al. 2020), and subsequent eggs are laid individually every 1-2 days, females lay 10-12 eggs total. Continuous incubation lasts 21-23 days and begins after the last egg is laid. The female occasionally leaves the nest to feed in the early morning or evening, usually within 200 m of the nest (Connelly et al. 2020).

In Michigan, hatching peaks in early to mid-June (Ammann 1957, Connelly et al. 2020). Renesting is common following the loss of a clutch to predation or weather. Females will typically renest farther from the lek than the initial nest site. Clutches from renesting attempts are often smaller (Connelly et al. 2020).

Brood-rearing

Young are precocious upon hatching (covered with down, legs well-developed, eyes open and alert). Within 7–10 days they can fly short distances. Juvenile plumage is visible within a few days and young are fully feathered by six weeks of age (Sjogren and Corace 2006). By 12 weeks of age young have completed most of their growth. In Wisconsin, care by the adult female concludes in Sept. (Gratson 1983, 1988).

Productivity – Nest Success Rate, Sex/Age Ratios

In Wisconsin, approximately 54% of sharp-tailed grouse nests were successful in hatching at least one chick (Bergerud and Gratson 1988). Adult sharp-tailed grouse are more successful at nesting compared to yearlings (61% and 43%, respectively). Connolly (2001) found that nest success was higher in recent clear-cut timber harvests (76.4%) when adjacent to core barrens areas. In the late 1990s, the highest and densest populations of sharp-tailed grouse in Wisconsin were found in a complex of clear-cuts salvaged due to a large outbreak of jack pine bud worm in southeastern Douglas County (Niemuth and Boyce 2004). The primary cause of nest failure is predation (79%) followed by nest abandonment, fire, flood and agricultural practices (Sjogren and Corace 2006). Approximately 86% of hens that lost their first nest

attempted to renest (Beregrud and Gratson 1988).

The male: female sex ratio of sharp-tailed grouse in Colorado is similar to that reported for many gallinaceous birds at 1:1 (Connelly et al. 2020). In Michigan, the sex ratio for juveniles was also not significantly different from 1:1 (Ammann 1957, Connelly et al. 2020).

Dispersal

Dispersal distance in Wisconsin varies from 200–400 m in summer to 800–1200 m in winter. Broods usually stay within 1.6 km of the nest site until dispersal in Sept. and Oct. Broods typically disperse <6 km from the natal site. Juveniles tend to disperse greater distances than adults, and juvenile females tend to move farther than juvenile males. Adult females also tend to disperse farther than adult males (Connelly et al. 2020). A maximum dispersal distance of 33.8 km (21 miles) was recorded in Michigan, but little additional information exists for other Midwestern states (Sjogren and Corace 2006). Factors influencing dispersal may include lek carrying capacity, amount and distribution of habitat and location of reliable food sources (Sjogren and Corace 2006).

Survival

The maximum documented life span is 7.5 years (Arnold 1988). In Washington, annual survival was estimated at 53% in an unhunted population and 17–42% in hunted populations (Schroeder 1994). Sexes had similar annual survival rates in South Dakota (Robel et al. 1972). Bergerud and Gratson (1988) found low survival for breeding females in spring (Connelly et al 2020*).* Connolly (2001) estimated daily hen survival in northwestern Wisconsin during the reproductive period to be 98% and 99% on unmanaged and managed landscapes, respectively.

Sharp-tailed grouse broods experience roughly 47% mortality, primarily within the first month of hatching (Johnsgard 1983). In Wisconsin, Connolly (2001) did not find a significant difference in brood survival between managed (43%) and unmanaged (30%) landscapes but indicated that adverse weather during the 2 to 3 weeks following hatching may have impacted survival in the study. During this period, chicks are especially susceptible to cool weather, predation and starvation (Hillman and Jackson 1973). The average brood size at hatching is 8.7 birds based on average clutch size and hatch rates (Johnsgard 1983), and Ammann (1957) reported brood size of 7.7 chicks per hen based on 451 broods monitored in the Upper Peninsula of Michigan during May–Aug.

Predation, hunting, and weather affect survival and recruitment in sharp-tailed grouse populations (Connelly et al. 2020). Winter mortality varies with severity and may be as low as 14% during mild winters and as high as 71% during severe winters (Idaho; Ulliman 1995). Even during severe winters, much of the mortality can be attributed to predation. Infectious diseases are not common in sharp-tailed grouse populations (Connelly et al. 2020).

Habitat Requirements

Prior to European settlement, habitat for sharp-tailed grouse in the Upper Great Lakes region included pine barrens, burned forest areas, brushy grasslands in the prairie-to-forest transition zone and non-forested wetlands. Sharp-tailed grouse populations expanded and contracted in response to natural disturbance events such as fire (Ammann 1957, Sjogren and Corace 2006). At this time early successional habitat was widespread. For example, Lorimer (2001) estimated that 13.2% of northern Wisconsin would have been classified as early successional habitat (Sjogren and Corace 2006).

Today, sharp-tailed grouse in Wisconsin use open barrens, brush prairie barrens, cut or burned-over forestland, wet meadows, and conservation farmlands (Sample and Mossman 1997, Evrard et al. 2000, Gregg and Niemuth 2000, Niemuth 2006). In northwestern Wisconsin, vegetation types heavily used by prairie sharp-tailed grouse vary by season but typically include pine/oak barrens, young open conifer woods, sedge (*Carex* spp.) meadows, shrub marshes, and croplands (Wisconsin All-Bird Conservation Plan 2007). Where they occur, dense herbaceous cover and shrubs are important habitat components (Connelly et al. 2020). Fire has long been the key disturbance process for creating and maintaining sharp-tailed grouse habitat. Depending on fire intensity and weather patterns, fires can create a mosaic of burned and unburned areas (Niemi and Probst 1990).

Sharp-tailed grouse are considered an area-sensitive species that generally avoid habitat edges (i.e., forest-field edge) and require large open blocks of early successional habitat to support viable populations (Gregg 1987, Temple 1992, Sample and Mossman 1997, Niemuth and Boyce 2004, Niemuth 2006). In Minnesota, blocks of contiguous habitat must be at least 5 km^2, and complexes of inter-connected smaller areas must contain parcels of at least 15 ha (Berg 1997). Berg (1999) reported in Minnesota that habitat blocks must be a minimum of 2 mi^2, but preferably 4 mi^2 where suitable habitat is remotely scattered. In areas where habitat exists rather uniformly in scattered but connected blocks, open habitat must be at least 0.5 mi^2. Temple (1992) estimated that in Wisconsin, 4000 ha is required to have a 95% probability of a population persisting over 50 years, and that a metapopulation needs to consist of at least 280 birds in each of 5 separate populations. Grange (1948) estimated a minimum of 2000 acre blocks are needed in Wisconsin. Gregg (1987) reported that 50,000 acres is needed to sustain 500 sharp-tailed grouse in Wisconsin. In 2022 the Interstate Working Group developed the recommendation for states to establish core areas consisting of 50,000-acre blocks of high-quality habitat distributed across the range to assure long-term viability (Houts et al 2022). However, the exact amount of habitat needed to sustain a viable population likely varies by ecological landscape and state.

Breeding/Lek Sites

Leks more typically occur in open, elevated sites with less vegetation than surrounding areas (Sample and Mossman 1997, Niemuth 2006). Lek sites often have short, sparse vegetation (Sample and Mossman 1997), and scattered shrubs adjacent to leks provide

escape cover (NRCS 2007). In Wisconsin, Niemuth and Boyce (2004) found that lek presence was positively associated with a higher proportion of grass and shrubs, a low proportion of forest and greater distance to forest edge than unused sites.

Lek locations are generally stable from year to year (Connelly et al. 2020). Lek location and attendance has been significantly correlated with grassland and shrubs, but not with distance between leks. Leks located near recent disturbance had significantly higher attendance than those in areas without (Niemuth 2006).

Leks cover a relatively small area, approximately 450 square meters (0.11 ac; NRCS 2007), with estimated vegetation composition of 70% grass, 15% forbs, 15% bare ground and <1% shrub with escape cover within 500 m (Baydack 1988). Leks on Namekagon Barrens Wildlife Area have anecdotally been observed to be roughly 0.5 acres and 0.7 to 1.5 miles apart, with 0.86 being a common distance from well-established leks and newly establishing leks. In Manitoba, the probability of lek abandonment increases when tree cover exceeds 56% and grassland coverage decreases below 15% (Berger and Baydack 1992), and the average distance between leks is 2.2 km (1.4 mi; Baydack 1988). Mean distances from lek to scattered brush, dense brush, and trees are 179 m, 252 m, and 275 m, respectively (Berg 1997).

Nesting & Incubation

Sharp-tailed grouse prefer to nest in structurally diverse habitat, dominated by dense herbaceous cover and often under shrubs or a small tree (Sjogren and Corace 2006, NRCS 2007, Connelly et al. 2020). Vegetation at the nest site is ≥30 cm in height with shrub cover up to 1.2 m high in the nest area (Connelly et al. 2020). Birds selected nesting areas further from tall (>5 m) trees. Berg (1999) reported that sharp-tailed grouse in Minnesota typically nest in grass or next to a brush clump, a stump or other protective cover. Females nested under or close to shrubs or small trees if available, or in thicker and taller residual vegetation (Pepper 1972). Connelly et al. (2020) summarized studies concluding structurally diverse habitat provides high quality nesting areas and that sharp-tailed grouse nest in relatively heavy cover, often under a shrub in vegetation >30 cm high with dense foliage. In Wisconsin, Connolly (2001) observed that sharp-tailed grouse preferred using recent clear-cuts adjacent to managed barrens and realized increased nesting success.

Research at Crex Meadows Wildlife Area (Ramharter 1976) found that nearly all nests (8 out of 10) were in 1 year old burn sites. Post burn sites have more vigorous growth and structure of grass/forbs the year after the burn. Most nests were located in a clump of residual big bluestem. No nests were found in 2-year-old burn sites, where grass growth is less vigorous after the initial first year flush of growth. Most nests were found in prairie lowlands wet-mesic prairie, typically the best stands of tall grass prairie. Big bluestem was the predominant grass species at nest sites, but sites included a mix of brush species including sweet fern, prairie willow, and hazel. Contrarily, sites with too much brush cover were avoided by hens (Ramharter 1976).

The amount, height and density of residual cover appear to be an important factor in

nest site selection (NRCS 2007). The nest is located where overhead concealment covers the nest and lateral cover allows the hen to see approaching predators. Nest composition is a combination of moss, grasses, sedges, herbaceous plants, leaves of shrubs and trees and breast feathers from the hen (Sjogren and Corace 2006). Coniferous tree cover, heath cover, deciduous woody cover and grass cover at the nest bowl were important factors. In recent clear-cuts raspberry, heath cover, and grass cover and height at nest bowl were important determinants of nest site selection (Connolly 2001). Similar to other sharp-tailed grouse habitat, plant species composition at nest sites is perhaps less important than vegetation structure, allowing for a wide variety of plants to be observed in nesting habitat and at nest sites.

Brood-rearing Habitat

Brood habitat is typically open habitat with little woody vegetation (Hamerstrom 1963, Artmann 1971, Connolly 2001). Ramharter (1976) found all broods (n = 10) in either spring burn sites (burned the same year) or sparsely vegetated old fields. Advanced phenology of burned sites provided the best habitat for insects, and grasshoppers in particular. Grange (1948) noted that grasshoppers were a major summer food in Wisconsin. Very little use of unburned sites was observed, except some use in late summer. After four weeks of age chicks switched from mostly insects to berries. Young sharp-tailed grouse depend on habitats with abundant forbs and insects, selecting areas with high diversity of herbaceous cover and shrubs with an interspersion of cover types (NRCS 2007, Connelly et al. 2020). The presence of shrub cover may be important in providing overhead and escape cover from predators (Connolly 2001). Brood cover has been described as grassland with some shrubs and trees, but few taller woody species (Hamerstrom 1963). Ramharter (1976) found no use by broods of open woodlands. Blueberries, cherries, and juneberries were described as valuable sources of soft mast. Predominantly open herbaceous brood habitat was used in fall and in winter brushier cover became important. Aspen and willows were most useful in small thickets and likely provide feeding areas in winter.

Soon after hatching broods begin movement towards brood-rearing habitat and summer ranges. Broods typically remain close to nesting areas throughout the summer (Marks and Marks 1987, Gratson 1988, Meints 1991) and have daily summer movements of 45–276 m (Schiller 1973; Gratson 1983,1988; Meints 1991). Chicks achieve approximately half their adult body weight by 8 weeks of age and attain nearly complete body growth by 12 weeks (McEwen et al. 1969, Pepper 1972). Broods begin to break up and disperse by mid- to late Sept. and early Oct. (Caldwell 1976, Gratson 1988).

Winter

Winter habitat requirements for sharp-tailed grouse are narrower than in any other season. Wintering sites often contain a higher shrub component in areas with less snow cover as birds shift from open to shrub dominated or marshy cover habitats (Gregg 1987, Sample and Mossman 1997, Connelly et al. 2020). Sharp-tailed grouse depend on snow roosting when snow depths and conditions are adequate. Woody vegetation is used for feeding, roosting, and escape cover (NRCS 2007). In Wisconsin, Gregg (1987)

observed that increased snow depth caused sharp-tailed grouse to move larger distances in search of winter food and cover. During snowless periods, birds preferred dense marshy vegetation while young upland forests and black spruce bogs were used during deep snows. Within a larger open barrens matrix, 10-acre brushy areas of deciduous brush and conifers serve as a source of winter browse, protection from severe weather, and escape cover (Ammenn 1957). Grange (1948) noted use of snow burrows in marsh or swamp vegetation, or open stands of tamarack or spruce when snow was not present. Paper birch buds and catkins were a primary winter diet, with aspen of secondary importance. Rose hips, hazel buds, and catkins were also important. Hamerstrom and Hamerstrom (1951) observed that the usual winter cruising radius was about 1 mile.

Open wetlands may be preferred but unnecessary vegetation communities for sharp-tailed grouse in Wisconsin. Aside from their possible value in reducing heat loss during snowless fall and spring months (due to the dense and upright position of the vegetation), sharp-tailed grouse may use sedge-meadows and shrub-marshes for other reasons. Shrub marsh cover was used by males in the summer, and both males and females consistently used these wetlands in the winter for snow-burrowing for thermal protection. The use of open wetlands may reduce the likelihood of predation. Fewer nocturnal predators of sharp-tailed grouse hunt open wetlands, preferring other cover types where their primary prey are located. The lack of perches reduces great horned owl use of open cover types (Peterson 1979).

Habitat: Considerations for Managers

Brood-rearing and nesting habitat are the most critical habitat needs for sharp-tailed grouse. Prescribed burning or other disturbance should be planned with brood-rearing habitat to be within a quarter mile of nesting habitat, which in turn needs to be proximal to leks. Brood-rearing habitat is best described as open barrens with significant herbaceous vegetation and high arthropod abundance following recent disturbance. Nesting habitat is provided by open barrens that have developed residual grass or shrub cover sufficient for nesting grouse. The annual juxtaposition of leks, nesting, and brood-rearing habitat over space is critical to recruitment of sharp-tailed grouse. Therefore, providing nesting and brood-rearing habitat in juxtaposition over time across a management area is an important planning aspect for long-term management.

As open barrens grow into brush prairie some nesting use may continue, but the habitat is transitioning into other uses for sharp-tailed grouse. These later successional habitats may provide escape, winter, loafing cover, and feeding areas depending on shrub/tree species present and time of year. These areas can be smaller while still providing value, and ten acres is considered adequate. As brush prairie grows into the next seral stage the habitat value drops considerably for sharp-tailed grouse. Gratson (1983) suggests the minimum practical size of a sharp-tailed grouse management area is a square mile of habitat with above average cover conditions. In poor habitat the minimum size should be at least 4 square miles.

On barrens managed for sharp-tailed grouse, it is recommended that at least 1/3 of the

habitat on these properties be in the Open Barrens Seral Stage, and no more than 2/3 of the habitat be in the Brush Prairie Seral Stage, at any given time. Definitions of barrens seral stages are from the Barrens Habitat Management Guidelines (Wisconsin DNR 2022).

Seral Stages Of Barrens Habitat, Definitions By Coarse Level Monitoring Protocol & Return Intervals

1. ***Open Barrens***: Herbaceous habitat with eleven or more barrens indicator species, few invasives, and barrens appropriate tree species under two feet. The very early successional seral stage of barrens the ground layer is prominent. Once woody vegetation dominates, the stand has moved to the next seral stage. Return interval treatments vary from 1–4 years.

2. ***Brush Prairie Barrens***: Herbaceous habitat with eleven or more barrens indicator species, few invasives, and 50% or less covering of 2- to 6-ft barrens appropriate tree species. Once canopy closure starts reducing the ground layer or structural height surpasses six feet, the stand moves into the next seral stage. If the site-specific objective is to maintain this seral stage, disturbance is needed when this occurs. Return interval treatments vary from 1–15 years.

Population Status and Distribution

North America – Historic & Current Distribution

Sharp-tailed grouse are the most widespread and adaptable of the North American prairie grouse species (Schroeder et al. 2004), historically occurring in 8 Canadian provinces and 21 U.S. states. Overall, sharp-tailed grouse populations are considered secure and do not warrant threatened or species of special concern status within the United States or Canada (NatureServe 2023). However, regional populations have declined, and sharp-tailed grouse are now extirpated from 8 states (Illinois, Iowa, Kansas, Oklahoma, New Mexico, Nevada, California, and Oregon; Johnsgard 1973). The prairie subspecies currently occupies less than 10% of its historical range in Michigan and Wisconsin, 30% in Minnesota, and 50–90% of Manitoba and Saskatchewan (Miller and Graul 1980, Houts et al. 2022) with the primary cause of decline attributed to extensive losses of preferred habitat. Conversion of sharp-tailed grouse habitat to agriculture is considered the primary cause of distributional losses and population declines while fire suppression inducing succession, and housing development have also contributed to population declines (Miller and Graul 1980, Houts et al. 2022) and resulted in fringe populations that occupy smaller and more isolated patches of available habitat.

Wisconsin - Historic & Current Distribution

Within Wisconsin, the prairie sharp-tailed grouse subspecies is a non-migratory, year-round resident and is classified as an upland game bird species. Its range has changed dramatically within the state, however, since European settlement (Niemuth 2006). Once found throughout Wisconsin (Schorger 1943), sharp-tailed grouse distribution retreated northward as the southern forests, savannas, and grasslands were cleared and converted to agriculture and the northern forests were cut and burned (Figure 4). Today, sharp-tailed grouse in Wisconsin exist primarily on a core group of managed public properties and scattered private lands in northwest and northcentral Wisconsin (Figure 5).

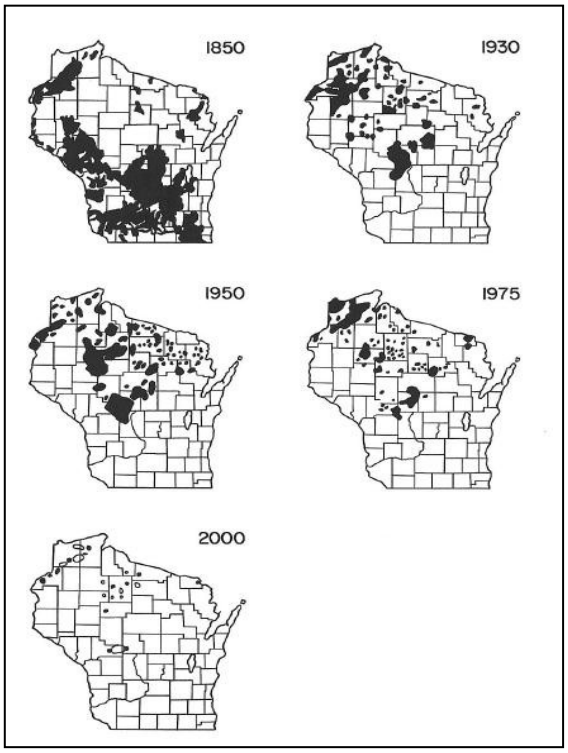


Figure 4. *Distribution of sharp-tailed grouse in Wisconsin from 1850–2000 (Gregg and Niemuth 2000).*

Conservation Status In Wisconsin

Given historical dramatic population declines within the state, sharp-tailed grouse are considered a Species of Special Concern in Wisconsin and listed as a Species of Greatest Conservation Need (SGCN) within Wisconsin's Wildlife Action Plan (Wisconsin DNR 2015b) and are also listed as Critically Imperiled at the state-level by NatureServe (2023). The main purpose of a Special Concern/SGCN designation is to focus conservation action on a species before it becomes threatened (THR) or endangered (END). Wildlife species listed as state THR or END are protected against collection, possession, sale, or killing anywhere in the state (i.e., on both public and private land).

Sharp-tailed grouse, like all native, naturally occurring wildlife species in the state, will be evaluated by the department during the upcoming END/THR list revision (2023–2025). Administrative code NR 27 states that the END/THR list should be reviewed as needed, based on changes in species population conditions and risk of extirpation. The decision about whether to list a species as THR or END is made after the department conducts a comprehensive conservation status assessment. This assessment includes range, population size and trends in the state and globally, threats, habitat specificity, intrinsic vulnerability and other considerations following the standardized, internationally accepted methods of conservation status assessment developed by NatureServe. Codifying changes to the END/THR species list follow the rules established by the Wisconsin legislature for administrative code revisions, a process that takes a minimum of 27 months.

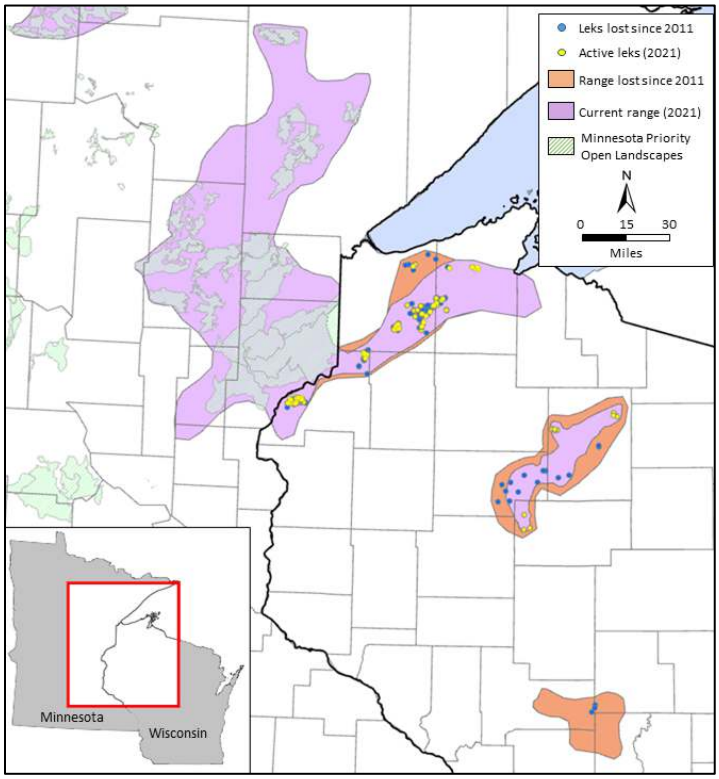


Figure 5. *Distribution of sharp-tailed grouse in Wisconsin from 2011–2021. Approximate current lek locations (2021, yellow dots) and leks that have become inactive since 2011 (blue dots) are provided for reference*

Conservation Issues And Concerns

Sharp-tailed grouse are managed as a game species in 18 states and provinces and protected in 5 states. Midwestern sharp-tailed grouse populations have experienced long-term population declines and are in possible danger of extirpation from some states, including Wisconsin (Niemuth and Boyce 2004). Sharp-tailed grouse are listed as a Species of Greatest Conservation Need in Wisconsin due to numerous factors that may threaten the persistence of the species in the state, including habitat loss and fragmentation, genetic degradation, and historic over-harvest (Gregg and Niemuth 2000, Niemuth and Boyce 2004, Niemuth 2006, Sjogren and Corace 2006, Wisconsin DNR 2015b). In this section, the key issues affecting sharp-tailed grouse in Wisconsin are outlined.

