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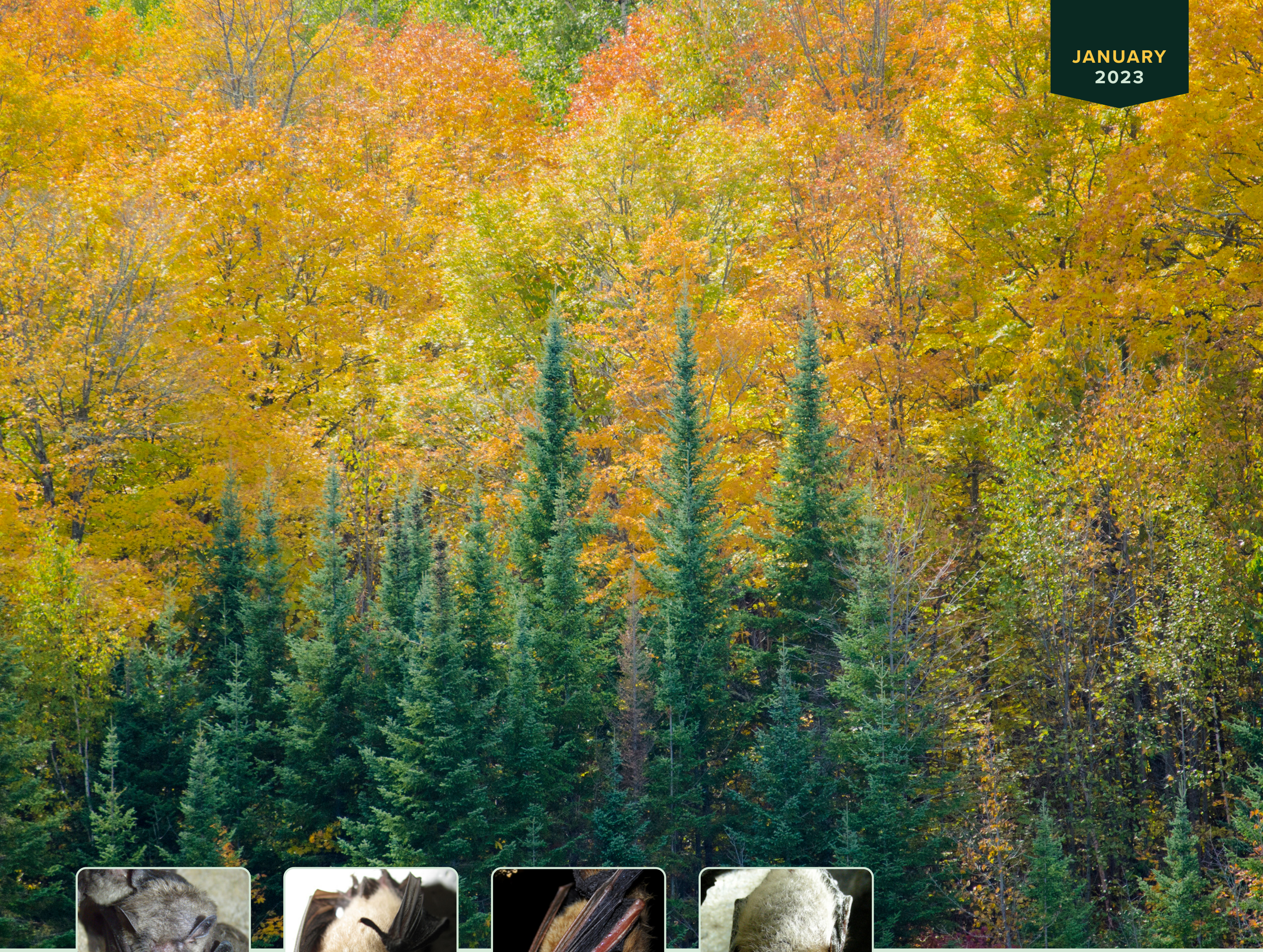

Lake States Forest Management Bat Habitat Conservation Plan

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Acronyms and Abbreviations

Term	Description
AOGCM	Atmosphere-Ocean General Circulation Model
ATFS	American Tree Farm System
BMPs	best management practices
CFR	Code of Federal Regulations
COI	certificate of inclusion
covered bats or covered species	Indiana bats, northern long-eared bats, little brown bats, and tricolored bats
dbh	diameter at breast height
DNR	Department of Natural Resources
ESA	Endangered Species Act
FIA	Forest Inventory and Analysis
FORIST	forest harvest database
FR	Federal Register
FSC®	Forest Stewardship Council®
GIS	geographic information system
HCP	habitat conservation plan
HCP Handbook	Habitat Conservation Planning and Incidental Take Permit Processing Handbook
Lake States	States of Michigan, Minnesota, and Wisconsin
Lake States HCP	Lake States Forest Management Bat Habitat Conservation Plan
NEPA	National Environmental Policy Act
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
SFI®	Sustainable Forestry Initiative®
SNAs	scientific and natural areas
State DNRs	Departments of Natural Resources for Michigan, Minnesota, and Wisconsin
U.S.C.	United States Code
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
Wind Energy Plan	Midwest Wind Energy Habitat Conservation Plan
WNS	white-nose syndrome

Executive Summary

ES.1 Introduction

The Michigan Department of Natural Resources (DNR), Minnesota DNR, and Wisconsin DNR, collectively referred to as the State DNRs, have developed the Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP) to address the potential for forest management activities to cause incidental take of two federally listed bat species and two bat species that may become listed during the permit term. The Lake States HCP covered activities include the following forest management and related activities: timber harvest and related forest management practices; road and trail construction, maintenance, and use; prescribed fire; and conservation strategy implementation. The State DNRs are requesting incidental take coverage for the following four bat species that inhabit forests from spring to fall and hibernate over the winter in caves and mines.

- **Indiana bat (*Myotis sodalis*).** A medium-sized, insectivorous bat that currently only occurs in Michigan. It is federally listed as endangered under the Endangered Species Act of 1973, as amended (ESA).
- **Northern long-eared bat (*Myotis septentrionalis*).** A medium-sized, insectivorous bat distinguished from other eastern species of *Myotis* by its long ears. It is federally listed under ESA as threatened with a 4(d) Rule and occurs in all three states. In March 2022, the U.S. Fish and Wildlife Service (USFWS) proposed to reclassify the northern long-eared bat as an endangered species under ESA. A listing decision was published on November 30, 2022, reclassifying the species as endangered. This final rule goes into effect on January 30, 2023. It occurs in all three states.
- **Little brown bat (*Myotis lucifugus*).** This bat was once among the most common and wide-spread species and is under discretionary status review with the potential to become federally listed due to its rapid decline from white-nose syndrome (WNS), but it is not currently listed under ESA. It occurs in all three states.
- **Tricolored bat (*Perimyotis subflavus*).** This wide-ranging species is also in decline due to WNS and has been petitioned for listing but is currently not listed under ESA. In September 2022, the USFWS proposed to list the tricolored bat as an endangered species under the ESA. It occurs in all three states.

The State DNRs practice sustainable forestry for the purpose of promoting wildlife, enhancing, and maintaining forest health, generating revenue, and providing recreational opportunities. Forested land in all three states is managed to benefit a variety of organisms, maintain ecosystem services, provide economic benefits, and provide recreational opportunities for residents. Enhancing and maintaining forest health has the potential to adversely affect covered bats at the site level overall; however, the State DNRs forest management activities result in long-term habitat maintenance and the creation of forest conditions that are beneficial to bats. As a result, the Lake States HCP provides a framework to avoid, minimize, and mitigate for potential site-level effects on bats while allowing the State DNRs and eligible landowners to conduct forest management activities in Michigan, Minnesota, and Wisconsin

The plan area for the Lake States HCP comprises the states of Michigan, Minnesota, and Wisconsin and is the broad area that was analyzed for the HCP. The covered lands for the Lake States HCP are all forestlands[1] not owned or managed by the federal government and occurring within the states of Michigan, Minnesota, and Wisconsin. More specifically, covered lands consist of approximately 47 million acres in three categories (Table ES-1): 1) forested State DNR lands, those owned or managed by the State DNRs, totaling approximately 9 million acres; 2) county and municipal forestlands totaling approximately 5 million acres; and 3) other nonfederal lands totaling approximately 32 million acres, which include—as categorized by the U.S. Forest Service (USFS) Forest Inventory and Analysis (FIA) program—approximately 1 million acres of Tribal forestlands. State DNR-owned or managed lands will be definitively covered by the incidental take permit. Other nonfederal lands (county and municipal, Tribal, and private forestlands) are eligible lands that can be covered by the permit through a Landowner Enrollment Program if program criteria are met. For the purposes of the HCP analysis, all eligible lands are considered covered lands, even though not all eligible lands will be managed under the permit.

Table ES-1. Total Nonfederal Forestlands in the Lake States (acres)

State	Total Nonfederal Forestlands (acres)	State DNR		County, Municipal, Private and Tribal Lands	
		Forestlands (acres)	Total Nonfederal Forestland (percent)	Forestlands (acres)	Total Nonfederal Forestland (percent)
Michigan [a]	17,028,369	4,208,397	24.71%	12,819,972	75.29%
Minnesota [a]	14,573,330	3,848,586	26.41%	10,724,744	73.59%
Wisconsin [a]	15,436,807	1,192,782	7.73%	14,244,025	92.27%
Total	**47,038,506**	**9,249,765**	**19.66%**	**37,788,741**	**80.34%**

Notes:

[a] Acreage values used in Chapter 2, *Covered Lands and Activities*, were derived from USFS FIA ownership acreage values (accessed 2017). Analyses conducted in Chapter 3, *Environmental Setting*, and Chapter 4, *Potential Effects of Covered Activities*, cross-walked National Land Cover Database (NLCD) to USFS FIA acreage values (as described in Chapter 3, Section 3.2.3.2, *Landcover*), which may result in discrepancies of acreage totals.

The State DNRs are seeking a 50-year incidental take permit from USFWS. The permit term of 50 years was selected because it provides a foreseeable planning horizon for covered activities, and for the full implementation and evaluation of the conservation strategy, including monitoring and adaptive management. In addition, 50 years will allow for a sufficient assessment of the impacts of the proposed forest management activities on covered bats and tracking the implementation of conservation actions, as well as tracking the responses of resources to climate change. In addition, 50 years will allow for a sufficient assessment of the impacts of the proposed forest management activities on covered bats, as some of the harvest treatments proposed as covered activities in the Lake States HCP (e.g., stand rotations) can take 50 years or more to reach maturity. Before the permit expires, the State DNRs can apply to renew or amend the Lake States HCP and to extend its associated permit.

[1] *Forestland* is defined as land where current and past vegetation evidence demonstrates that trees cover or covered over 10 percent of the ground.

The permittees consist of the three State DNRs and Landowner Enrollment Program participants. The State DNRs will apply for three separate permits that USFWS will issue individually to each agency based on the joint Lake States HCP. This HCP and associated separate permits will allow for independent implementation of the covered activities and conservation and monitoring measures. The Lake States HCP provides the basis through which the State DNRs may extend their incidental take coverage to eligible nonfederal landowners. To obtain take coverage, landowners need to obtain a certificates of inclusion (COIs) from the State DNR by participating in the Landowner Enrollment Program. The eligibility criteria for the Landowner Enrollment Program are outlined in Appendix B, *Landowner Enrollment Program*.

The Lake States HCP was developed by the Lake States Steering Committee comprising members of the State DNRs and USFWS who met regularly over multiple years. In addition, the steering committee collected input from a bat expert working group that met on January 12, 2017, to obtain the best available information from professionals working with the covered species across the plan area, especially on topics where peer-reviewed literature or data were not available. The steering committee also collected input from stakeholders in the Lake States through a formal review and written comment process in summer 2018, summer 2020, and fall 2020.

ES.2 Covered Activities

The primary goal of the Lake States HCP is to obtain a permit for incidental take of the four covered bat species under ESA for forest management activities that might affect listed or at-risk bat species. The Lake States HCP's covered activities include the following.

- Timber harvest and related forest management
- Road and trail construction, maintenance, and use
- Prescribed fire
- Conservation strategy implementation

Timber harvest and related forest management activities include cutting trees for regeneration, forest products, salvage, firewood, and the creation of habitat for wildlife. Road and trail construction, maintenance, and use activities consist of constructing, maintaining, and using permanent roads and trails. Prescribed fire activities include burning for fuel reduction, vegetation management, containment, invasive species control, wildlife habitat enhancement, and associated firebreaks. Finally, conservation strategy implementation activities include monitoring and restoration associated with implementation of the conservation strategy. All covered activities occur in the plan area on State DNR lands, county and municipal lands, and private lands (which include Tribal lands) except for roads and trails construction, maintenance, and use, which are only covered on State DNR lands and county lands that are enrolled in the Landowner Enrollment Program for forest management and public recreation.

Th Lake States HCP is focused on forestry and forestry-related activities because these activities enable the State DNRs to meet multiple objectives, including the improvement of habitat for wildlife, enhancement of recreational opportunities, the maintenance of healthy and safe forests, and economic contributions toward the respective programs and goals of each agency. This HCP does not address the following activities that may occur in the plan area over the permit term: lessee activities, gas and power line access, recreation, development and exploration of energy and other mineral resources, collection of firewood from downed and dead trees, and research by external parties. These activities were evaluated and excluded from coverage under this HCP for several reasons, such as the lack of information, the speculative nature of the projects, existing permits, permits obtained under a separate program, or the risk that the project or activity would change the scope of this effort.

ES.3 Environmental Setting

The environmental setting provides an overview of the existing physical and ecological conditions of the plan area (Michigan, Minnesota, and Wisconsin). These environmental baseline conditions are influenced by broader external factors that could affect the status of bats in Michigan, Minnesota, and Wisconsin. The collective information, obtained through literature reviews and analysis of state and federal data sources (e.g., NLCD and USFS FIA] database) was used to assess the distribution of the four covered species, to help quantify impacts, and to develop a conservation strategy for the Lake States HCP.

The area's dominant physical attributes (e.g., forestland distribution, proximity to the Great Lakes, climate, major watersheds, and geological features) affect the distribution of covered species throughout the year. Forest type distribution was determined using state-specific information for each state's covered lands. Forest type has meaning for bats, with some forest types providing high-quality habitat and other types providing lower-quality habitat. Chapter 3, Section 3.2.3.2*, Landcover*, includes a table (Table 3-2) that crosswalks the USFS FIA and NLCD datasets and provides bat habitat quality for each USFS FIA forest type. See also Figure ES-1.

Each of the four covered bat species' distribution was approximated for each state's covered lands. Michigan is the only state of the three Lake States to contain all four covered bat species, as Indiana bats do not currently occur in Minnesota or Wisconsin. Therefore, Indiana bat species distribution was only identified in Michigan, and the other three covered bat species were described in each of the three Lake States. Estimated species distribution is described in Chapter 3, *Environmental Setting*. These species move within the plan area seasonally, resulting in three geographical categories: winter, fall/spring, and summer habitat. Species and seasonal bat densities were derived from population estimates, which effectively created a patchwork of densities based on geographic location and habitat quality. The analysis breaks the region into a series of areas that are assumed to contain the same density of bats as other areas of similar habitat and location. These densities vary by time of year and habitat quality. This approach to estimating impacts at a landscape scale was necessary given that the location of bat colonies, location of harvest activities, and timing of activities are imprecisely known.

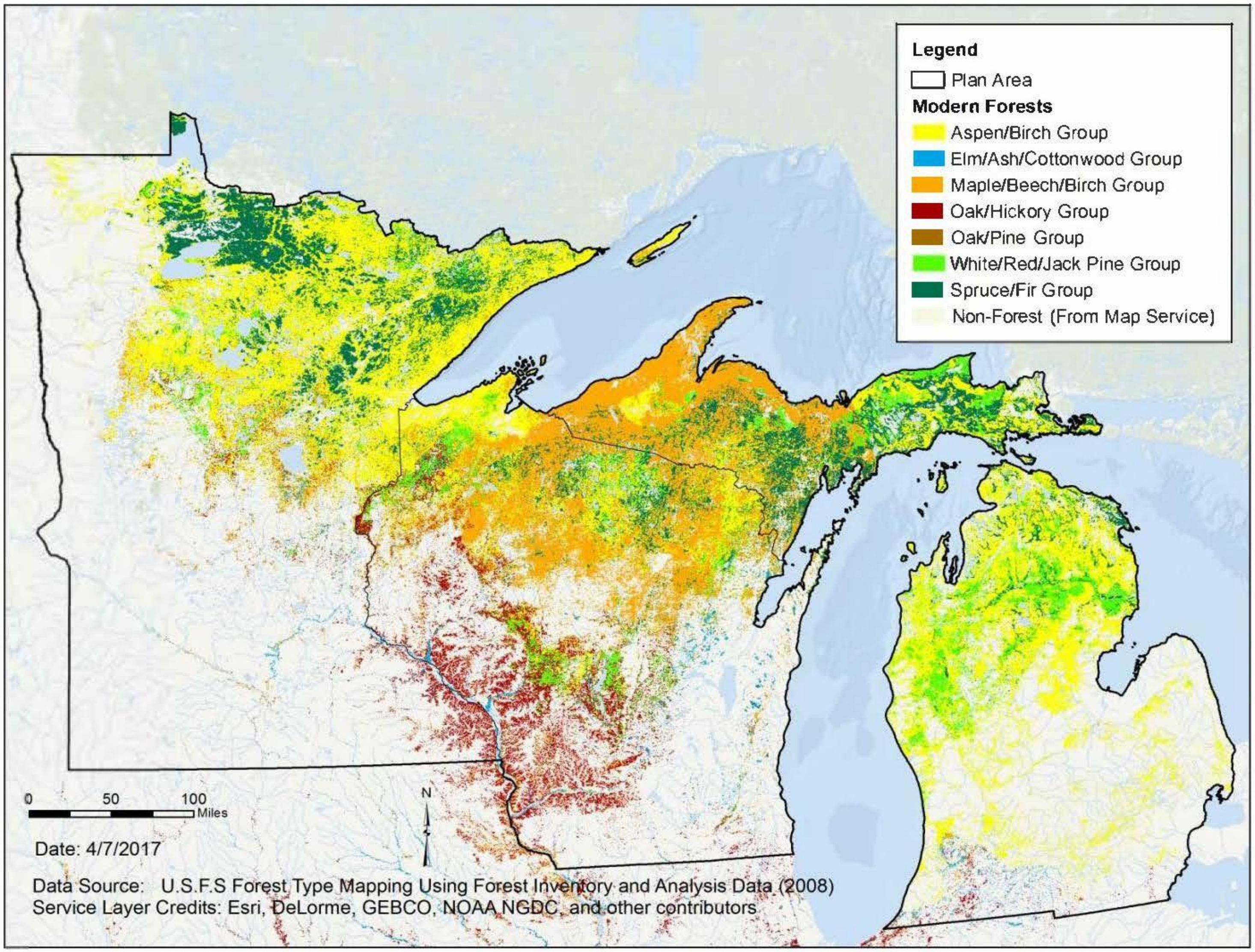

Figure ES-1. Current Forest Types in the Plan Area

The current environmental context of the plan area, or baseline, is marked by WNS, wind energy development, and forest management programs (Chapter 3, Section 3.3, *Environmental Baseline*). WNS is the core reason for population declines of covered species and was first detected in the plan area in winter 2011/2012. The plan area is in a region where the land-based wind energy industry is rapidly developing, and it has been documented that the operation of such facilities results in the accidental mortality of bats, including all four covered bat species. Each state's DNR manages extensive forested areas using widely accepted practices described in silvicultural guidelines or handbooks specific to each state.

ES.4 Potential Effects of Covered Activities

Quantification of the potential effects of covered activities on the covered species and a description of methods to fully offset the effects of the potential taking are requirements of the Lake States HCP process. Take can be quantified by identifying the number of affected individuals or breeding groups or by using acres of habitat as a surrogate. In the forestry industry, directly estimating the number of individuals that may be taken is difficult to predict for the covered species due to population dynamics, small body size, seasonal fluctuations in populations, habitat type (i.e., tree cavities), and the elusive nature of many species. Difficulty in estimating take is further amplified by the large plan area and timing of covered activities. Furthermore, the presence of WNS in bat populations presents uncertainty and varying effects from year to year. Based on these limitations, the Lake States HCP quantifies take by using the acres of habitat affected by covered activities as a surrogate for the number of bats taken within that habitat. Information on covered activities is integrated with information about covered lands, including bat distributions, to produce an estimate of the number of acres and (for context only) the number of bats at risk from various activities.

While bat populations may decrease over time due to the impact of WNS, it is assumed that the impact of covered activities will continue to be proportional to the population.

Covered activities have the potential to negatively affect bats in roosting trees. Direct effects are quantified with respect to timber harvest, related forest practices, and prescribed fire. Direct effects associated with road and trail construction, maintenance, and use are described qualitatively. The effects of implementing the conservation strategy are not quantified as impacts but are described as a conservation benefit in Chapter 5, *Conservation Strategy*. Table ES-2 summarizes the acres of habitat to be annually impacted by timber harvest and prescribed fire activities when bats are present, the estimated annual mortality by covered species, and the percent of statewide summer bat population.

Table ES-2. Acres of Habitat Impacted When Bats Are Present

Species	Annual Amount of Habitat [a] Harvested When Bats Are Present (acres)				Annual Amount of Habitat Impacted by Prescribed Fire (acres) [b]	Annual Estimated Number of Bats Killed		
	Winter Habitat	Fall/ Spring Habitat	Summer Habitat	Annual Total		Due to Timber Harvest	Due to Prescribed Fire	Percent of Statewide Summer Bat Population
Michigan								
Indiana bat	0	76	7,077	7,154	2,907	0.04	< 0.01	0.01%
Northern long-eared bat	0	3,007	35,249	38,256	2,907	1.93	0.06	0.02%
Little brown bat	0	2,941	35,666	38,607	2,907	7.48	0.25	0.01%
Tricolored bat	0	724	21,711	22,435	2,907	< 0.01	< 0.011	0.03%
Minnesota								
Northern long-eared bat	0	530	12,932	13,462	6,995	0.65	0.14	0.01%
Little brown bat	0	291	12,932	13,223	6,995	1.29	0.28	0.04%
Tricolored bat	0	274	8,244	8,518	6,995	0.01	< 0.01	0.01%
Wisconsin								
Northern long-eared bat	0	2,317	38,356	40,673	5,080	0.39	0.03	0.02%
Little brown bat	0	2,032	38,356	40,389	5,080	6.02	0.39	0.01%
Tricolored bat	0	1,855	17,807	19,663	5,080	0.06	< 0.01	0.03%

Notes:

[a] Includes both high- and low-quality forested bat habitat on DNR, county, municipal, and private lands.

[b] Includes forested and brushland habitats. Prescribed fire is only anticipated during the active season, and acreages provided are the full amount of area anticipated for prescribed fire, annually. Occupancy of acreages treated with prescribed fire is unknown due to uncertainty with where and when prescribed fire is used.

While there is always the potential to affect a bat, very few bats are expected to be directly affected by forestry practices each year, due in large part to the small amount of land that will be harvested during the active season for covered bats and the current low populations of bats.

The long-term (indirect) effects on covered bat species will be largely beneficial as the covered forest management activities improve bat habitat by creating and maintaining preferred roosting and foraging habitat. Indirect effects associated with timber harvest and prescribed fire will be generally positive. This habitat conservation plan (HCP) demonstrates that activities covered by the Lake States HCP will improve both roosting and foraging opportunities for bats in the plan area.

Chapter 4, *Potential Effects of Covered Activities*, characterizes direct and indirect effects associated with implementation of the Lake States HCP. Direct effects of forest management and related activities are presented for each Lake State by the covered bat species according to season, habitat quality, and ownership type. The results are calculated annually and over the 50-year permit term. The covered activities will have long-term beneficial effects (indirect effects), and most impacts from covered activities will be avoided by the implementation of protective buffers at known occupied maternity roosts and known hibernacula entrances. Acres avoided and enhanced under the Lake States HCP have also been quantified in Chapter 4.

ES.5 Conservation Program

The conservation strategy for the Lake States HCP is designed to avoid, minimize, and mitigate effects on the covered species such that the take described in Chapter 4, *Potential Effects of Covered Activities*, is fully offset. The conservation strategy is based on a set of biological goals and objectives described in Chapter 5, *Conservation Strategy*, developed specifically for the Lake States HCP. Conservation measures were identified to achieve these goals and objectives. Quantifying the offset of the conservation strategy is difficult because the exact location of bats is often unknown (making it difficult to quantify avoidance), and efforts to understand fecundity and recruitment of bats are in their infancy. However, the covered activities support the creation of high-quality bat habitat and, where feasible, the effect of avoidance has been quantified otherwise, beneficial, and net effects are discussed qualitatively.

All high-quality winter bat habitat is being avoided when bats are present in all three Lake States; therefore, no impacts on hibernating bats are anticipated. Only 0.07% of all high-quality fall/spring and summer habitat in Minnesota and in Wisconsin, and 0.16% of all high-quality fall/spring and summer habitat in Michigan will be affected when bats are present. Thus, over 99.8% of all high-quality fall/spring and summer habitat will be avoided when bats are present in all three Lake States. This information demonstrates the Lake States' commitment to ensure very minimal impacts on covered species by implementing covered activities for only a small amount of land during the active bat season. Table ES-3 presents a summary of the avoidance of high-quality bat habitat from covered activities in the Lake States when bats are present.

Table ES-3. Annual Impacts on High-Quality Bat Habitat from Forest Management in the Lake States When Bats Are Present, Percent of All High-Quality Bat Habitat Avoided Annually, and Annual Management/Enhancement of High-Quality Bat Habitat

Season	Percent of all High-Quality Bat Habitat Annually Affected When Bats Are Present			Percent of all High-Quality Bat Habitat Annually Avoided When Bats Are Present			Percent of all High-Quality Habitat Annually Managed/Enhanced		
	Michigan	Minnesota	Wisconsin	Michigan	Minnesota	Wisconsin	Michigan	Minnesota	Wisconsin
Timber Harvest									
Winter	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%	0.00%	0.00%	0.00%
Fall/spring [a]	0.16%	0.07%	0.16%	99.84%	99.93%	99.84%	0.79%	0.66%	0.86%
Summer [a]	0.16%	0.07%	0.16%	99.84%	99.93%	99.84%	0.79%	0.66%	0.86%
Prescribed Fire [b]									
Winter	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%	0.00%	0.00%	0.00%
Fall/spring [a]	0.01%	0.02%	0.01%	99.99%	99.98%	99.99%	0.01%	0.02%	0.01%
Summer [a]	0.01%	0.02%	0.01%	99.99%	99.98%	99.99%	0.01%	0.02%	0.01%
Total [c]									
Winter	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%	0.00%	0.00%	0.00%
Fall/spring [a]	0.16%	0.08%	0.17%	99.84%	99.92%	99.83%	0.80%	0.68%	0.87%
Summer [a]	0.16%	0.08%	0.17%	99.84%	99.92%	99.83%	0.80%	0.68%	0.87%

Notes:

[a] Fall/spring habitat overlaps summer habitat, thus acreages listed are double-counted.

[b] Seasonality of prescribed fire is assumed equally distributed across the active season. Presence of bats on areas treated with prescribed fire is unknown due to uncertainty with where and when prescribed fire is used.

[c] Because locations of forest management activities are unknown at this time, areas of timber harvest may overlap with prescribed fire and, thus, acres may be double-counted.

The State DNRs protect and sustainably manage 9.2 million acres of forestland used by northern long-eared bats, tricolored bats, and little brown bats, including over 339,000 acres of summer Indiana bat forestland managed by Michigan DNR. In addition, timber harvest is not allowed on over 200,000 acres of these DNR-owned forestlands (150,000 of these acres are in Michigan where Indiana bats are known to occur). Management of working forests protects potential habitat for bats, prevents habitat fragmentation, and maintains foraging and roosting habitat in high-quality habitat over time at the landscape level.

State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur annually on 15,460 acres of Indiana bat summer habitat in Michigan, 146,400 acres of northern long-eared bat summer habitat in the Lake States, 92,367 acres of tricolored bat summer habitat in the Lake States, and 146,400 acres of little brown bat summer habitat in the Lake States. In addition, management and enhancement activities will occur annually on other nonfederal forestlands located on private or county/municipal lands. For Indiana bats these activities will occur on 23,011 acres in Michigan, for northern long-eared bats on 370,354 acres in the Lakes States, for tricolored bats on 206,139 acres in the Lake States, and for little brown bats on 372,427 acres in the Lake States. A summary of the annual management and enhancement of high-quality bat habitat in the Lakes States is summarized in Table ES-3. Forestry management practices that enhance habitat for bats will increase stewardship outside State DNR lands by promoting and engaging in educational outreach efforts. Public outreach, research, and training on WNS will also occur as part of the Lakes States HCP.

Minimization of the injury and mortality of bats during forestry-management activities is achieved by implementing retention guidelines that leave some trees undisturbed and protect snags (except in cases that threaten forest health and human safety), protecting known occupied maternity roosts with seasonal avoidance buffers, minimizing impacts within the creation of Bat Protection Zones, and implementing bat-friendly burn strategies. Impacts from road and trail construction and maintenance are avoided through seasonal restrictions near known, occupied maternity roost trees and hibernacula entrances. Impacts from road and trail construction are further reduced by seasonal restrictions on removal of large-diameter trees. In addition, known bat hibernacula entrances will be protected with buffers, and management and enhancement of these entrances will also occur. Such measures will not only protect these hibernacula, but improve conditions at these sites, keep these areas out of the development stream, stabilize entrances to prevent collapse, and help maintain microclimates inside the hibernacula so that they remain favorable for hibernating bats.

Protection and maintenance of existing cave gates will help to prevent unauthorized access into the cave. By maintaining existing entrances, bat mortality is expected to reduce and bat fitness is expected to improve. Over time, an increase in fecundity and reproduction is also expected, which will result in more bats. A summary of the beneficial effects of the conservation strategy and the net effects of conservation and impacts can be found in Chapter 5, Section 5.4*, Beneficial and Net Effects*, and in Table ES-4.

Executive Summary

Table ES-4. Summary of Conservation Benefits for the Covered Bat Species

Species	Protect and Sustainably Manage Forestlands (9.2 million acres)	Management and Enhancement Activities on State DNR Summer Bat Habitat	Management and Enhancement Activities on Nonfederal Forestlands	Creation of Bat Protection Zones	Protective Buffer around Known Occupied Maternity Roost Trees [a]	Protective 0.25-Mile Buffer around Known Hibernacula Entrances [b]	Management and Enhancement Activities on 33 Known Hibernacula Entrances [b]	Public Outreach, Research, and Training
Indiana bat	x	x	x		x	x		x
Northern long-eared bat	x	x	x	x	x	x	x	x
Little brown bat	x	x	x	x	x	x	x	x
Tricolored bat	x	x	x	x	x	x	x	x

Notes:

[a] Indiana bat maternity roost protective buffers are 2.5 miles, and all other covered bat maternity roost buffers are 150 feet. The larger roost buffers for Indiana bat protect maternity colonies in lieu of Bat Protection Zones.

[b] Includes 15 known hibernacula entrances in Michigan, 11 in Minnesota, and 19 in Wisconsin. Currently, no Indiana bat hibernacula are located within the Lake States; however, any new hibernacula located would have these measures applied.

The Lake States HCP incorporates the concepts of passive and active adaptive management advocated and defined by USFWS for implementing HCPs (U.S. Fish and Wildlife Service 2016). Through passive adaptive management, the State DNRs will learn how the covered activities are affecting the landscape to ensure better attainment of the Lake States HCP biological goals and objectives based on the measured success of various approaches to implementing this HCP (as indicated by effectiveness monitoring results). The State DNRs will also take an active adaptive management approach to resolve uncertainties related to potential changing environmental conditions (e.g., shifts in distribution driven by climate change) or habitat features (e.g., addition or subtraction of subterranean habitat and/or addition or removal of known occupied maternity roost trees) to improve management over the permit term.

The Lake States HCP includes two principal types of monitoring: compliance monitoring and effectiveness monitoring. Compliance monitoring tracks the status of HCP implementation and documents that the requirements of the HCP are being met. Effectiveness monitoring assesses the biological success of the Lake States HCP by measuring the fulfillment of the biological goals and objectives. The monitoring actions (both compliance and effectiveness) for each objective are summarized in Chapter 5, Section 5.6.2.4*, Monitoring the Biological Goals and Objectives*. Parameters for the existing habitat distribution model will be refined and revised as more information becomes available. State DNRs will use the habitat distribution model to update modeled habitat for covered bat species every 5 years. Documentation of compliance monitoring will be included in an annual report submitted to USFWS.

ES.6 Implementation and Assurances

The Lake States HCP will be implemented by the State DNRs. The three separate Section 10(a)(1)(B) incidental take permits issued to the State DNRs by USFWS will address incidental take resulting from covered activities in the plan area that are owned and managed by State DNRs. This permit structure will allow for independent implementation of the covered activities and conservation and monitoring measures. These permits are severable, meaning that the revocation or suspension of one permit will not jeopardize the take authorization of the other permittees.

Additionally, each State DNR may extend its take authorization to other nonfederal landowners in its respective state that conduct covered activities that have the potential to result in take of covered bats. This authorization will be extended through participation in the Landowner Enrollment Program, described in detail in Appendix B, *Landowner Enrollment Program.* The size and scope of the Landowner Enrollment Program is at the discretion of the State DNRs.

A Lake States Advisory Committee consisting of representation from each of the State DNRs will distribute information among the states during implementation. In addition to this advisory committee, each State DNR will also assign responsibilities to specific staff members, including an HCP point of contact, implementation support team, geographic information system (GIS) technician, biologists, forestry staff, public outreach staff, consultants, and contractors. Each of the Lake States will designate a main point of contact(s) for the HCP (an HCP Coordinator or Administrator) and establish a team (or committee) of relevant staff to assist the HCP Coordinator or Administrator with implementing the Lake States HCP. Each State DNR will serve as the final decision-maker regarding the implementation of the Lake States HCP in their respective state and will ensure their State DNR is in compliance with the Section 10(a)(1)(B) permit terms and conditions. Key HCP decisions made by the State DNRs will include amendments, negotiations with USFWS, or extending incidental take coverage to third parties.

USFWS is the regulatory agency that issues the federal permit for incidental take and that will oversee implementation and enforcement of the Lake States HCP. The State DNRs will continue to engage USFWS through the Lake States Advisory Committee meetings (Chapter 6, Section 6.3.1, *Lake States Advisory Committee*) and through each State DNR's primary point of contact as specified in the Lake States HCP and will provide annual reports concerning its implementation.

While no formal scientific review committee will be established, the State DNRs will coordinate with other resource agencies, Tribes, other nonfederal landowners, foresters, biologists, science advisors, and the public, as needed, to ensure adequate and systematic implementation of their responsibilities under the Lake States HCP. Each State DNR will maintain a publicly accessible communication tool (e.g., website) throughout implementation to be used as the primary means of engaging the public in HCP implementation. This will include the application process for the Landowner Enrollment Program and related enrollment information, annual reports to USFWS, and contact information for each State DNR's HCP Coordinator or Administrator. The tool will also allow members of the public to register to receive communications on HCP implementation.

ES.7 Cost and Funding

The total direct cost to implement the Lake States HCP (all Lake States combined) is estimated at approximately $27.1 million over the 50-year permit term, or approximately $542,514 annually (Chapter 7, *Cost and Funding*). Direct costs include program administration, conservation program implementation, adaptive management, and changed circumstances. The State DNRs are solvent and committed to funding the implementation of the Lake States HCP, including program administration and implementation of the conservation program.

ES.8 Alternatives to Take

ESA requires that the applicant (State DNRs) for an incidental take permit specify what alternative actions to the take of the covered species were considered and why those alternatives were not selected. The alternatives discussed further in Chapter 8, *Alternatives to Take*, focus on significant differences in project approach that would avoid or reduce the take. The three alternatives considered but not selected for analysis in the Lake States HCP are 1) no take; 2) reduced covered activities; and 3) reduced geographic coverage.

The no take alternative was rejected because the State DNRs must continue to adhere to their mandates and missions to manage forests to benefit a variety of organisms, provide economic benefits to citizens, maintain ecosystem services, and provide recreational opportunities for residents in the states of Michigan, Minnesota, and Wisconsin. The reduced covered activities alternative was rejected because road and trail maintenance and use are necessary to the forest-management practices covered under the Lake States HCP, so it would not be beneficial to consider these activities separately from forest-management practices. The reduced geographic coverage alternative was rejected because, while it would reduce the amount of take associated with covered activities, it would also proportionally reduce the amount of conservation associated with the proposed alternative.

Chapter 1
Introduction

1.1 Overview

The Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP) provides a framework to protect four bat species while allowing eligible landowners to conduct forest management activities within Michigan, Minnesota, and Wisconsin. The Lake States HCP will also serve to improve and streamline the environmental incidental take permitting that each state will undergo under the federal Endangered Species Act (ESA).

The following state agencies developed the Lake States HCP.

- Michigan Department of Natural Resources (DNR)
- Minnesota DNR
- Wisconsin DNR

These three agencies (collectively referred to as the State DNRs) practice sustainable forestry for the purpose of promoting wildlife, enhancing, and maintaining forest health, generating revenue, and providing recreational opportunities. In addition, the State DNRs work closely with other nonfederal landowners to encourage sustainable forest management. Forested land in all three states is managed to benefit a variety of organisms, maintain ecosystem services, provide economic benefits, and provide recreational opportunities for residents. As a result, all forested lands[1] not owned or managed by the federal government and occurring within the states of Michigan, Minnesota, and Wisconsin are considered *covered lands* in the Lake States HCP. These covered lands comprise approximately 9.2 million acres of land owned or managed by the State DNRs (not all landowners can or will participate in this HCP through the Landowner Enrollment Program per Appendix B, *Landowner Enrollment Program*).

Covered lands also include 38.1 million acres of forestlands owned and managed by private, Tribes, county, and municipal landowners. The Lake States HCP includes a Landowner Enrollment Program for private, Tribal, county, and municipal landowners who wish to enroll and meet the eligibility requirements (see Section 1.3.4.2, *Landowner Enrollment Program Participants*, and Appendix B, *Landowner Enrollment Program*, for more information).

Covered lands provide potential habitat for bats, including federally listed and unlisted bats that will be covered under the Lake States HCP. The following bat species are covered in the Lake States HCP. At the writing of this HCP, the little brown bat and tricolored bat are undergoing a species status assessment by the U.S. Fish and Wildlife Service (USFWS) to determine an appropriate listing status.

- **Indiana bat (*Myotis sodalis*).** This species is federally listed as endangered and occurs in Michigan. It is not known to occur in Minnesota or Wisconsin.[2]

[1] *Forestland* is defined as land where current and past vegetation evidence demonstrates that trees cover or covered over 10 percent of the ground.

[2] The only confirmed occurrence of Indiana bat in Wisconsin was in the 1960s (Jackson 1961).

- **Northern long-eared bat (*Myotis septentrionalis*).** This species is federally listed as threatened with a 4(d) Rule. In March 2022, USFWS proposed to reclassify the northern long-eared bat as an endangered species under ESA (U.S. Fish and Wildlife Service 2022a). A listing decision was published on November 30, 2022, reclassifying the species as endangered. This final rule goes into effect on January 30, 2023.. It occurs in all three states.
- **Little brown bat (*Myotis lucifugus*).** This species is under discretionary status review with the potential to become federally listed but it is not currently listed under the ESA. It occurs in all three states.
- **Tricolored bat (*Perimyotis subflavus*).** This species has been petitioned for listing but is currently not listed under the ESA. In September 2022, the USFWS proposed to list the tricolored bat as an endangered species under the ESA (U.S. Fish and Wildlife Service 2022b). It occurs in all three states.

1.2 Purpose

The State DNRs have proposed to develop the Lake States HCP for each State DNR to obtain an incidental take permit pursuant to Section 10(a)(1)(B) of ESA. The State DNRs will request authorization for the incidental take of Indiana bats, northern long-eared bats, little brown bats, and tricolored bats (referred to collectively as *covered species*) for the forest management activities described in this HCP.

The Lake States HCP was created to provide the needed flexibility for the State DNRs to manage forests while addressing current federal and state regulations and guidelines that have the potential to restrict management practices, particularly during the summer months. While habitat in the Lake States is not a limiting factor for bat populations (white-nose syndrome [WNS] is currently the core reason for population decline), some forest management activities can affect or result in take of bats. A goal of this HCP is to provide conservation objectives and their associated conservation measures that minimize the risk for the take of individual bats, while also providing an overall conservation benefit for four covered species through implementation of forest management actions. In addition, this regional HCP will streamline ESA compliance by considering the impacts of forestry on covered species at a landscape scale rather than on a project-by-project basis (e.g., the stand level). This approach will allow the State DNRs to meet their legal mandates and missions efficiently, while incorporating a program of comprehensive, large-scale planning and conservation.

The mission statements of the State DNRs support the conservation goals of the Lake States HCP as follows.

- **Michigan.** The Michigan DNR is "committed to the conservation, protection, management, use and enjoyment of the state's natural and cultural resources for current and future generations. The Michigan DNR strives to protect natural and cultural resources, ensure sustainable recreation use and enjoyment, enable strong natural resource-based economies, improve and build strong relationships and partnerships, foster effective business practices and good governance" (Michigan Department of Natural Resources 2015).
- **Minnesota.** The mission of the Minnesota DNR is to "work with Minnesotans to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life" (Minnesota Department of Natural Resources 2020).

- **Wisconsin.** The mission of the Wisconsin DNR is to "protect and enhance our natural resources: air, land and water; wildlife, fish and forests and the ecosystems that sustain all life. To provide a healthy, sustainable environment and a full range of outdoor opportunities. To ensure the right of all people to use and enjoy these resources in their work and leisure. To work with people to understand each other's views and to carry out the public will. And in this partnership consider the future and generations to follow" (Wisconsin Department of Natural Resources 2013).

The goals, missions, and mandates of State DNRs are largely aligned with the need to protect and improve habitat for the four covered bat species. However, in some situations, activities undertaken to implement these goals may harm or otherwise *take*[3] covered bats. Specifically, State DNR duties to manage forests through timber harvest and prescribed fire for wildlife, recreation, and economic development sometimes result in unintentional take of bats. Road construction, maintenance, and use may also cause incidental take of bats. As a result, the State DNRs need federal authorization that will allow them to manage public forests while meeting their own legal mandates and missions, which include the conservation of bats and other wildlife.

The overall goal of the Lake States HCP is to develop and implement a conservation plan that will accomplish the following objectives.

- Avoid, minimize, and mitigate for incidental take of covered species resulting from forest management and related activities on covered lands.
- Identify and discuss existing forest management practices occurring on covered lands that benefit bats and their habitats.
- Accommodate current and future forest management activities on covered lands.
- Provide the basis for take authorization pursuant to ESA for effects that cannot be avoided.
- Identify targeted conservation efforts that can improve the value of covered lands for covered species.

1.3 Scope

This section introduces key elements of the Lake States HCP—covered activities, plan area, permit term, permittees, and covered species.

1.3.1 Covered Activities

A primary goal of the Lake States HCP is to obtain authorization for incidental take of ESA-listed species and species that may become listed, for specific activities, called *covered activities*. The Lake States HCP is focused on the following forest management and related activities.

- **Timber harvest and related forest management practices**. These activities include cutting trees for regeneration, forest products, salvage, firewood, and the creation of habitat for wildlife.

[3] To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (ESA Section 3 (19)). Harm is further defined as to "include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing behavioral patterns such as breeding, feeding, or sheltering" (see 50 CFR § 17.3).

- **Roads and trails construction, maintenance, and use.** These activities include constructing, maintaining, and using roads and trails associated with forestry and public recreation.
- **Prescribed fire.** These activities include burning for fuel reduction, vegetation management, containment, invasive species control, wildlife habitat enhancement, and associated firebreaks.
- **Conservation strategy implementation.** These activities include monitoring and restoration associated with implementation of the conservation strategy.

Chapter 2, *Covered Lands and Activities*, includes detailed descriptions of these covered activities and the selection process used to evaluate activities for coverage.

1.3.2 Plan Area and Covered Lands

The *plan area* for the Lake States HCP comprises the states of Michigan, Minnesota, and Wisconsin and is the broad area that was analyzed for the HCP. The *covered lands*, where all impacts occur, are all forestlands not owned or managed by the federal government and occurring within the states of Michigan, Minnesota, and Wisconsin. Forestlands are defined as land where current and past vegetation evidence demonstrates that trees cover or covered over 10 percent of the ground, Covered lands consist of approximately 47.3 million acres in three categories: 1) State DNR lands (those owned or managed by the State DNRs), 2) county and municipal forestlands, and 3) private forestlands, which include—as categorized by the U.S. Forest Service (USFS) Forest Inventory and Analysis (FIA) program—Tribal forestlands (Table 1-1).

Table 1-1. Estimated Covered Lands in Each State

State	Total Covered Lands (millions of acres) [a]
Michigan	**17.3**
State Lands [b]	4.2
County and Municipal Forestlands	0.4
Private Forestlands	12.6
Tribal Forestlands [c]	0.03
Minnesota [c]	**14.6**
State Lands [b]	3.8 [d]
County and Municipal Forestlands	2.6
Private Forestlands	7.5
Tribal Forestlands [c]	0.7
Wisconsin	**15.4**
State Lands [b]	1.2
County and Municipal Forestlands	2.4
Private Forestlands	11.5
Tribal Forestlands [c]	0.4
Total	**47.3**

Notes:

[a] Numbers may not sum exactly due to rounding.

[b] The USFS FIA data used in this table define State data as an ownership class of public lands owned by States or lands leased by States for more than 50 years. Covered State DNR lands will also include a small amount of federal lands that are managed by the DNRs.

[c] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the "Native American" owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[d] The USFS FIA data used in this table report that 3.8 million acres of forestland are managed by the State of Minnesota (*forestland* is defined as land where current and past vegetation evidence demonstrates that trees cover or covered over 10% of the ground). This figure is less than the acres reported as administered by the State of Minnesota in Table 2-10, which includes nonforestland and also lands that FIA data analysts do not report as being managed as forestland by the State of Minnesota. There may be some overlap in acres due to DNR managed lands that are county owned or vice versa.

Source: USFS 2017.

The first category—DNR-owned or managed lands—will be definitively covered by the incidental take permit. The following categories – also referred to as other nonfederal lands (county/municipal, Tribal, and private forestlands)—are *eligible lands* that can be covered by the permit through a program described in Section 1.3.4.2, *Landowner Enrollment Program Participants*. For the purposes of the Lake States HCP analysis, all *eligible lands* are considered *covered lands,* even though not all eligible lands will ultimately be covered by the permit.

The Lake States HCP provides the basis through which the State DNRs may extend their incidental take coverage to other nonfederal landowners through certificates of inclusion (COIs). A COI is the binding document that demonstrates participation in the Landowner Enrollment Program. To be eligible to enroll in the Landowner Enrollment Program, an eligible landowner must conduct (or plan to conduct) one or more of the covered activities within the plan area and agree to implement the applicable conservation actions as outlined in the Landowner Enrollment Program application process (Chapter 6, *HCP Implementation and Assurances* and Appendix B*, Landowner Enrollment Program*). Those landowners receiving incidental take coverage for activities covered under the Lake States HCP are referred to as *program participants*. Additional eligibility criteria and requirements for program participants under the Lake States HCP are described in Appendix B.

State DNR covered lands include state forests, wildlife or game areas, and parks, and they account for approximately 9.2 million acres of the covered forestlands. Other covered lands include county and municipal forestlands (approximately 5.4 million acres), private lands (approximately 31.6 million acres), and Tribal land (approximately 1.1 million acres). Chapter 2, *Covered Lands and Activities*, Chapter 3, *Environmental Setting*, and Appendix B, *Landowner Enrollment Program*, provide more information about covered lands.

A visual representation of covered lands (Figure 1-1) was prepared using a geographic information system (GIS) model of the distribution of forestland (Ruefenacht et al. 2008) based on the USFS FIA plot data (Miles 2017; U.S. Forest Service 2017). Forestlands on federal lands were removed from the GIS data using ownership data from the United States Geological Survey Protected Areas of the United States.

1.3.3 Permit Term

The State DNRs are seeking a 50-year incidental take permit from USFWS. All assessments in the Lake States HCP are, therefore, based on a 50-year period. The permit term of 50 years was selected because it provides a foreseeable planning horizon for covered activities, and for the full implementation and evaluation of the conservation strategy (Chapter 5, *Conservation Strategy*), including monitoring and adaptive management. In addition, 50 years will allow for a sufficient assessment of the impacts of the proposed forest management activities on covered bats, as some of the harvest treatments proposed as covered activities in the Lake States HCP (e.g., stand rotations) can take 50 years or more to reach maturity. Therefore, 50 years will also allow for a sufficient assessment of many of the effects of the proposed forest management activities on covered species, for tracking the implementation of conservation actions, and for tracking the responses of resources to climate change. Upon expiration of the initial permit or to incorporate major revisions during the permit term, the State DNRs may apply to renew or amend the permit and the associated Lake States HCP. State DNRs may also apply to amend the permit prior to its expiration.

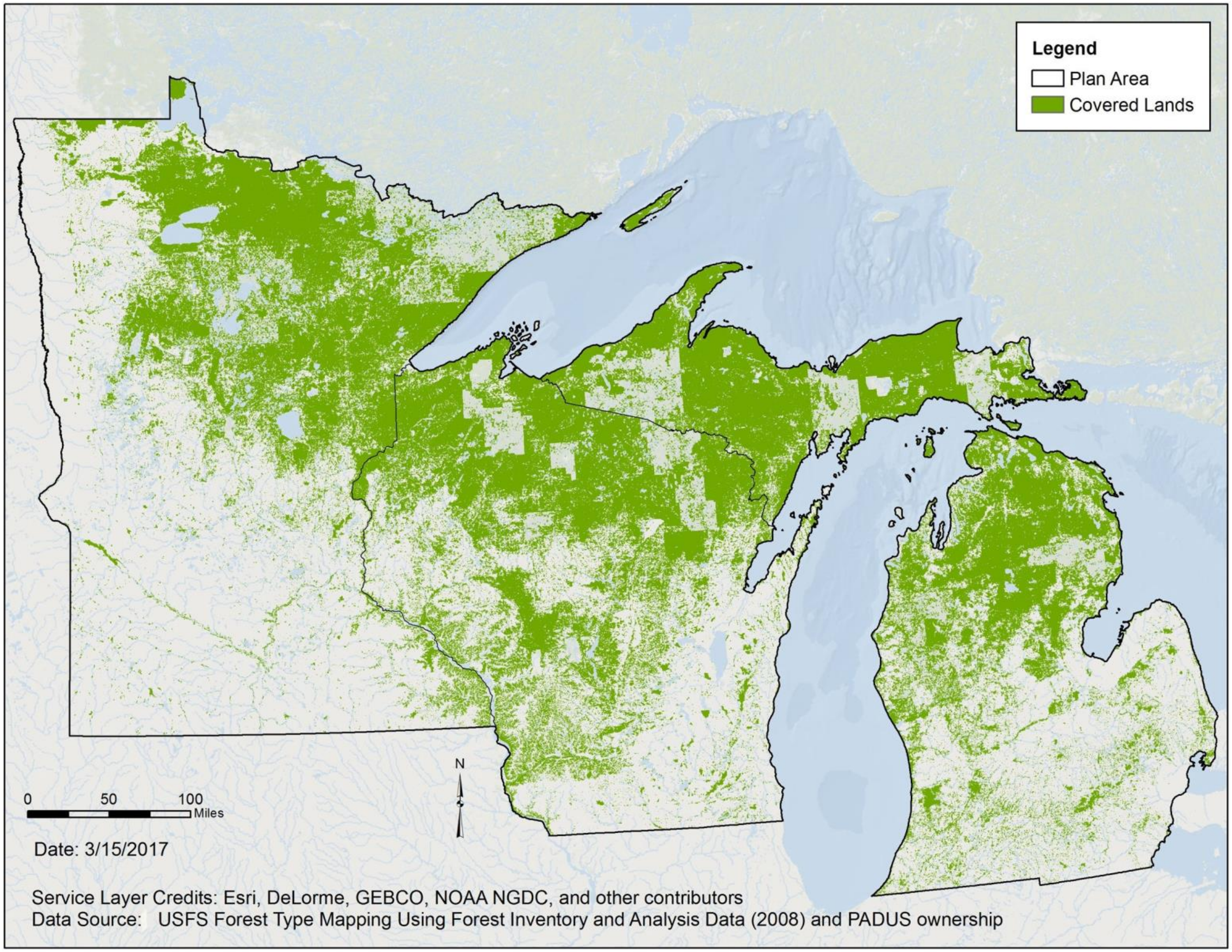

Figure 1-1. Covered Lands in the Lake States HCP

1.3.4 Permittees

1.3.4.1 State DNRs

The permittees under the incidental take permit are the individual State DNRs. For the purposes of the Lake States HCP, these State DNRs are jointly referred to as the *permittees*, although the text may specify an individual State DNR when necessary. The State DNRs will apply for three separate permits that USFWS will issue individually to each agency based on the joint Lake States HCP. This HCP and associated permits will allow for independent implementation of the covered activities and conservation and monitoring measures. HCP implementation is described in Chapter 6, *HCP Implementation and Assurances*.

1.3.4.2 Landowner Enrollment Program Participants

The Lake States HCP provides the basis through which the State DNRs may extend their incidental take coverage to other nonfederal landowners through certificates of inclusion (COIs).[4] A COI is the binding document that demonstrates participation in the Landowner Enrollment Program. To be eligible to enroll in the Landowner Enrollment Program, an eligible landowner must conduct (or plan to conduct) one or more of the covered activities within the plan area and agree to implement the applicable conservation actions as outlined in the Landowner Enrollment Program application process (Chapter 6, *HCP Implementation and Assurances* and Appendix B*, Landowner Enrollment Program*). Those landowners receiving incidental take coverage for activities covered under the Lake States HCP are referred to as *program participants*. Additional eligibility criteria and requirements for program participants under the Lake States HCP are described in Appendix B.

1.3.5 Covered Species

The State DNRs are requesting incidental take coverage for four bat species that hibernate in caves and mines and that inhabit forest from spring to fall: the Indiana bat, northern long-eared bat, little brown bat, and tricolored bat.

- **Indiana bat.** The Indiana bat, which currently occurs only in Michigan among the three states, is a medium-sized, insectivorous bat that ranges from New Hampshire south to North Carolina and west to the Great Plains. Factors such as habitat loss and degradation, disturbance during hibernation, and environmental contamination contributed to the species' decline, and USFWS listed the species as endangered on March 11, 1967 (U.S. Fish and Wildlife Service 1967). In addition to these factors, WNS has emerged as a significant threat to Indiana bat populations, causing the loss of approximately 20% of the population since 2007 (U.S. Fish and Wildlife Service 2017).
- **Northern long-eared bat.** The northern long-eared bat, which occurs in all three of the Lake States HCP's states, is a medium-sized, insectivorous bat distinguished from other eastern species of *Myotis* by its long ears. The species ranges from easternmost Quebec to Saskatchewan in Canada and south to the Florida Panhandle. The predominant threat to northern long-eared bats is WNS. Studies of northern long-eared bat populations in the northeastern United States

[4] Federal landowners are not eligible for COIs as they achieve ESA compliance through the Section 7 process (Section 1.4, *Regulatory Setting*).

have shown a 98 to 99% decline in the number of hibernating northern long-eared bats since the arrival of this syndrome in 2006, which has since spread steadily throughout the species' range (Turner et al. 2011; U.S. Fish and Wildlife Service 2019). USFWS published a proposed rule to list northern long-eared bats as endangered under ESA on October 2, 2013 (U.S. Fish and Wildlife Service 2013), but subsequently revised this on January 15, 2015, to propose its listing as threatened. USFWS published a final listing rule designating northern long-eared bats as threatened on April 2, 2015 (U.S. Fish and Wildlife Service 2015a). In addition to the listing rule, USFWS finalized a Section 4(d) rule exempting take that would occur as a result of certain activities, including most forest management activities, from the ESA's Section 9 take prohibition (U.S. Fish and Wildlife Service 2016). Under the 4(d) rule, incidental take resulting from tree removal is only prohibited if it (1) occurs within 0.25-mile (0.4 kilometer) of known northern long-eared bat hibernacula entrance; or (2) cuts or destroys known, occupied maternity roost trees or any other trees within a 150-foot (45-meter) radius around the known, occupied maternity tree during the pup season (June 1 to July 31). This effectively exempted take that might result from forest management activities in a large portion of the species' range. USFWS reevaluated the species and published the findings in the Federal Register on March 23, 2022, proposing to reclassify the northern long-eared bat as an endangered species under ESA (U.S. Fish and Wildlife Service 2022a). A listing decision was published on November 30, 2022, reclassifying the species as endangered. This final rule goes into effect on January 30, 2023 (U.S. Fish and Wildlife Service 2022c).

- **Little brown bat.** The little brown bat, once among the most common and widespread species of bats in North America, characterized by conspicuous maternity colonies and relatively stable populations, is now in rapid decline due to WNS (Kunz and Reichard 2010). While little brown bats were likely present in the region prior to settlement, mining activities facilitated some of the largest concentrations of this species ever observed. Ten different mines in the region once each contained more than 10,000 little brown bats. Three mines in Wisconsin each contained more than 300,000 little brown bats. The little brown bat is not currently listed under ESA, but a recently completed status review found evidence of dramatic and widespread declines throughout the eastern United States (Tinsley 2016). Similarly, recent data provide evidence of catastrophic population losses of greater than 70% throughout Michigan, Minnesota, and Wisconsin (Michigan, Minnesota, and Wisconsin Departments of Natural Resources pers. comm. 2019). USFWS is conducting an analysis for a formal review of the species to determine whether its listing under ESA as endangered or threatened is warranted.
- **Tricolored bat.** The tricolored bat, also known as the eastern pipistrelle, is wide-ranging over most of the eastern United States (including the Lake States) and southern Canada. This species is also in decline due to WNS, as well as habitat loss and fragmentation (Minnesota Department of Natural Resources 2015). Prior to settlement, the species was likely restricted to karst landscapes (Brack and Mumford 1984), but mining provided numerous opportunities for the species to expand its range (Brown and Kurta 2013; Kurta and Smith 2014). The tricolored bat is not currently listed under ESA; USFWS was petitioned in June 2016 to list this species as endangered or threatened (Center for Biological Diversity and Defenders of Wildlife 2016). On 20 December 2017, USFWS indicated the petition provided credible information in support of listing and launched a formal Species Status Assessment. USFWS conducted an analysis for a formal review of the species to determine whether its listing under ESA as endangered or threatened is warranted. USFWS completed its analysis and published the findings in the Federal Register on September 14, 2022, proposing to list tricolored bats as endangered under ESA (U.S. Fish and Wildlife Service 2022b).

1.3.6 Other Listed Species in the Plan Area

There are a number of other federally listed species in the plan area (Table 1-2). The Lake States HCP will not cover these species based on the following considerations: incidental take of the species as a result of the proposed covered activities is not reasonably foreseeable, the listed species are not found on State DNR lands, or insufficient data exist to cover the species. In all cases, either covered activities will avoid other listed species, or these species will be addressed in separate compliance processes, such as through Section 7 consultation. Table 1-2 displays federally listed species with the potential to occur in the Lake States, as well as state listing status. State listing is often a good indicator of the likelihood of federal listing, so state-listed species are displayed even if there is no state permit process.

Table 1-2. Other ESA-listed and Candidate Species in the Plan Area (as of the writing of the Lake States HCP)

Species in the Plan Area	Federal Status	State Status		
		Michigan	Minnesota	Wisconsin
Mammals				
Canada lynx (*Lynx canadensis*)	T	E	SC	SC
Gray wolf (*Canus lupus*)	—	SC	—	SC
Birds				
Piping plover (*Charadrius melodus*)	E	E	E	E
Rufa red knot (*Calidris canutus rufa*)	T	—	—	SC
Whooping Crane (*Grus americana*)	NEP	—	—	SC/NEP
Reptiles				
Copperbelly water snake (*Nerodia erythrogaster neglecta*)	T	E	—	—
Eastern massasauga (*Sistrurus catenatus*)	T	SC	E	E
Mussels				
Clubshell (*Pleurobema clava*)	E	E	—	—
Higgins eye pearlymussel (*Lampsilis higginsii*)	E	—	E	E
Northern riffleshell (*Epioblasma torulosa rangiana*)	E	E	—	—
Rayed bean (*Villosa fabalis*)	E	E	—	—
Scaleshell (*Leptodea leptodon*) [a]	E	E	—	—
Sheepnose, also known as bullhead (*Plethobasus cyphyus*)	E	—	E	E
Snuffbox (*Epioblasma triquetra*)	E	E	E	E
Spectaclecase (*Cumberlandia monodonta*)	E	—	E	E
White catspaw (*Epioblasma obliquata perobliqua*) [b]	E	E	—	—
Winged mapleleaf (*Quadrula fragosa*)	E	—	E	E
Insects				
Dakota skipper (*Hesperia dacotae*)	T	—	E	—
Hine’s emerald dragonfly (*Somatochlora hineana*)	E	E	—	E
Hungerford’s crawling water beetle (*Brychius hungerfordi*)	E	E	—	—

Species in the Plan Area	Federal Status	State Status		
		Michigan	Minnesota	Wisconsin
Karner blue butterfly (*Lycaeides melissa samuelis*)	E	T	E	SC
Mitchell's satyr (*Neonympha mitchellii mitchellii*)	E	E	—	—
Poweshiek skipperling (*Oarisma poweshiek*)	E	T	E	E
Rusty patched bumble bee (*Bombus affinis*)	E	SC	—	SC
Fish				
Topeka shiner (*Notropis topeka*)	E	—	SC	—
Plants				
American hart's tongue fern (*Asplenium scolopendrium* var. *americanun = Phyllitis japonica* ssp. *a.*)	T	E	—	—
Dwarf lake iris (*Iris lacustris*)	T	T	—	T
Dwarf trout lily (*Erythronium propullans*)	E	—	E	—
Eastern prairie fringed orchid (*Platanthera leucophaea*) [c]	T	E	—	E
Fassett's locoweed (*Oxytropis campestris* var. *chartaceae*)	T	—	—	E
Houghton's goldenrod (*Solidago houghtonii*)	T	T	—	—
Lakeside daisy (*Tetraneuris herbacea* may be known also as *Hymenoxy acaulis* var. *glabra*)	T	E	—	—
Leedy's roseroot (*Rhodiola integrifolia* ssp. *leedyi*)	T	—	E	—
Mead's milkweed (*Asclepias meadii*) [d]	T/NEP	—	—	—
Michigan monkey-flower (*Mimulus michiganensis*)	E	E	—	—
Northern monkshood (*Aconitum noveborancense*)	T	—	—	T
Pitcher's thistle (*Cirsium pitcheri*)	T	T	—	T
Prairie bush clover (*Lespedeza leptostachya*)	T	—	T	E
Small whorled pogonia (*Isotria medeoloides*) [e]	T	T	—	—
Western prairie fringed orchid (*Platanthera praeclara*)	T	—	E	—

Notes:

Species that have been extirpated (e.g., American burying beetle, woodland caribou, and fat pocketbook) are not listed on this table, unless protected or experimental populations still occur.

[a] USFWS does not recognize scaleshell mussel as occurring in the Lake States, but it is listed as a species of concern in Michigan based on the presence of a potentially introduced population that is now thought to be extirpated.

[b] In the Michigan Natural Features Inventory (https://mnfi.anr.msu.edu/species/description/12362/White-catspaw), described as Federally endangered.

[c] Listed in Michigan as the Prairie white-fringed orchid.

[d] Considered extirpated in the Lake States. Experimental populations only.

[e] Considered extirpated in Lake States. Known only from one protected population in Berrien County, Michigan; previously recorded in 1981.

Sources: U.S. Fish and Wildlife Service 2015b; NatureServe. 2015; Reznicek et al. 2011; Michigan State University Extension 2016; Wisconsin Department of Natural Resources; 2016; University of Michigan 2016.

Michigan PA 451 Part 365; Minnesota ESA § 84.0895; Wisconsin State Statute 29.604 and Administrative Rule NR27

E = Endangered; T = Threatened; SC = Species of Concern; P = Proposed for listing; NEP = Non-Essential Population; — dashes indicate lack of listing status (species may still occur in the state)

1.4 Regulatory Setting

USFWS issuance of an incidental take permit under ESA is subject to all of the applicable federal regulatory requirements associated with any federal action. In addition, applicable state laws, guidelines, and mandates must also be addressed for wildlife species, including the four covered bat species.

1.4.1 Applicable Federal Environmental Laws

1.4.1.1 Federal Endangered Species Act

In 1973, the federal government enacted the ESA (16 United States Code [U.S.C.] § 1531 *et seq.*). Congress intended to improve previous protective regulations by creating a more comprehensive approach that would protect not only individual species but also their habitats. For the first time, the ESA enunciated the intention of conserving the ecosystems on which endangered and threatened species depend, with a goal of restoring listed species to a condition that would render the protections of ESA unnecessary.

