KeyWind Energy Development in North Dakota

Best Management Practices

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SECTION 1. INTRODUCTION AND BACKGROUND

Introduction

The Great Plains offer incredible potential for wind energy and North Dakota is no exception (Figure 1). It is estimated that North Dakota has a potential capacity for wind generation anywhere from 394,519 MW up to 742,276 MW (depending on hub height), with only 3,640 MW currently installed (Office of Energy Efficiency and Renewable Energy; AWEA Market Report; 2017; AWEA, October, 2020). With turbines currently ranging from 1 to 3.5 megawatts, this estimate could equate to tens of thousands of turbines scattered across the North Dakota landscape.

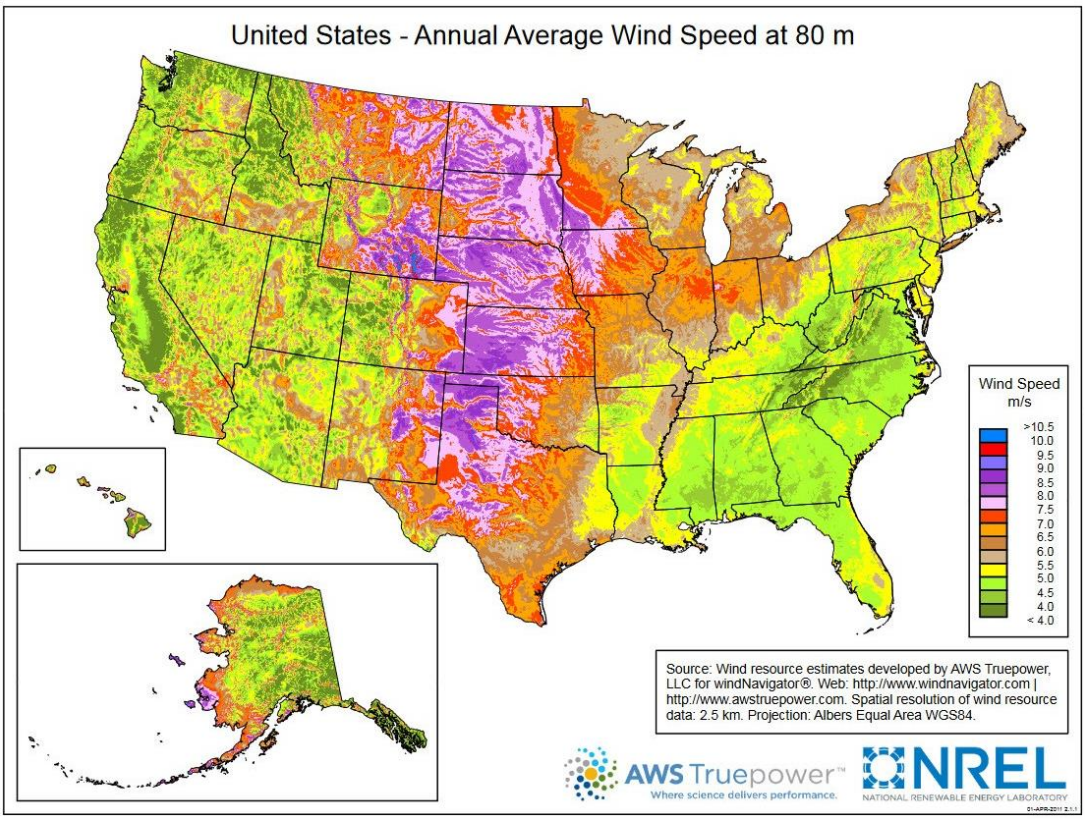


Figure 1. U.S. Wind Power Resource at 80 Meter Hub Height (NREL).

With an increased focus on reducing greenhouse gas emissions, clean energy resources are becoming more widespread. However, without appropriate planning, solutions intended to decrease emissions can turn into new challenges. Wind energy has a larger spatial footprint than other energy resources and, as the demand for

energy continues to grow, that footprint could result in increased loss and fragmentation of habitat, additional listings under the Endangered Species Act (ESA), a loss in biodiversity, and ecosystem collapse. This poses a great risk to North Dakota, which harbors large, contiguous stands of native prairie, one of the most imperiled ecosystems globally. Maintaining a healthy balance between development and conserving wildlife and habitat is key if we hope to preserve our rich heritage and appreciation of outdoor values while still promoting responsible development of North Dakota's natural resources.

North Dakota is a wildlife rich state that has many resident and migratory species that depend upon the grasslands, wetlands, and the sparse woodlands the state provides. Over the last century, urban expansion, conversion of native habitats to cropland, energy development, and other anthropogenic changes have greatly altered the landscape. As a result, many species have suffered as their habitats have been fragmented, degraded, or even lost. In 2007, there were seven threatened or endangered species in North Dakota. In 2019, that number had increased to 12, with 13 more being petitioned or under review for listing. As managing for listed species is far more restrictive, difficult, and expensive than preventing listings, it is vital that we maintain the key habitat resources needed to sustain healthy populations on the landscape.

In 2015, the North Dakota Game and Fish Department's State Wildlife Action Plan (SWAP) was approved. The SWAP was reviewed by a group of officials from the U.S. Fish and Wildlife Service (Service) and state wildlife agencies, and a public review process with input from a wide array of conservation groups, academics, NGOs, farm groups, and members of the public followed. The SWAP serves as North Dakota's comprehensive wildlife conservation strategy for the next 10 years and is the principal document for safeguarding fish and wildlife species in North Dakota. The SWAP identified 115 Species of Conservation Priority that represent rare, declining, or unique species in North Dakota. The ultimate goal of the SWAP is to prevent further listings under the Endangered Species Act.

North Dakota's SWAP is a habitat-based strategy that identified direct threats and conservation actions for grasslands, wetlands, lakes, rivers, streams and riparian areas, badlands, and upland forest. The SWAP also identified conservation actions that are needed to prevent further declines to rare and unique species. Table 1 contains an excerpt from the SWAP which is relevant to wind energy development.

Table 1. Direct threats and conservation actions to grasslands from renewable energy, roads and railroads, and utility and service lines, as identified in the North Dakota State Wildlife Action Plan (Dyke et al., 2015).

Classification	Direct Threat to Grassland	Conservation Action
3.3 Renewable Energy	a) conversion of grassland to alternative fuel crops b) fragmentation of grassland by wind or solar facilities c) promotion of non-native, monotypical alternative fuel crops d) direct or indirect mortality of wildlife species from structures e) altered wildlife migrations f) anthropogenic disturbance to grassland associated wildlife, e.g. noise, light	i. offer incentives and programs to protect, enhance, and restore grasslands ii. incentivize companies for implementing ecologically sound development iii. urge ecologically responsible ordinances and suitable reclamation standards iv. minimize footprint of development i. research to determine best areas for placement to minimize impacts to wildlife
4.1 Roads and Railroads	a) conversion of grassland to roads and railroads b) fragmentation of grassland by roads and railroads c) anthropogenic disturbance to grassland associated wildlife, e.g. noise, dust d) direct mortality of wildlife species with vehicles or trains e) roads acting as migration barriers for terrestrial wildlife f) proliferate noxious/invasive weeds g) road and railway incidents secondary effects, e.g. spills and explosions	i. urge ecologically responsible ordinances and suitable reclamation standards ii. appropriate mitigation, e.g. native grassland ecosystems iii. appropriate road restrictions, including speed limits iv. timing restrictions for construction v. maintain natural corridors or construct wildlife crossings
4.2 Utility and Service Lines	a) fragmentation of grassland by utility and service lines b) disturbance associated with development of utility and service lines can proliferate noxious/invasive weeds c) inadequate reclamation d) intensification and accumulation of infrastructure e) reduced management and flexibility in easement right-of-ways f) direct mortality of wildlife species, particularly birds, by collision or electrocution	i. consolidation corridors ii. encourage buried lines when feasible iii. urge ecologically responsible ordinances and suitable reclamation standards iv. engage in early consultation with the siting of utility and service lines vi. timing restrictions for construction v. require line marking devices vi. use suggested practices for avian protection on power lines

Objective

The Best Management Practices were developed to provide recommendations for addressing wildlife and habitat concerns at all stages of wind energy development. The objective of this document is to assist developers in minimizing impacts to key fish and wildlife species and habitat while maximizing wind energy benefits.

SECTION 2. IMPACTS TO WILDLIFE AND HABITAT

Key Species

First, it is essential to minimize impacts from wind energy development to currently listed threatened or endangered species under the Endangered Species Act (ESA). A second, but equally important urgency, is to preclude additional listings, by minimizing impacts of wind energy development to species identified as at-risk (in a rare and/or declining state). Lastly, the Best Management Practices (BMPs) should help in reducing impacts to certain native game species revered by North Dakota citizens and hunters.

1. Federally Threatened and Endangered Species

The U.S. Fish and Wildlife Service (Service) has primary authority over the ESA and listed species. The purpose of the ESA is to protect and recover sensitive and declining species and the habitats they depend upon. The list of threatened and endangered species in North Dakota current as of this document can be found in Appendix A. For a current list, please visit the Service's endangered species website.

2. Species of Conservation Priority

North Dakota does not have a state list of threatened and endangered species. However, there are 115 species of conservation priority (SOCP) that the Department has identified as rare, declining, or at-risk (Dyke et al., 2015). Some species are on the list because North Dakota is a core area for the species population (e.g. 30.9% of the Sharp-tailed Grouse global population, PIF March 14, 2018). The list includes 47 birds, two amphibians, nine reptiles, 21 mammals, 22 fish, 10 mussels, and four insects (Appendix A). The Department, using the best available science, expert review, and public opinion, placed these species into three levels, defined in Appendix A. However, regardless of the level, all species are important in North Dakota. The purpose of identifying these species is to provide additional management and oversight to preclude additional listings under the ESA and to keep common species common.

3. Native Game Species

Hunting is a popular, typically family-oriented tradition, and hunters play a crucial role in wildlife conservation. In North Dakota, residents and nonresidents spent approximately $2.1 billion on hunting and fishing related expenditures in 2017-2018 (Ndembe et al., 2019). Further, North Dakota produces abundant migratory game birds that provide hunting opportunities for hunters both within North Dakota and in other states. More than half the continent's population of waterfowl is produced in the Prairie Pothole Region, and waterfowl hunters in the United States spend approximately $1.3 billion on hunting related expenditures annually (Carver 2015).

Key Habitats

Unbroken Grasslands

unbroken grasslands*: grasslands that have not been tilled or otherwise broken. Grazing, haying, fire, or other types of management actions, as well as undesirable species, do not qualify a grassland as broken.*

Prairies, also referred to as grasslands, thrived in North Dakota because their deep root systems were able to withstand low amounts of precipitation and extreme climatic variability. Generally, grasslands are divided into three categories: shortgrass, mixed-grass, and tallgrass: all three of which are represented in North Dakota. As the annual precipitation increases from west to east across the state, conditions allow for taller grasses, creating a gradient of grassland types. The shortgrass prairie is found in the southwest (Missouri Slope region), the tallgrass prairie is found in the east (Red River Valley region), and the mixed-grass prairie makes up the rest of the state (Missouri Coteau and Drift Prairie regions). Grasslands provide the bedrock to a vastly important ecosystem that supports many wildlife species.

Prior to settlement, North Dakota was described as "great uninterrupted expanses of nearly treeless prairie" (Stewart, 1976). However, an estimated 75% of these native grasslands have been broken, i.e. converted in some way (NDGFD, unpublished). Though this ecosystem has been highly degraded, North Dakota still supports thriving industries that depend on healthy grassland ecosystems, including

ranching, hunting, and ecotourism (Coyle, 1998; Bangsund and Leistritz, 2003; Hodur et al., 2004; Burke-Olson, 2007). The remaining pieces of unbroken grassland are also essential for the health and long-term survival of many of North Dakota's native wildlife. Forty-eight species of conservation priority depend on this ecosystem, including birds, mammals, reptiles, and insects.

Native Woodlands

Forest systems are found in only a few locations in North Dakota. These native habitats include cottonwood, elm, and ash woodlands found in riparian zones across the state, the aspen/birch/oak woodlands associated with lakes, wetlands, and grassy meadows, as well as the pine/juniper forests in the North Dakota badlands. Although this habitat type accounts for only a small percent of North Dakota habitats, it is vital to stream health and provides important resources to several species, including 13 species of conservation priority.

Wetlands

A wetland is an area inundated by surface or groundwater long enough to support vegetation typically adapted for life in saturated soils. North Dakota has about 2.5 million acres of wetlands remaining from an estimated 4.9 million that once existed (Dahl 2014). The highest density of wetlands is found in the Missouri Coteau and Drift Prairie, collectively known as the Prairie Pothole Region. These wetlands are extremely important to both resident and migratory waterfowl, water birds, and shorebirds. They also support a plethora of other wildlife species, including 54 species of conservation priority.

CRP SAFE

The federal farm bill provides annual rental payments to agriculture producers for establishing and maintaining conservation cover on agriculture acres they voluntarily enroll in the United States Department of Agriculture's (USDA) Conservation Reserve Program (CRP). The goals of the program are to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat. CRP's State Acres For wildlife Enhancement (SAFE) initiative is a special CRP allocation which allows states to design

CRP practices to address local conservation needs, specifically for threatened and endangered species, species suffering significant population decline and species that provide significant social or economic value to communities. These contracts typically range from 10-15 years in length. In North Dakota, there are currently six SAFE projects totaling 218,751 acres (USDA, Farm Service Agency, Monthly CRP summary report, December 2020); North Dakota Coteau-Drift Prairie Waterbank project, North Dakota Habitat for Pheasants project, North Dakota Sagebrush Restoration project, North Dakota Tallgrass Prairie, North Dakota Declining Grassland Birds project, and North Dakota Habitat for Honey project. Because their specific, intended purpose is to help restore rare and declining species, these grassland acres established under CRP SAFE hold a high value to wildlife resource, similar to unbroken grasslands. Prior consultation with the Department and USDA is encouraged before sitting on acres enrolled in CRP SAFE contracts.

Other Restored Grasslands

As previously indicated, unbroken grasslands are a priority, as they provide the most diverse and vital, yet endangered resources. However, it is important to note that other restored grasslands (broken, replanted) be considered as well. Grasslands restored through other federal, state, or private programs/projects, whether for conservation “set-aside” or livestock forage, offer many benefits to wildlife. These re-established grasslands provide important wildlife forage and shelter, improve water quality, and sequester carbon. Further, these tracts have required a financial investment, either by the landowner or another organization. These things should be considered during early-stage planning.

Impacts of Wind Energy Development

Collisions

Though the greatest emphasis has predominantly been placed on collision fatalities at wind farms, there is still much uncertainty of the influence collision fatalities can have on local, regional, or global populations. Research has shown that fatalities

due to collisions ranges from three to six birds per MW per year ((Strickland et al. 2011; Loss et al. 2013; Erickson et al. 2014), and the number of birds killed is dependent on a variety of factors, including turbine and site features, species abundance and behavior, weather, and topography (Richardson, 2000; Erickson et al. 2001; Larsen & Clausen, 2002; Thelander et al., 2003; Drewitt & Langston, 2006; De lucas et al., 2008; Smallwood et al., 2009; Hull et al., 2013; Kitano & Shiraki, 2013). Studies have indicated that there may also be an increased risk of bird and bat collisions along migratory routes (Lewis et al., 1992; Arnett et al., 2005; Huppop et al., 2006). North Dakota supports millions of migrating waterfowl, shorebirds, and other water birds, including the federally endangered whooping crane, and collisions during migration are of great concern in the state. Moreover, the placement of turbines in grassland-dominated landscapes is of higher concern because the diversity of species killed is nearly three times that of turbines placed in cropland (Graff et al. 2016).

Research has shown that bats are likely at even greater risk of collisions with wind turbines than birds (Howe et al., 2002; Kuvlesky et al., 2007; Molvar, 2008). Though bats often depend on trees and wooded areas for roosting, they can be found feeding over grassland and agricultural fields. Several species are known to occur in the prairie dominated landscape of North Dakota. Bats are long-lived, reproduce slowly, and migrate long distances, making them particularly susceptible to wind development. Three bat species, in particular, have been shown to be highly vulnerable to wind turbine collisions- Hoary Bat, Eastern Red Bat, and Silver-haired Bat (Kunz et al., 2007; Arnett et al., 2008)- all of which are found in North Dakota, though only the Silver-haired Bat can be considered common.

Habitat Loss

Habitat loss has been identified as the greatest threat to biodiversity (Wilcove et al., 1998). There is a vast amount of peer-reviewed literature linking habitat loss to reductions in population abundance, species richness, genetic diversity, population growth, breeding success, predation, and foraging success (Findlay & Houlahan, 1997; Boswell et al., 1998; Sanchez-Zapata & Calvo, 1999; Mahan & Yahner, 1999.; Bergin et al., 2000; Best et al., 2001; Gibbs, 2001; Urban & Keitt, 2001; Steffan-Dewenter et al.,

2002; Fahrig, 2002; Bascompte et al., 2002; Chalfoun et al., 2002; Herkert et al., 2003; Arnett et al., 2007). This is of high concern because it has been estimated that habitat conversion happens at a rate eight times that of habitat protection (Hoekstra et al., 2005). The cumulative impacts of multiple projects across the landscape can be severely detrimental to many wildlife species.