Habitat Availability

Sharp-tailed grouse need relatively large areas of contiguous and heterogenous open habitat throughout their life cycle, requiring different vegetation structure for breeding, nesting, brood-rearing and winter survival. Both loss and degradation of suitable habitat are therefore two significant threats to persistent, healthy populations of the species (Houts et al. 2022). Regional and local population declines can be largely attributed to the loss and continued fragmentation of suitable habitat (Sjogren and Corace 2006). Since European settlement, there have been sweeping landscape and land use changes. Those having a greater impact on sharp-tailed grouse habitat and populations include the loss of native barrens, savanna, and grassland habitats, the shift to intensive agricultural practices, fire suppression, major changes in forest land management, and increased human development (Sjogren and Corace 2006).

The sharp-tailed grouse population in Wisconsin is not contiguous, and suitable habitat currently exists in scattered patches within a primarily forested matrix (Sjogren and Corace 2006). As a result, dispersal among habitat patches and colonization of new habitat is likely necessary to maintain overall population size and genetic viability. However, sharp-tailed grouse dispersal appears to be limited by significant habitat barriers. As a result, genetic exchange among subpopulations is also limited (B. Swanson, Central Michigan University, personal communication).

Historical Habitat Availability

Historically, pine barrens covered approximately one million hectares in Wisconsin, or 7% of the state's pre-European settlement landscape (Curtis 1959, Wisconsin DNR 2015a). Oak barrens covered approximately 730,000 hectares, or 5% of the pre-European settlement landscape. Native grasslands were also dominant on the landscape and once covered 850,000 hectares throughout the state. Extensive sedge meadows also occurred in central and northern Wisconsin prior to European settlement, with more than 450,000 hectares present in the early 1800s (Curtis 1959). Early successional habitat at this time was much more widespread and it is estimated that

13.2% of northern Wisconsin would have been early successional habitat (Lorimer 2001, Sjogren and Corace 2006). Over time most of these early successional habitats have matured into forest, aging out of suitable sharp-tailed grouse habitat. The pine/oak barrens ecotype is dynamic in nature, with historic wildfires creating large openings in a shifting mosaic across the landscape (Niemi and Probst 1990). The suppression of wildfires is one of several factors that have dramatically reduced the amount of pine barrens on the landscape and thus the availability of suitable sharp-tailed grouse habitat. Recent research documenting fire scarring of trees at sites across several ecological landscapes containing barrens found fire return intervals of 1-47 years in the Northwest Sands, and 1–36 years in the Northern Highlands, (Meunier et al. 2019).

Grazing, cultivation, conversion to red pine and fire suppression have further impacted barrens habitats (Mossman et al. 1991) while draining, ditching, cranberry farming and grazing have impacted both grasslands and sedge meadows (Mossman and Sample 1990).

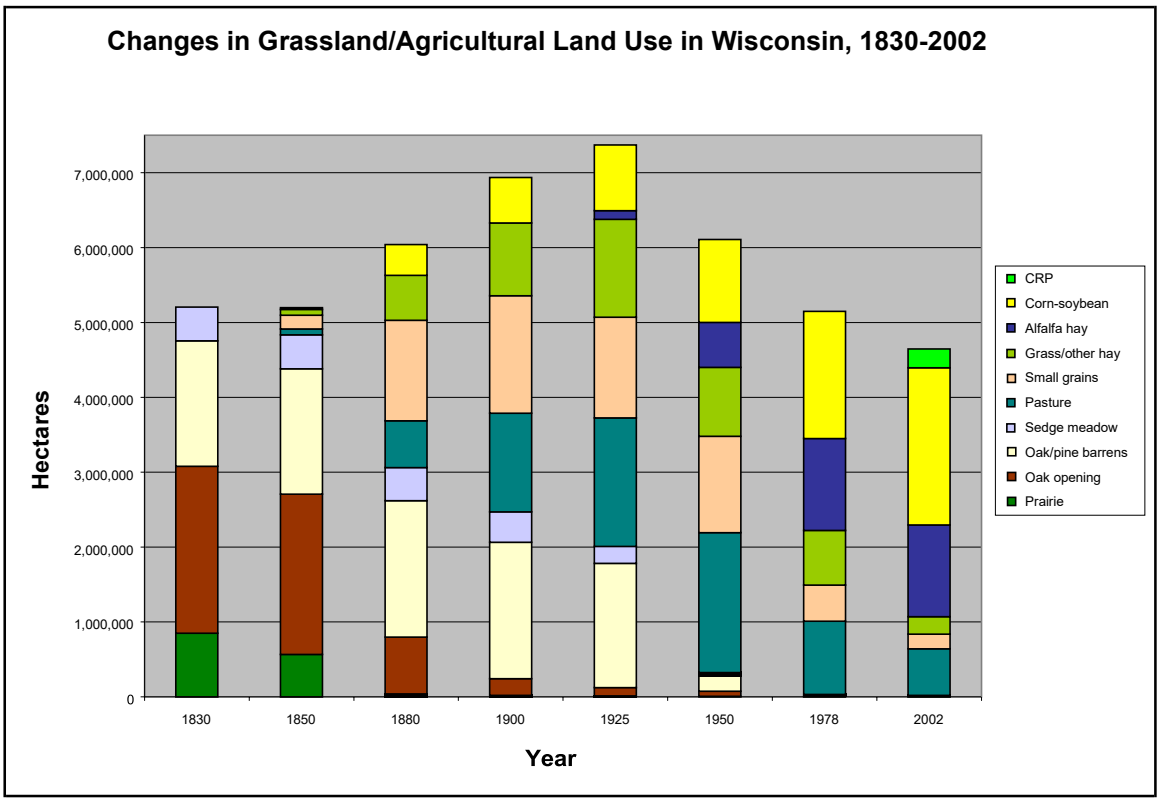


Figure 6. *Changes in grassland and crop coverage in Wisconsin, 1830-2002 (Sample and Mossman 2008). Data are from Curtis (1959), the US Dept. of Commerce Census of Agriculture, the Wisconsin Crop and Livestock Reporting Service, and the Wisconsin Department of Natural Resources Natural Heritage Inventory Program. CRP refers to the Conservation Reserve Program.*

Current Habitat Availability

Current suitable sharp-tailed grouse habitat in Wisconsin exists in scattered patches within a primarily forested matrix in the Northwest and North central Focus Areas. Most of this habitat is found on approximately six county, state, or federally managed properties. Total barrens area is estimated at 20,240 hectares or 50,000 acres (Wisconsin DNR 2015a).

In addition to barrens, less than 1% (3,200 hectares) of original native grasslands remains, while approximately 3% (12,000 hectares) of moderate to high quality sedge meadow habitat remains (Mossman and Sample 1990, Mossman et al. 1991) (Figure 6). Land conversion and use as pasture, grass/other hay, and incentive programs such as the Conservation Reserve Program (CRP) have resulted in the maintenance of several hundred thousand hectares of surrogate grassland habitat (Sample and Mossman 2008). However, any subsequent benefits to sharp-tailed grouse have not been realized as these patches are small and scattered within a wooded matrix.

There is concern that many of these habitat patches are not large enough to sustain a viable sharp-tailed grouse, and other area sensitive wildlife populations in the long-term. Additionally, the scattered distribution of remaining suitable habitat limits the dispersal and movement of sharp-tailed grouse among habitat patches. Given that there are multiple landowners across the landscape, many of whom are government entities, there are significant opportunities to manage for sharp-tailed grouse habitat on the landscape scale.

Conservation Opportunities

Sharp-tailed grouse are managed as a game species in 18 states and provinces and protected in 5 states. Midwestern sharp-tailed grouse populations have experienced long-term population declines and are in possible danger of extirpation from some states, including Wisconsin (Niemuth and Boyce 2004). Sharp-tailed grouse are listed as a Species of Greatest Conservation Need in Wisconsin due to numerous factors that may threaten the persistence of the species in the state, including habitat loss and fragmentation, genetic degradation, and historic over-harvest (Gregg and Niemuth 2000, Niemuth and Boyce 2004, Niemuth 2006, Sjogren and Corace 2006, Wisconsin DNR 2015b). In this section, the key issues affecting and opportunities to conserve sharp-tailed grouse in Wisconsin are outlined.

Habitat Management

Historical Management Activities

Sharp-tailed grouse management in Wisconsin began during the 1940s in response to population declines. As a result, as many as 20 sharp-tailed grouse management areas were designated throughout northern Wisconsin (Connolly 2001). Habitat management efforts for sharp-tailed grouse in Wisconsin have traditionally focused on prescribed

burning, mowing, and timber harvest on properties designated for sharp-tailed grouse management. Additionally, open-land habitat management has been implemented on county, state, and federal lands within USFS Region 9 in conjunction with silvicultural practices (Sjogren and Corace 2006). Populations have responded positively to habitat management on some sites. At other sites, little to no management occurred or sharp-tailed grouse failed to respond to the management (Gregg 1987, Connolly 2001). In other cases, sharp-tailed grouse have responded rapidly to improved habitat conditions created by large block timber harvests following both jack pine bud worm outbreaks and the Germann Road wildland fire. Pine/oak barrens ecosystems in Wisconsin are rare and extremely fragmented. Those that persist often do so deliberately via management by prescribed fire or timber harvest, or accidentally via wildfire or disease outbreak. However, as Niemuth and Boyce (1998) noted: “Whether created by prescribed fire or timber harvest, virtually all openings within the region are sharply bounded by standing timber,” which continues to pose significant, long-term management challenges for this globally important ecosystem (Reetz et al. 2013).

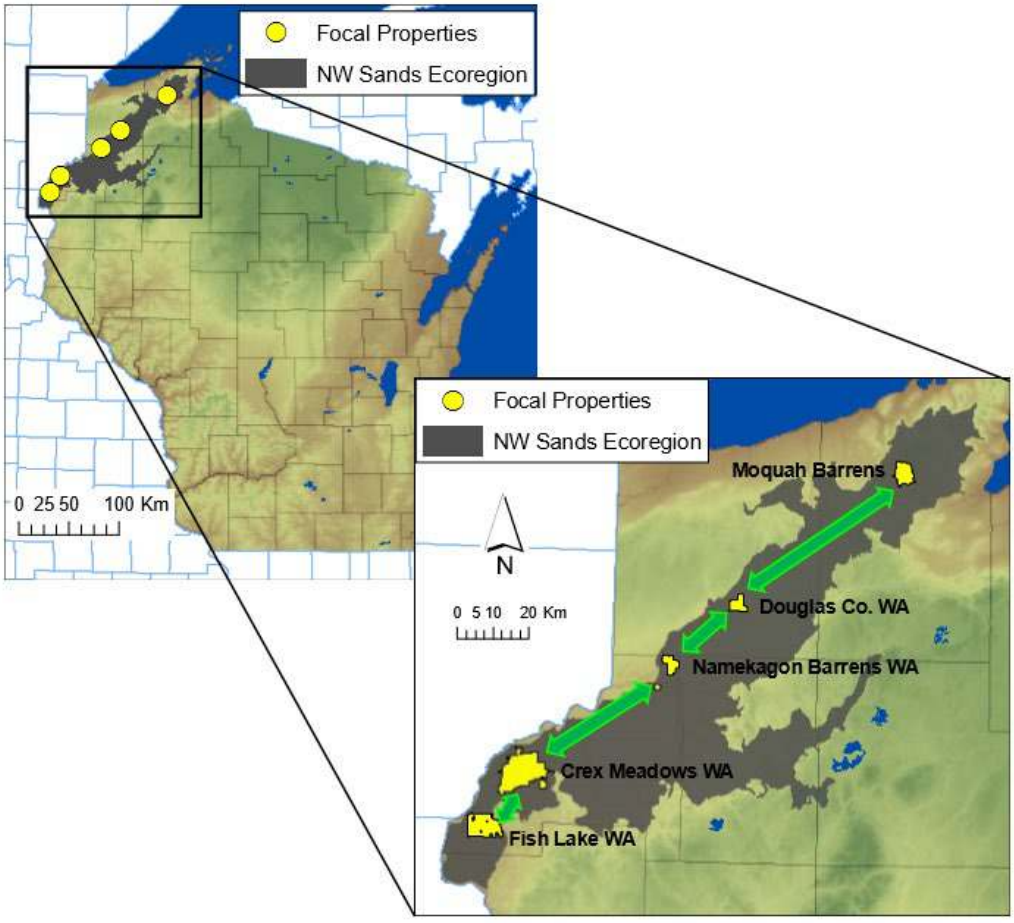


Figure 7. *Cover diagram from the Northwest Sands Habitat Corridor Plan (Reetz et al. 2013).*

Current Management Activities

Sharp-tailed grouse habitat is largely dependent on disturbance to maintain an open landscape and appropriate vegetative cover (Connelly et al. 2020). As an area-sensitive species, habitat management for sharp-tailed grouse also requires a landscape-scale perspective and to reconnect isolated populations. To accomplish this the 2011 Sharp-tailed Grouse Management Plan called for development of habitat corridors. In 2013, the University of Wisconsin-Madison and Wisconsin DNR partnered to create the Northwest Sands Habitat Corridor Plan (Reetz et al. 2013). Later in 2013, the Northwest Sands Coordinator Wildlife Biologist position was created to help implement this effort.

Since 2013, The Northwest Sands Habitat Corridor Plan has been an organizing resource to help assemble a collaborative group of partners to begin reversing habitat fragmentation and restoring habitat corridors in the northwest sands ecological landscape. The goal is to create a less fragmented barrens landscape that will benefit sharp-tailed grouse and other barrens-dependent species. Connecting large managed core barrens properties by strategically linking smaller patches of barrens (stepping-stones) will facilitate movement, and genetic flow between sharp-tailed grouse populations. At present a collaboration of land managers, biologists, and foresters are implementing the following landscape scale prescriptions to create inter-connected open barrens habitat, stepping-stones:

i) Habitat blocks, patches and stepping-stones should be a maximum distance of 3.1 miles from each other.

ii) Permanent barrens habitat stepping-stones should be 1,280 acres or greater.

iii) Rolling barrens habitat patches should be composed of a 500–1000-acre core surrounded by 500-1000 acres of rolling barrens resulting in approximately 1000–2000 acres open at any given time.

Core barrens are managed for barrens and sharp-tailed grouse to provide source populations for new habitats. Large tracts of open barrens are maintained on these properties through a combination of prescribed burning, mechanical treatment, timber harvests, mowing, or other mechanical manipulations. Core barrens are managed on DNR and Partners Lands including Crex Meadows, Fish Lake, and Namekagon Barrens Wildlife Areas, The Douglas County Wildlife Area (3/4 leased, ¼ State Owned), and Mott's Ravine Barrens on the Brule River State Forest. Bayfield County Forest manages the Barnes Barrens Core and Bass Lake Barrens. The Chequamegon-Nicolet National Forest manages the Moquah Barrens (See Table 1). All core barrens are well managed, and most have State Natural Area designations. When core barrens are expanded, the benefit is further amplified when expansion is toward the next barrens project contributing towards landscape level connectivity. Examples include the Crex Meadows and Namekagon expansions. Core barrens range in size from 1,300 to 19,000 acres.

Rolling barrens create temporary large open habitats and vistas using timber harvest on a rotating schedule, at times connected to a core barrens or other permanent opening (Figure 8). These temporary barrens create open habitats of the minimum effective size (1,280 acres) and improve the ecosystem function while providing high quality early seral stage barrens (see Opportunities, Flora – Fauna Section). These sites are then regenerated to jack pine barrens, and within 12 years age-out of suitable sharp-tailed grouse habitat and become young jack pine forest. The “rolling” harvest schedule provides more newly harvested stands to replace those that age-out. The rolling barrens is a working forest model that mimics the effect of a natural wildfire, while regenerating the next forest. This practice is similar to the large-scale forest harvest and regeneration events that occurred due to the jack pine budworm outbreak of the late 1980’s and early 1990’s. The scale of this event prompted the largest positive sharp-tailed grouse response in modern history. Rolling barrens partnerships are managed on DNR Lands, the Brule River LLC Legacy Easement Forest, Chequamegon-Nicolet National Forest, and on the Bayfield, Burnett, and Douglas County Forests.

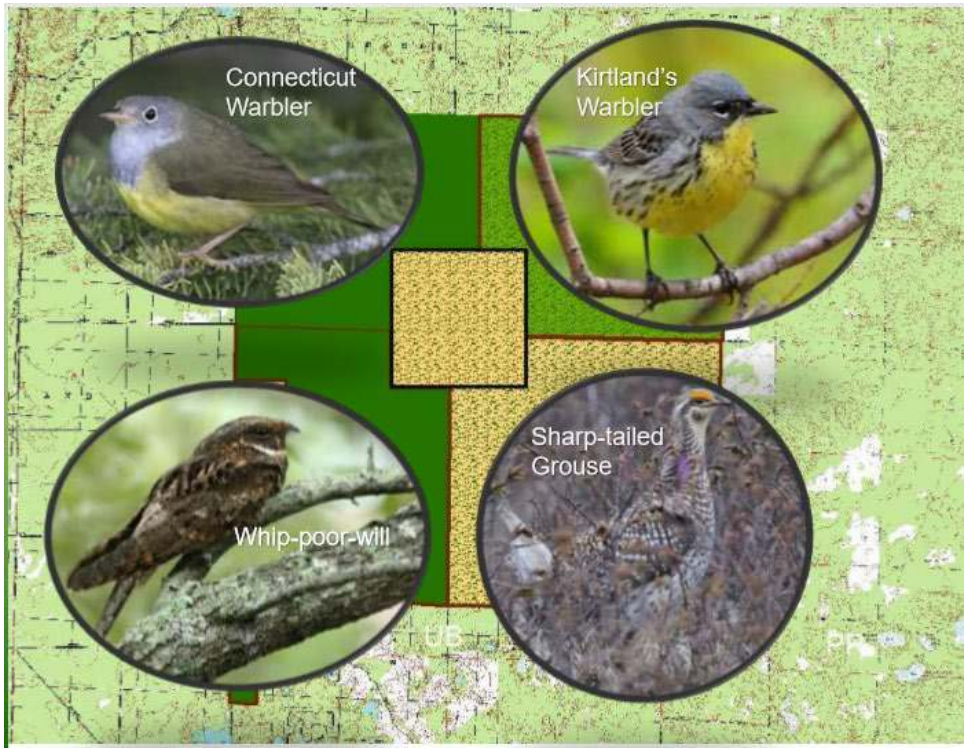


Figure 8. *Schematic of the rolling barrens providing varied habitat age classes of pine barrens for multiple species of greatest conservation need.*

Partnerships implementing the Northwest Sands Habitat Corridor Plan have begun the implementation of seven corridor projects, to date. Sharp-tailed grouse have been observed on 5 of the new project areas. This has been critical to begin landscape level connections, while offsetting populations lost on aging habitat within outlying lands. The barrens projects implemented today are following the guidelines set in the corridor plan,

to provide the minimum acreage needed to successfully restore landscape level connectivity. When working at this scale many other species benefit and quality habitats are created. Recent vegetation surveys show rolling barrens projects within the first growing season are providing over one hundred species of barrens plants. Timber management through harvest creates open habitat for rolling (temporary open) barrens and for restoration before prescribed burns. It is a critical element of this plan to support and increase the working forest operability and markets as an important partner in management. Continued and expanded collaborative planning implementing pine barrens projects is vital to the management of the species, and the globally important pine barrens landscape.

Property	Property Type	Start Date	Barrens Acres Maintained by Burn Units	Open Rolling or Temporary Barrens 2023	Total Barrens Acreage 2023
Crex Meadows	Core Barrens, State Wildlife Area	1946	19,053		19,053
Fish Lake	State Wildlife Area	1946	2,517		2,517
Namekagon Barrens	Core Barrens, State Wildlife Area, Rolling Barrens, Burnett County Forest	1940	6,526	100	6,626
Five Mile Barrens Brule River LLC	Rolling Barrens, Forest Legacy Easement	2016	0	900	900
Five Mile Barrens DCF	Rolling Barrens, Douglas County Forest	2016	0	900	900
Douglas Co WA	Core Barrens, State Lease, Douglas CF 2981ac State Wildlife Area 994ac	1948	3,625	100	3,975
Mott's Ravine Barrens	Core Barrens, Rolling Barrens, Brule River State Forest	1971	248		348
Barnes Barrens	Core Barrens, Plus Rolling, Bayfield County Forest	2008	850	1,000	1850
Bass Lake Barrens	Core Barrens, Bayfield County Forest	2021	800		800
Moquah Barrens	Core Barrens, US Forest Service, Washburn Ranger District	1950 2004 2009 2019	13,403	1,955	15,358
Total Corridor Projects			**47,022**	**4,855**	**52,327**

Table 1. *Current barrens partnerships and acreage in core barrens and rolling barrens*

Private Lands – Agriculture, Timber, Development & Changing Land Use Patterns

On private lands, in addition to fire suppression and forest succession, the development of agriculture on the landscape has also impacted sharp-tailed grouse habitat. Former delayed haying and less intensive grazing practices were beneficial to sharp-tailed grouse and other grassland associates. Today, practices such as annual tillage for row crops and early haying operations negatively influence sharp-tailed grouse during the nesting season (Sjogren and Corace 2006). Whereas tree planting and ecological succession has grown fields and fence lines into tall trees. Sharp-tailed Grouse avoid tall tree areas an effect known as edge avoidance (Figure 9); this further reduces available habitat.