USFWS and the National Marine Fisheries Service (NMFS) jointly administer ESA. ESA requires USFWS and NMFS to maintain lists of threatened and endangered species and provides substantial protections for listed species. NMFS' jurisdiction under ESA is limited to marine mammals, marine fish, and anadromous fish; as none of these species are proposed to be covered under the Lake States HCP, NMFS does not have jurisdiction over this HCP. USFWS has jurisdiction over all other species; all terrestrial and freshwater species in the plan area are subject to USFWS jurisdiction. As a result, USFWS will be responsible for oversight of this HCP.

Section 9 prohibits the take of any fish or wildlife species listed under ESA as endangered and most species listed as threatened. Unless specifically excluded at the time of listing, regulations prohibit all forms of take of threatened species.

Exceptions to these prohibitions on take are addressed in Section 7 (for federal actions) and Section 10 (for nonfederal actions) of ESA.

Section 4(d)

Section 4(d) of ESA allows USFWS to establish special rules for threatened (but not endangered) species, subspecies, and distinct population segments. These rules may either increase or decrease the normal take prohibitions established under Section 9 of ESA but must be "necessary and advisable to provide for the conservation of such species."

Section 6

Section 6 of ESA allows USFWS to enter into cooperative agreements with states for the purpose of conserving endangered or threatened species. When state activities deemed by USFWS to be adequate and active programs for the conservation of endangered species and threatened species are included in such a cooperative agreement, the prohibitions set forth in Section 4(d) and Section 9 of ESA do not apply to those activities as specified by regulations 50 CFR §17.21(c)(5) and 50 CFR §17.31(b)].The Lake States have all entered into cooperative agreements with USFWS and are, therefore, not required to secure an incidental take permit under Section 10 of ESA for those conservation activities covered under their cooperative agreements.

Section 7

Section 7(a)(2) of ESA requires all federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. To ensure that its actions do not violate these provisions, each federal agency must consult with USFWS, NMFS, or both (collectively referred to as *the Services*) when they determine that an action may affect listed species or designated critical habitat. If, after consultation, the Services conclude that the proposed action would jeopardize the continued existence of a listed species or adversely modify its critical habitat, the opinion may suggest *reasonable and prudent alternatives* to the proposed action. Before USFWS approves a habitat conservation plan (HCP), it is required to undertake an internal Section 7(a)(2) consultation because the issuance of an incidental take permit is a federal action that may affect one or more listed species. USFWS examines the HCP to ensure that it accurately documents the expected impacts of its federal action (i.e., issuance of an incidental take permit) and the mitigation proposed to compensate for those impacts. The Lake States HCP includes elements specific to the Section 7 process (e.g., analysis of indirect impacts on listed species) to facilitate this Section 7(a)(2) review.

Section 10

Private landowners, Tribes, corporations, state agencies, local agencies, and other nonfederal entities without a federal nexus must obtain a Section 10 incidental take permit for take of federally listed fish and wildlife species "that is incidental to, but not the purpose of, otherwise lawful activities." Although Section 9 of ESA includes prohibitions that apply to listed plants, the take prohibitions in Section 9 apply only to listed wildlife (animals), not to listed plants. However, because USFWS may not undertake an action that is likely to jeopardize the continued existence of listed plants, they are sometimes addressed in HCPs to facilitate the Services' finding under the intra-Service Section 7 consultation.

To receive an incidental take permit, the nonfederal entity is required under Section 10 to prepare an HCP that specifies the impacts that are likely to result from the taking, the measures the permit applicant will undertake to minimize and mitigate such impacts, and the funding that will be available to implement such measures.

1.4.1.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) (42 U.S.C. § 4332 *et seq*.) requires all federal agencies to evaluate the environmental effects of proposed agency actions as part of their decision-making process. This environmental impact analysis is documented in either an environmental assessment or an environmental impact statement. In addition, these documents, and a description of the efforts to avoid or minimize the adverse effects of proposed actions must be made available for public notice and review as part of the NEPA process.

USFWS' issuance of an incidental take permit is a federal action subject to NEPA review. To comply with NEPA, USFWS will prepare an environmental review document (either an environmental assessment or an environmental impact statement) to disclose the effects on the natural and human environment of issuing the incidental take.

1.4.1.3 National Historic Preservation Act

The National Historic Preservation Act (16 U.S.C. §§ 470–470x-6) is the principal federal statute protecting historical, architectural, archaeological, and cultural resources. The act establishes an independent agency, the Advisory Council on Historic Preservation, as well as the *National Register of Historic Places* within the National Park Service. In particular, Section 106 requires federal agencies to consider the effects of their undertaking (or action) and consult with specific parties on properties listed in or eligible for inclusion in the National Register. *Eligible* for listing in the National Register of Historic Places includes all properties that meet the specifications laid out in the Department of the Interior regulations at 36 CFR § 60.4.

USFWS' issuance of an incidental take permit is a federal action subject to Section 106 of the National Historic Preservation Act. To comply with Section 106, USFWS will have to consider the effects of permit issuance on properties listed in or eligible for inclusion in the National Register of Historic Places.

1.4.2 State Endangered Species and Wildlife Laws

This section describes the relevant state laws and regulations that pertain to endangered species or to wildlife protections for bats. State laws and regulations related to forest management and state-owned lands are summarized below and described in Chapter 2, *Covered Lands and Activities*.

1.4.2.1 Michigan

Natural Resources Environmental and Protection Act, Act 451

Part 365, Endangered Species Protection, Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, MCL 324.36501 to 324.36507 (Part 365), prohibits take of plants and animals listed as threatened and endangered. Part 365 defines take of fish and animals as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect or attempt to engage in any such conduct" and for plants as "to collect, pick, cut, dig up, or destroy in any manner." Part 365 reflects the desire of the people of Michigan to protect the rare natural resources of the state. Accordingly, the Michigan DNR is required to take those steps necessary to protect, conserve, and restore species listed as threatened and endangered. The Michigan DNR has discretion to permit take in some circumstances but must do so in a way that minimizes adverse impacts and considers all reasonable alternatives. All four covered species are listed by the state of Michigan: the Indiana bat is endangered, while northern long-eared, little brown, and tricolored bats are considered species of special concern. The covered activities under the Lake States HCP that directly affect Indiana bats would require a state threatened and endangered species permit; however, impacts on northern long-eared, little brown, and tricolored bats do not require a state permit since they are listed as species of special concern.

1.4.2.2 Minnesota

Endangered Species Statute

Minnesota's Endangered Species Statute (Minnesota Statutes 2015 § 84.0895) and associated rules (Minnesota Administrative Rules, Chapters 6212.1800, 6212.2300, and 6134) provide the state's guidelines for the designation and protection of threatened and endangered species. The statute requires the Minnesota DNR to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern and to regulate treatment of species designated as endangered and threatened. Under the statute, a person may not take, purchase, import, possess, transport, or sell any portion of an endangered or threatened species, except when allowed by permit or under certain specific exemptions. Species of special concern are not afforded regulatory protection under the statute or associated rules, but policies and best management practices exist to reduce potential impacts to species of special concern.

Of the species covered by the Lake States HCP, Indiana bats are considered not present in Minnesota, and the other three species are listed as species of special concern. As a result, at the writing of the Lake States HCP, no state endangered species permit is required for covered activities in Minnesota. If the state listing status of covered species changes over the course of the permit, Minnesota DNR will take appropriate steps to comply with the Endangered Species Statute.

Game and Fish Laws

Minnesota has extensive game and fish laws (Minnesota Statutes 2019, Chapter 97A and 97b) that regulate taking and possession of wild animals, state lands protected for wildlife, fish hatcheries, and other related topics. Under these statutes, the Minnesota DNR is charged to do “all things necessary to preserve, protect, and propagate desirable species of wild animals” (M.S., Section 97A.045, Commissioner, General Powers, and Duties, Subd. 1: Duties). Most provisions of the game and fish laws apply specifically to those species designated as *protected wild animals,* including bats. Minnesota DNR will take appropriate steps to comply with game and fish laws.

1.4.2.3 Wisconsin

Wisconsin defines, lists, and protects endangered and threatened species under state statute and administrative rules. Wisconsin State Statute 29.604 provides protection to certain wild animals and wild plants that are determined to be endangered or threatened and, therefore, entitled to preservation and protection. The legislation restricts take and possession of endangered or threatened species in Wisconsin and establishes a program for conservation and restoration. The rules necessary to implement this statute are provided in Chapter NR 27 of the Wisconsin Administrative Code. These rules govern the take, transportation, possession, processing, or sale of any wild animal or wild plant specified by the Wisconsin DNR list of endangered and threatened species.

Under the statute and administrative rules, the Wisconsin DNR may issue incidental take permits for take of state-listed species if the taking will be only incidental to the carrying out of an otherwise lawful activity. Take is defined as “shooting, shooting at, pursuing, hunting, catching or killing any wild animal; or the cutting, rooting up, severing, injuring, destroying, removing, or carrying away any wild plant.” (Wisconsin Administrative Code § NR 27.01(8)). Permits may not be issued to an applicant unless the applicant submits a conservation plan and implementing agreement to the Wisconsin DNR to include all of the following elements.

1. A description of the impact that will likely occur as a result of the taking of an endangered species or threatened species that is specified on the Wisconsin DNR’s endangered and threatened species list.

2. The steps taken to minimize and mitigate the impact that the endangered species or the threatened species will suffer.

3. A description of the funding that the parties specified.
4. A description of the alternative actions to the taking that have been considered and the reasons that these alternatives will not be utilized.
5. Any other measures that the Wisconsin DNR may determine to be necessary or appropriate (Wisconsin Administrative Code § 29.604 6(m)).

As stated in Section NR 27.06(1), "any person taking, transporting, possessing or selling any wild animal or wild plant included in the U.S. endangered and threatened species list, but not included in the Wisconsin endangered or threatened species lists, does not need a state permit if such person has a federal permit authorizing such possession."

In 2015, the Wisconsin DNR issued broad incidental take authorization (used by state agencies) and a broad incidental take permit (used by nonstate agencies and individuals), as provided for under s. 29.604, Wisconsin Statutes, to allow for the incidental taking of state threatened cave bats in Wisconsin that may occur as a result of specific public health concerns, bat removals, building demolitions, tree cutting, bridge demolitions, miscellaneous building repairs and wind energy development projects. The permit and authorization cover incidental take (under the state law only) of tricolored bat (also known as the eastern pipistrelle), little brown bats and northern long-eared bats. Because this coverage only applies to the state endangered species law, it remains necessary to cover take of these species under ESA via the Lakes States HCP. To the extent possible, the Lake States HCP will support the existing plan for take authorization in Wisconsin for these species.

1.5 Development of the Lake States HCP

The Lake States HCP was developed in coordination with several groups that provided technical advice and guidance on HCP development. These groups are outlined in Sections 1.5.1, *Steering Committee,* and 1.5.2, *Stakeholder Group*.

1.5.1 Steering Committee

The members of the steering committee and supporting staff who participated in the development of the Lake States HCP are identified in Table 1-3.

Table 1-3. Steering Committee Participants and Supporting Staff

Name	Agency	Title
Dan Kennedy	Michigan Department of Natural Resources	Endangered Species Coordinator, Wildlife Division
Keith Kintigh	Michigan Department of Natural Resources	Forest Conservation and Certification Specialist, Forest Resources Division
Don Mankee	Michigan Department of Natural Resources	West Upper Peninsula District Manager, Forest Resources Division
Rich Baker	Minnesota Department of Natural Resources	Endangered Species Consultant, Division of Ecological and Water Resources
Amber Ellering	Minnesota Department of Natural Resources	Policy and Planning Unit Supervisor, Division of Forestry

Name	Agency	Title
Bridget Henning-Randa	Minnesota Department of Natural Resources	Endangered Species Consultant, Division of Ecological and Water Resources
Kurt Hinz	Minnesota Department of Natural Resources	Assistant Area Forest Supervisor, Division of Forestry
Lacy Levine	Minnesota Department of Natural Resources	Forest Policy Program Consultant, Division of Forestry
Owen Boyle	Wisconsin Department of Natural Resources	Species Management Section Chief, Division of Fish, Wildlife, and Parks, Bureau of Natural Heritage Conservation
Sarah Herrick	Wisconsin Department of Natural Resources	Conservation Biologist, Division of Fish, Wildlife, and Parks, Bureau of Natural Heritage Conservation
Mark Heyde	Wisconsin Department of Natural Resources	Sustainable Forestry Certification Coordinator, Bureau of Forestry Field Operations
Kristin Lambert	Wisconsin Department of Natural Resources	Public and Private Forestry Section Chief
Jack Dingledine	U.S. Fish and Wildlife Service	Deputy Field Supervisor
Peter Fasbender	U.S. Fish and Wildlife Service	Field Office Supervisor
Scott Hicks	U.S. Fish and Wildlife Service	Field Office Supervisor
Laurel Hill	U.S. Fish and Wildlife Service	Fish and Wildlife Biologist
Andrew Horton	U.S. Fish and Wildlife Service	Regional HCP Coordinator
Lisa Mandell	U.S. Fish and Wildlife Service	Deputy Field Supervisor
Shauna Marquardt	U.S. Fish and Wildlife Service	Field Office Supervisor
Nick Utrup	U.S. Fish and Wildlife Service	Fish and Wildlife Biologist
Jenny Wong	U.S. Fish and Wildlife Service	Fish and Wildlife Biologist

1.5.2 Stakeholder Engagement

The HCP Steering Committee invited input from stakeholders and the public during the development of the draft HCP. Each individual state invited input from stakeholders and the public during the course of chapter development to inform state agency leaders of stakeholder perspectives. The primary opportunity to provide input was through formal stakeholder review and written comment. The Steering Committee chose this method to enable comments from stakeholders in the three states to be gathered at the same time. Comments were consolidated and reviewed by the three states. Revisions resulting from stakeholder comments were provided to the consultants developing the HCP. This was not a required part of the HCP but an additional effort the states chose to include in the process. In addition, USFWS will conduct a formal public comment process when a full draft of the HCP is complete to fulfill NEPA requirements.

1.6 Document Organization

This document contains the following chapters and appendices.

- Chapter 1, *Introduction*
- Chapter 2, *Covered Lands and Activities*
- Chapter 3, *Environmental Setting*
- Chapter 4, *Potential Effects of Covered Activities*
- Chapter 5, *Conservation Strategy*
- Chapter 6, *HCP Implementation and Assurances*
- Chapter 7, *Cost and Funding*
- Chapter 8, *Alternatives to Take*
- Chapter 9, *References*
- Appendix A, *Attributes of High-Quality Covered Bat Habitat in Managed Lake State Forests*
- Appendix B, *Landowner Enrollment Program*
- Appendix C, *Habitat Model Summary*
- Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*
- Appendix E, *Bat Protection Zones*
- Appendix F, *Impact Assumption Validation Assessment*

Chapter 2
Covered Lands and Activities

2.1 Overview

This chapter provides an overview of lands and activities for which take authorization is requested under the Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP). A primary driver for this HCP is the need to conduct forest management activities, especially timber harvest, on nonfederal lands in Michigan, Minnesota, and Wisconsin. The Departments of Natural Resources for these states (State DNRs) will be the recipients of the incidental take permit for each state and will be able to extend this incidental take coverage to eligible landowners within their state through the Landowner Enrollment Program (Appendix B, *Landowner Enrollment Program*). Forestlands are managed by the State DNRs to benefit a variety of organisms, provide economic benefits to citizens, maintain ecosystem services, and provide recreational opportunities for residents.

All forested lands not owned or managed by the federal government, within the states of Michigan, Minnesota, and Wisconsin are referred to as the covered lands. This comprises approximately 9.2 million acres of land owned or managed by the State DNRs, as well as 38.1 million acres of land owned and managed by other nonfederal entities. As described in Chapter 1, *Introduction*, any project with a federal lead agency or federal involvement (i.e., a federal permit, federal funding, or a project on federal land) must obtain their incidental take authorization through the federal Endangered Species Act (ESA) Section 7 with an incidental take statement in a biological opinion from USFWS (Section 1.4.1.1, *Federal Endangered Species Act*). The State DNRs conduct some actions with federal involvement, either on federal land, funded by federal grants, or perhaps that require a separate federal permit. These DNR actions with federal involvement are included in the Lake States HCP as covered activities to facilitate the separate take coverage through Section 7 as required by the ESA. If the DNRs implement the covered actions in compliance with the Lake States HCP, any relevant ESA Section 7 consultation process is expected to be greatly streamlined.

Covered activities are forest management activities on covered lands that could result in incidental take of covered species or their habitat. Descriptions of covered activities are based on current operations and available projections. As a programmatic plan covering multiple entities, the amount and exact location of these activities may shift over time. The nature of each activity is described below and the extent (acres) of each activity is provided for context. Chapter 4, *Potential Effects of Covered Activities*, quantifies the potential effects of these activities on covered species and anticipated take under the Lake States HCP for each covered species.

2.2 Covered Lands Summary

This section describes three categories of covered lands in each state: 1) State DNR-managed lands; 2) county and municipal lands; and 3) private lands (including corporate nongovernmental organizations, Tribal lands, family forests, etc.). Table 2-1 provides ownership information across the three states and includes a summary of federal lands, which, while not covered in the Lake States HCP, provides important context for evaluating the distribution of forests in the plan area. Table 2-1 also breaks out Tribal lands data, which are only available at the land ownership level; in subsequent analyses, Tribal lands are included with the private lands category. Ownership data were obtained from the U.S. Forest Service (USFS) Forest Inventory and Analysis (FIA) national program, a national forest dataset that provides a consistent, replicable record of forestland ownership, as well as forest type, timber harvest, and other variables relevant to subsequent analyses (U.S. Forest Service 2015). The USFS developed and maintains this system, which is one of the most comprehensive forest monitoring programs in the world. It is a multi-tiered inventory and data processing effort in which foresters use a combination of both field data collected by biologists and remote sensing data. The result is a publicly available dataset that is collected using a consistent approach across the Lake States (Smith 2002; Oswalt et al. 2014). The data are available as decadal summaries of forest resources by state and annual reports.[1] The FIA database was used to quantify ownership patterns across the Lake States. The FIA defines forestland as land that has at least 10% crown cover by live, countable trees, now or in the past (as evidenced by stumps, snags, etc.). Individual patches of forestland must be at least 1 acre and 120 feet wide. Tree-covered agricultural production areas, such as orchards, and tree clusters in urban settings, such as city parks, are excluded.

The 54.78 million acres of forestland in the Lake States are distributed unevenly across ownerships. Federal forestland accounts for 13.7% of forestland, states own 16.9%, county and municipal ownership is 9.8%, Tribal ownership is 2.0%, private corporations own 10.3%, noncorporate entities (private individuals) own 45.4%, and other entities such as nonprofit conservation groups and private clubs own 1.9%.

Among the State DNRs, Michigan holds the largest amount of forestland as defined by FIA, 4.20 million acres, followed by Minnesota with 3.85 million acres, and Wisconsin with 1.19 million acres.[2] County land represents a small fraction of Michigan's forestland (almost 435,000 acres), but Minnesota and Wisconsin counties and municipalities manage 2.57 million and 2.36 million acres, respectively. Nearly all Minnesota land reported as county land in the FIA data is actually held in trust by the state and managed as forestland by counties. For the purposes of the Lake States HCP, land managed by the counties, even if owned by the State DNRs, will not be covered by the DNRs' incidental take permits but could obtain take authorization via the Landowner Enrollment Program. Private forestland owners hold significant amounts of land in Michigan and Wisconsin (12.59 million and 11.47 million acres, respectively). Minnesota private forestland ownership is about 35% less, at 7.49 million acres. Individuals own the majority of private forestland in all states. Corporate holdings in Michigan, Minnesota, and Wisconsin are 2.9 million (23.0% of all private forestlands), 1.24 million (16.5%), and 1.5 million acres (13.0%), respectively. Tribal lands include 0.03 million acres in Michigan (0.1% of all forestlands in the state), 0.7 million acres in Minnesota (3.8%), and 0.4 million acres in Wisconsin (2.4%).

[1] Available at https://www.fia.fs.fed.us.

[2] Elsewhere in this document, state-owned lands exceed the acres of FIA-reported forestland due to inclusion of nonforestlands and, in Minnesota, the inclusion of state-owned forestland managed by counties.

Table 2-1. Acres of Forestland by Ownership across the Lake States

	Acres of Forestland			
FIA Ownership Class	**Michigan**	**Minnesota**	**Wisconsin**	**Total**
State				
State	4,208,398	3,848,587	1,192,783	9,249,768
County and Municipal				
County and municipal	426,537	2,569,083	2,354,532	5,350,152
Other local government	8,212	5,279	4,434	17,925
Total county and municipal	434,749	2,574,362	2,358,966	5,368,077
Private				
Corporate-forest industry	468,716	615,878	196,098	1,280,692
Corporate-other (e.g., universities)	2,432,879	622,836	1,299,873	4,355,588
Individual and family [a]	9,036,292	6,147,247	9,699,733	24,883,272
Nongovernmental conservation [b]	165,319	31,725	79,893	276,937
Unincorporated local partnership [c]	485,589	70,002	198,396	753,987
Total private	12,588,795	7,487,688	11,473,993	31,550,476
Tribal [d]				
Tribal	29,278	662,693	411,069	1,103,040
Total covered lands	**17,261,220**	**14,573,330**	**15,436,811**	**47,271,361**
Federal				
National forest	2,756,444	2,594,167	1,424,254	6,774,865
Bureau of Land Management	0	5,686	0	5,686
U.S. Fish and Wildlife Service	54,736	84,479	99,479	238,694
U.S. Department of Defense	6,156	12,013	40,233	58,402
Other federal	232,320	142,854	56,193	431,367
Total federal	3,049,656	2,839,199	1,620,159	7,509,014
Grand Total (all ownerships)	**20,310,876**	**17,412,529**	**17,056,970**	**54,780,375**

Notes:
[a] Includes trusts, estates, and family partnerships.
[b] Includes natural resources organizations.
[c] Includes associations and clubs.
[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the “Native American” owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.
Source: U.S. Forest Service 2015; Miles pers. comm. 2017

2.3 Covered Activities Summary

The Lake States HCP was developed to provide the State DNRs with incidental take coverage during implementation of forest management activities that might affect listed or at-risk bat species. The primary covered activity under this HCP is timber harvest; however, associated activities such as road and trail construction for forestry, prescribed fire, and monitoring, which may result in incidental take, are also covered (Table 2-2).

Table 2-2. Covered Activities by Ownership Category

Covered Activity	State DNR	County	Municipal	Private [a]
	Ownership Category			
Timber harvest and related forest management practices [b]				
Regeneration harvest	X	X	X	X
Intermediate harvest	X	X	X	X
Salvage/sanitation	X	X	X	X
Roads and trails construction, maintenance, and use [a]				
State DNR and county roads and trails construction [a]	X	X	--	--
State DNR and county road maintenance and use	X	X	--	--
Prescribed fire				
Fire breaks	X	X	X	X
Burning	X	X	X	X
Lake States HCP implementation				
Lake States HCP monitoring	X	X	X	X
Habitat restoration	X	X	X	X

Notes:
[a] Private lands data include Tribal lands.
[b] Temporary forest roads associated with forest management are covered as part of forestry in all ownership types.

2.3.1 Timber Harvest and Related Forest Management Practices

Timber harvest is an important and often-used tool in natural resources management. Timber harvests help regenerate and direct the growth of forest stands toward specific management objectives. Timber harvests can be aimed at controlling the growth, development, health, structure, composition, and quality of forest stands to meet a set of needs, including timber production, wildlife habitat, preservation of rare species, and recreation. The Lake States HCP covers tree cutting and other forest management activities that are administered by State DNRs for other organizations, e.g., U.S. Fish and Wildlife Service (USFWS) and U.S. Department of Transportation (USDOT). Timber harvest can also include actions such as single-tree removal, felling or girdling for wildlife habitat or recreation needs, and tree clearing for the construction of temporary roads associated with timber harvest activities.[3] The rate and extent of timber harvest range widely depending upon forest cover type, the age and development stage of timber resources, and the goals of the harvest. On covered lands, most timber is sold to private purchasers, providing an economic benefit to the landowner and supporting the forest products industry.

The silvicultural techniques used by the State DNRs are generally similar and timber harvest follows a spectrum of duration, disturbance, intensity, and frequency. For example, harvest can range from single-tree selection harvest, which is relatively low in intensity and includes multiple entries once

[3] The construction of temporary roads associated with timber harvest activities is part of the covered activity of timber harvest. The construction and maintenance of permanent roads and trails is covered as its own activity (for more information, see Section 2.3.2, *Roads and Trails Construction, Maintenance, and Use*).

every 10 to 15 years (depending upon the tree species and site conditions) over multiple decades, to a clearcut, which is a high-intensity management action that occurs at a single point in time and, depending on the tree species and site conditions, may only occur once every 50 to 100 years. Forest management includes several activities beyond timber harvest, brush control, browsing control, and more, as part of normal practices. Timber harvest, as practiced by the permittees, is further discussed in Section 2.3.1.1, *Background and Definitions*. Three types of harvest (regeneration harvest, intermediate harvest, and salvage/sanitation harvest) are described in Section 2.3.1.2, *Harvest Types*.

In keeping with their various missions, divisions in each of the State DNRs use a different mix of practices, and not all activities occur on all lands. Further, management practices vary due to differing site conditions and state-level regulations and directives. Terminology used to refer to timber harvest practices also varies across states.

A timber operation involves several activities, all of which are part of the broader category of timber harvest practices. For the purposes of the Lake States HCP, these activities are described in this section rather than individually in the subsections of Section 2.3.1.2, *Harvest Types*. These component activities include tree felling, skidding/forwarding, delimbing, bucking/chipping, loading, and hauling. Felling is done using either chain saws or mechanized fellers. Larger trees are usually processed into logs for transport by skidders or forwarders to roadside landings, where they are loaded onto trucks. Skidders drag logs or entire trees along skid trails, which confines the area on which logs are moved. Motorized equipment is used to cut, move, chip, and haul trees during harvesting operations.

Other examples of actions covered by the Lake States HCP and included as part of timber harvest are as follows: clearing of invasive plant species on multiple acres, clearing brush to prepare for seeding or planting, planting trees, use of wildlife repellants, fencing or other seedling protection, brush mowing, disking or other site preparation for tree establishment, and other vegetation control related to maintenance of forest roads and trails (see also Section 2.3.2, *Roads and Trails Construction, Maintenance, and Use*). Collectively, these activities are subsumed by the larger categories of activities (i.e., regeneration harvest, intermediate harvest, and salvage) described in Section 2.3.1.2, *Harvest Types*.

2.3.1.1 Background and Definitions

Forest managers use a wide variety of techniques to influence the current and future conditions of trees within a management unit termed a *stand*. One of the most important tools available to forest managers is timber harvest. The Lake States HCP recognizes three major categories of timber harvest based on the function and purpose of the harvest: regeneration harvest, intermediate harvest, and salvage/sanitation harvest. These harvest types are described below.

The general forestry definitions provided below are modified from the Society of American Foresters definitions (Helms 1998), unless otherwise cited. Note that many techniques in forestry are adapted or modified to suit desired outcomes, and the defined prescriptions may be used or modified in ways that are not specified here.

General Terms

- **Clutter**. Clutter describes the structural complexity of the overall forest (O'Keefe et al. 2014). The higher the clutter, the more complex the forest. Clutter can be measured by comparing the volume of trees and vegetation to the volume of open space in a stand.
- **Cohort**. A cohort is a group of trees developing after a single disturbance, commonly consisting of stems of similar age, although it can include a considerable range of tree ages from seedling or sprout origin, as well as trees that predate the disturbance.
- **Coppice**. A coppice is the production of new stems from the stump or roots, which can be used in combination with any other silvicultural technique to regenerate a stand.
- **Cord**. A cord is a measure of volume by which firewood and pulpwood are measured.
- **Firebreak**. A firebreak is an area empty of combustible material that prevents fire from spreading beyond it.
- **Intermediate harvest**. An intermediate harvest is a forest harvest method used to manipulate the growth, quality, vigor, and composition of a stand after establishment of regeneration and prior to final harvest (further described in Section 2.3.1.2, *Harvest Types*).
- **Management approach**. The management approach describes the practices used in forestry to achieve management objectives (Duncker et al. 2012).
- **Overstory removal.** Overstory removal refers to the harvesting of many to all of the trees within the upper layer of the canopy in a stand. This is usually done to facilitate the forest regeneration process, for example, to release seedlings and saplings in the understory. Overstory removal is employed in multiple even-aged management approaches.
- **Regeneration harvest**. A regeneration harvest is a forest harvest that uses various methods to remove trees from a mature stand to allow establishment of a new age class (further described in Section 2.3.1.2, *Harvest Types*).
- **Release.** Release refers to the increased growth rate caused when a tree gains access to a previously limited factor (usually sunlight, water, or nutrients). Most silvicultural techniques are aimed at releasing a targeted group of trees within a stand.
- **Salvage harvest**. Salvage harvest refers to a forest harvest completed to remove dead, dying, or damaged trees to avoid economic loss.
- **Seral stage.** The seral stage is the series of biotic communities formed by the process of ecosystem development called succession. In forested landscapes, the various vegetation communities that occupy disturbed sites are called seral stages. Seral-stage communities consist of vegetation types that are adapted to the site's particular set of physical and biotic conditions. A seral stage indicates the point of succession a forest is currently in (e.g., early seral, midseral, late seral).
- **Silviculture**. Silviculture is the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis (U.S. Forest Service 2014).
- **Slash.** Slash refers to the limbs, tops, branches, and/or bolewood left on the ground after logging.

- **Stand**. A stand is a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable and manageable unit.

Types of Stand Management

- **Even-aged**. An even-aged stand is one where trees in the stand are managed to consist of one to two cohorts at any given time. Even-aged stands are regenerated through the use of clearcuts, shelterwoods, or seed tree management approaches.
- **Uneven-aged.** An uneven-aged stand is one where trees in the stand are managed to consist of three or more cohorts at any given time. Uneven-aged stands are regenerated through the creation of gaps within an existing stand through either natural means or by harvest. Harvest approaches used to create uneven age management can consist of removing one tree at a time (single-tree selection) throughout the stand, or by removing small clusters of trees (group selection).

Management Systems that Produce Even-Aged Stands

- **Clearcut**. A clearcut management system uses an even-aged stand harvesting method in which all trees in a stand are removed to allow regeneration of a new age class.
- **Seed tree**. A seed tree management system uses an even-aged stand harvesting method in which most trees in a stand are removed except for a few trees that are retained to spread seeds for regeneration. Seed trees are often removed after regeneration occurs.
- **Shelterwood**. A shelterwood management system uses an even-aged stand harvesting method that involves the cutting of mature overstory trees in successive harvests. This is often conducted in three cuts: preparatory, regeneration or seeding, and removal.

Management Systems that Produce Uneven-Aged Stands

- **Group selection.** A group selection management system uses an uneven-aged stand harvest method that removes small clusters of trees and establishes new age classes within a stand.
- **Single-tree selection.** A single-tree selection system uses an uneven-aged stand harvest method where regeneration is managed in small gaps by harvesting individual trees.

Subtypes of Intermediate Harvests

- **Cleaning.** A cleaning removes select tree species to better support favored tree species.
- **Commercial thinning.** Commercial thinning removes trees of an appropriate size and type to be sold.
- **Precommercial thinning**. Precommercial thinning removes trees that are not marketable due to size and/or type.
- **Salvage cut**. A salvage cut removes dead or dying trees affected by adverse events (e.g., disease, insects, fire) to improve stand health, capture economic value that would be lost in the near future, and prevent additional mortality within or beyond a stand’s boundary.
- **Sanitation cut**. A sanitation cut removes either infected or healthy trees of a species prone to infection to limit the spread of a biotic pest (e.g., disease, insects).

- **Thinning.** Thinning removes trees to reduce competition and stem density, with the aim of improving growth, enhancing forest health, and recovering potential mortality.

2.3.1.2 Harvest Types

Regeneration Harvest

Regeneration harvest is timber harvest conducted to promote tree regeneration, balance forest age classes, and extract usable or merchantable timber. Regeneration cuts occur in forest stands that are either even-aged (consisting of one or two age classes) or uneven-aged (consisting of three or more age classes). Trees growing in even-aged stands have small differences in ages (typically less than 20% of the intended rotation age), while uneven-aged stands comprise trees having markedly different ages. In addition, uneven-aged stands tend to be more structurally complex than even-aged stands. Regeneration methods (Figure 2-1) have different ecological effects on bats, and they are grouped into two effect categories described in Section 2.3.1.3, *Ecological Categories of Harvest*.

Even-Aged Stand Harvests

Techniques that regenerate even-aged stands typically include clearcutting, shelterwood harvests, and seed tree harvests. Even-aged management can promote early seral to midseral stage species such as black cherry, oaks, and hickories, which are often particularly valuable for wildlife. For the purposes of the Lake States HCP, two-aged stand systems are included with the closely related even-age techniques. These typically have both young and old trees, often in woodland or savannah landscapes with relatively low canopy cover, which are also often highly valuable for wildlife. All types of even-aged stand harvests employ some kind of overstory removal, or the removal of the highest layer of canopy in a stand to release advance regeneration in the understory.

Clearcuts

> **Clearcuts** remove all or nearly all trees in an area. Residual trees may be left.

Michigan, Minnesota, and Wisconsin all define clearcuts as one of their timber harvest techniques. Historically, clearcuts removed all or nearly all trees from the stand in a single harvest. The State DNRs practice clearcuts with reserves, which retain a minimum of 3% of the trees. These remaining trees are called a residual, standard, or reserve. These trees are left either in clumps or as scattered individuals for maintaining a structural legacy or for wildlife habitat (i.e., retention of cavity, mast, legacy trees, and snags) or other benefits such as erosion control and aesthetics. In some cases, a more extensive reserve can be used to produce the same type of regeneration produced by a shelterwood (see below) without requiring re-entry to the stand. Clearcuts are usually regenerated by a combination of advance regeneration (seedlings already established), seed produced by trees adjacent to the harvest area or from trees cut in the harvest operation, sprouting from stumps or roots of cut trees, and the planting of seedlings. Regeneration might require site preparation and subsequent control of competing vegetation. A variation of a *two-aged* clearcut produces a stand with two-aged cohorts.

The Lake States HCP includes all clearcutting techniques the states perform, such as coppicing or clearcutting with sprouting, uniform, alternate, and progressive cuts. These activities are effective for managing different species of trees, but they all produce the same result of a cleared stand, most often with residuals. Species that are commonly managed with clearcuts include pine, oak and oak/hickory, aspen, birch, and spruce-fir forest types.

Figure 2-1. Diagrams of Basic Regeneration Methods

Outside of state and federal lands, property owners have discretion in how they apply various silvicultural practices (although many property owners abide by silvicultural requirements of programs that they are involved in). Clearcuts on non-State DNR land can range from leaving no residual trees in the stand to retaining a significant number of residual trees. Clearcuts conducted under the Lake States HCP are required to follow the retention guidelines used by the respective State DNR.

Shelterwood

Shelterwood is a system of partial harvesting that allows new trees to grow under an overstory of maturing trees.

The shelterwood system is an even-aged management system that involves the removal (cutting) of the mature overstory in two or more successive harvests. Residual, older trees in the overstory are kept for a specified time to serve as a source of seed and to protect seedlings or regeneration. The shelterwood method can be used to temper visual characteristics in a regenerating stand, and to maintain important habitat elements for specific wildlife and plant communities. These types of cuts are used in the Lake States for birch, oak, ash, black cherry, basswood, white pine, red maple, hemlock, spruce, balsam fir, cedar, and other shade-intolerant or intermediately shade-tolerant species. Shelterwood systems in the Lake States may be characterized by up to three types of cuts: preparatory, regeneration or seeding, and removal. In many cases, the preparatory and regeneration harvests are combined in a single event.

- **Preparatory cut.** A preparatory cut is an intermediate harvest that removes trees from which seeds are not desired. This cut may or may not occur, depending on the quality of the stand. The lower the quality, the greater the need for a preparatory cut.
- **Regeneration or seeding cut.** A regeneration or seeding cut is then conducted, which removes some of the larger trees and allows light into the subcanopy. This maintains spacing such that the large trees provide seeds that become the regenerating forest.
- **Removal harvest.** The final cut in a shelterwood system is a removal cut that eliminates most or all of the remaining overstory trees. Preparatory and regeneration cuts have a different effect on bats than the removal harvest. Therefore, these cuts are tracked separately (Section 2.3.1.3, *Ecological Categories of Harvest*). The result of a shelterwood system is an even-aged stand of trees that was initiated between the seeding and removal harvests. Once the overstory is removed, the seedlings and saplings that were already established in the understory are then "released" to grow, because the overstory was previously shading and inhibiting the growth of these smaller trees. Another term for the removal harvest is *overstory removal*.

Seed Tree

The seed tree system is similar to shelterwood but removes more trees in the regeneration cut.

The seed tree system is an even-aged management approach similar to a shelterwood that involves the removal (cutting) of the mature overstory in up to two successive harvests. Scattered trees (fewer than in a shelterwood system) are retained in the overstory and are kept for a specified time to serve as a source of seed. Seed trees may be harvested later or retained indefinitely in the stand. Seed tree techniques are often used in white, jack, and red pine, white birch, red maple, white spruce, balsam fir, black spruce, tamarack, and cedar stands. Seed tree systems in the Lake States may require up to two cuts: regeneration or seeding, and removal, as described previously under *Shelterwood*.

Uneven-Aged Stand Harvests

Techniques that can regenerate stands with at least three age classes are termed uneven-aged stand management and include group selection and single-tree selection.

Uneven-aged stand management is implemented by selectively removing individual trees or small groups of trees from a stand to match a target stand condition. In some cover types, this mimics a natural disturbance regime. Forest management often coincides with wildlife management, and some preferred wildlife species require older forest conditions rarely found in even-aged stands.

With either technique, the removal must be large enough to allow regeneration of new trees because promotion of trees from just the subcanopy can result in an even-aged stand. In a group selection, the greatest width of the group of trees that is felled is approximately twice the height of the most mature trees in that group. Individual tree selection creates new age classes in uneven-aged stands by removing individual or small clusters of trees throughout the stand to achieve the desired end stand structure. In some cases, a selective harvest is followed by noncommercial cutting or herbicide application to remove undesirable species, especially within regeneration gaps.

Group Selection

In group tree selection, gaps are made that may vary in size from just a few adjacent trees up to 0.5 acre. The species that benefit from group selection are trees that are tolerant of an intermediate amount of shade. Herbicide or brushing may be used to control competition from shrubs and other nontree species like blackberry. Group selection is becoming more common in the Lake States.

> **Group selection** harvests groups of trees to create opportunities for natural regeneration.

If very large groups in a stand are removed at one time, the harvest technique is termed a *patch cut.* These harvests create large openings in the overstory, which, when deployed across an entire stand, create even-aged patches that constitute an uneven-aged stand. These patches are termed *cohorts*. Cohorts should be created at different times so that each represents a distinct age class. A wider variety of trees can be grown using this method because openings are relatively large and sun exposure across the cohort varies from full shade to full sun. Trees that can be regenerated using group selection include red maple, central hardwoods, swamp hardwoods, bottomland hardwoods, white pine, white birch, oak, black walnut, white spruce, balsam fir, black spruce, tamarack, and white cedar.

Single-Tree Selection

Single-tree selections are very much like heavy thinnings, wherein trees are independently selected and felled to create an environment similar to small-scale natural disturbances. This type of selection is prescribed every 10 to 20 years for a stand and is often used when managing for a wildlife species that requires low levels of disturbance. Tree species that benefit from this type of management are shade-tolerant species, such as sugar maple,

> **Single-tree selection** harvests individual trees to encourage regeneration of the remaining stand.

American beech, basswood, hop-hornbeam, hemlock, red maple, balsam fir, black spruce, and cedar.

Intermediate Harvest

An intermediate harvest involves removing trees at the point in stand development between stand initiation and the final harvest or regeneration cutting method that ends a rotation. Intermediate harvest cuts are done to enhance the long-term value of commodities such as saw timber, or ecosystem services such as wildlife habitat, or both. These cuts are called intermediate cuts because they occur between regeneration events.

All Stands

Thinning (commercial, and precommercial) reduces number of trees per acre to improve forest quality for timber or wildlife.

For the purposes of the Lake States HCP, intermediate harvest types are separated into two categories: commercial thinning and precommercial thinning and release. Thinning occurs in even- and uneven-aged stands. All of the State DNRs practice thinning, although different practices may include complete release, partial release, weeding, cleaning, liberation, crown or high thinning, low thinning, and others. Thinning reduces the number of trees in a given area, leaving the remaining trees with more light and other resources. Thinning (both commercial and noncommercial) improves the health and value of any stand by creating openings in the stand that allow smaller trees to get larger and grow faster, or that allow larger trees to grow even larger. Thinning prevents stress and overcrowding and can alter the species composition of a stand, improve growing conditions, improve tree quality, and increase the economic value of the stand. Commercial thinning and precommercial thinning and release have different ecological effects on bats.

Commercial Thinning

Commercial thinning typically occurs in stands dominated by trees that are at least 5 inches diameter at breast height (dbh), but more typically 10 inches dbh in the Lake States.

The Lake States engage in a variety of types of commercial thinning. Different types of thinning may be carried out to achieve different forestry objectives. Row, strip, selective, and mechanical variations all describe how the thinning is performed (by rows, strips, or mechanical means). Crown, high, low, and free variations describe where the thinning is performed: crown or high thinning is in the upper canopy, low thinning is in the subcanopy, and free describes thinning both heights at once. Variable density thinning creates uneven density structure throughout a stand, and an improvement cutting is thinning primarily to improve composition and quality. For the purposes of the Lake States HCP, all commercial thinning has the same ecological effect on bats and is grouped accordingly.

Precommercial Thinning and Release

Precommercial thinning comprises a variety of activities that improve the stand but provides no economic value in terms of harvested wood (relative to commercial thinning described above). This category includes release thinning done for saplings soon after a regeneration harvest, liberation thinning that prevents overtopping by older trees of the same species that would not sell commercially, and cleaning and weeding. Cleaning or brushing removes trees and plants that are of undesirable species or are of the same age as the surrounding trees but are unmerchantable. A common type of brushing removes raspberry or blackberry bushes, or invasive species like bush honeysuckle. Cleaning is used in any sapling stand to release desirable stems, and it is not confined to any particular regeneration method. Precommercial thinning allows for release (freeing younger trees from competing vegetation) of preferred merchantable species.

Salvage

All Stands

A harvest (regardless of technique) whose primary purpose is to remove damaged, dead, or diseased trees from a stand is termed a salvage harvest. Salvage harvests are conducted in response to an unplanned event in which trees are killed by wildfire, flooding, disease, and insect outbreak. Salvage harvests can range from the sale of a single tree to the removal of all trees in the stand. Standard silvicultural terms used to describe regeneration or intermediate harvests are often used to describe salvage harvests. Salvage harvests can also be identified based on their purpose; for example, a sanitation cut is used to prevent spread of disease by removing healthy individuals.

Salvage Cuts

Salvage cuts remove dead, dying, or damaged trees after a widespread wind or fire event while the tree is still merchantable. Salvage cutting is done in response to outbreaks of forest pests and weather-related damage that impair forest health. Salvage cuts can range in scale from clearcuts to a type of thinning to the removal of individual stems by landowners for firewood. Salvage thinning removes individual trees either dead or actively dying from a disease or insect infestation. By their very nature, salvage cuts remove dead/dying trees; however, all three DNRs still recommend retention of wildlife trees. Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*, provides an illustration of how multiple salvage harvests occurred within the 1.5-mile buffer of a hypothetical roost of a northern long-eared bat, yet the area was still dominated by high-quality bat habitat following harvest.

- **Firewood**. All three states have programs that allow the public to remove firewood from state lands. Firewood removal can be considered small-scale salvage harvests. In Michigan, the salvaged material is primarily down and dead woody debris. In Minnesota, area managers can issue permits that allow for removal of up to 12 cords of fuelwood per year from dead, down, and damaged trees, or live trees that are of negative value under good forestry management practices (Statute 90.195). In Wisconsin, DNR property managers issue permits that allow the removal of up to 10 cords of firewood per individual.[4] Firewood harvesting may consist of both dead and downed trees as well as live trees, and the type and location of firewood removed is at the discretion of the property manager. People interested in harvesting firewood from Wisconsin state lands need to complete a state Forest Products Permit (Form 2460-008). Because the Minnesota and Wisconsin permits allow removal of standing trees that may be used by bats, there is potential for take. The permitted removal of firewood is considered a subcategory of salvage and is covered by the Lake States HCP.
- **Hazard tree removal.** Hazard trees are those trees that threaten people or their property. The removal of such trees is covered by the Lake States HCP. It is treated as a subcategory of salvage harvest although many such trees are not sold for timber.

[4] See https://dnr.wi.gov/topic/TimberSales/DNRManagedLandsNonCommercial.html.

All states practice salvage as a continuum between whole-stand removal and thinning. Most salvage operations in the Lake States are categorized by the silvicultural method used to complete the salvage. As such, a salvage where all trees are removed is termed a *clearcut salvage*, and a salvage harvest where only select trees are removed is termed a *thinning salvage*.

Sanitation Cuts

Sanitation cuts are used by all State DNRs and serve as an early response to a pending insect and/or disease outbreak. Actions involve the removal of trees to prevent the buildup or spread of a pest outbreak to susceptible or host trees. Depending upon the severity of a pending problem, the value of forest resources, and potential off-site impacts, sanitation cuts range from the removal of select individuals to clearcutting large areas. As such, sanitation cuts may remove both merchantable and nonmerchantable timber.

2.3.1.3 Ecological Categories of Harvest

Timber harvest activities are the primary focus of the Lake States HCP. These activities can be complex, representing a wide array of actions with different effects on bats. Harvest activities are described based on these different ecological effects.

- **Final harvest.** Final harvest activities have the greatest potential effect on bat habitat because they remove all or most canopy trees (i.e., potential roost trees) from the stand. Harvests will comply with current silvicultural guidelines (described in more detail in Chapter 5, *Conservation Strategy*) that ensure a proportion of canopy trees remain after final harvest. In Michigan, this equates to maintaining patches of trees that cover 3% to 10% of the stand. In Minnesota, at least 5% of the area is left standing in either reserve areas, or 6 to 12 scattered trees per acre. In Wisconsin 5% to 15% of stand area or crown cover (a measure of how much space is occupied by the top of the tree) is left standing. All three states also recommend that the retention be representative of the trees that were harvested and contain some trees that are especially valuable for wildlife including snags and cavity trees, mast trees, and legacy trees (which are meant to survive multiple timber rotations).
- **Partial harvest.** Partial harvest activities have a lower potential effect on bats because they remove only some of the potential roost trees from a stand while retaining other bat habitat features.

Table 2-3 identifies the timber harvest and forest management practices are identified according to their harvest type.

Table 2-3. Timber Harvest Systems

	Harvest Type	
Forest Practice	**Final Harvest**	**Partial Harvest**
Regeneration Harvest		
Even-Aged Stand Harvest		
Clearcut	X	
Clearcut with reserves	X	
Shelterwood preparatory cuts		X
Shelterwood regeneration/seeding cut		X
Shelterwood removal harvest	X	
Seed tree removal harvest	X	
Seed tree regeneration/seeding cut		X
Uneven-Aged Stand Harvest		
Group selection		X
Single-tree selection		X
Intermediate Treatment		
Commercial thinning		X
Precommercial thinning/release		X
Salvage Cutting [a]		
Salvage cut (prorated)	X	X
Sanitation cut (prorated)	X	X

Notes:
[a] Salvage cutting can be both partial and final. It will be distributed proportional to the amount of harvest occurring in the landscape.

2.3.2 Roads and Trails Construction, Maintenance, and Use

Management of forested areas requires the construction, maintenance, and use of roads and trails. Incidental take resulting from construction, maintenance, and use of roads and trails is covered on State DNR lands, as well as county lands covered by the Landowner Enrollment Program. These county lands are primarily used to support forestry operations and for public recreational use.

The Lake States HCP does not cover roads and trails that are not on State DNR or enrolled county lands unless they are temporary roads associated with timber harvests. Construction and use of temporary roads associated specifically with timber harvests are included as a covered activity for timber harvest on DNR and all enrolled lands (Section 2.3.1, *Timber Harvest and Related Forest Management Practices*). The Lake States HCP specifically excludes coverage for roads and trails that are built by third parties on State DNR lands for purposes outside of supporting forestry operations or public recreational use. Any such roads must seek separate permitting and incidental take authority, if desired.

2.3.2.1 Background and Definitions

Maintaining and creating roads in a forest requires some tree removal. In these cases, heavy timber harvest equipment, such as delimber machines, feller-bunchers, forwarders, harvesters, skidders, stump grinders, and forestry mowers are also used to remove trees along the roadway. The Lake

States HCP covers all activities that use heavy machinery that are affiliated with covered activities on State DNR-administered lands. The Lake States HCP also covers all tree cutting and other forest management activities that are administered by State DNRs for other organizations (e.g., USFWS, USDOT).

2.3.2.2 State DNR and County Road and Trail Construction

Constructing new roads provides access for forest management and public recreational use.[5] All three states will construct, maintain, and use roads to access areas for timber harvest. Road construction described here includes permanent roads, not temporary roads associated with other forest management activities (e.g., leases or timber harvest). Temporary roads associated with forest management are covered as an associated activity with timber harvest.

Some road construction and reconstruction entail the use of bulldozers and other heavy equipment to remove timber and stumps from the new roadbed. Heavy equipment is confined to designated alignments selected to minimize soil, water, and tree damage. Once woody material is removed, construction machinery, such as graders, bulldozers, backhoes, and dump trucks, is used to shape the road. Culverts or bridges are placed at stream crossings. Finally, gravel (or pavement) is added to the roadway and compacted with a roller.

Trail construction is often less intense than road construction. Construction of some trails may be similar to road construction, while other trails may require simple removal of woody vegetation with the use of hand tools.

2.3.2.3 State DNR and County Road and Trail Maintenance and Use

For all roads and trails, routine maintenance such as removing hazard trees, cutting or trimming trees to maintain or widen the road corridor, and removing trees to install or maintain culverts and bridges at any time during the active season may cause incidental take of bats using those trees or infrastructure as roosts. The Lake States HCP addresses all forms of incidental take associated with road maintenance.

Roads and trails are maintained to repair breakdowns and washouts, prevent sedimentation from dirt eroding into nearby streams or wetlands, and protect public safety.

Road maintenance typically consists of patching potholes; cleaning or repairing culverts and ditches; installing rock; repaving, repairing, or replacing V-shaped ditches; resculpting; sealing cracks; and minor grading. Road maintenance can be performed with a grader, a dump truck to distribute road base rock, and a roller to compact it. When needed, a bulldozer is used to clear roads where a grader will not work or cannot access the road. Road work at stream crossings is commonly accomplished with a backhoe or excavator to install or modify culverts or other drains. In general, roadside-maintenance activities can involve parking and/or soil disturbance in a strip with an average width of 4 feet on either side of the road.

Culvert upgrades, cleaning (both manually and mechanically), and replacement are required to reduce the risk of problems related to structural, hydrologic, and durability failure. Culvert maintenance, repairs, and replacement are performed as needed. Hand labor and backhoes are used

[5] Construction of roads for other purposes (e.g., mineral extraction) is not included as a covered activity.

to maintain culverts. Culvert upgrading, repair, and maintenance may affect areas up to 25 feet from the edge of the road.

Some sections of road or trail may need more maintenance than other sections. Therefore, some parts of the road system might not undergo maintenance during the permit term, while other parts might undergo frequent maintenance. Trail maintenance and repair includes vegetation maintenance and minimal grading to maintain the designed trail width.

The Lake States HCP covers normal road and trail use, including driving on roads and trails by State DNR staff, timber operators, and permittee contractors working on State DNR lands. This activity includes use by parties on all motorized vehicles (commercial trucks, passenger cars and trucks, motorcycles, snowmobiles, utility vehicles, and all-terrain vehicles). All road use is included under the permit. Recreational trail use by the public is not covered because recreational use of trails is unlikely to result in take. Recreation, in general, is not covered by the Lake States HCP (Table 2-4).

2.3.3 Prescribed Fire

Prescribed fire, as well as the creation of firebreaks, is a covered activity under the Lake States HCP. Foresters and ecologists use prescribed fire to accomplish a variety of goals including removing slash (discarded parts of felled trees), controlling fire-intolerant species, creating or maintaining wildlife habitat, and to help with regeneration (Natural Resources Conservation Service 2009). Proper training in the purpose, use, and application of prescribed burning is provided to personnel carrying out the burns so that each burn safely accomplishes its management objectives. The amount of prescribed fire and the conditions under which fires are used varies between the states.

Fire on state, county, and municipal lands is governed by a prescribed burn plan, and land managers in all three states must submit a plan containing the following elements to their respective State DNR's Division of Forestry (note this process is already carried out by the State DNRs and is not a new requirement).

- **Location.** The location includes the township, county, management unit, and ownership.
- **Description.** The description outlines how, when, and why the fire is being set, including the type of vegetation, detailed plan information, and a map.
- **Justification.** The justification explains why fire was chosen for the specific management goals of the site, and how the effectiveness of the fire will be measured.
- **Acceptable conditions.** The conditions for a prescribed fire must be met prior to the burn because of the unpredictability of fire in less-than-ideal conditions. Fires can escape control if variables such as wind and air temperature do not meet the acceptable conditions.
- **Fire behavior.** Behavior of the fire is defined to ensure safety and the achievement of desired fire effects. These behaviors include how tall the flames are and how fast the fire spreads.
- **Smoke management plan.** The purpose of a smoke management plan is directly related to the mitigation of public health, nuisance, and safety hazards posed by smoke intrusions into populated areas and roadways. It generally includes the actions to minimize emissions, an evaluation of smoke dispersion, air quality monitoring, and public notification and exposure reduction procedures.

Table 2-4. Activities Not Covered by the Lake States HCP

Activities	Description	Reason for Exclusion
Lessee activities	Activities can include, but are not limited to, farming and to energy exploration, extraction, and distribution across State DNR lands (see below for specific examples).	States will incorporate lease terms consistent with their incidental take permit for activities covered by the Lake States HCP only.
Gas and power line access	Use of rights-of-way and other routes to access gas and power lines on State DNR lands.	Right-of-way owner is responsible for ESA compliance for their activities.
Recreation	Participating in activities include hunting, hiking, biking, use of motorized vehicles (e.g., snowmobiles, ATVs), and camping. Recreational activities occur on State DNR lands throughout the year.	Recreational activities such as walking, swimming, horseback riding, biking, and using ATVs are unlikely to take bats. The states do not assume responsibility for any individual's take (incidental or otherwise) of covered species.
Development and exploration of energy and other mineral resources	Mineral resources occur below some State DNR lands. Exploration and development of these resources have the potential to affect the covered species. Similarly, changing technology may make other energy production methods (e.g., wind, solar, smaller-scale hydroelectric) economically viable on State DNR lands. All such exploration or development activities are excluded from coverage by the Lake States HCP, whether proposed by the state or by a private entity.	ESA compliance is the responsibility of the party seeking to develop the resource in question.
Collection of down and dead firewood	All three states allow the removal of down and dead trees for firewood in some capacity, or on some lands. This activity is distinct from the removal of standing live or dead trees, which is a covered activity.	Although bats may occasionally use down and dead material as a temporary roost, removal of such material is unlikely to result in take of bats.
Research by external parties	Research on covered lands by individuals or organizations not affiliated with or working for the permittees (e.g., academic studies).	The nature and impacts of future research projects cannot be predicted. Researchers would obtain a separate ESA section 10(a)(1)(A) permit.

Notes:
USFWS = U.S. Fish and Wildlife Service; dbh = diameter at breast height; ESA = federal Endangered Species Act; ATV = all-terrain vehicle

2.3.4 Conservation Strategy Implementation

As described in Chapter 5, *Conservation Strategy*, the effects of the conservation program are largely beneficial for the covered species. However, some activities associated with the conservation strategy are likely to result in some incidental take of the covered species. Therefore, the conservation activities, which are summarized below, must also be covered activities. Chapter 5 provides a more detailed description of the conservation program.

2.3.4.1 Habitat Protection and Restoration

Habitat management practices such as plantings, forest management, and prescribed fire are covered activities (Section 2.3.1, *Timber Harvest and Related Forest Management Practices*), but they also have benefits for covered species. These practices will create stands that support dead trees that receive significant solar exposure, as well as living trees with hollows. A variety of forest ages will provide a mix of both high suitability foraging and roosting habitat for all four covered species. Tree planting and early seral improvements may be used to increase roosting and foraging habitat for covered bat species. The return of fire to the landscape is essential for maintaining fire-adapted plant communities (Nowacki and Abrams 2008). Other conservation measures – such as removing obstructions around hibernacula, maintaining gates, and enhancing winter habitat – are also addressed as part of Chapter 5, *Conservation Strategy*. These activities, when carried out specifically to benefit bats, will be part of the conservation strategy, and any incidental take associated with these activities will be covered under the Lake States HCP's incidental take permit.

2.3.4.2 Monitoring

State DNRs or their contractors may conduct surveys of covered species in the plan area as part of monitoring and adaptive management. These surveys may require physical capture and inspection of specimens to determine identity, mark individuals, or measure physical features; such activities constitute incidental take under the ESA. Biologists participating in these monitoring efforts will be qualified surveyors as identified in the appropriate USFWS and State DNR regulations pertaining to the covered species. These individuals may include designated Agents of the State as outlined in the cooperative agreement between each State DNR and USFWS in Section 6 of ESA. Research on the covered lands by outside individuals (e.g., academic scientists) and others not acting under the control of the State DNRs is not covered by the Lake States HCP because the nature and impacts of these future research projects cannot be predicted, and these researchers are not bound by the terms of the permit.

2.3.5 Activities Not Covered by the Lake States HCP

Some projects and activities that may occur on covered lands over the permit term are not appropriate for coverage under the Lake States HCP for reasons such as the lack of information, the speculative nature of the project, existing permits, permits obtained under a separate program, or the risk that the project or activity is incompatible with the conservation strategy of the Lake States HCP. The projects and activities listed in Table 2-4 were considered but rejected for coverage under this HCP.

2.4 Methods for Quantifying Covered Activities

The State DNRs are public agencies that must comply with public records requirements under separate state statutes and thus maintain records of departmental activities. Such records are centrally located and have been subject to internal quality assurance/quality control measures. These data represent the best commercially and scientifically available data for properties owned or managed by the State DNRs. Conversely, record keeping on private lands varies from detailed records kept by some entities to conditions where a property owner has recently acquired a parcel with little to no knowledge of previous harvests and no definitive plan for future management. Acquiring, evaluating, and using such disparate data is challenging. Section 2.4.2, *County, Municipal, and Private Lands*, describes how publicly available data sources were used to estimate covered activities. Timber harvest and prescribed fire are the drivers for this Lake States HCP, accounting for almost all incidental take covered by the incidental take permit: the effects of these covered activities are estimated quantitatively. Activities associated with roads and trails and conservation strategy implementation are described qualitatively because accurate measures of the amount of the activity are not available and are not measurable over the course of HCP implementation.

Covered activities are quantified to assess impacts as precisely as possible. Data are collected from a range of years to assess variation and develop reasonable projections of the extent of covered activities under the permit term.

Additionally, to provide USFWS with assurances that the State DNRs will continue to harvest at the approximate levels projected, the Lake States HCP limits annual timber harvests at 5% of the total take limit for each State DNR (Chapter 4, Section 4.2, *Methods*, provides additional information regarding this assumption). Five percent of the total take limit is approximately 2.5 times the average level of harvest in each year.

2.4.1 State Lands

2.4.1.1 Primary Data Source

Information about all covered activities was provided by the State DNRs. These data typically consist of forest treatment types and acreages, salvage acreages, and prescribed fire acreages, and, in Wisconsin and Minnesota, the cords of firewood produced each year. Other forestry and prescribed burn acreages were obtained through publicly available databases and scientific literature.

2.4.1.2 Timber Harvest

Data Sources

Both Michigan and Wisconsin publish a formal silvicultural guide for their foresters. Definitions and methods of application are defined in those guides (Michigan Department of Natural Resources 2015; Wisconsin Department of Natural Resources 2012). Guidance in Minnesota follows the *Site-level Forest Management Guidelines* (Minnesota Forest Resources Council 2012) and describes their forestry practices through the Minnesota DNR's website.[6] These and other written resources provided the information on how each state conducts its forestry practices.

- **Michigan**. Michigan provided an estimate of the number of acres of timber harvest from 2014 to 2018 (Michigan Department of Natural Resources pers. comm. 2019).
- **Minnesota**. Annual forest harvest data for Minnesota were based on a query of the Minnesota DNR's forest harvest database (FORIST), completed in 2019 (Minnesota Department of Natural Resources pers. comm. 2019). These data are presented as annual harvest data from 2014 to 2018, which are then grouped into ecological categories.

[6] Available at http://www.dnr.state.mn.us/forestry/harvesting/prescription_defs.html.

- **Wisconsin**. Wisconsin provided an estimate of the number of acres of timber harvest as a series of spreadsheets that covered the years 2016 to 2018 (Wisconsin Department of Natural Resources pers. comm. 2019).

Timber harvest results, grouped by partial and final harvest, are found for each state in their respective *Timber Harvest* section below.

Seasonality of Harvest

Because bat densities in forests vary seasonally, information about when trees are harvested can greatly influence the potential risk faced by bats. However, data on the exact timing of harvest are not available. In general, harvest occurs year-round in the Lake States. The most frequent time-of-year restriction relates to harvests within lowland forest types. Sales within these stands typically require timber to be removed while the ground is frozen to prevent damage to wet soils and roads that receive limited maintenance. Harvested trees may be removed from the stand to an intermediate location prior to being sold. This can occur in different years, with storage in one year and shipment to the mill in the next. This is especially likely to occur when harvesters are working right before the thaw.

The winter season was designated as December through March and the growing season as April through November. Based on a review of mill receipts and opinions of State DNR foresters, the following general patterns are anticipated. Timber harvest in Michigan and Wisconsin occurs in roughly equal amounts per quarter. Timber harvest in Minnesota is heavily biased toward frozen ground conditions due to the large amount of lowland forest. These general patterns were used to frame seasonality of harvest on all lands. Working with State DNR foresters and stand-specific estimates from FIA, rough estimates of the seasonality of harvest were generated for all forest types for each state. For example, harvest for some forest types is regularly conducted only during the winter period, as is the case for elm, ash, and cottonwood. In this case, 100% of the harvest was assigned to winter. Given the annual and geographic climatic variation across the Lake States, at any location and in any year, actual harvest dates may occur later than the beginning and earlier than the end of the winter season. The variation at the edges of the harvest season, however, does not significantly affect the analysis because local changes to harvest activity occur in direct response to the same on-the-ground conditions that may shift bat emergence. For example, a winter harvest that extends into the first week of April is able to do so because frozen ground conditions are still present. Winter harvest conducted away from the hibernacula entrances avoids the potential for direct take of individuals but may affect habitat such as roost trees.

2.4.1.3 Roads and Trails

Roads and trails are not quantified in the Lake States HCP because there are no reliable sources of data that can both be quantified in the take assessment and monitored through HCP implementation. At present, there is no reliable database of forest roads on State DNR lands. In addition, unmapped roads and trails exist on many properties owned and managed by the State DNRs. However, relative to the effects of other covered activities, such as timber harvest and prescribed fire, the amount of take associated with roads and trails is expected to be very small. As the methods used to estimate take from timber harvest and prescribed fire are very conservative, it is expected that acreages associated with timber harvest will also represent any small amount of take associated with forest roads and trails.

2.4.1.4 Prescribed Fire

Each Lake State DNR provided data on the time of year and acres of prescribed fire.

- **Michigan**. The Michigan DNR provided information on prescribed fire in Michigan for the years 2014 through 2018 by email (Michigan Department of Natural Resources pers. comm. 2019).
- **Minnesota.** Data on prescribed fires were obtained for the years 2014 through 2018 from Minnesota DNR via email (Minnesota Department of Natural Resources pers. comm. 2019).
- **Wisconsin**. Wisconsin is in the process of placing prescribed fire under the control of the Wisconsin DNR Division of Forestry. Data were obtained for the years 2012 through 2016 by email (Wisconsin Department of Natural Resources pers. comm. 2019).

2.4.1.5 Lake States HCP Implementation

Chapter 5, *Conservation Strategy*, describes implementation methods for the Lake States HCP. Some of these methods could result in short-term impacts, such as disturbance during monitoring. Because these activities are expected to have a net benefit for bats and the activities are the focus of another chapter, they are not described in detail here.

2.4.2 County, Municipal, and Private Lands

2.4.2.1 Primary Data Source

Information on acres of timber harvest is not consistently collected and maintained by county, municipal, or private ownerships in Minnesota and Michigan. Wisconsin has only recently begun tracking timber harvest data at the county level. Absent accurate and consistent county-level data, FIA data were used to obtain comparable information on forest type acreage and harvest levels across these ownerships. In FIA data, Tribal lands data are included as part of the private lands. For Minnesota and Michigan, FIA data are the only consistent and easily available data source across the three states.

The publicly available FIA data provide a breakdown of forestland ownership into federal, state, county and municipal, and private (including Tribal) categories. With the assistance of an FIA research forester in the Northern Research Station (Miles pers. comm. 2017), detailed data were extracted and reaggregated for the purposes of this analysis.