Displacement and Avoidance

Numerous studies have described the many stressors energy development can place on an ecosystem. Though many of these impacts are direct, observable, and quantifiable, some are not. One such stressor is the displacement of local wildlife. Many species are likely to avoid areas that have historically acted as source habitat due to anthropogenic disturbance and development. Displacement can occur during the construction and operational phases of a project as well as after the life of the project has been extinguished. This is likely caused by a number of reasons: light and noise pollution, increased traffic, visual obstruction, increased undesirable vegetation, and changes in resource availability.

Quantifying displacement has proven to be an extremely difficult task. Consequently, there has been minimal consensus of the extent of its impact, as it seems to vary greatly from site to site and species to species (Klein et al, 1995; Petersen, 2004; Drewitt et al., 2006; Kaiser et al., 2006; Stevens et al., 2013). However, avoidance behavior due to anthropogenic disturbance has been observed in a number of species (Lyon, 1979; Bock et al, 1999; Leddy et al., 1999; Weller et al., 2002; Holloran, 2005; Stewart et al., 2005; Benitez-Lopez , 2010; Loesch, et al., 2013; Shaffer & Buhl, 2015) and this avoidance has been shown to have long-term effects, such as increased predation of displaced species, reduced value of habitat for forage and reproduction, increased pressure on adjacent habitat, reduced gene flow, and altered landscape structure (Madsen, 1994; Phillips et al., 2000; Steidl et al., 2000; Herkert et al. 2003, Thompson et al., 2005; USFWS, 2016).

Fragmentation

Habitat fragmentation is described as the process of dividing large tracts of contiguous native habitat into smaller, disconnected pieces. Habitat fragmentation results in an increased number of small habitat patches, isolated by a matrix of human altered land cover (Haddad, 2015). Breaking habitat into smaller pieces also increases the amount of edge, and animal behavior can be influenced by these "edge effects" (Lidicker et al., 1999; Ries et al., 2004; Batary et al., 2004). This reduction of habitat and connectivity and increase in edge effect has been shown to lead to a loss in biodiversity (Wilcox et al., 1985; Fletcher et al., 2007).

Cumulative Impacts

Cumulative impacts are those that result from the collective effects of multiple projects across the landscape. Each project has an individual impact on the environment, but the cumulative effects of multiple projects have the potential to be greater than the sum of the individual projects alone. Very little is known about the potential cumulative impacts of multiple, large-scale projects (Drewitt, et al., 2006). However, with the accelerated rate at which wind energy projects are being proposed across the state, the risk of cumulative impacts cannot be ignored.

SECTION 3. AVOIDANCE AND MINIMIZATION

Coordination and Process

The Department and the local U.S. Fish and Wildlife Service's Ecological Services team work jointly to assist developers with responsible siting. Developers should reach out to both parties early in the planning process, as both may be able to provide valuable biological data and will provide a guidance letter based on specific project locations. The Developer should use this guidance and the Best Management Practices recommended in this document throughout all stages of project planning (through Tier 3 in the U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines - WEGs). The permitting body, the Public Service Commission, seeks input

on wind energy development from the Department and the Service, which is requested 30 days prior to a permitting hearing. Therefore, a final (or near final) turbine layout, all pre-construction studies, a Bird and Bat or Wildlife Conservation Strategy (BBCS/WCS), and any voluntary offsets should be submitted to both parties 100 days prior to the hearing. The Department will use this information to analyze the anticipated impacts of the project to wildlife and wildlife habitat (page 20).

Early Coordination Contact List

NDGFD: Sandra Johnson (GIS data and maps) – 701-328-6382

NDGFD: Elisha Mueller (Guidance and Coordination) – 701-328-6348

USFWS: Heidi Riddle (Guidance and Coordination) – 701-355-8545

Risk Analysis

As a first step in the development process, environmental concerns should be considered, and the risk of a project should be evaluated. This Risk Analysis Assessment was created to alert developers to potential wildlife conflicts associated with development of a wind facility, including critical habitat, ESA listed species and certain native game species. The assessment also incorporates siting criteria the Public Service Commission (PSC) has identified in N.D. Admin. Code § 69-06-08-01 relative to wildlife, wildlife habitat, and places important for wildlife recreation.

The assessment offers a tool that will provide a fair and balanced approach to evaluating risk. It can provide a developer with more clarity for how the Department assess the environmental impact of the project, as well as provide the PSC with a summary to consider in the site suitability evaluation process relating to *“areas where animal or plant species that are unique or rare to this state would be irreversibly damaged*.” (N.D. Admin Code § 69-06-08-01(g)).

The assessment can be utilized in two phases of development. First, it should be used as a coarse screening tool when looking at broad geographic areas for potential wind development sites. The assessment is not meant to disqualify sites that may result in most likely or at-risk occurrences. As the siting process continues, a project area and individual turbines may be shifted to avoid high areas. The assessment does not relieve developers from direct risk, such as bird and bat fatality, but the potential for collisions should be minimized by placing wind facilities in spatial areas categorized as “least likely at-risk”.

As new information becomes available, the assessment may be adapted. See appendices for maps and how to obtain spatial data for each category.

Table 2. Risk Analysis Assessment for evaluating potential wildlife conflicts.

Category	MOST LIKELY AT-RISK	LIKELY AT-RISK	LEAST LIKELY AT-RISK	Response
Key Native Wildlife and Habitat Areas (Fig. B11)	>25% of project area in high impact category	<25% of project area in high impact category; and >50% of project area in medium impact category	<50% of project area in medium impact category; and >50% of project area in low impact category	
Whooping Crane (Fig. C1 a and b)	occurs within the 50% corridor and Decile 1	occurs within the 75% corridor and Deciles 1-3	occurs within or outside the 95% corridor and minimal or no Deciles	
USFWS Threatened and Endangered Species Critical Habitat (Fig. C2)	occurs in or within 1 mile of project area	does not occur within project area, but within 5 miles	none in or within 10 miles of project area	
Greater Sage-Grouse and Greater Prairie-Chicken Primary Range (Fig. C3)	project area is in or within 1 mile of primary range	project area is in or within 5 miles of primary range	project area is >5 miles from primary range	
Sharp-tailed Grouse Primary and Secondary Range (Fig. C4)	project area is in primary range and high impact category	project area is in primary range and medium impact category	project area is in secondary range and low impact category	
Big Game Primary Range – Bighorn Sheep, Elk, Mule Deer, Pronghorn (Fig. C5)	project area is in primary range	project area is within 1 mile of primary range	project area is > 1 miles from primary range	
Bald Eagle and/or Golden Eagle Nests (Fig. C6)	>10 nests in or within 2 miles of project area	5-10 nests in or within 2 miles of project area	<5 nests in or within 2 miles of project area	
Important Bird Areas (Fig. C7)	project area within 3 miles of state or global IBA	project area >3 miles, but <10 miles, of state or global IBA	project area > 10 miles of state or global IBA	
The Nature Conservancy Priority Areas (Fig. C8)	occurs in project area	occurs within 1 miles of project area	project area > 1 miles from primary range	
Designated national parks, wilderness areas, wildlife areas, wildlife refuges, inventoried roadless areas (Fig. C9)	occurs in or within 2 miles of project area	occurs within 5 miles of project area	>10 miles from project area	
Designated state parks, forests, forest management lands, game refuges, game management areas, management areas, nature preserves (Fig. C10)	occurs in or within 1/2 miles of project area	occurs within 5 miles of project area	>10 miles from project area	

Key Native Wildlife and Habitat Areas

Key areas for native wildlife and habitat were identified using the SWAP Focus Areas, larger tracts of unbroken grassland, and wetland dense areas (Appendix B). None of the areas represent complete avoidance or exclusion areas for wind energy development. Rather, the high and medium categories likely contain "*areas where animal or plant species that are unique or rare to this state would be irreversibly damaged"* (as per N.D. Admin. Code § 69-06-08-01). The map should be used as an initial scoping tool for wind energy development in North Dakota.

Low Impact to Native Wildlife and Habitat – This spatial area represents lands that are primarily broken or disturbed land; land that has been converted from its native state to other uses, such as cropland and developed areas, and is a highly fragmented landscape. Offsets for impacts to wildlife and habitat are relatively low, but appropriate siting could often result in little to no impacts. Approximately 37% of the state is in the low category. Constructing wind projects in the low category will have the least impact to key native wildlife and habitat.

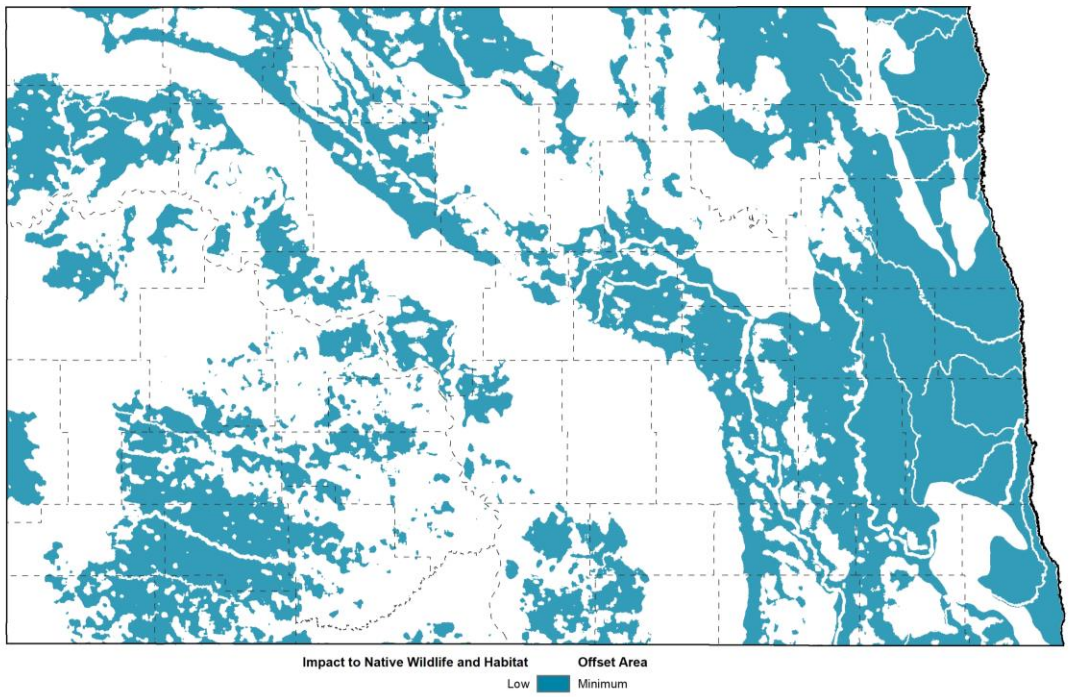


Figure 2. Areas of low impact to native wildlife and habitat.

Medium Impact to Native Wildlife and Habitat – This spatial area represents lands that are partially broken or disturbed. These areas may encompass tracts that have or have not been converted from its native state to other uses, such as cropland and urban sprawl, therefore it is a more fragmented landscape. Offsets for impacts to wildlife and habitat may be of moderate nature, but appropriate siting can result in minimal impacts. Approximately 25% of the state is in the medium category. Constructing wind projects in the medium category will have a higher likelihood of impacting key native wildlife and habitat than projects in the low impact areas.

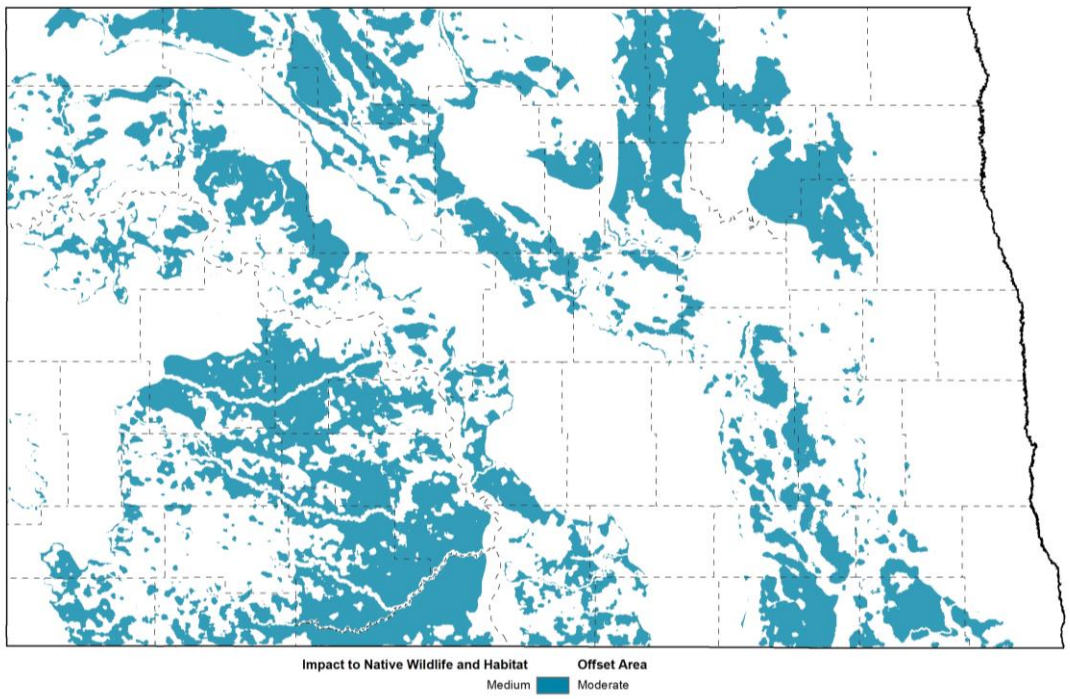


Figure 3. Areas of medium impact to native wildlife and habitat.

High Impact to Native Wildlife and Habitat – This spatial area represents a mostly intact and undisturbed landscape. These areas contain large tracts of land that have not been converted from their native state to other uses, such as cropland and developed areas, and are therefore a less fragmented landscape. Offsets for impacts to wildlife and habitat would be at their highest, but appropriate siting can result in moderate to minimal impacts. Approximately 37% of the state is in the high category. Constructing wind projects in the high category will have the greatest impact to key native wildlife and habitat.

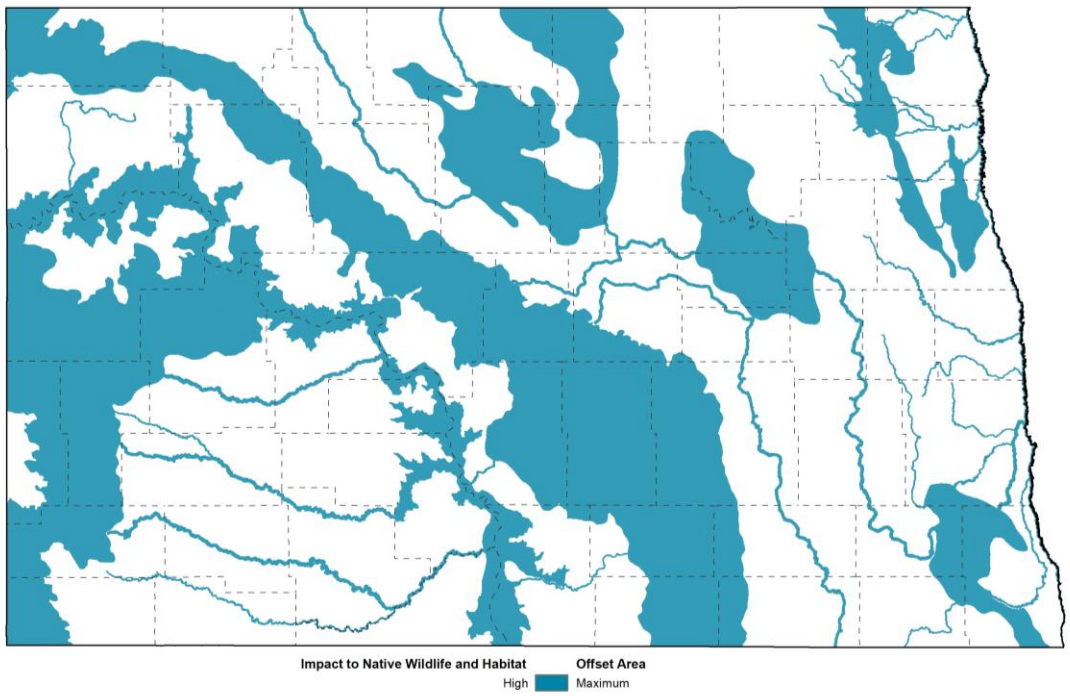


Figure 4. Areas of high impact to native wildlife and habitat.