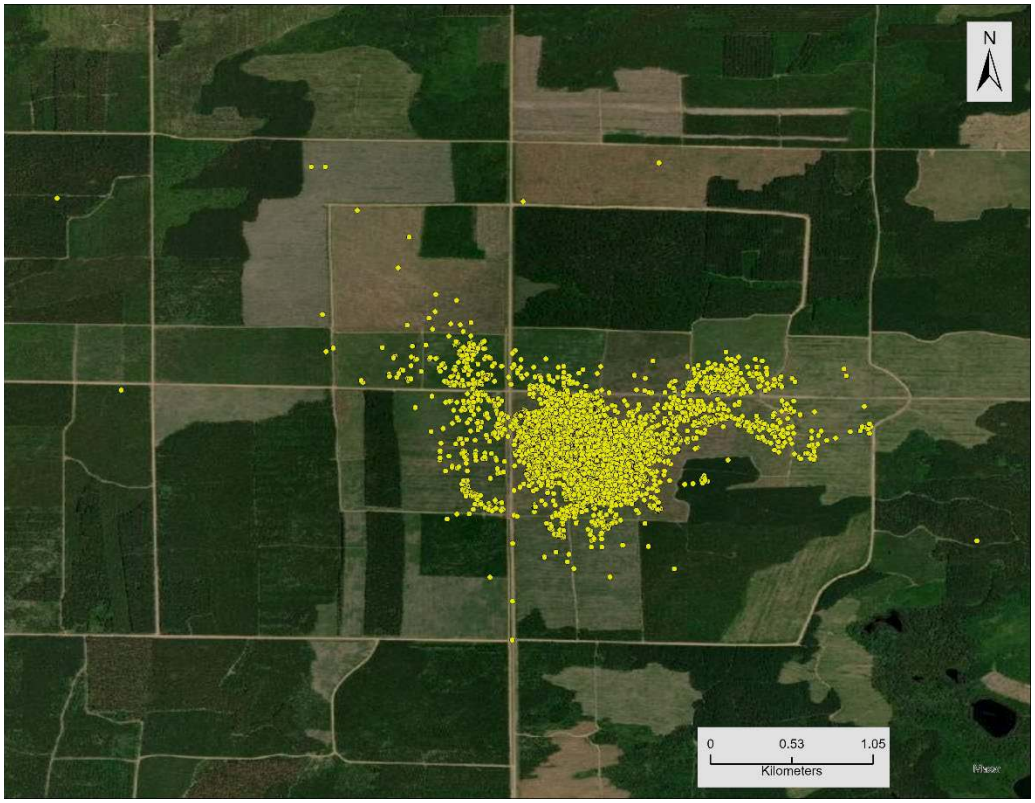


Figure 9. *Yellow dots indicate the locations of a sharp-tailed grouse in relation to edge avoidance created by wooded patches. <1% of transmissions occurred in forested habitats or near edges (NRRI bird lab).*

There are state and federal programs offering incentives to landowners to manage lands to benefit sharp-tailed grouse and other open habitat species. (Sjogren and Corace 2006). When approaching sharp-tailed grouse management it becomes evident that management and protection of private lands is imperative (Probst and Crow 1991). Landscape-level habitat initiatives will require consideration of both existing and potential sharp-tailed grouse habitat and involve strong partnerships with multiple

partners and private landowners (e.g., agriculture, timber industry, county, state, federal, and NGO's; Figure 10). Through the development of this plan two important private lands areas have been identified. One to help connect Moquah to Bass Lake Barrens, locally known as the Oulu Grasslands in addition to sharp-tailed grouse, rare grassland birds such as, Upland sandpipers, meadowlarks, bobolinks, sedge wrens and LeConte's, clay colored, and savanna sparrows are common here (G. Kessler personal communication). The second would connect Crex Meadows and Fish Lake Wildlife Areas, focusing on the agricultural lands east of Grantsburg. Discussions regarding private lands management partnerships will continue in the Goals section of this plan.

Collaborative land management partnerships are the proven method to achieve meaningful landscape-level connectivity. Management of barrens occurs on state, partner, and private lands. Many conservation partners further unite to help manage these barrens habitats through monetary partnerships, hands on work, and public outreach. Partners include the Wisconsin Sharp-tailed Grouse and Ruffed Grouse Societies, the Friends of Crex, Namekagon Barrens, and the Douglas County (the Bird Sanctuary) Wildlife Areas, the Wild Rivers Conservancy, Landmark Conservancy, the Trust for Public Lands, the Nature Conservancy, the Conservation Fund, American Bird Conservancy, Audubon, the Backcountry Hunters and Anglers, American Forests, the St. Croix National Scenic Riverway, the US Fish and Wildlife Service, and internal partners to Wildlife Management including Forestry and the Natural Heritage Programs in particular. During the Working Group Tours, the partnering land managers, and organizational partners toured the NW Sands Habitat Corridor to discuss the plan and future collaboration opportunities.

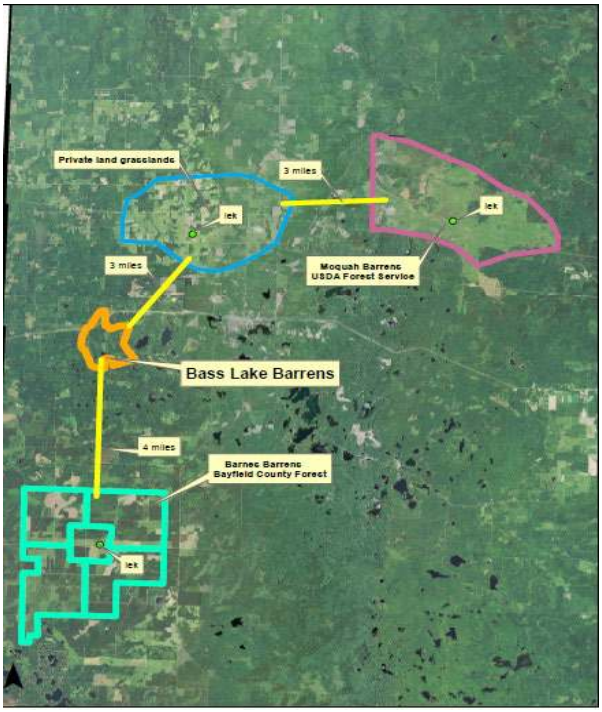


Figure 10. *An example of the Northwest Sands Habitat Corridor Plan implementation across Bayfield County (Bayfield County Forest Fifteen Year Plan 2019).*

Barrens Flora & Fauna

Beyond sharp-tailed grouse, stewarding barrens at the landscape scale will enhance and increase connectivity between existing, globally imperiled, barrens to benefit at-risk wildlife and plant species, strengthen ecosystem resilience, and support tribal conservation priorities. Due to its structure and composition, sharp-tailed grouse habitat provides suitable conditions for numerous uncommon wildlife species. The relatively open character of pine/oak barrens and native diversity is used by numerus uncommon wildlife for breeding season and year-round habitat. Management of pine/oak barrens for sharp-tailed grouse is often compatible with the life histories of these species and helps bolster local populations, aiding in species recovery efforts.

Managed pine/oak barrens also provide habitat for game species such as white-tailed deer, wild turkey, black bear, and canines. During the nesting season the barrens open landscape further provides critical nesting and brood rearing for breeding birds, and waterfowl when associated with wetlands. These open-landscape habitats also attract migratory grassland bird species such as common nighthawks, short-eared owl and northern harrier. Rolling barrens further provide multiple age classes of pine barrens forest habitat critical for the rare Kirtland's and Connecticut warblers, and common species such as wild turkey, snowshoe hare, and bobcat.

Pine/oak barrens plant species thrive under management techniques such as timber sales, prescribed fire, and brush mowing which maintain the open sunny character of barrens sites. Recent plant surveys at publicly owned core barrens sites revealed a relative abundance of native plant species, ranging from 140–262 species per site. Further community condition analysis indicated studied sites contain a high value species richness that forms a matrix of relationships providing a large suite of habitat needs (D. S. Anderson and P. S. Hlina, University of Wisconsin-Superior, unpublished report). Even in newly created sites (<3 years), data indicates that there is a strong response averaging 100+ species in these sites, improving species diversity. Overtime, with increased management and protection these can continue to evolve into better functioning early successional barrens (P. S. Hlina, University of Wisconsin-Superior, personal communication). This diverse habitat is critical for sharp-tailed grouse for structure and food resources. As discussed in the habitat section, many different parts of plants are consumed, greens, buds, catkins, berries, nuts, and seeds. Further the diversity of plants producing food resources and at differing times over the year stretches available resources. Diverse barrens habitat also produces insects species important for young broods, other wildlife, and pollinators. Uncommon butterfly and moth species also unique to barrens benefit from diversity and/or may require specific host plants.

Benefits To Local Communities

There are numerous benefits garnered by local communities from the management of barrens habitats and sharp-tailed grouse populations. Cited benefits often include the direct potential future harvest of sharp-tailed grouse and other game species. Deer, turkey, ruffed grouse, black bear, and canids are abundant in barrens habitats. The publicly accessible properties managed for barrens are widely known as destination locations for hunting these species. However, benefits go well beyond and can include the health and wellness of local individuals and user groups to both the realized and underutilized economic benefits of restoring/managing barrens habitats. As discussed in other portions of this plan, dog trainers and trialers are currently one of the largest direct user groups of the sharp-tailed grouse population. The Northwest Barrens Properties Master Plan 2017 notes that the Namekagon Barrens and Douglas County Wildlife Areas are prime destinations for professional and amateur field dog trials in North America with the economic benefit to the region estimated to be close to $90,000 within Burnett, Douglas, and Washburn Counties. Events generate over $8,000 in state and local tax revenue (UW, 2016). Use of The Douglas County Wildlife Area can be traced back to 1925 when the Northern States Amateur Field Trial Association conducted its first sport dog trial.

Bird watching and photography are also one of the largest direct economic benefits to the communities within the barrens landscape. Visitors regularly travel from throughout the country, especially from Minnesota, to viewing blinds positioned to watch the mating dance of sharp-tailed grouse. Although sharp-tailed grouse are the main attraction, users expect to also see other regionally rare or hard to find species like upland sandpipers. Sometimes these wildlife viewing visits are in combination with the other events hosted by the local friends groups or other activities like mushroom foraging and wild blueberry picking that are widely popular in the barrens.

Timber management, especially as part of the rolling barrens management strategy, also remains a highly important economic benefit to local communities, forests, logging contractors, and mills. Though more easily quantified in direct economic impacts through the sale of timber, secondary and tertiary benefits that lead into manufacturing, sales of finished products, construction, and energy supply chains a result of barrens management/maintenance are important, but less quantified. Further, there is likely much un-tapped opportunity for state, county, federal, and non-profit agencies/organizations to individually or cooperatively seek grant and funding opportunities to assist with barrens management and expansion. These opportunities could bring dollars to local communities in the form of hiring staff, employing local contractors to conduct commercial timber harvesting and non-commercial management, research/monitoring, and public outreach, turning barrens management into an economic engine for many rural areas.

Population Viability, Genetic Status Subpopulations & Population Persistence

Small, declining, and isolated wildlife subpopulations are susceptible to local extirpation due to a combination of factors including environmental and demographic stochasticity as well as inbreeding that can drive the population into an extinction vortex, resulting in local extirpation (Gilpin and Soulé 1986, Frankham et al. 2002, Lande et al. 2003, Fagan and Holmes 2006; Figure 11). Loss of genetic variation in small, isolated populations is inevitable but does not necessarily result in a declining population (Soulé and Mills 1998). Small populations may already be at risk because of random stochastic environmental or demographic events that may lead to local extirpation independent of degraded genetic quality (Soulé and Mills 1998). The extinction vortex process has largely been theoretical or model-based until recently.

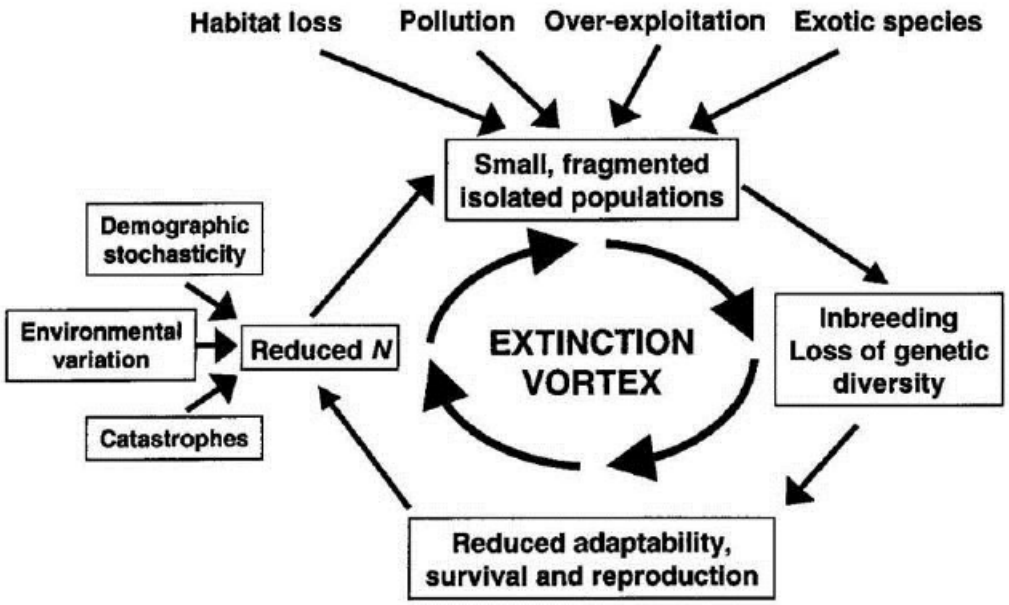


Figure 11. *The extinction vortex from Frankham et al. (2002). A feedback cycle through time that results in progressive loss of population viability and increased vulnerability to extinction. Environmental, genetic, and demographic drivers that are often associated with human causes interact synergistically to alter the structure and fitness of populations and increase vulnerability to future stochastic events.*

Recent field research and retrospective analyses have demonstrated a link between declining vertebrate populations and degraded genetics. In Illinois, a greater prairie-chicken population that declined over several decades had poor reproductive parameters (egg fertility and hatching success) that were correlated with a decrease in genetic variation (Westemeier et al. 1998). This led to a successful genetic rescue project in Illinois. More recently, Fagan and Holmes (2006) retrospectively demonstrated that several vertebrate populations have shown characteristics akin to the

extinction vortex prior to actual local extinction. Specifically, they noted that annual rates of population decline were negatively associated with time to extinction. This implies that aspects of population demographics deteriorated as local extinction neared. Researchers documented a population bottleneck and corresponding decline in genetic diversity in Wisconsin greater prairie-chickens but did not find an associated decline in fecundity (Bellinger et al. 2003). Nevertheless, a nationwide panel of conservation genetics experts recommended a genetic rescue effort for Wisconsin's greater prairie-chicken population similar to the effort used in Illinois (J. L. Bouzat, Bowling Green State University, unpublished report). However, Bouzat et al. (2009) cautioned that while genetic translocations can be effective at reducing acute impacts of low genetic diversity and high inbreeding, their long-term viability may not be guaranteed unless the effects of original threats such as habitat loss and fragmentation are reduced.

Genetic Implications For Sharp-tailed Grouse In Wisconsin

Like Wisconsin's greater prairie-chicken population, the sharp-tailed grouse population consists of several small, local subpopulations and almost no movement among the distinct subpopulations (Figure 5). Small population size and resultant population bottlenecks are of significant concern for sharp-tailed grouse and other prairie grouse. In a lek-based mating system females often mate with a smaller subset of the overall male population (Hess 2012). This reduces the effective size of the population. As a result, there is concern about the long-term viability of Wisconsin's sharp-tailed grouse population (Temple 1992, Connolly 2001). Genetic degradation and the overall lack of genetic information on sharp-tailed grouse in Wisconsin was cited in both the 1997 (Wisconsin DNR 1997) and 2011 (Wisconsin DNR 2011) sharp-tailed grouse management plans; and was similarly identified as a threat in Wisconsin's Wildlife Action Plan (Wisconsin DNR 2015b).

As a result, the Wisconsin DNR, in cooperation with the Wisconsin Sharp-tailed Grouse Society, Central Michigan University and Minnesota DNR, undertook a series of studies to determine the genetic status of Wisconsin's sharp-tailed grouse population to compare with other contemporary midwestern populations.

Samples were collected using hunter-harvested wings and feathers collected at lek sites. Sample sites included core sharp-tailed grouse properties, harvest units, and scattered private lands throughout central and northwestern Wisconsin. Additional samples from Minnesota were acquired through hunter wing collections to compare to Wisconsin sharp-tailed grouse and to identify potential donor populations for translocation efforts.

In fall 2008, Minnesota DNR collected hunter-harvested wings from their eastern sharp-tailed grouse population "East", and from their northwestern population "West" (Figure 12). Tissues from these wings were analyzed at Central Michigan University and compared to Wisconsin samples collected from 2001–2003 and 2007–2008.

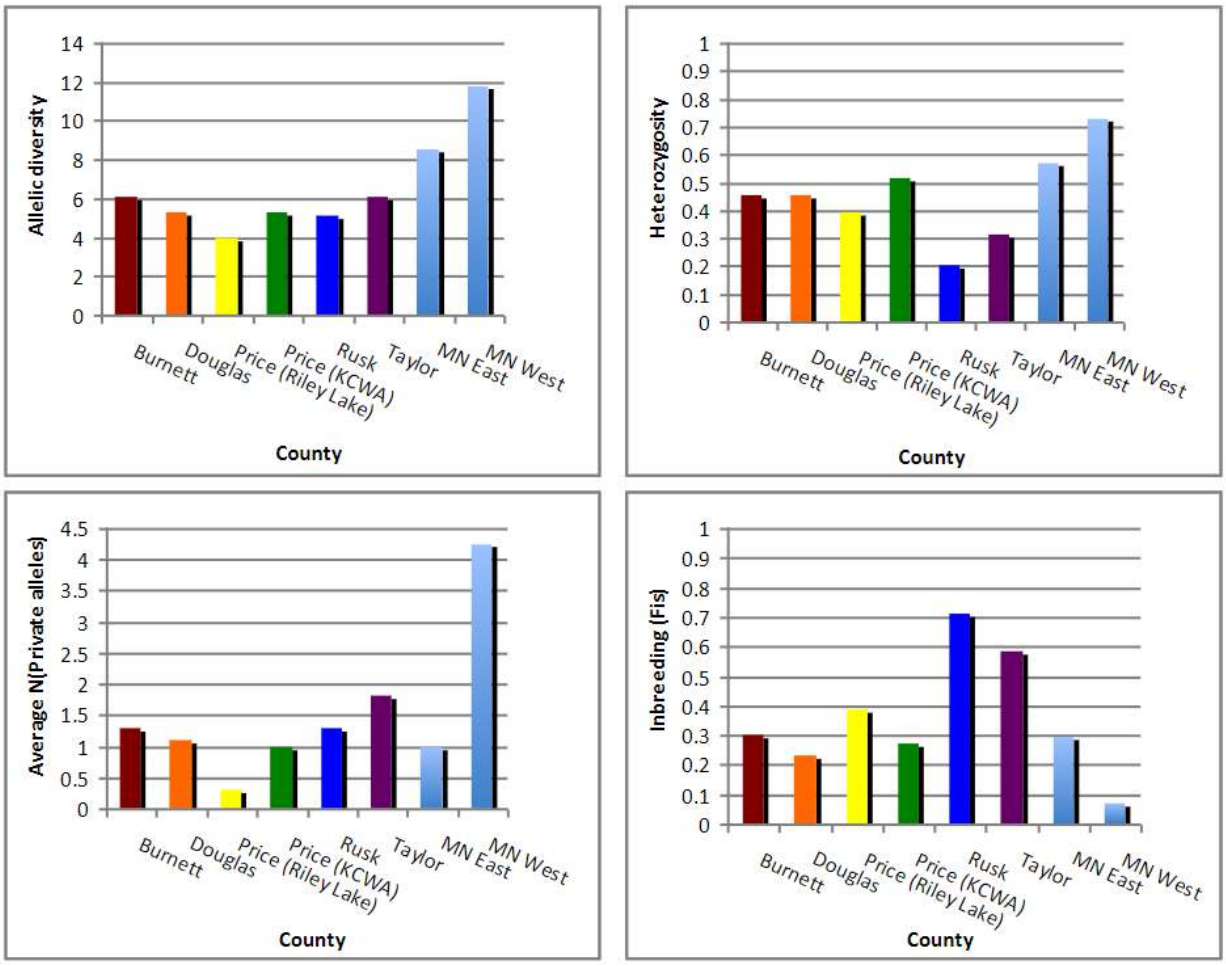


Figure 12. *Genetic status (heterozygosity, allelic diversity, inbreeding and private alleles) for Wisconsin's sharp-tailed grouse populations (grouped by county) compared to east-central and northwestern populations of Minnesota.*

The two populations in Minnesota were defined as western birds and eastern birds. These two populations exhibited significantly different distributions of allelic frequencies across six microsatellite loci ($p < 0.002$). However, the proportion of genetic variation between Minnesota subpopulations (FST value) was not as high as that found between the various Wisconsin subpopulations (Table 2). This indicates that Minnesota populations are more similar to each other than Wisconsin subpopulations are to each other. The eastern Minnesota population also is more genetically similar than the western Minnesota population to the average Wisconsin population based on FST and RST values (Table 2).

The Minnesota populations had higher heterozygosity levels than Wisconsin populations and higher allelic diversities (Figure 12). The inbreeding level (FIS) for the western Minnesota populations was significantly lower than that of the Wisconsin populations, but the eastern Minnesota population was not significantly different from the Wisconsin populations (Figure 12). The western Minnesota populations also had

more unique alleles than any other population (Figure 12), while the eastern Minnesota population did not have as many unique alleles compared to Wisconsin populations. In general, Wisconsin sharp-tailed grouse have many alleles system-wide, but relatively few in any specific population.

Population subdivision (FST) was also evaluated among the two Minnesota populations and grouped Wisconsin populations (Table 2). Generally, greater isolation (structure) between the populations results in a larger FST value or the amount of unique genetic variation found in each subpopulation. This is then inversely related to inter-population dispersal.

Subsequent research evaluated genetic variation and its relation to landscape factors within the western and eastern populations of sharp-tailed grouse in Minnesota. This study suggested that in Minnesota sharp-tailed grouse populations are often structured by habitat, but that long distance dispersal across less suitable landscapes between habitat may help maintain genetic diversity during periods of decreased population size (Roy and Gregory 2019).

Table 2. *FST values comparing two Minnesota regions to each Wisconsin subpopulation (grouped by county; KCWA denotes Kimberly-Clark Wildlife Area).*

	MN East	**MN West**	**Price (Riley Lake)**	**Price (KCWA)**	**Rusk**	**Taylor**	**Burnett**
MN West	0.0326						
Price (Riley Lake)	0.207	0.222					
Price (KCWA)	0.237	0.228	0.128				
Rusk	0.192	0.213	0.108	0.106			
Taylor	0.214	0.218	0.099	0.071	0.08		
Burnett	0.16	0.177	0.138	0.166	0.143	0.11	
Douglas	0.16	0.177	0.131	0.144	0.131	0.095	0.004
MN West	0.0226						
Wisconsin	0.1446	0.1586					

Surveys/Population Monitoring & Research

Survey Protocol & Population Monitoring

Lek or dancing ground surveys are the standard method used to monitor sharp-tailed grouse. Lek locations are typically stable from year to year, and are a reliable survey method used in Wisconsin, Minnesota and Michigan (Sjogren and Corace 2006), although specific survey techniques may vary. Surveys are conducted in the spring during the breeding period. The number of males attending each lek is recorded, with attempts made to survey during the peak of the breeding period. In some areas, flush counts at lek sites are conducted where the total number of birds flushed is recorded. Lek attendance provides an index to population changes rather than an absolute estimate. Survey results also can indirectly reflect changes in habitat quality for sharp-tailed grouse over time.

In Wisconsin, sharp-tailed grouse are a non-migratory game species, a Species of Greatest Conservation Need (SGCN), as well as a Species of Special Concern by the Wisconsin DNR and a Regional Forester's Sensitive Species (RFSS) by the US Forest Service. Wisconsin sharp-tailed grouse often exist at relatively low densities and surveys require repeated visits with the census period coinciding with the peak of lek attendance. From a logistical perspective, this provides the added challenge of coordinating sharp-tailed grouse surveys with other established spring-time survey requirements (Sjogren and Corace 2006). Survey efforts have also changed over time due to changes in the species' distribution, staffing reductions, and budgetary constraints. It is difficult to assess sharp-tailed grouse because current populations are disjunct, leks are inconsistent and/or hard to access. Additionally, in some areas snow limits access and the number of suitable days the property can be surveyed. Trained volunteers make surveying most areas possible, and more are needed. Further standardizing survey techniques and effort is a continuous improvement goal. However, continued survey efforts and the maintenance of existing and historical lek sites are critical to monitoring long-term population trends and adapting management to maintain or enhance current populations.