2.4.2.2 Timber Harvest

Data Sources

Among the metrics measured by FIA is the amount of timber harvested, which is obtained by a combination of mill receipts and stump counts within inventory plots. These data are reported by volume, as cubic feet. FIA data from 2015 represented the most recently available data at the time. It is similar to the previous several years and is considered representative of recent timber harvest levels in the plan area (Perry 2015; Pugh 2015; Minnesota Department of Natural Resources 2016). Subcategories were established for private lands and for forest type groups that are not publicly documented (Miles pers. comm. 2017). In particular, aspen-birch was subdivided into two size classes at 9 inches dbh, and pines were subdivided into the jack and red pine types versus the white pine and eastern hemlock types.

FIA data were used to develop a dataset that allowed quantification of non-State DNR ownership types for which harvest levels were not available. Use of the FIA dataset for county, municipal, and private (including Tribal) lands presented two main challenges: data were presented in cubic feet and not acres, and seasonality of harvest was not recorded.

Volume-to-Acres Conversions

FIA uses cubic feet as a measure of harvest. Therefore, for the purposes of the Lake States HCP it was necessary to convert the volume of harvested timber into acres for consistency across datasets. FIA data includes the per acre volume (in cubic feet) of all “sound” trees of 5 inches dbh and greater. Sound volume is a measure of the harvestable trees within a stand (i.e., those that can be sold), but volume increases over time as trees in the stand grow. To convert this volume to acres, for each forest type a stand age-volume table was generated from the FIA plot data. Plots were grouped by age (STDAGE) and the average sound volume per acre at each age was calculated (adjusted for FIA plot size). This produced a table of average stand volume per acre by age—an approach similar to that used by USFWS when developing the 4(d) rule for northern long-eared bat, 81 Federal Register 1900 (U.S. Fish and Wildlife Service 2016).

To select the average age of harvest to make the volume-to-acre conversion, State DNR foresters provided input on the typical age at which a stand was harvested. The volumes from the tables were averaged over a 20-year period to capture a range of stand harvest ages (i.e., volumes for the typical age of harvest and 10 years on either side). For example, aspen-birch is usually harvested at 50 years. The sound volume at 50 years was averaged for stands aged 40 to 59 years. The resulting average volume at harvest was then used to convert the harvest level for each forest type to acres. When a range of ages was given, the younger age was used. Overall, the State DNRs harvested forest types at a similar age.

2.4.2.3 Roads and Trails

Roads and trails are not quantified in the Lake States HCP because there are no reliable sources of data that can both be quantified in the take assessment and monitored through HCP implementation. At present, there is no public database of forest roads on private (including Tribal lands), county, and municipal properties. However, relative to the effects of other covered activities, such as timber harvest and prescribed fire, the amount of take associated with roads and trails is expected to be very small. As the methods used to estimate take from timber harvest and prescribed fire are very conservative, it is expected that acreages associate with timber harvest will also represent any small amount of take associated with forest roads and trails.

2.4.2.4 Prescribed Fires

The State DNRs work closely with other organizations to provide technical support for prescribed fires, especially where fires are used to manage rare habitat types or the habitat types of rare species. The total acres of prescribed fires on county, municipal, and private (including Tribal) lands include fires where the State DNRs provided support but were not present for the burn. However, prescribed burns on forestland performed by non-State DNR entities are few compared to prescribed fires performed within open habitat types. Estimates of the scope and intensity of prescribed fires on non-State DNR lands were made based on publicly available data for each state and with input from prescribed fire managers within each State DNR.

2.4.2.5 Lake States HCP Implementation

Chapter 5, *Conservation Strategy*, describes methods that will be used to implement the Lake States HCP on all covered lands. Some of these methods have the potential to result in short-term impacts, such as disturbance during monitoring. Because these activities are expected to have a net benefit for bats and the activities are the focus of another chapter, they are not described in detail here.

2.5 Covered Activities Results—Michigan

Below are results of the covered activities quantification for Michigan. As described in Section 2.4, *Methods for Quantifying Covered Activities*, only timber harvest and prescribed fire were assessed quantitatively.

2.5.1 State Lands

2.5.1.1 Covered Lands

Michigan DNR manages approximately 4.7 million acres of state lands (Table 2-5). Although all state lands are managed for a variety of purposes, the three divisions within the DNR have different roles and use different land management regimes. State wildlife areas are primarily used for wildlife conservation and to provide the public with hunting, fishing, and trapping opportunities. State forests provide a wide range of ecological, social, and economic values, including timber production, mineral resources production, watershed protection, rare-species protection, and public recreation. The Parks and Recreation Division owns more than 98 parks ranging in size from a few acres on a single lake or historic site to almost 55,000 acres (Michigan Department of Natural Resources 2007). The goals of the park system are to provide opportunities for outdoor recreation and to serve as an outdoor classroom for environmental education.

Table 2-5. Acres and Percent of Michigan DNR-Managed Lands by Division

	Michigan DNR-Managed Lands [a]	
Program	**Acres**	**Percent**
State forests	3,821,000	82%
State wildlife and fisheries	552,000	12%
State parks	299,000	6%
Total	**4,672,000**	**100%**

Notes:
[a] Includes forestland and nonforestland.
Source: Michigan Department of Natural Resources 2019

The Michigan DNR Forest Resources Division manages state forestlands for timber and mineral, gas, and oil production, fish and wildlife habitat, environmental quality, and recreation. Michigan currently manages 3.8 million acres as state forestlands, in 43 of 83 counties, accounting for more than 82% of the land administered by the Michigan DNR. Michigan's state-owned forest system is the largest of its kind in the United States (Garmon and Holste 2013). The DNR Forest Resources Division consists of four districts, all located in the northern two-thirds of the state. These four districts are divided into 15 forest units that administer all state forestlands. These lands, which are mostly forested, account for 20% of the 20.3-million-acre statewide forest resource (Michigan

Department of Natural Resources 2014). Geographically, 50% of Michigan's state forestland is in the Upper Peninsula.

- **State forests.** Michigan DNR's mission for state forestland is to "sustain fundamental ecological processes and functions that, in turn support representative, diverse, and productive biological assemblages; provide for a variety of ecosystem services that help sustain human civilization; provide for a variety of sustainable human values that are derived from ecosystems, including economic, recreational, and intrinsic values; and provide for a variety of forest-based products" (Michigan Department of Natural Resources 2008). Timber harvest on state forests supports a forest products industry comprising more than 270 mills, over 1,200 manufacturing companies and nearly 600 logging companies. This forest products industry generates $14 billion annually and sustains 154,000 jobs. From 2008 to 2012, the Michigan DNR generated $30 million to $40 million per year in revenue from timber sales (Michigan Department of Natural Resources 2014).
- **State wildlife and fisheries.** The Michigan DNR Wildlife Division manages about 552,000 acres on 70 state wildlife areas, mostly in southern Michigan, where 85% of the population resides. The mission of the Michigan DNR Wildlife Division is to manage populations and habitat of wildlife species that live in or pass through Michigan. The division is separated into four regions: Upper Peninsula, Northern Lower Peninsula, Southwestern Lower Peninsula, and Southeastern Lower Peninsula. The Michigan DNR Wildlife Division uses the sale of hunting and fishing licenses to fund conservation throughout Michigan. More than 1.5 million people fish and there are 750,000 licensed hunters in Michigan, bringing in $1 billion and $2 billion annually to the state's economy, respectively. A portion of this activity occurs on state-administered wildlife areas, as well as national forests and commercial forestlands in the Upper Peninsula. The DNR manages more than 400 species of animals, including game and nongame species, and administers the state's threatened and endangered species program.
- **State parks**. The Michigan DNR Parks and Recreation Division manages the state's 96 parks and recreation areas. These areas account for approximately 300,000 acres of recreation land, 142 miles of Great Lake shoreline, and 462 miles of inland lakes, rivers, and streams. The Parks and Recreation Division's mission is to "acquire, protect, and preserve the natural and cultural features of Michigan's unique resources, and to provide access to land and water based public recreation and educational opportunities" (Michigan Department of Natural Resources 2009). Boating and snowmobiling are popular activities in Michigan state parks: Michigan has 931,000 registered watercraft (third in the United States) and 390,000 registered snowmobiles (first in the United States). The Parks and Recreation Division manages 1,300 public boating access sites, 145 state forest campgrounds, more than 3,000 rustic campsites, and 6,200 miles of snowmobile trails.

The Michigan DNR is empowered to lease state-owned mineral rights for oil, gas, and other mineral exploration and development purposes. However, the Lake States HCP does not cover the lease or development of mineral rights because it focuses on forestry and forestry-related activities.

2.5.1.2 Covered Activities

Timber Harvest

Table 2-6 provides a summary of timber harvest on Michigan DNR lands from 2011 through 2016, from which a projected level of activity was developed for the Lake States HCP. In Michigan, timber harvest is spread evenly over the year, although the type of forest harvested varies depending on season (as described in Section 2.5.2.2, *Covered Activities*).

Table 2-6. Estimated Annual Timber Harvest Activities on Michigan State Lands (acres, 2014–2018)

Harvest Type	2014	2015	2016	2017	2018	5-Year Average	Projected Annual
Final harvest	37,256	45,319	36,078	40,234	38,274	39,432	40,000
Partial harvest	24,721	26,232	20,731	24,184	23,878	23,949	24,000
Total	**61,977**	**71,551**	**56,809**	**64,418**	**62,152**	**63,381**	**64,000**

Source: Michigan Department of Natural Resources pers. comm. 2019

Prescribed Fire

Michigan does not have a defined prescribed fire burn window but burns typically occur in the snow-free season during spring, late summer and fall: effectively March through October. Fire is assumed to be distributed equally across these months.

The amount of prescribed burns (both acreage and number of fires) conducted by the Michigan DNR from 2014 through 2018 is presented in Table 2-7. Annual totals vary substantially depending on staffing, and recent increases are the result of grant funding that allowed extensive use of prescribed fire in the southern portions of the Lower Peninsula for management of herbaceous wetlands, prairies, savannas, and oak woodlands. Michigan DNR plans more burns than those that are actually completed. For example, 27,000 acres of burns were planned for 2016, but funding, planning, weather, and limited staff reduced this amount by more than 70%.

Table 2-7. Prescribed Fire by All Michigan DNR Divisions on Michigan State Lands [a] (2014–2018)

Michigan DNR Division	Prescribed Fire (acres)					
	2014	2015	2016	2017	2018	5-Year Average
Forest resources	3,801	3,151	591	1,247	50	1,768
Parks and recreation	1,312	1,037	1,095	2,149	872	1,293
Wildlife	4,713	5,320	6,290	2,971	5,024	4,864
Total Acres	**9,826**	**9,508**	**7,976**	**6,367**	**5,946**	**7,925**
Number of fires	105	137	74	111	76	101

Notes:
[a] This includes prescribed fire on all land cover types occupied by bats, including both forest and grassland land covers as defined by the State DNRs.
Source: Michigan Department of Natural Resources pers. comm. 2019

The annual acres of prescribed fire from 2014 to 2018 were used by the DNRs to demonstrate recent trends and estimate an average amount of yearly prescribed fire. Predicted annual estimates of prescribed fire over the life of the permit were derived based on these numbers and projected future management which may not match the annual average in the table. The Michigan DNR expects to complete approximately 8,400 acres of prescribed burns each year over the duration of the permit, with only 25% (2,100) of those fires occurring in forested habitat. As indicated above, the amount burned each year will vary with changing weather, funding, and staffing. To address this pattern of “rolling-over” fire prescriptions, a cap of 45,000 acres of prescribed fire in Michigan will be applied to each 5-year increment of the Lake States HCP.

2.5.2 County, Municipal, and Private Lands

2.5.2.1 Covered Lands

The Lake States HCP provides a mechanism through which the Michigan DNR can extend their take authorization to nonfederal landowners in Michigan that implement covered activities through participation in the Landowner Enrollment Program (Appendix B, *Landowner Enrollment Program)*. As outlined in Table 2-1, the majority of these nonfederal lands are owned by private individuals or families (52%), more than double the amount managed by the DNR (24%). Corporations own approximately 17% of all covered lands, with the rest owned by county and municipal governments, Tribes, and private organizations such as hunting clubs and natural resource organizations. While not all of these landowners will be eligible to participate in the Landowner Enrollment Program (see eligibility criteria in Appendix B, Section B.2.1, *Eligibility*), the acreages presented in Table 2-1 represent a conservative estimate of land covered under the Lake States HCP in Michigan since it is unlikely that all eligible landowners will enroll.

2.5.2.2 Covered Activities

Timber Harvest

Table 2-8 provides data on the harvest rates by ownership type. Notably, while individuals and families own the majority of covered lands in Michigan, these forestland owners conduct the lowest level of forest harvest. County and municipal forests in Michigan are often received as the result of tax forfeiture of previously private lands. A specific goal for these properties is to allow revenues from timber harvest to offset revenues that otherwise would be raised from taxes. Similarly, corporate lands are also managed specifically for economic benefits associated with timber harvest. These two land classes are harvested at a much greater rate than lands held by individuals and families. State harvest levels derived here using FIA data are provided for comparison with total forest harvest levels above and to present harvest levels by forest types. Table 2-9 shows the forestland harvest by season and ownership in Michigan.

Table 2-8. Estimated Annual Harvest by Ownership Type and Harvest Type and Estimated Proportion of Partial and Final Harvest in Michigan

FIA Forest Type Group	Forest Type Group Annual Harvest	Cubic Feet/Acre at Harvest Age	Equivalent Area of Harvest [a]	Estimated Proportion of Harvest by Ecological Category	
	(cubic feet 2015)	(±10 yrs)	(Acres)	Partial	Final
County and Municipal					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	3,793,133	1,798	2,110	25%	75%
White pine/hemlock	-	2,670	0	90%	10%
Spruce/fir	-	929	0	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,520	0	10%	90%
Oak/pine	2,892,056	2,574	1,124	50%	50%
Oak/hickory	884,783	2,032	435	25%	75%
Elm/ash/cottonwood [b]	388,361	2,035	191	90%	10%
Maple/beech/birch	1,103,130	2,298	480	100%	0%
Aspen/birch <9 inches dbh	203,942	775	263	10%	90%
Aspen/birch >9 inches dbh	165,126	1,633	101	10%	90%
Other hardwoods	-	781	0	50%	50%
Exotic hardwoods group	-	860	0	10%	90%
Annual Total Harvest	**9,430,531**		**4,704**		
Private Corporation					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	2,786,069	1,798	1,550	25%	75%
White pine/hemlock	871,815	2,670	327	90%	10%
Spruce/fir	8,391,609	929	9,033	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,520	0	10%	90%
Oak/pine	-	2,574	0	50%	50%
Oak/hickory	4,427,924	2,032	2,179	25%	75%
Elm/ash/cottonwood [c]	4,694,782	2,035	2,307	90%	10%
Maple/beech/birch	55,402,341	2,298	24,109	100%	0%

FIA Forest Type Group	Forest Type Group Annual Harvest	Cubic Feet/Acre at Harvest Age	Equivalent Area of Harvest [a]	Estimated Proportion of Harvest by Ecological Category	
	(cubic feet 2015)	(±10 yrs)	(Acres)	Partial	Final
Aspen/birch <9 inches dbh	2,277,530	775	2,939	10%	90%
Aspen/birch >9 inches dbh	1,463,092	1,633	896	10%	90%
Other hardwoods	-	781	0	50%	50%
Exotic hardwoods	-	860	0	10%	90%
Annual Total Harvest	**80,315,162**		**43,339**		
Private Noncorporate					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	7,149,643	1,798	3,976	25%	75%
White pine/hemlock	3,725,384	2,670	1,395	90%	10%
Spruce/fir	6,449,926	929	6,943	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group [d]	3,219,625	1,520	2,118	10%	90%
Oak/pine	1,488,942	2,574	578	50%	50%
Oak/hickory	42,923,919	2,032	21,124	25%	75%
Elm/ash/cottonwood [e]	13,854,321	2,035	6,808	90%	10%
Maple/beech/birch	60,933,459	2,298	26,516	100%	0%
Aspen/birch <9 inches dbh	6,691,343	775	8,634	10%	90%
Aspen/birch >9 inches dbh	17,776,758	1,633	10,886	10%	90%
Other hardwoods	129,662	781	166	50%	50%
Exotic hardwoods	-	860	0	10%	90%
Annual Total Harvest	**164,342,982**		**89,145**		
Private Other (Including Tribal [f])					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	3,009,489	1,798	1,674	25%	75%
White pine/hemlock	-	2,670	0	90%	10%
Spruce/fir	341,566	929	368	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,520	0	10%	90%

FIA Forest Type Group	Forest Type Group Annual Harvest	Cubic Feet/Acre at Harvest Age	Equivalent Area of Harvest [a]	Estimated Proportion of Harvest by Ecological Category	
	(cubic feet 2015)	(±10 yrs)	(Acres)	Partial	Final
Oak/pine	-	2,574	0	50%	50%
Oak/hickory	68,549	2,032	34	25%	75%
Elm/ash/cottonwood	-	2,035	0	90%	10%
Maple/beech/birch	75,399	2,298	33	100%	0%
Aspen/birch <9 inches dbh	0	775	0	10%	90%
Aspen/birch >9 inches dbh	0	1,633	0	10%	90%
Other hardwoods	-	781	0	50%	50%
Exotic hardwoods	-	860	0	10%	90%
Annual Total Harvest	**3,495,003**		**2,109**		

Notes:

[a] As described in Section 2.4.2.2, *Timber Harvest*, a stand age-volume table was generated for each forest type. DNR foresters provided a typical age at which these stands would be harvested. To account for variation in harvest date, a typical volume was obtained by averaging 20 years of stand volumes based on the age provided by DNR foresters. This value was then divided into the volume of product.

[b] Includes 1,641 acres of oak/gum/cypress.

[c] Includes 7,330 acres of oak/gum/cypress.

[d] Includes 7,600 acres of fir/spruce/mountain hemlock.

[e] Includes 8,212 acres of oak/gum/cypress.

[f] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the "Native American" owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

Source: U.S. Forest Service 2015

NA = not applicable; yrs = years; dbh = diameter at breast height

Table 2-9. Estimated Annual Harvest by Season and Ownership in Michigan

	Estimated Proportion of Harvest by Season		Estimated Harvest Removals by Season (acres, 2015)	
Forest Type Group	**December–March**	**April–November**	**December–March**	**April–November**
County and Municipal				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	703	1,407
White pine/hemlock	33%	67%	-	-
Spruce/fir	67%	33%	-	-
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group	33%	67%	-	-
Oak/pine	67%	33%	749	375
Oak/hickory	67%	33%	290	145
Elm/ash/cottonwood [a]	100%	0%	191	-
Maple/beech/birch	50%	50%	240	240
Aspen/birch <9 inches dbh	33%	67%	88	175
Aspen/birch >9 inches dbh	33%	67%	34	67
Other hardwoods	33%	67%	-	-
Exotic hardwoods group	33%	67%	-	-
Private Corporate				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	517	1,033
White pine/hemlock	33%	67%	109	218
Spruce/fir	67%	33%	6,022	3,011
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group	33%	67%	-	-
Oak/pine	67%	33%	-	-
Oak/hickory	67%	33%	1,453	726
Elm/ash/cottonwood [b]	100%	0%	2,307	-
Maple/beech/birch	50%	50%	12,055	12,055
Aspen/birch <9 inches dbh	33%	67%	980	1,959
Aspen/birch >9 inches dbh	33%	67%	299	597

	Estimated Proportion of Harvest by Season		Estimated Harvest Removals by Season (acres, 2015)	
Forest Type Group	**December–March**	**April–November**	**December–March**	**April–November**
Other hardwoods	33%	67%	-	-
Exotic hardwoods	33%	67%	-	-
Private Noncorporate				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	1,325	2,651
White pine/hemlock	33%	67%	465	930
Spruce/fir	67%	33%	4,629	2,314
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group [c]	33%	67%	706	1,412
Oak/pine	67%	33%	385	193
Oak/hickory	67%	33%	14,083	7,041
Elm/ash/cottonwood [d]	100%	0%	6,808	-
Maple/beech/birch	50%	50%	13,258	13,258
Aspen/birch <9 inches dbh	33%	67%	2,878	5,756
Aspen/birch >9 inches dbh	33%	67%	3,629	7,257
Other hardwoods	33%	67%	55	111
Exotic hardwoods	33%	67%	-	-
Private Other (Including Tribal [e])				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	558	1,116
White pine/hemlock	33%	67%	-	-
Spruce/fir	67%	33%	245	123
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group	33%	67%	-	-
Oak/pine	67%	33%	-	-
Oak/hickory	67%	33%	23	11
Elm/ash/cottonwood	100%	0%	-	-
Maple/beech/birch	50%	50%	17	17
Aspen/birch <9 inches dbh	33%	67%	-	-

Forest Type Group	Estimated Proportion of Harvest by Season December–March	Estimated Proportion of Harvest by Season April–November	Estimated Harvest Removals by Season (acres, 2015) December–March	Estimated Harvest Removals by Season (acres, 2015) April–November
Aspen/birch >9 inches dbh	33%	67%	-	-
Other hardwoods	33%	67%	-	-
Exotic hardwoods	33%	67%	-	-

Notes:

[a] Includes 1,641 acres of oak/gum/cypress.

[b] Includes 7,330 acres of oak-/gum/cypress.

[c] Includes 7,600 acres of fir/spruce/mountain hemlock.

[d] Includes 8,212 acres of oak-/gum/cypress.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the “Native American” owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

Source: U.S. Forest Service 2015

NA = not applicable; yrs = years; dbh = diameter at breast height

Prescribed Fire

In Michigan, prescribed fire is rare outside of lands managed by the Michigan DNR. A limited amount of burning occurs on lands managed by conservation organizations and on industrial lands. Most such burning occurs within prairie and savanna landscapes managed by private conservation organizations such as The Nature Conservancy and Michigan Nature Association. Prescribed fire activities and techniques on private lands are coordinated through the Consortium for Prescribed Burning and the Michigan Prescribed Fire Council.[7]

Prescribed fires on county, municipal, and private (including Tribal) forestlands in Michigan are estimated at 1,000 acres per year or less.

2.6 Covered Activities Results—Minnesota

Below are results of the covered activities quantification for Minnesota. As described in Section 2.4, *Methods for Quantifying Covered Activities*, only timber harvest and prescribed fire were assessed quantitatively.

2.6.1 State Lands

2.6.1.1 Covered Lands

The State of Minnesota is approximately 51.0 million acres (U.S. Census Bureau 2010), 3.4 million acres of which are public water lakes (excluding Lake Superior) (Minnesota Department of Natural Resources 2016). The Minnesota DNR is responsible for managing more than 90% of all state-owned land, or approximately 6 million acres (Table 2-10). The main categories of public land managed by Minnesota DNR include school and university trust lands, consolidated conservation area lands, Volstead lands, and acquired lands. About 80% of Minnesota DNR land is forestland, primarily in state forest units, with other land in wildlife management areas, state parks, scientific and natural areas, fisheries management areas, water access sites, and state trails and recreation areas. Trust lands are managed for revenue and on behalf of beneficiary groups. In addition, the state holds title to 2.82 million acres of tax-forfeited lands and holds them in trust for local taxing authorities. The surface interest on most tax-forfeited land is managed by the counties, while the mineral interest is managed by the DNR.

In addition, the state holds title to 2.82 million acres of tax-forfeited lands and holds them in trust for local taxing authorities. The surface interest on most tax-forfeited land is managed by the counties, while the mineral interest is managed by the DNR. Land use and management planning for all these lands is done in accordance with Minnesota's Outdoor Recreation Act. For the purposes of the Lake States HCP, land managed by the counties—even if owned by the DNRs—will not be automatically covered by the DNR incidental take permit and are not analyzed as DNR lands. As land managers, the counties could obtain take authorization via the Landowner Enrollment Program.

The DNR also manages over 84,000 acres of forestland owned by the USFWS and leased to the state for wildlife management as part of the Beltrami Island Land Utilization Project,[8] which is

[7] Available at http://firecouncil.org.

[8] Available at https://www.dnr.state.mn.us/beltrami-island-lup/index.html.

predominately within Beltrami Island State Forest. These lands are included as covered lands in the Lake States HCP analysis as DNR-manage Wildlife Management Areas. As described in Section 2.1, *Overview*, these lands are included as covered by the HCP. The Minnesota DNR manages the Land Utilization Project lands similarly to other lands owned and managed by the Minnesota DNR.

Table 2-10. Acres and Percent of Minnesota DNR-Administered Lands by DNR Division

	Minnesota DNR-Administered Lands [a]	
Program	**Acres**	**Percent [b]**
State forests	4,232,000	71%
State wildlife and fisheries	1,300,000	22%
State parks	256,000	4%
Other [c]	214,000	4%
Total [d]	**6,002,000**	**100%**

Notes:

[a] There are approximately 383,000 acres of overlapping management units where the DNR manages for multiple objectives and land management is coordinated among divisions.

[b] Table values may not add up to 100 due to rounding.

[c] Includes water access sites, state trails, recreation areas, and scientific and natural areas.

[d] In addition, the DNR holds title to 2.8 million acres of tax-forfeited lands held in trust for and generally managed by the counties.

Source: Minnesota Department of Natural Resources pers. comm. 2017

- **State forests.** The Minnesota Division of Forestry manages 59 state forests to “protect and manage the trees, woodlands, and forests entrusted to them for the benefit of the people of Minnesota” (Minnesota Department of Natural Resources 2016). Its mission also includes providing a sustainable supply of forest resources, protecting lives and property from wildfires, and providing expertise to understand, sustain, and manage Minnesota's trees, woodlands, and forests. The Minnesota Division of Forestry provides services such as tree nurseries, timber harvest and sales, land reforestation, wildfire fighting, and management of state forest roads. The forest products from Minnesota have a $16 billion economic impact with an employment impact of nearly 63,000 jobs (Minnesota Department of Natural Resources n.d.).

- **State wildlife and fisheries.** Lands managed by the Minnesota DNR Division of Fish and Wildlife include designated wildlife management areas and aquatic and fish management areas. There are about 1,523 wildlife management areas in Minnesota in 86 of 87 counties. These sites support wildlife habitats, which range from prairies and wetlands to forests and swamps. They provide important opportunities for recreation for hunters, trappers, hikers, and wildlife enthusiasts. In Minnesota, 52% of residents are wildlife watchers and 15% are hunters. Together, these activities support a $1 billion annual industry related to the state’s wildlife resources (Minnesota Department of Natural Resources 2016). (Some of these recreational opportunities are also allowed in all or specific Scientific and Natural Areas, which are administered by the Division of Ecological and Water Resources.)

- **State parks.** The Minnesota Division of Parks and Trails is responsible for 232,000 acres in 66 state parks and recreation areas, nine waysides, approximately 5,000 campsites, more than 97 public water access sites, and more than 1,400 miles of state trails. In addition, it manages most state forest campgrounds and trails on State Forest land. Minnesota has about 10 million state park visitors, more than 810,000 registered watercraft, more than 216,000 registered snowmobiles, and 1.5 million licensed anglers. State park visitors spend $656 million in state park trip-related activities (Minnesota Department of Natural Resources 2016).

- **Other DNR lands.** The Division of Ecological and Water Resources is responsible for around 170 scientific and natural areas (SNAs) on over 200,000 acres of land. SNAs are established to protect natural features of exceptional scientific or educational value including rare species and native plant communities. These areas are managed to maintain these features and are generally open to recreational activities that do not disturb natural conditions, such as birdwatching, nature photography, and hiking. Other DNR lands also include water access sites, state trails, and recreation areas (which are managed by several divisions at the Minnesota DNR).

2.6.1.2 Covered Activities

Timber Harvest

Table 2-11 provides a summary of timber harvests on Minnesota DNR lands from 2014 through 2018, from which a projected level of activity was developed for the Lake States HCP. Note that Table 2-11 reflects actual acres harvested and estimates of projected acres to be harvested, not planned acres. Planned acres are those that the DNR will visit and assess for potential harvest. The projected harvest amount below was used to develop the take limit that is described in Chapter 4. Approximately 75% of harvest on DNR lands in Minnesota occurs from December 1 to March 31, with the rest occurring in approximately equal portions during the remaining months.

In December 2016, former Governor Mark Dayton directed the Minnesota DNR to analyze the sustainability of harvesting 1 million cords of timber per year from Minnesota DNR-managed forestlands. If the analysis determined that an annual harvest of 1 million cords was not sustainable, the governor asked Minnesota DNR to identify an alternative sustainable harvest volume target. In March 2018, after more than a year of rigorous scientific analysis and discussions with key partners, Minnesota DNR set a new 10-year sustainable timber volume target of 870,000 cords offered for sale annually from Minnesota DNR-managed forestlands. Beyond committing to provide 870,000 cords for sale from DNR lands annually from FY2019–FY2028, Minnesota DNR also launched a special 5-year initiative to offer up to 30,000 additional cords of ash and tamarack annually in response to the threat posed by emerald ash borer and eastern larch beetle, two invasive species that kill ash and tamarack trees. These new harvest goals are reflected in the projections in Table 2-11. Note that these figures reflect the timber sales and tree-cutting activities that Minnesota DNR conducts and/or administers for other agencies (such as the Minnesota Department of Transportation).

Table 2-11. Estimated Annual Timber Harvest Activities on Minnesota State Lands (acres, 2014–2018)

	2014	2015	2016	2017	2018	5-Year Average	Projected
Final harvest	32,869	30,940	29,374	20,894	26,771	28,170	36,500
Partial harvest	11,338	10,148	11,145	7,879	10,448	10,192	13,000
Total	**44,207**	**41,088**	**40,519**	**28,773**	**37,219**	**38,361**	**49,500**

Source: Minnesota Department of Natural Resources pers. comm. 2019. Annual forest harvest data for Minnesota were based on a query of the Minnesota DNR's forest harvest database (FORIST), completed in 2019. Note that the conservative projected amounts account for the sustainable timber harvest volume targets determined in 2018.

Prescribed Fire

Minnesota has four administrative regions: the Northwestern, Northeastern, Central, and Southern regions. Prescribed fire activities are coordinated and prioritized by the prescribed burn committees for each region. These committees act to ensure the following oversight.

- Burn activities are properly coordinated and priority for burning is given to more-complex burns.
- Fire resources are recorded and staff throughout the state are retained.
- The science of prescribed fire is advanced and coordinated.
- Contacts for the regional fire team leaders can provide the availability of personnel, equipment, and resources.
- Interdivisional burns are coordinated.
- Communication and coordination between the state's regions, divisions, and agencies is actively enhanced.
- Reviews of escaped burns are initiated, coordinated, and implemented.
- Regional burns are reviewed annually.

Table 2-12 provides an overview of prescribed fires conducted by Minnesota DNR staff from 2014 through 2018 (in acreage and number of fires).[9] Covered species may be found in isolated trees in any landscape, but the greatest risk to these bats occurs during burns of woodlands and brushlands. Approximately 6.5% of Minnesota's prescribed fires are in forestland, and most of these burns are conducted between April 1 and September 30. Fire is assumed to be distributed equally across these months. Brushland fires account for 13.1% of the burning program. The annual acres of prescribed fire from 2014 to 2018 were used by the DNRs to demonstrate recent trends and estimate an average amount of yearly prescribed fire. Predicted annual estimates of prescribed fire over the life of the permit were derived based on these numbers and projected future management which may not match the annual average in the table. In future years, Minnesota expects to continue a similar amount (6,800 acres per year) of activity in forested and brushland systems.

Table 2-12. Prescribed Fire on All Land Cover Types on Minnesota State Lands [a] (2014–2018)

	Prescribed Fire (Acres)					
Land Cover Type	**2014**	**2015**	**2016**	**2017**	**2018**	**5-year Average**
Forested	3	3	3,108	2,099	3,966	1,836
Brushland	416	1,426	5,374	6,137	5,151	3,701
Grass/wetland	12,775	10,103	26,608	24,344	39,696	22,705
Slash	1	47	42	160	16	53
Total	**13,195**	**11,579**	**35,132**	**32,740**	**48,829**	**28,295**
Number of fires	150	102	322	414	397	277

Notes:
[a] This includes prescribed fire on all land cover types occupied by bats, including both forest and grassland land covers as defined by the State DNRs.
Source: Minnesota Department of Natural Resources pers. comm. 2019

[9] Available at http://www.dnr.state.mn.us/rxfire/index.html. Accessed: January 29, 2016.

2.6.2 County, Municipal, and Private Lands

2.6.2.1 Covered Lands

The Lake States HCP provides a mechanism through which the Minnesota DNR can extend its take authorization to nonfederal landowners in Minnesota that implement covered activities through participation in the Landowner Enrollment Program (Appendix B, *Landowner Enrollment Program)*. As outlined in Table 2-1, slightly less than half (43%) of the covered lands in Minnesota are owned by private individuals or families, and approximately 18% are associated with county and municipal governments. County governments manage lands held in trust by the state and these lands are not included in the state ownership total and will not be directly covered by the DNR incidental take permit. Tribes (the "Native American Indian" owner group in the FIA data) own 5% of covered lands. Corporations, and organizations such as hunting clubs and natural resource organizations own and manage the remaining portions. While not all of these landowners will be eligible for enrollment in the Landowner Enrollment Program (see eligibility criteria in Appendix B, Section B.2.1, *Eligibility*), the acreages presented in Table 2-1 represent a conservative estimate of the maximum amount of land covered under the Lake States HCP in Minnesota since it is unlikely that all eligible landowners will enroll.

2.6.2.2 Covered Activities

Timber Harvest

Table 2-13 provides data on the harvest rates by ownership type. Notably, while individuals and families own the majority of covered lands in Minnesota, these owners conduct the lowest level of timber harvest. Many county and municipal forests in Minnesota are the result of tax forfeiture of previously private lands. A specific goal of these properties is to allow revenues from timber harvest to offset revenues that otherwise would be raised via taxes. Similarly, corporate lands are also managed specifically for economic benefits associated with timber harvest. These two land classes are harvested at a much greater rate than lands held by individuals and families. Forests managed by other types of owners are harvested at an intermediate level. Table 2-14 shows the forestland harvest by season and ownership in Minnesota.

Table 2-13. Estimated Annual Harvest by Ownership Type and Harvest Type and Estimated Proportion of Partial and Final Harvest in Minnesota

	Forest Type Group Annual Harvest	Cubic Feet/Acre at Harvest Age	Equivalent Area of Harvest [a]	Estimated Proportion of Harvest by Ecological Category	
FIA Forest Type Group	**(cubic feet 2015)**	**(±10 yrs)**	**(Acres)**	**Partial**	**Final**
County and Municipal					
Nonstocked	21,283	NA	0	NA	NA
Red/jack pine	1,144,004	1,566	730	25%	75%
White pine/hemlock	-	2,340	0	90%	10%
Spruce/fir	8,210,184	765	10,734	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,527	0	10%	90%

FIA Forest Type Group	Forest Type Group Annual Harvest (cubic feet 2015)	Cubic Feet/Acre at Harvest Age (±10 yrs)	Equivalent Area of Harvest [a] (Acres)	Estimated Proportion of Harvest by Ecological Category Partial	Final
Oak/pine	1,409,059	1,780	792	50%	50%
Oak/hickory	3,883,247	1,486	2,614	25%	75%
Elm/ash/cottonwood	744,502	1,263	589	90%	10%
Maple/beech/birch	1,595,636	1,775	899	100%	0%
Aspen/birch <9 inches dbh	7,960,814	601	13,245	10%	90%
Aspen/birch >9 inches dbh	40,549,809	1,172	34,608	10%	90%
Other hardwoods	-	333	0	50%	50%
Exotic hardwoods group	-	484	0	10%	90%
Annual Total Harvest	**65,518,538**		**64,211**		
Private Corporate					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	5,460,210	1,566	3,487	25%	75%
White pine/hemlock	-	2,340	0	90%	10%
Spruce/fir	2,190,850	765	2,864	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,527	0	10%	90%
Oak/pine	697,031	1,780	392	50%	50%
Oak/hickory	104,400	1,486	70	25%	75%
Elm/ash/cottonwood	198,659	1,263	157	90%	10%
Maple/beech/birch	236,063	1,775	133	100%	0%
Aspen/birch <9 inches dbh	5,558,260	601	9,248	10%	90%
Aspen/birch >9 inches dbh	10,855,968	1,172	9,265	10%	90%
Other hardwoods	377,830	333	1,135	50%	50%
Exotic hardwoods	-	484	0	10%	90%
Annual Total Harvest	**25,679,271**		**26,751**		
Private Noncorporate					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	4,783,220	1,566	3,054	25%	75%
White pine/hemlock	359,977	2,340	154	90%	10%
Spruce/fir	1,617,023	765	2,114	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,527	0	10%	90%
Oak/pine	594,527	1,780	334	50%	50%
Oak/hickory	7,614,267	1,486	6,406	25%	75%
Elm/ash/cottonwood	4,419,319	1,263	3,498	90%	10%
Maple/beech/birch	7,112,538	1,775	4,007	100%	0%
Aspen/birch <9 inches dbh	6,209,282	601	10,331	10%	90%
Aspen/birch >9 inches in dbh	17,825,795	1,172	15,214	10%	90%
Other hardwoods	342,197	333	1,028	50%	50%

FIA Forest Type Group	Forest Type Group Annual Harvest (cubic feet 2015)	Cubic Feet/Acre at Harvest Age (±10 yrs)	Equivalent Area of Harvest [a] (Acres)	Estimated Proportion of Harvest by Ecological Category	
				Partial	Final
Exotic hardwoods	66,448	484	137	10%	90%
Annual Total Harvest	**50,944,593**		**46,278**		
Private Other (including Tribal[b])					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	765,427	1,566	489	25%	75%
White pine/hemlock	-	2,340	0	90%	10%
Spruce/fir	1,780,723	765	2,328	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,527	0	10%	90%
Oak/pine	235,326	1,780	132	50%	50%
Oak/hickory	268,353	1,486	181	25%	75%
Elm/ash/cottonwood	25,681	1,263	20	90%	10%
Maple/beech/birch	652,511	1,775	368	100%	0%
Aspen/birch <9 inches dbh	428,774	601	713	10%	90%
Aspen/birch >9 inches dbh	4,850,981	1,172	4,140	10%	90%
Other hardwoods	-	333	0	50%	50%
Exotic hardwoods	-	484	0	10%	90%
Annual Total Harvest	**9,007,776**		**8,371**		

Notes:

[a] As described in Section 2.4.2.2, *Timber Harvest*, a stand age-volume table was generated for each forest type. DNR foresters provided a typical age at which these stands would be harvested. To account for variation in harvest date, a typical volume was obtained by averaging 20 years of stand volumes based on the age provided by DNR foresters. This value was then divided into the volume of product.

[b] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

Source: U.S. Forest Service 2015

NA = not applicable; yrs = years; dbh = diameter at breast height

Table 2-14. Estimated Annual Harvest by Season and Ownership in Minnesota

Forest Type Group	Estimated Proportion of Harvest by Season		Estimated Harvest Removals by Season (acres, 2015)	
	Dec–Mar	Apr–Nov	Dec–Mar	Apr–Nov
County and Municipal				
Nonstocked	0%	100%	-	-
Red/jack pine	75%	25%	548	183
White pine/hemlock	75%	25%	-	-
Spruce/fir	90%	10%	9,661	1,073
Other eastern softwoods	75%	25%	-	-
Exotic softwoods group	75%	25%	-	-
Oak/pine	75%	25%	594	198
Oak/hickory	75%	25%	1,961	654

	Estimated Proportion of Harvest by Season		Estimated Harvest Removals by Season (acres, 2015)	
Forest Type Group	**Dec–Mar**	**Apr–Nov**	**Dec–Mar**	**Apr–Nov**
Elm/ash/cottonwood	100%	0%	589	-
Maple/beech/birch	25%	75%	225	674
Aspen/birch <9 inches dbh	75%	25%	9,934	3,311
Aspen/birch >9 inches dbh	75%	25%	25,956	8,652
Other hardwoods	75%	25%	-	-
Exotic hardwoods group	75%	25%	-	-
Private Corporate				
Nonstocked	0%	100%	-	-
Red/jack pine	70%	30%	2,441	1,046
White pine/hemlock	70%	30%	-	-
Spruce/fir	90%	10%	2,578	286
Other eastern softwoods	70%	30%	-	-
Exotic softwoods group	70%	30%	-	-
Oak/pine	70%	30%	274	118
Oak/hickory	70%	30%	49	21
Elm/ash/cottonwood	100%	0%	157	-
Maple/beech/birch	30%	70%	40	93
Aspen/birch <9 inches dbh	70%	30%	6,474	2,774
Aspen/birch >9 in dbh	70%	30%	6,486	2,780
Other hardwoods	70%	30%	795	341
Exotic hardwoods	70%	30%	-	-
Private Noncorporate				
Nonstocked	0%	100%	-	-
Red/jack pine	67%	33%	2,036	1,018
White pine/hemlock	67%	33%	103	51
Spruce/fir	90%	10%	1,903	211
Other eastern softwoods	67%	33%	-	-
Exotic softwoods group	67%	33%	-	-
Oak/pine	67%	33%	223	111
Oak/hickory	67%	33%	4,271	2,135
Elm/ash/cottonwood	100%	0%	3,498	-
Maple/beech/birch	33%	67%	1,336	2,671
Aspen/birch <9 inches dbh	67%	33%	6,887	3,444
Aspen/birch >9 inches dbh	67%	33%	10,143	5,071
Other hardwoods	67%	33%	685	343
Exotic hardwoods	67%	33%	91	46
Private Other (Including Tribal [a])				
Nonstocked	0%	100%	-	-
Red/jack pine	75%	25%	367	122
White pine/hemlock	75%	25%	-	-
Spruce/fir	90%	10%	2,095	233

	Estimated Proportion of Harvest by Season		Estimated Harvest Removals by Season (acres, 2015)	
Forest Type Group	**Dec–Mar**	**Apr–Nov**	**Dec–Mar**	**Apr–Nov**
Other eastern softwoods	75%	25%	-	-
Exotic softwoods group	75%	25%	-	-
Oak/pine	75%	25%	99	33
Oak/hickory	75%	25%	136	45
Elm/ash/cottonwood	100%	0%	20	-
Maple/beech/birch	25%	75%	92	276
Aspen/birch <9 inches dbh	75%	25%	535	178
Aspen/birch >9 inches dbh	75%	25%	3,105	1,035
Other hardwoods	75%	25%	-	-
Exotic hardwoods	75%	25%	-	-

Notes:

[a] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

Source: U.S. Forest Service 2015

dbh = diameter at breast height

Prescribed Fire

In Minnesota, prescribed fire is conducted on private (including Tribal), county, and municipal lands, and often is conducted by DNR staff. Hunting organizations, including Ducks Unlimited, Pheasants Forever, and local hunting groups conduct burning on an irregular basis relative to habitat succession, weather, and staffing. The frequency of such fires is increasing as more individuals are trained to conduct prescribed fire and the practice becomes more widely accepted by the public. A limited amount of burning occurs on lands managed by conservation organizations and on industrial lands. The Minnesota DNR keeps records of the amount of acres burned on these non-DNR-administered lands. Based on these data, the level of this activity on forestland varies by more than an order of magnitude but is expected to affect fewer than 1,000 acres per year. Table 2-15 shows the acres of prescribed fire on county, municipal, and private (including Tribal) lands.

Table 2-15. Prescribed Fire on County, Municipal, and Private (Including Tribal) [a] Lands (acres, 2007–2011)

	2007	2008	2009	2010	2011	Average
Forested	2.5	227	29	21	520	160
Brushland	0	204	70	233	293	160
Grass/wetland	672	4,129	4,138	4,190	4,782	3,582
Slash	0	6	186	0	0	38
Total	**675**	**4,566**	**4,423**	**4,444**	**5,595**	**3,941**
Number of fires	32	91	66	70	68	65

Notes:

[a] Private lands data include Tribal lands. Note that during this timeframe, prescribed fire information in each ecosystem type was not collected by the DNR for Tribal lands. From 2015–2020 on Tribal lands, the average amount of prescribed fire annually was 4.6 acres on forested land, 0 acres on brush land, 12,514 acres on grassland, and 6.8 acres of slash. These prescribed fire amounts are included in the take analysis for the Lake States HCP, and prescribed fire is a covered activity for Tribes who are interested and eligible for coverage through the Landowner Enrollment Program.

Source: Minnesota Department of Natural Resources pers. comm. 2016

2.7 Covered Activities Results—Wisconsin

Below are results of the covered activities quantification for Wisconsin. As described in Section 2.4, *Methods for Quantifying Covered Activities*, only timber harvest and prescribed fire were assessed quantitatively.

2.7.1 State Lands

2.7.1.1 Covered Lands

Wisconsin has 34.7 million acres (U.S. Census Bureau 2010) of land, 1.5 million acres of which is owned by the Wisconsin DNR (about 4.3% of the state). Wisconsin also leases approximately 250,000 acres and manages these lands as part of the DNR system. For the purposes of the Lake States HCP, land managed by the counties—even if owned by the DNRs—will not be covered by the DNR incidental take permit and are not analyzed as State DNR lands. As land managers, the counties could obtain take authorization via the Landowner Enrollment Program. Wisconsin DNR-owned lands are partitioned into five areas by program as shown in Table 2-16.

Table 2-16. Acres and Percent of Wisconsin DNR-Owned and Managed by DNR Program

	Wisconsin DNR-Owned and Managed Lands [a]	
Program	**Acres**	**Percent**
State forest	541,000	36%
State wildlife and fisheries	645,000	43%
State parks	112,000	7%
Other (including State Natural Areas)	216,000	14%
Subtotal: DNR-owned lands	**1,514,000**	**100%**
DNR leased and managed lands	57,000	

Notes:

[a] Includes forestland and nonforestland.

Source: Wisconsin Department of Natural Resources pers. comm. 2017

- **State forests.** Wisconsin has 13 state forests that provide valuable recreational opportunities and outdoor activities including, biking, backpacking, camping, fishing, hunting, and snowmobiling. Wisconsin state forests are also sustainably managed for forest products and native biological diversity.
- **State wildlife and fisheries.** The Wisconsin DNR manages 202 state wildlife areas that allow hunting, fishing, trapping, hiking, nature study, and berry picking. Some wildlife areas also allow camping, bicycling, horseback riding, dog training, competitive field trials for dogs, and snowmobiling. Wisconsin also has 683 state natural areas that are managed by Wisconsin DNR for the preservation of biological diversity but allow low-impact activities such as research and educational use.
- **State parks**. The Wisconsin DNR state park system has 110 parks and recreation areas, southern forests, and state trails that receive over 14 million visitors each year (Wisconsin Department of Natural Resources 2015). All state parks provide a variety of different recreational opportunities and some offer hunting. In addition, DNR foresters set up and administer commercial timber harvests in state parks to improve and promote the ecological integrity and diversity of forestland.

2.7.1.2 Covered Activities

Timber Harvest

Table 2-17 provides a summary of timber harvest on Wisconsin DNR lands from 2016 through 2018, from which a projected level of activity was developed for the Lake States HCP. In Wisconsin, timber harvest is spread evenly over the year, although the type of forest harvested varies depending on season.

Table 2-17. Estimated Annual Timber Harvest Activities on Wisconsin State Lands (acres, 2016–2018)

	2016	2017	2018	3-Year Average	Projected Annual
Final harvest	9,335	9,754	10,106	9,732	10,000
Partial harvest	9,779	10,152	8,848	9,593	10,000
Total	**19,114**	**19,906**	**18,954**	**19,325**	**20,000**

Source: Wisconsin Department of Natural Resources pers. comm. 2019

Prescribed Fire

Table 2-18 describes a range of prescribed fires reported to the Wisconsin DNR (acreage and number of fires). Most prescribed fires occur in grasslands and herbaceous wetlands, although approximately 25% occur in forested landscapes where bats are more likely to occur. Most burns are performed in late winter/early spring when the opportunity for fires to escape control measures is least. Fire is assumed to be distributed equally across these months. However, fires can be conducted at any time of year so long as site-specific conditions are appropriate.

The annual acres of prescribed fire from 2014 to 2018 were used by the DNRs to demonstrate recent trends and estimate an average amount of yearly prescribed fire. Predicted annual estimates of prescribed fire over the life of the permit were derived based on these numbers and projected future management which may not match the annual average in the table. For Wisconsin, the same levels of burning are expected to continue throughout the permit term.

Table 2-18. Prescribed Fire on All Land Cover Types on Wisconsin State Lands [a] (acres, 2012–2016)

Region and Vegetation Type		Acres of Prescribed Fire					
Dominant	**Secondary**	**2012**	**2013**	**2014**	**2015**	**2016**	**Average**
Southern							
Grassland	Wetland	17,512	10,782	19,916	20,995	22,408	18,323
West Central							
Oak Savanna	Grassland/ hardwoods	1,175	548	3,045	3,335	3,717	2,364
Northwest							
Pine Barrens	Grassland/ wetland	1,252	2,310	4,508	4,978	7,295	4,069
Northeast							
Pine Barrens	Grassland/ wetland	1,290	525	852	914	1,205	957
Total							
Acres burned		21,229	14,165	28,321	30,222	34,625	25,712
Number of fires		420	367	523	631	687	526

Notes:

[a] This includes prescribed fire on all land cover types occupied by bats, including both forest and grassland land covers as defined by the State DNRs.

Source: Wisconsin Department of Natural Resources pers. comm. 2019

2.7.2 County, Municipal, and Private Lands

2.7.2.1 Covered Lands

The Lake States HCP provides a mechanism through which the Wisconsin DNR can extend its take authorization to nonfederal landowners in Wisconsin that implement covered activities through participation in the Landowner Enrollment Program (Appendix B, *Landowner Enrollment Program)*. As outlined in Table 2-1, the majority of the covered lands in Wisconsin (62.8%) are owned by private individuals or families. Approximately 9.69% of lands are associated with corporations and 15.3% are associated with county and municipal governments. The remaining lands are owned and managed by Tribes and organizations such as hunting clubs and natural resource organizations. While not all of these landowners will be eligible for enrollment in the Landowner Enrollment Program (see eligibility criteria in Appendix B, Section B.2.1, *Eligibility*), the acreages presented in Table 2-1 represent a conservative estimate of the maximum amount of land covered under the Lake States HCP in Wisconsin since it is unlikely that all eligible landowners will enroll.

2.7.2.2 Covered Activities

Timber Harvest

Table 2-19 provides data on the harvest rates by ownership type. As with the other states, timber is harvested at a lower rate per acre from lands managed by individuals and families compared to the other ownership types outlined in Table 2-19. Wisconsin DNR predicted the 2015 FIA data underestimates future timber harvest on county and municipal lands during the length of the permit term. Therefore, an increase of annual timber harvest of approximately 41% was assumed for county and municipal lands in Wisconsin. Other landowners conduct more timber harvest relative to individuals and families. Table 2-20 shows the forestland harvest by season and ownership in Wisconsin.

Table 2-19. Estimated Annual Harvest by Ownership Type and Harvest Type and Estimated Proportion of Partial and Final Harvest in Wisconsin

FIA Forest Type Group	Forest Type Group Annual Harvest (cubic feet 2015)	Cubic Feet/Acre at Harvest Age (±10 yrs)	Equivalent Area of Harvest [a, b] (Acres)	Estimated Proportion of Harvest by Ecological Category: Partial	Final
County and Municipal					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	9,290,945	1,798	8,706	25%	75%
White pine/hemlock	1,380,227	2,670	871	90%	10%
Spruce/fir	254,566	929	462	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,520	0	10%	90%
Oak/pine	1,739,672	2,574	1,139	50%	50%
Oak/hickory	12,222,652	2,032	10,131	25%	75%
Elm/ash/cottonwood	454,801	2,035	376	90%	10%
Maple/beech/birch	17,975,734	2,298	13,177	100%	0%
Aspen/birch <9 inches dbh	7,264,010	775	15,797	10%	90%
Aspen/birch >9 inches dbh	10,318,432	1,633	10,642	10%	90%
Other hardwoods	-	781	0	50%	50%
Exotic hardwoods group	-	860	0	10%	90%
Annual Total Harvest	**60,901,039**		**61,300**		
Private Corporate					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	6,602,283	1,798	3,672	25%	75%
White pine/hemlock	613,658	2,670	230	90%	10%
Spruce/fir	30,765	929	33	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,520	0	10%	90%
Oak/pine	514,608	2,574	200	50%	50%
Oak/hickory	4,493,238	2,032	2,211	25%	75%
Elm/ash/cottonwood	1,507,728	2,035	741	90%	10%
Maple/beech/birch	20,002,774	2,298	8,704	100%	0%
Aspen/birch <9 inches dbh	2,672,257	775	3,450	10%	90%
Aspen/birch >9 inches dbh	5,713,208	1,633	3,498	10%	90%
Other hardwoods	-	781	0	50%	50%
Exotic hardwoods	-	860	0	10%	90%
Annual Total Harvest	**42,150,519**		**22,738**		
Private Noncorporate					
Nonstocked	40,753	NA	0	NA	NA

FIA Forest Type Group	Forest Type Group Annual Harvest (cubic feet 2015)	Cubic Feet/Acre at Harvest Age (±10 yrs)	Equivalent Area of Harvest [a, b] (Acres)	Estimated Proportion of Harvest by Ecological Category: Partial	Final
Red/jack pine	21,333,565	1,798	11,866	25%	75%
White pine/hemlock	9,252,286	2,670	3,466	90%	10%
Spruce/fir	2,949,472	929	3,176	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	437,738	1,520	288	10%	90%
Oak/pine	3,850,391	2,574	1,481	50%	50%
Oak/hickory	62,290,393	2,032	30,345	25%	75%
Elm/ash/cottonwood	7,319,883	2,035	3,596	90%	10%
Maple/beech/birch	38,210,280	2,298	16,626	100%	0%
Aspen/birch <9 inches dbh	9,220,631	775	11,903	10%	90%
Aspen/birch >9 inches dbh	27,389,054	1,633	16,768	10%	90%
Other hardwoods	-	781	0	50%	50%
Exotic hardwoods	-	860	0	10%	90%
Annual Total Harvest	**182,294,446**		**99,515**		
Private Other (Including Tribal [c])					
Nonstocked	-	NA	0	NA	NA
Red/jack pine	2,560,323	1,798	1,424	25%	75%
White pine/hemlock	69,705	2,670	26	90%	10%
Spruce/fir	-	929	0	25%	75%
Other eastern softwoods	-	217	0	25%	75%
Exotic softwoods group	-	1,520	0	10%	90%
Oak/pine	-	2,574	0	50%	50%
Oak/hickory	1,920,557	2,032	936	25%	75%
Elm/ash/cottonwood	609,333	2,035	299	90%	10%
Maple/beech/birch	4,153,917	2,298	1,807	100%	0%
Aspen/birch <9 inches dbh	877,938	775	1,133	10%	90%
Aspen/birch >9 inches dbh	4,490,861	1,633	2,749	10%	90%
Other hardwoods	-	781	0	50%	50%
Exotic hardwoods	-	860	0	10%	90%
Annual Total Harvest	**14,682,634**		**8,375**		

Notes:

[a] As described in Section 2.4.2.2, *Timber Harvest*, a stand age-volume table was generated for each forest type. DNR foresters provided a typical age at which these stands would be harvested. To account for variation in harvest date, a typical volume was obtained by averaging 20 years of stand volumes based on the age provided by DNR foresters. This value was then divided into the volume of product. This value was then divided into the volume of product. For County/Municipal Forest, Wisconsin DNR has other data that projects 61,300 acres of harvest. Value was prorated across the various stand types to estimate harvest per type.

[b] Numbers may not sum due to rounding.

[c] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the "Native American" owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

Source: U.S. Forest Service 2015

NA = not applicable; yrs = years; dbh = diameter at breast height

Table 2-20. Estimated Annual Harvest by Season and Ownership in Wisconsin

	Estimated Proportion of Harvest by Season		Estimated Harvest Removals by Season (acres, 2015)	
Forest Type Group	**Dec–Mar**	**Apr–Nov**	**Dec–Mar**	**Apr–Nov**
County and Municipal				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	2,902	5,804
White pine/hemlock	33%	67%	290	581
Spruce/fir	90%	10%	415	46
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group	33%	67%	-	-
Oak/pine	67%	33%	759	380
Oak/hickory	67%	33%	6,754	3,377
Elm/ash/cottonwood	100%	0%	376	-
Maple/beech/birch	50%	50%	6,589	6,589
Aspen/birch <9 inches dbh	33%	67%	5,266	10,531
Aspen/birch >9 inches dbh	33%	67%	3,547	7,095
Other hardwoods	33%	67%	-	-
Exotic hardwoods group	33%	67%	-	-
Private Corporate				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	1,224	2,448
White pine/hemlock	33%	67%	77	153
Spruce/fir	90%	10%	30	3
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group	33%	67%	-	-
Oak/pine	67%	33%	133	67
Oak/hickory	67%	33%	1,474	737
Elm/ash/cottonwood	100%	0%	741	-
Maple/beech/birch	50%	50%	4,352	4,352
Aspen/birch <9 inches dbh	33%	67%	1,150	2,300
Aspen/birch >9 inches dbh	33%	67%	1,166	2,332
Other hardwoods	33%	67%	-	-
Exotic hardwoods	33%	67%	-	-
Private Noncorporate				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	3,955	7,911
White pine/hemlock	33%	67%	1,155	2,311
Spruce/fir	90%	10%	2,858	318
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group	33%	67%	96	192
Oak/pine	67%	33%	987	494
Oak/hickory	67%	33%	20,230	10,115
Elm/ash/cottonwood	100%	0%	3,596	-

	Estimated Proportion of Harvest by Season		Estimated Harvest Removals by Season (acres, 2015)	
Forest Type Group	**Dec–Mar**	**Apr–Nov**	**Dec–Mar**	**Apr–Nov**
Maple/beech/birch	50%	50%	8,313	8,313
Aspen/birch <9 inches dbh	33%	67%	3,968	7,935
Aspen/birch >9 inches dbh	33%	67%	5,589	11,179
Other hardwoods	33%	67%	-	-
Exotic hardwoods	33%	67%	-	-
Private Other (Including Tribal [a])				
Nonstocked	0%	100%	-	-
Red/jack pine	33%	67%	475	949
White pine/hemlock	33%	67%	9	17
Spruce/fir	90%	10%	-	-
Other eastern softwoods	33%	67%	-	-
Exotic softwoods group	33%	67%	-	-
Oak/pine	67%	33%	-	-
Oak/hickory	67%	33%	624	312
Elm/ash/cottonwood	100%	0%	299	-
Maple/beech/birch	50%	50%	904	904
Aspen/birch <9 inches dbh	33%	67%	378	755
Aspen/birch >9 inches dbh	33%	67%	916	1,833
Other hardwoods	33%	67%	-	-
Exotic hardwoods	33%	67%	-	-

Notes:
[a] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the "Native American" owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.
Source: U.S. Forest Service 2015
dbh = diameter at breast height

Prescribed Fire

In Wisconsin, prescribed fire is less common on private (including Tribal), county, and municipal lands and is often conducted in conjunction with DNR staff (and is, thus, included in Table 2-18). The Nature Conservancy owns approximately 12,000 acres of fire-maintained landscapes and conducts fires on an irregular basis depending on weather, funding, and successional dynamics. Prescribed fires also are conducted on the University of Wisconsin Arboretum properties owned by the Leopold Foundation, and private nature centers, with most efforts restricted to prairies and savannas. The Wisconsin-based Tallgrass Prairie and Oak Savanna Fire Science Consortium[10] is working to train and support individuals interested in the use of prescribed fire throughout the region, which may result in the amount of prescribed fire increasing over time in the Lake States. In Wisconsin, the level of prescribed fire in forestland is estimated at 5,000 acres per year throughout the duration of the permit. As with other covered activities, this estimate will function as a cap.

[10] Available at http://www.tposfirescience.org.

Chapter 3
Environmental Setting

3.1 Overview

This chapter provides information about the environmental setting of the plan area and for each of the Lake States: Michigan, Minnesota, and Wisconsin. This discussion includes a description of the area's dominant physical attributes (e.g., proximity to the Great Lakes, climate, major watersheds, and geological features) and how these attributes affect the distribution of covered species throughout the year.

The current environmental context of the plan area, or baseline, is affected by white-nose syndrome, wind energy development, and forest management programs. Section 3.3, *Environmental Baseline*, provides background on each of these factors and describes how they affect the environmental context.

This chapter also provides state-specific information on forest type and species distribution for each state's covered lands.

3.2 Regional Overview

3.2.1 Methods and Data

The physical and ecological descriptions of the plan area were assembled using the following resources.

- Literature review
- Geographic information system (GIS) datasets, including the U.S. Department of Agriculture's National Landcover Database (NLCD) (Homer et al. 2015; National Land Cover Database 2017)
- The U.S. Forest Service (USFS) Forest Inventory and Analysis (FIA) database (O'Connell et al. 2017; U.S. Forest Service 2017)
- Professional knowledge of the region

Landcover varies greatly across the plan area because of varying climate, soils, vegetation, and anthropogenic influences across the three states. As a result, GIS datasets were used to examine the diverse topography, geology, soils, hydrology, and landcover types across the plan area.

USFS FIA data were used to tabulate landcover and acres of forest type. Because USFS FIA data are not readily converted to a spatially explicit map, landcover maps were generated using the NLCD. The NLCD landcover groupings were cross-walked to the USFS FIA landcover and forest types to ensure that mapping of these data gave a reasonable depiction of the distribution of landcover across the plan area (Section 3.2.3.2, *Landcover*).

The NLCD was developed for the conterminous United States using 2011 Landsat 30-meter imagery. The landcover classes focus on vegetation but also include human activities that modify landcover (e.g., agriculture, urban). Classification also uses calculations of percent impervious surface and percent tree canopy cover. The NLCD supports a variety of governmental and nongovernmental entities that use these data for a variety of applications such as ecosystem status and health, patterns of biodiversity, land management policy, and the effects of climate change (National Land Cover Database 2017).

The modeled distribution of covered species in the plan area was described using data on bat occupancy provided by the Natural Heritage Program within the Department of Natural Resources (DNR) of all three states. These data were combined with information from peer-reviewed literature; the Bell Museum of Natural History; and input from species and technical experts from academia, industry, and state and federal agencies within each of the three states, to create a distribution model for each of the four bat species for winter, summer, and fall/spring (Sections 3.4.2, 3.5.2, and 3.6.2, *Modeled Species Distribution*). In particular, species experts also provided input on the roosting value of each USFS FIA landcover for bats. Additional detail on species distribution modeling can be found in Section 3.2.5, *Modeled Species Distribution*.

3.2.2 Environmental Setting

This section presents a broad overview of the physical and ecological attributes of the lands in the plan area (Michigan, Minnesota, and Wisconsin). In general, the interaction of an area's physical attributes (continental location, topography, geology and physiography, soils, climate, and hydrology) drives the ecosystems and vegetation types present in that area. These, in turn, influence the ranges of the four covered species of bats.

3.2.2.1 Location

The plan area is located in the Upper Midwest and is bounded by the Great Lakes to the north and east and the Great Plains to the west. The Corn Belt of Indiana, Illinois, and Iowa makes up the southern border of the region. In addition to the Great Lakes, the plan area is notable as the origin of the Mississippi River.

3.2.2.2 Topography

Topography influences vegetation and climate, both of which may affect covered species in the plan area. Continental glaciers over the last million years are the primary topographical architects of the plan area. Compared to states bordering the east, south, and west, the topography of the plan area is relatively unvaried. The relatively flat nature of these states is the result of glaciers and precipitation wearing down high points in the landscape while rivers and streams have deposited sediment in low-lying areas. Water moves slowly through this landscape and often collects in lakes, streams, and wetlands, which are abundant in the region. For example, the flat landscape of northwestern Minnesota once contained many wetlands and is itself a legacy of the southern lobe of glacial Lake Agassiz, a water body created by glacial melting that was larger than all the Great Lakes combined (Ojakangas and Matsch 1982). Ranges of low and high elevations are similar among the three states. The lowest elevations in Michigan, Minnesota, and Wisconsin are 571, 601, and 579 feet, respectively, and the highest elevations are 1,979, 2,302, and 1,951 feet, respectively. A few areas in the region are more rugged, including the Porcupine and Huron Mountains of Michigan's Upper Peninsula, the Sawtooth Mountains on the north shore of Lake Superior in Minnesota, and the Penokees of Wisconsin's Northern Highland Region. The Driftless Area along the border of

Minnesota and Wisconsin, unglaciated in the last ice age, is also a rugged landscape where exposed bedrock is common.

3.2.2.3 Geology

Bat distributions are tied closely to physiography. First, geology influences vegetation, which influences bat distribution. In addition, bats use specific geological features in the landscape. A karst landscape, with its caves and cliffs, provides potential sites that may serve as bat hibernacula. Similarly, past volcanic activity deposited minerals that are removed by mining, which in turn creates hibernacula for bats. The following discussion provides an overview of the geology and physiography in the plan area, with a description of features relevant for the covered species, as appropriate.

As noted above, continental glaciations dominate the recent geological history and visible geology of the plan area. Glacial drift topographic features (e.g., outwash plains, eskers, ice contact ridges, kettle and kame moraines) form the landscape that is familiar to human eyes, and much of this landscape does not contain the caves (and later mines) that allow the covered bats to hibernate through winter.