Best Management Practices

During the very early stages of siting, developers should consider the following recommendations to minimize their impacts on species of conservation concern and the habitat resources they depend on. The Service also has several Best Management Practices that supplement this list and can be found in their WEGs. The following are key recommendations but is not an all-inclusive list:

1. Avoid disturbance to native, unbroken habitats (grasslands, wetlands, and woodlands).
    a. Site turbines, roads, and other infrastructure on areas already disturbed land (tilled or otherwise broken) as often as possible.
    b. Avoid siting turbines, roads, or other infrastructure in areas that will fragment large, contiguous tracts of native habitats.
    c. Avoid siting turbines, roads, or other infrastructure in wetland dense areas.
2. Avoid disturbance to land enrolled in CRP SAFE.
3. Minimize, to the extent possible, the amount of area disturbed for siting and construction activities.
    a. Use pre-existing roads and minimize, to the extent possible, the length of new roads needed to be created.
4. Avoid siting turbines or other infrastructure within the Greater Sage-Grouse Priority Conservation Areas (PCA): https://gf.nd.gov/sites/default/files/publications/nd-sage-grouse-plan-2014_0.pdf
5. Avoid siting turbines in nesting habitat within a 2-mile buffer of Greater Prairie-Chicken and Sharp-tailed Grouse leks and within a 4-mile buffer of Greater Sage-Grouse leks.
    a. Moreover, due to the fragile status of these Greater Sage-Grouse and Greater Prairie-Chicken in our state, we prefer developers to avoid any limiting habitat within these two species' ranges. In particular, we are concerned with developments in the remaining habitat patches that are >= 0.5 square miles, or where smaller patches accumulate to over 0.5 miles without barriers to movement between patches. Critical limiting habitat for Greater Sage-Grouse consists of grassland tracts with >5% Big Sagebrush

(A*rtemesia tridentata*). Critical limiting habitat for prairie chickens consists of tallgrass prairie.

6. Avoid siting utility lines in nesting habitat within a 1-mile buffer of any prairie grouse lek.
7. Restrict construction within the above buffer zones during the lekking and nesting seasons (March 15-July 15).
8. Place utility lines along existing roads as often as possible.
9. Avoid siting turbines or other infrastructure within Bighorn Sheep habitat modeled and mapped by the Department.
10. Minimize, to the extent possible, placing turbines or associated infrastructure in areas that will have serious, detrimental impacts to flora or fauna listed under the Endangered Species Act.
11. Utility lines that are constructed across wetlands should be marked to decrease bird strikes and mortality.
12. To reduce eagle and raptor mortality from electrocution, utility line construction should follow recommendations by the Avian Power Line Interaction Committee (www.aplic.org).
13. The following table provides distance and seasonal restrictions, which if implemented, should assure that impacts to nesting raptors will be minimal. Development activities should not occur within the spatial buffer during the identified breeding period, which includes courtship and nest building, egg laying, fledgling, and through the post-fledgling dependency on the nest.

Common Name	Ability to co-exist?[1]	Spatial Buffer (miles)[2]	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Bald Eagle	Mod-High	0.5												
Golden Eagle	Low	0.5												
American Kestrel	Mod-High	0.125												
Broad-winged Hawk	Mod	0.25												
Cooper's Hawk	Mod-High	0.125												
Ferruginous Hawk	Low-Mod	1												
Merlin	Mod-High	0.125												
Northern Harrier	Mod-High	0.25												
*Osprey	High	0.25												
*Peregrine Falcon	Mod	0.5												
Prairie Falcon	Mod	0.5												
Red-tailed Hawk	High	0.33												
Sharp-shinned Hawk	Mod	0.25												
Swainson's Hawk	Mod-High	0.25												
Turkey Vulture	Mod													
Burrowing Owl	Low	0.25												
Eastern Screech-Owl	Mod	0.125												
Great-horned Owl	High	0.125												
Long-eared Owl	Mod	0.125												
*Northern Saw-whet Owl	Mod-High	0.125												
Short-eared Owl	Low-Mod	0.25												

[1] Ability to Co-exist? – Adapted from Table 3 in Demarchi and Bentley (2005), the degree to which the raptors' relative ability to co-exist with humans in urban and rural environments.

[2] Spatial buffers adapted from Whittington and Allen (February 2008).

* Rare breeding raptors in North Dakota.

a. Additionally, it is recommended that there be No Surface Occupancy (NSO), beyond that which historically occurred in the area, within ¼ mile radius of the following active nests: Bald Eagle, Golden Eagle, Ferruginous Hawk, and Prairie Falcon. Other landscape features may factor in the effect of a disturbance, such as topography, line-of-sight, or if the nest is in urban versus rural setting.

14. Minimize the number of permanent meteorological towers needed at the project site.
15. Avoid impacts to the hydrological function of wetlands as often as possible and follow all applicable provisions of the Clean Water Act (33 USC 1251-1387) and the Rivers and Harbors Act (33 USC 301 et seq.).
16. Avoid siting turbines within Game and Fish owned and/or operated lands.
17. Avoid sitting turbines on any Private Land Open To Sportsmen (PLOTS) land without prior consultation with the Department's private land section.

18. Avoid any other state or federally owned wildlife or recreational lands (i.e. waterfowl production areas, national wildlife refuges, state parks, and national parks).

Pre-construction Surveys (Analyses)

Tier 3 of the USFWS WEGs recommend conducting field studies to document wildlife and habitat and predict project impacts. While developers are free to continue using the voluntary WEGs to evaluate a site for determining impacts of a wind energy project, the Department also recommends the following:

1. **Conduct a native habitat desktop analysis**.

When the boundary of the project area has been determined, an initial habitat analysis should be conducted. This analysis will provide the developer with a clearer idea of the native unbroken grasslands, woodlands, and wetlands that fall within the project boundary and what areas should be avoided during the siting of turbines, roads and other infrastructure. North Dakota Game and Fish Department has spatial layers available upon request that can be used to assist developers in identifying native habitats within their project boundary.

2. **Conduct the following surveys (see Appendix D for methods)**.
    a. Grouse lek surveys
        i. Sharp-tailed Grouse surveys should be conducted state-wide, site-specific recommendations will be made for Greater Prairie-Chicken and Greater Sage-Grouse in the Department's initial guidance letter.
    b. Raptor nest surveys, both for stick nests and ground nests
    c. Bat surveys
    d. Any threatened and endangered species surveys as recommended by USFWS

3. Use existing scientific information to assess risk to the following:

a. Whooping Crane - Whooping crane occurrence is generated using spatial modeling techniques, digital landcover information from satellite imagery, the National Wetlands inventory, and whooping crane observations from the Cooperative Whooping Crane Tracking Project. The model is a strong indicator of whooping crane presence (Niemuth et al. 2018).

b. Grassland Bird Surveys – Many grassland birds are nomadic or irruptive, and a limited survey of 1-2 years may not detect the species presence. The native unbroken grassland analysis is the best predictor of grassland bird presence or absence because various species of conservation priority will be found on unbroken grassland throughout the state. USFWS HAPET spatial models (Niemuth et al. 2017) are strong indicators of predicted occurrence. If identifying a list of potential avian species is desired, use Breeding Bird Survey from the three closest survey routes or eBird observations.

c. Waterfowl Breeding Surveys – The USFWS HAPET office has developed numerous spatially explicit models using 30+ years of waterfowl data. A limited survey of 1-2 years may not provide an accurate assessment of waterfowl use in the project area because there is tremendous variation in wetland condition (i.e. drought or deluge) annually. Contact the HAPET office.

4. Impact Analysis

After the turbine layout has been finalized and the habitat analysis has been conducted, a final impact analysis can be done. This analysis will provide the developer with an estimation of impacts the wind project will have on wildlife and habitat. This information can be used to determine if voluntary offsets are necessary. See Appendix E for more information and methods for running an impact analysis.

Post-construction Surveys

Avian Mortality Surveys

Avian mortality surveys provide a quantitative measure of the birds and bats that collide with features of a particular wind project. At least one year of avian mortality surveys is recommended, as consistent with the USFWS WEGs (Tier 4: Post-construction studies to estimate impacts). Survey intensity should depend on the risk analysis assessment and the results of pre-construction raptor and bat surveys. The specifics of the number of turbines to be monitored, search plot size, searching interval, number of removal trials, number of searcher trials, etc., should be agreed upon by the developer and the Department prior to beginning surveys. Consider using dog searches, which compared to human searches, result in fatality estimates up to 6.4 and 2.7 times higher for bats and small birds, respectively, along with higher relative precision and >90% lower cost per fatality detection (Smallwood et al. 2020). However, during the development of a project specific avian mortality survey design, the developer can refer to the following documents that outline already established fatality search methodology: the California state guidelines (California Energy Commission, 2007), the Minnesota Avian and Bat Survey Protocols (Mixon et al., 2014), Kunz et al. (2007), Smallwood (2007), and Strickland et al. (2011).

APPENDIX A. SPECIES OF CONSERVATION CONCERN

Level I: Species that can be defined having one of the below.

- A high level of conservation priority because of declining status either here or across their range.
- A high rate of occurrence in North Dakota constituting the core of the species breeding range but are at-risk range wide.

Level II: Species that can be defined having one of the below.

- A moderate level of conservation priority
- A high level of conservation priority but a substantial level of non-SWG funding is available to them.

Level III: Species having a moderate level of conservation priority but are believed to be peripheral or non-breeding in North Dakota.

Species	Level	ESA	Habitat Descriptor
American Avocet	2		Wetland
American Bittern	1		Wetland
American Kestrel	2		Grassland
American Marten	2		Woodland
American White Pelican	2		Wetland
Arctic Shrew	3		Wetland
Baird's Sparrow	1		Grassland
Bald Eagle	2		Wetland/ Woodland
Big Brown Bat	1		Woodland
Black Sandshell	2		Aquatic
Black Tern	1		Wetland
Black-billed Cuckoo	1		Woodland
Black-footed Ferret	2	Endangered	Grassland
Blacknose Shiner	3		Aquatic
Black-tailed Prairie Dog	1		Grassland
Blue Sucker	1		Aquatic
Bobolink	2		Grassland
Brewer's Sparrow	3		Grassland
Burbot	2		Aquatic
Burrowing Owl	2		Grassland
Canadian Toad	1		Wetland

Canvasback	2		Wetland
Carmine Shiner	3		Aquatic
Chestnut Lamprey	3		Aquatic
Chestnut-collared Longspur	1		Grassland
Creek Heelsplitter	1		Aquatic
Creeper	3		Aquatic
Dakota Skipper	2	Threatened	Grassland
Deertoe	3		Aquatic
Dickcissel	2		Grassland
Eastern Spotted Skunk	3	Petitioned	Woodland
False Map Turtle	3		Aquatic
Ferruginous Hawk	1		Grassland
Finescale Dace	3		Aquatic
Flathead Chub	2		Aquatic
Fragile Papershell	3		Aquatic
Franklin's Gull	1		Wetland
Golden Eagle	2		Grassland
Golden Winged Warbler	-	Petitioned	Woodland
Grasshopper sparrow	1		Grassland
Gray Wolf	-		Grassland/ Woodland
Greater Prairie-Chicken	2		Grassland
Greater Sage-Grouse	1		Grassland
Hispid Pocket Mouse	3		Grassland
Horned Grebe	1		Wetland
Hornyhead Chub	3		Aquatic
Largescale Stoneroller	3		Aquatic
Lark Bunting	1		Grassland
Le Conte's Sparrow	2		Grassland
Least Tern	2		Wetland
Lesser Scaup	2		Wetland/ Grassland
Little Brown Bat	1		Woodland
Loggerhead Shrike	2		Grassland
Logperch	3		Aquatic
Long-billed Curlew	1		Grassland/ Wetland
Long-eared Bat	3		Woodland
Long-legged Bat	3		Woodland
Mapleleaf	3		Aquatic
Marbled Godwit	1		Wetland/ Grassland
McCown's Longspur	3		Grassland
Merriam's Shrew	3		Grassland
Monarch	1	Canidate	Grassland
Nelson's Sparrow	1		Grassland/ Wetland
Northern Harrier	2		Grassland
Northern Long-eared Bat	1	Threatened	Woodland

Northern Pearl Dace	1		Aquatic
Northern Pintail	2		Grassland/ Wetland
Northern Prairie Skink	3		Woodland
Northern Redbelly Dace	2		Aquatic
Paddlefish	2		Aquatic
Pallid Sturgeon	2	Endangered	Aquatic
Peregrine Falcon	3		Grassland
Pink Heelsplitter	2		Aquatic
Pink Papershell	1		Aquatic
Piping Plover	2	Threatened	Wetland
Plains Hog-nose Snake	1		Grassland
Plains Pocket Mouse	3		Grassland
Plains Spadefoot	1		Aquatic
Poweshiek Skipperling	2	Endangered	Grassland
Prairie Falcon	2		Grassland
Prairie Gray Fox	3	Petitioned	Woodland
Pugnose Shiner	3		Aquatic
Pygmy Shrew	2		Grassland
Red Knot	3	Threatened	Wetland
Red-headed Woodpecker	1		Woodland
Regal Fritillary	1	Petitioned	Grassland
Richardson's Ground Squirrel	2		Grassland
River Darter	3		Aquatic
River Otter	2		Aquatic
Rusty Patched Bumble Bee	-	Endangered	Grassland
Sagebrush Lizard	3		Grassland
Sagebrush Vole	3		Grassland
Sharp-tailed Grouse	2		Grassland
Short-eared Owl	2		Grassland
Short-horned Lizard	2		Grassland
Sicklefin Chub	1	Petitioned	Grassland
Silver Chub	2		Aquatic
Silver Lamprey	3		Aquatic
Smooth Green Snake	1		Grassland
Smooth Softshell	3		Aquatic
Snapping Turtle	2		Aquatic
Spiny Softshell	3		Aquatic
Sprague's Pipit	1		Grassland
Sturgeon Chub	1	Petitioned	Aquatic
Suckley's Bumble Bee	-	Petitioned	Grassland
Swainson's Hawk	1		Grassland
Swift Fox	2		Grassland
Threeridge	2		Aquatic
Townsend's Big-eared Bat	1		Woodland

Trout-perch	2		Aquatic
Upland Sandpiper	2		Grassland
Wabash Pigtoe	2		Aquatic
Western Bumble Bee	-	Petitioned	Grassland
Western Meadowlark	2		Grassland
Western Prairie Fringed Orchid	-	Threatened	Grassland
Western Small-footed Bat	3		Woodland
Whooping Crane	3	Endangered	Wetland
Willet	2		Wetland/ Grassland
Wilson's Phalarope	1		Wetland/ Grassland
Yellow Bullhead	3		Aquatic
Yellow Rail	1		Wetland

APPENDIX B. DEVELOPMENT OF NORTH DAKOT'S KEY NATIVE WILDLIFE AND HABITAT AREAS FOR WIND ENERGY SITING

The following maps and spatial data were used to develop the North Dakota Key Native Wildlife and Habitat Areas for use in siting wind energy facilities. The final product has three impact categories, corresponding to three levels of offsets. In instances where a given area had differing, overlapping categories of impact, the area was classified with the highest category of impact.

The information used to develop the Key Native Wildlife and Habitat Areas include:

- North Dakota State Wildlife Action Plan Focus Areas
- Native/Unbroken Grassland
- Native Woodland
- Wetlands

NORTH DAKOTA STATE WILDLIFE ACTION PLAN FOCUS AREAS

The North Dakota State Wildlife Action Plan (SWAP) was approved by the U.S. Fish and Wildlife Service on February 4, 2016. The SWAP was reviewed by the Regional Review Team, a group of officials from the Service and state wildlife agencies, and a public review process was completed. The SWAP serves as North Dakota's comprehensive wildlife conservation strategy for the next 10 years. It is the principal document for safeguarding rare and declining fish and wildlife species in North Dakota.

The SWAP is habitat based and a total of nine landscape components encompassing the major habitat types were identified. In some cases, there was enough information or reason to identify Focus Areas within a particular landscape component. To identify Focus Areas, level IV ecoregions boundaries were chosen and modified based on extant native vegetation (NDGFD native prairie and native woodland) and biological information provided by spatial datasets to identify where the maximum number of SCP may occur. Focus Areas typically exhibit unique or easily identifiable differences in vegetation, soils, topography, hydrology or land use. Focus Areas are highly variable in size and often represent an area of native vegetation or a natural community type rare to North Dakota. A total of 21 Focus Areas were identified (Fig. A1). The badlands is a unique land feature and was treated as a landscape component in the SWAP. However, for the Key Native Wildlife and Habitat Areas, the badlands was included as a Focus Area. Wetlands are represented in Figure B8.

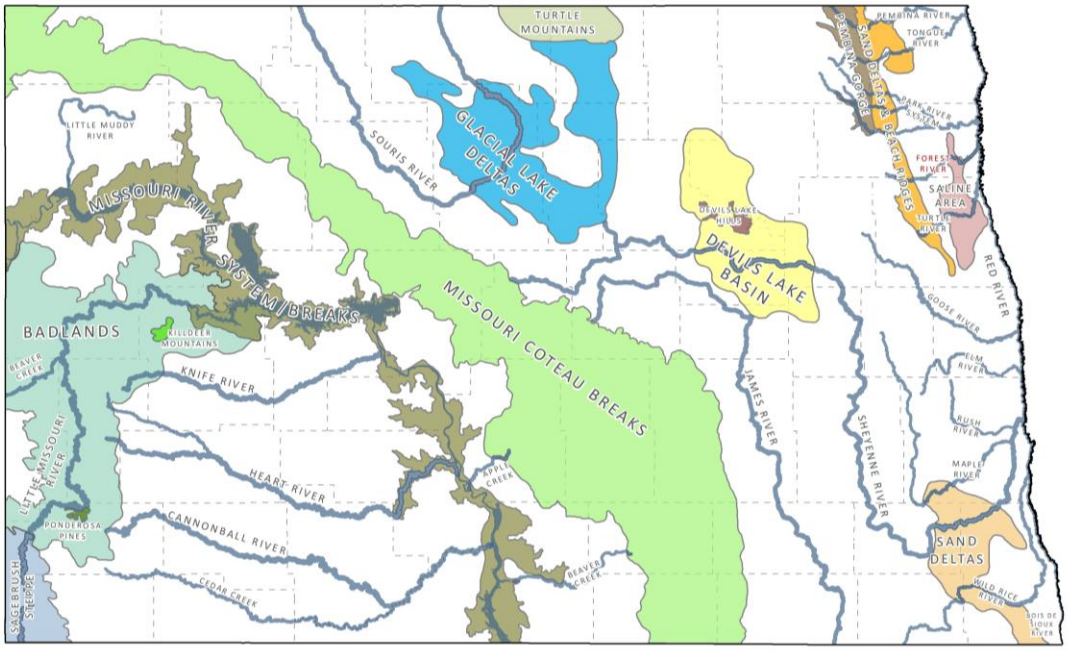


Figure B1. State Wildlife Action Plan Focus Areas with Badlands included.