Survey Results & Population Trends In Wisconsin

The Wisconsin DNR and US Forest Service have coordinated annual sharp-tailed grouse dancing ground surveys since the early 1980s, with data beginning in the 1950s on some properties. Volunteers and partner groups such as the Wisconsin Sharp-tailed Grouse Society, associated Friends Groups, and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) assist with survey efforts. Grouse populations historically appear to loosely follow a 10-year cycle (Gregg and Niemuth 2000, Niemuth 2006), more recent survey data does not show this trend (Table 3). Populations show short-lived peaks in outlying areas through landscape events, such as the jack pine budworm outbreak in the 1990s, and the Germann Road Fire in 2013, both resulted in thousands of acres of salvage logging across the species' current range; however, the populations rapidly decline as the habitat grows to forest.

Statewide populations have experienced long term population declines. The number of dancing males has also varied widely on individual properties with some experiencing severe fluctuations in the past 15 years (Table 3, Figures 13–18). The Central Sands region of Wisconsin no longer has sharp-tailed grouse, and birds in the North Central Forest region are critically low in numbers. Although bird numbers have reduced throughout much of the outlying areas in the Northwest Sands, this landscape provides hope (Figure 5). In general, within the Northwest Sands, habitat is improving, and sharp-tailed grouse numbers are positively responding. The core properties are source bird populations for neighboring properties and stepping-stone projects within the NW Sands Habitat Corridor Plan have had consistent, and even increasing, bird numbers recently.

Table 3. Sharp-tailed grouse male survey counts on wildlife management areas and additional outlying areas in northwest and northcentral Wisconsin, USA, 2008-2023. Missing counts indicate surveys were not conducted.

Property/Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Barrens Projects																
Crex Meadows W.A.	40	24	20	16	24	14	5	16	25	22	17	25	25	19	68	76
Douglas County W.A.	28	41	36	42	25	25	23	31	24	14	23	25	13	8	6	18
Kimberly Clark W.A.	10	10	11	n/a	8	na	3	4	6	0	0	0		0	0	0
Moquah Barrens W.M.A.	3	6	7	5	6	3	4	3	2	10	15	23	22	7	3	3
Namekagon Barrens W.A.	47	36	43	21	40	42	56	81	62	47	44	53	56	57	66	65
Five Mile Barrens, Brule R. LLC																2
Pershing W.A.	27	20	14	9	3	7	5	3	3	1	0	0		1	0	0
Riley Lake W.M.A.	27	37	31	15	33	25	19	27	16	21	6	24	12	7	6	12
Barnes Barrens Mgmt Area	16	27	na	na	6	8	10	19	31	23	12	11		4	15	19
Sub Total	**198**	**201**	**162**	**108**	**145**	**124**	**125**	**184**	**169**	**138**	**117**	**161**	**128**	**103**	**164**	**195**
Outlying Areas																
unit 2	241	178	79	66	57	28	53	42	25	24	33	18	23	8	4	0
unit 9	27	19	9	9	9	1	1	13	13	13	18	27	26	20	10	7
Rusk County	64	56	39	26	25	22	12	9	10	6	5	0		1	0	0
Sub Total	**332**	**253**	**127**	**101**	**91**	**51**	**66**	**64**	**48**	**43**	**56**	**45**	**49**	**29**	**14**	**7**
Annual Total	**530**	**454**	**289**	**209**	**236**	**175**	**191**	**248**	**217**	**181**	**173**	**206**	**177**	**132**	**178**	**202**

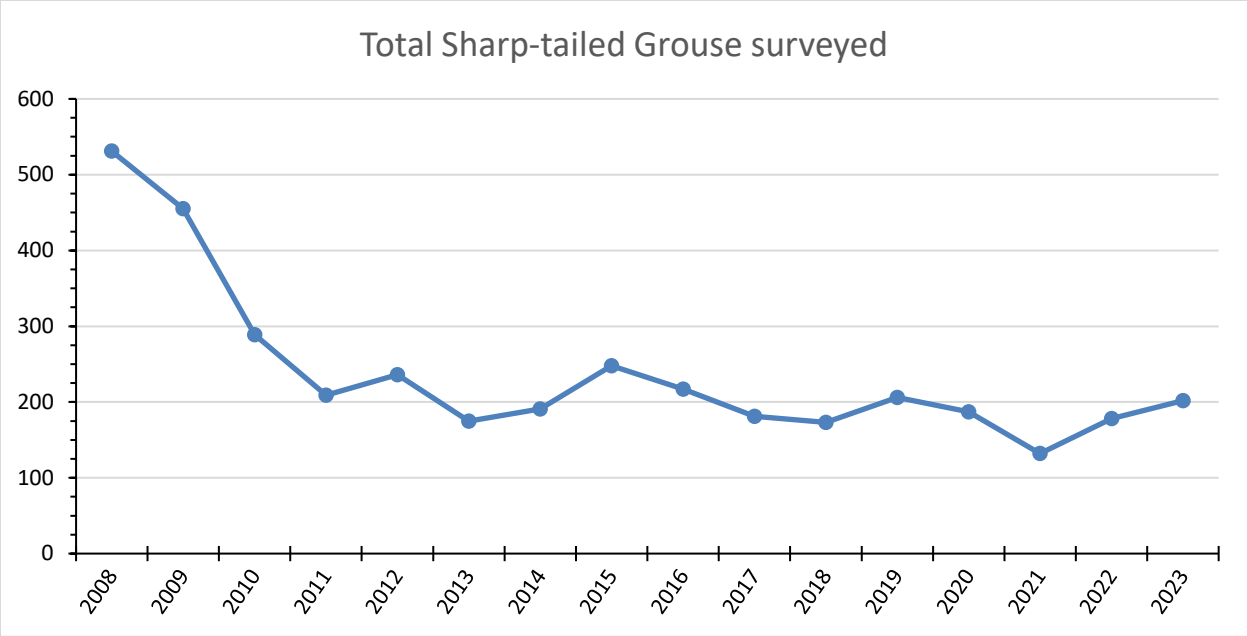


Figure 13. *Overall number of male sharp-tailed grouse observed during spring dancing ground surveys in northwest and northcentral Wisconsin, USA, 2008–2023. Annual values include the total counts from managed properties, non-managed properties, and private lands.*

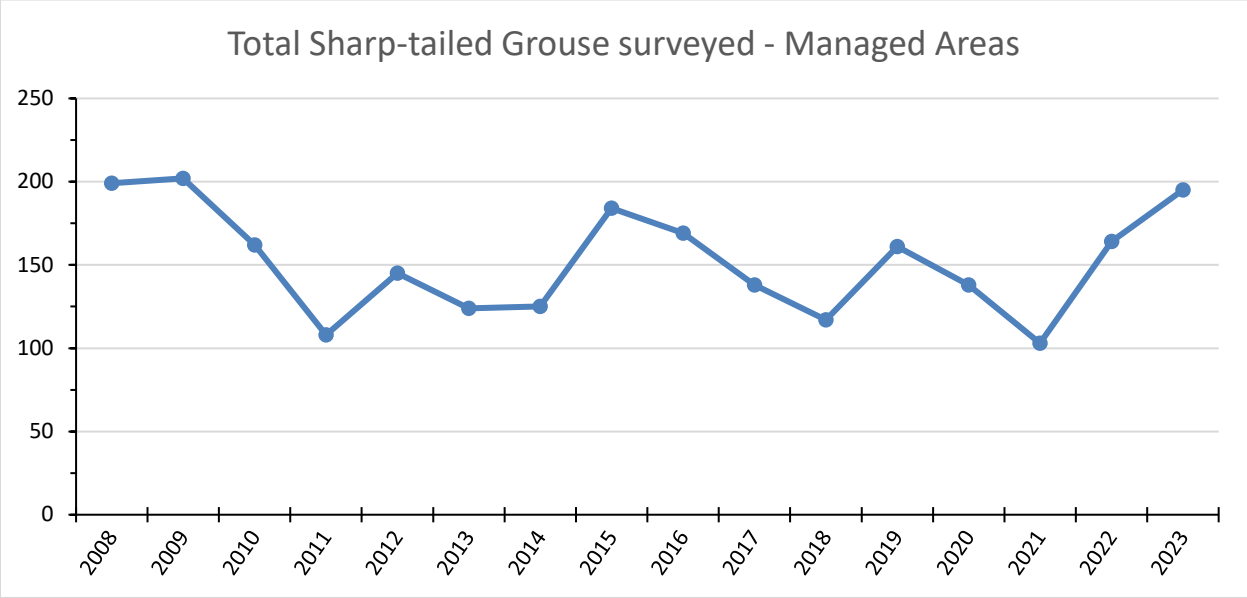


Figure 14. *Number of male sharp-tailed grouse observed during spring dancing ground surveys on wildlife management areas within northwest and northcentral Wisconsin, USA, 2008–2023. Properties include Crex Meadows W.A., Douglas County W.A., Kimberly Clark W.A., Moquah Barrens W.M.A., Namekagon Barrens W.A., Pershing W.A., Riley Lake W.M.A., Dike Seventeen, and Barnes Barrens Management Area.*

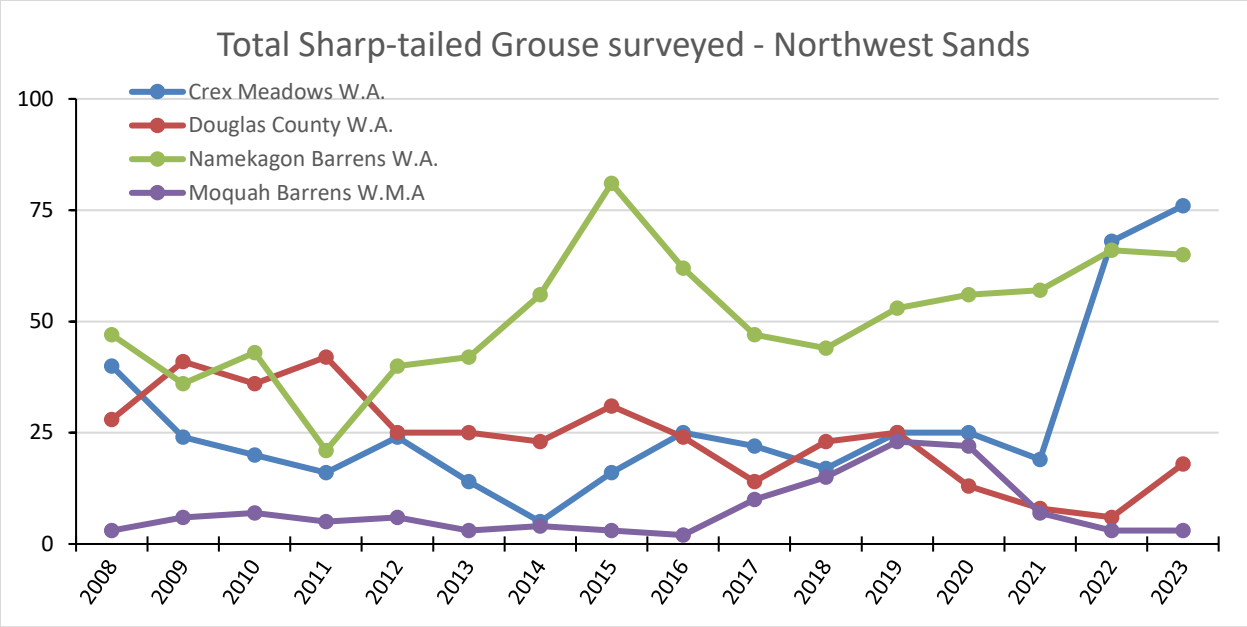


Figure 15. *Number of male sharp-tailed grouse observed during spring dancing ground surveys within the Northwest Sands Ecological Landscape and surrounding areas in northwest Wisconsin, USA, 2008–2023. Properties managed for sharp-tailed grouse within the Northwest Sands include Crex Meadows W.A., Douglas County W.A., Namekagon Barrens W.A., and Moquah Barrens W.M.A.*

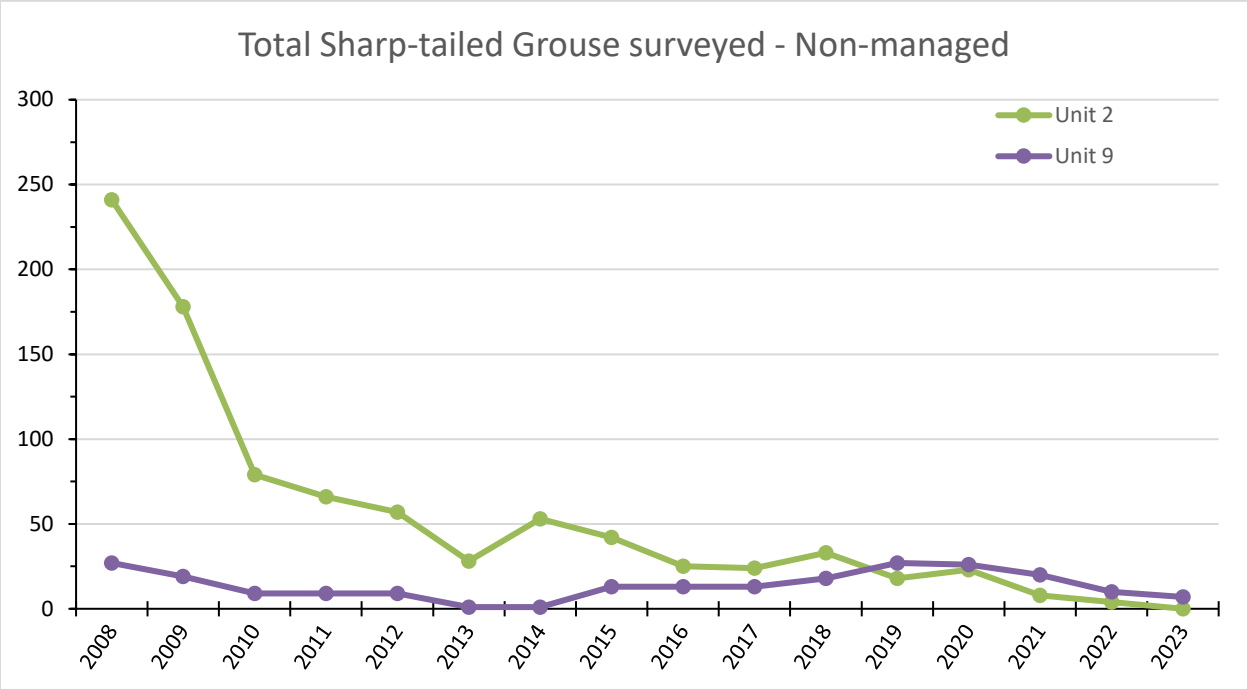


Figure 16. *Number of male sharp-tailed grouse observed during spring dancing ground surveys on outlying areas within Deer Management Units 2 and 9 in the Northwest Sands Ecological Landscape in northwest Wisconsin, USA, 2008–2023.*

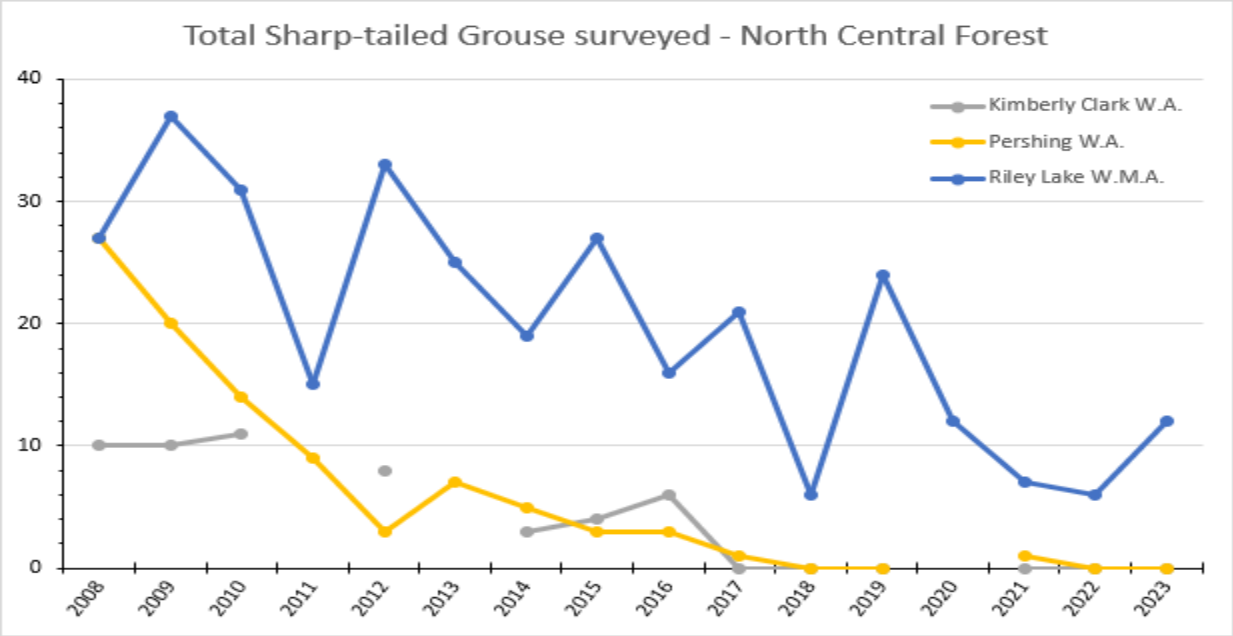


Figure 17. *Number of male sharp-tailed grouse observed during spring dancing ground surveys on wildlife management areas within the North Central Forest Ecological Landscape in Wisconsin, USA, 2008–2023. Properties managed for sharp-tailed grouse within the North Central Forest include Kimberly Clark W.A., Pershing W.A., and Riley Lake W.M.A.*

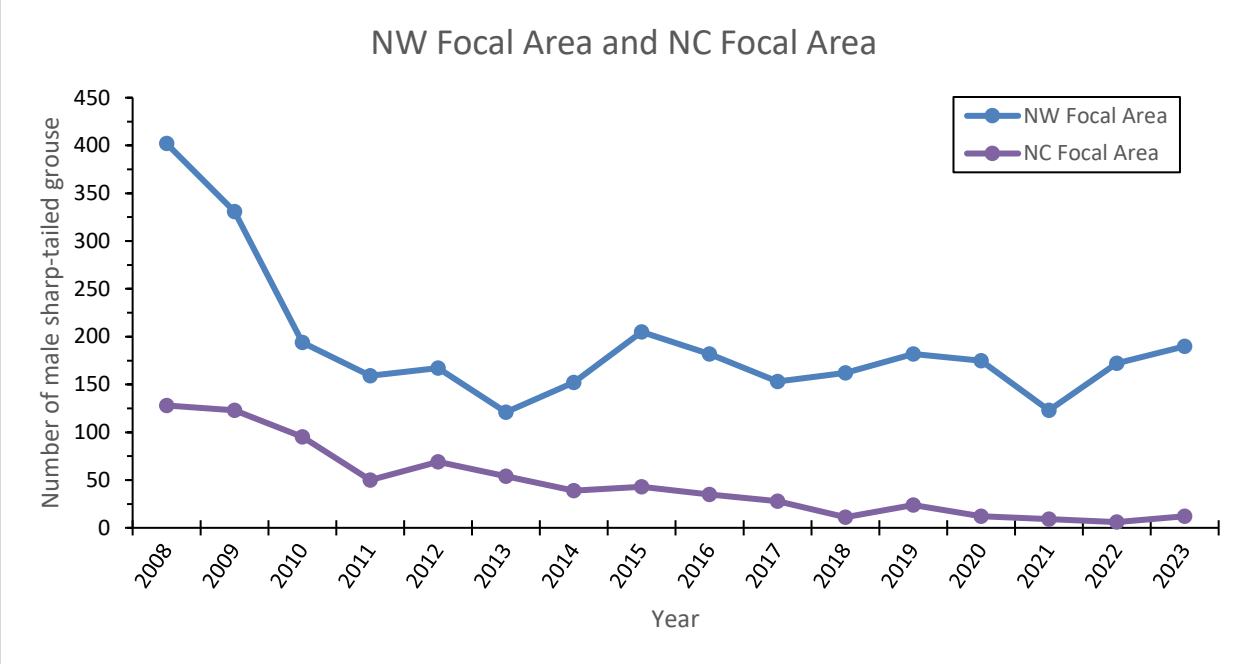


Figure 18. *Number of male sharp-tailed grouse observed during spring dancing ground surveys in the Northwest and North Central Focus Areas in Wisconsin, USA, 2008–2023.*

Recent Research

Research has been conducted on sharp-tailed grouse in Wisconsin and the surrounding upper Midwest region on a variety of topics from brood habitat selection to barrens management. Early efforts were conducted by Hamerstrom (1963), with more recent efforts by Connolly (2001) and, most recently, by the Wisconsin Department of Natural Resources in collaboration with the University of Wisconsin-Madison (2014–2018).

There remains considerable interest in restoring connectivity among managed barrens patches at regional scales, but, in general, sharp-tailed grouse habitat associations had yet to be evaluated at such spatial scales. To address potential scale-dependent relationships of sharp-tailed grouse, Hardy (2018) used roadside-based surveys in combination with an occupancy modeling framework and explored the roles of disturbance and contemporary land use in shaping the current distribution of sharp-tailed grouse at multiple spatial scales (1- to 6-km scales) within the Northwest Sands Ecological Landscape of Wisconsin. In total, over 3,000 surveys were conducted during the course of the study. Sharp-tailed grouse were rare overall across the sampled region (occupancy [ψ] = 0.21) but were more prevalent at the local scale. At the landscape scale, occupancy was higher in landscapes containing a greater proportion of disturbed forest and less agricultural cover. In contrast, local occupancy rates were most strongly associated with distance to established wildlife management areas and proximity to open patches. The relative importance of landscape characteristics appears to differ among spatiotemporal scales: agriculture and older disturbance events had a stronger influence on occupancy at larger spatial scales, whereas recent disturbance had the greatest effect at smaller spatial scales. The probability of sharp-tailed grouse occupancy was most strongly influenced by landscape characteristics at 5- and 6-km spatial scales.

Based on these results, Hardy (2018) proposed that forest management regimes that maximize the amount of regenerating forest approximately 20–25 years of age at 4–5 km scales would be most effective at promoting sharp-tailed grouse occupancy. In addition, patches disturbed more recently (approx. 1–15 years since disturbance event) are also likely important for sharp-tailed grouse at smaller, local scales (i.e., 1–3 km). Collectively, these results have important implications for conservation and management of barrens habitat and disturbance-dependent species, particularly within the context of establishing corridors and stepping-stones to enhance regional landscape connectivity. Furthermore, the work by Hardy (2018) supports management recommendations within the Northwest Sands Corridor Plan (Reetz et al. 2013) and highlights the urgent need for increased connectivity among management areas for the persistence of sharp-tailed grouse populations in northwestern Wisconsin.

Harvest & Recreational Opportunities

Currently, sharp-tailed grouse are considered a game species in Wisconsin. The overarching goal of this plan is to ensure a managed sustainable population of sharp-tailed grouse in Wisconsin, by implementing landscape level habitat strategies within the Northwest Focus Area.

The long-term goal is a managed sustainable population, with biologically-defensible best management practices for the persistence of the species. The Sharp-tailed Grouse Advisory Committee has conducted annual reviews of survey data to determine if the fall hunting season will allow for harvest. When implemented, harvest occurs during a state fall hunting season subject to state and tribal regulations. The state season is currently three weeks in length, running from mid-Oct. to early Nov. In addition to hunting, other sharp-tailed grouse recreational opportunities exist including dog training, dog trialing, and lek observations during the spring breeding season. The goal of previous plans was to provide for recreational opportunities as long as it would not compromise sustainability of the overall population.