In portions of the plan area, however, bedrock is the visible dominant feature. The Michigan Basin, consisting of layers from the Precambrian to Pennsylvanian, is centered on the Lower Peninsula of Michigan, and extends into the eastern Upper Peninsula on the north and west into eastern Wisconsin. It includes sandstones and carbonate rocks (limestones and dolostones). These geologic layers, formed during the Paleozoic, are visible in many locations along the Great Lakes shorelines (Dorr and Eschman 1970). Southeastern Minnesota and southwestern Wisconsin also contain areas of carbonate bedrock, exposed along the major rivers and elsewhere and forming what is termed a karst landscape of sinkholes and caves (Ojakangas and Matsch 1982). Figure 3-1 shows the major karst formations in the plan area.

Precambrian igneous and metamorphic rocks formed by ancient volcanic activity are visible in the northern portions of all three states. The Menominee River, which forms the northern border of Michigan and Wisconsin, flows along an ancient continental subduction zone that once produced volcanoes on the present-day Wisconsin side as the Michigan side slid beneath it (Schneider et al. 2003). Northeastern and north-central Minnesota also have bedrock of igneous and metamorphic origin associated with the mid-continental rift system.

Distribution and abundance of bats in the Lake States is closely associated with mining activities. Mining of iron, copper, nickel, gold, silver, and other precious metals is associated with several areas of ancient igneous and metamorphic bedrock (Figure 3-1). As a result, there are thousands of abandoned underground mines across these areas and many of these sites provide habitat for hibernating bats. These included the largest hibernating populations of little brown bats (*Myotis lucifugus*) and northern long-eared bats (*Myotis septentrionalis*) in all three states (Sections 3.4.2, 3.5.2, and 3.6.2, *Modeled Species Distribution*). It is likely that these mines made possible the relatively recent establishment of tricolored bats (*Perimyotis subflavus*) in the Upper Peninsula of Michigan (Kurta and Smith 2014).

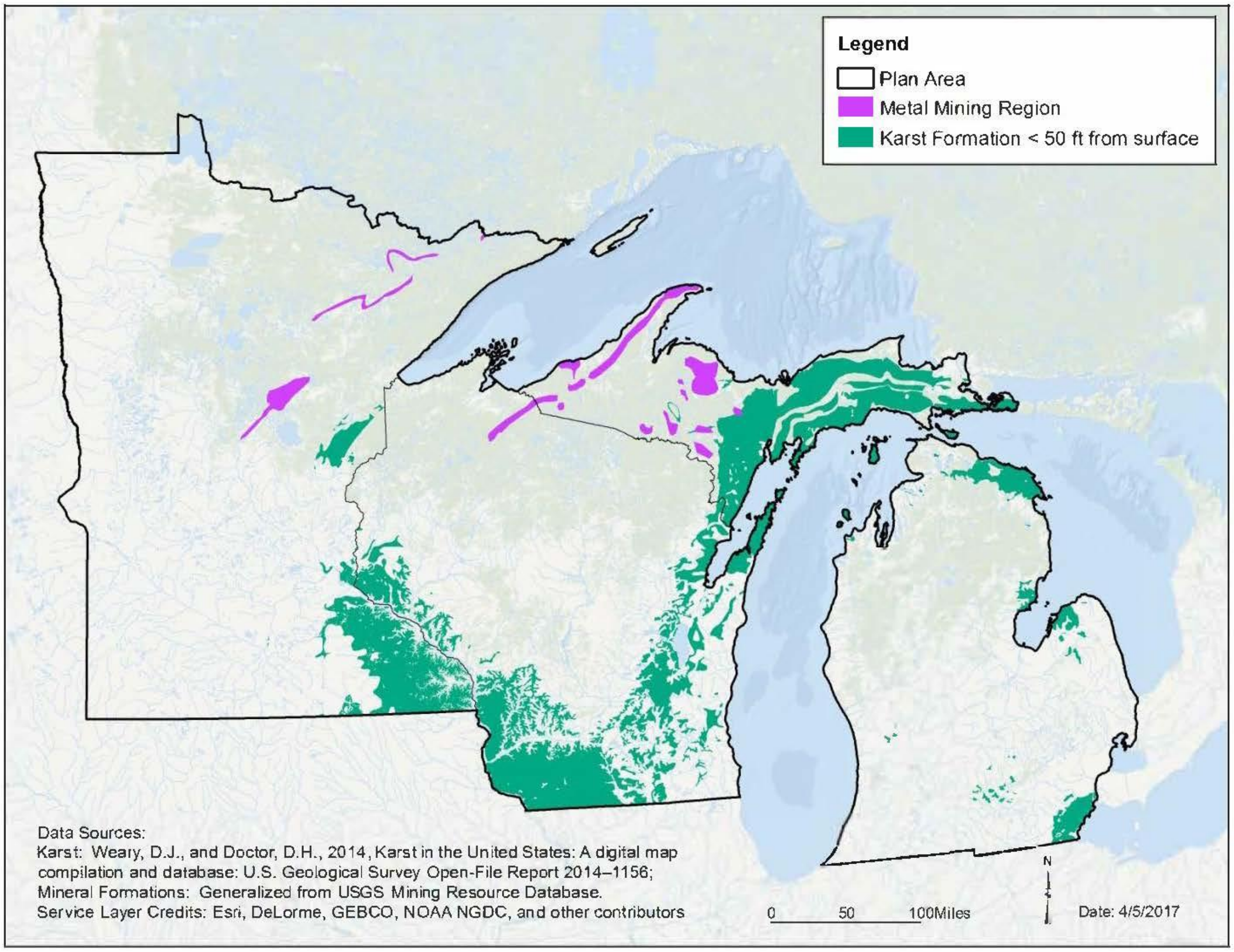

Figure 3-1. Major Karst Formations and Metal Mining Regions in the Plan Area

3.2.2.4 Physiography

Included in the plan area are two major physiographic regions designated by the U.S. Geological Survey (Fennemann and Johnson 1946). The first is the Laurentian Upland in northeast Minnesota, northern Wisconsin, and the western portion of Michigan's Upper Peninsula. This region is composed of Precambrian igneous, metamorphic, and sedimentary rock. The majority of this region is rolling to mountainous peneplain (an old landscape that has been extensively eroded) ranging from 800 to 1,400 feet above sea level (Ojakangas and Matsch 1982). The rest of the plan area is mapped as Interior Plains, a region created when original portions of continents (cratons) collided and welded together. Much of this area was covered by extensive ancient seas that resulted in the formation of sedimentary bedrock from the sea bottom (e.g., sandstones, limestones, and dolostones). Across the plan area, carbonate bedrock exposures are most evident in the karst-dominated Driftless Area of southwest Wisconsin and southeast Minnesota, and in areas associated with the Niagara Escarpment along Lake Michigan and Lake Huron shorelines (Figure 3-1).

As mentioned in Section 3.2.2.3, *Geology,* mining for metals has produced a large number of abandoned mines that are now used by hibernating bats. Prior to those mining efforts, the only known hibernacula in the Lake States were associated with the limestones and dolomites described in Section 3.2.2.3, *Geology*. Such caves were relatively few and did not contain the massive numbers of bats contained in some of the mines. Since settlement, anthropogenic activities within areas dominated by sedimentary bedrocks have also expanded hibernating opportunities for bats. Existing natural caves were expanded for a variety of purposes including tourism and underground storage (Kurta 2008). Finally, two of Wisconsin's large hibernacula are locations where sandstone is being mined to produce high-quality sand that is often used in hydraulic fracturing. Efforts to quarry limestone and dolomite have produced several small hibernacula (Slider and Kurta 2011). Two of Wisconsin's three large hibernacula are locations where underground sandstone is being mined with most current production being shipped out of state for use in hydraulic fracturing (Wisconsin Department of Natural Resources 2016).

3.2.2.5 Soils

Soils exert a strong influence on the landcover and forest types of the plan area and consequently affect bat habitat distribution. In a post-settlement world, areas of limited value for agriculture or development are often allowed to revert to natural landcovers, including forests. The dominant parent material of soils over much of the plan area is composed of glacial deposits (till) with some areas of loess deposits. In addition, northern Minnesota, northern Wisconsin, and the western end of Michigan's Upper Peninsula are dominated by glaciated metamorphic, igneous, and sedimentary bedrock in the highlands, with relatively shallow soils deposited by glaciers.

The plan area comprises seven U.S. Department of Agriculture soil orders classified by several parameters, including parent material, moisture and temperature (U.S. Department of Agriculture Soil Survey Staff 2015). These are alfisols, entisols, histosols, incepticols, mollisols, spodosols, and vertisols (Figure 3-2). Other patches occurring in smaller amounts are mapped as miscellaneous.

- **Alfisols**. Alfisols are found in large areas of all three states, mainly in the south. These soils are typically formed under broadleaf or conifer forests and are rich in nutrients. In the plan area, they correspond to cultivated and pastured agricultural lands on the landscape.

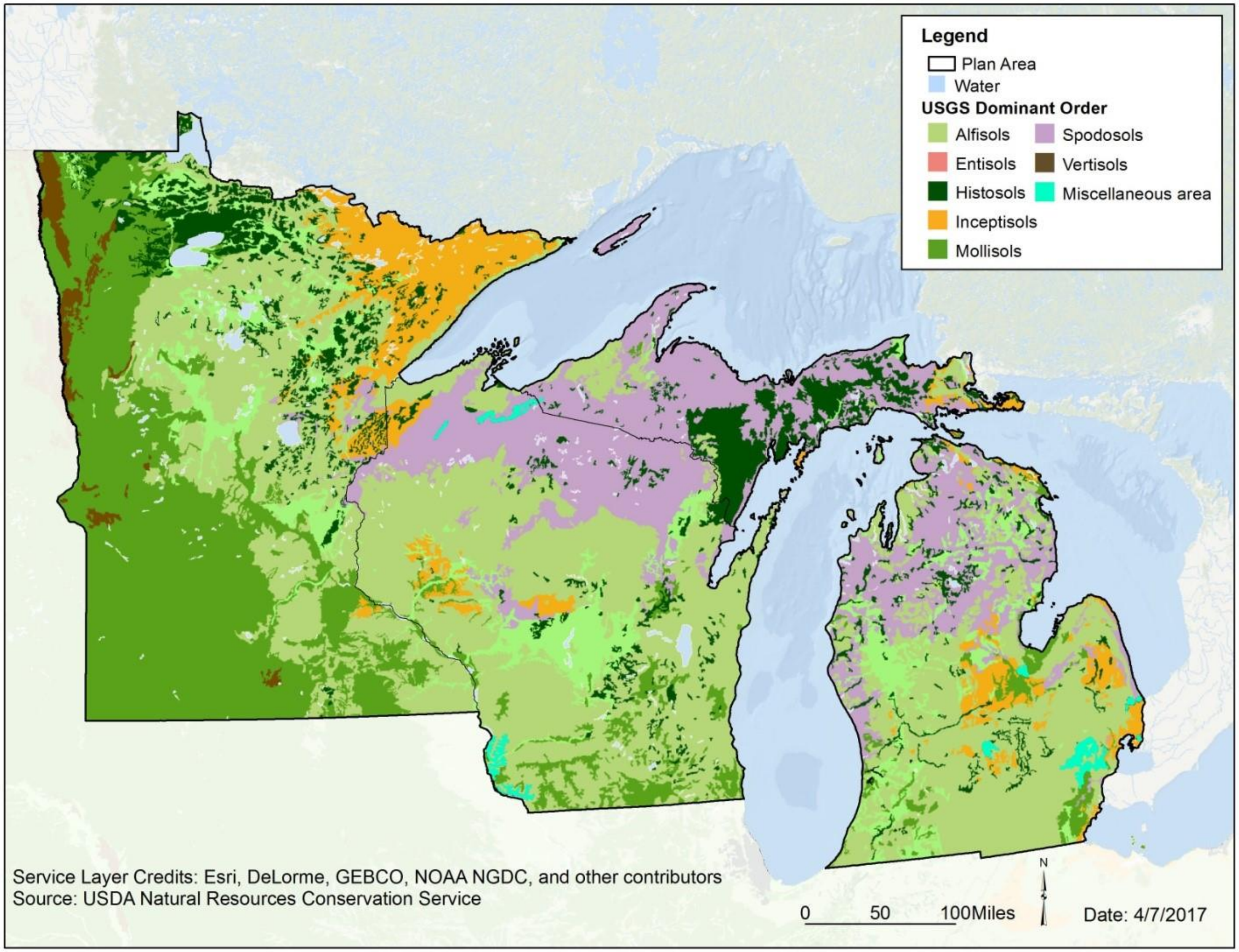

Figure 3-2. USGS Soil orders in the Plan Area

- **Entisols.** Entisols are found in areas where erosion or deposition outpaces soil formation, such as uplands and floodplains. These soils are of relatively recent origin and thus the topsoil is very similar to the subsoil. One of the largest contiguous areas of this soil is found in central Wisconsin in association with Glacial Lake Wisconsin, which was impounded during the last glaciation.
- **Mollisols.** Mollisols underly other agricultural lands in the plan area. These soils are typically found in areas with significant loess deposits where the original vegetation was native prairie, with large extents in the great plains of western Minnesota, as well as scattered patches in southern Wisconsin and Michigan.
- **Spodosols.** Spodosols, acidic soils common under pine forests in the cold, moist north, often have a sandy parent material underlying them. They occupy significant portions of Michigan (northern Lower Peninsula and north edge and west end of the Upper Peninsula), as well as northern Wisconsin. These areas correspond with land uses of forest product production, with interspersed hay and pasture lands.
- **Histosols.** Histosols are largely found in the eastern portion of Michigan's Upper Peninsula and in northern Minnesota. These soils exist under continuously saturated moisture regimes, usually with thick organic layers, such as those found in bogs and peatlands.
- **Inceptisols.** Inceptisols are relatively young soils of moderate horizon (soil layer) development typically found on steep topography overlying erosion-resistant bedrock, such as the large area in northeastern Minnesota.
- **Vertisols.** Vertisols are found in areas of northwestern Minnesota. These are clay-rich soils with little organic material that shrink and expand in response to a varied moisture regime. These were formed from clayey lake deposits in the Red River Valley.

3.2.2.6 Climate

Climate controls precipitation and temperature, which in turn affect bat prey type and abundance, timing of migration and overwintering, and even bat evolution. Overall, the weather of the plan area is dominated by a continental climate, influenced by the moderating effect of the Great Lakes in Michigan, northeastern Minnesota, and northern and eastern Wisconsin.

The Köppen Climate Classification is a widely used world climate system (Trewartha and Horn 1980). As modified by Peel et al. (2007), this system classifies the plan region into two major climate zones. The southern plan area has a hot-summer, humid, continental climate, with at least one month's average temperature over 72 degrees Fahrenheit (° F) (22 degrees Celsius [° C]), four months averaging 50° F (10° C) and higher, and at least one month colder than 36° F (2.2° C). The northern plan area has a warm-summer, humid, continental climate, with no month averaging over 72° F (22° C), but 4 months above 50° F (10° C) on average, and the coldest month below 32° F (0° C). These climate zones are closely tied to vegetative patterns, which in turn, are correlated with temperature and moisture regimes. This classification is used in climate change modeling to help predict vegetation changes in future decades (e.g., Mitchell and Keinholz 1997; Belda et al. 2014).

In the plan area, precipitation decreases from east to west, with the wettest area in southwest Michigan and southern Wisconsin and the driest in northwest Minnesota (Kunkel et al. 2013) (Figure 3-3). The only exception to the trend is the northeastern portion of Michigan's Lower Peninsula and small portions of the Upper Peninsula that experience less precipitation than the rest of the state.

Temperatures decrease from south to north with the coldest areas found in northern Minnesota and the areas of Michigan's Upper Peninsula that do not border a Great Lake (Kunkel et al. 2013) (Figure 3-4). The coldest temperature recorded in the plan area was a reading of -60°F (-51°C) recorded at Tower, Minnesota in February 1996. Michigan recorded a record low of -51°F (-46°C) at Vanderbilt in February 1934 and Wisconsin recorded -55°F (-48°C) at Couderay in February 1996.

3.2.2.7 Hydrology

Water resources can have a variety of direct and indirect effects on bats and their distributions. At the most simplistic level, bats need water to drink. In addition, aquatic insects are an important prey resource for all covered bat species. Riparian woodlands often play an important role in connecting landscapes dominated by agriculture, and/or human development. Very large water bodies, such as the Great Lakes, can serve as barriers to movement by bats, which in turn, cause bats to make extensive use of shorelines during dispersal and migration. Finally, flowing water erodes landscapes, exposing the bedrock that may itself be soluble (leading to the formation of caves or exposing minerals that can then be mined).

The plan area falls within three continental watersheds: the Great Lakes, the Missouri-Mississippi Rivers, and the Red River of the North. Michigan lies almost entirely within the Great Lakes basin, with waters reaching the Atlantic Ocean through the St. Lawrence River. The only exception is a tiny sliver of the headwaters of the Mississippi River in the western Upper Peninsula of Michigan at Lac Vieux Desert. In Michigan, the Menominee River constitutes the largest watershed of the Upper Peninsula. In addition, the Escanaba and the Manistique Rivers nearly cross the Upper Peninsula north to south, draining into Lake Michigan. Major watersheds of the Lower Peninsula include the Cheboygan, AuSable, Manistee, Muskegon, Saginaw, Grand, Kalamazoo, St. Joseph, Raisin, Clinton, and Huron Rivers (Figure 3-5).

Minnesota contains four major river drainages. The St. Croix and Minnesota Rivers join the Mississippi River, which dominates drainage patterns in the majority of the state. Lands along the north shore of Lake Superior drain to Lake Superior in the Great Lakes basin. Lands in the northwest portion of the state, north of the Laurentian Divide (an area once occupied by Glacial Lake Agassiz) have their waters captured by the Red River, which flows north and eventually reaches Hudson's Bay. The Rock River in extreme southwest Minnesota drains toward the Missouri River. The portions of Wisconsin that lie in the Great Lakes basin are the northern shore along Lake Superior and the eastern two-thirds that drain to Lake Michigan. The remainder of Wisconsin drains into the Mississippi River and south to the Gulf of Mexico. Major rivers draining Wisconsin include the St. Croix, Chippewa, Black-Buffalo, Wisconsin, Rock, and Sugar-Pecatonica Rivers—all draining to the Mississippi River. On the east side, Wisconsin shares a border with Michigan along the Menominee River, which flows to Green Bay of Lake Michigan. The Wolf River flows into Lake Winnebago, and from there the Fox River flows to Green Bay.

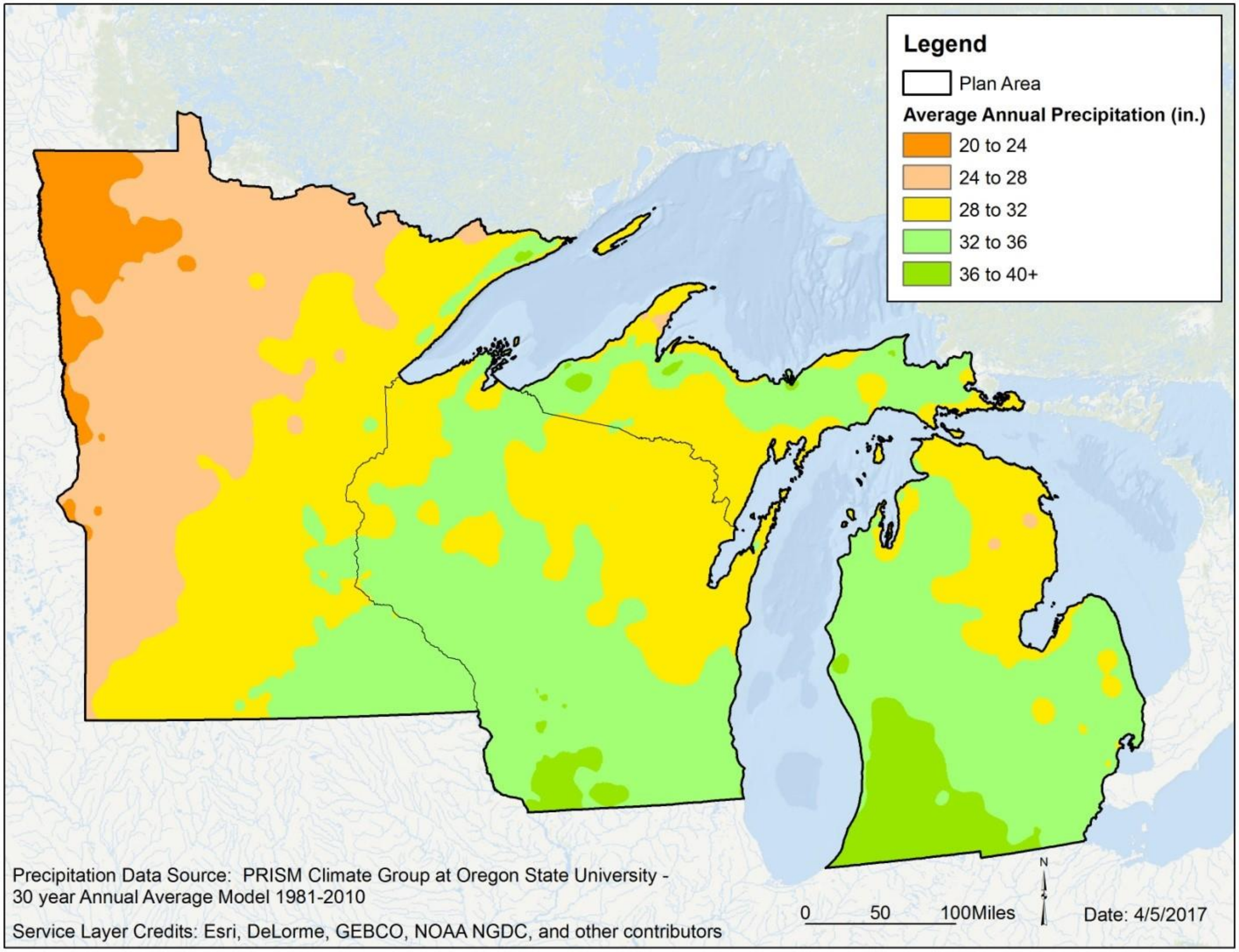

Figure 3-3. Average Annual Precipitation in the Plan Area

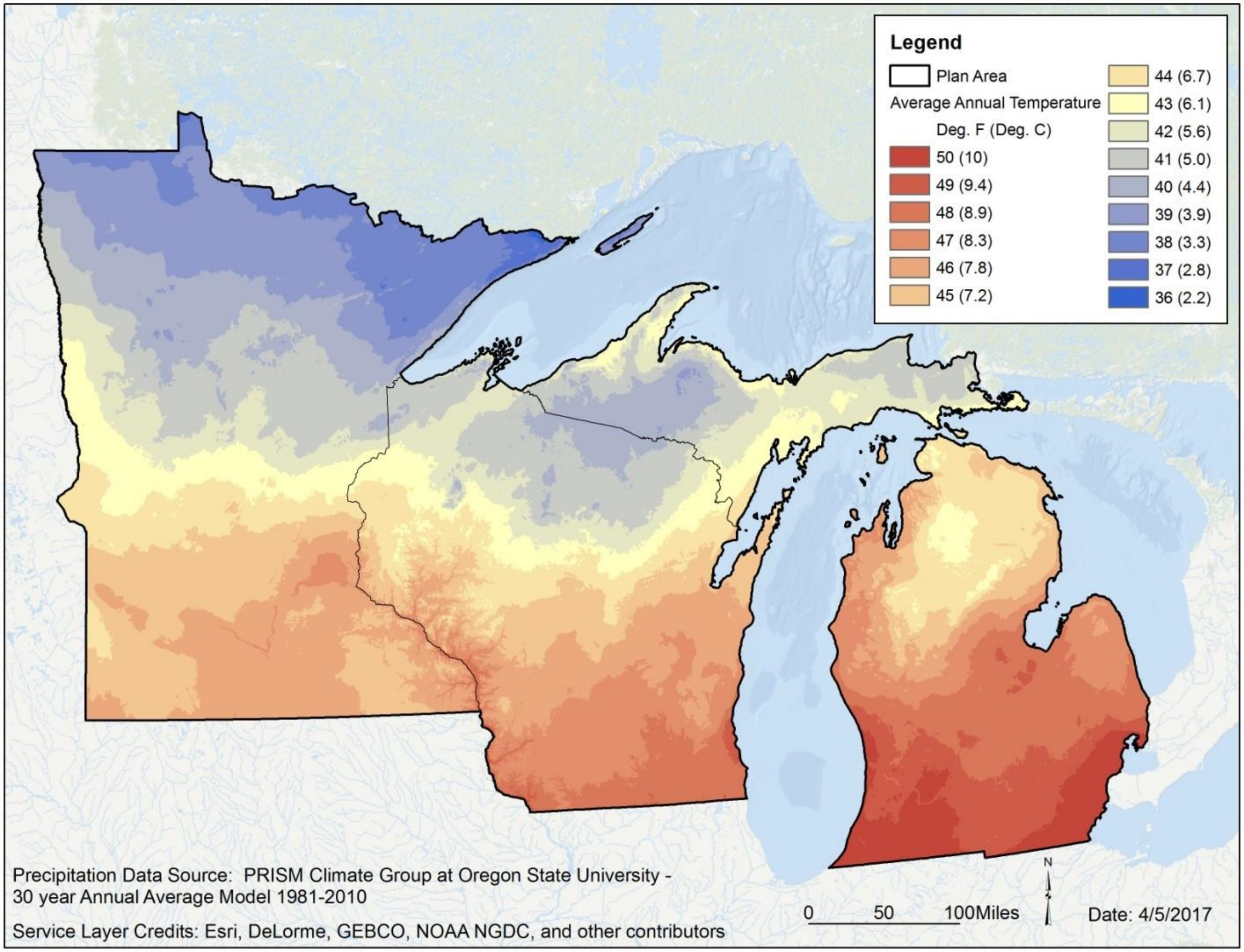

Figure 3-4. Average Annual Temperature in the Plan Area

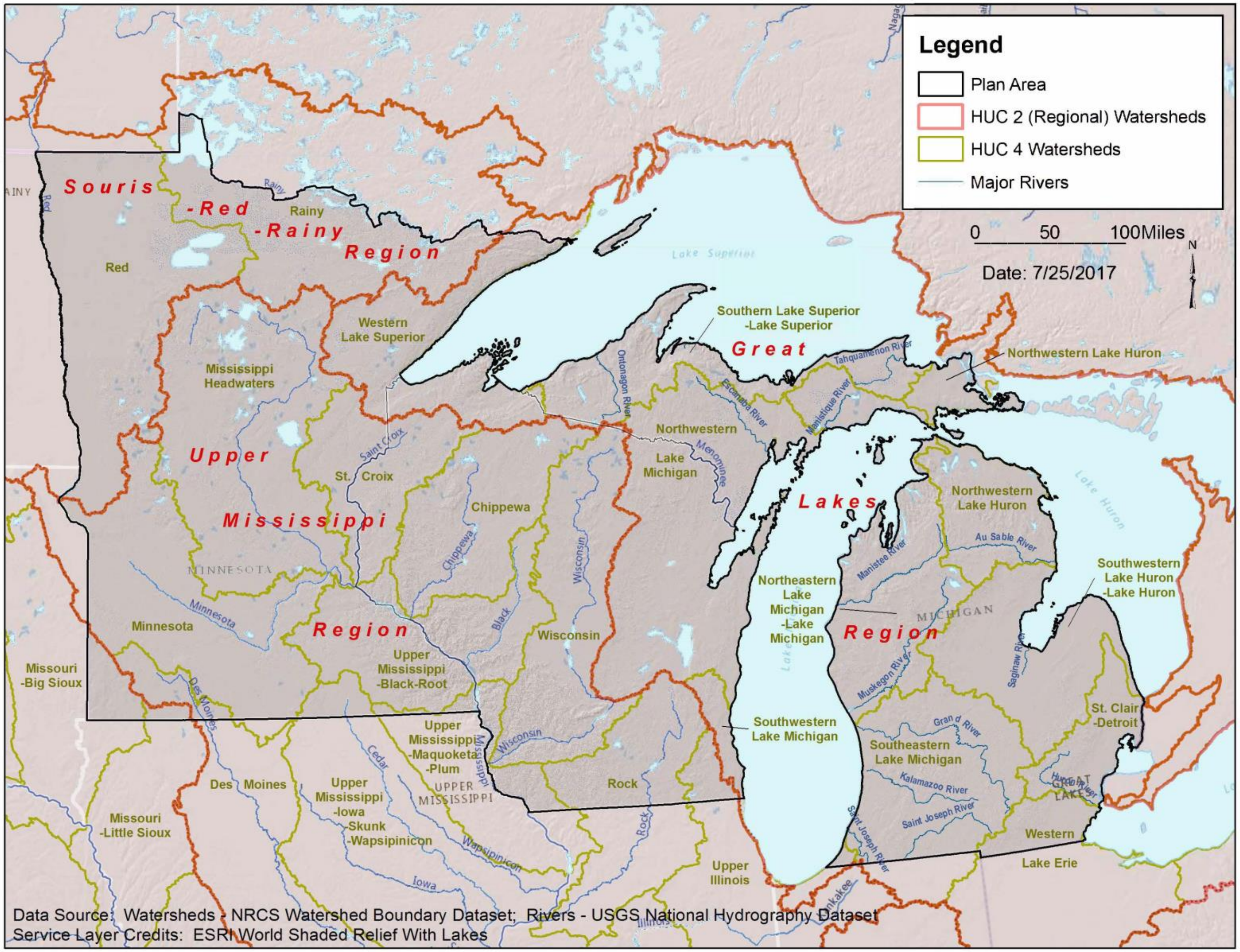

Figure 3-5. Major Watersheds in the Plan Area (HUC = Hydrologic Unit Codes)

It is an inescapable fact that the plan area's hydrology is dictated by its glacial legacy. The heterogeneity of glacial deposits influences the retention of water on the landscape, both as surface water and groundwater (Stephenson et al. 1988). As mentioned, large glacial features such as glacial lakes or outwash plains are not only drivers of hydrology but also of their associated vegetation. To illustrate, the poorly drained histosols and peatlands (both forms of organic, nonmineral soils) of Michigan's Upper Peninsula are legacies of the elevated levels of water bodies that preceded the Great Lakes and of the lacustrine depositions they left behind. In another example, sandy outwash plains that formed at the terminus of glacial moraines today are well drained and support pine and oak forests, although pockets of fine sediments remain as wetlands. In short, the hydrology of the plan area is complex in both form and function due to recent glaciations superimposed on underlying volcanic and sedimentary bedrock.

3.2.3 Ecosystems and Vegetation Types

3.2.3.1 Ecoregions

The landcover and forest types of the plan area are mapped at different geographic levels, called *ecoregions*. Ecoregions integrate multiple environmental factors to provide an ecological overview of the landscape. Because the distribution of forest types, bedrock, and other habitat elements is important for bats, an ecoregional framework provides a consistent approach for visualizing the distribution of those habitat factors over large areas. These ecoregions are defined by similar vegetation, wildlife, soils, geology, climate, hydrology, land use, and landforms.

The ecoregions used for the Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP) were derived from the U.S. Environmental Protection Agency's *Ecoregions of the United States* (Wiken et al. 2011). Ecoregions are mapped at four hierarchical levels of increasing detail and smaller geographical areas.

- **Level 1.** Level I contains 12 broad ecoregions across the continental United States, with three of these covering the plan area: northern temperate forests in the northern portions of each state, eastern temperate forests in the midsections, and Great Plains on the western edge of Minnesota.
- **Level II.** Level II contains 25 ecoregions in the continental United States, nested within Level I.
- **Level III.** Level III contains 105 more finely delineated and smaller ecoregions that nest within Level II. These further differentiate soils, geology, climate, and vegetation. Level III is generally considered more useful for understanding ecological dynamics over space and time than the coarser levels.
- **Level IV.** Level IV contains 967 detailed, descriptive ecoregions that nest within Level III. These are most appropriate for state-level or smaller, regional assessments.

Level III provides the appropriate detail to describe the different regions in the plan area that may be associated with variation in the distribution and abundance of bat species. As discussed, forests, other landcover, geology, and climate have a bearing on bat biology, and this information is described with relevant detail for bats at Level III. The plan area contains 12 Level III Ecoregions that are typically referred to by number and name, with associated descriptions (Wiken et al. 2011) (Figure 3-6 and Table 3-1).

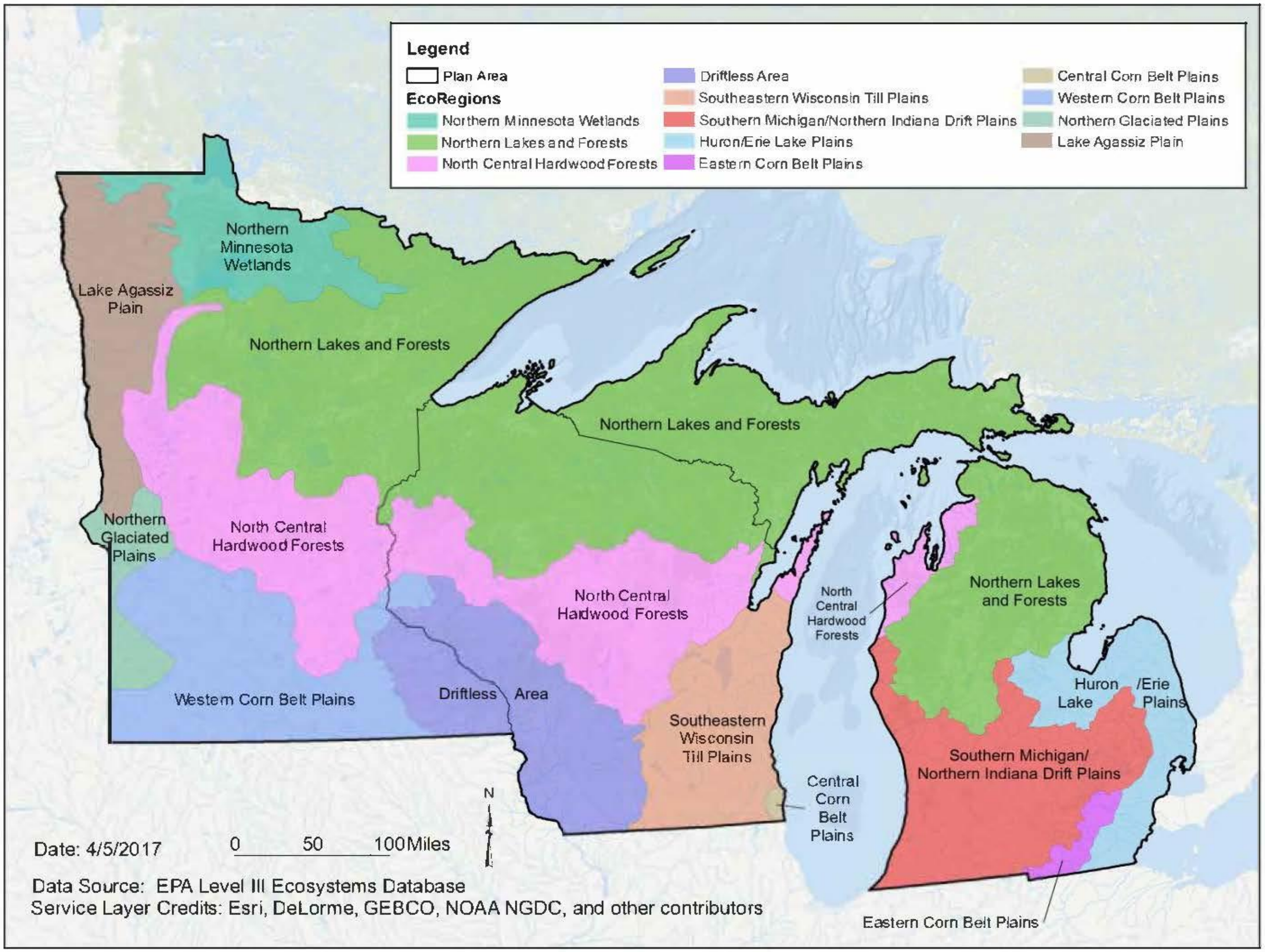

Figure 3-6. US EPA Level III Ecoregions in the Plan Area

Table 3-1. Acres and Proportions of Level III Ecoregions by State

USEPA Ecoregions (Level III, with Ecoregion Code)	Michigan (Acres)	Michigan (Proportion of State)	Minnesota (Acres)	Minnesota (Proportion of State)	Wisconsin (Acres)	Wisconsin (Proportion of State)
Northern Glaciated Plains (46)			2,268,397	4.2%		
Western Corn Belt Plains (47)			10,387,156	19.2%	391,311	1.1%
Lake Agassiz Plain (48)			6,608,873	12.2%		
Northern Minnesota Wetlands (49)			5,640,718	10.4%		
Northern Lakes and Forests (50)	20,314,842	54.4%	15,897,779	29.4%	11,308,863	31.5%
North Central Hardwood Forests (51)	1,129,356	3.0%	10,613,862	19.7%	10,237,360	28.5%
Driftless Area (52)			2,590,038	4.8%	6,920,576	19.3%
Southeastern Wisconsin Till Plains (53)					6,906,936	19.2%
Central Corn Belt Plains (54)					155,325	0.4%
Eastern Corn Belt Plains (55)	779,448	2.1%				
Southern Michigan/Northern Indiana Drift Plains (56)	10,225,738	27.4%				
Huron/Erie Lake Plains (57)	4,875,064	13.1%				
Total	**37,324,448**	**100%**	**54,006,823**	**100%**	**35,920,371**	**100%**

Source: U.S. Environmental Protection Agency 2013

The 12 Level III ecoregions (with identifying number) are described below.

Northern Glaciated Plains (46)

Two lobes of the Northern Glaciated Plains (46) cross Minnesota's western border with the Dakotas. This flat to gently rolling landscape of glacial till once supported tall grass and mixed grass prairie. The largely treeless landscape supports abundant seasonal pothole wetlands, which are subject to great variation in precipitation, including severe, prolonged drought.

Western Corn Belt Plains (47)

The southern portion of Minnesota is characterized as Western Corn Belt Plains (47). A tiny lobe enters Wisconsin from Minnesota at the middle of the state's western edge. This region of glaciated till plains possesses fertile soils that are extensively farmed.

Lake Agassiz Plain (48)

The northwest corner of Minnesota is classified as Lake Agassiz Plain (48) and was created by a series of glacial lakes existing in this area since the beginning of the Pleistocene. The rich soils once supported tall grass prairie. Today the area supports row-crop agriculture.

Northern Minnesota Wetlands (49)

The northern-central portion of Minnesota is characterized by the Northern Minnesota Wetlands (49), a vast, flat former glacial lakebed now occupied by marshes, bogs, and boreal forest.

Northern Lakes and Forests (50)

The Northern Lakes and Forests (50) consist of the entire Upper Peninsula and most of the northern third of the Lower Peninsula of Michigan, as well as northern Wisconsin and northeastern Minnesota. This ecoregion is characterized by nutrient-poor glacial soils that support conifer and hardwood forests on varied glacial topography. Agriculture is limited.

North Central Hardwood Forests (51)

In Michigan, the North Central Hardwood Forests is an area of wooded dunes and rich valley soils with a climate moderated by the Great Lakes. The topography is reflective of its recent glacial history and includes numerous lakes and wetlands. In Minnesota and Wisconsin, this ecoregion is part of the transition between the northern forests and the agricultural (once prairie and oak savanna) lands to the south. It encompasses the tension zone first described by Curtis (1959).

Driftless Area (52)

The southeast corner of Minnesota and western Wisconsin contains the Driftless Area (52), a loess-capped Paleozoic carbonaceous plateau deeply dissected by streams, with diverse agricultural operations in valleys and on flat ridgetops.

Southeastern Wisconsin Till Plains (53)

Southeastern Wisconsin Till Plains (53) are located in the southeastern area of Wisconsin. This ecoregion is a mosaic of vegetation types that are transitional between forest and savanna/prairie. Former prairie lands have been almost completely converted to forage crops.

Central Corn Belt (54)

A tiny lobe of the Central Corn Belt (54) reaches into extreme southeast Wisconsin. Once prairie and oak savanna, this ecoregion is today predominately agricultural.

Eastern Corn Belt (55)

A small lobe of the Eastern Corn Belt (55) extends into southeastern Michigan. The Eastern Corn Belt, once dominated by beech forests in presettlement times, today is predominately agricultural land growing corn and soybeans.

Southern Michigan/Northern Indiana Drift Plains (56)

Most of the southern two-thirds of the lower peninsula of Michigan are mapped as the Southern Michigan/Northern Indiana Drift Plains (56). This ecoregion constitutes a varied topography of landforms and soils, with agriculture occupying much of the area. Lakes, streams, and wetlands are abundant.

Huron/Erie Lake Plains (57)

The extensive lake plains associated with Michigan's "thumb" and extreme southeastern Michigan are designated as Huron/Erie Lake Plains (57). This ecoregion is a broad, fertile lake plain that has been cleared and drained and supports extensive agriculture.

3.2.3.2 Landcover

The ecoregions described above provide context for how ecological systems are grouped in the plan area. Landcover provides additional context on where landcover types in general, and forest types in particular, are distributed on the landscape, which has bearing on where covered bats are typically found. The Lake States HCP uses the NLCD to define and map landcover type (Homer et al. 2015). The NLCD has an accuracy rate of 83% to 89% (Wickham et al. 2017). As described in Section 3.2.1, *Methods and Data*, USFS FIA data were used to calculate acreages. However, USFS FIA data cannot be mapped. To provide visual maps, the NLCD was used and cross-walked to the USFS FIA forest types. As mentioned previously, forest type has meaning for bats, with some types providing high-quality habitat and other types providing lower-quality habitat. For example, studies completed in support of the Lake States HCP (Swingen et al. 2018) found that northern-long eared bats are more likely to roost in larger, deciduous trees located in upland areas and forests with greater tree cover. Additional species-specific habitat information can be found in Section 3.2.5, *Modeled Species Distribution*. Forests can be used as foraging and/or roosting habitat, but the quality of a forest as roosting habitat for the covered species is given more weight in our habitat-quality determination, based on the assumption that take is more likely to occur during roosting. Table 3-2 cross-walks the USFS FIA and NLCD datasets and provides bat habitat quality for each USFS FIA forest type. Collectively, this information forms the foundation of the impact analysis provided in Chapter 4, *Potential Effects of Covered Activities.*

Table 3-2. Crosswalk from NLCD Landcovers to USFS FIA and Acres of Landcover, Associated Bat Habitat Quality, and Typical Stand Age at Harvest

NLCD Landcover	USFS FIA Forest Type Group & Landcover Class	USFS FIA Code	USFS FIA Forest Type	Acres in Lake States (% of Lake State Acres)		Bat Habitat Quality [a]		Typical Stand Age At Harvest
						High	Low	(Years) [b]
Forest and Shrub/Scrub								
Shrub/Scrub	Nonstocked	Forest Type Group 999	NA	523,698	(0.42)		X	NA
Coniferous Forest	Red/Jack Pine	Forest Type Group 100	Jack Pine, Red Pine	3,572,734	(2.84)		X	50
	White Pine/Hemlock	Forest Type Group 100	Eastern White Pine, Eastern White Pine/Hemlock, Eastern Hemlock	1,340,157	(1.06)		X	80
	Spruce/Fir (upland & lowland)	Forest Type Group 120	Balsam fir, White Spruce, Black Spruce, Tamarack, Northern White Cedar	8,055,510	(6.40)		X	50
	Other Eastern Softwoods	Forest Type Group 170	Eastern Red Cedar (not lowland)	49,657	(0.04)		X	50
	Exotic Softwoods Group	Forest Type Group 180	Scotch Pine, Norway Spruce	250,457	(0.20)		X	50
Deciduous/ Mixed Forest	Oak/Pine	Forest Type Group 400	Eastern White Pine/Northern Red Oak/White Ash, Eastern Red Cedar/ Hardwood, Other Pine/Hardwood	1,437,695	(1.14)	X		80
	Oak/Hickory	Forest Type Group 500	White Oak/Red Oak/Hickory, White Oak, Northern Red Oak, Bur Oak, Scarlet Oak, Black Walnut, Elm/Ash/Black Locust, Red Maple/Oak	10,003,253	(7.95)	X		80

NLCD Landcover	USFS FIA Forest Type Group & Landcover Class	USFS FIA Code	USFS FIA Forest Type	Acres in Lake States (% of Lake State Acres)		Bat Habitat Quality [a]		Typical Stand Age At Harvest
						High	Low	(Years) [b]
	Maple/Beech/ Birch	Forest Type Group 800	Sugar Maple/Beech/Yellow Birch, Black Cherry, Hard Maple/ Basswood, Red Maple/Upland,	11,132,789	(8.84)	X		80
	Aspen/Birch	Forest Type Group 900	Aspen, Paper Birch, Balsam Poplar, Pin Cherry <9 in. dbh	5,362,908	(4.26)		X	25
			Aspen, Paper Birch, Balsam Poplar, Pin Cherry >9 in. dbh	6,969,267	(5.54)	X		50
	Other Hardwoods	Forest Type Group 960	Other Hardwoods	449,555	(0.36)	X		50
Deciduous/ Mixed Forest (continued)	Exotic Hardwoods group	Forest Type Group 990	Exotic Hardwoods	42,435	(0.03)		X	20
Woody Wetlands	Elm/Ash/ Cottonwood	Forest Type Group 700	Black Ash/American Elm/Red Maple, River Birch/ Sycamore, Red Maple/Lowland, Cottonwood/ Willow	5,563,585	(4.42)	X		80
Streams & Open Water								
Open Water	Water	NA	NA	5,542,206	(4.40)	NA	NA	NA
Open Land								
Barren Land	Barren	NA	NA	287,800	(0.23)	NA	NA	NA
Grassland/ Pasture/ Cultivated	Grassland	NA	NA	50,337,443	(39.99)	NA	NA	NA
	Mixed Vegetation	NA	NA			NA	NA	NA
	Agricultural Vegetation	NA	NA			NA	NA	NA
Emergent Herbaceous Wetlands	Non-Vascular Vegetation (in part)	NA	NA	5,260,778	(4.18)	NA	NA	NA
	Grassland (in part)	NA	NA			NA	NA	NA
Developed Urban/Suburban								
Low/Medium Intensity Development	Developed, Vegetated	NA	NA	9,279,661	(7.37)	NA	NA	NA

NLCD Landcover	USFS FIA Forest Type Group & Landcover Class	USFS FIA Code	USFS FIA Forest Type	Acres in Lake States (% of Lake State Acres)		Bat Habitat Quality [a]		Typical Stand Age At Harvest
						High	Low	(Years) [b]
High Intensity Development	Developed	NA	NA	412,306	(0.33)	NA	NA	NA

Notes:

[a] Bat habitat quality is only evaluated for forested landcover types because subsequent analyses are focused on impacts to and conservation of forest.

[b] The column Typical Stand Age at Harvest represents the stand age (in years) at which a given stand is typically harvested. For several forest types; however, harvest actually occurs within a range of years. The typical stand age at harvest is a simplifying assumption that allows the conversion of USFS FIA data (in volume) to acres for a given forest type. The typical stand age at harvest was arrived at in consultation with foresters from the State DNRs.

Source: Database Description and User Guide for Phase 2 (ver. 6.1.1) Appendix D (revision 09.2014) Forest Type Codes (U.S. Forest Service 2017)

As indicated in Table 3-2 and in the following sections, NLCD landcover types and USFS FIA forest types are categorized into high- and low-quality types for covered bats. This assessment is based on 1) expert opinion solicited from a team of bat biologists (consultants, academics, and DNR resource experts) on January 12, 2017, which is detailed in Appendix C, *Habitat Model Summary;* 2) studies completed in support of the Lake States HCP (Swingen et al. 2018); 3) reviewed literature; and 4) follow-up input from DNR bat biologists.

To summarize input from the expert panel, high-quality forest types for bats include stands with larger-diameter trees and trees with bark, cavities, and crevices that bats can use. This includes trees along larger edges, inclusions within larger stands of younger trees, and even isolated large trees within young stands. Specific trees species include aspen, maple, and oak/pine stands, Experts agreed that small-diameter aspen/birch and most conifer stands in the region provide limited roosting habitat for covered bats. Several experts also indicated that distance to hibernacula was an important consideration. One biologist estimated that covered bats are at least an order of magnitude less common in coniferous and other lower-quality habitat types than they are in high-quality forest types.

Based on these inputs and the inability to detect features, such as hollow trees from remotely sensed data, forest types were broken into areas of a high and low quality. High-quality habitats include most deciduous and mixed forest types. Low-quality habitat types are those dominated by coniferous trees, small-diameter aspen/birch stands, stands dominated by exotic species, and areas dominated by scrub/shrub. After the expert-solicitation process, protected species leads on the Lake States HCP steering committee questioned the inclusion of older-growth white pine communities. These communities are very rare, cannot easily be separated from other coniferous forest types using NLCD, and are mostly protected. Thus, they were not separated, but the State DNRs will continue to focus on restoration of this endangered habitat type with the expectation that such efforts will benefit bats.

Experts solicited as part of the science panel, as well as other bat biologists, concur that bats occur and use areas deemed low-quality habitat. Also, notably, mixed forest is considered high-quality habitat.

3.2.3.3 Forest and Shrub/Scrub

A large percent of the entire plan area (43.1%) is classified as forest and shrub/scrub. As noted in in Section 3.2.3.1, *Ecoregions*, most of this area is found in the northern portions of all three states and in the Driftless Area.

Shrub/Scrub

In shrub/scrub areas, 20% or more of the vegetative cover consists of shrubs and trees less than 5 meters tall. Woody species may include true shrubs (multiple stems and height under 5 meters), young trees, and trees stunted from environmental conditions such as nutrient-poor soils, bedrock, or saturated soils. This landcover class includes such areas as young regenerating aspen or abandoned agricultural land grown in with shrubs and small trees. It may also include areas of oak savanna in the south or oak barrens in the north, particularly those with recent disturbance (e.g., logging, fire, or storm damage). Shrub/scrub also includes natural shrub ecosystems, such as open bogs and shrub swamps. In the entire plan area, it accounts for 0.4% of the total acreage across the Lake States. Shrub/scrub is considered low-quality habitat for bats due to limited suitable roosts. Shrub/scrub may be used by foraging bats.

Coniferous Forest

Coniferous forests range in species composition from boreal assemblages in northeast Minnesota of white spruce, balsam fir, and white cedar, to forests with a mixture of pine species associated with sandy glacial soils. Despite extensive harvesting of coniferous forests since the late 1800s, such forests are still present in Northern and Central Wisconsin and the northern Lower Peninsula of Michigan. Before the large-scale pine logging at the end of the 19th century and beginning of the 20th century, the landscape percentages of coniferous forest were significantly larger. Naturally, existing examples of this landcover type are reliant on disturbances to persist on the landscape. Conversely, the category also includes pine plantations which are entirely anthropogenic in their origin and maintenance. This class accounts for 4.5% of the project acreage, or 6.9% of the acreage in Michigan, 5.3% in Wisconsin, and 2.4% in Minnesota (mainly in the northeast).

Forest types in this class include red/jack pine, white pine/hemlock, upland spruce/fir, lowland spruce-fir and other softwoods. Nearly all the spruce-fir forest in the plan area is in lowlands, containing various mixtures of white cedar, tamarack, spruce, and fir. Pine plantations in the Lake States are most typically composed of monotypic stands of red, Jack, and occasionally eastern white pines. Based on input from regional bat experts, coniferous forests are considered low-quality bat habitat—note that mixed conifer/deciduous stands are addressed below.

Deciduous/Mixed Forest

This class is found in the ecoregions of Northern Lakes and Forests, North Central Hardwood Forests, the Driftless Area, and portions of the Drift Plains in both Michigan and Wisconsin. Extensive blocks of this class are found in the northern portion of the plan area, corresponding to national forests and industrial forestlands. It varies in species composition throughout the plan area. In northern Michigan, for example, a deciduous/mixed forest might consist of maple-basswood-yellow birch with scattered hemlocks, spruce, and balsam fir. Areas in both the south and the north might consist of various oak species (*Quercus rubra, Q. velutina, Q. ellipsoidalis* in the red oak group; *Q. alba, Q. macrocarpa, Q. bicolor, Q. muhlenbergii* in the white oak group) with a pine component mixed in. At many locations in the southern plan area this forest does not have a conifer component, but other hardwoods uncommon in the north occur, including hickories and black walnut. This class accounts for 27.8% of the entire plan area with the highest percentage of the state's landcover in Michigan (35.2%) and Wisconsin (33.1%) and the lowest in Minnesota (19.3%).

Forest types within this class include oak/pine, oak/hickory, maple/beech/birch, aspen/birch, and other hardwoods. Based on input from the empaneled bat experts most deciduous/mixed forests are considered high-quality bat habitat. Small-diameter aspen/birch stands, and areas dominated by exotic hardwoods are considered low-quality habitat based on input from the expert panel and subsequent input from protected species biologists within the State DNRs. These characterizations are consistent with the results of studies completed in support of the Lake States HCP (Swingen et al. 2018; Wisconsin Department of Natural Resources 2017; Kaarakka 2018).

Woody Wetlands

Woody wetlands are areas where trees or shrubs account for more than 20% of the vegetative cover and the substrate is at least periodically saturated or inundated by water. They are found in many of the ecoregions of the plan area. They dominate the Northern Minnesota Wetlands ecoregion. In the north, alder, Michigan holly, viburnum, and dogwoods are likely to dominate the shrub layer, with black spruce, tamarack, and black ash among the major tree species. Farther south, there is a greater diversity of shrubs and trees. More southerly floodplains, for example, support forests of silver and red maples, elms, river birch, hackberry, and cottonwood, with an equally diverse shrub understory that often includes dense stands of buttonbush and other shrubs and vines, such as alder, willows, dogwood, river grape, Virginia creeper, and poison ivy. Michigan has the greatest percentage of state landcover in this class (11.9%), with Minnesota and Wisconsin possessing 10.2% and 8.6% respectively. This class accounts for about 10.3% of the entire plan area.

One forest type is within this class, elm/ash/cottonwood. Woody wetlands are considered high quality bat habitat, due to roosting opportunities presented by mature, dead, and dying large trees, as well as the foraging and gleaning opportunities presented by a complex and diverse forest structure, often in association with water.

3.2.3.4 Streams and Open Water

Over the entire plan area land base, 4.4% is classified as streams and open water. This percentage does not include the Great Lakes. In terms of bat habitat, these water features are important for the vegetative diversity they bring to the landscape and the foraging habitat for bats roosting nearby. They are often bordered by mature forests that have a higher proportion of snags than intensively managed upland forests, thus providing bat roosting habitat (Carter 2006).

Rivers and Streams

The streams and rivers of the plan area encompass a wide range of stream orders, with many first and second order streams being a legacy of the area's glacial history. Section 3.2.2.7, *Hydrology*, discusses rivers and streams and provides a map of the larger rivers (Figure 3-5). Stream miles for the states are 47,845 miles in Michigan, 60,100 miles in Minnesota, and 53,375 miles in Wisconsin.

Open Water

Areas of open water are defined as water having less than 25% coverage of vegetation or soil. Minnesota has the largest percentage (6.1%) followed by Wisconsin (3.5%) and Michigan (2.6%).

3.2.3.5 Open Land

Open land occupies 43.9% of the plan area, nearly the same percentage as forested lands. This is a composite category of barren land, grassland/pasture/cultivated, and open herbaceous wetlands. Although bats may use these cover types for foraging, they are unlikely to provide roosting habitat. Not surprisingly, Minnesota, with its western portion dominated by the Great Plains, has 53.9% of its surface covered by open land. Most of this is agricultural land. Wisconsin and Michigan, also both agricultural states, possess 41.2% and 32.1% of open land, respectively. Forested edges of open lands often provide high-quality foraging and commuting habitat for forest-roosting covered bats (Sheets et al. 2013a, 2013b). For purposes of the model, no bats are assumed to roost in these landcovers because roosts are very rare, and take is not expected to occur due to covered activities.

Barren Land

Within the plan area, barren land includes areas of sand dunes, bedrock escarpments, and pavements, as well as areas affected by past and present mining and quarrying. Vegetation accounts for less than 15% of the total cover in this category. Within the plan area, some areas of barren land correspond to the same metallic mining and karst areas described above, with a potential for bat hibernacula. With the exception of some large mining operations in northern Minnesota and Michigan, barren land rarely occurs over extensive areas. The plan area as a whole is 0.5% covered by this landcover class.

Grassland/Pasture/Cultivated

This composite classification lumps together open, upland vegetated lands regardless of the type of vegetation. It represents 39.6% of the total plan area, typical for states that are so heavily agricultural. Minnesota has the highest percentage at 47.2% and Michigan the lowest at 29.8%. Wisconsin weighs in at 38.2%. Native grasslands (restored or remnants) are only a tiny fragment of this total acreage. Agricultural lands range from pasture and hay lands to crop lands growing mainly corn and soybeans on a large scale, as well as other crops (vegetables, fruit) in smaller patches of land.

Emergent Herbaceous Wetlands

Open herbaceous wetlands are areas permanently or periodically saturated or inundated with water, and where perennial herbaceous vegetation accounts for more than 80% of the vegetative cover. These may be emergent or wet meadow wetlands. Native species may include native wetland grasses and forbs, native cattails, rushes, and sedges. Some wetlands in this category are dominated by alien invasive species such as narrow-leaved cattail, hybrid cattail, reed canary grass, or the invasive form of giant reed, particularly along the Lake Michigan shoreline. This class accounts for 4.1% of the total plan area with Minnesota possessing the highest percentage (6.5%) and Michigan the lowest (1.8%). Wisconsin herbaceous wetlands account for 3.0% of the state. Emergent herbaceous wetlands have been reduced through conversion to agriculture) in the southern portions of the plan area and in western Minnesota by 80% to 90% over the past 150 years.

3.2.3.6 Developed Urban/Suburban

In the plan area, 7.6% of the landscape is classified as developed/urban. These are lands where a human-constructed footprint dominates to varying degrees. The most highly developed areas in city and town centers provide limited habitat for bat species. Low to medium development may provide some habitat depending on the landscape context, style of development, and inclusion of green space. Developed open space presents the greatest opportunities for bats among these developed landcover types. Trees or anthropogenic features (bridges, buildings, etc.) contained within these landcovers can provide roosting habitat for covered bats, especially little brown bats (Whitaker et al. 2004; Helms 2010; Kaarakka 2018). Based on input from bat experts, 50% of little brown bats are assumed to roost in these features and in other nonforested landcover. Although some Indiana, tricolored, and northern long-eared bats may roost in developed lands, the distribution model assumes all other covered bats roost in forest and are exposed to take during forest management activities.

Low/Medium Intensity Development

Low to medium intensity development areas typically contain a greater mixture of constructed materials and vegetation with single-family housing being the main form of development. Impervious surfaces account for 20% to 49% of low intensity development areas and 50% to 79% of medium development areas. Such areas account for 7.3% of the entire plan area. Michigan's area contains 10.0% of this class, with Wisconsin and Minnesota following at 7.2% and 5.5% respectively.

High Intensity Development

High intensity development areas are those where large populations reside. These are the largest urban areas where only limited and fragmented natural habitat remains. Impervious surfaces (buildings and pavement) account for 80% to 100% of the total cover. High-intensity development also occurs in small patches within suburban and rural landscapes. This class accounts for 0.3% of the plan area, with Michigan having the highest percentage at 0.6%.

3.2.4 Forest Trends

Forest conditions in the plan area have always changed with varying climate and disturbance regimes, but significant changes in the last 200 years occurred over a shorter period than in the preceding centuries (Cole et al. 1998). Change continues, but the outcomes may be unpredictable due to interacting environmental factors, such as climate, and legacies in the soil and vegetation (e.g., Johnstone et al. 2016).

Several studies compared presettlement vegetation (ascertained from land survey records of the early to mid-1800s) to the modern forest cover and composition (Frelich and Lorimer 1991; Frelich 1995; Snetsinger and Ventura 2000). Although pre-1800 vegetation was managed to varying degrees by indigenous people for game and food crops, most notably with fire, it was not until European settlement in the early to mid-1800s that forest modification began in earnest. An era of cropland grubbing, clear-cutting, and uncontrolled wildfire, extending into the early 20th century, dramatically altered forest cover and composition across the Lake States. With agricultural clearing, primarily in southern Michigan and Wisconsin and in eastern Minnesota, the forested area declined by over 40%. Today on average, 41% (± 19%) of the ecoregions in the northern plan area is nonforested, compared to 12% (± 9%) before European settlement (Schulte et al. 2007). Beginning in the mid-20th century, however, forest cover across the plan area began increasing due to farmland abandonment, forest succession on hay meadows and pastures, and fire suppression. (Basic forest types classified by landcover are summarized in Section 3.2.3, *Ecosystems and Vegetation Types*.) Maps of presettlement and modern forests nevertheless show a dramatic change in forest extent, type, and patch size (Michigan Department of Natural Resources and Environment 1995; Rhemtulla et al. 2009; Minnesota Department of Natural Resources 1994) (Figures 3-7 and 3-8).

Unsustainable harvest practices prior to the establishment of professional forestry practices in the region also locally removed tree seed sources, especially conifers such as hemlock, red and white pine, and white cedar (Stearns and Likens 2002). Disease has altered and continues to simplify forest composition. Dutch elm disease removed American elm from forests in the second half of the 20th century. Presently, forest managers face the specter of multiple species of ash being affected by the emerald ash borer. Herbivory by high white-tailed deer populations favors species such as red maple, which are less palatable to or more tolerant of browsing, resulting in decreases in less tolerant or palatable species (Palik and Pregitzer 1992). Age structure has likewise been simplified both on the landscape as well as at the stand level.

On the other hand, recent forest growth trends suggest that forestland acreage and the size and age of trees on average are gradually and slowly increasing, with deciduous trees other than aspen and birch contributing the most to those trends (Miles and VanderSchaff 2015; Perry 2015; Pugh 2015). Snag abundance, which contributes to the quality of bat habitat, has been noted to peak when a Great Lakes forest stand is in the 90- to 150-year range. Thus, with a shift toward younger forests in the earlier historical period, a decline in snag abundance likely occurred. More recent trends, however, suggest snag abundance is increasing due to the growing number of older trees. At the same time, the more simplified, fragmented forests of the present, in comparison to forests of 150 years ago and before, are expected to exhibit less resilience in the face of climate change and greater vulnerability to disease and pests, leading arguably to the acceleration of change and simplification unless countermeasures, such as active forest management, are implemented (Kling et al. 2003).

To summarize, the forests of the plan area were drastically altered beginning in the early 1800s, but recovery of some characteristics, such as structure, of the pre-1800 forest ecosystem has occurred since. Currently, lake states forests "are marked by lower species diversity, functional diversity, and structural complexity compared to pre-Euro-American forests" (Schulte et al. 2007). These changes continued until the recent past, perhaps accelerated by changes in ownership and management, disease and pests, climate change, and legacies inherited from the past 200 years of land use (Schulte et al. 2007).

Given the anticipated regional changes in temperature and precipitation patterns, further forest parcelization and land use changes, and management which fails to prevent forest species simplification, it is unlikely that the composition, structure, and distribution of forests in the plan area will return to the landscape and stand level diversity of the early 1800s or even perhaps remain as they are today. For example, Frelich and Reich (2009) describe multiple factors acting on the forest ecosystems of northern Minnesota, which are anticipated to interact with climate change, potentially reducing or even eliminating over a dozen species of trees in the northern half of the plan area, and even diminishing the density of forest canopies by the late 21st century. Moreover, they predict a potential northeastward shift in the boundary between southern and northern forest types of up to several hundred kilometers by the end of the 21st century. In modeled simulations of forest composition with climate change in Minnesota and Michigan, Duveneck et al. (2014) learned that more diverse tree composition in forest stands in the northern plan area may increase the resistance and resilience of forests in the face of climate change.