The SWAP Focus Areas represent areas of North Dakota that are most important to the vast majority of Species of Conservation Priority. Due to the high value of these areas, all Focus Areas are categorized as High Impact to Native Wildlife and Habitat (Figure 2).

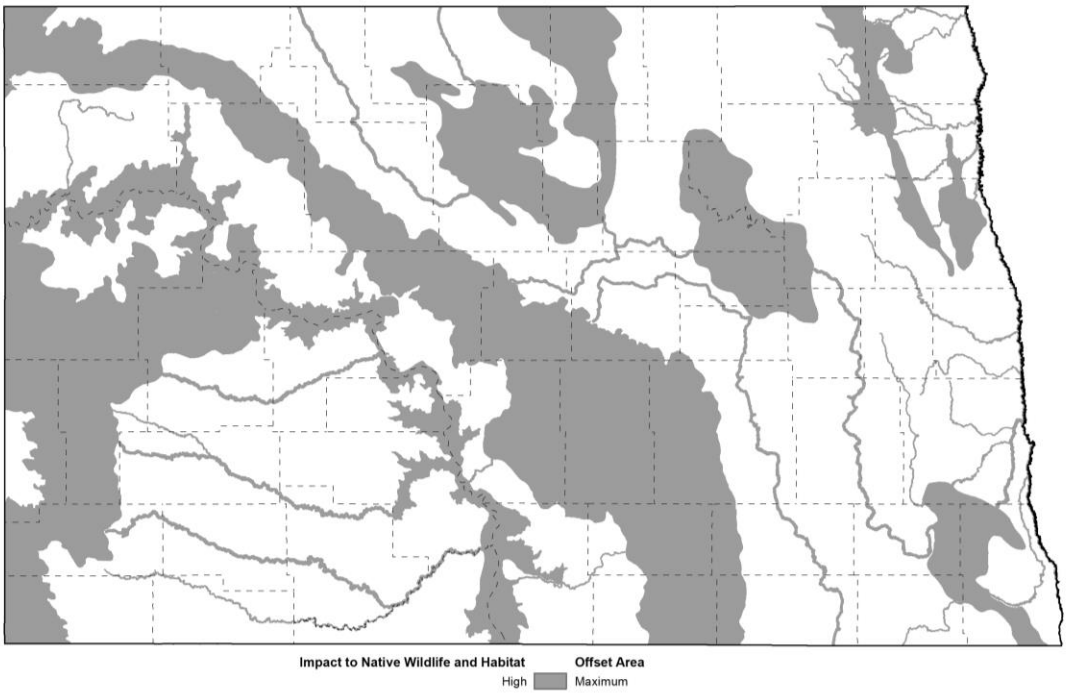


Figure B2. All SWAP Focus Areas, including the Badlands, are categorized as High Impact to Native Wildlife and Habitat.

NATIVE PRAIRIE/UNBROKEN GRASSLAND

North Dakota's natural habitat was predominantly prairie – large open areas that have few trees and covered in grasses. Consequently, numerous grassland endemic wildlife species are dependent upon native prairie. Over the past 150 years, the landscape of North Dakota has changed dramatically. Nearly ¾ of native prairie has been converted for cropland, urban development, energy development, roads, and other human uses. Since 48 species of conservation priority and myriad other wildlife in North Dakota depend on grasslands to complete their full annual life cycle, it is important to identify where native prairie, or unbroken grassland, remains on the landscape.

Recognize these analyses do not provide an assessment of habitat quality. Grasslands are a dynamic ecosystem, with vegetation composition, height, density, and ground cover varying greatly from year to year depending on climate conditions and land use. The amount of invasive and noxious vegetation is not captured in the analysis. Regardless of the visual quality or invasiveness of unbroken grassland, core areas of this crucial habitat are essential to sustain North Dakota wildlife and species of conservation priority for the future.

For the 2015 SWAP, the NDGFD identified extant native (uncultivated) prairie. The USGS 2010 GAP Landcover and the 2011 National Land Cover Dataset as foundation layers for identifying native grassland. To prevent overestimation of native grassland, additional data were utilized to filter out these occurrences. These data include USDA-NASS 2013 Cultivated Layer and USDA Farm Service Agency CRP data through the year 2012. Grassland vegetation classes were extracted from the foundation layers, reclassified and merged to create one raster layer identifying native grassland. NASS 2013 Cultivated Layer and FSA CRP 2012 were used to subtract cells potentially misclassified as grassland to prevent overestimation and a current representation of native grassland.

The final product consists of 30X30 meter raster layer of unbroken, native grassland vegetation. Neighborhood statistics were used to compute an output raster where the value for each output cell is a function of the values of all the input cells in the specified neighborhood. Using neighborhood statistics can provide a better representation of the landscape at varying scales and identify core native grassland areas. To accommodate various scales based on wildlife literature and survey methodology, the resulting datasets quantify the amount of native grassland in neighborhood sizes of 160 acres, 4 square miles and 16 square miles. These products are a derivative of a land use/landcover classification.

For the Key Native Wildlife and Habitat Areas, the moving window analysis was used to determine where unbroken grassland is ≥ 40% within a 4 square mile area (Fig. B3).

Spatial layers available: https://gf.nd.gov/maps/data

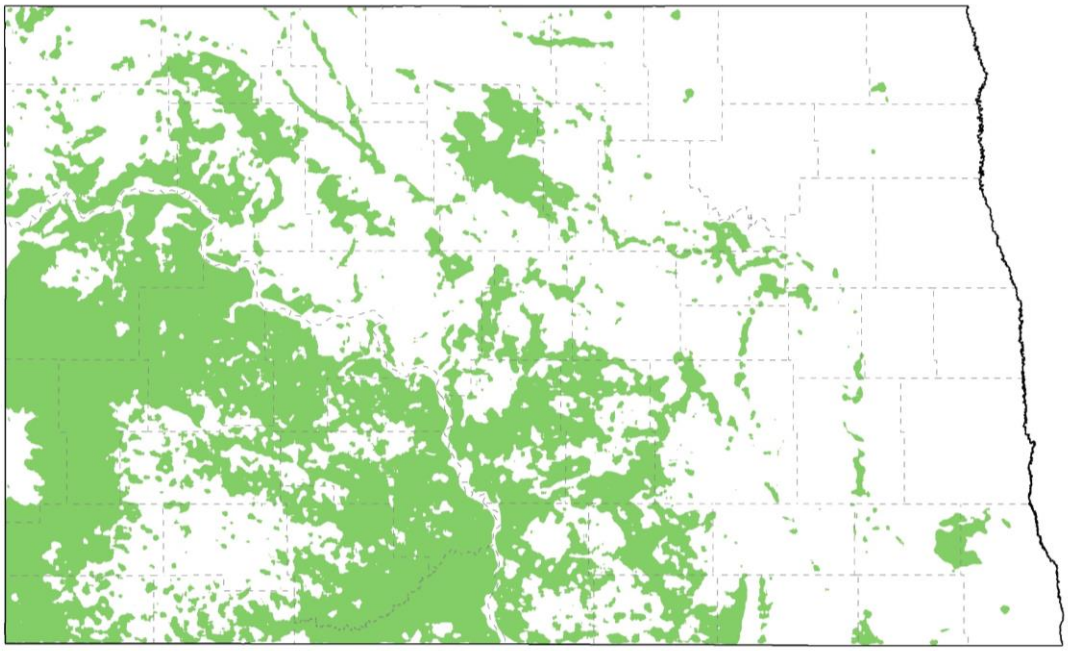


Figure B3. Areas where unbroken grassland is ≥ 40% within a 4 square mile area.

More than half of the core unbroken grassland occurs within Focus Areas.

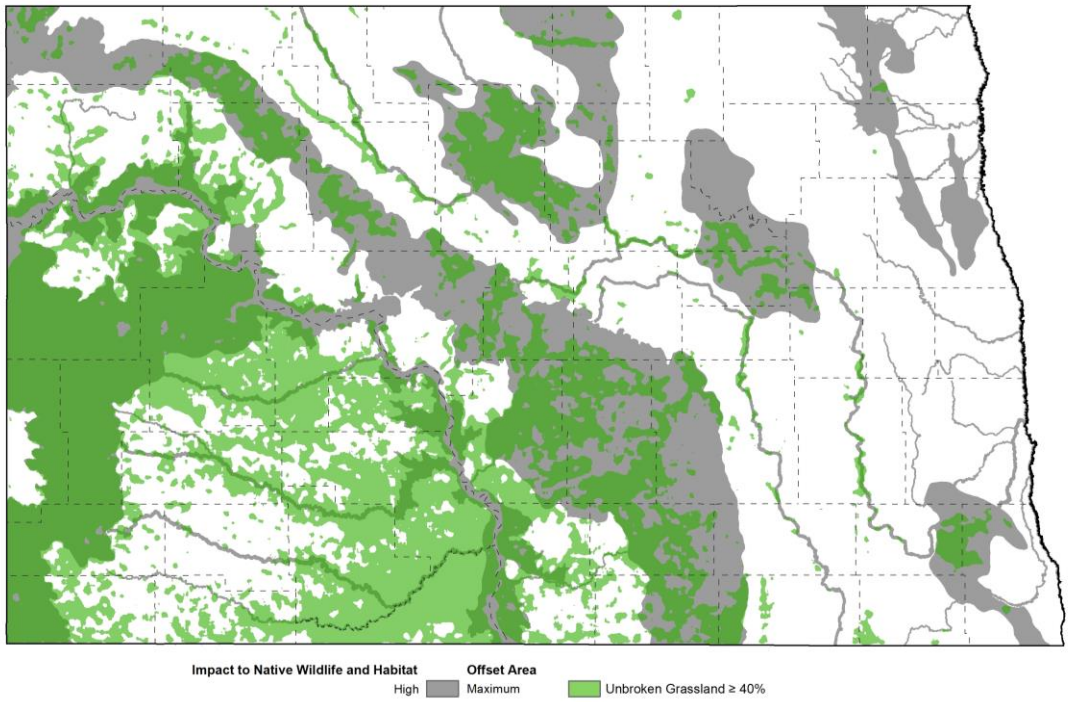


Figure B4. Intersection of unbroken grassland with SWAP Focus Areas/High Impact to Native Wildlife and Habitat.

Unbroken grassland that falls within the Focus Areas is classified as High Impact to Native Wildlife and Habitat. Unbroken grassland that falls outside the Focus Areas is classified as Medium Impact to Native Wildlife and Habitat.

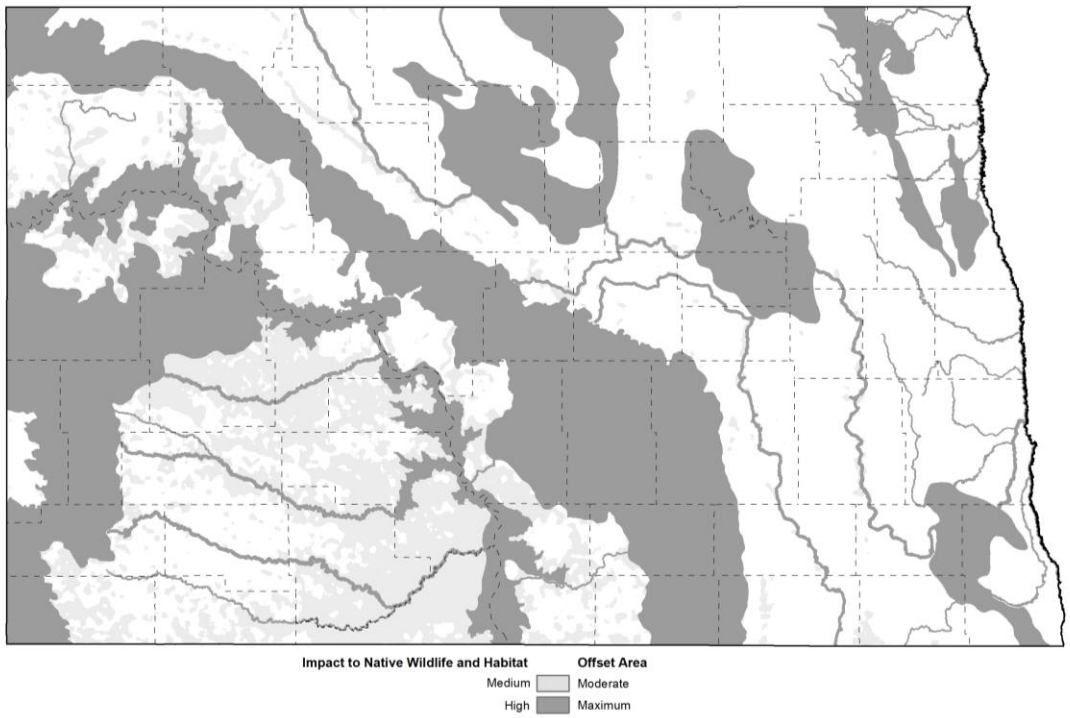


Figure B5. Unbroken grassland located outside the SWAP Focus Areas/High Impact to Native Wildlife and Habitat is classified as Medium Impact to Native Wildlife and Habitat.

NATIVE WOODLAND

The NDGFD identified extant native woodland using a process similar to identifying unbroken grassland. The product used for the Key Native Wildlife and Habitat Areas is where woodland/shrubland is ≥ 40% within a 2 square mile area (Fig. B6). A smaller neighborhood was used because native woodland resources are minimal in North Dakota. Seventeen species of conservation priority are dependent on woodland habitat.

Spatial layers available: https://gf.nd.gov/maps/data

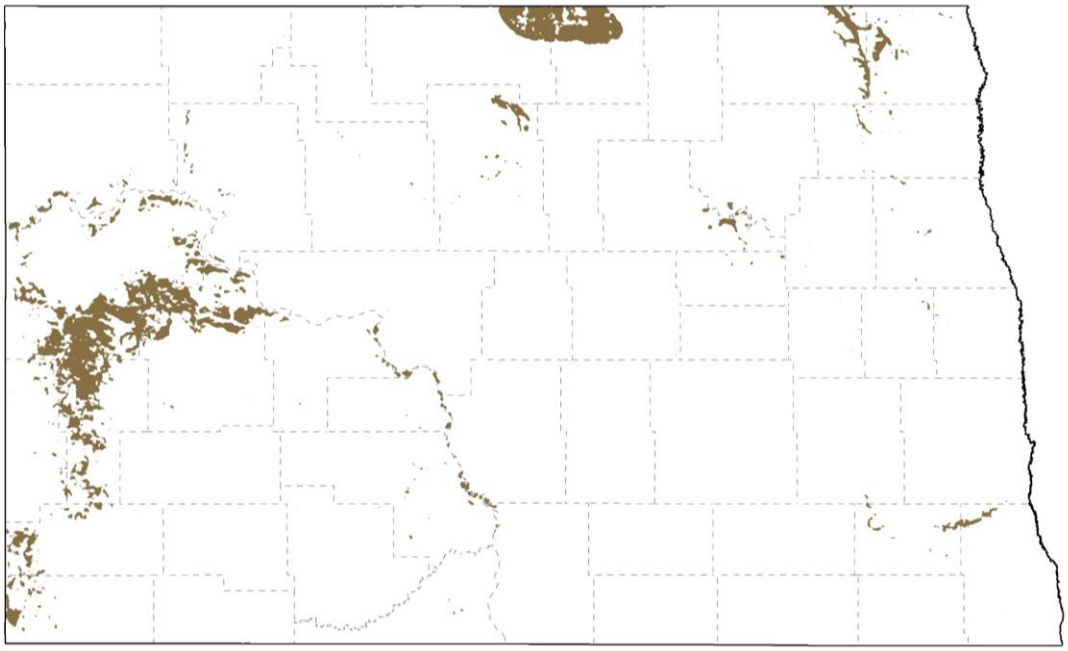


Figure B6. Areas where native woodland is ≥ 40% within a 2 square mile area.

Essentially all of the core native woodland areas occur within Focus Areas (see Figure 7). Therefore, all native woodland will be classified as High Impact to Native Wildlife and Habitat.