Current Harvest Framework

Research indicates that Wisconsin's sharp-tailed grouse are comprised of isolated and genetically different populations tied to noncontiguous properties. A population viability analysis, discussed in greater detail below, also suggests that if we continue to manage the birds as identified in the previous management plan, there may not be a long-term future of sharp-tailed grouse in the state.

In 1997, a tightly regulated quota and permit system was implemented after the fall hunting season was temporarily closed in 1996 due to concerns about over-harvest. The 2011 Management Plan harvest system used a combination of population survey information and harvest data to set quotas and permit levels within established Deer Management Units (Figure 20; see calculations below). To hunt sharp-tailed grouse in Wisconsin, hunters applied for a harvest permit and were entered into a drawing. The bag limit was set at one bird per issued permit. Reported harvest was recorded on hunter registration stubs sent in by successful hunters. Reported total harvest has steadily declined since the advent of the current permit system and is largely a function of dwindling populations (Figure 19, Table 3, Table 4). Hunter compliance was reviewed and suggests that compliance was high. Due to recent and long-term trends in spring lek count surveys and a population viability analysis suggesting harvest impacts (M. A. Hardy, University of Wisconsin-Madison, personal communication), hunting permits have not been available since 2018. The 2022 Sharp-tailed Grouse Advisory Committee has called for a new quota setting system reflective of this information and discussed in the Goals Section of this plan.

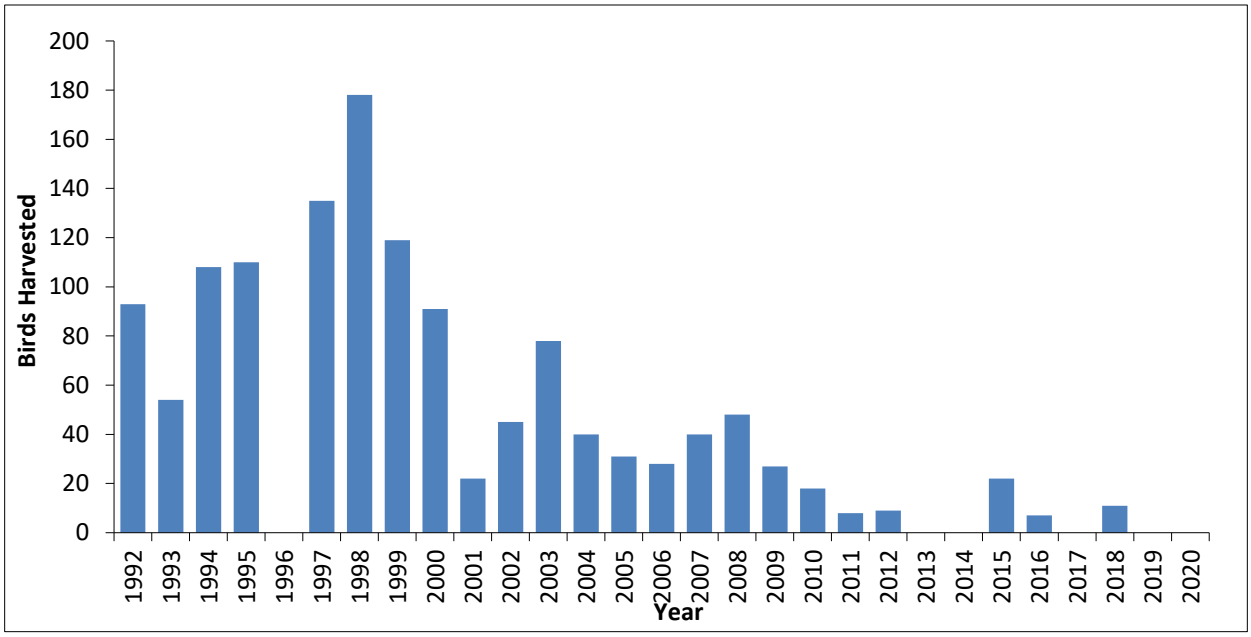


Figure 19. *Reported sharp-tailed grouse harvest in Wisconsin, USA, 1992–2022. No permits were available for the harvest season in 1996, 2013-2014, and 2019-2022.*

Table 4. *2009-2018 sharp-tailed grouse reported harvest & hunter survey results (2013, 2014, 2017, and 2019-2022 seasons are not shown, as no permits were issued.*

Category	2010	2011	2012	2015	2016	2018
Permits issued	330	250	235	100	25	25
Individual permit holders	231	123	213	100	25	25
Registered harvest	18	8	9	22	7	11
Individuals harvested >1 bird	2	2	0	0	0	0
Harvest success rate	5.5%	3.2%	3.8%	22%	28%	44%
Hunter surveys returned	160(69%)	90 (73%)	59 (28%)	65 (65%)	24 (96%)	24 (96%)
Permit holders who hunted*	89 (56%)	48 (53%)	40 (68%)	39 (60%)	19 (79%)	18 (75%)
Total trips in the field	159	97	77	57	33	28
Total hours in the field	784	417	305	213.5	146.5	92
Mean trip length (hours)	4.9	4.3	4	6.1	4.4	3.3
Hunters making 1 trip**	50 (56.2%)	18 (37.5%)	15 (39.5%)	19 (54.3%)	9 (47.4%)	12 (66.7%)
Hunters making 2 trips	21 (23.6%)	17 (35.4%)	14 (36.8%)	11 (31.4%)	8 (42.1%)	3 (16.7%)
Hunters making 3 trips	11 (12.4%)	9 (18.8%)	6 (15.8%)	4 (11.4%)	1 (5.3%)	2 (11.1%)
Hunters making 4+ trips	7 (7.9%)	4 (8.3%)	3 (7.9%)	1 (2.9%)	1 (5.3%)	1 (5.6%)
Rating	3.3	3.1	3.4	4.3	3.9	4.7

*Based on number of surveys returned

**The number hunters that reported pursuing sharp-tails for 1 day

The Sharp-tailed Grouse Advisory Committee has also recommended that hunting zone boundaries be reconsidered. Previous sharp-tailed grouse hunting zones were the same as deer management units, which do not accurately identify sharptailed grouse habitat and population boundaries. (Figure 20) This plan recommends reestablishing zone boundaries to match bird presence on management properties; however, this will need to be a future rule change and is not directly covered under the authority of this plan.

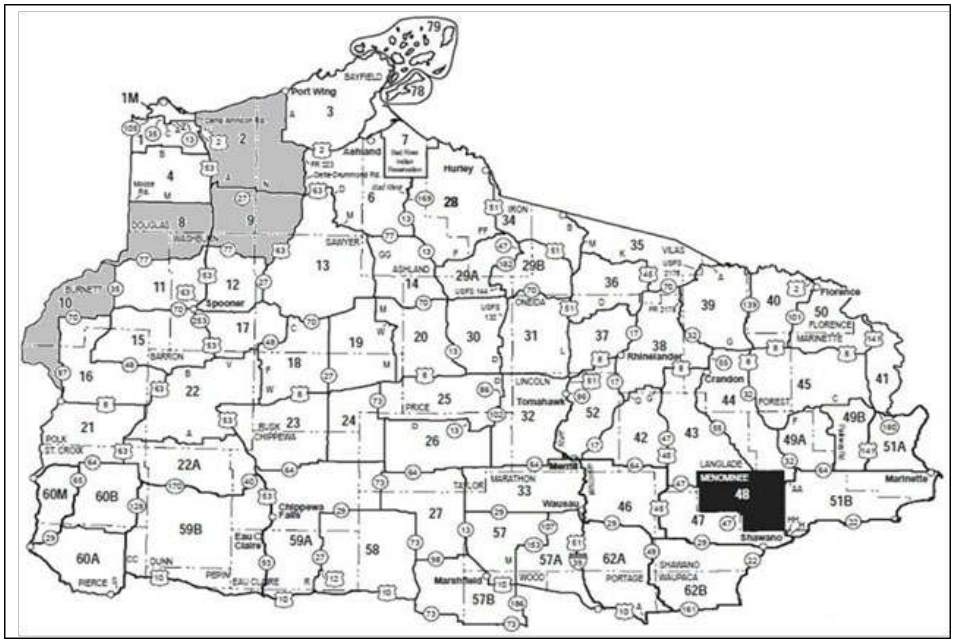


Figure 20. *Deer Management Units (shaded in gray) which have issued Sharp-tailed grouse permits in recent years.*

Impacts Of Harvest

Although there is little empirical evidence with regards to the influences of hunting on larger sharp-tailed grouse populations, some studies have suggested that hunting mortality is at least partially additive to natural mortality (Bergerud and Gratson 1988). Estimates of harvest rates range from 12–39% for sharp-tailed grouse (Connelly et al. 2020), but others have indicated that higher harvest rates are more likely to be additive for other grouse species (Sandercock et al. 2011, Blomberg 2015). Actual harvest impacts likely vary with population size, timing of the harvest season, weather, and habitat quality.

In the mid-1980s, the estimated average harvest rate for sharp-tailed grouse in Wisconsin was 30%, and the highest kill rates were associated with stable or declining sharp-tail breeding populations, a lack of regularly used dancing grounds, and greater hunter interest (Gregg 1990). This, in part, led to the creation of a quota and permit system in Wisconsin prior to the 1997 harvest season. Permit success rates steadily declined in the years that followed implementation of the quota and permit system

(20.8% success in 1997 vs. 3.8% in 2012). However, spring surveys indicated that the statewide sharp-tail population continued to decline in Wisconsin, and the average harvest permit success rate during the 2015–2018 harvest seasons increased to 31.3%. The continued steady decline in population indices raised concerns that hunting may be adversely impacting sharp-tailed grouse in Wisconsin despite efforts to maintain a small, limited harvest opportunity. Because of these trends, and a population viability analysis that evaluated the risk of harvest (below), harvest permits have not been made available since 2018.

Population Viability Analysis

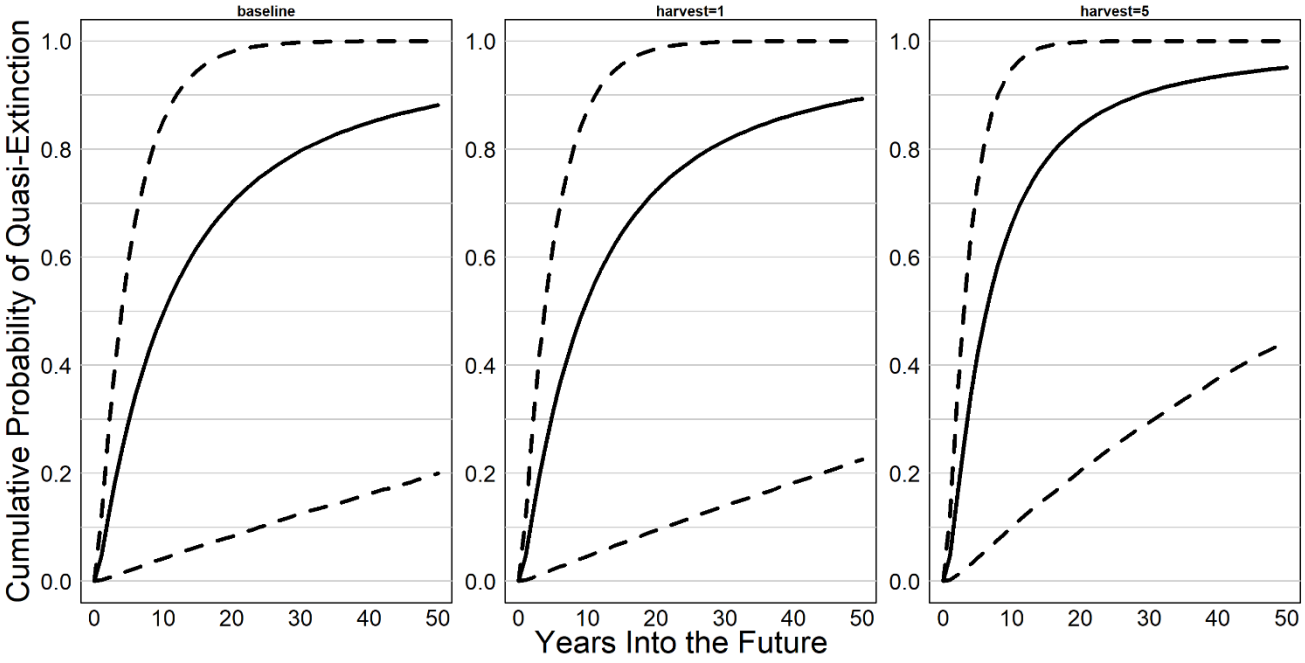
Given the concerns surrounding harvest, the Wisconsin DNR collaborated with the University of Wisconsin-Madison to assess potential impacts of harvest on sharp-tailed grouse in Wisconsin. Researchers at UW-Madison used a count-based population viability analysis (PVA) to assess the vulnerability of Wisconsin's sharp-tailed grouse population to hunting pressure. Population viability analyses are common analytical tools used to aid in decision making for managing wildlife populations, particularly with species of conservation concern such as sharp-tailed grouse (Beissinger and Westphal 1998). Standard uses of a PVA include estimating a population's relative extinction probability over a set time period or estimating the minimum viable population. In general, the optimal use of a PVA is to compare different management options to evaluate relative differences in extinction probability compared to a baseline scenario (i.e., to assess potential implications of various levels of harvest risk; Milligan et al. 2018). In this regard, PVAs can augment knowledge from previous research or management by comparing different management actions and habitat improvement scenarios to better inform future efforts.

Counts from spring lek surveys at Namekagon Barrens from 1991–2018 were used to conduct the PVA. Data were limited to only Namekagon Barrens because sharp-tailed grouse appeared to be the most stable over this time period at this property relative of other wildlife areas where sharp-tailed grouse occur. Other parameters for the count-based PVA model included:

- Population growth rate
- Carrying capacity (highest number of birds counted [n = 81 in 2015])
- Standard deviation (variation in annual lek counts)
- Sex ratio (50:50, where number of dancing males = number of available females)

The model simulated the probability of persistence of sharp-tailed grouse at Namekagon Barrens over a 50-year timespan. Models were conducted under 3 scenarios to simulate different levels of harvest: baseline with no harvest, annual harvest of 1 bird, and annual harvest of 5 birds. Each model calculated the cumulative probability of quasi-extinction, which was defined as a population with ≤ 20 breeding females. A nonparametric bootstrap (10,000 replicates) was performed for each scenario to estimate model uncertainty.

The results for each PVA scenario indicated that, even under the best circumstances, the risk of quasi-extinction was quite high for sharp-tailed grouse (Figure 21). Even under the scenario with no annual harvest, the risk for quasi-extinction increased to at least 10% after 25 years, and approximately 20% after 50 years. As harvest pressure increased, so too did the risk of quasi-extinction; the modeled scenario with an annual harvest of 5 birds suggested the probable risk of quasi-extinction after 50 years was > 45% (Figure 21).



It should be noted that while the results of each PVA model have important implications for sharp-tailed grouse management, there are caveats of PVAs that are relevant to management (Milligan et al. 2018). Model outputs indicated that there was quite a bit of uncertainly in the final estimates. Confidence intervals ranged from approximately 20–100% in the baseline and minimal harvest model (harvest = 1), and 45–100% in the scenario with the most harvest pressure (harvest = 5). An inconsistent harvest season structure, where permit availability changes annually, and the increased stochastic variability (genetic, demographic, and environmental stochasticity) often associated with small populations frequently leads to increased uncertainty. Additionally, PVAs are only as good as the data that are used to build the underlying demographic models. This evaluation only included data from Namekagon Barrens because sharp-tail populations at Namekagon have been the most stable relative to other wildlife areas where sharp-tailed grouse occur in Wisconsin. Inclusion of data from other wildlife areas, where spring lek-count surveys have indicated consistently declining populations, would have likely led to a rapid increase in the projected risk of quasi-extinction for sharp-tailed grouse. Thus, the PVA results presented here are likely overly optimistic and may not represent the full range of sharp-tailed grouse population dynamics, and population viability, across northwest Wisconsin. Reassessing viability as more information becomes available about sharp-tailed grouse in Wisconsin will be important for better estimating the true sustainability of the population.

Structured Stakeholder Input

An important aspect of effective species management is understanding how various stakeholders value and engage with a species and what opinions they may have about management. Key stakeholder groups for sharp-tailed grouse include bird watchers, friends groups, dog trainers, and hunters. We solicited information from these stakeholder groups through a commenting exercise at an open-house event and through intercept interviews with dog trainers working their dogs on sharp-tailed grouse.

Public Open House

In June 2022, department staff engaged with members of property friends groups, hunters, and dog trainers/trialers that attended a sharp-tailed grouse open-house event at Douglas County Wildlife Area. Attendees at this event were asked to participate in a comment exercise to identify what aspects of sharp-tailed grouse they valued most, and what concerns they had for future management. The full summary of findings from this comment exercise can be found in Appendix B, but significant findings are described below.

- *Sharp-tailed grouse are valued as a native species in Wisconsin and as an indicator species of a healthy barrens ecosystem, which supports many other flora and fauna.*
- *Attendees generally felt that Wisconsin has done a good job at managing barrens habitat, but that more could be done to restore habitat corridors and foster partnerships to add habitat.*
- *Regarding future management, attendees prioritized increasing sharp-tailed grouse populations, increasing suitable habitat, education and outreach, and research.*
- *Those interested in hunting would like a clear plan and measures of success in working toward that opportunity.*
- *Attendees felt most concerned for funding limitations and lack of staff to create and manage a sufficient amount of barrens habitat in Wisconsin.*

Dog Trainer Interviews

Between Aug. 1 and Aug. 12, 2022, Wildlife Management staff members visited Crex Meadows Wildlife Area, Namekagon Barrens Wildlife Area, and Douglas County Wildlife Area and interviewed a total of 30 visitors training dogs on the properties. Interviews followed a pre-determined script of questions developed to assess experiences training dogs on sharp-tailed grouse including how far visitors travel, how many dogs they have, the properties they use most often, their history of hunting sharp-tailed grouse, and their opinions on future hunting opportunities in the state of Wisconsin. Interviews also provided opportunity to solicit opinions on crowding, conflicts with other trainers, and concern about overworking birds on the property.

The full summary of findings from these interviews can be found in Appendix C, but significant findings are described below.

- *Most interviewed trainers primarily or exclusively use Namekagon Barrens to work their dogs on sharp-tailed grouse.*

- *During the months of Aug. and Sept., many trainers are working their dogs weekly. Trainers avoid conflict by spacing out over the course of the day and the week. The result is that different groups of trainers are on the property early and late morning as well as evenings on weekdays and weekends. Those in the dog trialing community and professional dog trainers are working their dogs more frequently and may work several different dogs.*

- *Conflicts with other trainers were not commonly reported but some felt that professional dog trainers and trialing events have a disproportionate impact on sharp-tailed grouse and the habitat.*

- *Some trainers felt concerned for stress placed on broods during active training periods of Aug. and Sept. They worry the same broods are repeatedly flushed by different waves of trainers.*

- *Comments from trainers suggest that they would be supportive of restrictions on training activity if there was evidence that dog training was limiting the recovery of the species in Wisconsin. Specific suggestions included limiting the number of trainers in an area either through permits or temporary closures, delaying the training season to give young broods time to mature, or working to increase available barrens habitat in the state.*

- *Regarding sharp-tailed grouse hunting, many hunt in western states and use Wisconsin to train their dogs on wild birds. While hunting in Wisconsin is an opportunity many would be interested in, nearly all interviewed trainers felt that sharp-tailed grouse hunting in Wisconsin is only important to them if it can be done sustainably.*

Dog Training

Dog trainers and trialers report that Wisconsin is one of the best places to train dogs on sharp-tailed grouse because the open landscape of pine/oak barrens habitat provides handlers excellent viewing of their dogs. In addition, high concentrations of sharp-tailed grouse in small managed areas make the chances of encountering sharp-tailed grouse highly likely. Special permits are granted to allow two to five sharp-tailed grouse dog trials every year on Namekagon Barrens Wildlife Area and Douglas County Bird Sanctuary. Dog trainers and trialers commonly make multiple annual week-long trips from across the country to pursue this opportunity.

An insert is included below to provide a primer and user perspective on dog training:

Training of Bird Dogs on Sharp-tailed Grouse in Wisconsin by Ken Jonas

"Dog training refers to any teaching or exercising activity involving sporting dogs in which the primary purpose is to enhance field and/or water performance. Sporting dogs are used for hunting game birds and game mammals and include breeds as pointers, setters, retrievers, and hounds. Regulations governing the training of sporting dogs vary according to what species of dogs are being trained with and where the training takes place. In addition, the department also issues permits for dog trials occurring on both public and private land." - Wisconsin DNR Dog Training and Trialing Web Page

Bird dogs are frequently trained with the intended goal of being able to successfully locate and handle game birds for their owners and hunters during a state's open harvest season.

"Training a gun dog with live birds increases the likelihood of a successful harvest of game during the hunting season. Dog training has deep roots in hunting and conservation culture. In order to develop dogs that can reliably hunt and recover game, it is vital to train with a variety of game under varying conditions." – Wisconsin DNR, Dog Training and Trialing Web Page

There are two primary categories of dogs used in the pursuit of upland gamebirds – flushers and pointers. The training of pointing dogs is the most frequent activity on state and county properties. This activity occurs frequently during the training season in the northern part of the state where there still exists a viable population of sharp-tailed grouse. Pointing dog breeds are defined by their ability to find birds through scenting and remain in a stationary position facing them once they have determined their precise location. This is a trait that has been selectively bred for through the centuries and is an exaggeration of the "pause before the pounce" commonly observed in wild canids hunting birds and small mammals. Pointing dog training is typically started at an early age with captive birds in a controlled situation that reinforces the pointing and holding steady behavior. Dogs are trained through reinforcement techniques to not move from the pointing stance when the bird is flushed and flown. The pointing dog that masters this behavior is termed to be "steady to wing" and is a primary goal in pointer training.

As stated previously much of the early training of pointing dogs takes place in a controlled situation using captive birds, but eventually a dog must be exposed to wild birds by free ranging in natural cover to become better prepared for actual hunting conditions. The off-leash training, of pointing dogs on wild birds in the "northern restricted zone" can start as early as Aug. 1 on lands owned by the Wisconsin Department of Natural Resources. While the Wisconsin Sharp-tailed Grouse Society supports the use of trained dogs for hunting, there are some concerns regarding the impacts to young sharp-tailed grouse broods especially early in the training period. The cumulative impacts of dog training on sharp-tailed grouse populations especially on popular properties throughout the training season is currently an unknown.

Viewing Blinds

People travel from all over the continent to Wisconsin for the opportunity to enjoy sharp-tailed grouse. The positive impact of this tourism is often overlooked because viewing occurs in very remote parts of the state. The goal is to provide ample recreational opportunities while not compromising the sustainability of the overall population.

Viewing blinds are available for the public to watch sharp-tailed grouse dance on leks during the mating season in the spring. Namekagon Barrens Wildlife Area is one of the most popular properties drawing observers regularly from all over Wisconsin, Minnesota and from as far as California and Canada. Friends groups manage the observation calendars and provide additional educational opportunities. Minnesota DNR research found that users may interfere with breeding if blind guidelines are not strictly followed (Roy and Coy 2021). Out of an abundance of caution, Wisconsin observers are now required to sign a user pledge that was modeled after Minnesota's in order to reduce possible negative impacts.