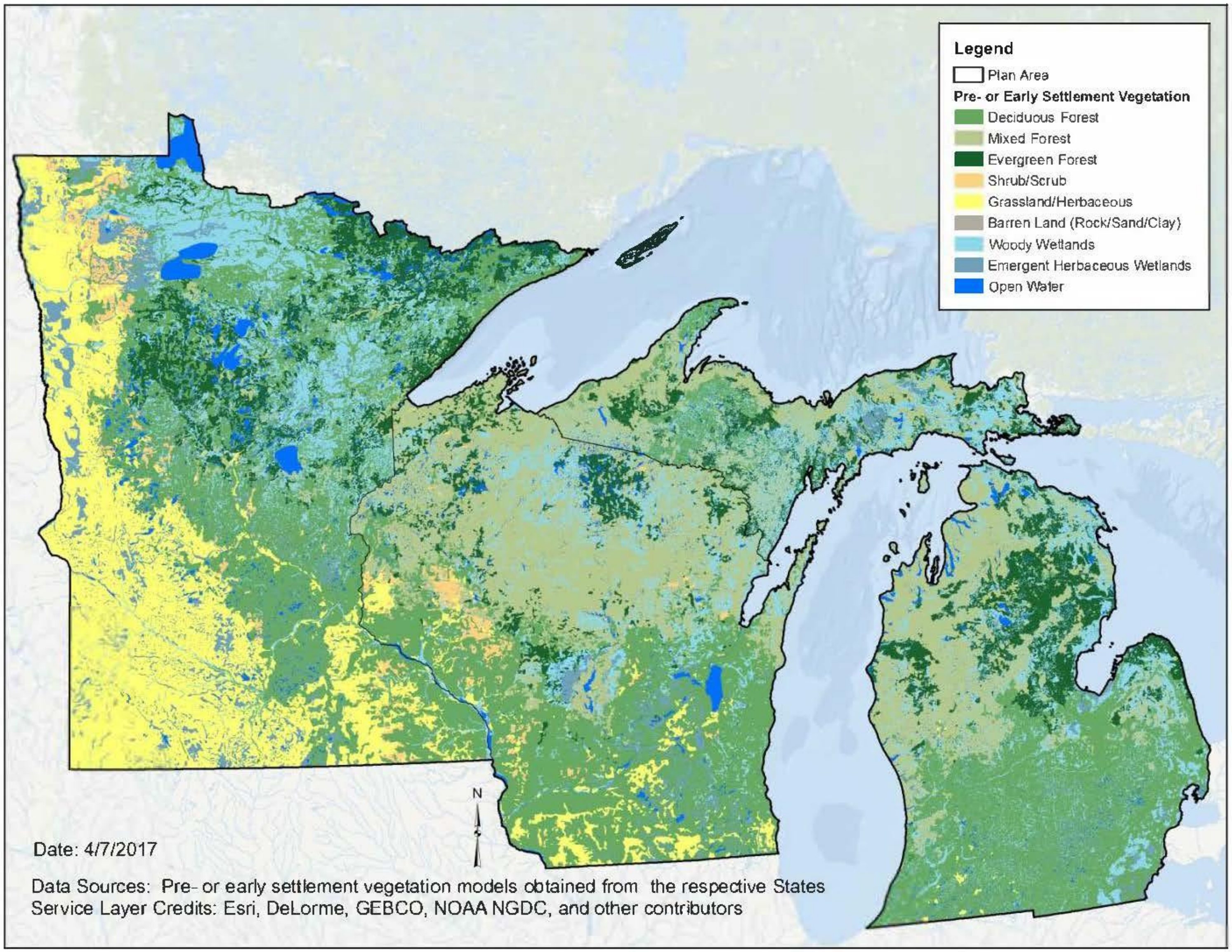

Figure 3-7. Pre- or Early-Settlement Vegetation Types in the Plan Area

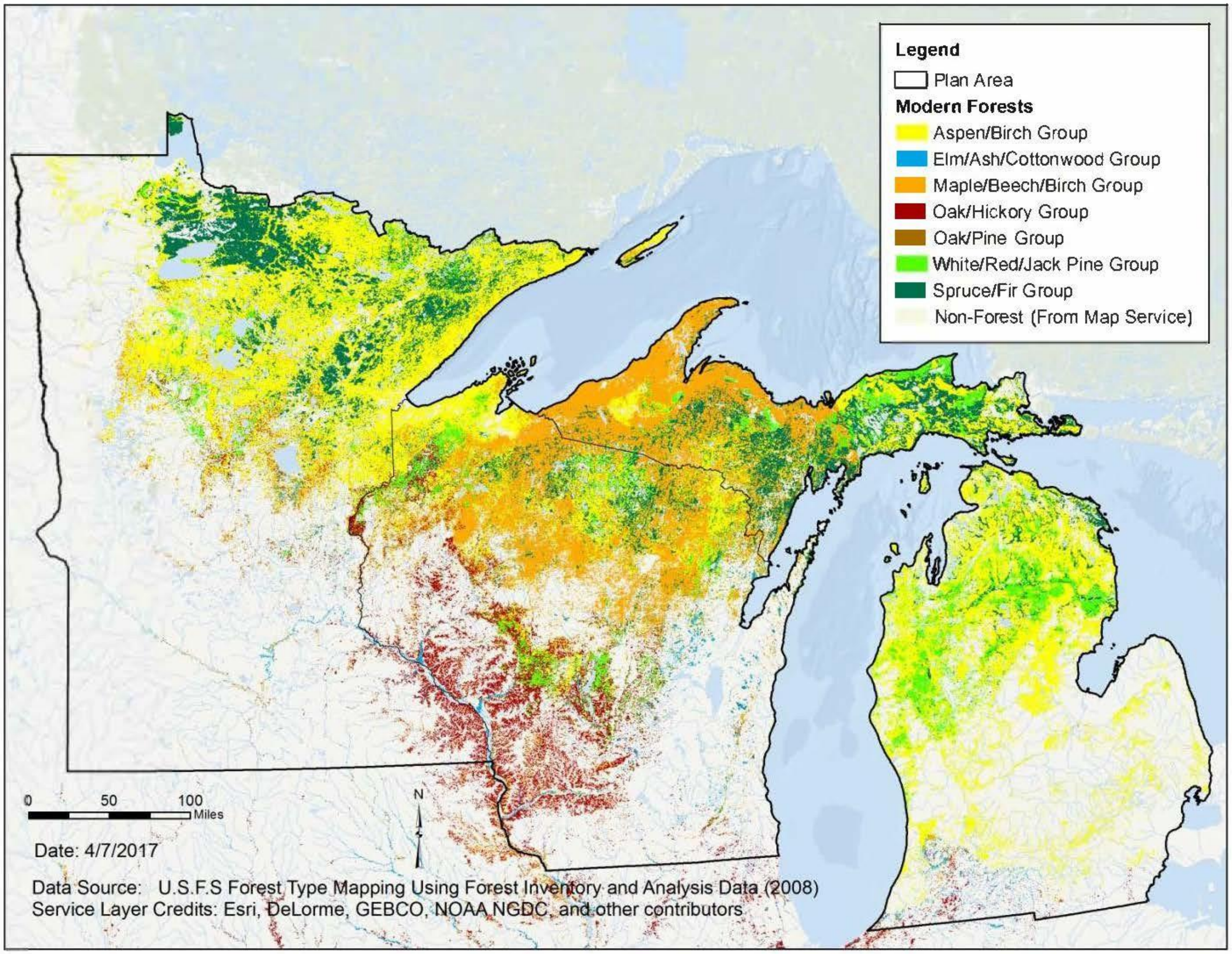

Figure 3-8. Modern Forest Types in the Plan Area

The legacy conditions of forests in the Lake States, however, combined with climate change and disturbances, make it difficult to reliably predict the future composition and structure of the plan area's forests (Johnstone et al. 2016). The dilemma foresters find themselves in is to manage for multiple forest benefits in the face of unknown future influences, while responding with appropriate forest management practices to reduce undesirable outcomes, such declines in tree species diversity and forest productivity.

3.2.5 Modeled Species Distribution

3.2.5.1 Overview

The Lake States HCP covers four species of small bats (5 to 11 grams) that exclusively feed on insects. The life histories of these species can be identified in four components (Table 3-3), which are broadly similar among the four species (hibernation in winter, fall/spring migration between winter and summer habitats, reproduction in summer, and staging/swarming at the hibernacula). Prior to settlement, all four covered species relied on caves for hibernation and spent most of the summer roosting in trees. As such, each of these species migrates between winter and summer habitats and may occur in a wide variety of habitats at that time. All four species also engage in behaviors known as autumn swarming, when large numbers of bats fly in, out, and around the entrances of potential hibernacula. Upon exiting a hibernaculum in the spring, some bats mass near the hibernaculum as they recover from hibernation and prepare for migration—a behavior known as spring staging. Swarming and staging are associated with mating and feeding to prepare for and recover from the rigors of hibernation. A summary of seasonal modeled distribution for covered bats is provided in Table 3-3, and a detailed account of all species is found in their respective sections (Sections 3.2.5.2, *Indiana Bat*, 3.2.5.3, *Northern Long-Eared Bat*, 3.2.5.4, *Little Brown Bat*, and 3.2.5.5, *Tricolored Bat*).

Table 3-3. Covered Bat Modeled Distribution by Season

Season	Dates	Modeled Distribution	Rationale
Winter (Hibernation)	October 16 through April 14	Bats are restricted to within 0.25 mile of entrances to hibernacula.	• The 0.25-mile buffer eliminates or reduces disturbance associated with vibration and noise. • The 0.25-mile buffer addresses the reality that locations of hibernacula entrances are often poorly mapped. • The season, dates, and modeled distribution are consistent with FWS guidance on hibernacula entrance buffers (e.g., northern long-eared bat 4(d) rule.)
Fall/Spring	April 15 through May 14 and	Modeled bat distributions are centered near entrances to hibernacula with bats occurring within the following: • 5 miles for most hibernacula (up to 10,000 bats) or	• Bats concentrate near hibernacula entrances in fall/spring for swarming and staging. • Distances determined in conversations with USFWS based

Season	Dates	Modeled Distribution	Rationale
	August 16 through October 15	• 10 miles for very large hibernacula (could include >10,000 bats, pre-WNS). • Bats presumed to be ten times more likely to occur in high-quality fall/spring habitat than low quality. [a]	on experience with the wind industry and on published data.
Summer	May 15 through August 15	• Bats are distributed in forested habitat throughout the Lake States. • Bats are more likely to be found in forest types that have larger trees and so more potential roosts. Forests communities that have higher potential to be used by roosting bats identified in Table 3-2. • Bats are 10-times as common in high-quality bat habitat than in low quality habitat. [a]	• Bats are widely dispersed on the landscape during summer. • Bats are most dense in forest types identified as being high quality bat habitat in Table 3-2.
Nonvolant Pups	June 1 through July 31	See Summer, above	Nonvolant juveniles are present in maternity roosts—we assume a doubling of the female population. [a]

Notes:
[a] Based on solicited expert opinion.
WNS = white-nose syndrome

All covered species make extensive use of forest for roosting and foraging; however, the intensity of use varies among forest types (Table 3-2). Furthermore, bats use forests in different ways at different times of year. To understand the distribution of bats across the landscape at different times of year, forest type and associated habitat quality from Table 3-2 are intersected with seasonal distribution from Table 3-3 (Figure 3-9) to provide a modeled distribution and density matrix for each species. This process is repeated for each of the four covered species for the four seasonal components of the annual life cycle.

The following is a discussion of how each of the seasons affects estimates of bat modeled distribution. For ease of calculation, seasonality is assigned to distinct time periods so that all bats are assumed to enter, exit, and occupy particular seasonal habitats on specific dates recommended by resource experts within the State DNRs. Bats do not follow an exact schedule, but rather move in and out of seasonal habitat in response to a variety of stimuli including physical condition, and current weather conditions. Selecting specific (typical) dates allows simplification of a complex impact assessment that attempts to understand general patterns of bat occurrence and density across a three-state geographic area.

As noted in Appendix C, Section C.4, *Expert Process,* a group of bat experts were assembled to provide input on key assumptions including seasonality. Following the meetings, bat experts provided additional input on seasonality, habitat quality, and on the range and populations of covered bats. Dates and distributions were derived based on the literature (Whitaker and Rissler

1992; Veilleux and Veilleux 2004; U.S. Fish and Wildlife Service 2007, 2014, 2020; Kurta 2008; Whitaker and Sparks 2008; Helms 2010), survey experience of the consulting team, and DNR wildlife biologists and were vetted with a team of bat experts assembled January 12, 2017, and associated follow-up discussions.

Figure 3-9. Flowchart Illustrating Method for Modeling Seasonal Bat Distribution by Habitat

Also contained in Appendix C, Section C.6.5, *Calculating Bat Densities*, is a description of how species and seasonal bat densities were derived from population estimates (Section C.6). These estimates effectively create a patchwork of densities based on geographic location and habitat quality. These models capture the reality that high-quality habitat near a major hibernaculum hold more bats than an isolated area of low-quality habitat. Thus, the models break the region into areas that are assumed to contain the same density of bats as other areas of similar habitat and location. This is a realistic approach to estimating impacts at a landscape scale when the location of bat colonies, location of harvest activities, and timing of activities are imprecisely known. Such an “even-density” approach is not appropriate when examining very small spatial and temporal scales where the coloniality of bats or site-specific habitat information is available.

Ares of Winter Use

All four covered species make use of caves, mines, and similar sites for hibernation during winter. During these periods, the bats are sensitive to a variety of disturbances. In the Lake States, mining has created many hibernacula in areas where few previously occurred. Details on how winter use habitat was modeled for each species can be found in their respective sections.

Areas of Fall/Spring Use

All four species spend part of the active (nonhibernation) fall and spring season massed near hibernacula entrances. During this time, they fly in and out of the entrance of the hibernacula and may roost in trees near the entrance—a behavior that puts them at risk of being affected by forestry operations. During fall, this behavior is termed swarming and is thought to be driven primarily by mating, but also includes a component of bats preparing for hibernation. Fall swarms can be highly intense activities. Prior to the arrival of WNS, it was not unusual to observe hundreds or thousands of bats of multiple species engaged in this activity from September through October.

Spring staging is less intense as bats begin to forage and prepare for migration, although some mating also occurs at this time.

During most of the swarming and staging periods these bats stay within five miles of hibernacula entrances. At large hibernacula (i.e., those containing more than 10,000 bats); however, bats may use larger areas. Details on how fall/spring habitat was estimated can be found in the species-specific sections that follow. Forest types that have an abundance of potential roosts are identified as high-quality habitat, whereas forest types with few such roosting opportunities are deemed low-quality habitat (Table 3-2). Based on input from regional bat experts, bats are assumed to be ten times as abundant in forest types considered having high suitability. Although bats may use areas without forest cover (Open Water, Cultivated Crops, Developed High Intensity, and Developed Medium Intensity), these are not considered habitat in our analysis due to our focus on forest habitat and forest management. This decision mathematically results in some bats that roost in these habitats being mathematically placed in forested habitat.

Migratory Areas

Before swarming and after staging, bats migrate from and to their summer ranges. Little is known about any distinctive behaviors at this time, although it is currently a topic of intense interest to biologists as this is the time when bats are most at risk of colliding with wind turbines. Migration habitat is not specifically modeled or addressed by the Lake States HCP. Further, it is notable that migration occurs within the summer range, which is considered occupied through August 15, a time that most bats have begun to arrive at the swarming range. As such, although migration habitat is not modeled separately, it is included in other habitat types.

Areas of Summer Use

In summer, bats spread out from hibernacula and can be found throughout the Lake States. All four species roost in trees and manmade structures. Use of human-made structures varies among the four species. Little brown bats make extensive use of such habitats, whereas Indiana bats (*Myotis sodalis*) only rarely do so; northern long-eared and tricolored bats are intermediate in their use of such structures. In forested areas, Indiana, northern long-eared, and little brown bats make extensive use of dead, dying, or damaged trees by roosting under exfoliating bark and in cavities and crevices, which are most likely to occur in larger, older trees. Tricolored bats roost primarily in clusters of dead and live leaves, but preferentially select larger trees. Forest types that have an abundance of such potential roosts are thus identified as high-quality habitat, whereas forest types with few such roosting opportunities are deemed low-quality habitat (Table 3-2). Based on input from regional bat experts, bats are assumed to be ten times as abundant in forest types considered having high suitability.

The presence of hibernacula can have a dramatic effect on the abundance of these species in spring and fall and, for some species, in the summer as well, although this pattern is not as strong in Wisconsin as for Michigan and Minnesota. A description of how summer modeled distribution was estimated can be found in each of the species–specific sections that follow.

3.2.5.2 Indiana Bat

Species Description

The Indiana bat is distinguished from the little brown bat and northern long-eared bat by differences in morphology of the feet and ankles. Indiana bats have a distinctly keeled calcar (cartilage that extends from the ankle to support the tail membrane), smaller feet, and relatively sparse and short hairs on the toe. The fur is dull and dark, but upon close inspection weakly tricolored.

The species was amongst the first species to be listed as endangered under a precursor of the modern Endangered Species Act (ESA). It is also listed as endangered under the Michigan endangered species statute; it is not known to occur in Minnesota or Wisconsin.

Habitat Preferences

Although broadly distributed in forested habitats throughout the eastern United States, the Indiana bat is rarely encountered in the Lake States (Figure 3-10).[1] The species has not been recorded in Wisconsin for over half a century (Ainslie 1983), and no records exist for Minnesota. In Michigan, the species occupies the southernmost three tiers of counties in the Lower Peninsula during summer and hibernates at Tippy Dam in Manistee County. Most summer residents in Michigan migrate into the karst regions of Indiana, Ohio, and Kentucky during winter.

Summer colonies of Indiana bats in Michigan begin forming in late April or early May and the bats leave again by late September or early October. Most (about 89%) of the adult Indiana bats in Michigan are reproductive females (Kurta and Rice 2002) who typically form maternity colonies of 15 to 30 adults. These colonies focus their roosting and foraging behaviors on forested wetlands. Every colony uses multiple trees during the summer, with individual bats moving amongst trees every 1 to 3 days. Trees that are used by most of the bats on most of the days are termed primary roosts. They tend to be very large snags with exfoliating bark or vertical cracks and substantial solar exposure. Roosts used by smaller numbers of bats are termed alternate roosts, and often are smaller, have lower solar exposure, and may include live trees. Most roost trees in Michigan are wetland-adapted species and include elms, maples, and ashes, although other trees are used if they have the appropriate structure.

Foraging Indiana bats focus on patches of forest especially those that are connected to each other by fencerows and forested streams (Murray and Kurta 2004). In other states, forest edge and open habitats are also regularly used (Sparks et al. 2004).

The only known active hibernaculum of Indiana bats in the Lake States is Tippy Dam, which has previously housed approximately 20 Indiana bats (U.S. Fish and Wildlife Service 2015). A male tagged during Kurta's 1995 study of bats swarming at the site roosted in forested wetlands within 2.5 miles of the spillway where the bats hibernate.

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[1] Range maps are not meant to be static nor all-inclusive of all possible areas that may be used by Indiana bats. The Modeled Summer Habitat (pink shading) used to estimate the amount of take is designed to identify those areas where Indiana bats are most likely to occur based on the best available data. For consultation purposes, USFWS considers Indiana bats potentially present in the outlined counties (USFWS Summer Consultation Areas). Currently, Indiana bats may occasionally be found outside either or both areas and be exposed to a very low risk of take. As described in the adaptive management section, habitat models will be revised over time to include new data and conservation measures for Indiana bats are applied any time a new colony is discovered.

Note: As described in Section 3.2.5.2 the modeled habitat for the Lake States HCP includes only portions of the Indiana bat's range where take is reasonably likely to occur from covered activities.

Figure 3-10. Modeled Indiana Bat Distribution in the Plan Area

Modeled Distribution and Population Estimates

The modeled distribution description that follows is made for pre-WNS populations of the species. We assume for the purposes of the Lake States HCP that the distribution has remained unchanged, even though the species have become less dense on the landscape. For Indiana bats this is based on data for the Midwest Recovery Unit (U.S. Fish and Wildlife Service 2019) and reflects our best understanding of the population remaining after WNS affected the species.

The only known active hibernaculum for the Indiana bat in the plan area is the spillway of Tippy Dam. A historical record of a hibernating Indiana bat is known from Wisconsin, but this appears to have been a transient individual. Approximately 20 bats hibernated in Tippy Dam prior to the arrival of WNS.

Winter habitat for this species is modeled as occurring within a 0.25-mile radius around Tippy Dam. Kurta and Smith (2017) noted that Indiana bats still occur in Tippy Dam and that populations of all bats at that site remain high. As such, the winter population is still best estimated at 20 individuals (U.S. Fish and Wildlife Service 2019).

Fall/Spring

While some bats may range 20 miles or more from the entrance of the hibernaculum (Environmental Solutions & Innovations 2005; Chenger 2007), swarming activity is typically restricted to an area within 5 miles of the entrance (Gumbert et al. 2002; Rommé et al. 2002; Chenger 2007). The only Indiana bat tagged in the Lake States during swarming was an adult male at Tippy Dam, which roosted approximately 2.5 miles from the hibernaculum.

Fall/spring habitat for this species was modeled as 5 miles from Tippy Dam. The quality of forest habitat within 5 miles of Tippy Dam was assigned to high- or low-quality categories based on forest type as described in Table 3-2. Based on input from regional bat experts, bats are assumed to be 10 times as abundant in forest types considered having high suitability, which are most forests except those dominated by conifers, small-diameter aspen/birch, or invasive trees.

Migration

Details about migration in this species are limited to band returns and mortality of bats at wind energy sites. As such, migration habitat is assumed to occur anywhere between summer and winter habitat. Most Indiana bats that summer in Michigan are summer migrants from hibernacula in Indiana, Kentucky, Ohio, and Illinois. Thus, migration in the Lake States occurs within the area identified as the summer range (described below) and along the shore of Lake Michigan, which connects the summer range to Tippy Dam.

Summer

As described in detail below, the number and modeled distribution of Indiana bats in Michigan varies depending on the season. Approximately 20 Indiana bats hibernate in Tippy Dam (U.S. Fish and Wildlife Service 2019), and this number has been consistent since at least 2011. In summer, these 20 bats are joined by bats that migrate into the state from Ohio, Kentucky, and Indiana and possibly other states as well. The exact number of Indiana bats that summer in Michigan is unknown but can be estimated based on the number of colonies and the number of bats per colony. Prior to WNS, the USFWS had information indicating the presence of 12 maternity colonies of Indiana bats (U.S. Fish and Wildlife Service 2007). Kurta (2008) suggested typical colony size in Michigan is 30 bats but also noted that approximately 11% of Indiana bats captured in Michigan are adult males. Based on 12 colonies with an estimated 30 bats, there are approximately 360 adult females in Michigan during the summer. These females give birth to a maximum of one pup each summer (i.e., 360 pups). If 11% of the adults in the state are males, then there are also approximately 40 adult males that summer in the state providing an estimate of 400 adult and 360 juveniles in the state pre-WNS.[2] Since the arrival of WNS in the Lake States, the population of Indiana bats in the Midwest Recovery Unit has declined by approximately 20.4% (U.S. Fish and Wildlife Service 2019). Thus, the summer population in 2020 was estimated to contain 32 adult males and 287 adult females who gave birth to 287 juvenile bats.

In the summer, Indiana bats roost almost exclusively in forested areas, although scattered trees in other landcover types may be used for foraging and other behaviors. The species makes extensive use of larger, dead, and dying trees. Accordingly, high- and low-quality forested habitat for the species is assigned in Table 3-2.

As outlined in Figure 3-10, USFWS considers Indiana bats to potentially be present throughout a large portion of the Lower Peninsula in summer. However, this area of possible occupancy is based in large part on climatic data, the presence of the Tippy Dam hibernacula, and occasional acoustic detections. Based on the expert elicitation process, the Lake States HCP only calculates take based part of this area as described below.

Indiana bats in the summer are assumed restricted to portions of the Lower Peninsula of Michigan within the average migratory distance (429 kilometers or 266 miles) of hibernacula in Kentucky, Ohio, and Indiana (Rockey et al. 2013). The summer range, illustrated in Figure 3-10 was modeled by buffering Priority 1 and 2 hibernacula (those with a history of containing more than 1,000 Indiana bats) in Indiana, Ohio, and Kentucky, with the maximum reported migration distance for the species. Modeled summer habitat covers the majority of counties considered part of USFWS modeled summer consultation areas (36 out of 40 counties) including portions of Allegan, Barry, Bay, Berrien, Branch, Calhoun, Cass, Clinton, Eaton, Genesee, Gratiot, Hillsdale, Ingham, Ionia, Jackson, Kalamazoo, Kent, Lapeer, Lenawee, Livingston, Macomb, Monroe, Montcalm, Muskegon, Oakland, Oceana, Ottawa, Saginaw, Sanilac, Shiawassee, St. Clair, St. Joseph, Tuscola, Van Buren, Washtenaw, and Wayne counties. Modeled summer habitat does not overlap with USFWS summer consultation areas in Benzie, Leelanau, Manistee, or Mason counties. The Lake States HCP model was developed with the purpose of estimating take that is likely or reasonably foreseeable to occur. Thus, it does not correspond precisely to the USFWS consultation map for Indiana bat in Michigan. While there are potential impacts outside of the Lake States HCP model, based on the current understanding of Indiana bat distribution, these impacts are extremely unlikely. Should any maternity roost trees be identified in areas outside of the modeled summer habitat for Indiana bat, a process for modifying mapped habitat is identified in Chapter 5, Section 5.5.3.1, *Discovery of Occupied Maternity Roost Tree*.

[2] Approximately 20 Indiana bats hibernate in Tippy Dam in Manistee County, Michigan. The summer range of bats from this hibernaculum is unknown, but, according to band returns (Kurta et al. 1993, 1996, 1997; Foster and Kurta 1999; Kurta and Murray 2002; Kurta and Rice 2002; Winhold 2007; Kurta 2008, 2010; Rockey et al. 2013; Kurta and Smith 2014; Auteri and Kurta 2015), they most likely migrate south along the shore of Lake Michigan, where they mingle with other bats migrating northward from hibernacula in Ohio, Kentucky, Indiana, Illinois, and possibly other states. Band returns (Foster and Kurta 1999; Winhold and Kurta 2006; Rockey et al. 2013; Auteri and Kurta 2015) have helped establish both the hibernacula used by Indiana bats that summer in Michigan and the maximum flight range of these bats.

This different approach is appropriate because the consultation map used by USFWS is intended to capture all areas where Indiana bats may occur. Conversely, the goal of the distribution map used in the Lake States HCP is to estimate the area for which forestry impacts are reasonably certain to result in take. As outlined in Chapter 5, Section 5.2.2.1, *Biological Goal 2: Protect and enhance roosting and foraging habitat for bats*, additional protective measures are applied within 2.5 miles of all known Indiana bat capture and roost sites. Further, as also outlined in Chapter 5, Section 5.4.4.1, *Beneficial Effects*, the 2.5-mile buffers around Indiana bat known occupied maternity roost trees will be implemented if Indiana bats are captured or detected within or outside the area of modeled habitat used in the Lake States HCP (i.e., within the entire HCP plan area).

3.2.5.3 Northern Long-Eared Bat

Species Description

Northern long-eared bats closely resemble Indiana and little brown bats. The most obvious difference is the much larger ears that, when laid flat, extend well beyond the tip of the nose. The tragus, a small projection of the ear, is also much longer and more pointed than in the other two species. The feet are moderately sized with a few scattered hairs, and the calcar can be lightly keeled. Before the arrival of WNS, the species was widely distributed in the Lake States. In response to population declines caused by WNS, the northern long-eared bat is now listed as a species of special concern in Michigan and Minnesota and as threatened in Wisconsin. The species was listed as threatened under ESA on April 15, 2015, and proposed for listing as endangered in March 2022, and a final listing determination in November 2022 reclassified the species to endangered, effective January 30, 2023.

Habitat Preferences

Northern long-eared bats occur throughout the Lake States. The species is presumed to be evenly distributed across the forested landscape although it may be more abundant in areas of higher-quality forest, especially when those habitats occur near suitable hibernacula known to include caves, mines, the spillway at Tippy Dam, and potentially a variety of rock crevices.

Available data indicate that northern long-eared bats begin to form summer colonies with large numbers grouped together in May and early June before the birth of a single pup per female in late June or early July. This species uses a much wider variety of trees and conditions of trees as roosts during summer compared to Indiana bats and a wide variety of woodlands. The species readily makes use of smaller trees (3 inches dbh or smaller), live trees, roosts with low solar exposure, and hollows within trees. However, within this pattern, large trees (especially snags and hollow trees) are used preferentially (Swingen et al. 2018). In more southern portions of the Lake States, there is an apparent preference for ashes, maples, oaks, and elms, but species such as quaking aspen (*Populus tremuloides*) are important in more northern areas (Catton 2014; Swingen et al. 2016). The species makes use of bat boxes when available (Whitaker et al. 2006) and other artificial roosts such as bridges and culverts. Like Indiana bats, northern long-eared bats move between roosts every few days.

Unlike most other bats in the region, northern long-eared bats readily forage in interior forests with much vegetation. Forest management practices in the partial harvest group (commercial thinning, the regeneration harvest of shelter woods, and single-tree selection) were found to create preferred foraging and roosting habitat for this species (Pauli 2014; Silvis et al. 2016) indicating the species can benefit from low-intensity disturbance.

Like the other species covered by the Lake States HCP, northern long-eared bats begin returning to staging areas around caves and mines to hibernate in late August and early September. In caves and mines, individual bats are often found hidden within cracks and crevices, making them very difficult to locate. Several closely related species in the western United States, including the Western long-eared bat (*Myotis evotis*) and Keen's bat (*Myotis keenii*), use rocky outcrops and slopes covered with loose rock (talus) as roosts at multiple times of the year (Boland et al. 2009; O'Shea et al. 2011; Snider et al. 2013). Northern long-eared bats also make use of such sites when caves and mines are rare (Lemen et al. 2016). As such, the northern long-eared bat may also hibernate in such sites. Two of the known hibernacula (Gnomen, and Hole-in the-Head) are caves associated with the rocky shorelines of Lake Superior in Minnesota, and it is likely that many other northern long-eared bats hibernate in this area as well.

Modeled Distribution and Population Estimates

The modeled distribution description that follows is made for pre-WNS populations of the species. The population estimates have been updated with post-WNS numbers current as of 2019.

Winter

Northern long-eared bats are known or thought to hibernate in at least 158 sites historically throughout the Lake States, including 77 sites in Michigan, 60 sites in Wisconsin, and 21 sites in Minnesota. Potential hibernacula in this list include rocky cliffs along Minnesota's portion of the Lake Superior shoreline and two mines in Michigan. Northern long-eared bats have not been positively identified in the Millie Mine in the Upper Peninsula of Michigan, but most bats at this site are too far away to positively identify. Similarly, Tilden Mine in the Upper Peninsula is unsafe to enter but is suspected of containing large numbers of bats including little brown, tricolored, and northern long-eared bats. Winter habitat for this species is described as a 0.25-mile radius around the entrances to these hibernacula within which limited winter activities (by bats) are occurring. This modeled winter habitat also protects hibernacula from disturbance and addresses inaccurate locations typical of hibernacula entrances.

Because the species secrets itself within cryptic over-wintering locations, hibernacula counts are an ineffective way to estimate the population. As a simplifying assumption, the winter population in each state is assumed to be the same as the summer population. Higher numbers of bats are associated with larger hibernacula.

Fall/Spring

Northern long-eared bats return to the hibernacula in the fall, initiate swarming activities, and begin hibernation. Lowe (2012) found that once northern long-eared bats began swarming, roosts were regularly located within 4.5 miles of the hibernacula entrance. These data were used by USFWS to support the 5-mile protective buffer currently used around known hibernacula entrances (U.S. Fish and Wildlife Service 2014). In terms of forested habitat, high- and low-quality habitat is assigned in Table 3-2 and is consistent with known foraging and roosting behaviors of the species (Kunz 1973; Brack and Whitaker 2001; Whitaker et al. 2004; Amelon and Burhans 2006).

To estimate distribution in the plan area, a 10-mile buffer, is used to model fall/spring habitat for northern long-eared bat around the 14 hibernacula that historically have contained more than 10,000 hibernating bats regardless of species. A 5-mile buffer is used for the smaller, known hibernacula.

Unlike the Indiana bat, the number of winter northern long-eared bats is unknown due to the cryptic hibernation habits of the species and subsequently winter hibernacula counts provide more of an index than a population estimate. Therefore, the fall/spring population is assumed to be the same as the summer population. Summer population estimates are themselves difficult to determine due to the wide range and diffuse nature of the species and the lack of a regional standardized sampling scheme. To estimate summer population of northern long-eared bats, the abundance ratios and population of little brown bats was used for comparison since little brown bats can more easily be counted in hibernacula. Abundance ratios (i.e. the number of northern long-eared bats compared to the number of little brown bats) were derived from summer capture rates provided by state bat experts (White pers. comm. 2017) and available literature (Kurta and Tibbels 2000; Winhold et al. 2008; Catton 2014; Swingen et al. 2016). The ratio was then applied to little brown bat total population to derive a summer population of 724,971 northern long-eared bats in the Lake States. Data presented in Kurta and Smith (2019) indicate that northern long-eared bats in Michigan have declined by 97% to yield a summer 2020 population of 21,750 bats in the Lake States. To distribute the fall/spring population to hibernacula, the proportions of northern long-eared bats reported observed in large and small hibernacula are assumed to be a real predictor of the proportion of bats present. Thus, it is assumed that 85% of northern long-eared bats hibernate in major hibernacula.

Migration

Details about migration in this species are limited to band returns and mortality of bats at wind energy sites. During migration, the species could occur anywhere in the Lake States.

Summer

Northern long-eared bats are locally abundant and can be found throughout the Lake States (Figure 3-11). Table 3-2 contains a list of forest types and assigns those forest types to high and low habitat quality for covered bat species.

Because the species hibernates in cryptic locations, winter counts in hibernacula provide more of an index than a population estimate. However, based on abundance ratios (of northern long-eared bats and little brown bats in the summer) provided by the state bat experts (White pers. comm. 2017) and available literature (Kurta and Tibbels 2000; Winhold et al. 2008; Catton 2014; Swingen et al. 2016), it is estimated that 724,971 northern long-eared bats occur in the Lake States. After taking into account recent declines due to WNS described by Kurta and Smith (2019), summer 2020 population of northern long-eared bats in the Lake States is estimated to be 21,750 bats.

Unlike some of the other covered bat species that cluster around hibernacula entrances during the summer, northern long-eared bats are presumed to be distributed throughout forested areas in low- and high-quality habitats as identified in Table 3-2.

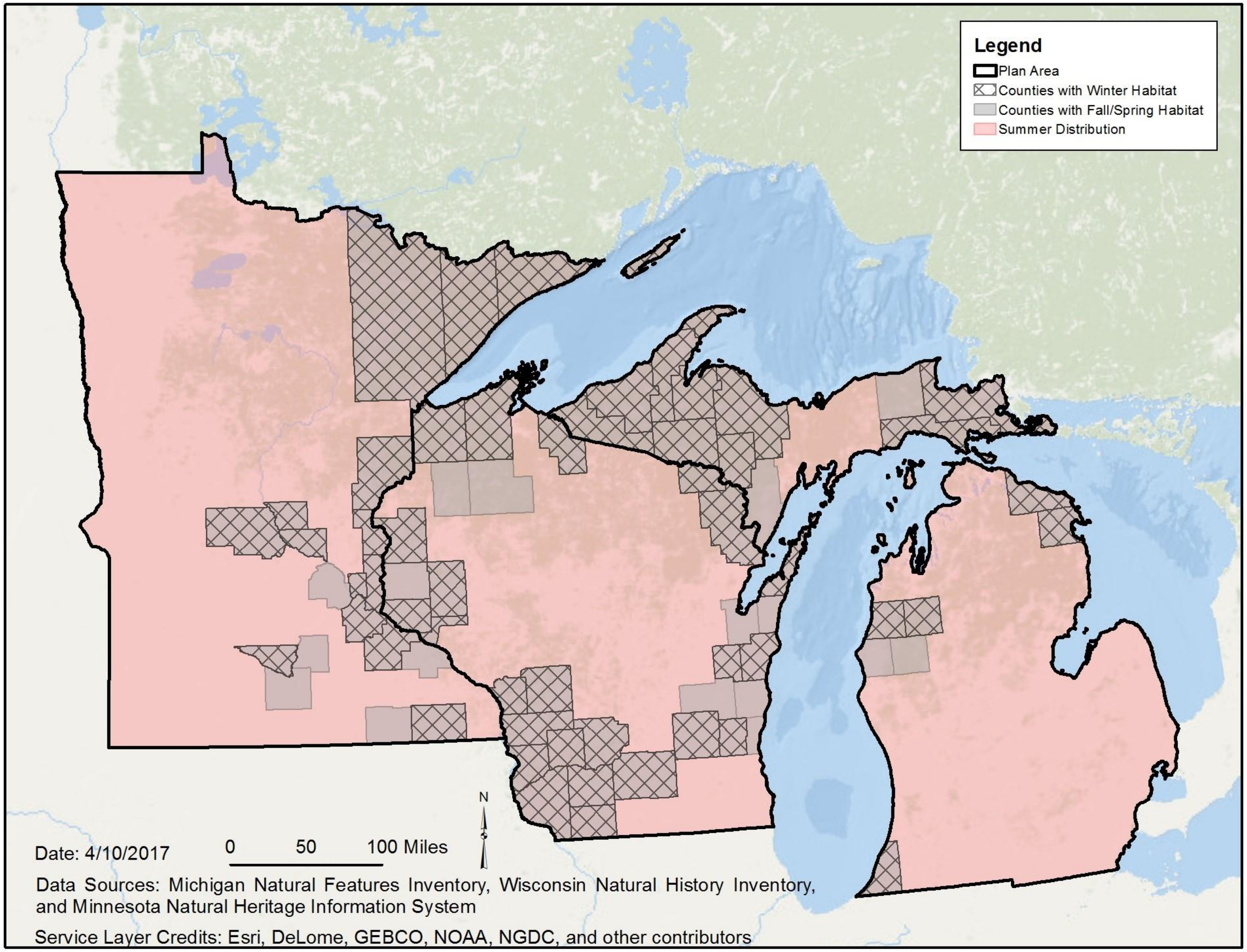


Figure 3-11. Modeled Northern Long-Eared Bat Distribution in the Plan Area

3.2.5.4 Little Brown Bat

Species Description

The little brown bat is most easily confused with the Indiana bat, from which it is separated by its brownish/brassy coloration, a medium-sized foot with many long hairs, and an unkeeled calcar. The ears are smaller than the northern long-eared bat, and do not extend past the tip of the nose when laid down. Little brown bats are widely but unevenly distributed across North America from central Alaska to central Mexico (Harvey et al. 1999) and can be found throughout the Lake States especially near known hibernacula (Figure 3-12). Before the arrival of WNS, the species was abundant across much of the region, but the species is now listed as a species of special concern in Minnesota and threatened in Wisconsin in response to the arrival of WNS. Following the arrival of WNS in North America, declines of more than 90% have occurred and the species is now under consideration for federal listing in the year 2023 (Tinsley 2016).

Habitat Preferences

Unlike other species addressed under the Lake States HCP, the little brown bat makes extensive use of buildings as roosts and, thus, has been able to reduce its reliance on forested habitats, a trait that makes it widely distributed within the Lake States (Figure 3-12). For the purposes of the Lake States HCP, it is assumed that half the little brown population summers in buildings based on data provided by bat biologists active in the region. Known hibernacula are scattered throughout the region and include natural caves, mines, surge tunnels, and the spillway at Tippy Dam (Kurta 2008; Slider and Kurta 2011).

Seasonality of summer colonies for little brown bats is similar to the other covered species with the exception that the use of buildings may allow this species to arrive a little earlier and leave a little later. These bats use a variety of anthropogenic structures such as attics, barns, and bridges as roosts, with a typical Michigan colony containing 100 to 300 bats with some colonies containing 1,000 bats (Kurta 2008) although numbers are likely decreasing due to WNS. Bats move around within a roosting structure, but most bats remain in the same structure. It is likely that some of these bats still use trees as roosts, and (based on data from other areas) primary roosts would be large, dead or dying trees with exfoliating bark or cavities similar in structure to those used by Indiana bats. Trees used by nonreproductive individuals and males tend to be smaller, but still consist of exfoliating bark, cavities, and/or crevices.

Little brown bats make extensive use of aquatic resources, especially emergent wetlands for foraging (Belwood and Fenton 1976; Anthony and Kunz 1977; Fenton and Bell 1979; Kunz and Reichard 2010; Bergeson 2012; Bergeson et al. 2013). Within forested landscapes, the species makes extensive use of edge habitats and corridors for foraging and commuting, although it is also capable of using unbroken forest in areas with limited clutter (Lacki et al. 2007; Sheets et al. 2013a, 2013b; U.S. Fish and Wildlife Service 2013).

Little brown bats throughout the eastern United States make extensive use of caves, mines, and other suitable underground environments (e.g., tunnels, sewers, basements, bear dens) for hibernation with swarming occurring at the entrances in September and October. Little brown bats can occupy a wide variety of conditions within the hibernacula, using temperatures ranging from 37 °F to 46 °F.

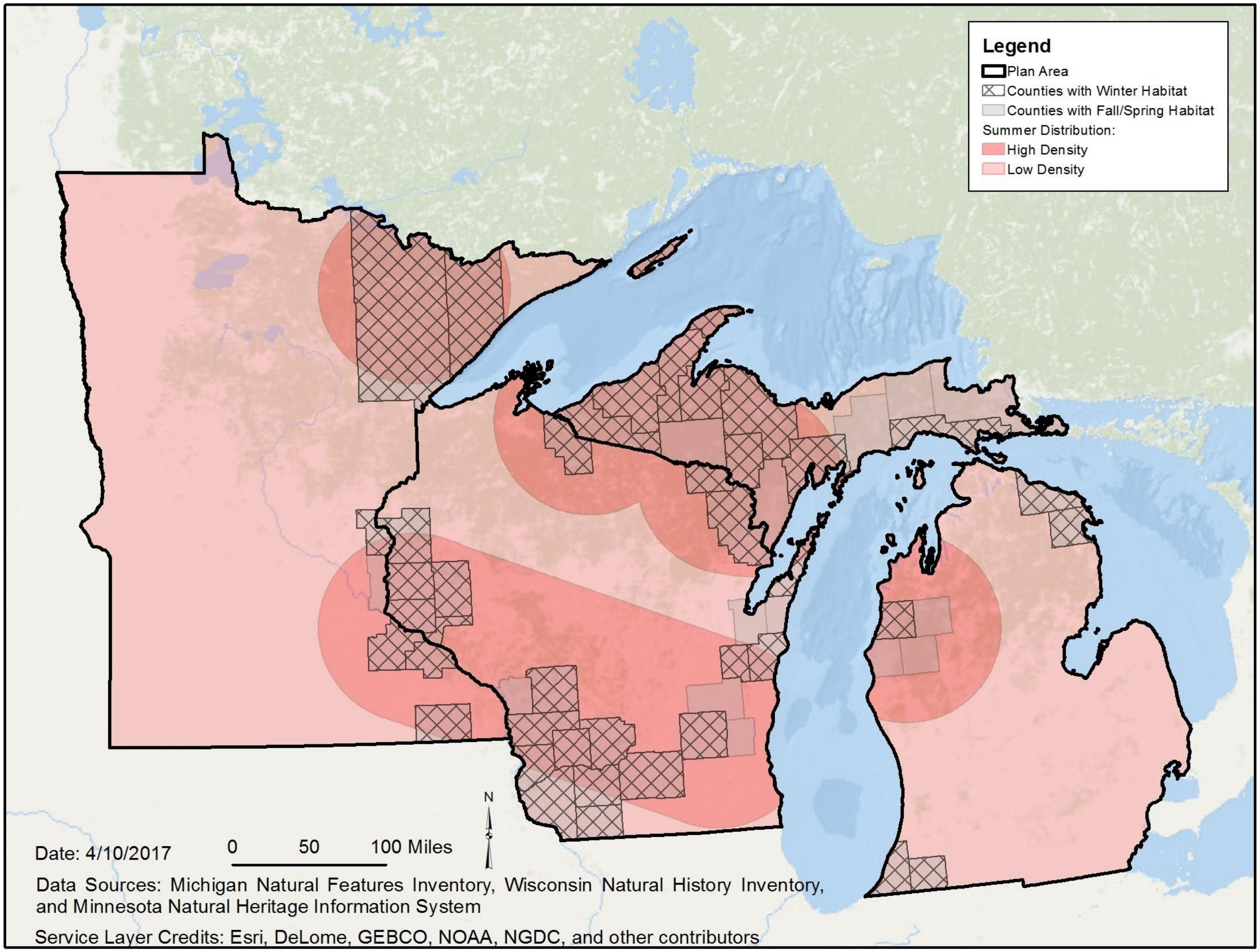


Figure 3-12. Modeled Little Brown Bat Distribution in the Plan Area

Modeled Distribution and Population Estimates

The modeled distribution description that follows is made for pre-WNS populations of the species. The population estimates have been updated with post-WNS numbers current as of 2019.

Winter

In the Lake States, the largest hibernaculum for this species in each of the three states is an abandoned mine. Based on natural heritage inventory data, little brown bats are known to hibernate in at least 174 sites throughout the Lake States, including 81 sites in Michigan, 52 sites in Wisconsin, and 41 sites in Minnesota. Eleven of these sites (seven in Michigan, one in Minnesota, and three in Wisconsin) contain more than 10,000 little brown bats. Most accessible mines and caves in Minnesota and Wisconsin have been surveyed. However, the Upper Peninsula of Michigan is riddled with unexplored mines that are expected to contain bats, including at least one (Tilden Mine) that likely housed a population of 10,000 or more bats. Tilden Mine in the Upper Peninsula is unsafe to enter but is suspected of containing large numbers of bats including little brown, tricolored, and northern long-eared bats. Winter habitat for this species is modeled as a 0.25-mile radius around these hibernacula entrances.

As such, it is likely that many of Michigan's bats have not been counted. Based on data produced during hibernacula surveys (and an estimate of those in unsurveyed sites), the hibernating populations of Michigan (500,000 bats), Minnesota (25,000 bats), and Wisconsin (330,000 bats) was estimated by local bat experts, yielding a region-wide population estimate of 855,000 hibernating little brown bats. Based on the 83% decline reported for little brown bats in hibernacula in Michigan (Kurta and Smith 2019), the current hibernating populations of the three states are approximately Michigan (85,000 bats), Minnesota (4,250 bats), and Wisconsin (56,100 bats) for a grand total of 145,350.

Little brown bats are known to move between the Lake States and surrounding states. However, it is assumed the same number of bats remain in the Lake States at all times of years. Most bats are associated with large hibernacula that contained 10,000 or more bats prior to the arrival of WNS.

Fall/Spring

Little brown bats return to the hibernacula in the fall and initiate swarming activities. A recently completed master's thesis (Lowe 2012) included studies of little brown bats near the hibernacula. Once bats were involved in swarming, more than 80% of roosts were located within 2 miles of the hibernacula, and the furthest any bat traveled was 8.1 miles. At very large hibernacula (or complexes of hibernacula) bats may need to travel further to find resources and, thus, a buffer of 10 miles was applied to those mines with 10,000 or more bats. A 5-mile buffer around the entrance is used for smaller hibernacula.

Each forest type was assigned to either high- or low-quality habitat categories (Table 3-2), consistent with described forest associations for foraging and roosting (Belwood and Fenton 1976; Anthony and Kunz 1977; Fenton and Bell 1979; Barclay 1991; Barclay and Brigham 1991; Kunz and Reichard 2010; Bergeson 2012; Bergeson et al. 2013).

Migration

Details about migration in this species are limited to band returns and mortality of bats at wind energy sites. It is known that bats from the Lake States migrate outside the region to other states and Canada. Indeed, most large hibernacula occur on or near a state border. Thus, migrating little brown bats can be found anywhere within the Lake States.

Summer

As a simplifying assumption, winter estimates for little brown bats are described as roughly equivalent to summer populations, even though bats migrate in and out from other regions. Further, based on consultation with regional bat biologists, it is assumed that at least half the population (427,500 bats) is located in anthropogenic structures, including buildings, bridges, and bat houses and, thus, does not occupy forested habitat. The remaining bats (427,500) are again separated into two groups, with 213,750 bats (50%) residing in areas of high density near large hibernacula (10,000 or more little brown bats prior to WNS). Based on banding data (Humphrey and Cope 1976), these high-density areas are within 100 kilometers of the large hibernacula, as well as a band across southern Wisconsin that connects the three major hibernacula in the state (Figure 3-12). The presence of this high-density band is supported by data provided by J. Paul White, who leads Wisconsin's bat program. The remaining 213,750 bats are assumed to occur across the larger forested landscape. This approach recognizes that 1) little browns occupy both trees and anthropogenic roosts, 2) that the species is most dense in areas with large hibernacula, and 3) that some bats are found at great distances from hibernacula. Based on the 83% decline reported for little brown bats in hibernacula in Michigan (Kurta and Smith 2019), the 2020 summer population in the Lake States is assumed to be 145,350 bats with 72,675 bats found in forested habitats.

Summer habitat is mapped in Figure 3-12, with areas of high and low suitability based on the descriptions in Table 3-2.

3.2.5.5 Tricolored Bat

Species Description

The tricolored bat (or eastern pipistrelle) is the smallest species addressed under the Lake States HCP and is usually recognized by the reddish skin along the forearm and fingers that contrast strongly with the nearly black flight membranes and a pelage that is golden to reddish brown. Adhering to its common name, the bat's guard hairs have a tricolored appearance—dark at the base, yellow in the middle and dark at the top. The species is distributed sporadically across the Lake States (Figure 3-13) and was absent from most glaciated areas before settlement (Brack and Mumford 1984). Because the species is relatively rare in the region and is severely affected by WNS, the species is now listed as special concern in Michigan, special concern in Minnesota, and threatened in Wisconsin. USFWS reviewed a petition for listing under ESA and in September 2022, proposed to list the tricolored bat as an endangered species under the ESA.

Habitat Preferences

Tricolored bats occur sporadically in the Lake States, especially along the edge of Lake Michigan and typically summer within 85 miles of usable hibernacula. Density of the species declines rapidly with increasing distance from potential hibernacula, which are known to include caves, mines, surge tunnels, and the spillway at Tippy Dam.

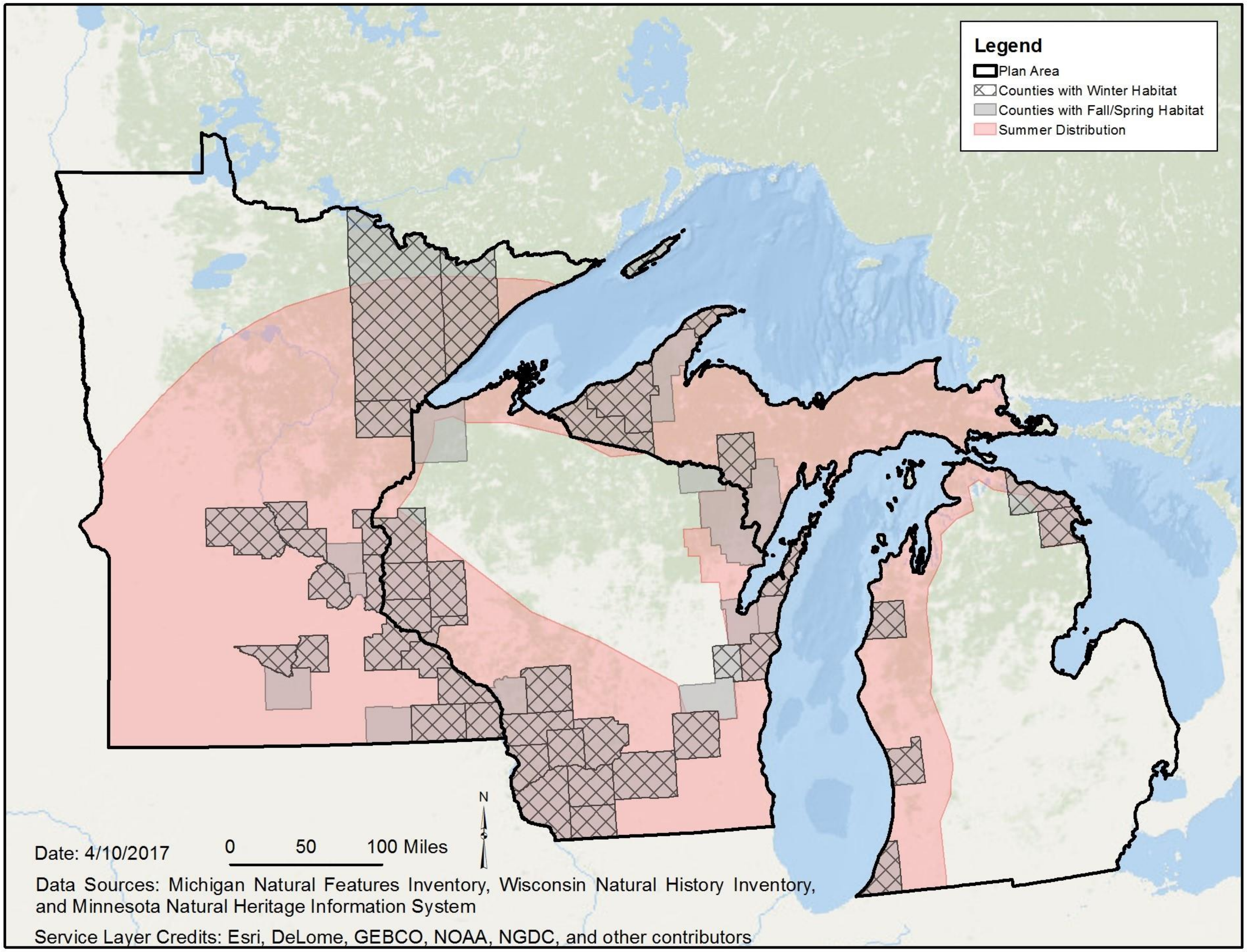


Figure 3-13. Modeled Tricolored Bat Distribution in the Plan Area

Tricolored bats move from the caves to summer habitat in spring, and may make use of migration roosts including open areas of buildings such as shaded porches or bridges (Whitaker 1998). Some of these sites are used throughout summer. Most bats then move to roosts in trees, most of which are located in clusters of dead and live leaves, although they have also been seen to roost in lichen and pine needles accumulated in tree splits (Veilleux et al. 2003; Perry and Thill 2007; Wisconsin Department of Natural Resources 2013). In areas with extensive forest, they tend to roost in forested areas that have dense understory vegetation. However, in developed areas, the species occasionally roosts in isolated trees within a variety of landscape types. Males roost alone and females roost in small colonies of less than 30 adult bats.

Tricolored bats forage in a variety of habitat types located within 2.5 miles of their roost trees (Veilleux et al. 2003; Helms 2010). They forage in and along the edges of woodlands and areas of scrub/shrub. While they avoid areas of intense development, they routinely forage right up to the edges of such habitats.

Tricolored bats typically roost alone in the hibernacula (as opposed to clustering) and, thus, it is not unusual for this species to be the only bat using a relatively small underground void, such as a short mine shaft or even hand-dug wells.

Modeled Distribution and Population Estimates

The modeled distribution description that follows is made for pre-WNS populations of the species. The population estimates have been updated with post-WNS numbers current as of 2019.

Winter

Tricolored bats are known to hibernate in at least 147 sites throughout the Lake States, including 34 sites in Michigan, 70 sites in Wisconsin, and 43 sites in Minnesota. The species hibernates in caves, mines, and similar underground structures. Tilden Mine in the Upper Peninsula is unsafe to enter but is suspected of containing large numbers of bats including little brown, tricolored, and northern long-eared bats—it is included as a hibernaculum.

Based on hibernacula surveys and an estimate of tricolored bats in unsurveyed sites, the hibernating populations of Michigan (100 bats), Minnesota (1,000 bats), and Wisconsin (2,300 bats) produce a region-wide population estimate of 3,400. Generalizing the 90% decline of this species noted by Kurta and Smith (2019), the current hibernating populations of Michigan (10 bats), Minnesota (100 bats), and Wisconsin (230 bats) equate to a region-wide population estimate of 340 hibernating tricolored bats.

The number of bats in the Lake States is presumed to be the same at all times despite the fact that individual bats may move in and out of the region. Winter habitat for this species is modeled as a 0.25-mile radius around these hibernacula entrances.

Fall/Spring

No telemetry studies have been completed for tricolored bats engaged in swarming or staging, but, relative to the other covered species the bat is a weak flyer. Therefore, a 5-mile buffer around all known hibernacula entrances was assumed as being appropriate for modeling fall/spring habitat. The 340 bats are assumed to be evenly distributed in fall/spring habitat within areas of high- and low-quality habitat (Table 3-2).

Migration

Details about migration in this species are limited to mortality of bats at wind energy sites and the locations of summer and winter populations. As such, no calculation of take has been completed and migration habitat is assumed to occur anywhere between summer and winter habitat.

Summer

Tricolored bats occur sporadically within the plan area, although they are most abundant in the southern portions of the Lake States. The species is rare/absent across most of the Lower Peninsula of Michigan, outside the karst region of Wisconsin, and in western Minnesota. Summer habitat is mapped in Figure 3-13, with areas of high and low suitability following the descriptions in Table 3-2.

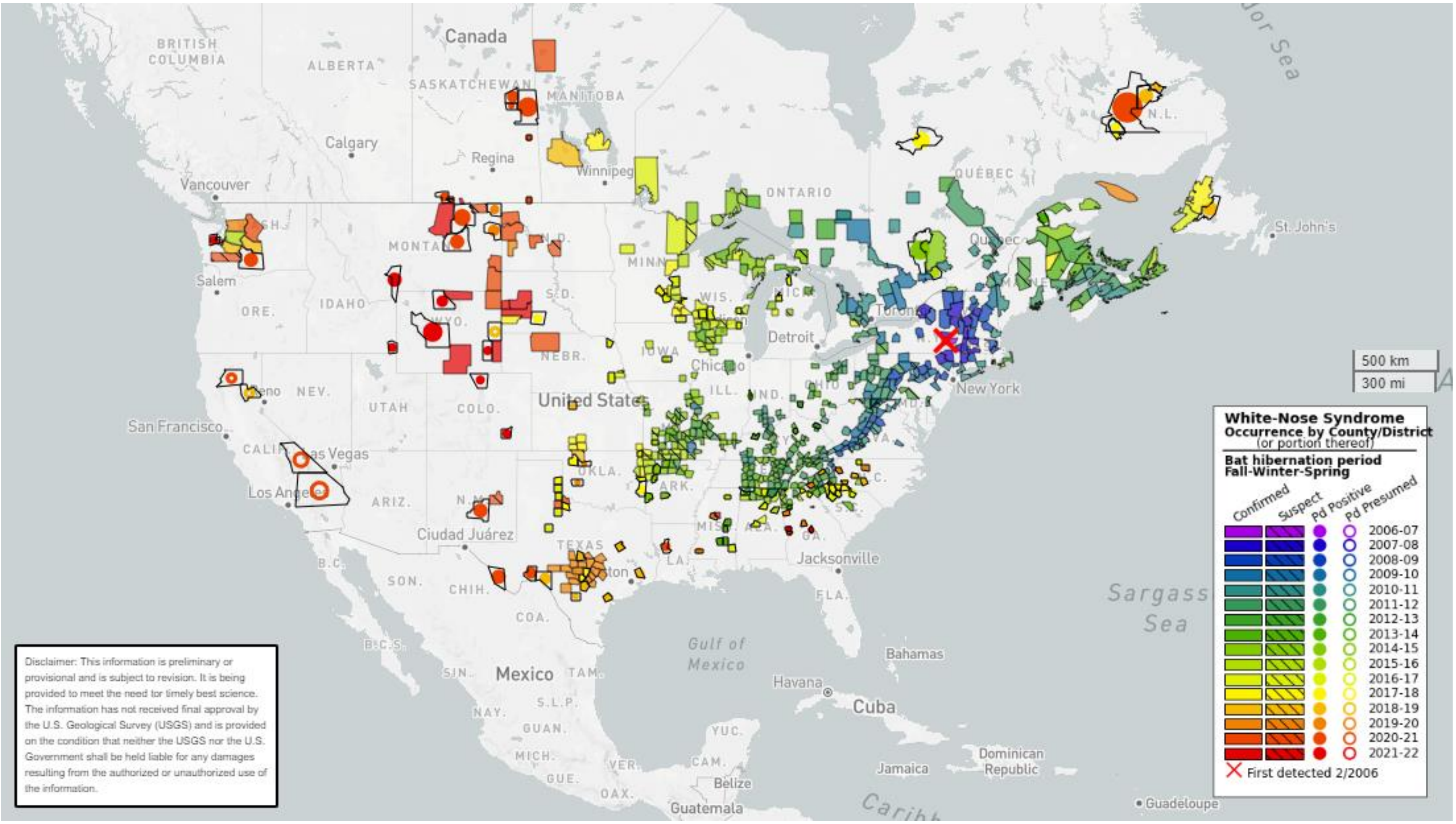
3.3 Environmental Baseline

3.3.1 White-Nose Syndrome

The discovery of white fungus on the noses of bats hibernating in a cave near Albany, New York, in 2006 was the first sign of an emerging infectious disease. The white-nose syndrome (WNS) fungus (*Pseudogymnoascus destructans*) thrives in cold and humid conditions characteristic of the caves and mines used by hibernating bats, including the covered species (Gargas et al. 2009), and readily invades the tissue of hibernating bats. When the bats are using the caves and mines during hibernation, they have a reduced immune response, making them susceptible to infection (Carey et al. 2003). Since 2006, WNS has spread across most of North America and has been detected in 38 states and 8 Canadian provinces (Figure 3-14) (U.S. Fish and Wildlife Service 2022) .

Following the arrival of WNS at a hibernaculum, populations of most cave hibernating bats decline rapidly, but the level of mortality varies with physical conditions at the site and species-specific responses to infection (Langwig et al. 2012, 2016). Emerging data (Frick et al. 2017) provide evidence that in the decade since WNS first arrived in the Northeast, the Indiana bat has suffered significant population declines, but those declines are less severe than other similar species and populations are no longer declining. Similarly, populations of little brown and tricolored bats were severely affected but now are no longer rapidly declining. Unfortunately, population declines for northern long-eared bats continue without signs of slowing.

Federal, state, local, and private entities are investing significant time and funding into research aimed at reducing effects from WNS (Michigan Department of Natural Resources and Environment 2010; Minnesota Department of Natural Resources 2013; Wisconsin Department of Natural Resources 2011), but efforts for treatment or prevention remain experimental. The fungus is initially transmitted primarily through bat-to-bat contact, but once it is present in a hibernaculum it can persist for long periods within the cave system (Lorch et al. 2013; Zukal et al. 2014). Decontamination protocols are available from USFWS to prevent spread of the disease by researchers (White-Nose Syndrome Disease Management Working Group 2020). Cave management and conservation organizations are limiting or not allowing access to caves and are requiring that clothing and equipment be disinfected in an effort to prevent the spread of the WNS fungus.



Map depicts the first time WNS is reported suspect or confirmed in a county or district (or portions thereof); each time period in the legend spans a winter bat hibernation period. Citation: White-nose syndrome occurrence map – by year (2022). Data Last Updated 9/26/2022. Available at: whitenosesyndrome.org.

Figure 3-14. White-Nose Syndrome Occurrences in the United States (2022)

Within the plan area, the first evidence of WNS was the detection of the fungus in samples collected from bats in winter 2011/2012 at Minnesota's largest hibernacula (Minnesota Department of Natural Resources 2013). Diseased bats were found at several Michigan hibernacula in spring 2014 (Kurta and Smith 2014), and bat mortalities related to WNS were recorded in Keweenaw County in January 2015 (Michigan Department of Health and Human Services 2017). Hibernacula surveys in Michigan during early 2017 have documented widespread population declines consistent with observations in other WNS-affected states (Kurta pers. comm. 2017). Bat mortalities related to WNS were confirmed at Soudan Underground Mine in January 2016 (Minnesota Department of Natural Resources 2016). Winter surveillance of 75 bat hibernacula in Wisconsin during 2014 and 2015 found 14 sites in eight counties that contained either *P. destructans* or WNS, including Grant, Crawford, Richland, Door, Dane, Iowa, Dodge, and Lafayette Counties (Wisconsin Department of Natural Resources 2015). The site in Grant County, the original point of infection in Wisconsin, saw a 70% population decrease from pre-WNS estimates (Wisconsin Department of Natural Resources 2015). Finally, Indiana bats migrate to the covered lands from surrounding states, including Indiana, Kentucky, and Ohio, where WNS has also reduced numbers of this species (U.S. Fish and Wildlife Service 2015).

Leveraging efforts of wildlife management agencies to record winter counts of hibernating bats, Cheng et al. (2021) collated data for five species of bats (including all four covered bat species) from over 200 sites across 27 U.S. states and 2 Canadian provinces from 1995 to 2018 to determine the impact of WNS. Their assessment showed that counts of bats have declined by more than 90% at monitored hibernacula within the decade since WNS emerged for these species. The severity of the WNS threat is extreme indicating a high to very high level of WNS impact for northern long-eared bats, little brown bats, and tricolored bats as the geographic extent of WNS now overlaps 36% to 79% of their ranges (Cheng et al. 2021; www.whitenosesydrome.org). The severity of declines caused by WNS was more variable and complex for Indiana bats, with a mean decline in wintering colonies of 84%. However, a small number of sites with very large colonies exhibited less severe declines than the majority of smaller sites, suggesting the overall severity of WNS is more moderate (Cheng et al. 2021). Generally, the severity of declines caused by WNS were more severe in the northeast than in midwestern and southeastern regions for all species (Cheng et al. 2021).

The pathogen that causes WNS has caused severe declines in several species of insectivorous bats, and the magnitude of this decline could have cascading effects on agricultural pests, pathogen vectors, and other aquatic and terrestrial insects that bats consume (Hoyt et al. 2021). This pathogen can establish long-term environmental reservoirs; therefore, it is unlikely that it could be eradicated from North America (Hoyt et al. 2021). The impacts of WNS will likely last for many decades, and some impacts may be permanent (Hoyt et al. 2021). Thus, the Lake States HCP is being developed at a time when WNS is rapidly reducing the population of the covered species in the region and will likely continue to cause impacts for decades.