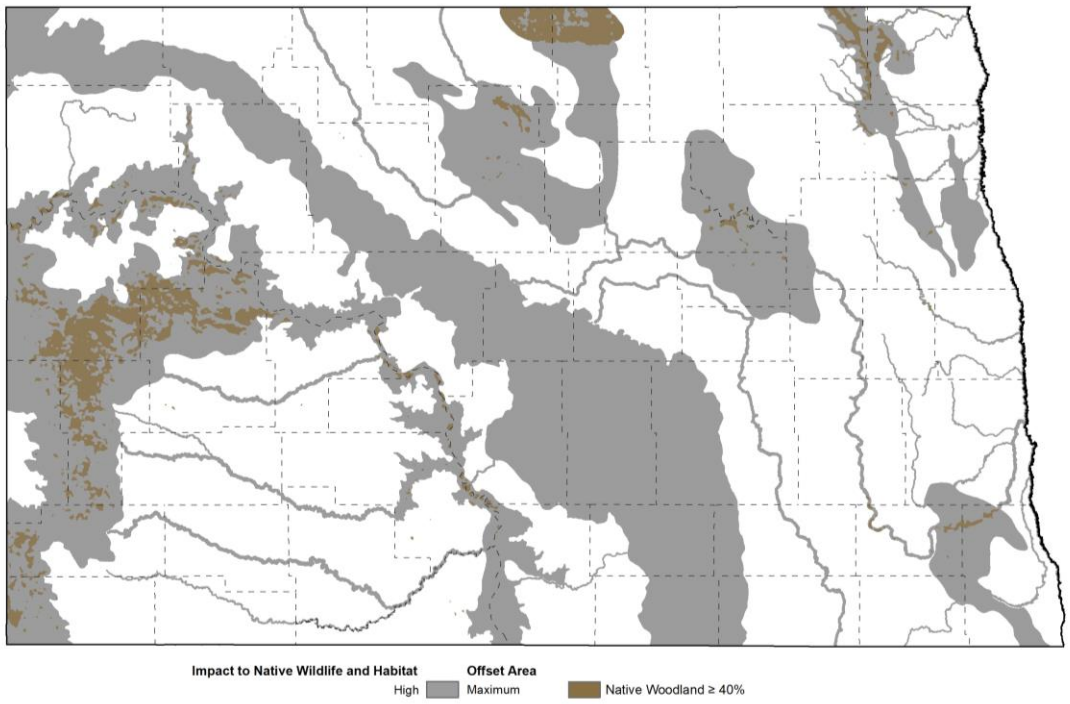


Figure B7. Intersection of native woodland with SWAP Focus Areas/High Impact to Native Wildlife and Habitat.

WETLANDS

The USFWS developed spatially explicit models targeting waterfowl populations that prioritize habitats (e.g. wetland complexes) to benefit upland nesting waterfowl (Reynolds et al. 2006). The upland accessibility by breeding duck pairs is a suitable depiction of wetland density in North Dakota. As such, it also adequately characterizes areas important to the 30 species of conservation priority that are dependent on wetlands. This model is used by the USFWS and other partners to prioritize conservation efforts that benefit waterfowl and other water dependent wildlife. For the Key Native Wildlife and Habitat Areas, the model was selected where the accessibility for breeding duck pairs per square mile is greater than 60.

Spatial layers available: https://gf.nd.gov/maps/data

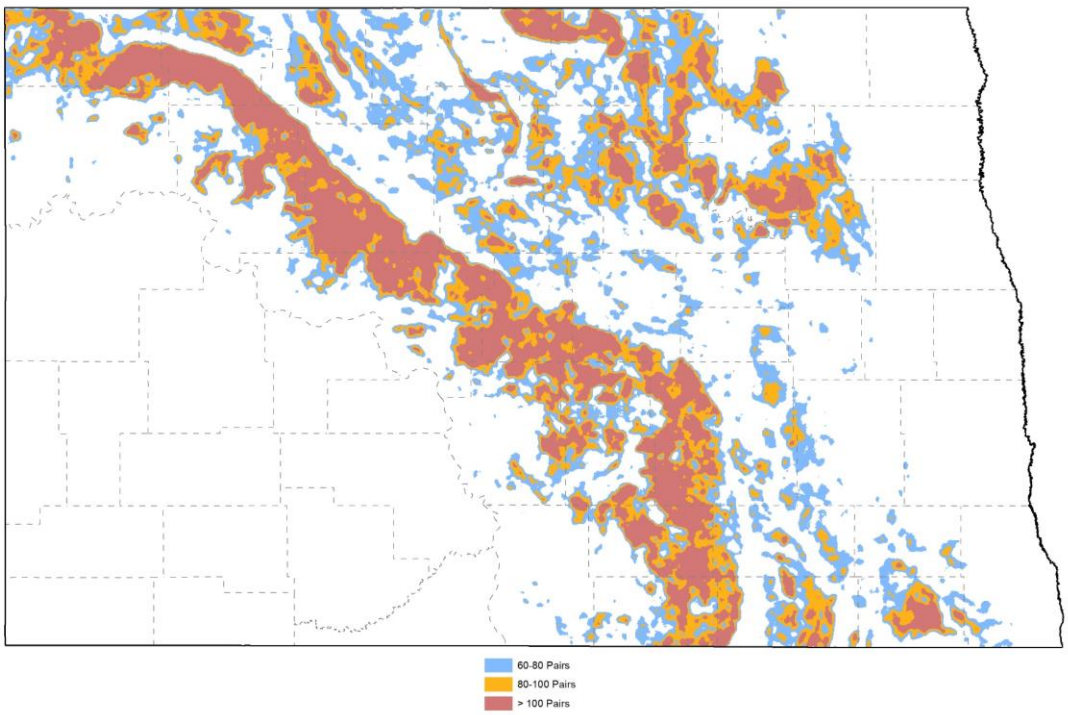


Figure B8. Upland accessibility by breeding duck pairs, also known as the thunderstorm map, is a representation of wetland density.

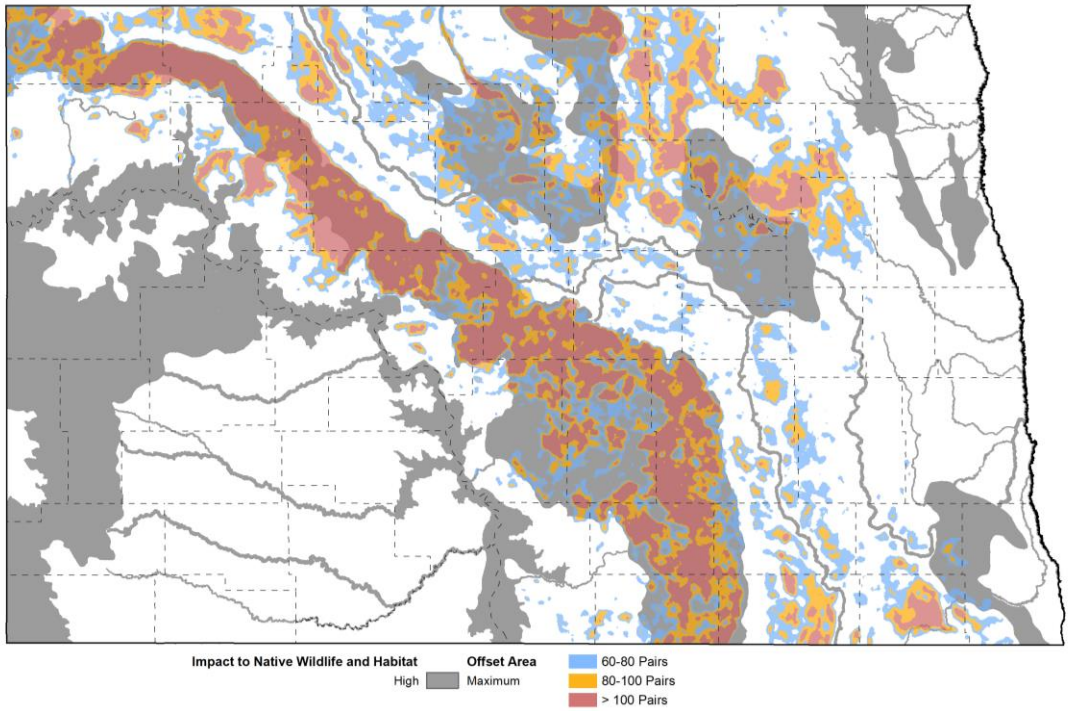


Figure B9. Intersection of the wetland dense areas and the SWAP Focus Areas/High Impact to Native Wildlife and Habitat.

Wetland areas that fall within the Focus Areas is classified as High Impact to Native Wildlife and Habitat. Wetland areas that fall outside the Focus Areas is classified as Medium Impact to Native Wildlife and Habitat.

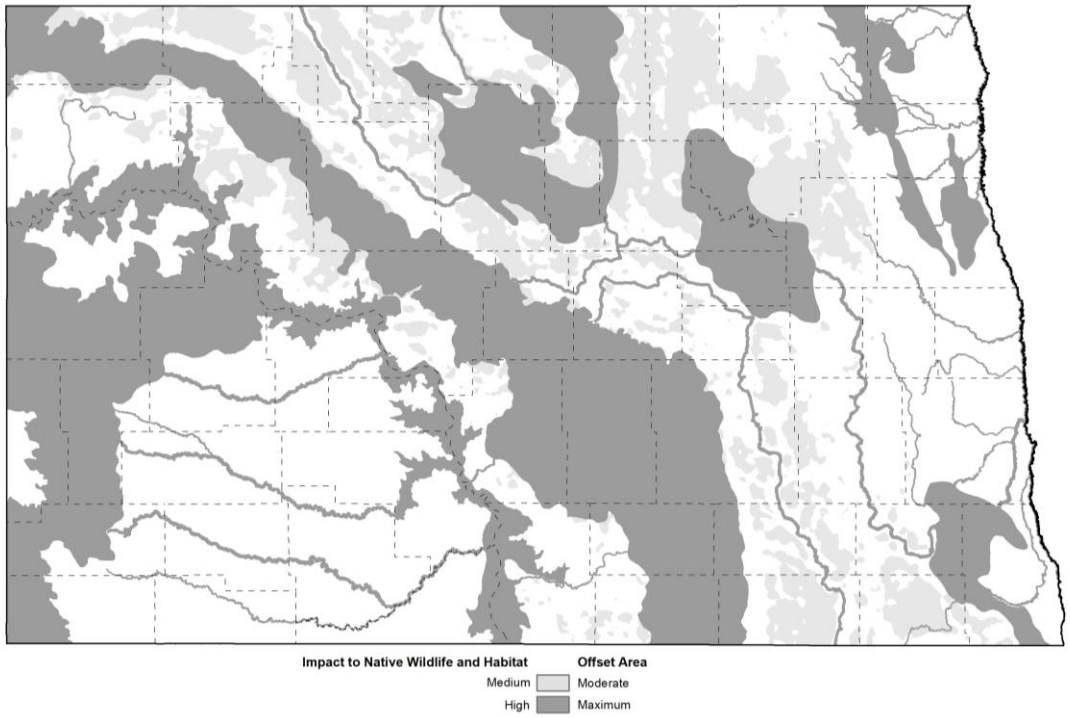


Figure B10. Wetland dense areas located outside the focus areas are classified as Medium Impact to Native Wildlife and Habitat.

KEY NATIVE WILDLIFE AND HABITAT AREAS

The final Key Native Wildlife and Habitat Areas are depicted in Fig. B11. These areas do not represent complete avoidance or exclusion areas for wind energy development. Rather, the high and medium categories contain "*areas where animal or plant species that are unique or rare to this state would be irreversibly damaged."* The map can be used as an initial scoping tool for project siting in areas where impacts to native wildlife and habitat will be minimized.

Characterizations of the impact areas:

Low Impact Native Wildlife and Habitat Areas – This spatial area represents lands that are primarily broken or disturbed land; land that has been converted from its native state to other uses, such as cropland and developed areas, and is a highly fragmented landscape. Offsets for impacts to wildlife and habitat are relatively low, but appropriate siting could often result in little to no impacts. Approximately 37% of the state is in the low category. Constructing wind projects in the low category will have the least impact to key native wildlife and habitat.

Medium Impact Native Wildlife and Habitat Areas – This spatial area represents lands that are partially broken or disturbed. These areas may encompass tracts that have or have not been converted from its native state to other uses, such as cropland and urban sprawl, therefore it is a more fragmented landscape. Offsets for impacts to wildlife and habitat may be of moderate nature, but appropriate siting can result in minimal impacts. Approximately 25% of the state is in the medium category. Constructing wind projects in the medium category will have a higher likelihood of impacting key native wildlife and habitat than projects in the low impact areas.

High Impact Native Wildlife and Habitat Areas – This spatial area represents a mostly intact and undisturbed landscape. These areas contain large tracts of land that have not been converted from their native state to other uses, such as cropland and developed areas, and are therefore a less fragmented landscape. Offsets for impacts to wildlife and habitat would be at their highest, but appropriate siting can result in moderate to minimal impacts. Approximately 37% of the state is in the high category. Constructing wind projects in the high category will have the greatest impact to key native wildlife and habitat.

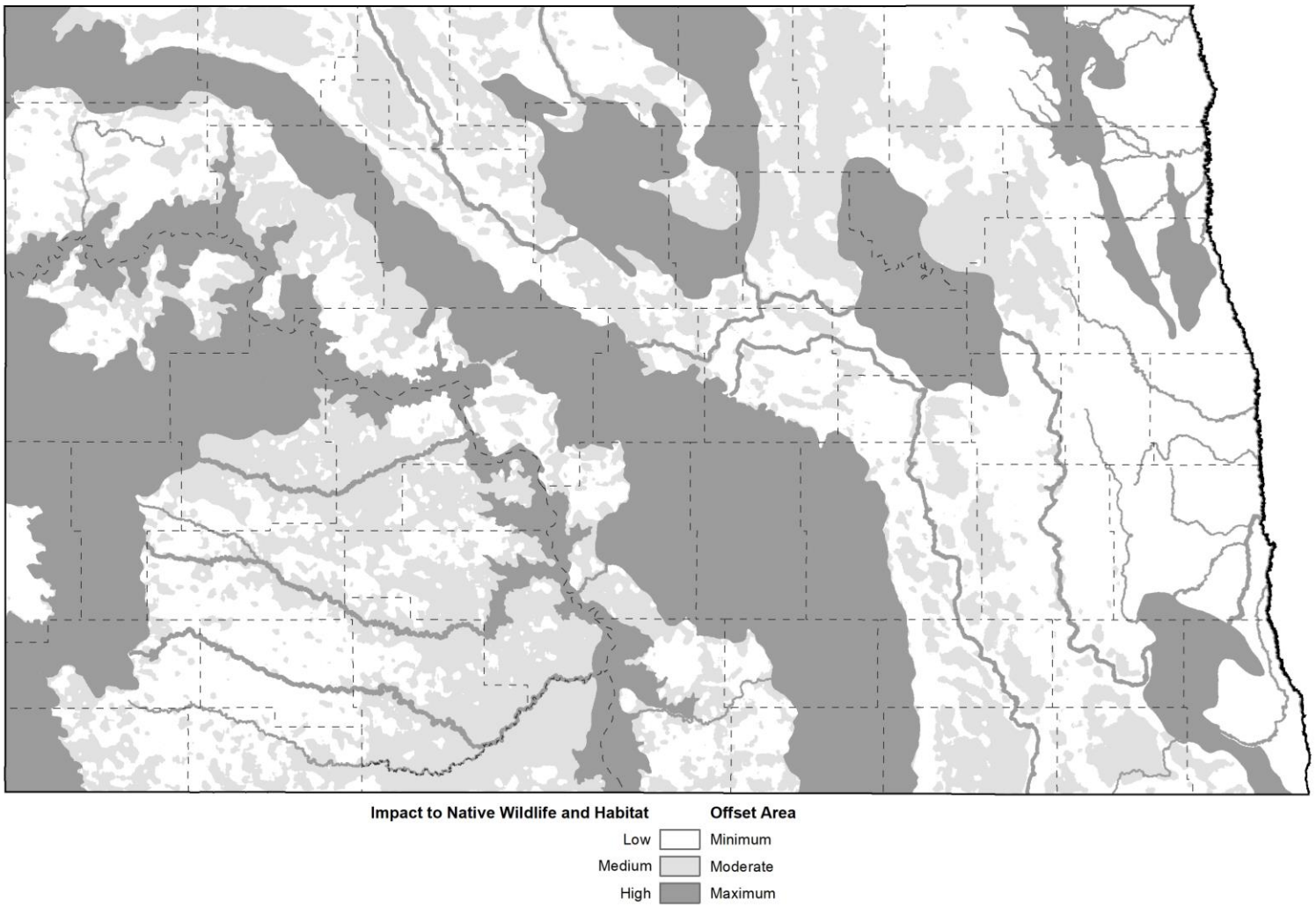


Figure B11. Key Native Wildlife and Habitat Areas.

APPENDIX C. SUPPLEMENTAL MAPS FOR WIND ENERGY SITING

The following maps should be used in conjunction with Table 2. Risk Analysis Assessment.

WHOOPING CRANE

Whooping crane migration corridors were delineated using opportunistic sightings and location data from telemetered birds. The migration corridors are well defined and include 50%, 75%, and 95% core corridors (Pearse et al. 2018).