Health - Disease, Predation & Interspecific Competition

Disease

There has not been any disease agent or parasite identified as a threat to sharp-tailed grouse on a population scale. The relative apparent abundance of the species in many of the greater prairie states in comparison to other prairie grouse species likely reduces already limited resources for baseline health data in relation to disease exposure and parasite loads. As diseases can have a disproportionate effect on small populations (Johnson et al. 2020), the lack of identified diseases of concern for the national population should not be construed as the small population being safe from disease impacts. These effects can be secondary to disease introductions affecting a large proportion of the population as they are confined to a small location or due to increased susceptibility. In Wisconsin, the relatively small geographic area available to sharp-tailed grouse, in addition to factors such as fragmentation of their habitat and climate change could also increase the general physiological stress response for the population. This response could increase susceptibility of members of the population to disease agents and other inflammatory processes (Hing et al. 2016).

In general, there are certain diseases that are considered a greater threat to gallinaceous birds, wild and domestic. The Wildlife Health Committee of the Western Association of Fish and Wildlife Agencies developed a health screening protocol to use for screening and sampling of wild Galliformes prior to translocation events (WAWFA 2019) which is inclusive of many of the diseases that could put wild galliform populations at risk. The impact of West Nile Virus (WNV), a virus spread by mosquitos that was first identified in the United States in 1999, on a variety of grouse populations has been a question of further investigation. To date, WNV has not been reported as a disease agent in sharp-tailed grouse.

Health monitoring is an important component of the management program to determine disease presence and potential impacts including population-level changes. Health screenings and necropsies of sharp-tailed grouse in Wisconsin have occurred with translocation and monitoring events with no significant health concerns identified. Thirty-two sharp-tailed grouse were trapped in Douglas County in 2010 for health evaluation and disease screening as part of a pre-intrastate translocation effort. These animals had samples collected to test for exposure to Avian Influenza Virus, New Castle Disease Virus, and *Mycoplasma synoviae*, *M*. *gallisepticum*, and *M*. *meleagridas*. No exposure was found in this population. The continued monitoring of populations for possible health related impacts that could contribute to the overall health is warranted.

A variety of internal and external parasites have been documented in Wisconsin sharp-tailed grouse in assessments from as early as the 1940s (Morgan and Hammerstrom 1941, Emerson 1951). These accounts are consistent with what would be expected in wildlife populations and the most recent health survey in 2010 found no additional parasitic species.

It is also important to note that changing environmental landscapes, global travel, and increased contact between wildlife and domestic species has resulted in a number of emerging diseases as well as the translocation of diseases worldwide (Daszak et al. 2000, Bengis 2004). Because it is difficult to predict which diseases may emerge and impact wildlife populations, it is imperative that populations be monitored, and mortalities be investigated when warranted (Jones et al. 2008). As the transmission of many diseases can be multi-factorial (age, species susceptibility, social structure, previous exposure, increased contact with carrier populations, density-dependent, magnified by distress, etc.) population dynamics should also be monitored and evaluated. Community relationships should continue to be fostered that allow citizens to report unusual lesions, mortality events, unusual/abnormal behavior, or population changes to assist in monitoring diseases of known concern as well as those that may be emerging.

Predation

The association between predator and prey is commonly believed to be a simple relationship, but predation, like other factors, can alter prey populations by influencing several life cycle components. Sharp-tailed grouse are prey for a wide array of avian and mammalian predators – most upland game bird mortality is due to predation. Across grouse species, about 85% of reported mortalities are due to predation (Bergerud and Gratson 1988) and like other ground-nesting birds, sharp-tailed grouse typically experience high annual nest and adult mortality rates due to predation. Large clutch sizes, precocial development, and a discrete pattern of habitat selection have likely evolved in response to strong selective pressures imposed by predators and allow sharp-tailed grouse populations to persist with this level of annual mortality.

Predation affects sharp-tailed grouse at all life stages, but the primary predator often varies dependent upon the specific life stage. Adult sharp-tailed grouse most frequently are preyed on by avian predators including northern goshawks, red-tailed hawks, great-

horned owls, and other raptors (Connolly 2001). Eggs are primarily eaten by mammalian predators (Connelly et al. 2020), including fox, coyotes, skunks, raccoons, badgers, ground squirrels, and others. Nest success is often considered the most significant factor in prairie grouse population dynamics and is highly variable from year to year. Previous work in Wisconsin indicated that predators may be responsible for >75% of nest failures (Connolly 2001). Chick survival is also a significant variable in prairie grouse population dynamics. Unfortunately, chick or brood survival is much more difficult to measure, thus few studies have documented the role of predators in chick mortality. An estimated 40–50% of chicks perish between hatching and the time of independence (Bergerud and Gratson 1988). Studies of other upland game birds, including wild turkeys and greater prairie-chickens, have indicated that chicks are most vulnerable to mortality within the first two weeks of hatching (Pollentier et al. 2014, Broadway 2015). Sharp-tailed grouse brood survival has been shown to also vary between unmanaged and managed lands (30% on unmanaged vs. 43% on managed lands in Wisconsin); however, because chicks were not equipped with transmitters, the direct cause of mortality could not be determined (Connolly 2001).

Documented predation rates on adults, nests, and young, and the intuitive assumption that reducing predator numbers should lead to increased survival has stimulated numerous attempts to use predator control to increase breeding population size. Reducing predator numbers also may seem to be a more realistic and achievable goal than attempting to mitigate the effects of other limiting factors (e.g., disease, landscape-level habitat loss/change, weather) on bird population growth. Literature documenting the effect of predator control on prey population vital rates is varied and extensive. However, recent reviews have summarized much of this research, leading to a general understanding of the utility of predator control as a potential strategy for managing bird populations.

Cote and Sutherland (1997) summarized 20 studies and found that predator removal had a significant positive effect on nest success and on post-breeding (i.e., autumn) population size, but not on subsequent breeding population size. Smith et al. (2010) summarized 83 studies and found significant increases in nest success and in post-fledging survival (which Cote and Sutherland [1997] did not measure), but not in post-breeding population size. Smith et al. (2010) also found a small but significant increase in breeding population size. However, of the 83 studies they assessed, the majority involved removal of all or a subset of mammalian predators; raptors were removed in only three of the studies (all from Europe). These results suggest that predator control has some general utility for increasing nest success but that effects do not predictably extend beyond the breeding season, and the magnitude and duration of any benefits can be strongly influenced by a wide variety of interacting and often site-specific factors. For example, improved nest success and post-fledging survival may not result in an increase in breeding population if many juveniles die over the winter due to lack of adequate winter food supply or if limited nest-sites and territoriality prevent them from breeding during the following breeding season (Cote and Sutherland 1997).

On the surface, it may seem counter-intuitive that the removal of predators from an area does not necessarily lead to increases in prey survival or population size. Wildlife

populations are regulated in complex ways, as multiple extrinsic factors (e.g., weather, predators, disease, food availability) interact to determine levels of survival and reproduction that ultimately influence population size. Factors important in determining how individuals of a prey species survive between years may act in a compensatory fashion. A reduction in mortality during one portion of the life cycle (e.g., nest survival) brought about by controlling one mortality factor (e.g., predation) may be partially offset by increases in mortality due to another factor (e.g., food limitation) such that overall mortality (and, thus, population size) remains unchanged. Such compensation has been well documented among bird species and suggests there is a "doomed surplus" where individuals are removed from a population each year until the number supportable by the local habitat is reached. In this context, the specific mortality agent is not important, and reductions in one agent will be offset by increases in others. Importantly, even if levels of predation are significant, control of predators will have no impact on subsequent breeding densities. Compensatory mortality, therefore, keeps populations at levels reflective of habitat quality and is consistent with the principle of carrying capacity.

A similar process may dampen response of wildlife populations to predator control. Mortality and reproductive rates in birds and other wildlife species often vary according to the density of individuals within a population. As densities increase, survival and/or reproductive rates generally decrease. This density-dependent response forces populations toward a density that can be supported by the available habitat. For example, overwinter mortality in red grouse (*Lagopus scotica*) was positively related to fall population size; when grouse densities were high in the fall, a large percentage died during the subsequent winter (Redpath and Thirgood 1997). This may partially explain why so few predator control studies report increases in subsequent breeding densities, despite increases in nest and post-fledging chick survival.

Failure of predator control to bring about desired increases in survival may also be attributed to unpredictable consequences of removal activities. In many cases, intensive predator control efforts have been unable to significantly reduce predator populations due to low trapping success (Duebbert and Lokemoen 1980, Meckstroth and Miles 2005), inability to target important species (e.g., prohibition on raptor removal via the Migratory Bird Treaty Act), or rapid immigration of predators from the surrounding landscape (Guthery and Beasom 1977, Speake 1980). Predator control efforts may also alter predator community dynamics. For example, the removal of coyotes may depress nest survival of ground-nesting birds due to increased densities of fox, skunks, and other small mammalian predators (Sovada et al. 1995, Ritchie and Johnson 2009) through what is often termed a "meso-predator release" (Crooks and Soulé 1999).

Predicting the demographic response by sharp-tailed grouse populations to predator removal is inherently difficult and, as summarized above, depends upon a suite of interacting factors. Given these limitations and uncertainties, as well as potential high costs and controversies of direct predator control, many have suggested that resources may be better spent on habitat improvement rather than predator management (see Cote and Sutherland [1997], Smith et al. [2010]). Wisconsin's sharp-tailed grouse population has responded positively to large scale disturbance events, such as fire and

clear-cutting, in the surrounding forest landscape. Documented and dramatic increases in sharp-tailed grouse numbers over the past five decades normally followed major disturbances in the surrounding landscape, and in the absence of predator control. These data provide support for the prevailing notion that the availability of high-quality barrens habitat is the key to sustaining sharp-tailed grouse as a member of Wisconsin's wildlife community. Though predation is certainly responsible for mortality of grouse, it likely does not limit population growth.

Interspecific Competition

Evidence has indicated that ring-necked pheasants may adversely impact other species of ground-nesting game birds, including sharp-tailed grouse, via nest parasitism, competition for habitat, transmission of disease, and aggressive behavior (Vance and Westemeier 1979, Kimmel 1988). Pheasants have been documented to disrupt leks and harass greater prairie-chickens (Vance and Westemeier 1979) and numerous observations of pheasant eggs in nests of other game birds and waterfowl have been reported (Kimmel 1988, Westemeier et al. 1998, Hagen et al. 2002). Ring-necked pheasants have been shown to parasitize nests of sharp-tailed grouse, which may lead to reduced nest success (Vance and Westemeier 1979, Geaumon et al. 2010). Vance and Westemeier (1979) reported greater prairie-chickens abandoned eggs with viable embryos, presumably because females left with the parasitic pheasant brood, which hatched before her own eggs. While sharp-tailed grouse have an incubation period similar to ring-necked pheasants, approximately 21–24 days versus 23–25 days, respectively, pheasant eggs in sharp-tailed grouse nests frequently hatch before sharp-tailed grouse eggs (Geaumon et al. 2010), suggesting that nest parasitism by pheasants could result in reduced fecundity of sharp-tailed grouse in areas where the species coincide. To date, no observations of ring-necked pheasant eggs in sharp-tailed grouse nests have been made in Wisconsin.

Ring-necked pheasants do occur on the very southern Wisconsin DNR-managed properties that are inhabited by sharp-tailed grouse. Though the DNR does not release pheasants on state-owned or managed lands where sharp-tailed grouse occur, pheasants are present on nearby agricultural private lands. Observations have been reported of pheasants harassing sharp-tailed grouse on leks during the breeding season (P. Q. Engman, personal communication) but impacts from such occurrences are likely low.

Other Limiting Factors

Additional factors that may be cause for concern regarding long-term sharp-tailed grouse population viability include accidents such as collisions with wires, fences, and vehicles, annual dancing ground surveys or research which may disturb activity at a lek or nest site, invasive species, and climate change (Sjogren and Corace 2006).

Climate Change

Wisconsin's climate is expected to change substantially over the next 100 years. A changing climate will impact the state's wildlife, including sharp-tailed grouse. As a result, adaptation strategies based on research are needed. Climate change in Wisconsin could have direct and indirect impacts on sharp-tailed grouse. Direct impacts could include things such as altered snow cover or more intense storms. Indirect impacts could include changes in distribution of suitable habitat or shifts in species distributions.

Specific adaptation and/or mitigation strategies for dealing with impacts of future climate change on sharp-tailed grouse populations in Wisconsin are important considerations. Specific strategies may include providing high quality nesting/brood rearing cover, to offset poor breeding season weather, or providing winter cover in the event snow roosting conditions are poor. Strategies to ensure that vital rates within ecosystems at least stay within recorded variability (Noss 2001) will be required over the short-and long-term. Such strategies may include land protection, connectivity, and a strong adherence to adaptive management strategies (WICCI 2011).

Review Of Previous Management Plans

The 1996-1997 Management Plan, Outcomes

The 1996 plan's overarching goal was to ensure a minimum viable population of sharp-tailed grouse across the current range. Language was included pertaining to 50,000 acres needed to sustain 500 breeding sharp-tailed grouse, but it was not clear if that was a statewide goal or individual property goal. Further, there was no clear implementation program established for this management plan and no clear method for adapting the plan as new information was collected despite a clearly stated objective. One objective that was fully met since the adoption of the 1996 plan was the harvest framework/permit system established in 1997.

The 2011 Sharp-tailed Grouse Management Plan, Review

2011 Specific Goal

The specific goal of this plan was to ensure a viable population of sharp-tailed grouse within the state that also provided regulated harvest opportunities.

Focus Areas

In 2011 the core sharp-tailed grouse population was assessed and found to occur in

northern Wisconsin within the Northwest Sands, North Central Forest, and Superior Coastal Plains Ecological Landscapes. A small remnant population was thought to exist in the Central Sand Plains Ecological Landscape. The primary focus of the Sharp-tailed Grouse Management Plan was on the species' current range within Wisconsin. (Figure 22)

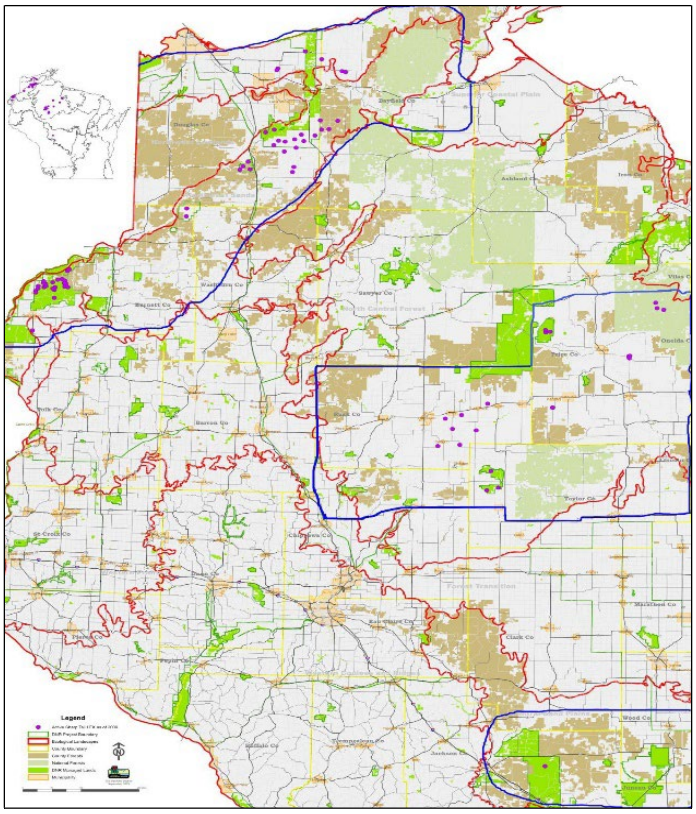


Figure 22. *2011 Sharp-tailed Grouse Conservation Areas.*

Goal: Habitat Availability & Management: Establishing Sharp-tailed Grouse Conservation Areas, developing implementation plans and associated habitat acreage goals, developing a habitat model/corridor plan starting in the NW Sands, and developing habitat goals based on projected population goals needed to sustain a viable population were deemed important components of the plan.

Outcome: The Northwest Sands Habitat Corridor Plan: The habitat modeling and habitat corridor analysis created the Northwest Sands Habitat Corridor Plan (discussed in the Current Habitat Section). Implementation of the corridor has begun and led to many collaborative partnerships.

Goal: Effectiveness of Habitat Management Practices: Evaluate habitat management practices on core and partner properties and establish guidelines for best management practices for sharp-tailed grouse and other open landscape- dependent species.

Outcome: Barrens Habitat Management Guidelines: Wildlife Management led efforts

to develop Barrens Habitat Management Guidelines.

Goal: Develop Dispersal Corridors with Minnesota: Determine if dispersal is occurring, identify dispersal corridors, and facilitate dispersal of birds among MN and WI.

Outcome: Crex Meadows/Minnesota St. Croix State Park Connection: A partnership with Minnesota has been developed with a goal of increasing connectivity to habitats and leks in the Minnesota East Central Population. Effective dispersal habitat has been restored between Minnesota's St. Croix State Park and Crex Meadows, with new observations of birds at St. Croix State Park. This connection was produced through purposeful barrens habitat restoration work on both properties.

Goal: Develop Secure Dedicated Funding for Sharp-tailed Grouse Management: Habitat goals derived in the habitat feasibility study will determine the amount of funding needed for habitat management and land acquisition.

Outcome: The Northwest Sands Habitat Corridor modeled position and landscape scale requirements of sharp-tailed grouse habitat patches. The Barrens Habitat Management Guidelines further defined barrens management, standardized practices, and prioritized where the work should occur. This prioritization process has helped sharp-tailed grouse barrens projects successfully compete for project-based funding. Dedicated funding for approved habitat management and acquisition projects has not yet been identified.

Goal: 2011 Population Viability & Genetic Status

Goal: Stabilize long-term population and increase genetic diversity on and outside core managed properties. Conduct genetic rescue from Douglas County properties to Pershing Wildlife Area. Translocation from Northwest Minnesota to Moquah Barrens (USFS) to increase bird numbers at Moquah Barrens.

Outcome: Pershing Wildlife Area Translocation

Malone (2012) concluded translocating females between Wisconsin populations can increase genetic diversity, but because of the demographic failure of the translocation, we cannot conclude if this is a viable management strategy for sharp-tailed grouse in Wisconsin. If more translocations are carried out, more birds should be released to account for high mortality and dispersal after release.

Malone (2012) goes on to explain, populations that are small and isolated often become genetically depauperate, which can negatively impact their fitness and increase extinction risk. Translocating individuals into a critically small population mimics natural gene flow and can increase genetic diversity and lead to population growth, a process known as genetic rescue. The sharp-tailed grouse population in Wisconsin consists of small, isolated subpopulations with low genetic diversity. We translocated 19 and 11 sharp-tailed grouse females during the spring of 2010 and 2011, respectively, to the

subpopulation at Pershing Wildlife Area, Taylor County, WI. Females released in 2010 were not monitored. Of the 11 females translocated and monitored in 2011, only one was still alive and at Pershing Wildlife Area after six weeks. Two females nested but both nests failed before hatching. Genetic analyses indicate that females mated at the release site. Heterozygosity was significantly higher in the eggs of translocated females (0.722 ± 0.103) than in the release site population prior to translocations (0.307 ± 0.034; $p = 0.004$)."

Outcome: Moquah Barrens Translocation 2016–2018: Brian Heeringa, USFS Washburn District Wildlife Biologist

In an effort to bolster the population of sharp-tailed grouse inhabiting the Moquah Barrens of the Chequamegon-Nicolet National Forest, 160 sharp-tailed grouse were translocated from NW Minnesota over a three-year period between 2016 and 2018. This translocation effort, on-going monitoring, and landscape restoration were made possible by funding through the Great Lakes Restoration Initiative and the USDA Lake Superior Landscape Restoration Partnership; with partners from the Wisconsin and Minnesota Department of Natural Resources, Bad River and Red Cliff Bands of Lake Superior Chippewa, Wisconsin and Minnesota Sharp-tailed Grouse Societies, Great Lakes Indian Fish and Wildlife Commission, US Fish and Wildlife Service, and numerous other volunteers.

Historically, within the Moquah Barrens, sharp-tailed grouse used nine lek areas based on annual breeding season observations by the U.S. Forest Service and Wisconsin Department of Natural Resources. However, in more recent years, sharp-tailed grouse have experienced statewide population declines, including those found at the Moquah Barrens. In fact, prior to the recent translocation effort, over the last decade or more, only one Moquah Barrens dancing ground has been active, and in 2015, only 2–6 males and 1–2 females were estimated to visit this one location. Likely more birds existed on the Barrens, but due to the size of the area and personnel constraints, it was difficult to fully census the low-density population.

To supplement the remaining grouse population, in 2013, the Chequamegon-Nicolet National Forest, in cooperation with its partners, implemented a plan to translocate approximately 150-200 sharp-tailed grouse over the course of 2–3 years. All translocation efforts followed recommendations established within the Wisconsin Sharp-tailed Grouse Management Plan 2011-2021 and provided by the Wisconsin Sharp-tailed Grouse Committee, Minnesota Department of Natural Resources, and through advisement with the Wisconsin and Minnesota Sharp-tailed Grouse Societies and other partners.

From 2016–2018, 160 sharp-tailed grouse were moved to the Moquah Barrens with 29 birds (16 male, 13 female) released in 2016, 67 (45 male, 22 female) released in 2017, and 64 (33 male and 31 female) released in 2018. Of these birds, a small subset (5 in 2016, 10 in 2017, and 20 in 2018) were fitted with very high frequency (VHF) radio transmitters and tracked from the spring of 2016 through the fall of 2019. Of the 35 tracked sharp-tailed grouse, around 50% of them dispersed out of the Moquah Barrens

with some returning later. Dispersal of birds from the original release site have ranged from as little as 0.25 miles to as much as over 24 miles, based on radio-telemetry observations. Released birds have been found visiting active and historic dancing ground locations within the Moquah Barrens as well as on county and state managed lands, and private property. The farthest dispersal of a translocated bird was documented based on the verified leg bands of a harvested bird at the Namekagon Barrens, a straight-line distance of over 50 miles. 16 of the 35 birds were found as mortalities, 2 dropped transmitters, 1 was never located after the initial release, 4 disappeared within one month of their release, and the remaining 12 birds were tracked until the signal was lost, the bird could no longer be located, or it was assumed the VHF transmitter battery expired. Of the 16 confirmed mortalities, seven of them or 20% of all radio-collared birds, occurred within the first two months of the birds' release. 18 (51.4%) of the radio-collared sharp-tailed grouse dispersed out of the Moquah Barrens at some time. Of the eighteen, only two returned to the Moquah Barrens after dispersing. Five (14.3%) sharp-tailed grouse were never detected or were only detected within one month of being released, then never found again.

Goal: Verify population status of the Central Conservation Area, in northern and northeast Wisconsin.

Outcome: These populations are no longer present.

Goal: Current statewide population size is insufficient to sustain a viable population. Set Interim Focus Area population and genetic targets:

Outcome: The Northwest Sharp-tailed Grouse Conservation Area population has seen long-term declines but potentially a recent small increase in bird numbers. The North Central Sharp-tailed Grouse Conservation Area has extremely low bird numbers.

2011 Surveys & Research

Goal: Revise and standardize current survey protocol.

Outcome: Annual survey efforts have continued, and improvements were made including increasing the accuracy of GPS-based location data for lek sites.

2011 Harvest & Recreational Opportunities

Goal: Determine impacts of harvest mortality.

Outcome: See Population Viability Analysis, page 51.