3.3.2 Wind Energy Development

The plan area for the Lakes States HCP is located in a region where land-based wind energy is a rapidly developing industry. The Infrastructure Investment and Jobs Act (2021) and the Inflation Reduction Act (2022) are both promoting renewable energy development. The operation of commercial wind energy facilities results in the accidental mortality of both birds and bats, including all four species addressed by the Lake States HCP. On behalf of the industry, the American Wind Energy Association has championed the development of the Midwest Wind Energy Habitat

Conservation Plan (Wind Energy Plan) to address the potential effects of this industry on three of the species covered by the Lake States HCP. Following an initial public review, the draft Wind Energy Plan became stalled, and as of November 2022 is considered defunct. However, the Wind Energy Plan (U.S. Fish and Wildlife Service. 2016) and associated environmental impact statement provide detailed predictions about levels of future construction and associated impacts on the covered bats. Furthermore, these wind projects are expected to use habitat conservation plans (HCPs) for ESA compliance. While the conservation measures that will be used in these future HCPs are not known, for the purposes of informing the baseline, it is reasonable to assume that these future measures will be similar to those proposed in the Wind Energy Plan.

To calculate effects, the draft Wind Energy Plan made use of a proportional mortality model. This model works by combining data obtained when biologists survey operating wind turbines for dead birds and bats (i.e., carcass searches). To obtain an accurate estimate of mortality, biologists must not only count the number of carcasses they find but also account for those carcasses that are taken by scavengers before they are found, overlooked by biologists, or fall outside of designated search areas. When these mortality estimates are combined across multiple studies, it is possible to estimate the number of bats killed per tower, standardized to the size of the towers in megawatts, and the proportion of those mortalities that are assignable to a particular species.

Based on studies throughout the Midwest (defined as Ohio, Indiana, Illinois, Iowa, Michigan, Minnesota, Missouri, and Wisconsin), the number and size of operating turbines, and the number and size of turbines expected to be built in the region during the next 45 years, it was possible to estimate the number bats that will be killed at these sites. Thus, the draft Wind Energy Plan estimates that over the next 45 years, wind energy in the Midwest will take 16,822 Indiana bats, 9,753 northern long-eared bats, and 440,830 little brown bats.

The model used to estimate mortality of Indiana bats was re-created for a variety of other species, including the tricolored bat, to estimate the impacts of the draft Wind Energy Plan on these nontarget species. That model predicted the mortality of 51,389 tricolored bats.

These numbers are based on summer 2016 population estimates and are expected to decline as WNS reduces the population of bats throughout the region. These numbers also do not reflect conservation measures included in the draft Wind Energy Plan that are designed to achieve the following goals.

- Reduce mortality of all bat species by at least 50%.
- Prevent wind energy sites from being built in highly sensitive areas.
- Create and manage habitat to mitigate for impacts to the three species covered in the draft Wind Energy Plan (little brown, Indiana, and northern long-eared bats).

As noted in the associated environmental impact statement, such steps are also likely to benefit other species, including the tricolored bat.

An analytical assessment of North American Bat Program data conducted by Straw et al. (2022) documented that northern long-eared bats, little brown bats, and tricolored bats exhibited a decline in counts of call sequences with an increasing wind energy risk index (a factor of the size, number, and distribution of wind energy installations, as well as specific flight distances). The assessment indicates that wind energy continues to be a threat to bats.

3.3.3 Forest Management Programs

3.3.3.1 Forest Management on DNR and County Lands

Each state's DNR manages extensive forested areas using widely accepted practices described in silvicultural guidelines or handbooks specific to each state. Those practices are similar among states and described in detail in Chapter 2, *Covered Lands and Activities*. County land management staff also use practices similar to those employed by the State DNRs.

Management on DNR and county lands usually occurs as a timber sale to a private firm. DNR or county staff specify the type of management to be performed in a specified area, called a stand, and firms compete to purchase this stumpage[3] on public lands. Thinning and similar timber stand improvement cuts, which are less profitable, may be undertaken by DNR or county staff and temporary employees, or a private firm may be hired to complete the project.

Over the last few decades, the State DNRs have established standards for forest management that include protection of water quality and soil integrity, provision for endangered and threatened species habitat, and wildlife habitat enhancement, such as leaving standing dead trees and snags. Third-party certification documents the attainment of such standards for implementing these and other forest management practices. See Section 3.3.3.3, *Federal-State Joint and Third-Party Programs*.

3.3.3.2 Voluntary Best Management Practices

The primary objectives of forestry best management practices are protecting water quality in streams, wetlands, lakes, wildlife habitat, historic/cultural resources, and forest soil productivity. Although these forestry best management practices are voluntary and not all of them are tied to certification, tax incentives, or other incentives, they can result in improvements to forest management activities, such as road building and harvesting in riparian areas.

3.3.3.3 Federal-State Joint and Third-Party Programs

Each state participates in two federal-state joint programs, the Forest Stewardship Program and the USFS's Forest Legacy Program (Table 3-4). Hundreds of thousands of private acres have been formally enrolled in these programs. Involvement in these programs results in cost-share, payments for easements and technical assistance. Some acres may be required to be open to public hunting.

[3] Stumpage is the price on standing timber and the right to harvest it, reckoned as a unit value per stump.

Table 3-4. Involvement in the Forest Stewardship, Forest Legacy, and Forest Certification Programs by Ownership Type and Percent of all Forestland between States as of 2020

					Forest Certification Programs					
Program	Forest Stewardship Program		Forest Legacy Program		Sustainable Forestry Initiative		Forest Stewardship Council		American Tree Farm System	
Ownership Type	Acres	% [a]	Acres	% [a]	Acres	% [a]	Acres	% [a]	Acres	% [a]
Michigan										
State DNR Lands [b]	NA	-	4,170	0.1%	3,900,000	92.7%	3,900,000	92.7%	0	-
County and Municipal [c]	23,688	5.4%	NA	-	NA	-	NA	-	0	-
Private and Tribal [d]	923,840	7.3%	150,479	1.2%	1,516,323	12.0%	279,753	2.2%	176,535	1.4%
Minnesota										
State DNR Lands [b]	NA	-	NA	-	4,500,900	90.0%	4,500,900	90.0%	NA	-
County and Municipal [c,e]	0	-	8,664	0.3%	1,460,542	56.7%	1,127,688	43.8%	NA	-
Private and Tribal [d,e]	947,181	11.6%	344,013	4.2%	578,432	7.1%	13,137	0.2%	NA	-
Wisconsin										
State DNR Lands [b]	NA	-	NA	-	1,528,985	100%	1,528,985	100%	0	-
County and Municipal [c]	NA	-	NA	-	2,223,355	94.3%	1,783,439	75.6%	0	-
Private and Tribal [d]	3,445,017	29.0%	259,436	2.2%	214,026	1.8%	3,098,625	26.1%	2,742,125	23.1%
Grand Total	**5,339,726**		**766,762**		**15,922,563**		**16,232,527**		**2,918,660**	

Notes:

[a] Refers to percent of enrolled acres relative to all forestland in the state under that ownership. The values in this table are estimates and may change over time.

[b] Nearly all DNR State Forest Lands are dual-enrolled in SFI and FSC.

[c] County Forest Lands are enrolled in one or both certification programs. 358,800 acres on MN county lands and 1,614,043 acres on WI county land are dual-certified.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the "Native American" owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] All county lands and 206,349 acres of private lands are enrolled in the state-equivalent "Minnesota Forests for the Future" program.

Another forest management initiative, third-party certification, leads to commercial benefits, such as the ability of a landowner to sell forest products under a certification label, as well as numerous ecological benefits and sustainable forestry practices. Certification standardizes and documents the attainment of best forest management practices. The programs all require that a forest management plan, written by or reviewed by natural resource professionals, be completed for each enrolled land parcel. As natural resource issues are identified or emerge, such as WNS and the decline of cave-hibernating bat species or new listing of a species, the expectations for these plans changes and new best practices are incorporated into the management plans. In this regard, all these lands have or will over time very likely incorporate protections for cave-dwelling bats.

Forest Stewardship Program

The Forest Stewardship Program is a partnership between the USFS, a state DNR or similar agency, and private sector foresters who offer professional planning and technical assistance to private (including Tribal) forestland owners. The purpose of the program is to encourage long-term stewardship of family forestland by developing and implementing a Forest Stewardship Plan that produces both economic and ecological benefits. To be eligible for the program, a landowner must own 20 acres with at least 50% of that forested. Enrollees must also commit to 10 years of management actions. Each Forest Stewardship Plan is customized and describes the landowner's personal goals, unique forest resources, and suggested management activities. A landowner may use their Forest Stewardship Plan to enroll in the Commercial Forest Program (Michigan) or the Qualified Forest Program (Michigan). Although participation in the Forest Stewardship Program is voluntary, these referenced tax programs require landowners to comply with their forest management plan in exchange for a reduced property tax. The Natural Resources Conservation Service also accepts Forest Stewardship Plans when a landowner applies for financial assistance to implement conservation practices recommended in their plan. Landowners might also use a Forest Stewardship Plan to enroll in the American Tree Farm System® to certify the sustainable management of their forestland. Plans have been established for several thousand private landowners covering nearly 924,000 acres in all 83 counties in Michigan and almost 24,000 acres of county and municipal lands (Table 3-4). Most of these properties were from 40 to 80 acres. In Minnesota, approximately 947,000 acres of forestland have a Forest Stewardship Plan. In Wisconsin, the Forest Stewardship Program covers approximately 3,445,000 acres of private forestland. Although Forest Stewardship Program enrollments represent less than 30% of private forestland acres in each state, it is the most effective program to implement professional forest management on private lands.

Forest Legacy Program

The Forest Legacy Program seeks to protect privately owned and environmentally significant forestland from being converted to nonforest uses. The program is voluntary and provides funds to acquire land in fee ownership or development rights through a conservation easement. The Forest Legacy Program encourages partnerships with local governments and land trusts, recognizing the important contributions that private (including Tribal) landowners, local communities, and environmental organizations make to forest conservation efforts. Michigan has enrolled approximately 150,000 acres of primarily private land (Table 3-4). Minnesota has enrolled more than 352,000 acres of public and private lands. Minnesota also implemented its own forest conservation easement program, the Minnesota Forests for the Future Program, in tandem with Forest Legacy. Wisconsin has enrolled a little more than 259,000 acres in Forest Legacy. Forest

Legacy easements cover less than 5% of the total private forestland acres in each state, but because it targets productive timberlands and seeks to prevent parcelization, it is an effective method to maintain forest cover and avoid landscape fragmentation due to development.

Forest Certification Programs

Forest certification is widely seen as the most important initiative in recent decades for promoting sustainable forest management. Forest certification is a voluntary process based on independent, third-party audits of a landowner's management program, practices, policies, and on-the-ground forest activities. Each of these elements is measured against specific management standards that address environmental, social, and economic parameters. Certification provides an objective and quantitative means for recognizing well-managed forestland. State DNR lands in all three states are certified by the Sustainable Forestry Initiative (SFI®) and Forest Stewardship Council (FSC®).[4] Forest management practices on certified lands are required to conform with standards from SFI and FSC. Examples of standard requirements include the following.

- Prohibiting conversion of one forest cover type to another type except in justified circumstances, such as dealing with disease.
- Limiting (minimizing to avoid) pesticide use and requiring that pesticides be properly vetted and/or government approved.
- Safeguarding rare, threatened, and endangered species and their habitats.

The American Tree Farm System (ATFS), a program of the American Forest Foundation, provides tools and information to help tree farmers and woodland owners keep forests healthy and productive. In early 2015, several updates to the certification standards were instituted. One enhancement provides clarifying language that identifies clear obligations for protection of occupied threatened and endangered species habitats and communities on enrollee lands.

Certification represents a significant investment of time and money. A decision to pursue and maintain forest certification is usually made by the landowner. Provisions also exist for landowners to join a group seeking certification. Private landowners sometimes pursue group certification, as do some municipal and county entities. Certified forests support certain markets for timber (local through global) as many forest products manufacturing facilities need certified wood to satisfy customer demands.

There are members of all landowner groups in the Lake States who participate in the most common and recognized forest certification programs: ATFS, SFI and FSC. Over 23.17 million acres of forestland are certified under one or more of these programs (Table 3-4). Specifically, Michigan has 5.87 million certified acres (State DNR lands are dual-certified to SFI and FSC) (Table 3-4). Minnesota has 7.32 million certified acres. Approximately 90% of Minnesota DNR-managed lands are dual certified to SFI and FSC. Even though public forestlands make up the bulk of the certified acres, nearly 592,000 acres of certified private forestland in Minnesota are enrolled in one of these programs. These include family forests, industrial forests, and conservation lands owned by entities such as The Nature Conservancy. Wisconsin has 9.98 million certified acres and 27 of Wisconsin's County Forests are third-party certified to either SFI or FSC (19 counties are dual certified). State DNR lands in Wisconsin are dual-certified. Private lands in Wisconsin are certified under one or more programs, including ATFS, FSC, or SFI.

[4] Michigan FSC® C014912, Minnesota FSC® C020394, Wisconsin FSC® C006979.

The percent of certified acres in an ownership type approaches or exceeds that reported in USFS FIA data for that ownership type. This is because certified tracts of land include nonforested lands.

3.3.3.4 State-Specific Forestry Programs

Each state has a forestry program that incentivizes landowners to manage their forest resources primarily to ensure a supply of good timber for commercial use but also to prevent the conversion of forestland to nonforested land. Landowners enrolled in these programs receive a tax benefit. Participants must complete a forest management plan. Such a plan could include provisions to protect certain key natural resources. At a minimum, enrollees are required to not damage legally protected resources.

The following discussion highlights forest management programs that are unique to individual states. These programs offer potential connections with foresters while providing incentives for landowners to manage their lands under the guidelines established by the Lake States HCP.

Michigan Forestry Programs

Commercial Forest Program

The Commercial Forest Program, which is administered by the DNR, provides a significant property tax reduction to private landowners as an incentive to retain and manage their forestland for long-term timber production in support of the state's forest products industry. Landowners do not pay *ad valorem* taxes, which are based on a property's assessed value, but pay a specific tax per acre per year for land enrolled in the program. Additionally, the State of Michigan makes an annual per-acre payment (from the general fund) to each county with commercial forestland, to help offset the lost local tax revenue. The specific tax and payment rate increase $0.05 every 5 years and the rate for 2017–2021 is $1.30 per acre annually. It is estimated that approximately 2.2 million acres of private forestland owned by 1,800 landowners are enrolled in the program, including eleven landowners owing at least 10,000 acres. Commercial forest landowners range from large, industrial timber producers to small, nonindustrial businesses, private individuals, civic groups, and trusts.

Program participants assume the following responsibilities.

- Managing the property for commercial timber production.
- Having a written forest management plan.
- Certifying that the forest management plan is in effect.
- Allowing public access (foot) for hunting and fishing.

Prohibited activities include agriculture; grazing; and industrial, residential, resort, or commercial activities. The penalty for withdrawing a property is complicated, but generally costs approximately $100 per acre.

Qualified Forest Property Program

The purpose of the Qualified Forest Program, which is administered by the Department of Agriculture and Rural Development, is to encourage private forestland owners to manage their land in an economically viable and environmentally sustainable manner. Landowners receive an exemption from local school operating taxes and/or exemptions from the uncapping of the taxable value of their property in the event of a change in ownership. Enrolled properties must have a forest management plan that is prepared by a qualified forester. Enrollees must also agree to manage their forest in accordance with the forest management plan. Enrollees must report to the Michigan Department of Agriculture and Rural Development when a forest practice or timber harvest has occurred on a qualified property. If a landowner does not accomplish forest practices and harvests within 3 years of the time specified in the current forest management plan, the property will revert to its former tax status and be subject to a recapture tax.

To enroll in the program, the parcel must be at least 20 acres. For parcels of fewer than 40 acres, at least 80% must be stocked with productive forest (producing at least 20 cubic feet of wood per acre per year). For parcels of 40 or more acres, at least 50% must be stocked with productive forest. A maximum of 640 acres per property owner may be enrolled in a tax-collecting unit of government.

Since its inception, approximately 368,000 acres have been enrolled in the program, which is only a fraction of the approximate 12.6 million acres of private forestland in Michigan. Unlike the Commercial Forest Program, public access for hunting and fishing is not required for enrolled property.

Minnesota Forestry Programs

Sustainable Forest Incentive Act

The Sustainable Forest Incentive Act is one of the more popular programs available to private forestland owners in Minnesota. Established in 2001, the program is administered by the Minnesota Department of Revenue in coordination with the Minnesota DNR. The program provides an incentive payment rather than a tax rebate or credit. Upon meeting the eligibility criteria, the landowner pays full property taxes and in turn gets a subsequent payment from the state. Eligibility requires a minimum of 20 contiguous forested acres. Owners must adhere to a covenant, with a mandated minimum 8-year commitment. Enrollees are required to develop a forest management plan that is usually satisfied by a forest stewardship plan. Nonmotorized public access is required for landowners who enroll more than 1,920 acres.

Recently, the annual payment was codified in statute at $7.00 per acre. In the first year of the program, 320 landowners enrolled with a corresponding 531,508 acres. Enrollment peaked in 2010 with 2,048 landowners having enrolled over 917,000 acres. Starting in 2010, payments were capped at $100,000 per landowner. This action had significant economic implications for some of the state's largest forestland owners who ultimately opted out. In 2016, more than 836,000 acres remained enrolled.

2C Managed Forest Classification

Unlike the Sustainable Forestry Incentive Act program, the 2C tax classification-managed forestland designation is a standard property tax rate deduction. The 2C classification lowers the class rate of eligible properties from 1.00 to 0.65%. Similar to the Sustainable Forestry Incentive Act program, eligibility requirements include a minimum of 20 acres, as well as a written management plan. There is no stipulation for public access and the classification has a maximum enrollment cap of 1,920 acres per landowner. From 2008 (the first year) to 2012, the number of enrolled acres increased nearly fivefold from 47,162 to 226,713 acres.

Rural Preserve Program

The Rural Preserve Program was launched in 2011 to accommodate changes made to the Green Acres tax program. The Green Acres Program provides property tax relief for owners of agricultural property where the market value of land is affected by development pressure, sales or recreational land, or other non-agricultural factors. The program requires a minimum of 10 acres of rural vacant land, which may or may not be forested. The program does not require a conservation plan or public access. The land is taxed at the current use value as opposed to the estimated market value.

Wisconsin Forestry Programs

Managed Forest Law Program

Wisconsin's Managed Forest Law is a private landowner property tax incentive program that requires enrollees to practice sustainable forestry. Management plans contain recommendations related to forestry, wildlife management, water quality, endangered resources, and aesthetics. Roughly 3.35 million acres of private forestland are enrolled in the program. Lands enrolled into the program can also qualify for voluntary membership in the Managed Forest Law Certified Group (ATFS and FSC). Landowners can opt in or out of the group at any time.

Managed Forest Law enrollees pay an acreage share tax instead of the regular (*ad valorem*) property tax. Wisconsin has an average statewide tax for productive timberlands of $42.70 per acre and provides a 95% reduction in property taxes if public access is allowed. The average net tax under the program is $2.14 per acre if enrolled after 2004, and $0.79 per acre if enrolled between 1987 and 2004. If public access is prohibited, the tax rate increases to $10.68 per acre for lands enrolled after 2004 and $1.87 per acre for lands enrolled earlier.

To qualify and comply with the Managed Forest Law, lands must be restricted from other industries or land uses such as agriculture, grazing, commercial storage facilities, game farms, cell towers, mines, quarries, and campgrounds. To participate in the program, landowners designate property as *Open* or *Closed* to public access for recreation and commit to a 25- or 50-year sustainable forest management plan. The plan sets the schedule for specific forestry practices, which landowners must complete. In return, participants make a small annual payment in lieu of regular property taxes.

To qualify for Managed Forest Law designation, a forested parcel must meet the following criteria.

- Contain at least 20 contiguous acres under the same ownership.
- Be at least 80% covered by forest dedicated to growing commercial timber products and able to grow at least 20 cubic feet of wood per acre per year. Up to 20% of each forest parcel may be deemed unsuitable for growing timber or is characterized by an unmanaged vegetation type to include forested no-cut zones.

Mandatory forest management practices such as the following must be carried out during the Managed Forest Law entry period.

- Harvesting timber according to sound forestry standards.
- Thinning plantations and natural stands for merchantable products.
- Releasing trees from competing vegetation.
- Tree planting to maintain necessary forest density.

- Treating before and after harvest to ensure adequate forest regeneration.
- Controlling soil erosion.

A noncompliance fee of $250 may be assessed on a landowner who fails to complete each mandatory practice according to the established schedule. Failure to follow the management plan can result in the loss of Managed Forest Law designation and an assessment of withdrawal taxes and fees.

Forest Crop Law Program

The Forest Crop Law Program was retired in 1986 and is in the process of being phased out. It is considered a legacy program for previously enrolled acreages. All new enrollments and changes of ownership are directed to the Managed Forest Law Program. Almost 114,000 acres of private land remain enrolled under the Forest Crop Law Program.

3.4 Michigan Covered Lands

Covered lands in Michigan include state, private (including Tribal), municipal, and county lands. In the Lower Peninsula, State DNR lands are scattered and relatively sparse due to human development. Some State DNR landholdings can be found in the Allegan pine plains, the morainal region north of Detroit, and along major rivers (Figure 3-15). In the northern Lower Peninsula large blocks of State DNR lands separate two units of the Huron-Manistee National Forest. Private ownership comprises the majority of forestland in the southern Lower Peninsula. The eastern Upper Peninsula is predominantly State DNR lands, with two units of the Hiawatha National Forest on either side of the State DNR lands. The Seney National Wildlife Refuge, a vast wetland mosaic with scattered old forest patches, lies between these two units. A large block of State DNR lands occurs in the western Upper Peninsula, with smaller blocks in the Huron Mountains, the Keweenaw Peninsula, and along Green Bay. Private and county forestlands lie between public forestlands in the northern Lower and Upper Peninsulas (Figure 3-15).

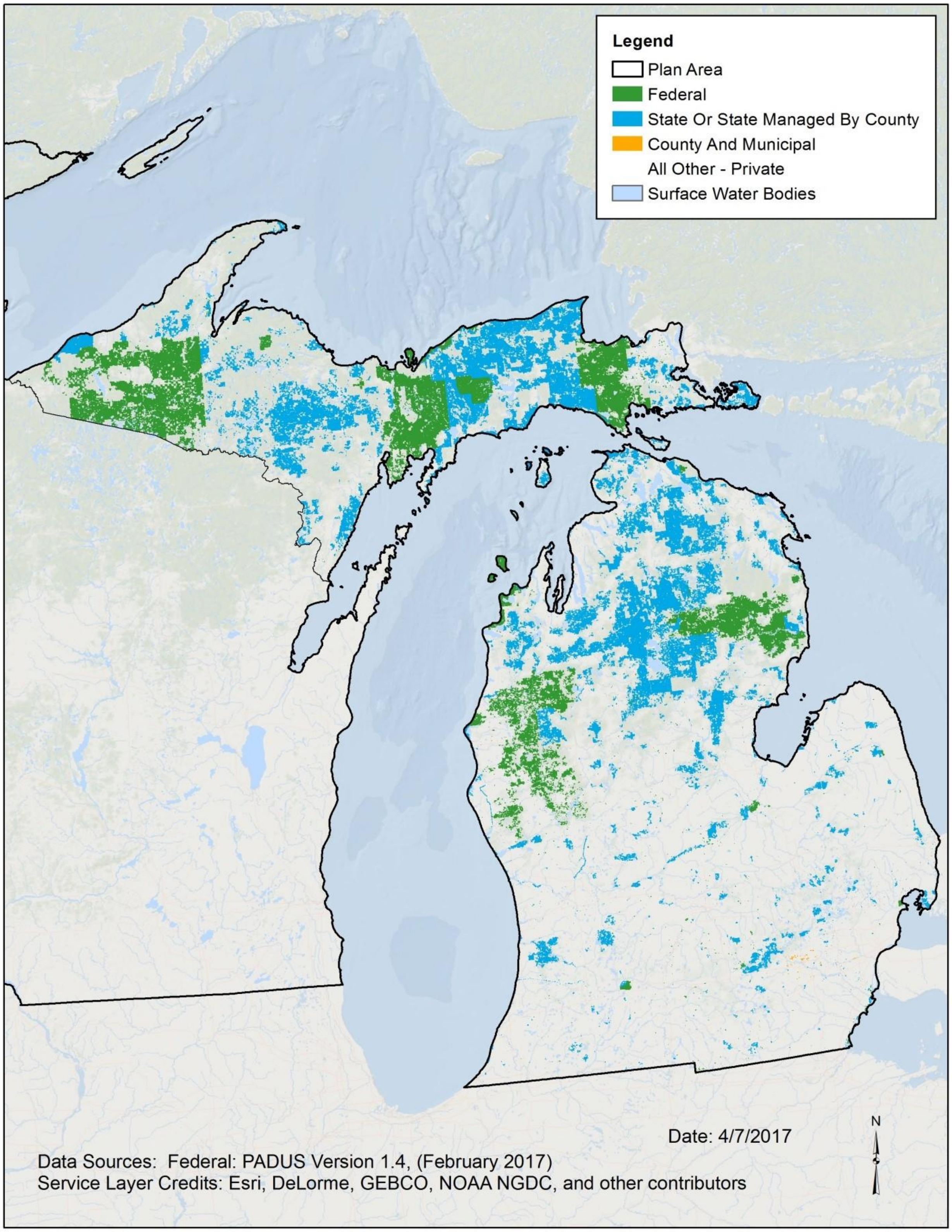


Figure 3-15. Michigan Lands by Ownership Type

3.4.1 Forest Type Distribution

Forestland in Michigan is found throughout the state, but in the southern two-thirds of the Lower Peninsula it is a small proportion of landcover because of extensive agriculture and urban/suburban development. In the northern Lower and entire Upper Peninsulas, forest is the dominant landcover.

In the southern Lower Peninsula, maple/beech/birch and oak/hickory are the predominant forest types. In the northern Lower Peninsula and eastern Upper Peninsula aspen/birch and smaller areas of white/red/jack pine forest predominate. The eastern Upper Peninsula's forestland consists of a complex mosaic of types: aspen/birch, white/red/jack pine, and in lowlands, spruce/fir. In the western Upper Peninsula, maple/beech/birch predominates, with large expanses of aspen-birch. There remain but few remnants of old growth, long-lived conifer stands like those that once dominated the northern portion of the state. Table 3-5 shows other landcover classes within the state. Table 3-6 shows the forested landcover classes addressed by the Lake States HCP (i.e., State DNR, county and municipal, and private lands). Figure 3-16 displays the landcover classes, including forestlands, within the state.

Table 3-5. Michigan Landcover Class Acreages and Percentages

Landcover Class	Acres [a]	% of Total
Forested	20,310,876	54.6%
Open water	978,215	2.6%
Barren land	171,835	0.5%
Emergent herbaceous wetlands	686,992	1.8%
Grassland/pasture/cultivated	11,124,993	29.9%
Low/medium-intensity development	3,717,082	10.0%
High-intensity development	211,680	0.6%

Notes:

[a] NLCD acres and USFS FIA acres do not match exactly and are not interchangeable across tables, thus, acres of forested landcover are not totaled.

Source: National Land Cover Database 2017; U.S. Forest Service 2017

Table 3-6. Michigan Nonfederal Forestland by Ownership Type

			Nonfederal Ownership Type					
	Total		State DNR		County and Municipal		Private	
Forestland Type	Acres	% of Forest Types	Acres	% All Nonfederal Forestland	Acres	% All Nonfederal Forestland	Acres	% All Nonfederal Forestland
Forested	17,028,369	NA	4,208,397	24.7%	434,749	2.6%	12,385,223	72.7%
Shrub/scrub	130,451	0.8%	30,493	0.2%	3,853	0.02%	96,105	0.6%
Coniferous forest	3,827,446	22.5%	1,411,579	8.3%	73,770	0.4%	2,342,097	13.8%
Deciduous/-mixed forest	11,083,626	65.1%	2,524,216	14.8%	298,077	1.8%	8,261,333	48.5%
Woody wetlands	1,986,846	11.7%	242,109	1.4%	59,049	0.3%	1,685,688	9.9%

Source: U.S. Forest Service 2017

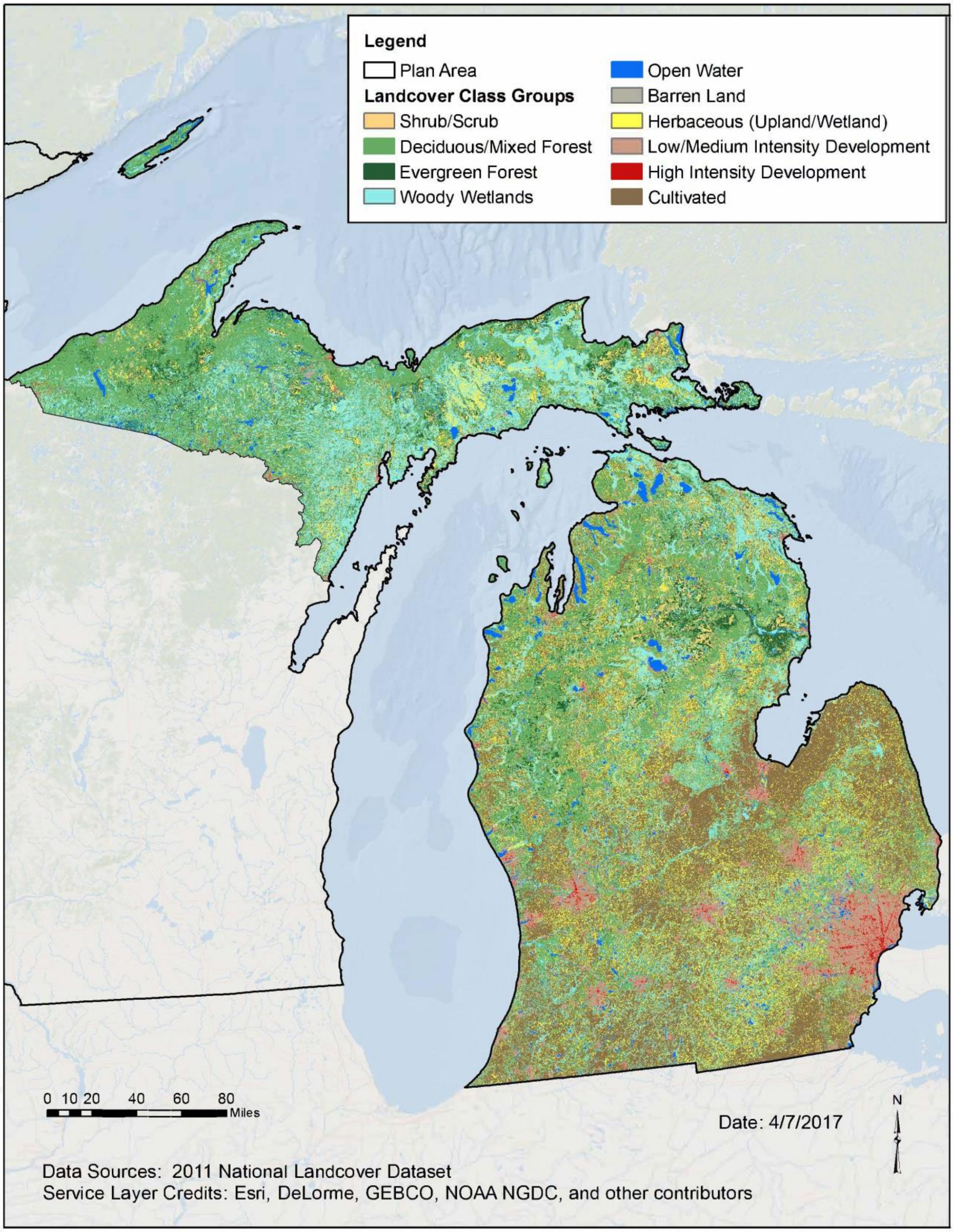


Figure 3-16. Michigan Landcover Class Groups

3.4.2 Modeled Species Distribution

The following section discusses the expected modeled distribution of the covered species on covered lands in Michigan. Tables 3-7 and 3-8 show the seasonal modeled distribution of covered bats by habitat quality for all covered lands and State DNR lands only, respectively. As described in Section 3.2.5.1*, Overview*, the exact location of individual bats is unknown. Thus, bats were assumed to be evenly distributed within various seasonal habitats (i.e., summer, spring/fall) with 10 times more bats found in high- versus low-quality habitat.

3.4.2.1 Indiana Bat

The only known active hibernaculum for the Indiana bat in Michigan is located at the spillway of Tippy Dam. During fall and spring, the species is likely to be found within 5 miles of this hibernaculum in high- and low-quality forest types as outlined in Table 3-2. In addition, Indiana bats that hibernate in Kentucky, Ohio, and Indiana are present in Michigan during the summer. All Indiana bats in the summer are assumed restricted to portions of the Lower Peninsula of Michigan within the average migratory distance (429 kilometers or 267 miles) (Rockey et al. 2013).

The approach for describing the modeled distribution of Indiana bats is found in Section 3.2.5.2, *Indiana Bat*. High- and low-quality habitat for bats is identified in Table 3-2, and modeled bat distribution by season is identified in Table 3-3. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season.

3.4.2.2 Northern Long-Eared Bat

Northern long-eared bats are known to hibernate at 77 sites in Michigan, including mines, caves, and the spillway at Tippy Dam. During fall and spring, it is likely the species occurs within 5 or 10 miles of these hibernacula in high- and low-quality forest types identified in Table 3-2. During summer, it is likely that the species is found throughout forested habitat in the state. Although covered bats may be found using Open Water, Cultivated Crops, Developed High Intensity, and Developed Medium Intensity, these land cover types are not considered high- or low-quality forest habitat for covered bats due to a lack of potential impacts under the Lake States HCP.

The approach for describing modeled distribution of northern long-eared bat is described in Section 3.2.5.3, *Northern Long-Eared Bat*. High- and low-quality habitat for bats is identified in Table 3-2, and modeled bat distribution by season is identified in Table 3-3. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season.

3.4.2.3 Little Brown Bat

Little brown bats are known to hibernate at 81 sites in Michigan, which include natural caves, mines, surge tunnels, and the spillway at Tippy Dam. Seven of these sites, mostly abandoned mines in the Upper Peninsula, have historically contained 10,000 or more little brown bats during winter. Little brown bats are modeled to occur within 10 miles of these large hibernacula during fall and spring as described in Table 3-3. At smaller sites, little brown bats are expected to occur within the same landcover classes within 5 miles of the hibernaculum.

Table 3-7. Modeled Seasonal Distribution of Covered Bats in Michigan by Habitat Quality

Modeled Habitat by Season [a]	Acres of Forested Habitat by Quality (% Total) [b]				Estimated Total Number of Bats in Modeled Seasonal Habitat [c]	Bats Per Acre [d]	
	High		Low			High	Low
Winter Habitat							
≤0.25 mile around hibernaculum	26	(51%)	25	(49%)	16 Indiana bats	0.55	0.05
	37,102	(57%)	27,858	(43%)	85,000 little brown bats	2.13	0.21
	197,010	(78%)	55,151	(22%)	10,855 northern long-eared bats	0.05	0.01
	4,055	(77%)	1,178	(23%)	10 tricolored bats	< 0.01	< 0.01
Fall/Spring							
≤5 miles around hibernacula with <10,000 bats	31,957	(75%)	10,784	(25%)	16 Indiana bats	< 0.01	< 0.01
	695,870	(78%)	192,663	(22%)	72,250 little brown bats (large hibernacula)	0.10	0.01
	626,935	(79%)	165,583	(21%)	12,750 little brown bats (small hibernacula)	0.02	< 0.01
≤10 miles around hibernacula with >10,000	695,870	(78%)	192,663	(22%)	9,227 northern long-eared bats (large hibernacula)	0.01	< 0.01
	669,293	(80%)	165,593	(20%)	1,628 northern long-eared bats (small hibernacula)	< 0.01	< 0.01
	312,837	(76%)	96,305	(24%)	10 tricolored bats	< 0.01	< 0.01
Early Summer [e]							
All forested lands	3,780,278	(89%)	485,046	(11%)	318 Indiana bats	< 0.01	< 0.01
	7,326,831	(78%)	2,010,343	(22%)	12,838 little brown bats (large hibernacula)	0.04	< 0.01
	8,844,172	(80%)	2,251,597	(20%)	13,676 little brown bats (broader landscape)	0.01	< 0.01
	16,171,003	(79%)	4,261,940	(21%)	10,855 northern long-eared bats	< 0.01	< 0.01
	9,908,015	(80%)	2,553,973	(20%)	10 tricolored bats	< 0.01	< 0.01
Nonvolant Pups [f]							
All forested lands	3,780,278	(89%)	485,046	(11%)	287 Indiana bats	< 0.01	< 0.01
	7,326,831	(78%)	2,010,343	(22%)	6,419 little brown bats (near large hibernacula)	0.01	< 0.01
	8,844,172	(80%)	2,251,597	(20%)	6,838 little brown bats (broader landscape)	0.01	< 0.01
	16,171,003	(79%)	4,261,940	(21%)	5,428 northern long-eared bats	< 0.01	< 0.01
	9,908,015	(80%)	2,553,973	(20%)	10 tricolored bats	< 0.01	< 0.01

Modeled Habitat by Season [a]	Acres of Forested Habitat by Quality (% Total) [b] High		Low		Estimated Total Number of Bats in Modeled Seasonal Habitat [c]	Bats Per Acre [d] High	Low
Once Pups are Flying							
All forested lands	3,780,278	(89%)	485,046	(11%)	605 Indiana bats	< 0.01	< 0.01
	7,326,831	(78%)	2,010,343	(22%)	19,257 little brown bats (near large hibernacula)	0.02	< 0.01
	8,844,172	(80%)	2,251,597	(20%)	20,514 little brown bats (broader landscape)	0.02	< 0.01
	16,171,003	(79%)	4,261,940	(21%)	16,283 northern long-eared bats	< 0.01	< 0.01
	9,908,015	(80%)	2,553,973	(20%)	20 tricolored bats	< 0.01	< 0.01

Notes:

[a] See Table 3.3 and Section 3.2.5, *Modeled Species Distribution*, for an explanation of modeled seasonal habitat.

[b] Acres of habitat by quality were generated by calculating the proportion of high- or low-quality forest type (Table 3.2) within the state and using that proportion within each category of modeled seasonal habitat.

[c] The total number of bats in the state was generated based on post-WNS (after 2011) population estimates described in Section 3.2.5 for each species. Population numbers are limited to the forested suitable habitat excluding non-forested habitat and anthropogenic structures.

[d] Bats per acre are calculated by distributing the number of bats in the state at different times of year across the acres of high- and low-quality habitat assuming ten times as many bats are in high- rather than low-quality habitat per Table 3.3.

[e] The number or early summer bats includes overwintering bats and (for Indiana bats) individuals that migrate in from other states as described in Section 3.2.5.2, *Indiana Bat, Modeled Distribution and Population Estimates, Summer.* For little brown bats, half of all adults are assumed to use anthropogenic structures and, thus, are not included as present in modeled seasonal habitat. Further, half of the remaining little brown bats are assumed to be within 100 kilometers of a major hibernaculum, while the other half are assumed to occur elsewhere on the broader forested landscape (see Section 3.2.5.4, *Little Brown Bat, Modeled Distribution and Population Estimates, Summer*, for more details).

[f] The number of nonvolant pups is estimated at one pup per female for Indiana, little brown, and northern long-eared bats. The estimated number of nonvolant pups for tricolored bats is two pups per female (Table 3.3).

Table 3-8. Modeled Seasonal Distribution of Covered Bats in Michigan by Habitat Quality for State DNR Lands Only

Modeled Habitat by Season	Covered Bat Species	Acres of Forested Habitat by Quality (% DNR)			
		High		Low	
Winter Habitat					
≤0.25 mile around hibernaculum	Indiana bats	-	-	-	-
	Little brown bats	426.42	(0.01%)	67.96	(< 0.01%)
	Northern long-eared bats	433.09	(0.01%)	78.42	(< 0.01%)
	Tricolored bats	122.15	(< 0.01%)	50.20	(< 0.01%)
Fall/Spring					
≤ 10 miles around large hibernacula (>10,000 bats) ≤ 5 miles around small hibernacula (<10,000 bats)	Indiana bats	-	-	-	-
	Little brown bats (large hibernacula)	90,942	(1.93%)	19,206	(0.41%)
	Little brown bats (small hibernacula)	75,512	(1.61%)	15,571	(0.33%)
	Northern long-eared bats (large hibernacula)	90,942	(1.93%)	19,206	(0.41%)
	Northern long-eared bats (small hibernacula)	78,940	(1.68%)	15,385	(0.33%)
	Tricolored bats	41,359	(0.88%)	10,608	(0.23%)
Summer					
All forested lands	Indiana bats	309,863	(6.59%)	29,955	(0.64%)
	Little brown bats (near large hibernacula)	1,243,891	(26.45%)	303,326	(6.45%)
	Little brown bats (broader landscape)	1,974,074	(41.98%)	561,383	(11.94%)
	Northern long-eared bats	3,217,965	(68.43%)	864,709	(18.39%)
	Tricolored bats	335,592	(7.14%)	776,483	(16.51%)

During summer, little brown bats may use anthropogenic structures as roosts in addition to forested habitats. This species is expected to be found in structures as well as on the forest types outlined in Table 3-2. For the purposes of future analyses, bats in anthropogenic structures are not assessed.

The approach for describing modeled distribution of little brown bat is described in Section 3.2.5.4, *Little Brown Bat*. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season.

3.4.2.4 Tricolored Bat

The tricolored bat is known to hibernate at 34 sites in Michigan, including caves, mines, and the spillway at Tippy Dam. Tricolored bats are modeled to occur within 5 miles of these hibernacula during fall and spring as described in Table 3-3. During summer, the species occurs sporadically on the landscape, concentrated in the lower portion of the state, along Lake Michigan. Most tricolored bats summer within 85 kilometers of their hibernacula (Center for Biological Diversity and Defenders of Wildlife 2016).

The approach for describing modeled distribution of tricolored bat is described in Section 3.2.5.5, *Tricolored Bat*. Covered bats at risk of being taken by covered activities are those present in high- and low-quality forests during the active dates for each season.

3.5 Minnesota Covered Lands

Covered lands in Minnesota include state, private (including Tribal), municipal, and county lands. State lands are most common in the northeastern forested part of the state, with large blocks from the Nemadji State Forest at the Wisconsin line north and northwestward to Rainy Lake and Lake of the Woods (Figure 3-17). State DNR lands are also distributed in small parcels across the rest of the state. Much of this State DNR land is managed by county governments. These large blocks under state ownership are interspersed with federal forestland in the Chippewa and Superior National Forests. The latter is the location of the (federally owned) Boundary Waters Canoe Area Wilderness, with Voyageurs National Park lying just to the west. Private forestland is much more extensive than public forestland in the Driftless Area but is interspersed with the extensive public holdings in the other forested regions of the state.

3.5.1 Forest Type Distribution

Forestland in Minnesota is distributed statewide. Although forest has encroached significantly into the prairie region, the most extensive and best-developed forests today are in the Driftless Area, along large rivers, and in the northeastern third of Minnesota.

In the southeastern Driftless Area, oak/hickory prevails, with elm/ash/cottonwood in river bottoms and the maple/beech/birch type (with basswood but absent beech, which does not occur in the state) on northerly-facing slopes (Figure 3-18). The forest along the transition zone, angling from the northwest to the southeast is predominantly maple/beech/birch and aspen/birch. In the northern to northeastern third of the state, aspen/birch is the dominant forest type, with extensive spruce/fir forest in peatlands and lowland settings. White/red/jack pine forests are present but not extensive. At the southern edge of the northern coniferous-deciduous forest region are found oak/pine forests.

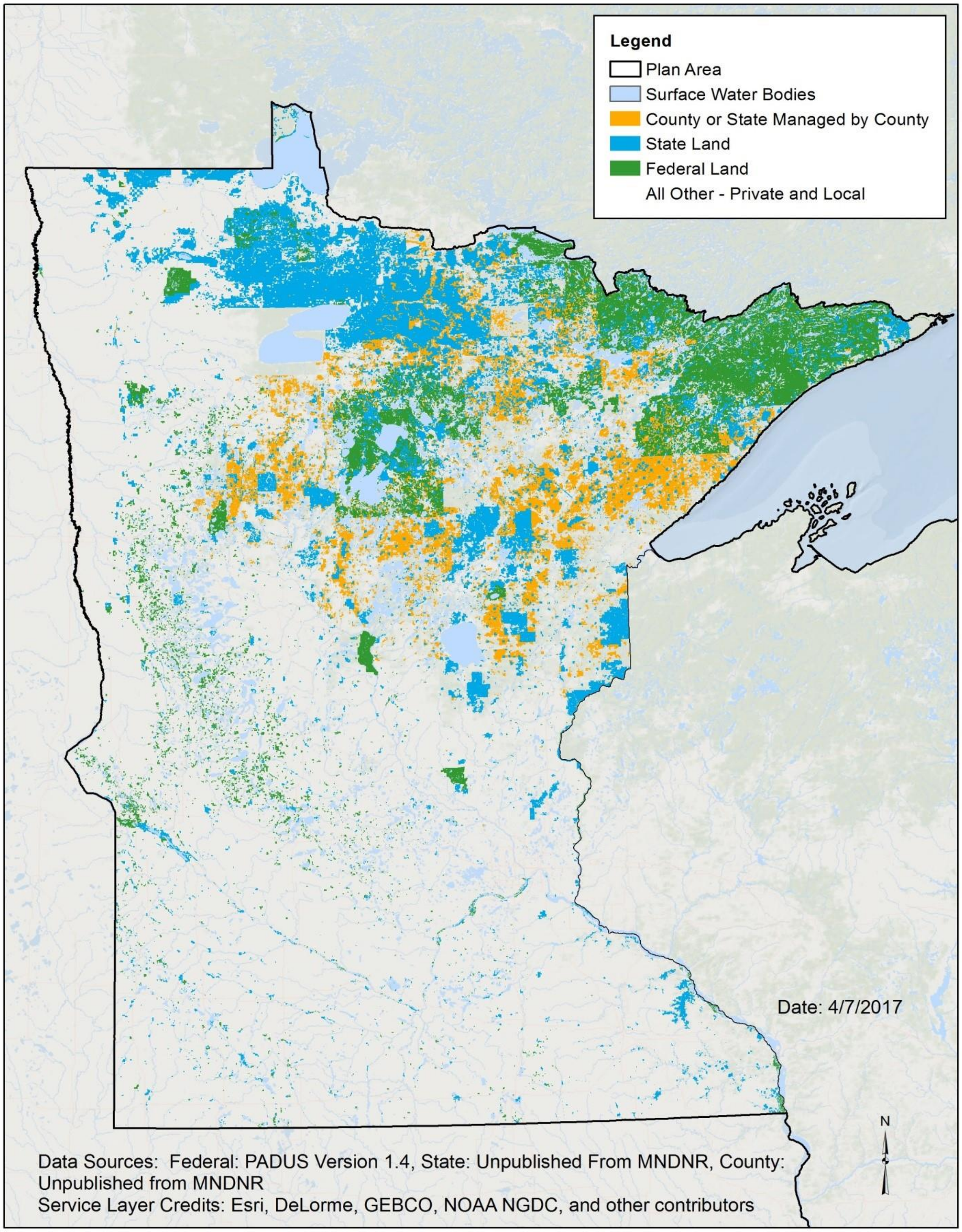


Figure 3-17. Minnesota Lands by Ownership Type

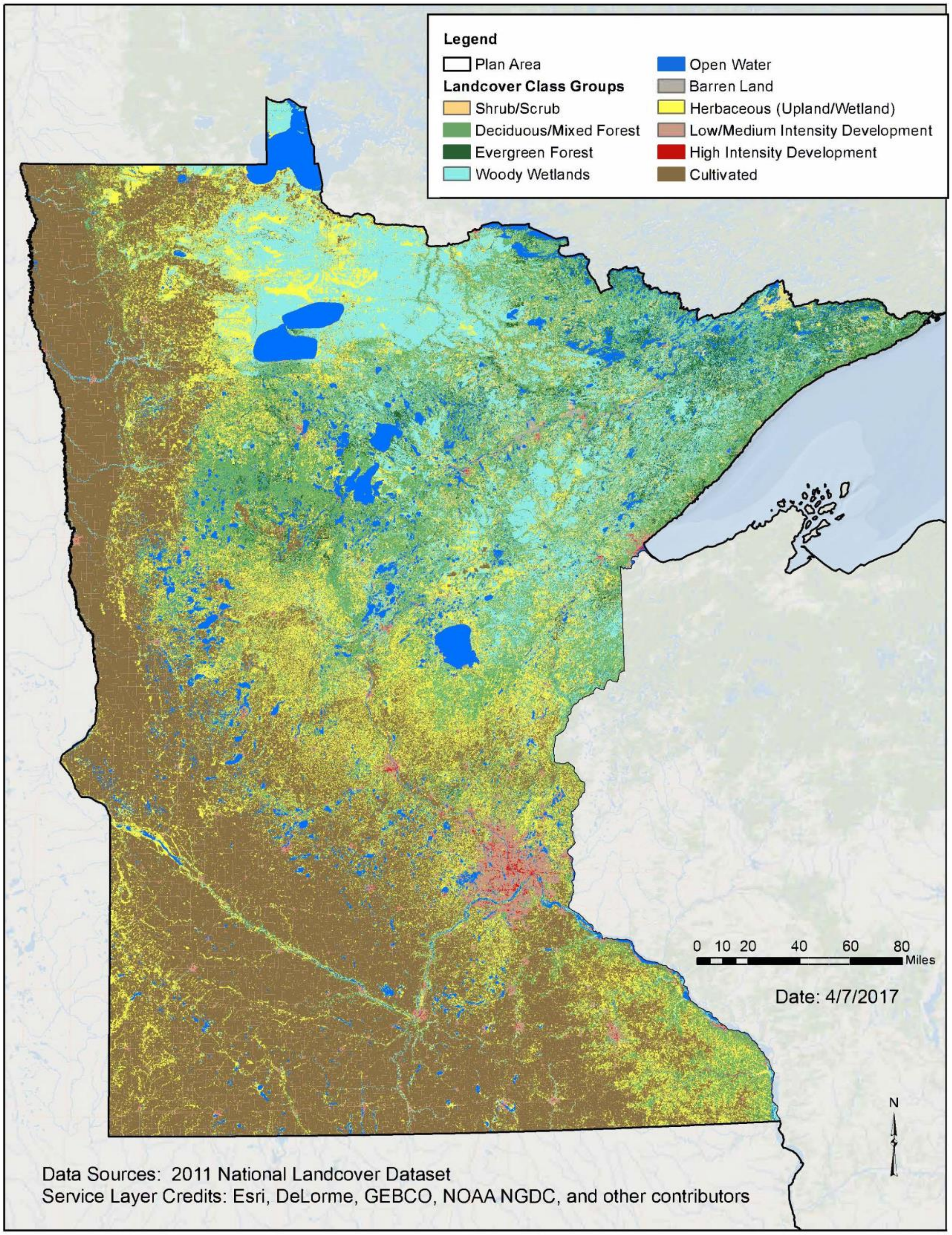


Figure 3-18. Minnesota Landcover Class Groups

Current forests are different from historical forests that existed before large-scale logging between 1850 and the early 1900s. The dramatic changes in this period resulted in some elements of the forest becoming rarer than before, despite their previous persistence in the landscape. Rarer elements of Minnesota's forestland than in the early 1800s are long-lived conifer species (white pine, white cedar) and old-growth stands. Extensive forested areas were always rare in the southern to northwestern third of the state, but in the third of the state between the prairie region and northeastern state, extensive forests are in wet, steep, or sandy areas where land was difficult to farm. Table 3-9 shows other landcovers in Minnesota and Table 3-10 shows forestland by ownership type.

Table 3-9. Minnesota Landcover Class Acreages and Percentages

Landcover Class	Acres [a]	Percent (%)
Forested	17,412,529	32.9%
Open water	3,294,278	6.2%
Barren land	80,760	0.2%
Emergent herbaceous wetlands	3,505,114	6.6%
Grassland/pasture/cultivated	25,505,176	48.2%
Low/medium-intensity development	2,981,808	5.6%
High-intensity development	104,757	0.2%

Notes:

[a] NLCD acres and USFS FIA acres do not match exactly and are not interchangeable across tables, thus, acres of forested landcover are not totaled.

Source: National Land Cover Database 2017; U.S. Forest Service 2017

Table 3-10. Minnesota Nonfederal Forestland by Ownership Type

			Nonfederal Ownership Type					
	Total		State DNR		County and Municipal		Private and Tribal [a]	
Forestland Type	Acres	% of Forest Types	Acres	% All Nonfederal Forestland	Acres	% All Nonfederal Forestland	Acres	% All Nonfederal Forestland
Forested	**14,573,330**	**NA**	**3,848,586**	**26.4%**	**2,574,362**	**17.7%**	**8,150,382**	**55.9%**
Shrub/scrub	174,739	1.2%	53,592	0.4%	32,778	0.2%	88,369	0.6%
Coniferous forest	3,987,644	27.4%	1,892,571	13.0%	735,769	5.0%	1,359,304	9.3%
Deciduous/mixed forest	8,893,259	61.0%	1,642,313	11.3%	1,580,947	10.8%	5,669,999	38.9%
Woody wetlands	1,517,688	10.4%	260,110	1.8%	224,868	1.5%	1,032,710	7.1%

[a] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the “Native American” owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

Source: U.S. Forest Service 2017

3.5.2 Modeled Species Distribution

The following discusses the expected modeled distribution of the covered species on covered lands in Minnesota. As noted in Chapter 1, *Introduction*, the Indiana bat is not known to occur in Minnesota. Table 3-11 and Table 3-12 show the modeled seasonal distribution of covered bats by habitat quality for all covered lands and State DNR lands only, respectively. As described in Section 3.2.5.1, *Overview*, the exact location of individual bats is unknown. Thus, bats were assumed to be evenly distributed within various seasonal habitats (i.e., summer, spring/fall) with 10 times more bats found in high- versus low-quality habitat.

3.5.2.1 Northern Long-Eared Bat

The northern long-eared bat is known to hibernate at 28 sites in Minnesota, including caves and mines. During fall and spring, it is likely the species occurs within 5 miles of these hibernacula in high- and low-quality forest types identified in Table 3-2. During summer, it is likely that the species is found throughout forested habitat in the state. Although covered bats may be found using Open Water, Cultivated Crops, Developed High Intensity, and Developed Medium Intensity landcover types, these landcover types are not considered high- or low-quality forest habitat for covered bats due to a lack of potential impacts under the Lake States HCP.

The approach for describing modeled distribution of northern long-eared bat is described in Section 3.2.5.3, *Northern Long-Eared Bat*. High- and low-quality habitat for bats is identified in Table 3-2, and bat modeled distribution by season is identified in Table 3-3. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season

3.5.2.2 Little Brown Bat

Little brown bats are known to hibernate in 23 or more sites throughout the eastern half of the state. One hibernaculum, Soudan Mine, historically contained more than 10,000 little brown bats during winter. Little brown bats are modeled to occur within 10 miles of these large hibernacula during fall and spring as described in Table 3-3. At smaller sites, little brown bats are expected to occur within the same landcover classes within 5 miles of the hibernacula.

During summer, little brown bats may use anthropogenic structures as roosts in addition to forested habitats. This species is expected to be found in structures, as well as on the forest types outlined in Table 3-2. For the purposes of future analyses, bats in anthropogenic structures are not assessed.

The approach for describing modeled distribution of little brown bats is described in Section 3.2.5.4, *Little Brown Bat*. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season.

3.5.2.3 Tricolored Bat

Tricolored bats are known to hibernate in 21 sites in Minnesota, often in small numbers at caves, mines, and similar underground structures within the state. During fall and spring, the species is expected occur within 5 miles of these hibernacula entrances. Most tricolored bats summer within 85 kilometers of their hibernacula (Center for Biological Diversity and Defenders of Wildlife 2016).

The approach for describing modeled distribution of tricolored bat is described in Section 3.2.5.5, *Tricolored Bat*. Covered bats at risk of being taken by covered activities are those present in high- and low-quality forest types during the active dates for each season.

During summer, the species occurs sporadically in the southern portion of the state and within 85 miles of suitable hibernacula. Within this 85-mile area, tricolored bats are likely to occur in all land classes except Open Water, Cultivated Crops, Developed High Intensity, and Developed Medium Intensity. The modeled distribution of bats that roost in forested habitat (i.e., those at risk of take) is outlined in Tables 3-11 and 3-12.

Table 3-11. Modeled Seasonal Distribution of Covered Bats in Minnesota by Habitat Quality

Modeled Habitat By Season [a]	Acres of Forested Habitat by Quality (% State) [b]				Estimated Total Number of Bats in Modeled Seasonal Habitat [c]	Bats Per Acre [d]	
	High		Low			High	Low
Winter Habitat							
≤0.25 mile	140	(40%)	209	(60%)	4,250 little brown bats	26.36	2.64
	7,952	(53%)	6,990	(47%)	8,781 northern long-eared bats	1.01	0.10
	1,218	(72%)	472	(28%)	100 tricolored bats	0.08	0.01
Fall/Spring							
≤5 miles except for hibernacula with >10,000 bats	122,817	(66%)	62,787	(34%)	3,613 little brown bats (large hibernacula)	0.03	<0.01
	161,312	(71%)	64,777	(29%)	638 little brown bats (small hibernacula)	<0.01	<0.01
	122,817	(66%)	62,787	(34%)	7,464 northern long-eared bats (large hibernacula)	0.06	0.01
	343,891	(62%)	210,948	(38%)	1,317 northern long-eared bats (small hibernacula)	<0.01	<0.01
	266,218	(69%)	121,292	(31%)	100 tricolored bats	<0.01	<0.01
Early Summer [e]							
All forested lands	4,256,531	(69%)	1,924,070	(31%)	7,587 little brown bats (near large hibernacula)	0.01	<0.01
	9,404,956	(76%)	2,948,380	(24%)	14,626 little brown bats (broader landscape)	0.01	<0.01
	13,661,487	(74%)	4,872,450	(26%)	8,781 northern long-eared bats	<0.01	<0.01
	8,345,931	(71%)	3,393,876	(29%)	100 tricolored bats	<0.01	<0.01
Nonvolant Pups [f]							
All forested lands	4,256,531	(69%)	1,924,070	(31%)	3,794 little brown bats (near large hibernacula)	0.01	<0.01
	9,404,956	(76%)	2,948,380	(24%)	7,313 little brown bats (broader hibernacula)	0.01	<0.01
	13,661,487	(74%)	4,872,450	(26%)	4,390 northern long-eared bats	<0.01	<0.01
	8,345,931	(71%)	3,393,876	(29%)	100 tricolored bats	<0.01	<0.01
Once Pups are Flying							
All forested lands	4,256,531	(69%)	1,924,070	(31%)	11,381 little brown bats (near large hibernacula)	0.02	<0.01
	9,404,956	(76%)	2,948,380	(24%)	21,940 little brown bats (broader hibernacula)	0.02	<0.01
	13,661,487	(74%)	4,872,450	(26%)	13,171 northern long-eared bats	<0.01	<0.01
	8,345,931	(71%)	3,393,876	(29%)	200 tricolored bats	<0.01	<0.01

Notes:

[a] See Table 3.3 and Section 3.2.5, *Modeled Species Distribution*, for an explanation of modeled seasonal habitat.

[b] Acres of habitat by quality were generated by calculating the proportion of high- or low-quality forest type (Table 3.2) within the state and using that proportion within each category of modeled seasonal habitat.

[c] The total number of bats in the state was generated based on post-WNS (after 2011) population estimates described in Section 3.2.5 for each species. Population numbers are limited to the forested suitable habitat excluding non-forested habitat and anthropogenic structures.

[d] Bats per acre are calculated by distributing the number of bats in the state at different times of year across the acres of high- and low-quality habitat assuming ten times as many bats are in high- rather than low-quality habitat per Table 3.3.

[e] The number or early summer bats includes overwintering bats and (for Indiana bats) individuals that migrate in from other states as described in Section 3.2.5.2, *Indiana Bat, Modeled Distribution and Population Estimates, Summer*. For little brown bats, half of all adults are assumed to use anthropogenic structures and, thus, are not included as present in modeled seasonal habitat. Further, half of the remaining little brown bats are assumed to be within 100 km of a major hibernaculum, while the other half are assumed to occur elsewhere on the broader forested landscape (see Section 3.2.5.4, *Little Brown Bat, Modeled Distribution and Population Estimates, Summer*, for more details).

Table 3-12. Modeled Seasonal Distribution of Covered Bats in Minnesota by Habitat Quality for State DNR Lands Only

		Acres of Forested Habitat by Quality (% DNR)			
Modeled Habitat by Season	**Covered Bat Species**	**High**		**Low**	
Winter Habitat					
≤0.25 mile around hibernaculum	Little brown bats	161.80	(< 0.01%)	72.83	(< 0.01%)
	Northern long-eared bats	123.63	(< 0.01%)	60.52	(< 0.01%)
	Tricolored bats	188.57	(< 0.01%)	78.97	(< 0.01%)
Fall/Spring					
≤ 10 miles around large hibernacula (>10,000 bats) ≤ 5 miles around small hibernacula (<10,000 bats)	Little brown bats (large hibernacula)	21,499	(0.38%)	6,059	(0.11%)
	Little brown bats (small hibernacula)	22,430	(0.40%)	7,925	(0.14%)
	Northern long-eared bats (large hibernacula)	21,499	(0.38%)	6,059	(0.11%)
	Northern long-eared bats (small hibernacula)	22,053	(0.39%)	7,879	(0.14%)
	Tricolored bats	26,941	(0.48%)	9,285	(0.17%)
Summer					
All forested lands	Little brown bats (near large hibernacula)	785,559	(13.97%)	189,035	(3.36%)
	Little brown bats (broader landscape)	2,829,178	(50.32%)	301,812	(5.37%)
	Northern long-eared bats	3,614,737	(64.29%)	490,847	(8.73%)
	Tricolored bats	199,615	(3.55%)	429,342	(7.64%)

3.6 Wisconsin Covered Lands

Covered lands in Wisconsin include state, private (including Tribal), municipal, and county lands. These lands are most common in the northern third of the state (Figure 3-19). State DNR lands are predominantly located between the Chequamegon and Nicolet units of the National Forest but are found in smaller areas elsewhere in northern Wisconsin. County forestlands are distributed across the northern third of the state. In Wisconsin's southern two-thirds, state, county, and federal ownership is concentrated at discrete locations, often incorporating unusual landscape features, such as the Kettle Moraine, or wildlife concentration areas, such as Horicon Marsh.

3.6.1 Forest Type Distribution

Forestland in Wisconsin is distributed across the state. In the state's southern two-thirds, it is a small fraction of the total land area due to agriculture and urban/suburban development (Figure 3-20).

In the southwestern Driftless Area, oak/hickory prevails, with elm/ash/cottonwood in river bottoms and maple/beech/birch on northerly-facing slopes (although beech is limited in Wisconsin to a band near Lake Michigan, it is included in the name of the forest type [Carpenter 1974]). The forest in the state's southeastern quarter is highly fragmented and consists primarily of oak/hickory with areas of maple/beech/birch and elm/ash/cottonwood along rivers. Maple/beech/birch and aspen/birch dominate the northern third of the state up to the Michigan border, with large inclusions of white/red/jack pine forest. Spruce/fir in peatlands and lowlands are also present in this area. South of here, up to the Driftless Area, forest cover consists of small stands, except in the extensive central Wisconsin sand plains between Black River Falls and Baraboo, where oak/pine forest predominates. Current forests are different from historical forests that existed before large-scale logging between 1850 and 1950. The dramatic changes in this period resulted in some elements of the forest becoming rarer than before. Rare elements of Wisconsin's forestland are long-lived conifer species (hemlock, white pine, white cedar) and old-growth stands. Extensive forested areas are rare in the southern two-thirds of the state, except in the Driftless Areas and on the central Wisconsin sand plain. Table 3-13 shows other landcovers in Wisconsin and Table 3-14 shows forestland by ownership type.

Table 3-13. Wisconsin Landcover Class Acreages and Percentages

Landcover Class	Acres [a]	% of Total
Forested	17,056,970	47.6%
Open water	1,269,713	3.5%
Barren land	35,205	0.1%
Emergent herbaceous wetlands	1,068,672	3.0%
Grassland/pasture/cultivated	13,707,274	38.3%
Low/medium-intensity development	2,580,771	7.2%
High-intensity development	95,870	0.3%

Notes:

[a] NLCD acres and USFS FIA acres do not match exactly and are not interchangeable across tables, thus acres of forested landcover are not totaled.