Spatial layer available:
https://www.sciencebase.gov/catalog/item/5a314a72e4b08e6a89d707e0

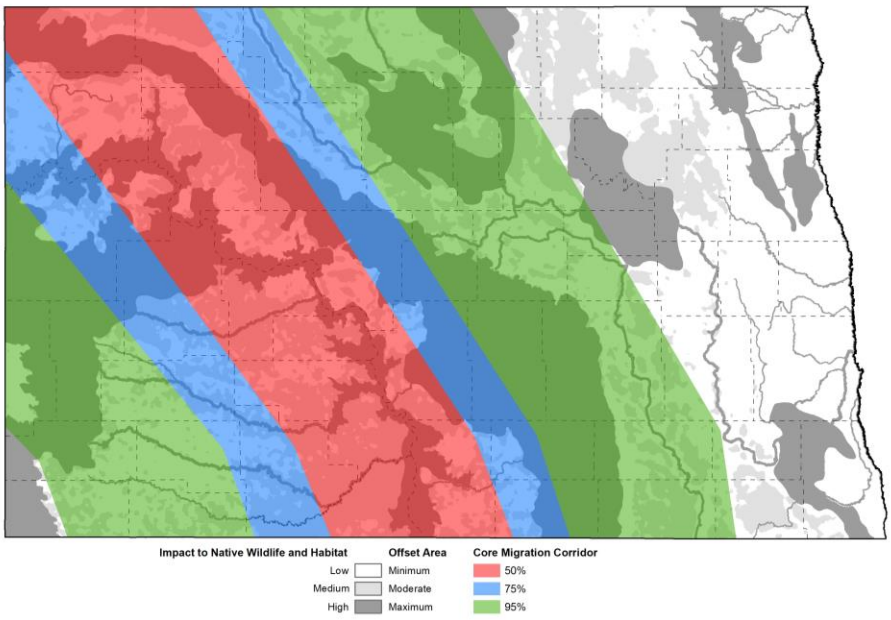


Figure C1 (a). Whooping Crane core migration corridors.

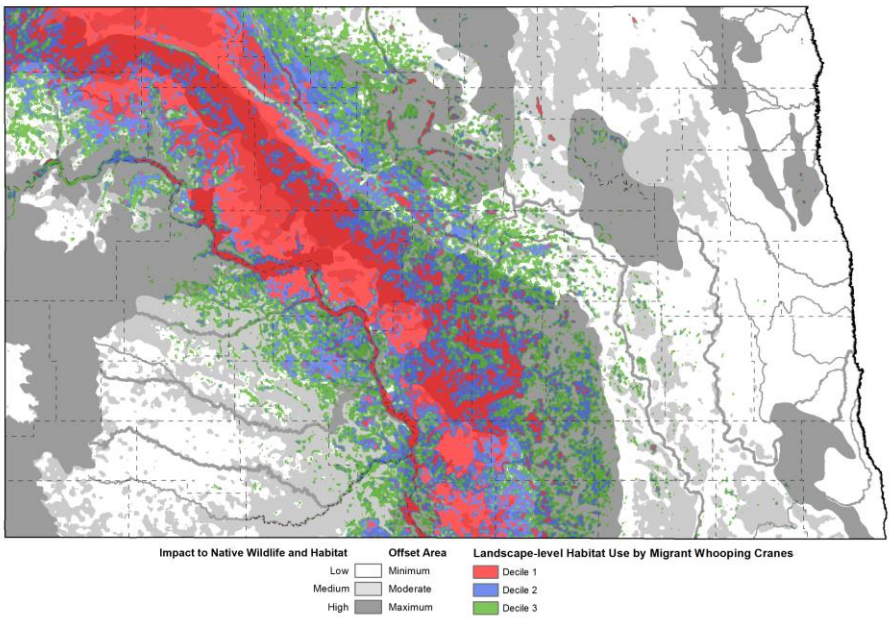


Figure C1 (b). Ranked probability of landscape-level habitat use by migrant Whooping Cranes in North Dakota (Niemuth et al. 2018). This spatial layer can be used for site-level planning.

USFWS THREATENED AND ENDANGERED SPECIES CRITICAL HABITAT

Critical habitat has been identified for four federally listed threatened or endangered species: Piping Plover, Interior Least Tern, Dakota Skipper and Poweshiek Skipperling. Most of the designated critical habitat is located within High Impact to Native Wildlife and Habitat.

Spatial layers available: https://www.fws.gov/gis/data/national/

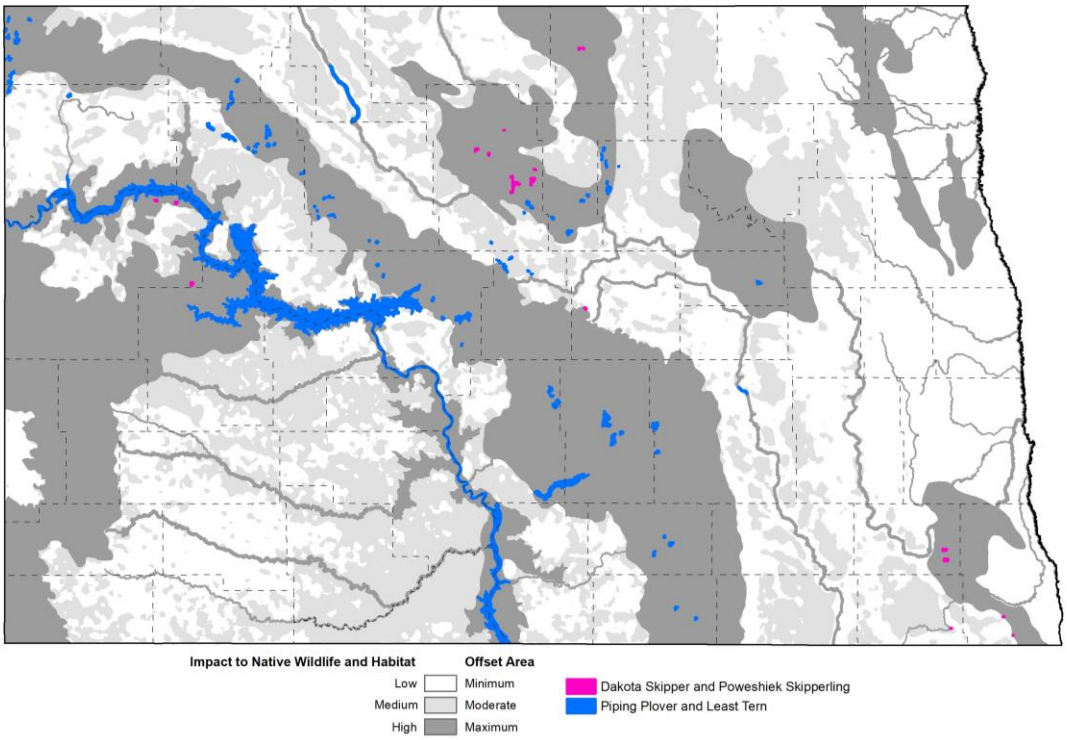


Figure C2. Threatened and endangered species critical habitat.

GREATER SAGE-GROUSE AND GREATER PRAIRIE-CHICKEN PRIMARY RANGE

The sage-grouse and prairie-chicken have limited ranges and population in North Dakota. They are unique, high-valued upland game birds. Due to a variety of reasons, namely loss of habitat, the two species are on the verge of extirpation from the state. Their primary ranges overlap mostly High Impact to Native Wildlife and Habitat.

Spatial layers available: https://gf.nd.gov/maps/data

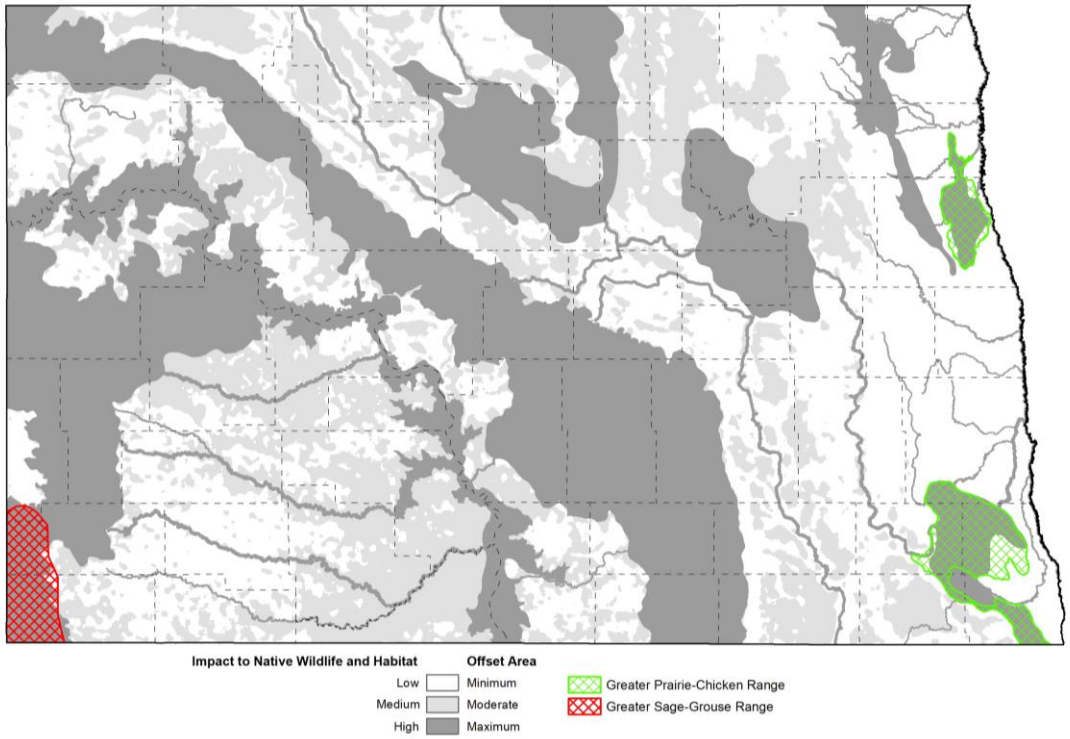


Figure C3. Greater Sage-Grouse and Greater Prairie-Chicken primary ranges.

SHARP-TAILED GROUSE PRIMARY AND SECONDARY RANGE

The Sharp-tailed Grouse is found across North Dakota, but abundance increases from east to west. The majority of leks are found on grassland within Medium and High Impact to Native Wildlife areas.

Spatial layers available: https://gf.nd.gov/maps/data

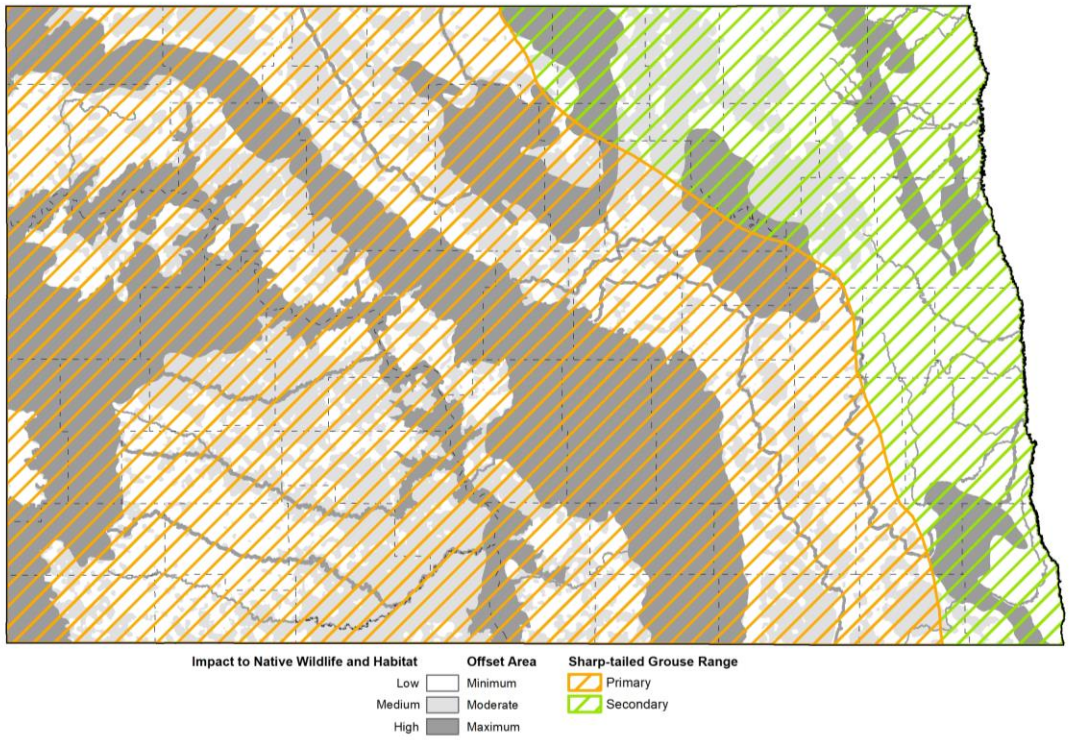


Figure C4. Sharp-tailed Grouse primary and secondary range.

BIG GAME PRIMARY RANGE – BIGHORN SHEEP, ELK, MULE DEER AND PRONGHORN

Bighorn sheep, elk, mule deer and pronghorn are four of North Dakota's most prized big game species. These species have a limited range in the state compared to other big game. These species are more sensitive to habitat fragmentation and anthropogenic disturbance than other big game species.

Spatial layers available: https://gf.nd.gov/maps/data

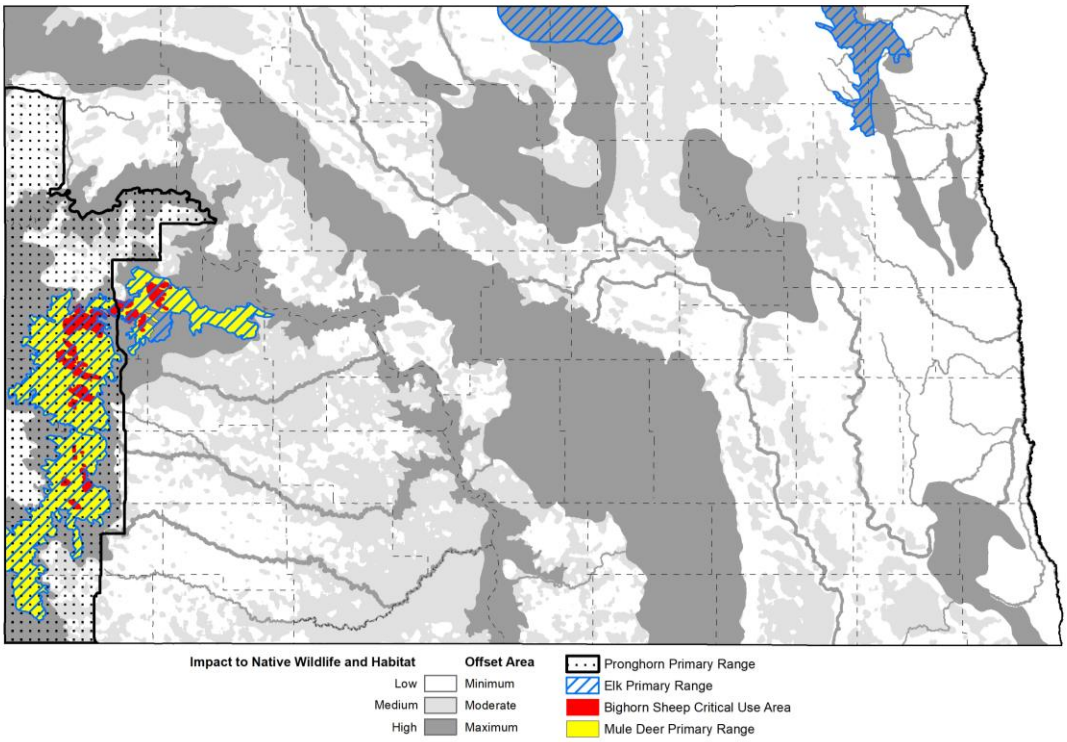


Figure C5. Big game primary ranges and critical use areas.

BALD AND GOLDEN EAGLES

The bald eagle population and number of nest sites is increasing significantly in North Dakota. The number of nest sites has increased from 10 known sites in 2000 to more than 300 in 2017. Due to the continual increase and selection of non-traditional nest sites, it is possible that bald eagle nests may be found anywhere across the state where large trees are present. However, 65% of the known bald eagle nest sites are within High Impact to Native Wildlife and Habitat and nearly 75% of the known sites are in or within 1 mile of High Impact to Native Wildlife and Habitat.

The golden eagle population and nest sites are not increasing as much as bald eagles. The primary nesting range is known but not all nests have been documented. More than 95% of the known golden eagle nest sites are within High Impact to Native Wildlife and Habitat.