Goal: Estimate harvest reporting rate and actual harvest rate

Outcome: Harvest rates and hunter success is available in the Hunting & Recreational Opportunities section, page 47. Last hunt in 2018.

Goal: Education about sharp-tailed grouse identification and their habits and habitat use.

Outcomes: Sharp-tailed grouse information is widely available on the DNR Sharp-tailed Grouse Management Page, and from DNR Education Centers. The WI Sharp-tailed Grouse Society and Wildlife Area Friends Groups also provide information and education.

2023 Plan Goals And Recommendations For Implementation

Overarching Plan Goal

The overarching goal of this plan is to ensure a managed sustainable population of sharp-tailed grouse in Wisconsin, by implementing landscape level habitat strategies within the Northwest Focus Area.

This vision calls for developing and facilitating voluntary and cooperative partnerships among public and private organizations to ensure the long-term viability of sharp-tailed grouse populations and their habitat in Wisconsin through an ecological landscape approach in the Northwest Focus Area. Objectives are tailored to maintain or improve the viability of sharp-tailed grouse by implementing contemporary management strategies that improve the probability of a sustainable population. Objectives will further evaluate necessary monitoring and research priorities to develop biologically defensible and adaptive best management practices for long-term persistence of the species, develop adaptive and sustainable harvest frameworks, and create measures of success.

The management plan follows an adaptive management or conservation action planning approach (Gordon et al. 2005). That is, the plan has set goals based on the best available information and has identified a number of information needs and a series of actions to address them. When new information becomes available and information needs are met, we will adapt the ten-year plan as necessary to reach the plan goals.

Goal: Implement strategic conservation efforts at the landscape scale

Objective: The 2022 core sharp-tailed grouse population occurs primarily in the Northwest Focus Area, with a small remnant in the North Central Remnant Area (Figure 23). The primary objective of the Sharp-tailed Grouse Management Plan is to expand and reconnect the species' current range within the Northwest Focus Area.

> **Strategy:** Employ a strategic and targeted management approach in the Northwest Focus Area by implementing the Northwest Sands Habitat

Management Corridor Plan. Some management efforts will continue in the North Central Remnant Area on select properties.

Northwest Sharp-tailed Grouse Focus Area

Ecological Landscape(s): Northwest Sands and Superior Coastal Plains

Properties within the Focus Area:

Crex Meadows, Fish Lake, Namekagon Barrens Douglas County Wildlife Areas

Moquah Barrens, USFS

Barnes Barrens, and Bass Lake Barrens, Bayfield County Forest

Mott's Ravine, Brule River State Forest

Five Mile Barrens, Douglas County Forest

Five Mile Barrens, Brule River LLC

Private lands in Bayfield, Douglas, Burnett, Washburn Counties

Additional Public and Private Lands Currently Not Mapped

North-Central Sharp-tailed Grouse Remnant Area

Ecological Landscape(s): North Central Forest

Properties within the Remnant Area:

Pershing, and Kimberly Clark Wildlife Areas

Riley Lake Unit, USFS

Price, Rusk, Taylor County private lands

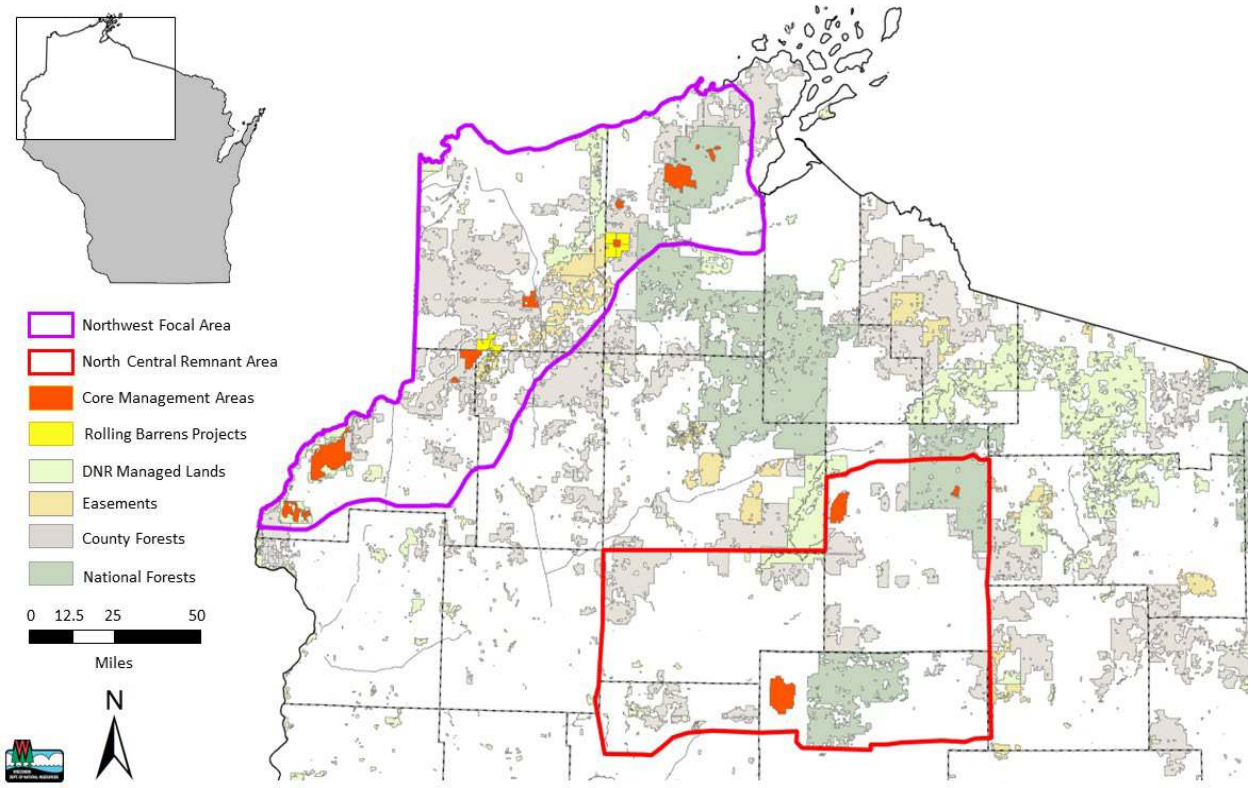


Figure 23. *2023 Sharp-tailed Grouse Focus and Remnant Areas.*

Goal: Provide high quality habitat at the landscape scale to reconnect subpopulations of sharp-tailed grouse

Objective: As a long-term objective, implement the Northwest Sands Habitat Corridor Plan providing at least 50,000 acres of high-quality connected habitat across the Northwest Focus Area. As a short-term objective, provide at least 10,000 acres of high-quality connected habitat for each isolated population within the Northwest Focus Area. This objective is likely the most significant step to accomplishing the overarching plan goal and will be carried out for the life of this plan and beyond.

- **Strategy:** Prioritize DNR and partner efforts to provide habitat between existing barrens that restores landscape level connectivity for sharp-tailed grouse, and other barrens associated species. Identify and target priority areas for barrens habitat restoration projects. This plan proposes 11 such potential locations for priority projects to occur. These projects implement the Northwest Sands Habitat Corridor Plan recommendations to strategically reconnect sharp-tailed grouse populations and their habitat at the landscape scale. To reach the plan's short and long-term objectives and realize these new barrens restoration projects it will be vital to build upon existing partnerships, foster new partnerships, and collaborate with private landowners. The Northwest Sands Habitat Corridor Plan recommends a minimum project size of 1,280 acres. Projects are prioritized first within 3.1 miles of core managed areas within the Northwest Sands Habitat Corridor. Additional priority

levels are then provided beyond this priority one area to accomplish the long-term connectivity objective, see the maps provided in figures 24 and 25.

i. Priority One: 6 projects

ii. Priority Two: 4 projects

iii. Priority Three: 1 project

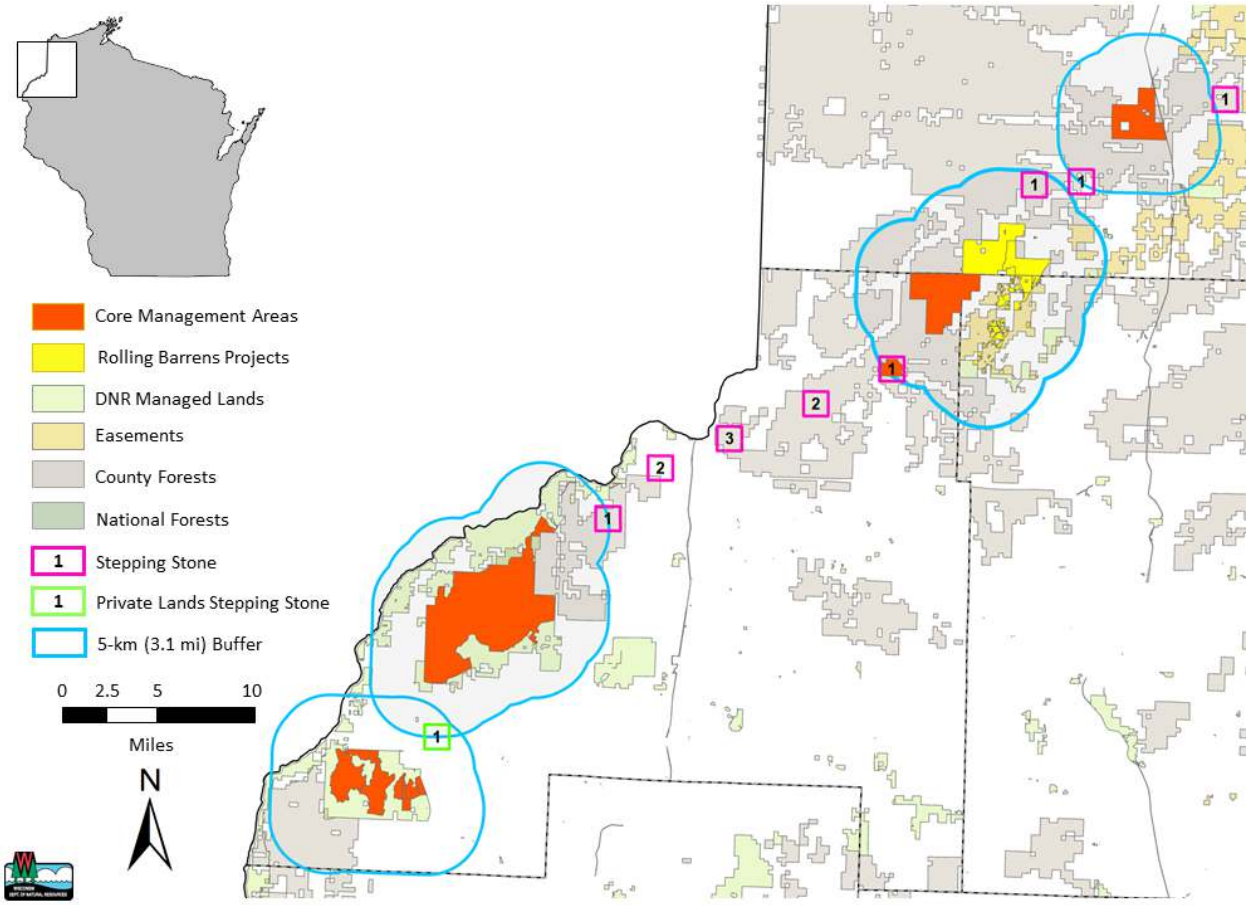


Figure 24. *Hypothetical 1,280-acre management blocks or "stepping-stones" (pink squares) between Crex Meadows/Fish Lake Wildlife Areas and Douglas County Wildlife Area in northwest Wisconsin, USA. All potential management blocks are located ≤5 km (3.1 mi) of each other. Block numbers represent order of priority for establishment of habitat management projects, where projects near block "1" would be higher priority given their juxtaposition to core management areas (outlined by 5-km buffer). Note that a block is green on this map, this denotes a private lands area that should be a focus for private lands initiatives to maintain and enhance sharp-tailed grouse habitat.*

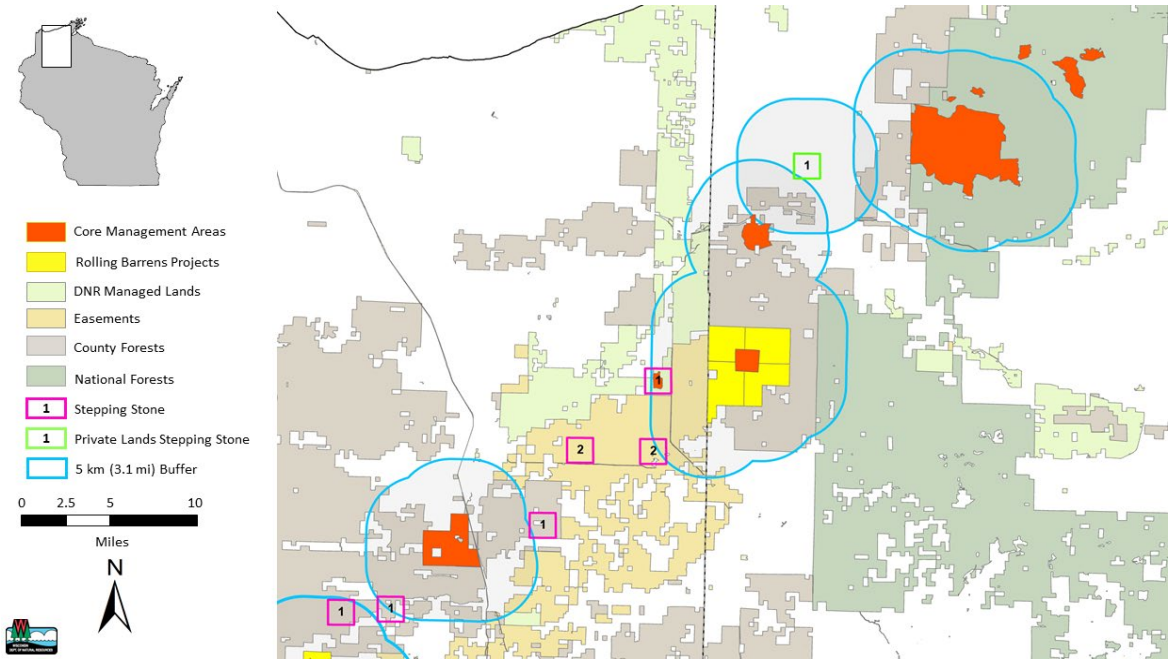


Figure 25. *Hypothetical 1,280-acre management blocks or "stepping-stones" (pink squares) between Douglas County Wildlife Area and Moquah Barrens, USFS in northwest Wisconsin, USA. All potential management blocks are located ≤5 km (3.1 mi) of each other. Block numbers represent order of priority for establishment of habitat management projects, where projects near block "1" would be higher priority given their juxtaposition to core management areas (outlined by 5-km buffer). Note that a block is green on this map, this denotes a private lands area that should be a focus for private lands initiatives to maintain and enhance sharp-tailed grouse habitat.*

- **Strategy:** On DNR managed lands identified as a priority for sharp-tailed grouse continue to manage quality barrens and expand core barrens. As a ratio of the total area, implement habitat treatments that restore and maintain at least 1/3rd of barrens acres in the open barrens seral stage and no more than 2/3^{rds} of barrens acres in the brush prairie seral stage. Definitions of these seral stages are found in the Barrens Habitat Management Guidelines (See Habitat – Considerations for Management section). Currently DNR manages 29,554 acres of barrens at 4 state wildlife areas (Crex Meadows, Fish Lake, Namekagon Barrens, and the Douglas County Wildlife Areas, at a cost of $281,945 per year, see Appendix 1). DNR Forestry also manages for barrens habitat at Mott's Ravine. On DNR core management areas continue to maintain and restore additional quality barrens habitat. Currently maintaining existing habitat requires treating an estimated average of 6,000 acres/year with prescribed fire, mechanical disturbance, or other land management practices. Restoring additional barrens habitat will require increased treatment acreage. On partner properties including Barnes and Bass Lake Barrens, Bayfield County Forest, and Moquah Barrens (USFS) provide technical assistance and partner to seek additional funding to implement this objective.

- **Strategy:** Continue to expand rolling barrens partnerships through active engagement; support working forest projects that provide high quality sharp-tailed grouse habitat within the Northwest Sands Habitat Corridor. Seek funding for associated regeneration costs or support partners in doing so. Current estimated costs of regenerating rolling barrens projects (Bayfield, Douglas, and Burnett County Forests, and Brule River Forest Legacy Easement) for our partners is around $200 per acre and current annual project footprint is around 700 acres.

- **Strategy:** Foster new partnerships following the strategies and priorities set by the Northwest Sands Habitat Corridor Plan to increase landscape connectivity of barrens habitat to benefit sharp-tailed grouse (Figures 24 and 25). Engage and participate in partnerships set by the following criteria, then adjust engagement according to the needs of the partnership:

  All tools should be considered and new ways of doing business explored.

  - For new managed barrens cores and rolling barrens strategically pursue project areas that provide high quality habitat, or that can be readily restored for this purpose.

  - Actively pursue partnerships that restore core or rolling barrens.

  - Encourage rolling barrens adjacent to existing or new barrens cores, other openings, or as stand-alone projects.

  - Work with a greater partnership to develop management agreements, leases, or easements that enhance barrens habitat connectivity.

  - Consider land trades or consolidation for management purposes, pursue targeted acquisitions, and/or protections to achieve partnership success. The Bureau of Facilities and Lands, within the Internal Services Division, provides property planning and real estate management services to the Bureau of Wildlife Management. DNR Master planning efforts should ensure plans, project boundaries and acquisition goals are consistent with this plan's goals. Estimated project costs and values of these partnerships are listed in Appendix 1, Table 5.

- **Strategy:** Collaborate with a team of internal and external management partners to assist private landowners in voluntarily managing early successional habitat to benefit sharp-tailed grouse. Two private lands focus areas have been identified through this planning process (Figures 24 and 25). These projects areas identify predominantly privately owned landscapes that could provide critical habitat linkages by maintaining open farm country. Current land use within these project areas include grasslands, pastures, row crops, delayed hay ground, brushlands and woodlands that historically provided habitat connectivity for sharp-tailed grouse. Both private land areas are also mapped and identified as a priority in the DNR Grassland Habitat Management Guidelines and should continue to be prioritized for grassland management. Partners should continue outreach to private landowners in these

project areas to provide options for conservation through existing programs. These options may include Farm Bill Programs (CRP, CSP, EQIP, RCPP), Managed Forest Law (MFL) timber harvests, Deer Management Assistance Program (DMAP), conservation grazing, and pollinator habitat initiatives. Continue to collaborate with this focused partnership and use this plan to help prioritize work in these private land areas. Seek opportunities as partners for additional funding sources to achieve cooperative goals.

- **Strategy:** Continue to partner with Minnesota DNR to strengthen the landscape level habitat connection between the two states at Crex Meadows and MN St. Croix State Park.

- **Strategy:** Continue actively engaging landscape level partnerships through the Northwest Sands Coordinator Wildlife Biologist position.

Goal: Manage sharp-tailed grouse populations and related recreation opportunities

Objective: Develop a sustainable harvest framework for sharp-tailed grouse that allows for continued population growth. Use annual survey data, best available science, research needs identified within this plan, and public input gathered to inform this process. Following the availability of new information, facilitate Sharp-tailed Grouse Species Advisory Committee discussions to develop a harvest framework with the goal of managing a sustainable population of sharp-tailed grouse.

- **Strategy:** Within two years of plan approval, complete a sensitivity analysis to assess the demographic rate(s) that have the greatest potential influence on population growth. Identify the minimum viable population size of Wisconsin's sharp-tailed grouse using the best available demographic information and stochastic modeling to better understand potential consequences of management decisions. Both investigations will be crucial for conservation of this species and will serve as a foundation for future management recommendations identified in this plan.

- **Strategy:** Recent population trends and count-based viability analyses suggest that the current quota setting system instituted in 2011 may be inappropriate to achieve continued population growth of sharp-tailed grouse in Wisconsin. Following the completion of demographic sensitivity and minimum viable population analyses (identified above), and any additional monitoring data, available science, and/or public input, the Sharp-tailed Grouse Advisory Committee will discuss an objective-based harvest framework to reestablish a hunting quota system. Until a new quota system is determined, the committee will continue meeting annually to discuss lek survey results, population trends, and any new information as it becomes available to evaluate the suitability of authorizing harvest permits.

Objective: Develop Sharp-tailed Grouse Management Zones that reflect genetic composition, habitat connectivity, and can support harvest management actions should science and the species committee support a season.

- **Strategy:** Develop an updated zone boundary proposal with the best available science and input from the Sharp-tailed Grouse Advisory Committee. These zone boundaries would then be submitted as a rule change to administrative code, within the life of this plan.

Objective: Form and continue partnerships to educate the public about sharp-tailed grouse, barrens habitat, and recreation opportunities

- **Strategy:** Work with our partners to craft new educational materials regarding sharp-tailed grouse identification, life history requirements, and landscape level habitat. Consistent messaging will benefit all involved in this collaborative partnership. Potential products include brochures, booklets, website links, signage, kiosk design, and other educational materials.

Informational Needs

Goal: Annually monitor Wisconsin's sharp-tailed grouse population

Objective: Annually monitor sharp-tailed grouse population indices.

- **Strategy:** Maintain current spring dancing ground surveys to provide an index to population changes.

- **Strategy:** Evaluate dancing ground survey protocol(s), standardize survey methodology, and assess data collection procedures to improve effectiveness and efficiency of surveys and maximize utility of collected data to improve inferences.

- **Strategy:** Explore use of alternative and/or supplemental monitoring methods to use in conjunction with annual in-person dancing ground surveys.

Goal: Continue collaboration on research and habitat management efforts to improve probability of population growth and persistence

Objective: Identify habitat management strategies that improve probability of population growth and persistence of sharp-tailed grouse.

- **Strategy:** For the life of this plan, evaluate and measure existing habitat conditions and suitability across the Northwest Focus Area. Look for partnerships to help monitor habitat conditions.

- **Strategy:** As necessary based on evolving research results, adaptively incorporate updated habitat management actions and guidance that improve the probability of long-term population persistence.

Goal: Strategically target research to address priority issues and guide future management

Objective: Conduct and collaborate on research as needed to address specific informational needs related to sharp-tailed grouse populations and management; use research findings to guide sharp-tailed grouse management.

- **Strategy:** Conduct a sensitivity analysis of population dynamics to help prioritize future research needs by identifying potential drivers and vital rates that most influence population growth of sharp-tailed grouse. Complete this research within two years of plan approval.

- **Strategy:** Identify the minimum viable population that results in a sharp-tailed grouse population that has an acceptable probability of persistence, considering stochastic events and potential changes in reproductive success and recruitment, predation, hunting pressure, disease, and habitat conditions. Complete this research within two years of plan approval.

- **Strategy:** Investigate the susceptibility of sharp-tailed grouse populations to projected impacts of climate change, including assessment of how variability in winter conditions and snow cover may influence the population in a given year. Additional potential impacts may include vulnerability to drought or wet conditions during spring and summer, potential health effects and overall measures of fitness, potential for disease, and physiological stress.

- **Strategy:** Within the life of this plan, conduct genetic analyses to determine current genetic condition of Wisconsin's sharp-tailed grouse population and evaluate connectivity between populations in northwest Wisconsin and east central Minnesota.

Objective: Determine strategies for measuring success and achievement of plan objectives

- **Strategy:** Within the life of this plan, use lek surveys and coarse level monitoring to estimate carrying capacity through habitat performance in the Northwest Focus Area. Establish ranges of carrying capacity based on the number of birds per square mile of habitat. Lek survey data population indices may be sufficient to compare habitat suitability and identify habitat management priority work areas.