Source: National Land Cover Database 2017; U.S. Forest Service 2017

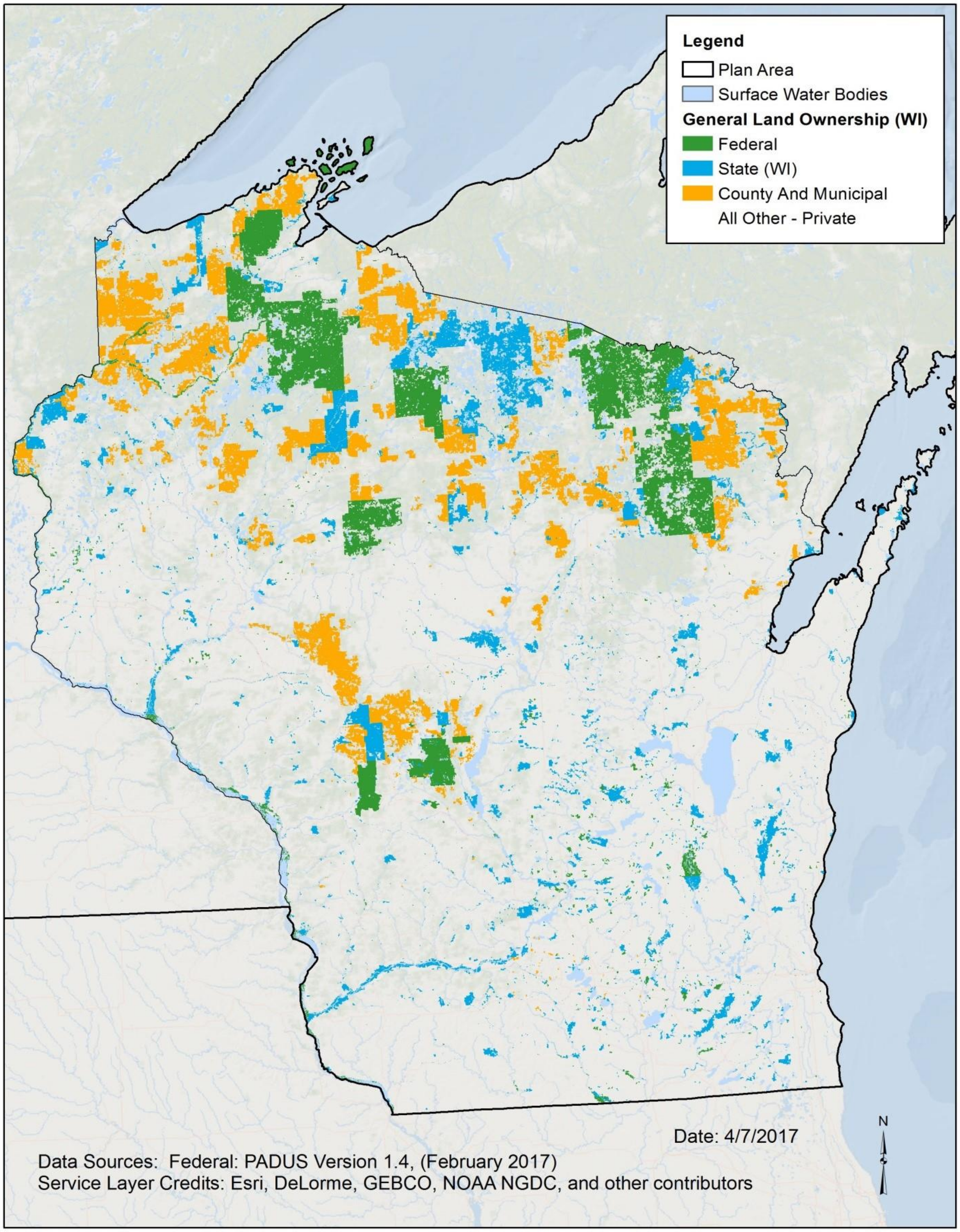


Figure 3-19. Wisconsin Lands by Ownership Type

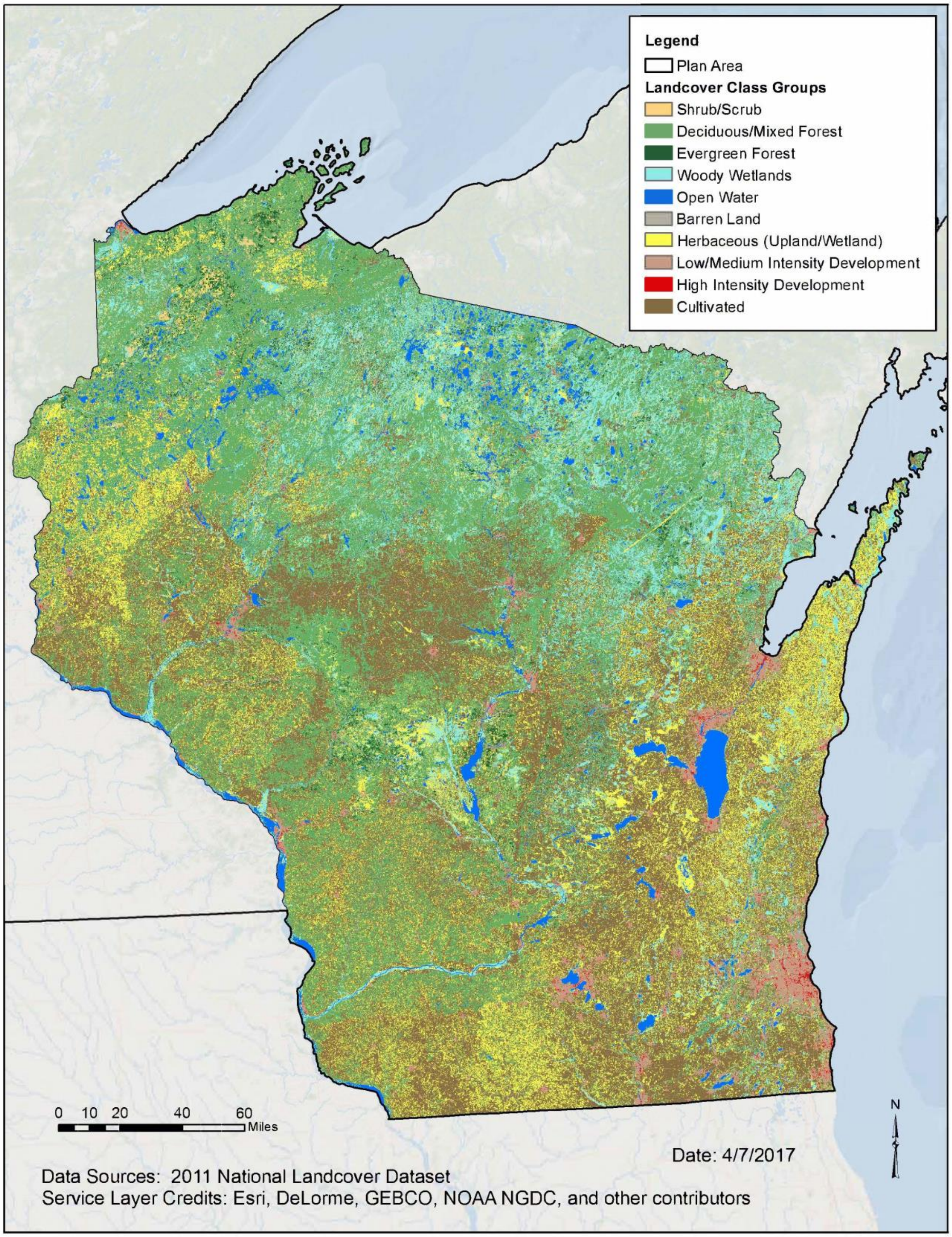


Figure 3-20. Wisconsin Landcover Class Groups

Table 3-14. Wisconsin Nonfederal Forestland by Ownership Type

			Nonfederal Ownership Type					
	Total		State DNR		County and Municipal		Private [a]	
Forestland Type	**Acres**	**% of Forest Types**	**Acres**	**% All Nonfederal Forestland**	**Acres**	**% All Nonfederal Forestland**	**Acres**	**% All Nonfederal Forestland**
Forested	**15,436,807**	**NA**	**1,192,782**	**7.7%**	**2,358,966**	**15.3%**	**11,885,059**	**77.0%**
Shrub/scrub	161,615	1.05%	24,953	0.16%	7,459	0.05%	129,203	0.84%
Coniferous forest	2,778,877	18.0%	290,984	1.89%	549,667	3.56%	1,938,226	12.56%
Deciduous/-mixed forest	10,783,977	69.86%	691,836	4.48%	1,599,061	10.36%	8,493,080	55.02%
Woody wetlands	1,712,338	11.09%	185,009	1.20%	202,779	1.31%	1,324,550	8.58%

Notes:
[a] Private lands data include Tribal lands.

3.6.2 Modeled Species Distribution

The following section discusses the expected modeled distribution of the covered species on covered lands within Wisconsin. Tables 3-15 and 3-16 show the seasonal modeled distribution of covered bats by habitat quality for all covered lands and State DNR lands only, respectively. As described in Section 3.2.5.1, *Overview*, the exact location of individual bats is unknown. Thus, bats were assumed to be evenly distributed within various seasonal habitats (i.e., summer, spring/fall) with 10 times more bats found in high- versus low-quality habitat.

3.6.2.1 Indiana Bat

A single historical record of a hibernating Indiana bat is known from Wisconsin, but this appears to have been a transient individual. The Indiana bat is not expected to occur in Wisconsin at any point in the year and is not expected to occupy any land classes in this state. The modeled distribution of bats that roost in forested habitat (i.e., those at risk of take) is outlined in Tables 3-1 and 3-2.[5]

3.6.2.2 Northern Long-Eared Bat

The northern long-eared bat is known to hibernate in at least 60 sites in Wisconsin, including caves and mines, and other suitable hibernacula.

During fall and spring, it is likely the species occurs within 5 or 10 miles of these hibernacula entrances in high- and low-quality forest types identified in Table 3-2. During summer, it is likely that the species is found throughout forested habitat in the state. Although covered bats may be found using Open Water, Cultivated Crops, Developed High Intensity, and Developed Medium Intensity, these landcover types are not considered high- or low-quality forest habitat for covered bats due to the lack of potential impact from the Lake States HCP.

The approach for describing modeled distribution of northern long-eared bat is described in Section 3.2.5.3, *Northern Long-Eared Bat*. High- and low-quality habitat for bats is identified in Table 3-2, and modeled bat distribution by season is identified in Table 3-3. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season.

3.6.2.3 Little Brown Bat

Little brown bats are known to hibernate in at least 52 sites in Wisconsin. Three of these sites historically contained 10,000 or more little brown bats during winter. Little brown bats are modeled to occur within 10 miles of these large hibernacula during fall and spring as described in Table 3-3. At smaller sites, little brown bats are expected to occur within the same landcover classes within 5 miles of the hibernaculum.

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[5] Although covered bats may be found using Open Water, Cultivated Crops, Developed High Intensity, and Developed Medium Intensity, these landcover types are not considered high- or low-quality forest habitat for covered bats.

Table 3-15. Modeled Seasonal Distribution of Covered Bats in Wisconsin by Habitat Quality

Modeled Habitat By Season [a]	Acres of Forested Habitat by Quality (% State) [b]				Estimated Total Number of Bats in Modeled Seasonal Habitat [c]	Bats Per Acre [d]	
	High		Low			High	Low
Winter Habitat							
≤0.25 mile	5,864	(72%)	2,235	(28%)	56,100 little brown bats	9.22	0.92
	32,510	(88%)	4,335	(12%)	2,113 northern long-eared bats	0.06	0.01
	25,017	(87%)	3,754	(13%)	230 tricolored bats	0.01	< 0.01
Fall/Spring							
≤5 miles except for hibernacula with > 10,000 bats	166,812	(88%)	22,101	(12%)	53,295 little brown bats (large hibernacula)	0.32	0.03
	670,434	(87%)	104,196	(13%)	2,805 little brown bats (small hibernacula)	< 0.01	< 0.01
	166,812	(88%)	22,101	(12%)	2,007 northern long-eared bats (large hibernacula)	0.01	< 0.01
	774,039	(86%)	125,642	(14%)	106 northern long-eared bats (small hibernacula)	< 0.01	< 0.01
	788,739	(88%)	108,423	(12%)	230 tricolored bats	< 0.01	< 0.01
Early Summer [e]							
All forested lands	9,154,011	(84%)	1,761,326	(16%)	15,912 little brown bats (near large hibernacula)	0.01	< 0.01
	5,226,638	(84%)	1,020,798	(16%)	8,035 little brown bats (broader landscape)	0.01	< 0.01
	14,380,649	(84%)	2,782,124	(16%)	2,113 northern long-eared bats	< 0.01	< 0.01
	6,431,046	(83%)	1,360,493	(17%)	230 tricolored bats	< 0.01	< 0.01
Nonvolant Pups [f]							
All forested lands	9,154,011	(84%)	1,761,326	(16%)	7,956 little brown bats (near large hibernacula)	0.01	< 0.01
	5,226,638	(84%)	1,020,798	(16%)	4,018 little brown bats (broader hibernacula)	0.01	< 0.01
	14,380,649	(84%)	2,782,124	(16%)	1,056 northern long-eared bats	< 0.01	< 0.01
	6,431,046	(83%)	1,360,493	(17%)	230 tricolored bats	< 0.01	< 0.01
Once Pups are Flying							
All forested lands	9,154,011	(84%)	1,761,326	(16%)	23,868 little brown bats (near large hibernacula)	0.02	< 0.01
	5,226,638	(84%)	1,020,798	(16%)	12,053 little brown bats (broader hibernacula)	0.02	< 0.01
	14,380,649	(84%)	2,782,124	(16%)	3,169 northern long-eared bats	< 0.01	< 0.01
	6,431,046	(83%)	1,360,493	(17%)	460 tricolored bats	< 0.01	< 0.01

Notes:

[a] See Table 3.3 and Section 3.2.5, *Modeled Species Distribution*, for an explanation of modeled seasonal habitat.

[b] Acres of habitat by quality were generated by calculating the proportion of high- or low-quality forest type (Table 3.2) within the state and using that proportion within each category of modeled seasonal habitat.

[c] The total number of bats in the state was generated based on post-WNS (after 2011) population estimates described in Section 3.2.5 for each species. Population numbers are limited to the forested suitable habitat excluding nonforested habitat and anthropogenic structures.

[d] Bats per acre are calculated by distributing the number of bats in the state at different times of year across the acres of high- and low-quality habitat assuming ten times as many bats are in high- rather than low-quality habitat per Table 3.3.

[e] The number or early summer bats includes overwintering bats and (for Indiana bats) individuals that migrate in from other states as described in Section 3.2.5.2, *Indiana Bat, Modeled Distribution and Population Estimates, Summer*. For little brown bats, half of all adults are assumed to use anthropogenic structures and thus are not included as present in modeled seasonal habitat. Further, half of the remaining little brown bats are assumed to be within 100 km of a major hibernaculum, while the other half are assumed to occur elsewhere on the broader forested landscape (see Section 3.2.5.4, *Little Brown Bat, Modeled Distribution and Population Estimates, Summer*, for more details).

[f] The number of nonvolant pups is estimated at one pup per female for Indiana, little brown, and northern long-eared bats. The estimated number of nonvolant pups for tricolored bats is two pups per female (Table 3.3).

Table 3-16. Modeled Seasonal Distribution of Covered Bats in Wisconsin by Habitat Quality for State DNR Lands Only

		Acres of Forested Habitat by Quality (% DNR)			
Modeled Habitat by Season	**Covered Bat Species**	**High**		**Low**	
Winter Habitat					
≤0.25 mile around hibernaculum	little brown bats	478.07	(0.03%)	94.38	(0.01%)
	northern long-eared bats	518.88	(0.04%)	66.24	(< 0.01%)
	tricolored bats	150.87	(0.01%)	42.39	(< 0.01%)
Fall/Spring					
≤ 10 miles around large hibernacula (>10,000 bats) ≤ 5 miles around small hibernacula (<10,000 bats)	little brown bats (large hibernacula)	13,352	(0.91%)	1,234	(0.08%)
	little brown bats (small hibernacula)	49,817	(3.39%)	5,428	(0.37%)
	northern long-eared bats (large hibernacula)	13,352	(0.91%)	1,234	(0.08%)
	northern long-eared bats (small hibernacula)	45,507	(3.10%)	4,295	(0.29%)
	tricolored bats	42,108	(2.87%)	3,942	(0.27%)
Summer					
All forested lands	little brown bats (near large hibernacula)	416,330	(28.36%)	43,602	(2.97%)
	little brown bats (broader landscape)	501,388	(34.15%)	82,421	(5.61%)
	northern long-eared bats	917,719	(62.51%)	126,023	(8.58%)
	tricolored bats	15,779	(1.07%)	36,187	(2.47%)

During summer, little brown bats may use anthropogenic structures as roosts in addition to forested habitats. This species is expected to be found in structures, as well as in the forest types outlined in Table 3-2. For the purposes of future analyses, bats in anthropogenic structures are not assessed.

The approach for describing modeled distribution of little brown bats is described in Section 3.2.5.4, *Little Brown Bat*. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season.

3.6.2.4 Tricolored Bat

Tricolored bats are known to hibernate in at least 70 sites in Wisconsin, including caves, mines, and other similar underground structures. During fall and spring, the species is expected to occur within 5 miles of all known hibernacula entrances as described in Table 3-3. Most tricolored bats summer within 85 kilometers of their hibernacula (Center for Biological Diversity and Defenders of Wildlife 2016).

The approach for describing modeled distribution of tricolored bats is described in Section 3.2.5.5, *Tricolored Bat*. Covered bats at risk of being taken by covered activities are those present in high- and low-quality habitat during the active dates for each season.

Chapter 4
Potential Effects of Covered Activities

4.1 Overview

This chapter addresses the potential effects of covered activities (Chapter 2, *Covered Lands and Activities*) on covered species and describes the amount of take of covered species in the Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP). The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (HCP Handbook) (U.S. Fish and Wildlife Service 2016a) states that "quantifying the amount of take provides a key basis for evaluating project impacts." Take can be quantified as numbers of affected individuals or number of breeding groups. Alternatively, acres of habitat can be used as a surrogate for numbers of individuals.

This chapter shows how information on covered activities is integrated with information about covered lands, including bat distributions, to produce an estimate of the number of acres and (for context) the number of bats at risk from various activities. While bat populations may decrease over time due to the impact of white-nose syndrome (WNS), it is assumed that the impact of covered activities will be proportional to the population.

This chapter quantifies the potential effects of timber harvest and prescribed fire. Other covered activities (i.e., roads and trail maintenance and use) are ongoing efforts that are not easily or reliably quantified and that, with conservation measures, result in a very small amount of take. Furthermore, these covered activities often occur as part of forest management. As such, they will not be quantified separately, but will be assumed to be addressed through the larger (and very conservative) calculations for timber harvest and prescribed fire, as described in Chapter 2, *Covered Lands and Activities*.

While timber harvest and prescribed fire have the potential to harm individual bats or roosts directly, State Department of Natural Resource (DNR) forest management with retention improves habitat for bats over the long term (Sparks 2018; Gallagher et al. 2021). The beneficial effects of covered activities coupled with conservation measures are described in Chapter 5, Section 5.3, *Offsetting the Effects of the Take*. Indirect effects are described qualitatively in this chapter. A detailed case study is provided in Section 4.4.1.2, *Case Study of Indirect Effects in High-Quality Forest*, as an example of how the positive indirect effects that covered activities quantitatively improve habitat for bats.

4.1.1 Definitions

4.1.1.1 Endangered Species Act Definitions

The following definitions are from the HCP Handbook (U.S. Fish and Wildlife Service 2016a).

- **Take.** Take, (HCP Handbook, Section 1.1), is to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.
- **Harm.** Harm is an act that actually kills or injures wildlife, further defined by the U.S. Fish and Wildlife Service (USFWS) to include significant habitat modification or degradation that results

in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering (HCP Handbook, Section 1.3).

- **Direct effects.** Direct effects occur at the time and place of project implementation (e.g., ground disturbance or removal of roost trees). Direct effects can be either temporary or permanent (HCP Handbook, Section 13.3).
- **Temporary effects.** Temporary effects result in short-term changes and are typically restricted to 1) construction activities (such as vehicle noise) that cease when construction ceases; or 2) changes to a landcover that begins recovering when construction is complete (such as effects from a temporary workspace).
- **Permanent effects.** Permanent effects result in permanent habitat loss and are the result of construction of permanent features (e.g., creation of a new right-of-way or access road).
- **Indirect effects.** Indirect effects are manifested after a covered activity has occurred and are reasonably certain to occur (e.g., trees killed by a prescribed fire could become viable bat roosts after several years and may remain in use for several years thereafter). Indirect effects can occur outside the area directly affected by the action (HCP Handbook, Section 13.3).

4.1.1.2 Additional Habitat Conservation Plan Definitions

The following terms have been defined in a prior chapter but are included here for reference.

- **Stand.** A part of the forest that, due to its age, species composition, and other conditions, is identifiably different from its surroundings. A forest is composed of many stands.
- **Final harvest.** Final harvest activities have the greatest potential direct effect on bat habitat because they remove all or most of the canopy trees serving as potential roost trees from a stand. Landowners following silvicultural guidelines always leave a few canopy trees standing in a final harvest. In Michigan, this equates to approximately 3 to 10% of trees in a stand. In Minnesota, at least 5% of the area is left standing in either reserve areas and/or as scattered trees, and in Wisconsin, 5 to 15% of stand area or crown cover is left standing. The category of final harvest was created to simplify and group various harvest types (e.g., regeneration).
- **Partial harvest.** Partial harvest activities remove only some of the canopy trees from a stand, and most canopy trees are retained.
- **Canopy closure.** Canopy closure measures the proportion of the sky covered by vegetation from a single point (Paletto and Tosi 2009). This term is relevant to the Lake States HCP because it provides a measure of solar exposure at potential bat roosts.
- **Basal area.** Basal area is the amount of land covered by the stems of trees measured at breast height (4.5 feet or 1.4 meters) (Elledge and Barlow 2009).

4.1.2 Endangered Species Act Requirements

Per the HCP Handbook, habitat conservation plans (HCPs) must include a description of the "impact that will likely result from the taking of covered species" (U.S. Fish and Wildlife Service 2016a). This "impact of the taking" must be described in defined units in terms of either individuals or habitat. When habitat is used as a proxy for individuals, it should be quantified in terms of the units of habitat to be affected. The Lake States HCP uses acres of habitat affected when bats are present to specify the authorized levels of incidental take on the permit issued by USFWS.

4.2 Methods

As noted above, take in the Lake States HCP is quantified based on acres of potentially occupied bat habitat. This method is practicable because tracking and monitoring take of individuals at a landscape level are not feasible. Furthermore, the anticipated take of individual bats will change over time in an unpredictable way as the effects of WNS are experienced by local bat populations. The Lake States HCP, however, also assesses the number of individuals potentially taken using current (as of 2019) densities of bats on the landscape. This number is provided to contextualize the estimate of habitat acres used in the HCP. Note that numbers of bats on the landscape are low and will decrease over time as effects of WNS are experienced by local bat populations (Chapter 3, Section 3.3.1, *White-Nose Syndrome*, for more details). Habitat is also the metric used in the conservation strategy to demonstrate benefits of the HCP, allowing for a like-to-like comparison of impacts and conservation. This section describes how impacts on bat habitat (when bats are present) are quantified and how impacts on individual bats (provided for context) are estimated.

The effects analysis provided in this section is based on 1) the covered activities described in Chapter 2, *Covered Lands and Activities*; 2) forestland ownership information provided in Chapter 2; 3) landcover data provided in Chapter 3, *Environmental Setting*; and 4) the seasonal species distribution and abundance models presented in Chapter 3. This take assessment uses these previous analyses to estimate the amount of affected habitat when bats are present and (for context) the number of bats taken by covered activities before the conservation strategy described in Chapter 5, *Conservation Strategy*, is applied. To the extent feasible, the tables and sections from which information is drawn are referenced. Covered activities will result in the incidental take of covered bats; the effects analysis in this chapter derives the number of bats taken by acres of habitat affected by covered activities (e.g., acres of habitat impacted is used as a surrogate for number of bats), which is ultimately the amount each DNR will be authorized to take on the incidental take permits. The amount of take authorized on the incidental take permits is for the full 50-year permit term. Timber harvest is the covered activity that results in the majority of take.

The effects analysis is based on a general assumption of a relatively even pace of harvest over the 50-year permit term. This assumption does not account for when there are large wind events or other natural disasters that create a need to conduct larger-than-average salvage harvests over 1 or multiple years.

The State DNRs and counties have policies in place that guide and direct the amount of harvest established (i.e., contracts issued for timber sales) in any one harvest season. For example, these policies include requirements for sustainable harvest, the Forest Stewardship program, and the Forest Legacy Program. Timber harvest contracts typically extend for 3 years, so actual harvest often varies from year to year depending on market conditions, weather, and other factors beyond the control of the State DNRs. Timber harvest levels in the future are expected to follow historical patterns, based in part on the assumption that state policies will remain in place or may even be strengthened. The State DNRs recognize, however, that policies can be changed, so the Lake States HCP provides a conservation strategy that the State DNRs will implement over the course of the 50-year permit term.

To provide USFWS with assurances that the State DNRs and Landowner Enrollment Program participants will continue to harvest at the approximate levels projected, the Lake States HCP includes an annual limit of 5% of total timber harvest and prescribed fire for each State DNR (and Landowner Enrollment Program participants), as shown in Table 4-1. Each State DNR will ensure that their planned annual timber harvest and prescribed fire acreage needs are incorporated into planning processes and prioritized. Five percent was determined as 2.5 times an average level of harvest in each year (which is 2% or one-fiftieth of the permit term). This annual limit of 5% of the total take limit by state will be calculated across all State DNR lands and all lands enrolled in the HCP, with one exception. This annual limit will not include infrequent, large salvage events due to wind or other natural disasters that create a need to conduct larger-than-average salvage harvests over one or multiple years. USFWS and the State DNRs agree that this annual limit of 5% is still within the range of harvest considered in the effects analysis. Anything greater than this harvest amount in 1 year may exceed that analysis. The limits reflect a conservative estimate of timber harvest and prescribed fire that may occur on State DNR lands and lands that are eligible to participate in the Landowner Enrollment Program (Appendix B, *Landowner Enrollment Program*). The annual limit will not be enforced based on habitat quality type; however, Table 4-1 shows estimated acreages of high- and low-quality habitat based on their modeled distribution on covered lands for context. The assumptions of the HCP will be reviewed every 5 years by the State DNRs to ensure they are accurate (see Chapter 6, Section 6.4.2, *Reporting*, and Appendix F, *Impact Assumption Validation Assessment*, for more information).

Limits on Covered Activities

The State DNRs' incidental take permits will authorize take over the full 50-year permit term. Annual take limits are provided for timber harvest (the covered activity resulting in the majority of take) and prescribed fire. For both activities, we assume that activity levels are evenly distributed over the permit term. To provide USFWS with assurances that the State DNRs and Landowner Enrollment Program participants will not exceed expected levels of activity year to year, the Lake States HCP includes an annual take limit of no more than 5% of the estimated annual take over the 50-year permit term (Table 4-1).

Table 4-1. Annual Timber Harvest and Prescribed Fire in Forests Acreage Limit by State

	Permit Term Limit (acres)				Annual Limit (acres)		
State	Total	Estimated Amount of High-Quality Habitat [a]	Estimated Amount of Low-Quality Habitat [a]	Annual Cap	Total	Estimated Amount of High-Quality Habitat [a]	Estimated Amount of Low-Quality Habitat [a]
Michigan	8,964,258	6,625,651	2,338,607	5% of Total	448,213	331,283	116,930
Minnesota	7,256,274	4,760,021	2,496,253		362,814	238,001	124,813
Wisconsin	9,544,131	6,423,856	3,120,275		477,207	321,193	156,014

Notes:
a The annual limit will not be enforced based on habitat quality type. These values are estimated based on modeled habitat quality distribution on covered lands.

For the uninitiated, forestry can be a challenge to understand because a simple summary of acres affected fails to capture the overall process. Some stands will never be entered over the 50-year permit term. Conversely, some stands will be entered multiple times. Stands harvested with Final

Harvest techniques are likely to only be harvested once; whereas, stands harvested using partial harvest techniques are likely to be reentered several times. Unplanned entries into a stand may be required should that stand become damaged by storms or disease requiring salvage operations. Similarly, planned entries may be skipped when the stand does not meet silvicultural targets of when labor shortages prevent harvest. Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*, provides a review of activities within 1.5 miles of a hypothetical northern long-eared bat roost located in Gaylord Forest Management Area, Emmet County, Michigan. The example includes proposals for forest management from 2003 through 2020 and a summary of completed projects between 2013 and 2021

4.2.1 Direct Effects

Effects on bats can be both direct and indirect. As defined in the federal Endangered Species Act (ESA), direct effects are the direct or immediate effects of the project on the species or its habitats. The methods for assessing these direct effects are described in this section. Four groups of covered activities were identified in Chapter 2, *Covered Lands and Activities*: timber harvest and related forest management practices; prescribed fire; road and trail construction, maintenance, and use; and conservation strategy implementation. Direct effects are quantified with respect to timber harvest and related forest practices and prescribed fire. Direct effects pertaining to road and trail construction, maintenance, and use are described in narrative form. The effects of implementing the conservation strategy are not quantified as impacts but are described as a conservation benefit in Chapter 5, *Conservation Strategy*.

Acres of Habitat as Surrogate for Individual Bats

Direct effects on bats are only included for context and to help evaluate the impact of the take on the species. Because the Lake States HCP occurs over a very large area and over a long timeframe, it would be impractical to track the number of individual bats taken by covered activities, particularly as numbers decline because of white-nose syndrome. Instead, acres of suitable forested habitat removed or modified when bats are present serve as a surrogate for the take of individual bats or assemblages of bats. As such, the requested take is expressed in terms of the acres of suitable habitat removed or modified when bats are present. Likewise, during implementation impacts on covered species will be tracked using acres of habitat and not by individual bats.

4.2.1.1 Habitat

The direct effects of covered activities on bats are estimated using the following information (Figure 4-1): acres of impact, type of harvest, seasonality of impacts, habitat quality, and seasonal use by bats.

- **Acres of impact.** The acres of impact from covered activities were estimated and described in Chapter 2, Sections 2.5, *Covered Activities Results—Michigan*; 2.6, *Covered Activities Results—Minnesota*; and 2.7, *Covered Activities Results—Wisconsin*.
- **Type of harvest**. The type of harvest, or intensity of harvest, is defined as either partial or final based on Chapter 2, Table 2-3.
- **Impact by season.** The seasonality of impacts pertains to the timing of covered activities during the year and is determined using estimates provided by each State DNR. For timber harvest, estimates provided by each DNR are described in Chapter 2, Section 2.4.1.2, *Timber Harvest*, and

quantified in Sections 2.5.1.2, *Covered Activities* (Michigan), 2.6.1.2, *Covered Activities* (Minnesota), and 2.7.1.2, *Covered Activities* (Wisconsin), under *Timber Harvest*.[1] Information about prescribed fire was provided by each DNR as described in Chapter 2, Section 2.4.1.4, *Prescribed Fire*,. The seasonality of prescribed fire and amount of prescribed fire is quantified in Sections 2.5.1.2 (Michigan), 2.6.1.2 (Minnesota), and 2.7.1.2 (Wisconsin), *Covered Activities*, under *Prescribed Fire*.

- **Habitat quality.** Habitat quality is broken into high- and low-quality landcover types, as outlined in Chapter 3, Table 3-2.
- **Seasonal distribution.** Seasonal distribution or use identifies when bats are present on the landscape and is determined based on the bat activity windows and seasonal distribution assumptions (e.g., distance from hibernacula entrances) described in Chapter 3, Table 3-3.

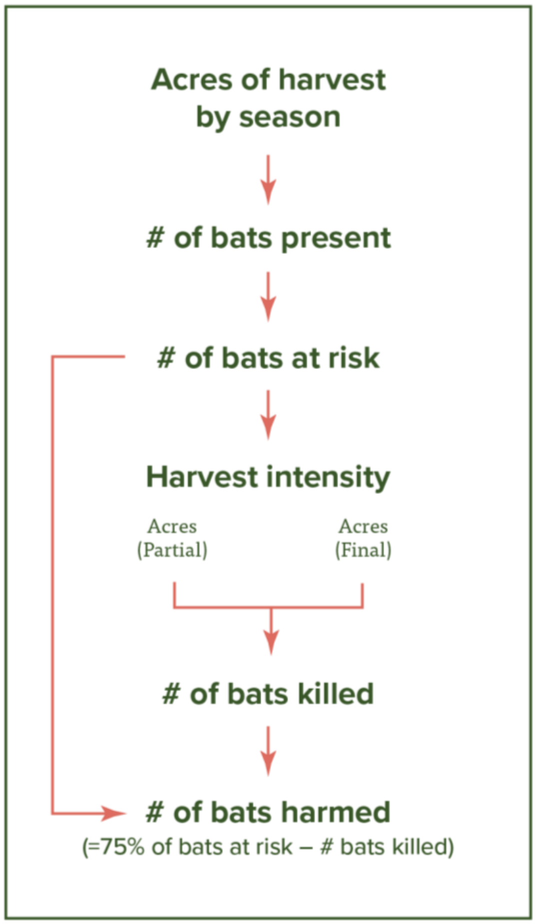

Figure 4-1. Flowchart Estimating Acres Affected by Covered Activities When Bats Are Present

[1] In Michigan and Wisconsin, timber harvest occurs evenly over the year. In Minnesota, approximately 75% of harvest on State DNR lands occurs from December 1 to March 31, with the rest occurring in approximately equal portions during the remaining months. A complete description of this rationale is found in Chapter 2, Section 2.4.1.2, *Timber Harvest*.

Direct impacts on habitat are quantified by estimating the acres of harvest (partial or final) in bat habitat (high- and low-quality) when bats are present. Covered activities that occur in suitable habitat at a time when bats are absent have no direct effects. Acres of harvest are determined in different ways depending on ownership (i.e., State DNR lands versus other nonfederal lands).

Timber Harvest on State DNR Lands

For timber harvest on state-DNR–managed lands, levels of harvest by acres and by intensity (i.e., partial versus final) are straightforward to calculate because the State DNRs maintain partial versus final harvest information for their lands. Chapter 2*,* Tables 2-6, 2-11, and 2-17, for Michigan, Minnesota, and Wisconsin, respectively, provide the projected annual acres of timber harvest and intensity for each state DNR. The effects analysis also requires an understanding of the seasonal timing of activities and the presence or absence of bats on the landscape at different times of year. The method for determining seasonality of harvest is described in Chapter 2, Section 2.4.1.2*, Timber Harvest, Seasonality of Harvest*. To determine when bats are present in bat habitat, see Chapter 3, Table 3-3, for seasonal occupancy windows.

The estimated bat distribution by season across high- and low-quality habitat is summarized in Tables 3-7, 3-11, and 3-15 for Michigan, Minnesota, and Wisconsin, respectively.[2] The effects analysis uses this collective information to determine the amount and type of harvest in areas where bats are present, at times of year when bats are present.

Timber Harvest on Other Nonfederal Lands

For timber harvest on other nonfederal lands (private, county, Tribal, and municipal lands), acres of harvest were estimated using Forest Inventory and Analysis (FIA) data because FIA data are the only consistent and easily available data across the three states for these analyses. FIA provides the volume of merchantable timber sold and the age at which a typical harvest occurs. The approach that uses this information to convert volume to equivalent acres is described in Chapter 2, Section 2.4.2.2, *Timber Harvest*, *Volume-to-Acres Conversions.*[3] The FIA data do not distinguish between partial and final harvest. To convert these equivalent acres to partial and final harvest, the Lake States HCP uses the proportions of each partial versus final harvest for each forest type as described in Tables 2-8, 2-13, and 2-19, for Michigan, Minnesota, and Wisconsin, respectively. The acres of partial and final harvest on county, municipal, Tribal, and private lands is found in Tables 2-9, 2-14, and 2-20 for Michigan, Minnesota, and Wisconsin, respectively. For the seasonal timing of activities and the presence or absence of bats on the landscape at different times of year, the same assumptions as those described above for State DNR lands were used. Collectively, this information provides the amount of partial versus final harvest that occurs on federal lands during times of year when bats are present.

All State DNR lands are automatically covered by the Lake States HCP. All county and municipal lands are eligible to enroll in the HCP, and thus all impacts from their enrollment are analyzed in the

[2] The covered activities are estimated to occur over a 50-year period; thus, this analysis is not spatially explicit. Rather, effects are assumed to be proportional to the presence of affected landcover on the landscape.

[3] This estimate should over-represent harvest acres when trees are left on the landscape because 1) residual trees are deliberately left as part of a final removal; 2) as noted in Chapter 2, *Covered Lands and Activities*, partial harvests leave most canopy trees; and 3) not all trees are harvested due to retention guidelines and site-specific constraints.

impact analysis. However, the DNRs do not have the capacity to administer an enrollment program for all private landowners in the state (between 200,000 and 415,00 ownerships in each state). Thus, not all private (and Tribal) landowners are eligible to enroll in the HCP. An approach was developed (Appendix B, *Landowner Enrollment Program*) to manage the number of ownerships eligible to enroll based on the potential that a group or size class of owners may affect a single bat and, thus, have a need to comply with ESA. The State DNRs recognize that the chance of impacting a single bat is higher where 1) bats are already known to occur (i.e., on lands with known hibernacula or known roost trees); or 2) in larger ownerships where forest management activities occur. The criteria for eligibility in the Landowner Enrollment Program are described in Appendix B, *Landowner Enrollment Program*.

Based on these ownership thresholds, the Landowner Enrollment Program could include up to 80% of lands in private ownership in Michigan and Wisconsin and up to 30% of lands in private ownership in Minnesota. Differences between Minnesota and the other two states are the result of a much lower density of bats in Minnesota (where major hibernacula are rare) and the fact that 75% of timber harvest in Minnesota occurs during winter, when no direct impacts are expected.

Prescribed Fire

For prescribed fire, the acres of forest affected by prescribed burns on state lands were provided by each DNR and can be found in Tables 2-7, 2-12, and 2-18 for Michigan, Minnesota, and Wisconsin, respectively. The amount of forest burned on other nonfederal lands is described in Chapter 2, Sections 2.5.2.2, 2.6.2.2, and 2.7.2.2, *Covered Activities*, under *Prescribed Fire*, for Michigan, Minnesota, and Wisconsin, respectively. Seasonality of prescribed fire was assumed to be equally distributed across the active season for covered bats based on typical windows for burning provided by the State DNRs. For the distribution of impacts on forest community types and habitat quality, the same assumptions were used as those described above for timber harvest. Collectively, this information is used to determine the amount and type of prescribed fire on covered lands in areas where bats are present, at times of year when bats are present.

4.2.1.2 Bats

An HCP can track impacts on habitat, populations, or individuals. The Lake States HCP tracks impacts on habitat when bats are present as a surrogate for impacts on individuals. This approach was taken because 1) tracking individual impacts over a large landscape would not be feasible in practice, and 2) the population of bats is declining every year making the numbers of individuals taken unpredictable over time. Nonetheless, the number of bats impacted is provided for context and to help clarify the impacts of the taking. These impacts are derived from the estimates of affected habitat. The number of individual bats taken is anticipated to track populations as they change and as bats succumb to or recover from WNS.

To estimate effects on individual bats, the analysis distributed the number of bats known to be present[4] across the forested landscape based on high- and low-quality habitat on where bats were presumed to be present at different times of year (see Appendix C, Section C.3, *Limitations of Model*, for details). For example, during the spring, the known bat population was distributed entirely

[4] Estimated based on winter hibernaculum entrance surveys and summer capture records, with input from DNR bat biologists.

within spring habitat (i.e., within 5 or 10 miles from the hibernaculum entrance per Chapter 3, Table 3-3). The number of bats assumed affected (either killed or harmed) was based on the number of acres affected when bats were present, the number of bats present, and the published risk of mortality (see *Mortality* section below) (U.S. Fish and Wildlife Service 2016b). For timber harvest, this analysis included an assessment of final or partial harvest. Two different types of impacts on bats were assessed, mortality (or lethal take) and harm, as described below.

As described in Chapter 3, Section 3.2.4, *Forest Trends*, females of all four covered species form maternity colonies each summer. Males are typically, but not exclusively solitary. The density of colonies can be calculated from the number of individuals encountered by multiplying by the proportion of females in the adult population (11% for Indiana bats and 50% [based on the assumption of equal sex ratios] for the other three species) to obtain an estimate of the density of females. The density of females is then divided by the number of bats per colony. This analysis used a colony size of 30 Indiana bats based on adult populations of 15 to 30 adults mentioned by Kurta (2008), 39 northern long-eared bats for colonies in Michigan and Wisconsin (Minnesota was estimated as 45) by the USFWS (2016b), 24 little brown bats based on the maximum group size of little brown bats tracked to tree roosts in four studies reviewed by Barclay and Kurta (2007), and 8 tricolored bats reported by Veilleux and Veilleux (2004) for colonies in Indiana. Notably, colony sizes of all four species may be larger in other areas (for Indiana bats) or when colonies occur in structures. Thus, data were selected from tree roosts or near the Lake States when available.

Mortality

Bats may be killed as a direct result of forestry operations. For example, Belwood (2002) documented the death of an adult and three juvenile Indiana bats (*Myotis 4-9odalist*) during tree harvest. Two additional juveniles survived the initial event and died later. In another case, 11 dead adult female Indiana bats were retrieved (by people) when their roost was felled in Knox County, Indiana (Whitaker, pers. Comm., 2005 cited in U.S. Fish and Wildlife Service 2016b). Based on these data, USFWS (2016b) suggested a mortality rate for forestry of 3% for adult bats and 15% for juvenile bats. This rate is also consistent with impacts observed when a tree was bulldozed to clear pasture (Cope et al. 1974). Although none of these examples is derived from a study of forestry impacts, they represent the only available measured impacts that occur when a known occupied maternity roost tree is felled.

The number of bats present (calculated for each state in Chapter 3, Tables 3-7, 3-11, and 3-15 for Michigan, Minnesota, and Wisconsin, respectively) was assessed relative to acres affected as described previously (Section 4.2.1.1, *Habitat*). To determine the number of bats killed, the numbers of bats present was prorated by the mortality rate used by USFWS for northern long-eared bats, 15% for nonvolant juveniles and 3% for adult bats that are present in trees when felled (U.S. Fish and Wildlife Service 2016b) or exposed to prescribed fire. Figure 4-2 illustrates the process for determining the mortality of bats from timber harvest or prescribed fire in the absence of conservation measures.

Harm

The definition of harm is provided in Section 4.1.1, *Definitions*. In short, harm is disturbance that rises to the level of take by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering.[5] USFWS is required to consider all forms of take, including nonlethal take such as disturbance, on bats (HCP Handbook, Section 8.2). Not all bats within a stand are likely to be disturbed, and not all disturbance of bats within a stand rises to the level of take. Bats may be harmed by actions when flushed from their roosts and exposed to physiological stress, increased risk of predation, or injury as they move between roosts. Some individuals may suffer minor injuries and could be considered harmed by activities such as tree felling, noise and machinery, human presence, and other forms of disturbance. Such disturbance can cause flushing from trees and is a temporary effect. No data are available to estimate the percent of bats harmed during forestry operations, thus 75% was used to recognize that at least some bats do not suffer death or harm during timber harvest and prescribed fire. The number of bats harmed is, thus, estimated as 75% of the number of bats present minus any bats killed. This process is illustrated in Figure 4-2.

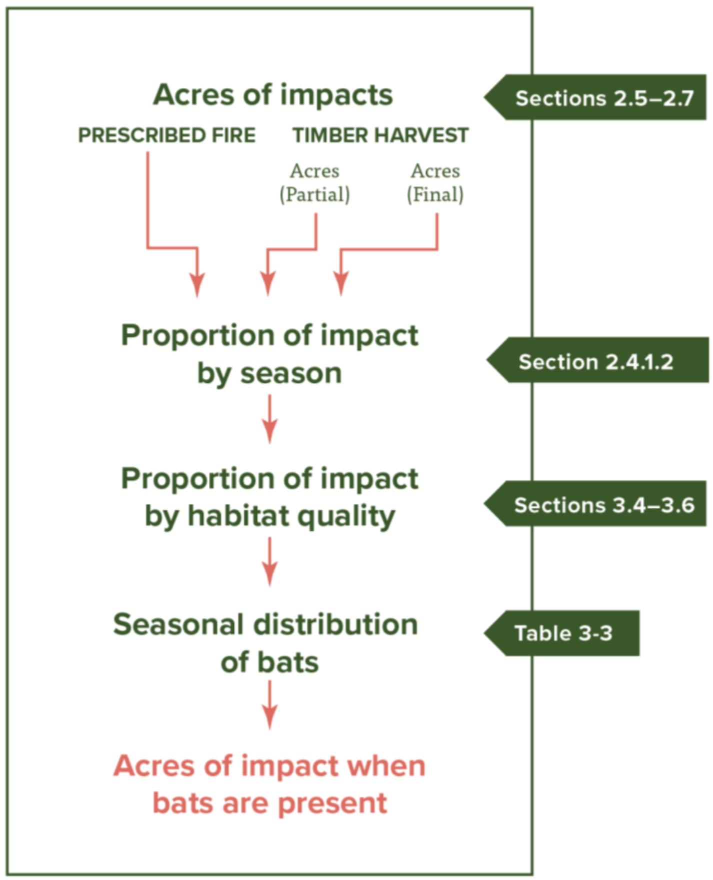

Figure 4-2. Flowchart Estimating the Number of Bats Killed and Harmed by Timber Harvest

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[5] *Arizona Cattle Grower's Association v. USFWS* confirmed that, to qualify as harm under ESA, habitat modification must result in actual death or injury to wildlife. This decision also held that potential for harm is insufficient. Rather, a take must be *reasonably certain to occur*.

Changing Bat Populations

Populations of all covered species have undergone substantial declines since the arrival of WNS in the region in approximately winter 2013/2014 (Indiana bats: 20.4% decline, northern long-eared bats: 97% decline, little brown bats: 83% decline, and tricolored bats: 90% decline). Population numbers presented in Chapter 3, *Environmental Setting*, are current as of 2019. If bat populations in the Lake States follow the pattern seen in states to the east, declines will continue for several years following implementation of the Lake States HCP. When combined with the colonial nature of bats, the resulting distribution is one where a few bats are concentrated in a very small (and often unpredictable) part of the landscape. As bat densities continue to decline, most covered activities completed under the HCP will not result in take, and this risk of take will continue to decline over time. However, any individuals impacted make up a greater portion of the overall population. Thus, as outlined in Chapter 5, *Conservation Strategy*, conservation measures focus on protecting those trees most likely to be used by bats (especially maternity colonies) and avoiding areas of known or suspected bat concentrations. While take is tracked as acres of impact for ease of implementing the permit, it is important to clarify that the number of individual bats taken is anticipated to go down over time.

4.2.2 Indirect (Beneficial) Effects

As defined in Section 4.1.1, *Definitions*, indirect effects are manifested later in time and are reasonably certain to occur. For the covered species, these indirect effects are largely beneficial. In the biological opinion for the northern long-eared bat 4(d) rule, USFWS notes that some forestry activities improve habitat quality for bats. By following habitat quality through time in three case studies, the Lake States HCP demonstrates that activities covered by the Lake States HCP improve both roosting and foraging opportunities for bats on the covered lands. These case studies are provided in Section 4.4, *Indirect (Beneficial) Effects*. Chapter 5, *Conservation Strategy*, proposes conservation measures that will provide additional benefits.

The analysis of indirect effects focuses on long-term changes to habitat quality. Over the long term, sustainable forest management practices can create and maintain foraging and roosting habitat for bats (Carter et al. 2002; Guldin et al. 2007; Sheets et al. 2013a, 2013b; Pauli et al. 2015a, 2015b; Blakey et al. 2016; Silvis et al. 2016; U.S. Fish and Wildlife Service 2016b; Gallagher et al. 2021). An exact quantification of habitat effects would require detailed, site-specific data on conditions before and after harvest—a level of detail beyond the scope of the Lake States HCP. However, it is possible to categorize effects within a stand relative to baseline for a variety of harvest types. The approach used herein assigns an effect size to both the direct effects of harvest and changes in a stand that occur via ecological succession and subsequent stand development. Thus, stand development is treated as an indirect effect of harvest—a critical concept to understand because many of the harvests completed in the Lake States are designed to regenerate the stand.

The example provided in Section 4.4.1.2, *Case Study of Indirect Effects in High-Quality Forest,* is based on northern long-eared bats within a stand of mesic hardwoods. To quantify these changes through time, a numeric value is assigned that represents changes in habitat quality compared to the initial baseline and is termed a magnitude of effect. This magnitude of effect is on a scale of -1.0 to +1.0 where the sign indicates the direction of the effect (i.e., negative effects are expressed as negative numbers), and is typically based on the graphs presented in Sheets et al. (2013b) and analysis included in the Pennsylvania State Lands HCP for Bats (Pennsylvania Game Commission and Department of Conservation and Natural Resources 2020). The magnitude of effect for a given covered activity is based on best available information, as well as professional judgment. The assignment of a magnitude of effect value was done separately for foraging and roosting habitat because roosting habitat for covered bats is estimated to be twice as important as foraging habitat.

Magnitude of effect values are described as follows.

- No Effect
- +/-0.05 Trace Effect
- +/-0.25 Minor Effect
- +/-0.5 Moderate Effect
- +/-0.75 High Effect
- +/-1.00 Complete Change of Habitat Value

By following changes in the stand over time it is possible to arrive at an understanding of the relative quality of that stand at any given time as compared to the value of the original stand. Working at a landscape scale, it is also possible to see how having a variety of stands managed with multiple techniques provides bats with long-term access to foraging and roosting habitat (O'Keefe 2009; Sheets et al. 2013b; Pauli 2014; Pauli et al. 2015a, 2015b). Section 4.4.1.3*, Qualitative Examples of Habitat Changes Associated with Common Management Systems of the Lake States,* describes how silvicultural techniques influence forest succession, which in turn, results in changes in habitat quality for bats roosting or foraging in a stand. For illustrative purposes, changes in habitat quality (both roosting and foraging) will be described through time for three types of forests common to the Lake States (aspen/birch, pine plantation, and oak-hickory). Indirect effects are also described for roads and trails and prescribed fire, based on available scientific literature and input from professional foresters.

4.3 Direct Effects

This section provides the results of the analysis for the three states: Michigan, Minnesota, and Wisconsin. The methods for estimating direct effects are described in Section 4.2.1, *Direct Effects*. As described in previous sections of this chapter, take in the Lake States HCP is quantified based on acres of potentially occupied bat habitat. However, the number of individuals potentially taken is also assessed, using current (as of 2019) densities of bats on the landscape. This number is provided to contextualize the estimate of habitat acres used in this HCP.

4.3.1 Michigan

This section describes effects on the covered species from covered activities in the state of Michigan. For timber harvest and prescribed fire this is done quantitatively. For roads and trails, effects are described qualitatively and a cap is provided. The effects of Lake States HCP Implementation are described in Chapter 5.

4.3.1.1 Timber Harvest

Habitat Effects

Based on data presented in Chapter 2, Table 2-6, Michigan DNR expects to complete approximately 64,000 acres per year of timber harvest including 40,000 acres per year of final harvest and 24,000 acres per year of partial harvest. Timber harvest on other covered lands was derived from FIA data and approximates final harvest of 139,297 acres across all forest types (numbers derived from totals for each ownership type in Chapter 2, Table 2-8). Tables 4-2 through 4-5 provide acres harvested each year by ownership category along with the amount of harvest (in acres and percent) expected to occur by season. Note that not all of the 139,000+ harvested acres are assessed as effects in this analysis. While all county and municipal lands are eligible for coverage, only a portion of private and tribal landowners are eligible to enroll in the program (Appendix B, *Landowner Enrollment Program*). Take estimates for the Lake States HCP assume all eligible landowners enroll.

Table 4-2. Acres of High- and Low-Quality Indiana Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
		Michigan DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
26	25	Private and Tribal [e]	80%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]				-			
		Michigan DNR	100%	100	34	25	8
		County and Municipal	100%	5	6	1	2
31,957	10,784	Private and Tribal [e]	80%	149	84	24	17
		Annual Total	-	254	124	50	27
		Permit Duration	-	12,676	6,195	2,486	1,329
Summer Habitat [g]				-			
		Michigan DNR	100%	11,841	1,519	2,960	380
		County and Municipal	100%	537	287	71	72
3,780,278	485,046	Private and Tribal [e]	80%	17,613	3,767	2,850	744
		Annual Total	-	29,991	5,573	5,882	1,196
		Permit Duration	-	1,499,528	278,656	294,075	59,786
Annual Totals [h, i]				-			
		Michigan DNR	-	-	-	2,985	388
		County and Municipal	-	-	-	72	73
		Private and Tribal [e]	-	-	-	2,874	761
		Annual Total	-	-	-	5,931	1,222

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Permit Duration (50 Years) [i]				-			
		Michigan DNR	-	-	-	149,258	19,413
		County and Municipal	-	-	-	3,600	3,664
		Private and Tribal [e]	-	-	-	143,703	38,038
		Grand Total		-	-	296,561	61,116

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Table 3-2.

[b] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the U.S. Forest Service (USFS) Forest Inventory and Analysis (FIA) data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14 and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values. Annual totals for seasonal habitat harvested were not provided because winter, fall/spring, and summer habitat overlap geographically.

[i] Numbers may not total due to rounding.

Table 4-3. Acres of High- and Low-Quality Northern Long-Eared Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
		Michigan DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
197,010	55,151	Private and Tribal [e]	80%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]				-			
Near Large Hibernacula Entrances				-			
		Michigan DNR	100%	2,180	603	545	151
		County and Municipal	100%	99	114	13	28
695,870	192,663	Private and Tribal [e]	80%	3,242	1,496	525	296
		Annual Total	-	5,521	2,214	1,083	475
		Permit Duration	-	276,032	110,684	54,133	23,747
Near Small Hibernacula Entrances				-			
		Michigan DNR	100%	2,096	519	524	130
		County and Municipal	100%	95	98	13	24
669,293	165,593	Private and Tribal [e]	80%	3,118	1,286	505	254
		Annual Total	-	5,310	1,903	1,041	408
		Permit Duration	-	265,489	95,132	52,066	20,411
Summer Habitat [g]				-	-	-	-
16,171,003	4,261,940	Michigan DNR	100%	50,651	13,349	12,663	3,337
		County and Municipal	100%	2,296	2,373	305	593

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
		Private and Tribal [e]	80%	75,345	31,174	12,191	6,159
		Annual Total	-	128,291	46,896	25,159	10,089
		Permit Duration	-	6,414,573	2,344,792	1,257,975	504,458
Annual Totals [h, I]							
		Michigan DNR	-	-	-	13,732	3,618
		County and Municipal	-	-	-	331	646
		Private and Tribal [e]	-	-	-	13,221	6,708
		Annual Total	-	-	-	27,283	10,972
Permit Duration (50 Years) [i]							
		Michigan DNR	-	-	-	686,584	180,892
		County and Municipal	-	-	-	16,561	32,310
		Private and Tribal [e]	-	-	-	661,028	335,414
		Grand Total		-	-	1,364,174	548,616

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.

[b] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14 and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values. Annual totals for seasonal habitat harvested were not provided because winter, fall/spring, and summer habitat overlap geographically.

[i] Numbers may not total due to rounding.

Table 4-4. Acres of High- and Low-Quality Little Brown Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
37,102	27,858	Michigan DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
		Private and Tribal [e]	80%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring [f]							
Near Large Hibernacula Entrances							
695,870	192,663	Michigan DNR	100%	2,180	603	545	151
		County and Municipal	100%	99	114	13	28
		Private and Tribal [e]	80%	3,242	1,496	525	296
		Annual Total	-	5,521	2,214	1,083	475
		Permit Duration	-	276,032	110,684	54,133	23,747
Near Small Hibernacula Entrances							
626,935	165,583	Michigan DNR	100%	1,964	519	491	130
		County and Municipal	100%	89	98	12	24
		Private and Tribal [e]	80%	2,921	1,286	473	254
		Annual Total	-	4,974	1,903	975	408
		Permit Duration	-	248,687	95,126	48,771	20,410
Summer Habitat [g]							
Near Large Hibernacula Entrances							
7,326,831	2,010,343	Michigan DNR	100%	22,949	6,297	5,737	1,574
		County and Municipal	100%	1,040	1,189	138	297
		Private and Tribal [e]	80%	34,138	15,613	5,524	3,085
		Annual Total	-	58,127	23,099	11,399	4,956
		Permit Duration	-	2,906,344	1,154,932	569,969	247,793

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
General Landscape							
8,844,172	2,251,597	Michigan DNR	100%	27,702	7,052	6,925	1,763
		County and Municipal	100%	1,256	1,331	167	333
		Private and Tribal [e]	80%	41,207	17,487	6,668	3,455
		Annual Total	-	70,165	25,871	13,760	5,551
		Permit Duration	-	3,508,229	1,293,531	688,006	277,530
Annual Totals [h, i]							
		Michigan DNR	-	-	-	13,699	3,618
		County and Municipal	-	-	-	330	683
		Private and Tribal [e]	-	-	-	13,189	7,089
		Annual Total	-	-	-	27,218	11,390
Permit Duration (50 Years) [i]							
		Michigan DNR	-	-	-	684,926	180,892
		County and Municipal	-	-	-	16,521	34,143
		Private and Tribal [e]	-	-	-	659,432	354,446
		Grand Total	-	-	-	1,360,879	569,481

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.

[b] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14 and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values. Annual totals for seasonal habitat harvested were not provided because winter, fall/spring, and summer habitat overlap geographically.

[i] Numbers may not total due to rounding.

Table 4-5. Acres of High- and Low-Quality Tricolored Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
4,055	1,178	Michigan DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
		Private and Tribal [e]	80%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring [f]							
312,837	96,305	Michigan DNR	100%	980	302	245	75
		County and Municipal	100%	44	57	6	14
		Private and Tribal [e]	80%	1,458	748	236	148
		Annual Total	-	2,482	1,107	487	237
		Permit Duration	-	124,094	55,326	24,336	11,870
Summer Habitat [g]							
9,908,015	2,553,973	Michigan DNR	100%	31,034	8,000	7,758	2,000
		County and Municipal	100%	1,407	1,510	187	377
		Private and Tribal [e]	80%	46,164	19,835	7,470	3,919
		Annual Total	-	78,605	29,345	15,415	6,296
		Permit Duration	-	3,930,225	1,467,244	770,764	314,801
Annual Totals [h, i]							
		Michigan DNR	-	-	-	8,003	2,075
		County and Municipal	-	-	-	193	392
		Private and Tribal [e]	-	-	-	7,706	4,066
		Annual Total	-	-	-	15,902	6,533

Acres of Forested Habitat in Michigan [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Permit Duration (50 Years) [i]							
		Michigan DNR	-	-	-	400,172	103,765
		County and Municipal	-	-	-	9,653	19,586
		Private and Tribal [e]	-	-	-	385,277	203,321
		Grand Total	-	-	-	795,101	326,671

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.

[b] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14 and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values. Annual totals for seasonal habitat harvested were not provided because winter, fall/spring, and summer habitat overlap geographically.

[h] Numbers may not total due to rounding.

Impacts on Individuals

Impacts on individual bats are provided for context, noting that the number of individual bats taken will go down as bat populations decrease due to WNS (Chapter 3, Section 3.3.1, *White-Nose Syndrome*). Impacts on individual bats were derived from estimates of impacts on habitat (Tables 4-6 through 4-9). These are overlaid with bat densities estimated in Tables 3-7 (Michigan), 3-11 (Minnesota), and 3-15 (Wisconsin). Results have been provided for number of bats harmed through disturbance and killed if conservation measures are not applied. These data are presented in Tables 4-6 through 4-9.

4.3.1.2 Roads and Trails

Effects associated with road and trail maintenance are captured by other analyses: trees removed for maintenance were included as a type of salvage, and the value of these roads as foraging and commuting habitat is considered under Section 4.4, *Indirect (Beneficial) Effects*. Construction of new roads and trails has not been quantified but is expected to be minimal and will be offset by the mitigation for other forest management activities. Impacts from roads and trails will be less than 0.15% of all impacts.[6]

[6] For Michigan that is 13,500 acres over the life of the permit. This is equivalent to constructing approximately 112 miles of road 20 feet wide per year.