Spatial layers available: Contact NDGFD for the most current information.
Golden eagle cliff nesting habitat available: https://gf.nd.gov/maps/data

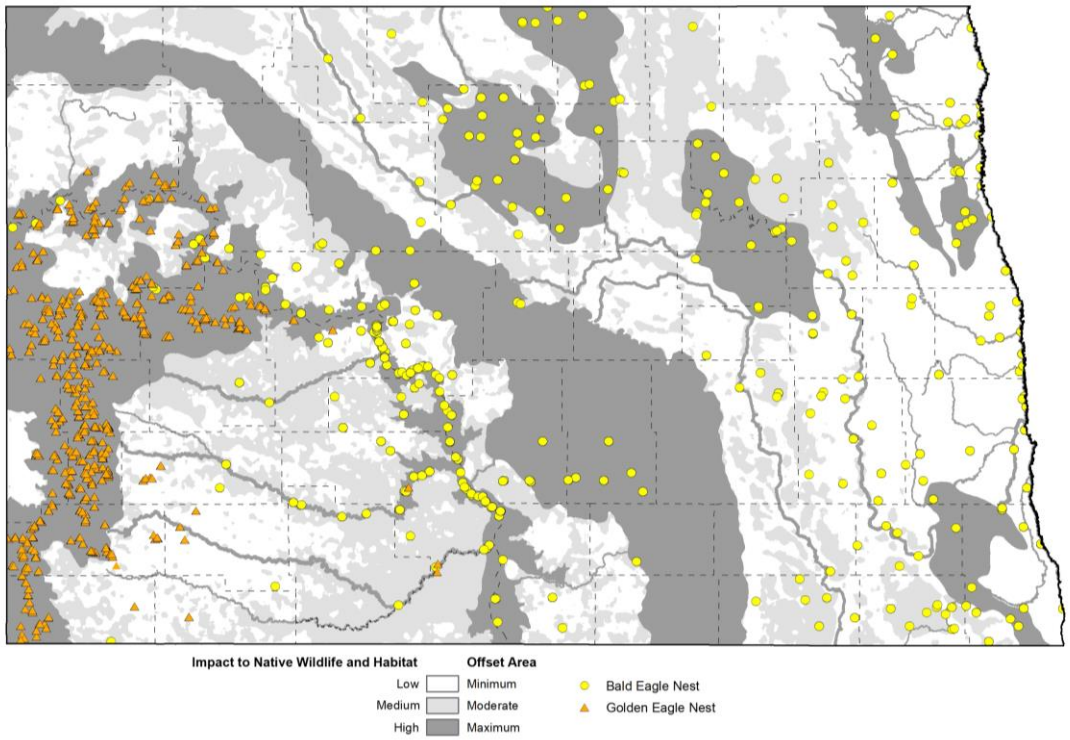


Figure C6. Known bald and golden eagle nest sites as of March 2018. Not all nest sites displayed in the figure are active. This figure provides developers a general sense of the geography of bald and golden eagle nest sites. Contact the NDGFD for current information.

IMPORTANT BIRD AREAS

BirdLife International, in conjunction with partners such as the Audubon Society, has identified over 12,000 Important Bird Areas (IBA). These sites represent some of the most important places for birds at the global or regional level.

Spatial layers available:
http://www.arcgis.com/home/item.html?id=af5fe0b13bae4f8297700345d27201fa

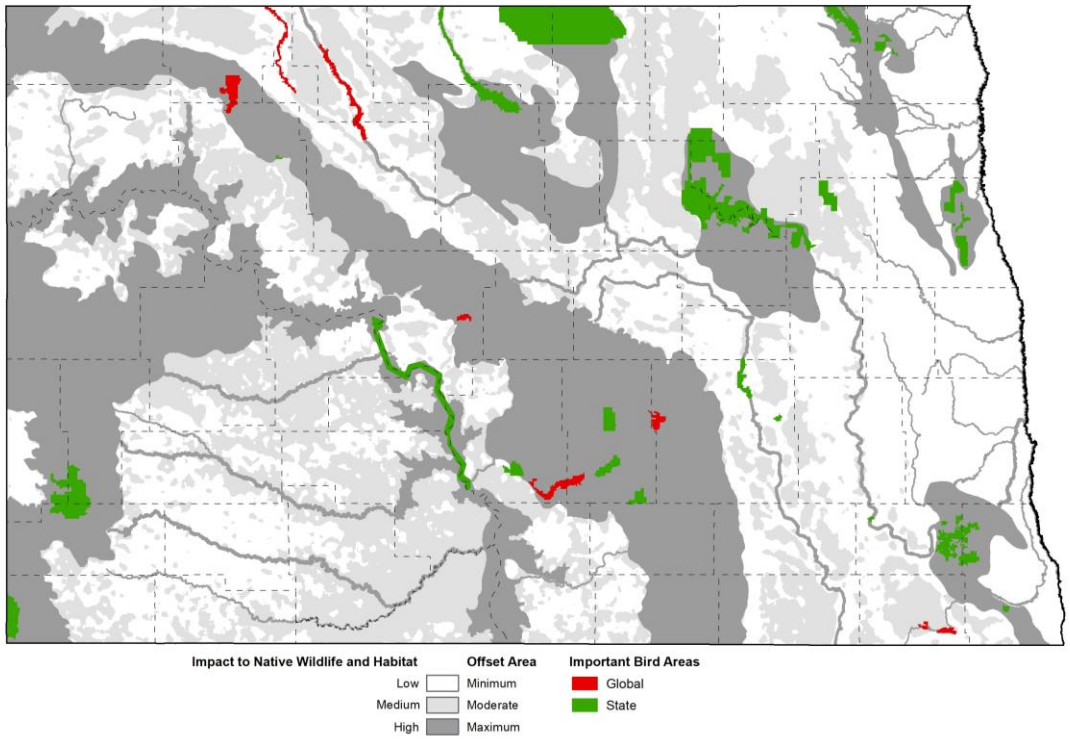


Figure C7. Important Bird Areas in North Dakota.

THE NATURE CONSERVANCY PRIORITY CONSERVATION AREAS AND TARGETS

The Nature Conservancy identified areas in ecoregions throughout the United States that represent the top places where native species and plant communities should be conserved.

Spatial layers available: http://www.uspriorityareas.tnc.org/

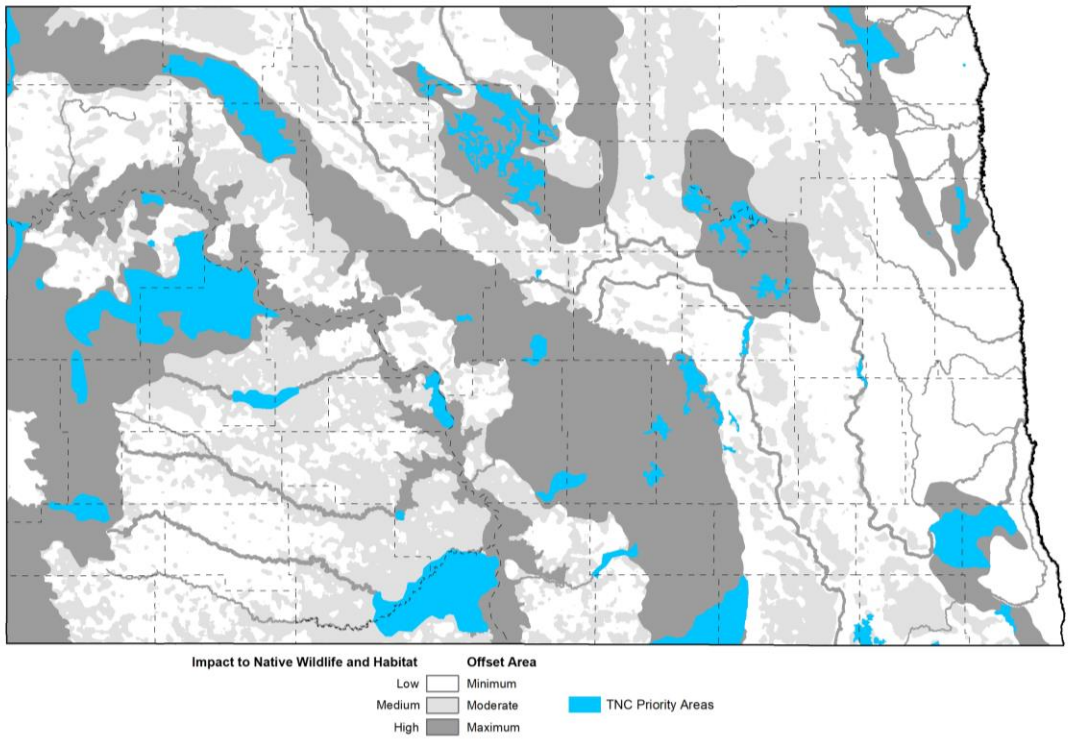


Figure C8. The Nature Conservancy Priority Conservation Areas.

DESIGNATED NATIONAL PARK, WILDERNESS AREA, WILDLIFE AREAS, WILDLIFE REFUGES, AND FEDERAL ROADLESS AREAS

N.D. Admin. Code § 69-06-08 lists criteria that must guide the energy conversion facility site suitability evaluation process. Figure 20 depicts the national geographical areas which are relevant to native wildlife and habitat, signified below in bold text from N.D. Admin. Code § 69-06-08-01. Note that no wild, scenic or recreational rivers have been designated in North Dakota.

1. Exclusion areas. The following geographical areas must be excluded in the consideration of a site for an energy conversion facility.

    a. Designated or registered national: **parks**; memorial parks; historic sites and landmarks; natural landmarks; historic districts; monuments; **wilderness areas**; **wildlife areas**; wild, scenic, or recreational rivers; **wildlife refuges**; and **grasslands**.

Spatial layers available: https://gishubdata.nd.gov/

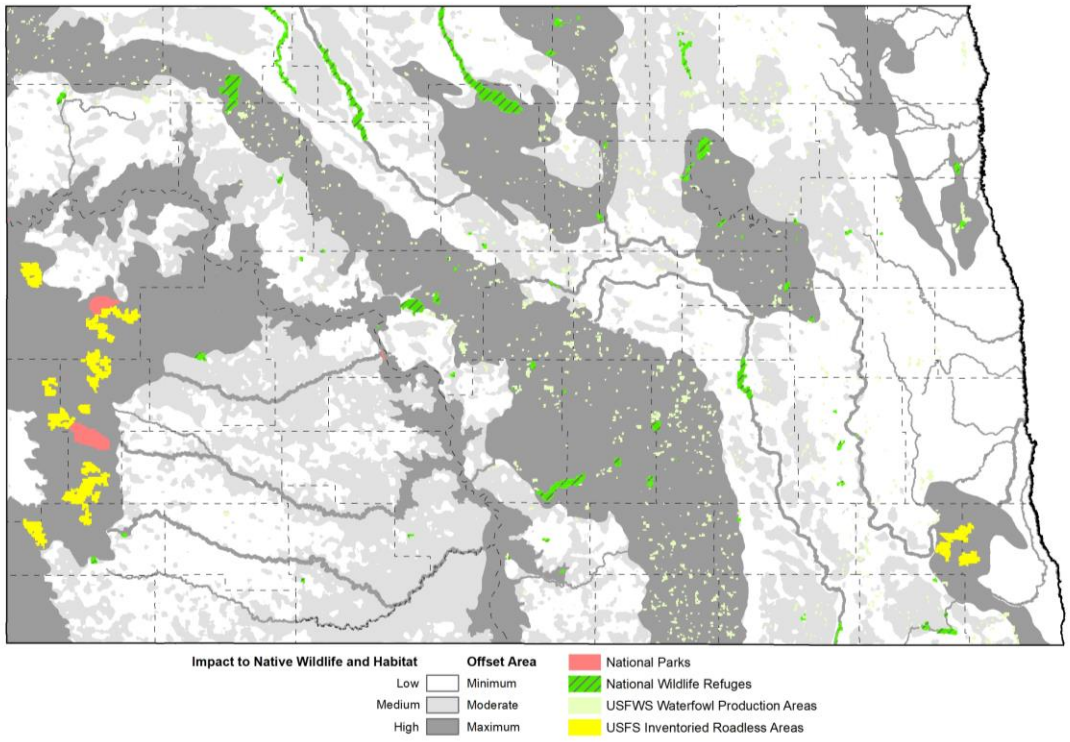


Figure C9. National parks, wildlife refuges, USFWS waterfowl production areas, and USFS inventoried roadless areas.

DESIGNATED STATE PARKS, FORESTS, FOREST MANAGEMENT LANDS, GAME REFUGES, GAME MANAGEMENT AREAS, MANAGEMENT AREAS, NATURE PRESERVES

N.D. Admin Code § 69-06-08 lists criteria that must guide the energy conversion facility site suitability evaluation process. Figure 21 depicts the state geographical areas which are relevant to native wildlife and habitat, signified below in bold text from N.D. Admin Code § 69-06-08-01. Note that no wild, scenic or recreational rivers have been designated in North Dakota.

1. Exclusion areas. The following geographical areas must be excluded in the consideration of a site for an energy conversion facility.

> b. Designated or registered state: **parks**; **forests**; **forest management lands**; historic sites; monuments; historical markers; archaeological sites; **grasslands**; wild, scenic, or recreational rivers; **game refuges**; **game management areas**; **management areas**; and **nature preserves**.

Spatial layers available: https://gishubdata.nd.gov/

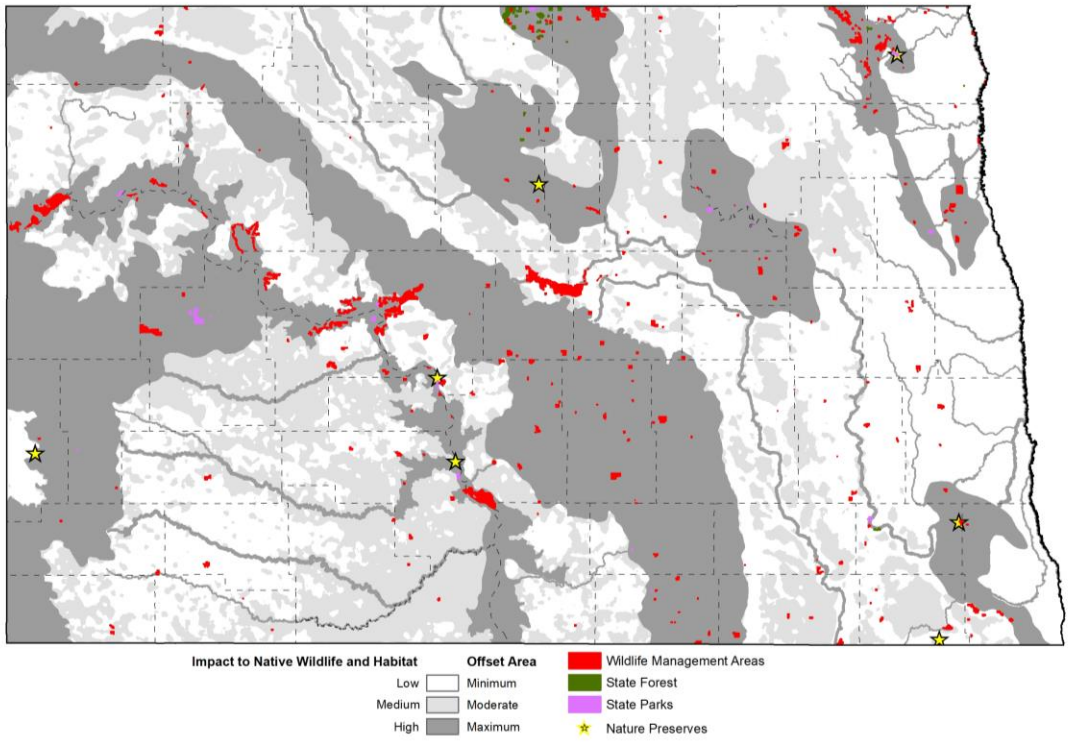


Figure C10. State parks, forests, wildlife management areas, and nature preserves.

APPENDIX D. RECOMMENDED WILDLIFE SURVEY METHODS

Raptor Surveys

Bald and Golden Eagle

NDGFD maintains a spatial database of known Bald and Golden Eagle nests and other raptors in North Dakota. The records are protected by ND Century Code §20.1-02-29 and only shared for legitimate projects. To request a query of known nests within the impacted project area, e-mail a shapefile (not zipped) of the project area and description of the project to Sandra Johnson, sajohnson@nd.gov. A data sharing agreement is required before data may be provided. Additionally, the recipient of the data will be required to provide results of wildlife surveys conducted for the specified project.

Surveys for eagle nests should follow the U.S. Fish and Wildlife Service (USFWS) Region 6, Recommended Protocol for Conducting Pre-construction Eagle Nest Surveys at Wind Energy Projects, January 14, 2020. https://www.fws.gov/guidance/sites/default/files/documents/USFWS%20R6%20recommended%20Eagle%20Nest%20Survey%20Protocol%20for%20wind%20projects_14Jan2020.pdf

Other Raptors

In general, aerial raptor nest surveys should be conducted at least twice during the breeding season. Surveys can be conducted during pre-breeding season, before leaf-out, to identify stick nests. Conduct follow-up surveys during the active breeding season (May-July) to identify species and occupancy. Record GPS coordinates of every nest site. Recognize that several raptor species nest on the ground, typically in grasslands (Ferruginous Hawk, Burrowing Owl) or wetland edges (Northern Harrier). Survey methods and intensity may vary across the state. Project proponents should coordinate with the NDGFD and USFWS during the early planning phase on specific raptor protocol.