Objective: Evaluate impacts of disturbance from increased use of managed properties

- **Strategy:** Within the life of this plan, evaluate potential impacts to sharp-tailed grouse on managed properties from increased use of motorized vehicles, including disturbance of habitat, increased noise disturbance, and illegal off-trail use.

Appendix A - Estimated Costs And Partnership Values

Estimated costs/values provided below are categorized using the mapped priority levels for landscape connectivity goals. Within the Northwest Sands Habitat Corridor Plan hypothetical management of 1280-acre blocks consist of approximately 70% public and 30% private lands. Acreage and cost estimates are provided as a single entity, maximum expense scenario, where one partner absorbs all costs without other partners. Estimates are provided for management costs, as well as staff time for restoring or managing as barrens for sharp-tailed grouse and associated species within the Northwest Focus Area. These estimates do not account for partnerships, timber sale revenues, and other considerations that may defray these costs. The current annual cost to manage 29,554 acres of barrens at 4 state wildlife areas (Crex Meadows, Fish Lake, Namekagon Barrens, and the Douglas County Wildlife Areas) is estimated to be $281,945 based on budgetary information from fiscal years 2021 and 2022. This averages to a per acre cost of $9.54. Easement and lease costs are variable depending on agreement details. Costs/values are also provided for land acquisition/values, in Table 5.

Table 5. *Cost/value estimates based on a single entity incurring all expenses for acquisition and management of a project. Estimates also based on a minimum sized barrens core project, and without rolling barrens.*

Acquisition by Priority Level	Acres	Acquisition Cost Ranges[1]	Annual Management Costs[2]	Initial Management Annual Staff Time (hours)[3,]	Long-term Management Annual Staff Time (hours)[4,]
1 Corridor Project	1,280	$1,792,000 - $2,480,640	$12,211	504	282

[1] Acquisition costs are provided as ranges based on a scenario where one entity purchases all required land, where partnerships do not aid in these costs. Estimated costs are based on previous DNR and partner acquisitions within the planning area ($1,400-1,938/acre).

[2] Management costs are estimated using an average ($9.54/acre) annually of all DNR management costs within the planning area assigned to budget codes associated with barrens management during fiscal years 2021 and 2022.

[3] Initial management annual staff time is calculated using the Wisconsin DNR Managed Lands Needs Assessment (2010), which provides a statewide estimate of 1.31 hours of staff time per acre for restoring barrens properties and an estimate of 0.73 for barrens habitat maintenance once restored. The ratio of these estimates was used to prorate projected staff time based on FY21-22 timesheet data within the Northwest Sands to provide a localized estimate of initial management staff time. This is appropriate for properties being restored or converted to a managed barrens state and should be considered to represent management during the life of the plan.

[4] Long-term management annual staff time is calculated using actual staff time data from the Northwest Sands during fiscal years 2021 and 2022. This is appropriate for properties that have already been restored to a managed barrens state and should be considered to represent management after the life of the plan.

Projected Timber Sale Revenue

Timber sales are used to efficiently restore forested stands to an open barrens condition. Depending on several factors, these harvests generate a substantial amount of revenue and have a secondary goal of reducing management costs by accomplishing tasks such as fire break construction and woody fuels reduction. On some barrens-managed properties, forested stands are managed in the short-term using sustainable forestry, with a long-term goal of conversion to open barrens, providing an additional source of revenue.

Table 6*. Projected and reported timber sale revenue from established and completed harvests on barrens-managed properties owned by the Wisconsin DNR and Bayfield County Forest.*

Landowner	Timber sales - 2021-2022	Total Acres	Total Revenue	$/Acre
Bayfield County	2	126	$619,609	$4,917.53
Wisconsin DNR	7	937	$472,190	$503.94

Appendix B - Summary of Sharp-tailed Grouse Open House Comments

Author: Lauren Bradshaw, Bureau of Environmental Analysis & Sustainability

The Wildlife Management program hosted an open house event on 24 May 2022 to share information on current sharp-tailed grouse management and to answer questions about the 10-year management planning process for this species. As a part of that event, Wildlife Management asked the Analysis Services section to help gather feedback from attendees using a comment exercise.

The event took place from 6:00–8:00 p.m. at The Bird Sanctuary Clubhouse on the Douglas County Wildlife Area in Gordon, Wisconsin. A Zoom attendance option was provided for those unable to attend in person. Following a short presentation and Q&A session with Wildlife Management staff, attendees were invited to respond to five questions regarding their relationship with sharp-tailed grouse, their opinions on the past 10-years of barrens habitat work, what they would like to see from the plan going forward, and their concerns for sharp-tailed grouse management.

Attendance was not meticulously tracked, but overall, roughly 30 people attended in-person and attendance on Zoom peaked around 25 people. Many Zoom attendees chose not to participate in the comment exercise, perhaps because of limited means of interactive communication under the hybrid meeting style. Participating attendees included members of area friends groups (e.g., Friends of Namekagon Barrens) who had an interest in conserving the Northwest Sands ecological landscape. Other participating attendees held some place-based attachment to the barrens habitat through a history of hunting and dog training for sharp-tailed grouse, birdwatching, and/or native species conservation. Findings from this comment exercise represent the opinions of attendees at this event and do not convey how widespread any of these opinions may be among the general public or among the specific groups in attendance (e.g., grouse hunters and dog trainers).

Below is a summary of major comment themes observed for each question in the comment exercise. Text in italics represents verbatim quotes from attendee responses that are illustrative of the general observations or represent unique points of view.

Findings

Why are Wisconsin sharp-tailed grouse important to you?

For many attendees, sharp-tailed grouse are viewed as one aspect of the larger ecosystem. Their importance is tied to their role as indicator species for a well-functioning barrens ecosystem, which includes and supports many other flora and fauna. Several participants felt that the importance of sharp-tailed grouse lies in their inherent worth as a native species in Wisconsin and that they are deserving of protection for that reason alone. This feedback may reflect that a number of attendees were active in volunteer friends groups that value barrens habitat conservation.

> *As an indicator species and treasured resource by their very existence.*
>
> *Not only are grouse a charismatic bird species that is impossible not to adore, but they are a sentinel of good barrens habitat management.*

A few participants explicitly mentioned hunting and hunting-related recreation as important to them. However, these individuals clarified that hunting is important "*when populations dictate*" or that hunting is important "*even if [opportunity] is nearly nonexistent like it has been the last 4 years*." These clarifying statements about hunting suggest that grouse hunters recognize that opportunity for sharp-tailed grouse hunting depends on healthy grouse population growth.

How do you think Wisconsin has been doing at managing sharp-tailed grouse barrens areas habitats over the last 10 years?

Sharp-tailed grouse habitat management has involved many partnerships between the department, non-profits and county and federal land managers. To capture those relationships, this question intentionally does not reference a singular agency but rather

“Wisconsin” as a collaborative unit working toward habitat conservation goals. Attendees generally felt that Wisconsin has done a good job at managing barrens habitat, particularly in the Northwest Sands area of the state. Some comments highlighted specific DNR-managed properties within that region as success stories for barrens habitat and sharp-tailed grouse. However, comments also expressed disappointment that sharp-tailed grouse populations and suitable habitat have declined in other areas of the state. A few participants felt that reductions in available agency resources followed by COVID-19 precautions have limited potential habitat work.

> *Namekagon Barrens is a success story. The Douglas Co. Wildlife area is a success story.*
>
> *Good in the NW sands; Poor in other areas in the central part of the state to lose the populations or see declines*

How do you think Wisconsin has been doing at restoring habitat corridors between barrens habitats over the last 10 years?

A prevailing sentiment from attendees was that Wisconsin (as a collaborative unit) has made a good effort to restore habitat corridors, but that these efforts haven’t been enough and that more can and should be done. In particular, participants highlighted opportunities for the department to form and foster more partnerships with externals, to add more habitat via both land acquisition and restoration of current properties, and to fund DNR positions that support barrens habitat restoration work.

> *It has been a slow process. More effort and action is needed to implement the corridor plan.*

What would you like to see from the new Wisconsin plan going forward for barrens and sharp-tailed grouse habitat?

Priorities that attendees would like to see included in the new plan generally fell into the categories of increased grouse populations, increased habitat, education and outreach, and research. It may seem like an obvious priority, but many individuals would like “*more birds*.” Some participants would simply like to see the species flourish in Wisconsin, but others have an interest in future sharp-tailed grouse hunting seasons. For the latter group of participants, their comments recognize that although an adequate population for hunting is the long-term goal, grouse harvest may need to be prohibited or carefully limited in areas where grouse populations are not robust. Regardless, those interested in hunting would like a clear plan and measures of success in working toward that opportunity.

> *Less hunting when numbers are down, even if it hurts your PR. There are other ways to get revenue.*
>
> *A plan to provide the sideboards for a limited harvest in specific areas when populations and occupied landscape are suitable.*

While hunting WI [sharp-tailed grouse] should remain the ultimate goal of management and restoration, growing [sharp-tailed grouse] populations…probably without hunting, should be the 10-year objective.

Many attendees also recognized that an increasing and healthy sharp-tailed grouse population in Wisconsin depends on the quality and quantity of suitable habitat. In the management plan going forward, attendees would like to see increased habitat through mowing and burning to maintain the current barrens properties and through additional land acquisition and restoration. Some of these comments also recognized that increasing managed habitat correspondingly increases the work and funding demands placed on the department. These participants would like to see DNR explore partnership opportunities with external groups that could help accomplish land acquisition goals. One attendee highlighted that "*many species of flora and fauna thrive in open barrens habitat*," and organizations like land trusts or Wisconsin chapters of The Nature Conservancy or Audubon Society may be interested in preserving barrens habitats as well.

Try to encourage more rotating barrens areas where feasible near existing populations to provide more suitable habitat and increase genetic diversity between populations

Ensure that the core properties have the funding and staff to maintain high quality habitat

A few attendees would like to see the future management plan include education and outreach campaigns about barrens habitat and sharp-tailed grouse. These participants felt that educational campaigns could increase support among the public for management objectives. Specific suggestions included: a sharp-tailed grouse identification and conservation section included in the small game hunting regulations pamphlets and filming and sharing video of dancing male grouse. Others would like to see outreach to county forestry units about pairing management for rolling barrens habitat with their planned timber harvests.

…for the Wisconsin public to care about barrens and sharp-tailed grouse into the future, the citizens need first to even know they have existed here for hundreds of years…

Finally, attendees would like to see research included in the forthcoming plan. Some would like to see the department partner and participate in research conducted by counties and by academic institutions in Wisconsin and Minnesota. Specific research questions raised by attendees included understanding the population dynamics, particularly of small meta-populations of sharp-tailed grouse, and understanding how sharp-tailed grouse use habitat at different life stages. Other participants highlighted that research into why and when sharp-tailed grouse disperse into new suitable habitats may greatly support work on restoring new barrens habitat areas and corridors. Finally, a few attendees would like to see the plan include research into how climate change will affect barrens habitat in Wisconsin.

What concerns do you have for Wisconsin sharp-tailed grouse management in the future?

Concerns that attendees held for sharp-tailed grouse management closely aligned with what they would like to see included in the plan going forward and the capacity to accomplish those goals. Many attendees felt concerned about funding limitations and lack of staff. Related to habitat corridor goals and increasing suitable habitat, some attendees felt concerned that limited resources will be spread too thinly, and that available time and money should focus on properties with a high probability of management success. Others held doubts that sharp-tailed grouse can reach sustainable population levels in Wisconsin without additional corridors and constant effort from land managers.

> *Emphasis on broad strategies that are also realistic.*
>
> *[My concern is] the birds survival - whether huntable or not.*

Also related to the habitat corridor goals, some attendees expressed concern for genetic diversity and inbreeding in metapopulations. However, some of these attendees may have been echoing information on genetic diversity concerns that were discussed in the earlier Q&A session with Wildlife Management staff. On a broad level, this topic reflects concern for potential causes of decline in the species, genetic diversity being one of those. Other attendees expressed concerns regarding stress and mortality of sharp-tailed grouse caused by increased use of barrens habitat by dog trainers, ATV use, and potential for hunter misidentification of sharp-tailed grouse when seeking ruffed grouse.

Appendix C - Summary of 2022 Sharp-tailed Grouse Dog Trainer Interviews

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As a part of the department's 10-year management plan update for sharp-tailed grouse, Wildlife Management asked the Analysis Services section to assist in gathering input from stakeholders. One such stakeholder group is those who have hunted or may be interested in hunting sharp-tailed grouse in the future. Wisconsin has not held a sharp-tailed grouse hunting season since 2018, however, both Wisconsinites and non-residents continue to train and trial their hunting dogs on sharp-tailed grouse populations in Wisconsin. This memo summarizes interviews conducted with sharp-tailed grouse dog trainers to gather insights regarding their experiences training dogs on sharp-tailed grouse in Wisconsin and their opinions regarding future management and hunting of the species.

Interview Process

Wildlife Management staff members visited Crex Meadows Wildlife Area, Namekagon Barrens Wildlife Area, and Douglas County Wildlife Area and intercepted visitors with dogs that could feasibly be training on sharp-tailed grouse. Visitors that were clearly not training dogs (e.g., bikers) were not targeted for this effort. Staff interviewed a total of 30 visitors between Aug. 1 and Aug. 12, 2022. The beginning weeks of the training season were targeted because many trainers travel to western states once grouse hunting seasons open. We recognize that cooler weather and Labor Day weekend likely brought more trainers out to these properties, but scheduling conflicts prevented staff from conducting interviews later into the month. Our findings do not suggest that later season trainers would have held substantially different opinions than those that staff interviewed in early Aug.

Interviews followed a pre-determined script of questions developed in consultation with Wildlife Management to assess key aspects of the management plan update. The interview questions focused on experiences training dogs on sharp-tailed grouse (how far visitors travel, how many dogs they have, how many years of experience they have, the properties they use most often), their history of hunting sharp-tailed grouse, and their opinions on future hunting opportunities in the state of Wisconsin. Interviews also provided opportunity to solicit opinions on crowding, conflicts with other trainers, and concern about overworking birds on the property.

Findings

A summary of broader themes heard across interviews follows. Text in italics are quotes from interviews.

Characterizing Interviewees

In total, staff interviewed 30 visitors. Of these visitors, 24 were training their dog(s) on sharp-tailed grouse the day of the interview. One visitor was walking their dog on the day of the interview but had trained their dog on sharp-tailed grouse in the past and admitted that their dog occasionally flushes birds on casual walks. These 25 dog trainers were mostly men (23 of 25). They averaged 47 years old, but age ranged from 22 to 76 years old; 10 of the 25 dog trainers were under the age of 40. Most dog trainers (14 of 25) were Wisconsin residents, and the 11 non-resident visitors were primarily traveling from Minnesota.

Of the remaining visitors, two were dog walkers who do not field train at all and three were training their dogs on black bears (note: any further reference to dog trainers only includes those training on sharp-tailed grouse). During property visits, interviewers also observed visitors biking, hiking, and riding ATVs but since these individuals were clearly not training dogs, they were not interviewed.

Dog Training Experiences

Visitors' experience training dogs on sharp-tailed grouse ranged from brand new (1 year) to one individual with 51 years of experience. Interviewees averaged 14 years of experience but around half (13 of 25) had between one and five years of experience. The remainder all had 12 or more years of experience and six had 25 or more years of experience.

Regardless of experience level, interviewees committed substantial time to participate in this non-consumptive activity. On average, trainers traveled 71 one-way miles to visit the property where they were interviewed. Travel distances ranged from 6 miles to 160 one-way miles. Several of those traveling from further distances indicated that they maintain or rent a cabin nearby and stay there for three- to four-day stretches to train their dogs. On average, trainers make 14 visits per year to train their dogs on Wisconsin sharp-tailed grouse, but some make as many as 60 visits per year. Property visits to train dogs were regular (e.g., weekly) for many during the months of Aug. and Sept., but spring prior to April 15 is also an active period for some trainers.

[I train] 6 times in the spring and then once every weekend in Aug. and Sept.

Most interviewees were either alone (15 of 25) or in groups of two (8 of 25), but several singles told staff that they commonly join with one or two other singles and train together. Most interviewees (23 of 25) were on the property to train their personal dogs, but two individuals were professional dog trainers hired to train others' dogs. Among personal dog trainers, those that are active in the dog trialing community may be more similar to professional trainers in the intensity of their training. Whereas other interviewees working with personal dogs take a more casual approach.

The number of dogs per group ranged from one to seven but most visitors (19 of 25) had one or two dogs on the day they were interviewed. Some indicated they had more dogs at home or at times train their friends' dog(s) as well. The two professional trainers interviewed had seven dogs and two dogs with them, respectively. Generally, personal dog trainers indicated that even if they bring multiple dogs, they only run one at a time on the property. This means that in the span of a visit they may make separate, back-to-back outings into the property with each dog. In contrast, the professional dog trainers staff spoke with may run 3 to 4 dogs at a time.

Properties Used for Dog Training

Wildlife staff made both morning and late afternoon visits on weekdays and weekends to Crex Meadows, Douglas County, and Namekagon Barrens wildlife areas to look for dog trainers. However, all but one of the interviewed dog trainers were encountered at Namekagon Barrens. When asked about the properties they use for training, many (13 of 25) told us they only used Namekagon Barrens and for others that was their most frequently used property. Three trainers indicated they used Crex Meadows and four used Douglas County, however, these interviewees often added that they used them "infrequently" or used them "in the past" and that low bird numbers make the other properties a less attractive option than Namekagon Barrens. Five interviewees indicated they used the Barnes Barrens property in Bayfield County and others still added that

they “have considered” training dogs at Moquah Barrens State Natural Area or Crex Meadows Wildlife Area but do not currently.

Among the three bear dog trainers encountered, all of them clarified that they primarily train on county forest land and only end up on managed barrens properties if the bears lead them there.

Overall, trainers were pleased with their experiences on the property where they were interviewed. Nearly all (24 of 25) agreed that the wildlife habitats were good quality, that the property was not crowded (21 of 25), and they saw the species they hoped to see (14 of 18; some skipped this question).

Crowding and Conflicts on DNR Properties

While only three of 25 interviewed dog trainers felt the property was crowded on the day of their visit, several remarked that Namekagon Barrens was more crowded now than in years past. These individuals speculated that sharing about the property on social media may play a role in increased use by dog trainers. Additionally, numerous interviewees made comments that they alter their own behavior to avoid crowds. Examples include arriving particularly early to the property to secure a “good” spot for training, avoiding weekends entirely due to anticipated crowds, or avoiding weekdays due to presence of professional trainers (who often bring multiple dogs). Interviewers observed that, while some trainers choose to arrive just before sunrise and leave a few hours later, other trainers are only just arriving at that time. While this behavior resolves potential for crowding, the result is consistent waves of trainer presence on the property throughout the cooler morning hours of the day.

> *To get a spot [I] parked at 5:10am*

Staff also asked trainers about any conflicts they have had with other property users that prevented them from using the property as they planned. Most (19 of 25) reported no experience with conflicts and that other trainers were generally respectful. Among those who did have a conflict of some sort, the most common example was with professional trainers and during trialing events. These interviewees felt that professional trainers tended to let their dogs go too far ahead of them (e.g., up to ¾ mile away) and were unaware of their dogs’ behavior. Examples were cited of dogs running into where others were training or running through private property. Some interviewees commented that the use of horses at trialing events damages the trails and that professional trainers with many dogs have a disproportionate impact on broods. A few trainers also cited frustration with illegal ATV use on the property that damages trails and that ATV riders appear unconcerned about the rules because of limited DNR staff presence on the property. In fact, during the course of one interview, an ATV rider crested a hill in an area of the property where ATV use was not allowed, seemingly spotted the state vehicle plates of the interviewer, and turned around quickly.

> *Some people think this is the wild west…[I] would like wardens to be here and control mobile vehicles driving where they aren't supposed to go.*

Professionals with 15 dogs is too many…they run longer and scatter birds.

Concern for Overworked Birds

When asked if they worry that the birds are getting worked too much, trainers were fairly divided in their responses: nine trainers agreed that they worry, six disagreed, and 10 were not sure. Some trainers were surprised by the question and admitted that they had never really thought about it or would expect DNR to monitor and tell them if they are impacting the birds. Those who did worry about overworked birds expressed concern for the consistent stress caused by training. They worry that the same broods are getting flushed repeatedly throughout the day and for days on end through Aug. and Sept. by different waves of trainers. Some trainers told staff they avoid training in the evening out of concern for disturbing broods prior to evening roosting. Some interviewees also shared personal stories of seeing young broods get separated from each other or instances of their dog(s) and others' dog(s) catching grouse. Its unclear from these interviews how frequently this may occur or what the impact is on Wisconsin's sharp-tailed grouse.

8-10 dogs every morning is too many and the [sharp-tailed grouse] get hit hard.

When asked what they thought the department should do about trainer crowding or overworked birds (should it be deemed a problem) some trainers felt it was simply unavoidable. Others felt that if there were data indicating that training is hurting or limiting the recovery of the species in Wisconsin, then the department should restrict the season in some way.

Suggestions for how the department could or should restrict the season varied. Some suggested the use of permits which they pointed out could help to estimate how many trainers are active and also be used to restrict trainers to certain properties, areas within properties, or periods of time. Others referenced the later training season start dates in western states and suggested that Wisconsin could do the same. Some suggested that the department should buy or create more barrens habitat to spread trainers out.

The birds will get worked and pressured no matter what you do.

If we had more big barrens…it would be better for the bird and spread trainers out.

Sharp-Tailed Grouse Hunting

All but one of the interviewees have hunted sharp-tailed grouse in the past but most did so in other states. Some had harvested in Wisconsin (7 of 25) or had applied for a permit but never harvested in Wisconsin (4 of 25). Most (13 of 25) primarily hunted sharp-tailed grouse in states like South Dakota, North Dakota, Montana, Nebraska, or Kansas. Some added that they have not or would not hunt in Wisconsin because of limited availability of birds to harvest.

I never applied in Wisconsin because there weren't enough birds.

Regarding future opportunities to hunt sharp-tailed grouse in Wisconsin, most dog trainers felt it was unimportant (11 of 25) or very unimportant to them (7 of 25). Six felt it was either important or very important to them. Comments made during interviews underscored that for many would-be hunters, hunting was only desirable if and when its sustainable for the population. One individual added that the season was unimportant to them right now because there were not enough birds.

…birds and habitat come first. Would be great if population increases so that a season could happen.

[I] would really like to hunt in Wisconsin, but when it is sustainable to hunt.

When specifically asked to consider the trade-off of a hunting season sooner but perhaps with limited opportunities (fewer permits, small bag limits) versus waiting until population size allows for more opportunities (more permits, higher bag limits), staff found that trainers were divided but generally prioritized the birds over hunting. Seven interviewees preferred a season as soon as possible, nine would prefer to wait until more permits could be made available, and nine had no preference one way or the other. Regardless of their preference, nearly all trainers made additional comments to underscore that a season is dependent on a healthy growing population and that the birds should come first. A few interviewees brought up concerns for long-term funding and the relationship between license sales and species management. These interviewees felt it was important to continue working towards a hunting season, not because they are personally eager to hunt but because revenue from hunting permits and licenses supports habitat work.

Season is population dependent...if can support it then good, if not, fine.

Would really like to hunt but when its sustainable.

As long as I can train here, I don't care about a hunting season.

If they are no longer hunted, [then they are] no longer viewed as a game species. Support is needed to do management and need permits to continue to view as a game species

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