Grouse Surveys

Greater Sage-Grouse and Greater Prairie-Chicken

NDGFD and collaborators attempt to locate and monitor all known displaying grounds (leks for Sage-Grouse or booming grounds for Prairie-Chicken) in North Dakota. For this reason, Greater Sage-Grouse and Greater Prairie-Chicken surveys are not recommended. NDGFD will provide pre-survey data to the developer for the relevant area.

Sharp-tailed Grouse

NDGFD and collaborators conduct annual Sharp-tailed Grouse surveys on 32 survey areas across the state. When a footprint overlaps an active survey area, NDGFD will provide pre-survey data for the relevant survey area ONLY.

Survey Efforts

1. Approximately a dozen mornings are needed to census a township (36 square miles).
2. Secure permission to access area by vehicle.
    - It is recommended that the surveyor be able to drive within 1/2 mile of any spot in the area to listen for displaying grouse and be able to count each ground from a vehicle. Displaying grouse will allow a much closer approach by a vehicle than a person on foot. If grouse are spooked, detection of leks is very unlikely unless the birds flush.
3. Increased effort is required to survey grouse near highways, power plants, or other sources of noise pollution. Most grounds should be located by sound so any interference should be avoided to the extent possible.
    - Wetland areas are also a source of interference due to large numbers of waterfowl, blackbirds and other noisy critters.
4. ***Note: Aerial surveys for prairie grouse displaying grounds are inappropriate for pre-development surveys because they have been shown to produce low levels of detection rates and, subsequently, yield results that identify occupied areas as unoccupied.***

Survey Methods

1. Set up a 0.5 x 0.5 mile grid of points that are accessible by vehicle or ATV.
2. Drive to each point, shut off vehicle, and walk at least 20m from the vehicle (to avoid vehicular noises, such as engine cooling.)
3. Listen for 3-5 minutes during peak activity time.
    - 45 minutes before to 45 minutes after sunrise.
4. Listen for 5-10 minutes during decreased activity time.
    - 45 minutes after sunrise to 2 hours after sunrise.
5. While listening, use binoculars to glass surrounding terrain.
    - When grouse are dancing their white tails are very visible and easily seen from a distance, providing the vegetation is not too tall.
    - In tall vegetation grouse often “flutter jump” about 5 feet into the air which can help locate grounds.
    - Knolls and flats are likely areas to search for grounds, but grounds can be anywhere (even summer fallow) so do not neglect areas that may initially appear unsuitable.
6. Plot travel and listening stops on a map each day. This will help determine areas of missed coverage and aid in covering the entire area.

Survey Conditions

- Surveys should occur between 15 March and 15 May.
    - Peak of attendance by females on grounds in North Dakota is usually 15-25 April but may vary depending on weather.
- Each area should be surveyed entirely 3 times with at least 2 weeks between survey efforts.
- Survey effort should only take place 45 minutes before sunrise to 2 hours after sunset.
- Conditions should be clear (no precipitation) and calm (wind < 10mph).
    - Do not attempt surveys during any sort of precipitation; grouse are not active at that time.

Bat Surveys

Bats are long-lived (up to 30 years), reproduce at slow rates (as low as one young per year) and can move long distances during spring and fall, making them particularly susceptible to population declines. High bat fatalities at some eastern wind facilities (4,000 annual deaths at one facility in West Virginia) have brought recent attention to the potential negative impacts to these species posed by wind facilities (Arnett 2005).

Acoustic monitoring is the most cost effective and common method to determine bat activity in the proposed area. Bats use echolocation calls to navigate and forage for prey during flight. These calls can be recorded by specialized equipment to determine species composition, baseline patterns in seasonal and daily bat activity levels, and the timing and occurrence of short-term increases in activity such as migration.

Survey Duration and Timing

Acoustic surveys should begin at a minimum two years pre-construction. Acoustic monitoring should adequately cover periods of migration as well as periods of known high activity for resident species (USFWS WEGs). For North Dakota, surveys should be conducted from April 15 through October 15. This period encompasses the earliest migrants into the state in spring and out of the state in fall (Seabloom 2011).

Recording should occur daily beginning 30 minutes prior to sundown and end 30 minutes after sunrise to cover the foraging period. Detectors should be monitored often for proper function to avoid long periods without data collection.

Detector Placement

Detectors should be place on all temporary and permanent metrological towers (met towers) in the proposed area. Equipment should be placed in a manor to cover both the rotary sweep zone (RSZ) and near ground level (< 10m) to detect all bat activity in the proposed area. Having detectors at multiple heights can improve the detection of the bat species in the area (Collins and Jones 2009). If the number of met towers at the site is insufficient to gather meaningful bat acoustic data, raising

temporary towers is recommended. In addition to met tower sample locations, ground level detectors should be deployed to sample all habitat types, particularly any water or trees within the project area.

Reporting

Bat acoustic survey reports should include a detailed description of survey methods: equipment used, start and end dates, height of detector(s), description of habitat surrounding the detector(s), map of detector location(s) and any other pertinent information. Bat acoustic survey reports should be specific and include total number of call files; number and percent of call files identified as bat calls; bat calls per hour; bat calls per night graphed; bat calls by species/species group in table and graph format; number and percent of unidentified bat calls; filtering parameters; any potential relationship to high-value habitat (i.e. large blocks of grassland/forest, stream corridors, wetlands, hibernacula); influences of detector location(s); influence of weather on calls; and any other pertinent information (Mixon 2014).

Study Evaluation

It is recommended that survey designs be shared with the NDGFD prior to beginning surveys to ensure that it meets the needs of a pre-construction survey.

Northern Long-eared Bat Maternity Roost Survey

The Northern Long-eared Bat is one of eleven bat species found in North Dakota. It is listed as threatened under the Endangered Species Act. If tree removal is necessary for construction of the wind farm, it is recommended the area be surveyed for Northern Long-eared Bat maternity roosts. If a maternity roost is located, the surveying entity should notify NDGFD personnel. The surveying entity should also refer to the Federal Register Final 4(d) Rule for the Northern Long-eared Bat for addition regulations (Endangered and Threatened Wildlife and Plants 2016).

APPENDIX E. IMPACTS ANALYSIS AND VOLUNTARY OFFSETS

Impacts to Grasslands

Refer to "*A Desktop Approach to Avoid and Minimize Development Impacts to Grassland Habitat and Wildlife in North Dakota*" (insert web link). The purpose of this document is to describe three scales of desktop grassland assessment (statewide, regional, and local) that can be used to minimize impacts to this important habitat during development projects. An example is included to illustrate how various raster and vector spatial layers may be utilized to refine and on-screen digitize the current extent of grassland types within a select project area. This is the process and categories used by the NDGFD to produce a vector dataset of unbroken, restored, and unspecified or inconclusive grassland.

The NDGFD, first and foremost, recommends that project development avoid siting on unbroken grassland. Impacts to other grassland types should be minimized or avoided to the greatest extent possible. To compensate for unavoidable environmental impacts to grasslands, voluntary offsets are recommended to replace the biological loss of affected areas. A framework can be used that quantifies the amount of habitat needed to provide equivalent biological values. For example, the avian-impact offset method (AIOM) described by Shaffer et al. (2019) is a science-based tool that calculates biological values (i.e., avian density) lost by development in a spatially explicit manner. The AIOM includes a model for breeding grassland birds and a model for breeding waterfowl pairs.

The following are two options to assist in determining the amount of impact and offset numbers: (1) Avian Impact Offset Method, and (2) ArcGIS analysis using the grassland assessment final product and assigned metrics.

Note: results may vary depending on the site location and accuracy of spatial products. The NDGFD recommends examining both options.

Option (1). The Avian Impact Offset Method (Shaffer et al. 2019). This method enables the user to estimate the amount of grassland area needed to offset breeding grassland bird avoidance, based on the ability to define five metrics: impact distance, impact area, pre-impact density, percent displacement, and offset density. The model also identifies comparable habitat for potential offset sites. The AIOM can be applied for wind energy and oil and gas development impacts since recent studies have provided evidence and estimates of behavioral avoidance in the vicinity of energy infrastructure. Note the models use assigned raster layers (e.g., grassland cover class used to create Type III GBCA). However, the model allows the user to enter site specific metrics, such as pre-impact and post-impact density, if known, and the model may be adapted with a user's grassland data.
AIOM Access: contact HAPET office in Bismarck, including instructions on how to use AIOM tool. See also Shafer et al. 2019, Shaffer and Buhl 2016, Loesch et al. 2013.

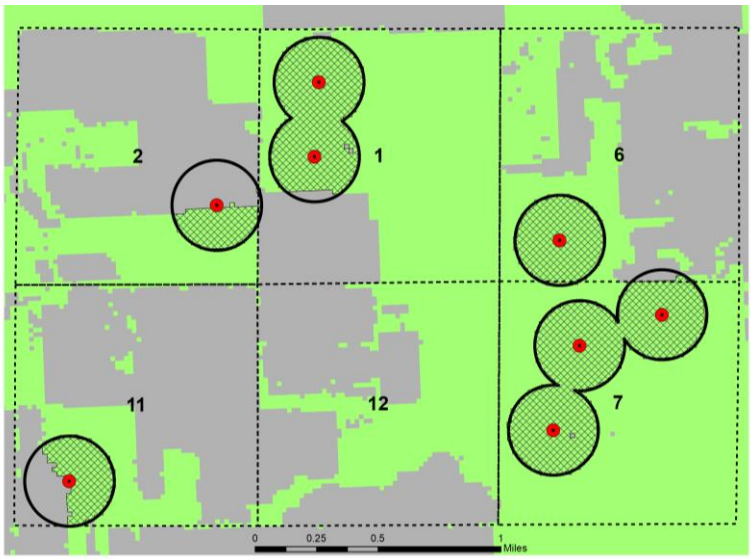
Option (2). ArcGIS analysis using the grassland assessment final product and assigned metrics. This method is used by the NDGFD to assess impacts to unbroken grasslands and grassland bird avoidance because of wind energy development. A standard 300-meter buffer around turbine sites and 53% bird displacement is applied.

The following examples illustrate the results of the two options for wind turbines: a) sited on grassland, and b) not sited on grassland.

EXAMPLE (a): 8 turbines sited *on* grassland

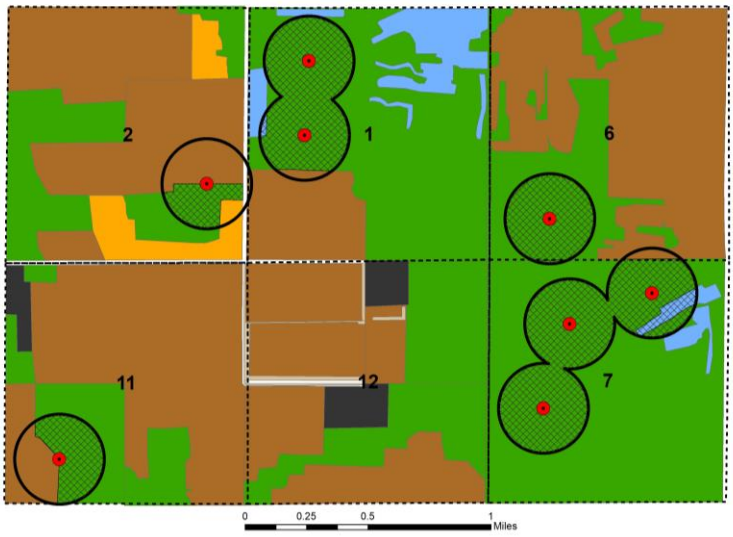
Option (1). Avian Impact Offset Method. The AIOM tool was executed as developed, with default displacement buffer of 300 meters, and displacement of 53%.
Grassland habitat (green), non-compatible grassland bird habitat (gray), wind turbine (red circle), 300 meter buffer (cross hatch).

- Acres of grassland impacted = 477
- Offset acres = 253



Option (2). ArcGIS analysis using the grassland assessment final product and assigned metrics. A 300 meter dissolved buffer was used to clip the local grassland assessment vector layer (unbroken and inconclusive grassland only) and displacement of 53% applied to acres impacted.
Unbroken grassland (green), restored grassland (orange), unspecified or inconclusive grassland (blue), active cropland (brown), and farmsteads (black), wind turbine (red circle), 300-meter buffer (cross hatch).

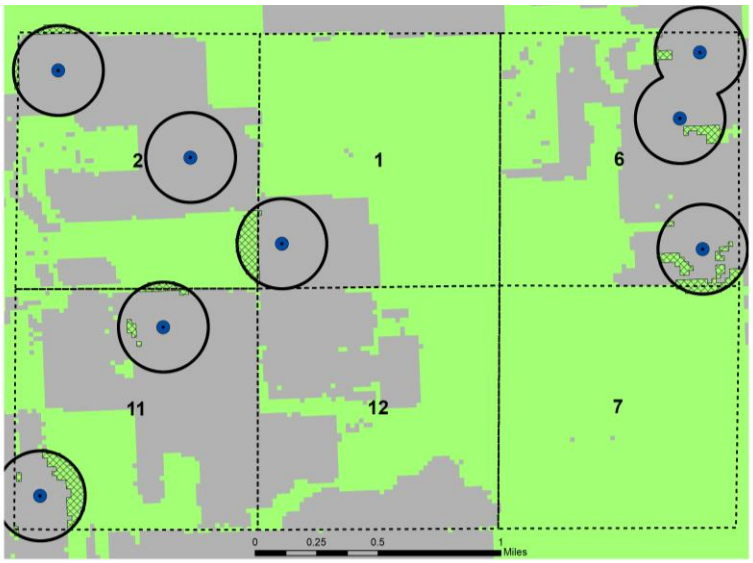
- Acres of unbroken grassland impacted = 474
- Offset acres = 251



EXAMPLE (b): 8 turbines *not* sited on grassland

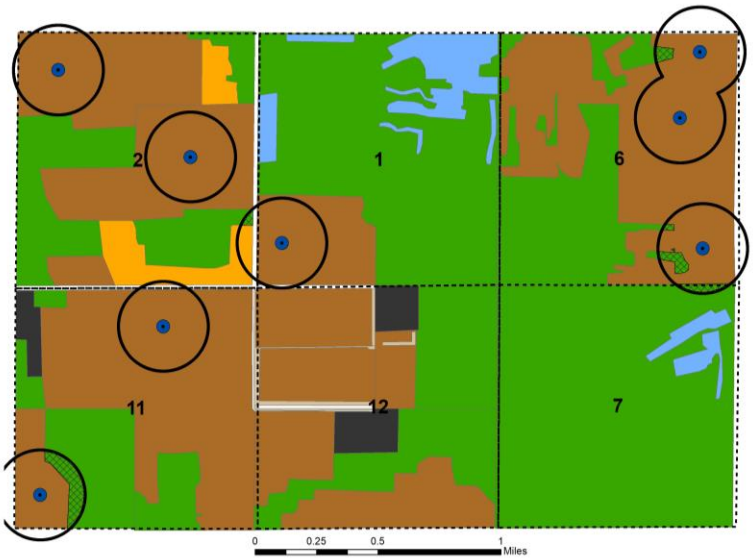
Option (1). Avian Impact Offset Method. The AIOM tool was executed as developed, with default displacement buffer of 300 meters, and displacement of 53%.
Grassland habitat (green), non-compatible grassland bird habitat (gray), wind turbine (blue circle), 300 meter buffer (cross hatch).

- Acres of grassland impacted = 60
- Offset acres = 32



Option (2). ArcGIS analysis using the grassland assessment final product and assigned metrics. A 300 meter dissolved buffer was used to clip the local grassland assessment vector layer (unbroken and inconclusive grassland only) and displacement of 53% applied to acres impacted.
Unbroken grassland (green), restored grassland (orange), unspecified or inconclusive grassland (blue), active cropland (brown), farmsteads (black), wind turbine (blue circle), 300-meter buffer (cross hatch).

- Acres of grassland impacted = 26
- Offset acres = 14



Impacts to Woodlands

To determine the impacts to woodland and woodland obligate species, all trees should be inventoried using diameter breast height (DBH) measurement, which is the tree's diameter, measured approximately 54" from ground level. Trees with a DBH of 2 inches or larger shall be individually counted, trees with a DBH smaller than 2 inches and all shrubs shall be clump counted by square foot. Clump count by square foot is defined as taking the complete square footage of an area of small trees or shrubs and the count estimated to be removed or destroyed equals 1 small tree or shrub per square foot. To obtain the measurement for a multi-stem tree, each stem is to be tallied separately having its own DBH measurement. This inventory should be taken in all areas where removal is expected (turbine pads, roads, and all other infrastructure).

Impacts to Wetlands

The US Fish and Wildlife's Habitat And Population Evaluation Team (HAPET) has developed a Local Siting Decision Support Tool (DST) to estimate the number of duck pairs that are displaced based on research conducted in the Dakotas (Loesch et al. 2013, Loesch 2016). The model also produces an approximation of the number of wetlands requiring restoration that offset the displacement of these breeding pairs. The developer should reach out to the HAPET team, as this tool can be used to estimate impacts and voluntary offsets.

Voluntary Offsets

Voluntary offsets should be considered on a case by case basis. After all pre-construction surveys are completed, the developer should coordinate with the North Dakota Game and Fish Department and US Fish and Wildlife to evaluate if, and what kind of voluntary offsets should be considered based on impacts that could not be avoided.

APPENDIX F. LITERATURE CITED & SUPPLEMETNAL LITERATURE

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