Table 4-6. Number of Indiana Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Winter [c]						
Michigan DNR	N/A	54.87	5.49	0.00	0.00	0.00
County and Municipal	-	54.87	5.49	0.00	0.00	0.00
Private and Tribal [d]	-	54.87	5.49	0.00	0.00	0.00
Fall/Spring[e]						
Michigan DNR	38%	0.05	< 0.01	0.01	< 0.01	0.01
County and Municipal	-	0.05	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	0.05	< 0.01	0.03	< 0.01	0.02
Early Summer (before pups are born) [f,g]						
Michigan DNR	38%	0.01	< 0.01	0.04	< 0.01	0.03
County and Municipal	-	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	0.01	< 0.01	0.09	< 0.01	0.07
Dependent Pup Season (adults) [h]						
Michigan DNR	38%	0.01	< 0.01	0.17	< 0.01	0.12
County and Municipal	-	0.01	< 0.01	0.01	< 0.01	0.01
Private and Tribal [d]	-	0.01	< 0.01	0.38	< 0.01	0.28
Dependent Pup Season (non-volant pups) [h]						
Michigan DNR	38%	< 0.01	< 0.01	0.08	0.01	0.05
County and Municipal	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	< 0.01	< 0.01	0.19	0.01	0.13
Late Summer (after pups can fly) [i]						
Michigan DNR	38%	0.01	< 0.01	0.06	< 0.01	0.05
County and Municipal	-	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	0.01	< 0.01	0.14	< 0.01	0.11

Ownership Type	% Partial Harvest	Density [a] (Bats/100 Acres) High-Quality Habitat	Density [a] (Bats/100 Acres) Low-Quality Habitat	Impacts on Covered Lands [b] Bats Present	Impacts on Covered Lands [b] Bats Killed	Impacts on Covered Lands [b] Bats Harmed
Annual Totals [j]						
Michigan DNR	38%	-	-	< 1	< 1	< 1
County and Municipal	-	-	-	< 1	< 1	< 1
Private and Tribal [d]	-	-	-	1	< 1	1
Annual Total	-	-	-	1	< 1	1
Permit Duration (50 years) [j]						
Michigan DNR	38%	-	-	18	1	13
County and Municipal	-	-	-	1	< 1	1
Private and Tribal [d]	-	-	-	42	1	31
Grand Total	-	-	-	61	2	44

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-7.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Early summer is from May 16 through May 31.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

Table 4-7. Number of Northern Long-Eared Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Winter Habitat [c]						
Michigan DNR	N/A	5.36	0.54	0.00	0.00	0.00
County and Municipal	-	5.36	0.54	0.00	0.00	0.00
Private and Tribal [d]	-	5.36	0.54	0.00	0.00	0.00
Fall/Spring [e]						
Near Large Hibernacula Entrances						
Michigan DNR	38%	1.29	0.13	7.23	0.22	5.26
County and Municipal	-	1.29	0.13	0.42	0.01	0.31
Private and Tribal [d]	-	1.29	0.13	16.57	0.21	12.27
Near Small Hibernacula Entrances						
Michigan DNR	38%	0.24	0.02	1.28	0.04	0.93
County and Municipal	-	0.24	0.02	0.07	< 0.01	0.05
Private and Tribal [d]	-	0.24	0.02	2.92	0.04	2.16
Early Summer (before pups are born) [f,g]						
Michigan DNR	38%	0.07	0.01	1.42	0.04	1.03
County and Municipal	-	0.07	0.01	0.08	< 0.01	0.06
Private and Tribal [d]	-	0.07	0.01	3.24	0.04	2.40
Dependent Pup Season (adults)[h]						
Michigan DNR	38%	0.07	0.01	5.67	0.17	4.12
County and Municipal	-	0.07	0.01	0.32	< 0.01	0.24
Private and Tribal [d]	-	0.07	0.01	12.97	0.17	9.60
Dependent Pup Season (non-flying pups)[h]						
Michigan DNR	38%	0.03	< 0.01	2.83	0.43	1.81
County and Municipal	-	0.03	< 0.01	0.16	0.01	0.11
Private and Tribal [d]	-	0.03	< 0.01	6.49	0.42	4.55

Ownership Type	% Partial Harvest	Density [a] (Bats/100 Acres) High-Quality Habitat	Density [a] (Bats/100 Acres) Low-Quality Habitat	Impacts on Covered Lands [b] Bats Present	Impacts on Covered Lands [b] Bats Killed	Impacts on Covered Lands [b] Bats Harmed
Late Summer (after pups can fly)[i]						
Michigan DNR	38%	0.10	0.01	2.13	0.06	1.55
County and Municipal	-	0.10	0.01	0.12	< 0.01	0.09
Private and Tribal [d]	-	0.10	0.01	4.86	0.06	3.60
Annual Totals [j]						
Michigan DNR	38%	-	-	21	1	15
County and Municipal	-	-	-	1	< 1	1
Private and Tribal [d]	-	-	-	47	1	35
Annual Total	-	-	-	69	2	50
Permit Duration (50 years) [j]						
Michigan DNR	38%	-	-	1,027	48	734
County and Municipal	-	-	-	59	1	43
Private and Tribal [d]	-	-	-	2,353	47	1,729
Grand Total	-	-	-	3,439	96	2,507

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-7.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Early summer is from May 16 through May 31.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

Table 4-8. Number of Little Brown Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Winter Habitat [c]						
Michigan DNR	N/A	213.10	21.31	0.00	0.00	0.00
County and Municipal	-	213.10	21.31	0.00	0.00	0.00
Private and Tribal [d]	-	213.10	21.31	0.00	0.00	0.00
Fall/Spring[e]						
Near Large Hibernacula Entrances						
Michigan DNR	38%	10.10	1.01	56.58	1.70	41.16
County and Municipal	-	10.10	1.01	3.26	0.05	2.41
Private and Tribal [d]	-	10.10	1.01	129.77	1.68	96.07
Near Small Hibernacula Entrances						
Michigan DNR	38%	1.98	0.20	9.98	0.30	7.26
County and Municipal	-	1.98	0.20	0.57	0.01	0.42
Private and Tribal [d]	-	1.98	0.20	22.89	0.30	16.95
Early Summer (Before pups are born) [f,g]						
Near Large Hibernacula Entrances						
Michigan DNR	38%	0.17	0.02	1.68	0.05	1.22
County and Municipal	-	0.17	0.02	0.10	< 0.01	0.07
Private and Tribal [d]	-	0.17	0.02	3.84	0.05	2.84
General Landscape						
Michigan DNR	38%	0.15	0.02	1.78	0.05	1.30
County and Municipal	-	0.15	0.02	0.10	< 0.01	0.08
Private and Tribal [d]	-	0.15	0.02	4.09	0.05	3.03

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Dependent Pup Season (Adults)[h]						
Near Large Hibernacula Entrances						
Michigan DNR	38%	0.17	0.02	6.70	0.20	4.88
County and Municipal	-	0.17	0.02	0.39	0.01	0.29
Private and Tribal [d]	-	0.17	0.02	15.37	0.20	11.38
General Landscape						
Michigan DNR	38%	0.15	0.02	7.14	0.21	5.19
County and Municipal	-	0.15	0.02	0.41	0.01	0.30
Private and Tribal [d]	-	0.15	0.02	16.37	0.21	12.12
Dependent Pup Season (Non-flying pups)[h]						
Near Large Hibernacula Entrances						
Michigan DNR	38%	0.09	0.01	3.35	0.50	2.14
County and Municipal	-	0.09	0.01	0.19	0.01	0.13
Private and Tribal [d]	-	0.09	0.01	7.69	0.50	5.39
General Landscape						
Michigan DNR	38%	0.08	0.01	3.57	0.54	2.28
County and Municipal	-	0.08	0.01	0.20	0.02	0.14
Private and Tribal [d]	-	0.08	0.01	8.18	0.53	5.74
Late Summer (After pups can fly) [i]						
Near Large Hibernacula Entrances						
Michigan DNR	38%	0.26	0.03	2.51	0.08	1.83
County and Municipal	-	0.26	0.03	0.14	< 0.01	0.11
Private and Tribal [d]	-	0.26	0.03	5.76	0.07	4.27
General Landscape						
Michigan DNR	38%	0.23	0.02	2.68	0.08	1.95
County and Municipal	-	0.23	0.02	0.15	< 0.01	0.11
Private and Tribal [d]	-	0.23	0.02	6.14	0.08	4.54

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Annual Totals [j]						
Michigan DNR	38%	-	-	96	4	69
County and Municipal	-	-	-	6	< 1	4
Private	-	-	-	220	4	162
Annual Total	-	-	-	322	7	236
Permit Duration (50 years)[j]						
Michigan DNR	38%	-	-	4,799	185	3,460
County and Municipal	-	-	-	276	5	203
Private and Tribal [d]	-	-	-	11,006	183	8,117
Grand Total	-	-	-	16,080	374	11,779

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-7.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Early summer is from May 16 through May 31.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

Table 4-9. Number of Tricolored Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Michigan)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Winter Habitat [c]						
Michigan DNR	N/A	0.24	0.02	0.00	0.00	0.00
County and Municipal	-	0.24	0.02	0.00	0.00	0.00
Private and Tribal [d]	-	0.24	0.02	0.00	0.00	0.00
Fall/Spring [e]						
Michigan DNR	38%	< 0.01	< 0.01	0.01	< 0.01	0.01
County and Municipal	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	< 0.01	< 0.01	0.02	< 0.01	0.01
Early Summer (Before pups are born) [f,g]						
Michigan DNR	38%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
County and Municipal	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dependent Pup Season (Adults) [h]						
Michigan DNR	38%	< 0.01	< 0.01	0.01	< 0.01	< 0.01
County and Municipal	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	< 0.01	< 0.01	0.01	< 0.01	0.01
Dependent Pup Season (Non-flying pups) [i]						
Michigan DNR	38%	< 0.01	< 0.01	0.01	< 0.01	< 0.01
County and Municipal	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	< 0.01	< 0.01	0.01	< 0.01	0.01
Late Summer (After pups can fly) [i]						
Michigan DNR	38%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
County and Municipal	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Private and Tribal [d]	-	< 0.01	< 0.01	0.01	< 0.01	< 0.01

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Annual Totals [j]						
Michigan DNR	38%	-	-	< 1	< 1	< 1
County and Municipal	-	-	-	< 1	< 1	< 1
Private and Tribal [d]	-	-	-	< 1	< 1	< 1
Annual Total	-	-	-	< 1	< 1	< 1
Permit Duration (50 years) [j]						
Michigan DNR	38%	-	-	1	< 1	1
County and Municipal	-	-	-	< 1	< 1	< 1
Private and Tribal [d]	-	-	-	3	< 1	2
Grand Total	-	-	-	4	< 1	3

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-7.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Early summer is from May 16 through May 31.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

4.3.1.3 Prescribed Fire

As noted in Section 4.4, *Indirect (Beneficial) Effects*, prescribed fire has dramatic, long-term benefits to bat habitat, but the activity may have short-term impacts due to 1) the loss of some roost trees to the fire itself and trees removed to limit the spread of a fire; and 2) the harm and mortality of some bats within the stand at the time of fire. Results of prescribed fire on bat habitat and bat individuals is presented in Table 4-10. Impacts from prescribed fire are assumed to occur evenly across the three seasons when bats are active on the landscape (spring, summer, and fall). Note that relative to current levels of prescribed fire conducted by Michigan DNR (an average of 7.925 acres per year for 5 years [Chapter 2, Table 2-7]), the total annual acreage of anticipated prescribed fire under the Lake States HCP is higher (8,400 acres) to accommodate growth in the prescribed fire program. In Michigan, prescribed fire is rare outside of lands managed by the Michigan DNR; As a result, prescribed fires on county, municipal, and private (including Tribal) forestlands in Michigan are estimated at 1,000 acres per year or less (Chapter 2, Section 2.5.2.2, *Covered Activities, Prescribed Fire*).

Table 4-10. Impact (Number of Bats Killed and Harmed) from Prescribed Fire on Covered Bats (Michigan)

Acres of Prescribed Fire	Percent Eligible for Enrollment [a]	Maximum Acres of Forest/ Brushland Affected	Species	Impacts on Covered Lands [c]	
				Bats Killed	Bats Harmed
Michigan DNR					
8,400	100%	2,100	Indiana bat	< 0.01	0.09
			Northern long-eared bat	0.05	0.79
			Little brown bat	0.18	3.58
			Tricolored bat	< 0.01	0.02
Counties and Municipalities					
Unknown	100%	34	Indiana bat	< 0.01	< 0.01
			Northern long-eared bat	< 0.01	0.01
			Little brown bat	< 0.01	0.04
			Tricolored bat	< 0.01	< 0.01
Private and Tribal [b]					
Unknown	80%	773	Indiana bat	< 0.01	0.02
			Northern long-eared bat	0.02	0.26
			Little brown bat	0.06	1.18
			Tricolored bat	< 0.01	< 0.01

Acres of Prescribed Fire	Percent Eligible for Enrollment [a]	Maximum Acres of Forest/ Brushland Affected	Species	Impacts on Covered Lands [c]	
				Bats Killed	Bats Harmed
Permit Duration (50 years) [c]					
Michigan DNR					
420,000	100%	105,000	Indiana bat	0.05	4.35
			Northern long-eared bat	2.35	39.60
			Little brown bat	9.13	178.80
			Tricolored bat	< 0.01	0.76
Counties and Municipalities					
Unknown	100%	1,688	Indiana Bat	< 0.01	0.04
			Northern long-eared bat	0.03	0.42
			Little brown bat	0.10	1.92
			Tricolored bat	< 0.01	0.01
Private and Tribal [b]					
Unknown	80%	38,649	Indiana bat	0.02	1.23
			Northern long-eared bat	0.78	13.10
			Little brown bat	3.02	59.22
			Tricolored bat	< 0.01	0.22

Notes:

[a] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[b] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[c] Numbers may not total due to rounding.

4.3.1.4 Effects of HCP Implementation

Conservation efforts outlined in Chapter 5, *Conservation Strategy*, are designed to benefit all four covered species of bats. These include the protection of hibernacula entrances and strategic restoration of foraging and roosting habitat associated with both summer and fall/spring habitat, as well as monitoring for compliance with the conservation strategy. All mitigation efforts will improve habitat quality and will have no direct impacts on bats. Monitoring may have negligible impacts on bats and will be carried out in the least intrusive way for the data required.

4.3.2 Minnesota

This section describes effects on the covered species from covered activities on covered lands in Minnesota. For timber harvest and prescribed fire this is done quantitatively. For roads and trails, effects are described qualitatively. The effects of Lake States HCP Implementation are described as part of the conservation strategy in Chapter 5.

4.3.2.1 Timber Harvest

Habitat Effects

Based on data presented in Chapter 2, Table 2-11, Minnesota DNR expects to complete approximately 49,500 acres per year of timber harvest including 36,500 acres per year of final harvest and 13,000 acres per year of partial harvest. Timber harvest on other covered lands was derived from the FIA data and approximates annual harvest of 145,611 acres across all forest types (numbers derived from totals for each ownership type in Chapter 2, Table 2-13). Tables 4-11 through 4-13 provide acres harvested each year by ownership category along with the amount of harvest (in acres and percent) expected to occur by season. Note that not all of the 145,000+ harvested acres are assessed as effects in this analysis. While all county and municipal lands are eligible for coverage, only a portion of private and tribal landowners are eligible to enroll in the program (Appendix B, *Landowner Enrollment Program*). Take estimates for the Lake States HCP assume all eligible landowners enroll.

Table 4-11. Acres of High- and Low-Quality Northern Long-Eared Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Minnesota)

Acres of Forested Habitat in Minnesota [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
7,952	6,990	Minnesota DNR	100%	0	0	0	0
-	-	County and Municipal	100%	0	0	0	0
-	-	Private and Tribal [e]	30%	0	0	0	0
-	-	Annual Total	-	0	0	0	0
-	-	Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]							
Near Large Hibernacula Entrances							
122,817	62,787	Minnesota DNR	100%	328	168	31	16
-	-	County and Municipal	100%	354	321	34	22
-	-	Private and Tribal [e]	30%	125	136	15	14
-	-	Annual Total	-	807	625	80	52
-	-	Permit Duration	-	40,345	31,267	4,007	2,588
Near Small Hibernacula Entrances							
343,891	210,948	Minnesota DNR	100%	918	563	86	53
-	-	County and Municipal	100%	991	1,080	96	75
-	-	Private and Tribal [e]	30%	350	458	43	46
-	-	Annual Total	-	2,259	2,101	224	174
-	-	Permit Duration	-	112,968	105,050	11,220	8,696

Acres of Forested Habitat in Minnesota [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Summer Habitat [g]							
13,661,487	4,872,450	Minnesota DNR	100%	36,487	13,013	3,421	1,220
-	-	County and Municipal	100%	39,371	24,941	3,804	1,729
-	-	Private and Tribal [e]	30%	13,898	10,574	1,690	1,069
-	-	Annual Total	-	89,756	48,529	8,915	4,017
-	-	Permit Duration	-	4,487,790	2,426,438	445,737	200,869
Annual Totals [h,i]							
-	-	Minnesota DNR	-	-	-	3,537	1,289
-	-	County and Municipal	-	-	-	3,934	1,826
-	-	Private [e]	-	-	-	1,748	1,129
-	-	Annual Total	-	-	-	9,219	4,243
Permit Duration (50 Years) [i]							
-	-	Minnesota DNR	-	-	-	176,875	64,426
-	-	County and Municipal	-	-	-	196,699	91,295
-	-	Private and Tribal [e]	-	-	-	87,391	56,432
-	-	Grand Total	-	-	-	460,965	212,154

Notes:
[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.
[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.
[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.
[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.
[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.
[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.
[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.
[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values. Annual totals for seasonal habitat harvested were not provided because winter, fall/spring, and summer habitat overlap geographically.
[i] Numbers may not total due to rounding.

Table 4-12. Acres of High- and Low-Quality Little Brown Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Minnesota)

Acres of Forested Habitat in Minnesota [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
		Minnesota DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
140	209	Private and Tribal [e]	30%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]							
Near Large Hibernacula Entrances							
		Minnesota DNR	100%	328	168	31	16
		County and Municipal	100%	354	321	34	22
122,817	62,787	Private and Tribal [e]	30%	125	136	15	14
		Annual Total	-	807	625	80	52
		Permit Duration	-	40,345	31,267	4,007	2,588
Near Small Hibernacula Entrances							
		Minnesota DNR	100%	431	173	40	16
		County and Municipal	100%	465	332	45	23
161,312	64,777	Private and Tribal [e]	30%	164	141	20	14
		Annual Total	-	1,060	645	105	53
		Permit Duration	-	52,991	32,258	5,263	2,670
Summer Habitat [g]							
Near Large Hibernacula Entrances							
		Minnesota DNR	100%	11,368	5,139	1,066	482
		County and Municipal	100%	12,267	9,849	1,185	683
4,256,531	1,924,070	Private and Tribal [e]	30%	4,330	4,176	527	422
		Annual Total	-	27,965	19,163	2,778	1,586
		Permit Duration	-	1,398,268	958,170	138,879	79,321

Acres of Forested Habitat in Minnesota [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
General Landscape							
9,404,956	2,948,380	Minnesota DNR	100%	25,119	7,874	2,355	738
		County and Municipal	100%	27,104	15,092	2,619	1,046
		Private and Tribal [e]	30%	9,568	6,399	1,164	647
		Annual Total	-	61,790	29,365	6,137	2,431
		Permit Duration	-	3,089,522	1,468,268	306,858	121,548
Annual Totals [h, i]							
-	-	Minnesota DNR	-	-	-	3,492	1,252
		County and Municipal	-	-	-	3,883	1,774
		Private and Tribal [e]	-	-	-	1,725	1,097
		Annual Total	-	-	-	9,100	4,123
Permit Duration (50 Years) [i]							
-	-	Minnesota DNR	-	-	-	174,589	62,596
		County and Municipal	-	-	-	194,157	88,702
		Private and Tribal [e]	-	-	-	86,262	54,829
		Grand Total	-	-	-	455,008	206,128

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values. Annual totals for seasonal habitat harvested were not provided because winter, fall/spring, and summer habitat overlap geographically.

[i] Numbers may not total due to rounding.

Table 4-13. Acres of High- and Low-Quality Tricolored Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Minnesota)

Acres of Forested Habitat in Minnesota [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
		Minnesota DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
1,218	472	Private and Tribal [e]	30%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]							
		Minnesota DNR	100%	711	324	67	30
		County and Municipal	100%	767	621	74	43
266,218	121,292	Private and Tribal [e]	30%	271	263	33	27
		Annual Total	-	1,749	1,208	174	100
		Permit Duration	-	87,452	60,402	8,686	5,000
Summer Habitat [g]							
		Minnesota DNR	100%	22,290	9,064	2,090	850
		County and Municipal	100%	24,052	17,373	2,324	1,204
8,345,931	3,393,876	Private and Tribal [e]	30%	8,490	7,365	1,032	744
		Annual Total	-	54,833	33,802	5,446	2,798
		Permit Duration	-	2,741,633	1,690,121	272,305	139,914
Annual Totals [h, i]							
		Minnesota DNR	-	-	-	3,421	1,220
		County and Municipal	-	-	-	3,804	1,729
		Private and Tribal [e]	-	-	-	1,690	1,069
		Annual Total	-	-	-	8,915	4,017

Acres of Forested Habitat in Minnesota [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Permit Duration (50 Years) [i]							
-	-	Minnesota DNR	-	-	-	3,537	1,289
		County and Municipal	-	-	-	3,934	1,826
		Private and Tribal [e]	-	-	-	1,748	1,129
		Grand Total	-	-	-	89,756	48,529

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Numbers may not total due to rounding.

Impacts on Individuals

Impacts on individual bats are provided for context, noting that the number of individual bats taken will go down as bat population decreases due to WNS (Chapter 3, Section 3.3.1, *White-Nose Syndrome*). Impacts on individual bats were derived from estimates of impacts on habitat (Tables 4-14 through 4-16). These values are overlaid with bat densities estimated in Chapter 3, Table 3-11. Results have been provided for the number of bats harmed through disturbance and killed if conservation measures are not applied. These data are presented in Tables 4-14 through 4-16.

Table 4-14. Number of Northern Long-Eared Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Minnesota)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Winter Habitat [c]						
Minnesota DNR	N/A	101.50	0.64	0.00	0.00	0.00
County and Municipal	-	101.50	0.64	0.00	0.00	0.00
Private and Tribal [d]	-	101.50	0.64	0.00	0.00	0.00
Fall/Spring [e]						
Near Large Hibernacula Entrances						
Minnesota DNR	26%	5.78	0.58	1.87	0.06	1.36
County and Municipal	-	5.78	0.58	2.84	0.06	2.08
Private and Tribal [d]	-	5.78	0.58	1.56	0.03	1.15
Near Small Hibernacula Entrances						
Minnesota DNR	26%	0.36	0.04	0.33	0.01	0.24
County and Municipal	-	0.36	0.04	0.50	0.01	0.37
Private and Tribal [d]	-	0.36	0.04	0.28	0.01	0.20
Early Summer (before pups are born) [f, g]						
Minnesota DNR	26%	0.06	0.01	0.37	0.01	0.27
County and Municipal	-	0.06	0.01	0.56	0.01	0.41
Private and Tribal [d]	-	0.06	0.01	0.30	0.01	0.22
Dependent Pup Season (adults) [h]						
Minnesota DNR	26%	0.06	0.01	1.47	0.04	1.07
County and Municipal	-	0.06	0.01	2.22	0.05	1.63
Private and Tribal [d]	-	0.06	0.01	1.22	0.02	0.90
Dependent Pup Season (non-flying pups) [h]						
Minnesota DNR	26%	0.03	< 0.01	0.73	0.11	0.47
County and Municipal	-	0.03	< 0.01	1.11	0.12	0.74
Private and Tribal [d]	-	0.03	< 0.01	0.61	0.06	0.41

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Late Summer (after pups can fly) [i]						
Minnesota DNR	26%	0.09	0.01	0.55	0.02	0.40
County and Municipal	-	0.09	0.01	0.83	0.02	0.61
Private and Tribal [d]	-	0.09	0.01	0.46	0.01	0.34
Annual Totals [j]						
Minnesota DNR	26%	-	-	5	< 1	4
County and Municipal	-	-	-	8	< 1	6
Private and Tribal [d]	-	-	-	4	< 1	3
Annual Total	-	-	-	18	1	13
Permit Duration (50 years) [j]						
Minnesota DNR	26%	-	-	266	12	190
County and Municipal	-	-	-	403	14	292
Private and Tribal [d]	-	-	-	221	6	161
Grand Total	-	-	-	890	33	643

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-11.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Early summer is from May 16 through May 31.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

Table 4-15. Number of Little Brown Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Minnesota)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Winter Habitat [c]						
Minnesota DNR	N/A	2,635.63	263.56	0.00	0.00	0.00
County and Municipal	-	2,635.63	263.56	0.00	0.00	0.00
Private and Tribal [d]	-	2,635.63	263.56	0.00	0.00	0.00
Fall/Spring[e]						
Near Large Hibernacula Entrances						
Minnesota DNR	26%	2.80	0.28	0.90	0.03	0.66
County and Municipal	-	2.80	0.28	1.38	0.03	1.01
Private and Tribal [d]	-	2.80	0.28	0.75	0.01	0.56
Near Small Hibernacula Entrances						
Minnesota DNR	26%	0.38	0.04	0.16	< 0.01	0.12
County and Municipal	-	0.38	0.04	0.24	0.01	0.18
Private and Tribal [d]	-	0.38	0.04	0.13	< 0.01	0.10
Early Summer (before pups are born) [f, g]						
Near Large Hibernacula Entrances						
Minnesota DNR	26%	0.17	0.02	0.32	0.01	0.23
County and Municipal	-	0.17	0.02	0.48	0.01	0.35
Private and Tribal [d]	-	0.17	0.02	0.26	< 0.01	0.19
General Landscape						
Minnesota DNR	26%	0.15	0.02	0.61	0.02	0.44
County and Municipal	-	0.15	0.02	0.92	0.02	0.68
Private and Tribal [d]	-	0.15	0.02	0.51	0.01	0.37

Ownership Type	% Partial Harvest	Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
		High-Quality Habitat	Low-Quality Habitat	Bats Present	Bats Killed	Bats Harmed
Dependent Pup Season (adults) [h]						
Near Large Hibernacula Entrances						
Minnesota DNR	26%	0.17	0.02	1.27	0.04	0.92
County and Municipal	-	0.17	0.02	1.92	0.04	1.41
Private	-	0.17	0.02	1.05	0.02	0.78
General Landscape						
Minnesota DNR	26%	0.15	0.02	2.44	0.07	1.78
County and Municipal	-	0.15	0.02	3.70	0.08	2.71
Private and Tribal [d]	-	0.15	0.02	2.02	0.04	1.49
Dependent Pup Season (non-flying pups) [h]						
Near Large Hibernacula Entrances						
Minnesota DNR	26%	0.09	0.01	0.63	0.09	0.40
County and Municipal	-	0.09	0.01	0.96	0.11	0.64
Private and Tribal [d]	-	0.09	0.01	0.53	0.05	0.36
General Landscape						
Minnesota DNR	26%	0.08	0.01	1.22	0.18	0.78
County and Municipal	-	0.08	0.01	1.85	0.21	1.23
Private and Tribal [d]	-	0.08	0.01	1.01	0.09	0.69
Late Summer (after pups can fly) [i]						
Near Large Hibernacula Entrances						
Minnesota DNR	26%	0.26	0.03	0.47	0.01	0.35
County and Municipal	-	0.26	0.03	0.72	0.02	0.53
Private and Tribal [d]	-	0.26	0.03	0.40	0.01	0.29
General Landscape						
Minnesota DNR	26%	0.23	0.02	0.92	0.03	0.67
County and Municipal	-	0.23	0.02	1.39	0.03	1.02
Private and Tribal [d]	-	0.23	0.02	0.76	0.01	0.56

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Annual Totals [j]						
Minnesota DNR	26%	-	-	9	< 1	6
County and Municipal	-	-	-	14	1	10
Private and Tribal [d]	-	-	-	7	< 1	5
Annual Total	-	-	-	30	1	21
Permit Duration (50 years) [j]						
Minnesota DNR	26%	-	-	447	25	317
County and Municipal	-	-	-	678	28	488
Private and Tribal [d]	-	-	-	371	12	269
Grand Total	-	-	-	1,497	65	1,074

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-11.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Early summer is from May 16 through May 31.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

Table 4-16. Number of Tricolored Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring and Summer by Ownership Type (Minnesota)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Winter Habitat [c]						
Minnesota DNR	N/A	7.90	0.79	0.00	0.00	0.00
County and Municipal	-	7.90	0.79	0.00	0.00	0.00
Private and Tribal [d]	-	7.90	0.79	0.00	0.00	0.00
Fall/Spring [e]						
Minnesota DNR	26%	0.04	< 0.01	0.03	< 0.01	0.02
County and Municipal	-	0.04	< 0.01	0.04	< 0.01	0.03
Private and Tribal [d]	-	0.04	< 0.01	0.02	< 0.01	0.02
Early Summer (before pups are born) [f, g]						
Minnesota DNR	26%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
County and Municipal	-	< 0.01	< 0.01	0.01	< 0.01	< 0.01
Private and Tribal [d]	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dependent Pup Season (adults) [h]						
Minnesota DNR	26%	< 0.01	< 0.01	0.02	< 0.01	0.01
County and Municipal	-	< 0.01	< 0.01	0.03	< 0.01	0.02
Private and Tribal [d]	-	< 0.01	< 0.01	0.01	< 0.01	0.01
Dependent Pup Season (non-flying pups) [h]						
Minnesota DNR	26%	< 0.01	< 0.01	0.02	< 0.01	0.01
County and Municipal	-	< 0.01	< 0.01	0.03	< 0.01	0.02
Private and Tribal [d]	-	< 0.01	< 0.01	0.01	< 0.01	0.01
Late Summer (after pups can fly) [i]						
Minnesota DNR	26%	< 0.01	< 0.01	0.01	< 0.01	0.01
County and Municipal	-	< 0.01	< 0.01	0.01	< 0.01	0.01
Private and Tribal [d]	-	< 0.01	< 0.01	0.01	< 0.01	0.01

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed**	**Bats Harmed**
Annual Totals [j]						
Minnesota DNR	26%	-	-	< 1	< 1	< 1
County and Municipal	-	-	-	< 1	< 1	< 1
Private and Tribal [d]	-	-	-	< 1	< 1	< 1
Annual Total	-	-	-	< 1	< 1	< 1
Permit Duration (50 years) [j]						
Minnesota DNR	26%	-	-	4	< 1	3
County and Municipal	-	-	-	5	< 1	4
Private and Tribal [d]	-	-	-	3	< 1	2
Grand Total	-	-	-	12	1	9

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-11.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[d] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[e] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[f] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[g] Early summer is from May 16 through May 31.

[h] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[i] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

4.3.2.2 Roads and Trails

Effects associated with road and trail maintenance are captured by other analyses: trees removed for maintenance were included as a type of salvage, and the value of these roads as foraging and commuting habitat is considered under Section 4.4, *Indirect (Beneficial) Effects*. Construction of new roads and trails has not been quantified but is expected to be minimal and will be offset by the mitigation for other forest management activities. Impacts from roads and trails will be less than 0.15% of all impacts.[7]

4.3.2.3 Prescribed Fire

As noted in Section 4.4, *Indirect (Beneficial) Effects,* prescribed fire has dramatic, long-term benefits to bat habitat, but the activity may have short-term impacts due to 1) the loss of some roost trees to the fire itself and trees removed to limit the spread of a fire; and 2) the harm and mortality of some bats within the stand at the time of fire. Results of prescribed fire on bat habitat and bat individuals are presented in Table 4-17. Impacts from prescribed fire are assumed to occur evenly across the three seasons when bats are active on the landscape (spring, summer, and fall). Note that relative to current levels of prescribed fire conducted by Minnesota DNR (an average of 28, 295 acres per year for 5 years [Chapter 2, Table 2-12]), the total annual acreage of anticipated prescribed fire under the Lake States HCP is higher (34,300 acres) to accommodate growth in the prescribed fire program. Only a portion of prescribed fire will affect forest/brushland as depicted in Table 4-17 below. Likewise, for county, municipalities, private and Tribal lands, the estimates provided in Chapter 2, Table 2-15 are for all land cover types. Impacts to bats are assessed for forest/brushland land cover types only. Note also that in Minnesota only 30% of private and Tribal lands are eligible to enroll and thus included in this analysis.

Table 4-17. Impact (Number of Bats Killed and Harmed) from Prescribed Fire on Covered Bats (Minnesota)

Acres of Prescribed Fire	Percent Eligible for Enrollment [a]	Maximum Acres of Forest/ Brushland Affected	Species	Impacts on Covered Lands [c]	
				Bats Killed	Bats Harmed
Minnesota DNR					
34,300	100%	6,800	Northern long-eared bat	0.14	2.29
			Little brown bat	0.27	3.99
			Tricolored bat	< 0.01	0.54
Counties and Municipalities					
1,738	100%	141	Northern long-eared bat	< 0.01	0.04
			Little brown bat	< 0.01	0.07
			Tricolored bat	< 0.01	0.01
Private and Tribal [b]					
2,203	30%	54	Northern long-eared bat	< 0.01	0.01

[7] For Minnesota, that is 10,900 acres over the life of the permit. This is equivalent to constructing approximately 91 miles of road 20 feet wide per year.

Acres of Prescribed Fire	Percent Eligible for Enrollment [a]	Maximum Acres of Forest/ Brushland Affected	Species	Impacts on Covered Lands [c] Bats Killed	Bats Harmed
			Little brown bat	< 0.01	0.03
			Tricolored bat	< 0.01	< 0.01
Permit Duration (50 years) [c]					
Minnesota DNR					
1,715,000	100%	340,000	Northern long-eared bat	6.79	114.44
			Little brown bat	13.48	199.65
			Tricolored bat	0.11	26.82
Counties and Municipalities					
86,900	100%	7,056	Northern long-eared bat	0.12	2.04
			Little brown bat	0.24	3.54
			Tricolored bat	< 0.01	0.41
Private and Tribal [b]					
110,150	30%	2,683	Northern long-eared bat	0.04	0.73
			Little brown bat	0.09	1.27
			Tricolored bat	< 0.01	0.15

Notes:

[a] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[b] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[c] Numbers may not total due to rounding.

4.3.2.4 Effects of HCP Implementation

Conservation efforts outlined in Chapter 5, *Conservation Strategy*, are designed to benefit all four covered species of bats. These include the protection of hibernacula entrances and strategic restoration of foraging and roosting habitat associated with both summer and fall/spring habitat, as well as monitoring for compliance with the conservation strategy. All mitigation efforts will improve habitat quality and will have no direct impacts on bats. Monitoring may have negligible impacts on bats and will be carried out in the least intrusive way for the data required.

4.3.3 Wisconsin

This section describes effects on the covered species from covered activities in the state of Wisconsin. For timber harvest and prescribed fire this is done quantitatively. For roads and trails, effects are described qualitatively. The effects of Lake States HCP Implementation are described as part of the conservation strategy in Chapter 5.

4.3.3.1 Timber Harvest

Habitat Effects

Based on data presented in Chapter 2, Table 2-17, Wisconsin DNR expects to complete approximately 20,000 acres per year of timber harvest on State DNR lands including 10,000 acres per year of final harvest and 10,000 acres per year of partial harvest. Timber harvest on other covered lands was derived from the FIA data and approximates harvest of 192,000 acres across all forest types (numbers derived from totals for each ownership type in Chapter 2, Table 2-19). Tables 4-18 through 4-20 provide acres harvested each year by ownership category along with the amount of harvest (in acres and percent) expected to occur by season. Note that not all of the 190,000+ harvested acres are assessed as effects in this analysis. While all county and municipal lands are eligible for coverage, only a portion of private and tribal landowners are eligible to enroll in the program (Appendix B, *Landowner Enrollment Program*). Take estimates for the Lake States HCP assume all eligible landowners enroll.

Table 4-18. Acres of High- and Low-Quality Northern Long-Eared Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Wisconsin)

Acres of Forested Habitat in Wisconsin [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
		Wisconsin DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
32,510	4,335	Private and Tribal [e]	80%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]							
Near Large Hibernacula Entrances							
		Wisconsin DNR	100%	194	26	49	6
		County and Municipal	100%	407	218	75	54
166,812	22,101	Private and Tribal [e]	80%	825	275	140	64
		Annual Total	-	1,426	519	263	124
		Permit Duration	-	71,314	25,954	13,169	6,217
Near Small Hibernacula Entrances							
		Wisconsin DNR	100%	902	146	225	37
		County and Municipal	100%	1,887	1,241	348	306
774,039	125,642	Private and Tribal [e]	80%	3,829	1,563	649	365
		Annual Total	-	6,618	2,951	1,222	707
		Permit Duration	-	330,908	147,547	61,105	35,341

Acres of Forested Habitat in Wisconsin [a]		Ownership Type	Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat			High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Summer Habitat [g]							
14,380,649	2,782,124	Wisconsin DNR	100%	16,758	3,242	4,189	811
		County and Municipal	100%	35,057	27,488	6,465	6,768
		Private and Tribal [e]	80%	71,142	34,614	12,051	8,073
		Annual Total	-	122,957	65,343	22,705	15,651
		Permit Duration	-	6,147,854	3,267,174	1,135,254	782,557
Annual Totals [h, i]							
-	-	Wisconsin DNR	-	-	-	4,464	854
		County and Municipal	-	-	-	6,888	7,127
		Private and Tribal [e]	-	-	-	12,839	8,502
		Annual Total	-	-	-	24,191	16,482
Permit Duration (50 Years) [i]							
-	-	Wisconsin DNR	-	-	-	223,179	42,678
		County and Municipal	-	-	-	344,385	356,345
		Private and Tribal [e]	-	-	-	641,964	425,091
		Grand Total	-	-	-	1,209,528	824,114

Notes:
[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.
[b] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.
[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.
[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.
[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.
[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14 and in fall habitat from August 16 through October 15.
[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.
[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values.
[i] Numbers may not total due to rounding.

Table 4-19. Acres of High- and Low-Quality Little Brown Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Wisconsin)

Acres of Forested Habitat in Wisconsin [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
5,864	2,235	Wisconsin DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
		Private and Tribal [e]	80%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]							
Near Large Hibernacula Entrances							
166,812	22,101	Wisconsin DNR	100%	194	26	49	6
		County and Municipal	100%	407	218	75	54
		Private and Tribal [e]	80%	825	275	140	64
		Annual Total	-	1,426	519	263	124
		Permit Duration	-	71,314	25,954	13,169	6,217
Near Small Hibernacula Entrances							
670,434	104,196	Wisconsin DNR	100%	781	121	195	30
		County and Municipal	100%	1,634	1,029	301	253
		Private and Tribal [e]	80%	3,317	1,296	562	302
		Annual Total	-	5,732	2,447	1,059	586
		Permit Duration	-	286,616	122,362	52,926	29,308
Summer Habitat [g]							
Near Large Hibernacula Entrances							
9,154,011	1,761,326	Wisconsin DNR	100%	10,667	2,052	2,667	513
		County and Municipal	100%	22,316	17,402	4,115	4,284
		Private and Tribal [e]	80%	45,286	21,914	7,671	5,111
		Annual Total	-	78,268	41,368	14,453	9,909
		Permit Duration	-	3,913,420	2,068,405	722,647	495,427

Acres of Forested Habitat in Wisconsin [a]				Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Percent of Lands Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
General Landscape							
5,226,638	1,020,798	Wisconsin DNR	100%	6,091	1,190	1,523	297
		County and Municipal	100%	12,741	10,086	2,350	2,483
		Private and Tribal [e]	80%	25,857	12,700	4,380	2,962
		Annual Total	-	44,689	23,975	8,252	5,743
		Permit Duration	-	2,234,433	1,198,769	412,607	287,130
Annual Totals [h, i]							
-	-	Wisconsin DNR	-	-	-	4,433	847
		County and Municipal	-	-	-	6,841	7,075
		Private and Tribal [e]	-	-	-	12,752	8,440
		Annual Total	-	-	-	24,027	16,362
Permit Duration (50 Years) [i]							
-	-	Wisconsin DNR	-	-	-	221,670	42,365
		County and Municipal	-	-	-	342,056	353,737
		Private and Tribal [e]	-	-	-	637,623	421,979
		Grand Total	-	-	-	1,201,349	818,082

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.

[b] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14 and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values.

[i] Numbers may not trouble due to rounding.

Table 4-20. Acres of High- and Low-Quality Tricolored Bat Habitat Harvested in Winter, Fall/Spring, and Summer by Ownership Type (Wisconsin)

Acres of Forested Habitat in Wisconsin [a]			Percent of Lands	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type	Eligible for Enrollment [b]	High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Winter Habitat [d]							
25,017	3,754	Wisconsin DNR	100%	0	0	0	0
		County and Municipal	100%	0	0	0	0
		Private and Tribal [e]	80%	0	0	0	0
		Annual Total	-	0	0	0	0
		Permit Duration	-	0	0	0	0
Fall/Spring Habitat [f]							
788,739	108,423	Wisconsin DNR	100%	919	126	230	32
		County and Municipal	100%	1,923	1,071	355	264
		Private and Tribal [e]	80%	3,902	1,349	661	315
		Annual Total	-	6,744	2,547	1,245	610
		Permit Duration	-	337,193	127,326	62,266	30,497
Summer Habitat [g]							
6,431,046	1,360,493	Wisconsin DNR	100%	7,494	1,585	1,874	396
		County and Municipal	100%	15,678	13,442	2,891	3,309
		Private and Tribal [e]	80%	31,815	16,927	5,389	3,948
		Annual Total	-	54,987	31,954	10,154	7,654
		Permit Duration	-	2,749,329	1,597,689	507,687	382,680

Acres of Forested Habitat in Wisconsin [a]			Percent of Lands Eligible for Enrollment [b]	Maximum Acres of Seasonal Habitat Harvested [c]		Maximum Acres of Seasonal Habitat Harvested When Bats Are Present	
High-Quality Habitat	Low-Quality Habitat	Ownership Type		High-Quality Habitat	Low-Quality Habitat	High-Quality Habitat	Low-Quality Habitat
Annual Totals [h, i]							
-	-	Wisconsin DNR	-	-	-	2,103	428
		County and Municipal	-	-	-	3,246	3,573
		Private and Tribal [e]	-	-	-	6,050	4,262
		Annual Total	-	-	-	11,399	8,264
Permit Duration (50 Years) [i]							
-	-	Wisconsin DNR	-	-	-	105,166	21,397
		County and Municipal	-	-	-	162,281	178,657
		Private and Tribal [e]	-	-	-	302,506	213,123
		Grand Total	-	-	-	569,953	413,177

Notes:

[a] All forest types were assigned to either high- or low-quality bat habitat per Chapter 3, Table 3-2.

[b] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] Bats are assumed to be present in different locations on the landscape at different seasons as described in Chapter 3, Table 3-3.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14 and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Annual totals were calculated as a sum of winter, fall/spring, and summer habitat values.

[i] Numbers may not total due to rounding.

Impacts on Individuals

Impacts on individual bats are provided for context, noting that the number of individual bats taken will decrease as bat population decrease due to WNS (Chapter 3, Section 3.3.1, *White-Nose Syndrome*). Impacts on individual bats were derived from estimates of impacts on habitat (Tables 4-21 through 4-23). These are overlaid with bat densities estimated in Table 3-15. Results have been provided for number of bats harmed through disturbance and killed if conservation measures are not applied. These data are presented in Tables 4-21 through 4-23.

Table 4-21. Number of Northern Long-Eared Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Wisconsin)

Ownership Type	% Partial Harvest	Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
		High-Quality Habitat	Low-Quality Habitat	Bats Present	Bats Killed [c]	Bats Harmed [c]
Winter Habitat [d]						
Wisconsin DNR	N/A	6.41	0.64	0.00	0.00	0.00
County and Municipal	-	6.41	0.64	0.00	0.00	0.00
Private and Tribal [e]	-	6.41	0.64	0.00	0.00	0.00
Fall/Spring [e]						
Near Large Hibernacula Entrances						
Wisconsin DNR	50%	1.19	0.12	0.58	0.02	0.43
County and Municipal	-	1.19	0.12	1.83	0.03	1.35
Private and Tribal [e]	-	1.19	0.12	3.26	0.05	2.41
Near Small Hibernacula Entrances						
Wisconsin DNR	50%	0.01	< 0.01	0.03	< 0.01	0.02
County and Municipal	-	0.01	< 0.01	0.10	< 0.01	0.07
Private and Tribal [e]	-	0.01	< 0.01	0.17	< 0.01	0.13
Early Summer (before pups are born) [g, h]						
Wisconsin DNR	50%	0.01	< 0.01	0.10	< 0.01	0.07
County and Municipal	-	0.01	< 0.01	0.33	0.01	0.24
Private and Tribal [e]	-	0.01	< 0.01	0.58	0.01	0.43
Dependent Pup Season (adults) [i]						
Wisconsin DNR	50%	0.01	< 0.01	0.41	0.01	0.30
County and Municipal	-	0.01	< 0.01	1.30	0.02	0.96
Private and Tribal [e]	-	0.01	< 0.01	2.31	0.04	1.70
Dependent Pup Season (non-flying pups) [i]						
Wisconsin DNR	50%	0.01	< 0.01	0.21	0.03	0.13
County and Municipal	-	0.01	< 0.01	0.65	0.05	0.45
Private and Tribal [e]	-	0.01	< 0.01	1.15	0.09	0.80

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed [c]**	**Bats Harmed [c]**
Late Summer (after pups can fly) [j]						
Wisconsin DNR	50%	0.02	< 0.01	0.15	< 0.01	0.11
County and Municipal	-	0.02	< 0.01	0.49	0.01	0.36
Private and Tribal [e]	-	0.02	< 0.01	0.87	0.01	0.64
Annual Totals [k]						
Wisconsin DNR	50%	-	-	1	< 1	1
County and Municipal	-	-	-	5	< 1	3
Private and Tribal [e]	-	-	-	8	< 1	6
Annual Total	-	-	-	15	< 1	11
Permit Duration (50 years) [k]						
Wisconsin DNR	50%	-	-	74	3	53
County and Municipal	-	-	-	235	6	172
Private and Tribal [e]	-	-	-	417	10	305
Grand Total	-	-	-	726	20	530

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-15.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] As described in Section 4.2.1.2, *Bats*, Figure 4-2, the number of bats harmed or killed in an area equals 75% of the population in that area.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the “Native American” owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Early summer is from May 16 through May 31.

[i] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[j] Late summer is from August 1 through August 15.

[j] Numbers may not total due to rounding.

N/A = not applicable

Table 4-22. Number of Little Brown Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Wisconsin)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed [c]**	**Bats Harmed [c]**
Winter Habitat [d]						
Wisconsin DNR	N/A	921.56	92.16	0.00	0.00	0.00
County and Municipal	-	921.56	92.16	0.00	0.00	0.00
Private and Tribal [e]	-	921.56	92.16	0.00	0.00	0.00
Fall/Spring [f]						
Near Large Hibernacula Entrances						
Wisconsin DNR	50%	31.53	3.15	15.53	0.47	11.30
County and Municipal	-	31.53	3.15	48.54	0.76	35.84
Private and Tribal [e]	-	31.53	3.15	86.53	1.38	63.86
Near Small Hibernacula Entrances						
Wisconsin DNR	50%	0.41	0.04	0.82	0.02	0.59
County and Municipal	-	0.41	0.04	2.57	0.04	1.90
Private and Tribal [e]	-	0.41	0.04	4.57	0.07	3.37
Early Summer (before pups are born) [g, h]						
Near Large Hibernacula						
Wisconsin DNR	50%	0.17	0.02	0.77	0.02	0.56
County and Municipal	-	0.17	0.02	2.45	0.04	1.81
Private and Tribal [e]	-	0.17	0.02	4.35	0.07	3.21
General Landscape						
DNR	50%	0.15	0.02	0.39	0.01	0.28
County and Municipal	-	0.15	0.02	1.24	0.02	0.91
Private and Tribal [e]	-	0.15	0.02	2.20	0.04	1.62

Ownership Type	% Partial Harvest	Density [a] (Bats/100 Acres) High-Quality Habitat	Density [a] (Bats/100 Acres) Low-Quality Habitat	Impacts on Covered Lands [b] Bats Present	Impacts on Covered Lands [b] Bats Killed [c]	Impacts on Covered Lands [b] Bats Harmed [c]
Dependent Pup Season (adults) [i]						
Near Large Hibernacula Entrances						
Wisconsin DNR	50%	0.17	0.02	3.09	0.09	2.25
County and Municipal	-	0.17	0.02	9.81	0.15	7.24
Private and Tribal [e]	-	0.17	0.02	17.39	0.28	12.83
General Landscape						
Wisconsin DNR	50%	0.15	0.02	1.56	0.05	1.14
County and Municipal	-	0.15	0.02	4.96	0.08	3.66
Private and Tribal [e]	-	0.15	0.02	8.79	0.14	6.48
Dependent Pup Season (non-flying pups) [i]						
Near Large Hibernacula Entrances						
Wisconsin DNR	50%	0.09	0.01	1.55	0.23	0.99
County and Municipal	-	0.09	0.01	4.91	0.39	3.39
Private and Tribal [e]	-	0.09	0.01	8.70	0.70	6.0
General Landscape						
Wisconsin DNR	50%	0.08	0.01	0.78	0.12	0.50
County and Municipal	-	0.08	0.01	2.48	0.20	1.71
Private and Tribal [e]	-	0.08	0.01	4.39	0.35	3.03
Late Summer (after pups can fly) [j]						
Near Large Hibernacula Entrances						
Wisconsin DNR	50%	0.26	0.03	1.16	0.03	0.84
County and Municipal	-	0.26	0.03	3.68	0.06	2.72
Private and Tribal [e]	-	0.26	0.03	6.52	0.10	4.81
General Landscape						
Wisconsin DNR	50%	0.23	0.02	0.59	0.02	0.43
County and Municipal	-	0.23	0.02	1.86	0.03	1.37
Private and Tribal [e]	-	0.23	0.02	3.29	0.05	2.43

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed [c]**	**Bats Harmed [c]**
Annual Totals [k]						
Wisconsin DNR	50%	-	-	26	1	19
County and Municipal	-	-	-	82	2	61
Private and Tribal [e]	-	-	-	147	3	108
Annual Total	-	-	-	255	6	187
Permit Duration (50 years) [k]						
Wisconsin DNR	50%	-	-	1,311	53	944
County and Municipal	-	-	-	4,125	88	3,027
Private and Tribal [e]	-	-	-	7,336	159	5,383
Grand Total	-	-	-	12,772	301	9,354

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-15.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] As described in Section 4.2.1.2, *Bats*, Figure 4-2, the number of bats harmed or killed in an area equals 75% of the population in that area.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrances (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Early summer is from May 16 through May 31.

[i] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[j] Late summer is from August 1 through August 15.

[k] Numbers may not total due to rounding.

N/A = not applicable

Table 4-23. Number of Tricolored Bats Killed or Harmed (Disturbed) by Timber Harvest in Winter, Fall/Spring, and Summer by Ownership Type (Wisconsin)

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed [c]**	**Bats Harmed [c]**
Winter Habitat [d]						
Wisconsin DNR	N/A	0.91	0.09	0.00	0.00	0.00
County and Municipal	-	0.91	0.09	0.00	0.00	0.00
Private and Tribal [e]	-	0.91	0.09	0.00	0.00	0.00
Fall/Spring [f]						
Wisconsin DNR	50%	0.03	< 0.01	0.07	< 0.01	0.05
County and Municipal	-	0.03	< 0.01	0.21	< 0.01	0.15
Private and Tribal [e]	-	0.03	< 0.01	0.37	0.01	0.28
Early Summer (before pups are born) [g, h]						
Wisconsin DNR	50%	< 0.01	< 0.01	0.01	< 0.01	0.01
County and Municipal	-	< 0.01	< 0.01	0.04	< 0.01	0.03
Private and Tribal [e]	-	< 0.01	< 0.01	0.06	< 0.01	0.05
Dependent Pup Season (adults) [i]						
Wisconsin DNR	50%	< 0.01	< 0.01	0.04	< 0.01	0.03
County and Municipal	-	< 0.01	< 0.01	0.14	< 0.01	0.11
Private and Tribal [e]	-	< 0.01	< 0.01	0.25	< 0.01	0.19
Dependent Pup Season (non-flying pups) [i]						
Wisconsin DNR	50%	< 0.01	< 0.01	0.04	0.01	0.03
County and Municipal	-	< 0.01	< 0.01	0.14	0.01	0.10
Private and Tribal [e]	-	< 0.01	< 0.01	0.25	0.02	0.17
Late Summer (after pups can fly) [j]						
Wisconsin DNR	50%	0.01	< 0.01	0.02	< 0.01	0.02
County and Municipal	-	0.01	< 0.01	0.07	< 0.01	0.05
Private and Tribal [e]	-	0.01	< 0.01	0.13	< 0.01	0.09

		Density [a] (Bats/100 Acres)		Impacts on Covered Lands [b]		
Ownership Type	**% Partial Harvest**	**High-Quality Habitat**	**Low-Quality Habitat**	**Bats Present**	**Bats Killed [c]**	**Bats Harmed [c]**
Annual Totals [k]						
Wisconsin DNR	50%	-	-	< 1	< 1	< 1
County and Municipal	-	-	-	1	< 1	< 1
Private and Tribal [e]	-	-	-	1	< 1	1
Annual Total	-	-	-	2	< 1	1
Permit Duration (50 years) [k]						
Wisconsin DNR	50%	-	-	9	1	7
County and Municipal	-	-	-	30	1	22
Private and Tribal [e]	-	-	-	53	2	39
Grand Total	-	-	-	93	3	67

Notes:

[a] Bat density estimates were based on winter hibernaculum entrance surveys and summer capture records with input from DNR bat biologists, adjusted for the proportion of the population remaining after the impacts of WNS. Density estimates vary based on habitat quality and season. Population estimates and additional density information can be found in Chapter 3, Table 3-15.

[b] Appendix B, *Landowner Enrollment Program,* explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[c] As described in Section 4.2.1.2, *Bats*, Figure 4-2, the number of bats harmed or killed in an area equals 75% of the population in that area.

[d] Winter habitat is modeled as 0.25 mile around known hibernacula entrances with bats assumed to be present from October 16 through April 14 (Chapter 3, Table 3-3). No timber harvest takes place in winter habitat during the winter; therefore, effects on bats in winter habitat are zero.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Fall/spring habitat is modeled as either 5 or 10 miles around hibernacula entrances, depending on the size of the hibernaculum entrance (Chapter 3, Table 3-3). Bats are assumed to be present in spring habitat from April 15 through May 14, and in fall habitat from August 16 through October 15.

[g] Summer habitat for bats is all forested habitat. Bats are assumed to be present in summer habitat from May 15 through August 15.

[h] Early summer is from May 16 through May 31.

[i] Dependent pup season is from June 1 through July 31 (Chapter 3, Table 3-3).

[j] Late summer is from August 1 through August 15.

[k] Numbers may not total due to rounding.

N/A = not applicable

4.3.3.2 Roads and Trails

Effects associated with road and trail maintenance are captured by other analyses: trees removed for maintenance were included as a type of salvage, and the value of these roads as foraging and commuting habitat is considered under Section 4.4, *Indirect (Beneficial) Effects*. Construction of new roads and trails has not been quantified but is expected to be minimal and will be offset by the mitigation for other forest management activities. Impacts from roads and trails will be less than 0.15% of all impacts. [8]

Prescribed Fire

As noted in Section 4.4, *Indirect (Beneficial) Effects*, prescribed fire has dramatic, long-term benefits to bat habitat, but the activity may have short-term impacts due to 1) the loss of some roost trees to the fire itself and trees removed to limit the spread of a fire; and 2) the harm and mortality of some bats within the stand at the time of fire. Results of prescribed fire on bat habitat and bat individuals is presented in Table 4-24. Impacts from prescribed fire are assumed to occur evenly across the three seasons when bats are active on the landscape (spring, summer, and fall). Note that relative to current levels of prescribed fire conducted by on Wisconsin DNR lands and county, municipal, and private including Tribal lands (an average of 25,712 acres per year for 5 years; see Chapter 2, Table 2-18), the total annual acreage of anticipated prescribed fire under the Lake States HCP is higher (25,800 acres for Wisconsin DNR lands plus 5,000 acres for county, municipal, and private [including Tribal] lands) to accommodate growth in the prescribed fire program (Table 4-24). In Wisconsin, prescribed fire is less common on private (including Tribal), county, and municipal lands and is often conducted in conjunction with DNR staff and was, thus, included in Table 2-18.

Table 4-24. Impacts (Number of Bats Killed and Harmed) from Prescribed Fire on Covered Bats (Wisconsin)

Acres of Prescribed Fire	Percent Eligible for Enrollment [a]	Maximum Acres of Forest/Brushland Affected	Species	Impacts on Covered Lands	
				Bats Killed	Bats Harmed
Annual					
Wisconsin DNR					
25,800	100%	4,000	Northern long-eared bat	0.02	0.35
			Little brown bat	0.32	6.01
			Tricolored bat	< 0.01	0.22
Counties and Municipalities					
1,089	100%	399	Northern long-eared bat	< 0.01	0.03
			Little brown bat	0.02	0.43
			Tricolored bat	< 0.01	0.01

[8] For Wisconsin, that is 14,320 acres over the life of the permit. This is equivalent to constructing approximately 119 miles of road 20 feet wide per year.

Acres of Prescribed Fire	Percent Eligible for Enrollment [a]	Maximum Acres of Forest/Brushland Affected	Species	Impacts on Covered Lands	
				Bats Killed	Bats Harmed
Private and Tribal [b]					
3,911	80%	681	Northern long-eared bat	< 0.01	0.05
			Little brown bat	0.05	0.85
			Tricolored bat	< 0.01	0.03
Permit Duration (50 years) [c]					
Wisconsin DNR					
1,290,000	100%	200,000	Northern long-eared bat	1.04	17.50
			Little brown bat	15.99	300.50
			Tricolored bat	0.17	10.78
Counties and Municipalities					
54,450	100%	19,962	Northern long-eared bat	0.07	1.25
			Little brown bat	1.14	21.44
			Tricolored bat	0.01	0.680
Private and Tribal [b]					
195,550	80%	34,031	Northern long-eared bat	0.15	2.48
			Little brown bat	2.26	42.52
			Tricolored bat	0.02	1.34

Notes:

[a] Appendix B, *Landowner Enrollment Program*, explains the insignificant effect of low levels of forestry activities by some landowners and details what makes landowners eligible to enroll in the Lake States HCP.

[b] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[c] Numbers may not total due to rounding.

4.3.3.3 Effects of HCP Implementation

Conservation efforts outlined in Chapter 5, *Conservation Strategy*, are designed to benefit all four covered species of bats. These include the protection of hibernacula entrances and strategic restoration of foraging and roosting habitat associated with both summer and fall/spring habitat, as well as monitoring for compliance with the conservation plan. All mitigation efforts will improve habitat quality and will have no direct impacts on bats. Monitoring may have negligible impacts on bats and will be carried out in the least intrusive way for the data required.

4.4 Indirect (Beneficial) Effects

Indirect effects are those effects that occur at a different time and/or place than the initial action or covered activity. Over time, indirect effects of the covered activities provide improved habitat for bats as forestry activities create a variety of seral stages, retaining trees that become high-quality roosts, and creating edge and lower clutter habitats that provide high-quality foraging sites (Guldin et al. 2007; Silvis et al. 2012; Sheets et al. 2013b; Pauli et al. 2015b; Gallagher et al. 2021). These indirect effects are described qualitatively, with the exception of Section 4.4.1.2, *Case Study of Indirect Effects in High-Quality Forest*, which quantifies indirect effects using a case study approach. The following covered activities are addressed: timber harvest, roads and trails maintenance and use, and prescribed fire.

4.4.1 Timber Harvest

This section describes the indirect effects resulting from timber harvest. These indirect effects include the improvement of roosting and foraging habitat over time (Blakey et al. 2016; Guldin et al. 2007; Pauli et al. 2015a, 2015b; Sheets et al. 2013b; Silvis et al. 2012; Silvis et al. 2016, Gallagher et al. 2021). Improvements in roosting and foraging habitat will increase fecundity and fitness and promote survivorship of the covered species.

4.4.1.1 Overview of Changes in Habitat Quality

- Timber harvest sets in motion long-term changes in habitat quality that can be seen for decades after the harvest has ended. The four covered bat species all use forested areas for roosting and foraging; thus, timber harvest can dramatically affect habitat quality for bats, and these effects can manifest for years after a stand is manipulated. Several recent publications have reviewed the impact of forest management on bats (Gallagher et al. 2021; Sheets et al. 2013a; Pauli 2014; Pauli et al. 2015a, 2015b; Silvis et al. 2016; Voigt and Kingston 2016). Figure 4-3 is based on analyses contained in Sheets et al. (2013a) that examined how all four covered species (especially the Indiana bat) would react to a variety of potential forest management practices in the oak/hickory forests of central Indiana.
- The same timber harvest can have dramatically different effects on roosting and foraging habitat. For example, some types of timber harvest, especially a final harvest with limited residuals such as the final harvest of Jack Pine on well-drained, sandy soil, can remove most of the potential roosts from a stand. However, the open space created by that harvest and, more importantly, the edge around that open space provide bats with high-quality foraging habitat. Thus, it is important to examine both roosting and foraging habitat.
- The interaction between bats, timber harvest, and succession is complex. When considered at a landscape scale, stands of multiple ages and types of forest create a mosaic of habitat that provides for all life cycle needs of bats (Gallagher et al. 2021). Each stand harvested results in different outcomes for bat habitat quality based on the type of harvest, the forest type, and the species of bat. For these reasons, the Lake States HCP does not quantify the net effects on habitat quality for each species in each forest type for each treatment type at various intervals of time. This HCP does demonstrate herein that the indirect effects of harvest (and subsequently other covered activities) are largely beneficial. The following section (4.4.1.2) provides a case study that quantifies the long-term benefits of timber harvest to illustrate how and why these benefits might accrue. Section 4.4.1.3, *Qualitative Examples of Habitat Changes Associated with Common Management Systems of the Lake States*, describes qualitatively how timber harvest benefits bats in three common forest types.

4.4.1.2 Case Study of Indirect Effects in High-Quality Forest

The direct effects of timber harvest are described in Section 4.3, *Direct Effects,* and can include killing, harming, or harassing bats at the time of harvest. However, the long-term or indirect effects of timber management on bats are largely beneficial. This case study demonstrates that—on balance—habitat for bats improves over time following timber harvest. This analysis takes into account the type of harvest (final versus partial) and improvements or declines to roosting versus foraging habitat. This case study uses the approach outlined in Sheets et al. (2013a), which investigates the response of Indiana bats to timber harvest in two state forests in Indiana. This approach was also the basis for similar analyses contained in the recent Forestry HCP for Bats on Pennsylvania State Game Lands, State Forests, and State Parks (Pennsylvania Game Commission and Department of Conservation and Natural Resources 2020). The objective of this case-study analysis is to examine the net effect of timber harvest on bats over time, using northern long-eared bats in oak-history stands as an example.

Indirect effects of final and partial harvest are described in the subsections below. A summary of combined direct and indirect effects is provided in Tables 4-25 and 4-26, using northern long-eared bat as an example. Northern long-eared bat was analyzed for this case study since it is the most widely distributed bat across the three Lake States, and it is the most affected by changes to roosting habitat. Oak-hickory was analyzed in this case study because it is a common forest type across the states, and it was used in the Sheets et al. (2013a) study upon which this analysis is based.

Roosting habitat and foraging habitat are quantified in this analysis. Roosting habitat is the area used by covered bats for roosting and rearing young and is generally characterized by snags, trees with cavities or hollow, and trees with loose or shaggy bark. Roost trees with high levels of solar exposure provide better roosting conditions than those that are shaded.

Foraging habitat is the area used by covered bats for feeding. For covered bats, foraging habitat quality is affected by the openness of the stand. To combine the relative contribution of roosting and foraging habitat to overall habitat quality, we followed the approach used in the recently permitted Forestry HCP for Bats on Pennsylvania State Game Lands, State Forests, and State Parks (Pennsylvania Game Commission and Department of Conservation and Natural Resources 2020): roosting habitat is considered twice as valuable as foraging habitat for covered bats.

Different forest management activities have different effects on covered bats. Namely final harvest and partial harvest practices are categorized and discussed separately below for both foraging and roosting habitat.

Final Harvest

Final harvest has an immediate (negative) direct effect on both roosting and foraging habitat within the stand. For northern long-eared bats, the forest begins to recover habitat value the year following harvest, exceeding baseline conditions for combined *roosting and foraging* quality around year 10 (Figure 4-3). The effects of final harvest on both roosting and foraging habitat are discussed in more detail in this section.

Table 4-25. Levels of Direct and Indirect Effects from Timber Harvest Compared to Baseline on Forest Habitat for Northern Long-Eared Bats

	Direct Effects			Indirect Effects		
Harvests	**Category of Effect**	**Magnitude of Effect [a]**	**Year of Effects**	**Category of Effect**	**Magnitude of Effect [a]**	**Justification**
Effects on Roosting Habitat						
Final harvest	High negative effect	-0.75	At harvest	No change	0.00	-
	No change	0.00	Year 1	Moderate improvement	0.50	Retained roost trees have higher solar exposure. Some retained trees die/become decadent and become roosts. Damaged and broken limbs are regularly used by northern long-eared bats.
	No change	0.00	Biannually [b] years 2–20	Trace improvement	0.05 per every other year	Retained roost trees have higher solar exposure. Some retained trees die/become decadent and become roosts. Remaining trees get larger.
	No change	0.00	Year 21–50	No change	0.00	Young trees begin to fill the stand. Northern long-eared bats will continue to roost in residual trees.
Partial harvest	No change	0.00	At harvest	No change	0.00	-
	No change	0.00	Annually years 1–10	Trace improvement	0.05 per year	Retained roost trees have higher solar exposure. Some retained trees die and become roosts. Surviving damaged trees become more decadent and become roosts. Remaining trees get larger.
	No change	0.00	Annually years 10–50	No change	0.00	As the trees grow there is less space between them for bats to fly. However, residual trees become older and become decadent.

Harvests	Direct Effects		Indirect Effects			
	Category of Effect	Magnitude of Effect [a]	Year of Effects	Category of Effect	Magnitude of Effect [a]	Justification
Effects on Foraging Habitat						
Final harvest	Minor decline	-0.25	At harvest	No change	0.00	-
	No change	0.00	Year 1–10	Trace improvement	0.05	Understory regenerates and provides a second vegetative interface.
	No change	0.00	Years 10–50	No change	0.00	Saplings begin to fill the understory. Vegetation begins to fill the stand, but it remains usable for northern long-eared bats.
Partial harvest	Minor decline	-0.25	At harvest	No change	0.00	-
	No change	0.00	Year 1–10	Trace improvement	0.05	Saplings begin to fill understory. More cluttered understory becomes prime foraging.
	No change	0.00	Years 11–50	No change	0.00	Understory becomes progressively more full with vegetation but remains usable by northern long-eared bats.

Notes:

[a] Effect size (sign indicates the direction of the effect): 0.00 = no effect; 0.05 = trace; 0.25 = minor; 0.50 = moderate; 0.75 = major; 1.00 = complete.

[b] 0.05 (trace effects) is the smallest increment used in the model outputs. Although real effects are occurring continually throughout time, in these results it is shown as a trace output every other year.

Table 4-26. Calculations for Annual Net Timber Harvest Effects on Northern Long-eared Bat Habitat Quality in an Oak-Hickory Stand for the Purpose of Illustrating Habitat Change From Timber Harvest [a]

			Final Harvest					Partial Harvest					
				Magnitude of Effect					Magnitude of Effect				
Years Since Harvest	Total Harvest (Acres)	Oak-Hickory Harvest (Acres) [b]	Affected Area Final Harvest (Acres)	Roosting Quality	Foraging Quality	Roosting and Habitat Quality	Habitat Impacts (Acres) [c]	Affected Area Partial Harvest (Acres)	Roosting Quality	Foraging Quality	Roosting and Habitat Quality	Habitat Impacts (Acres) [c]	Total Habitat Impacts (Acres) [c]
Baseline	64,000.00	9,582.59	5,989.12	N/A	N/A	1.00	0.00	3,593.47	N/A	N/A	1.00	0.00	0.00
At Harvest	64,000.00	9,582.59	5,989.12	-0.75	-0.25	0.42	-3,493.65	3,593.47	0.00	-0.25	0.92	-299.46	-3,793.11
1	64,000.00	9,582.59	5,989.12	0.50	0.05	0.77	+2,096.19	3,593.47	0.05	0.05	0.97	+179.67	+2,275.87
2	64,000.00	9,582.59	5,989.12	0.05[d]	0.05	0.82	+299.46	3,593.47	0.05	0.05	1.02	+179.67	+479.13
3	64,000.00	9,582.59	5,989.12	0.00[d]	0.05	0.83	+99.82	3,593.47	0.05	0.05	1.07	+179.67	+279.49
4	64,000.00	9,582.59	5,989.12	0.05[d]	0.05	0.88	+299.46	3,593.47	0.05	0.05	1.12	+179.67	+479.13
5	64,000.00	9,582.59	5,989.12	0.00[d]	0.05	0.90	+99.82	3,593.47	0.05	0.05	1.17	+179.67	+279.49
6	64,000.00	9,582.59	5,989.12	0.05[d]	0.05	0.95	+299.46	3,593.47	0.05	0.05	1.22	+179.67	+479.13
7	64,000.00	9,582.59	5,989.12	0.00[d]	0.05	0.97	+99.82	3,593.47	0.05	0.05	1.27	+179.67	+279.49
8	64,000.00	9,582.59	5,989.12	0.05[d]	0.05	1.02	+299.46	3,593.47	0.05	0.05	1.32	+179.67	+479.13
9	64,000.00	9,582.59	5,989.12	0.00[d]	0.05	1.03	+99.82	3,593.47	0.05	0.05	1.37	+179.67	+279.49
10	64,000.00	9,582.59	5,989.12	0.05[d]	0.05	1.08	+299.46	3,593.47	0.05	0.05	1.42	+179.67	+479.13
11	64,000.00	9,582.59	5,989.12	0.00[d]	0.00	1.08	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00[d]
12	64,000.00	9,582.59	5,989.12	0.05[d]	0.00	1.12	+199.64	3,593.47	0.00	0.00	1.42	0.00	+199.64[d]
13	64,000.00	9,582.59	5,989.12	0.00[d]	0.00	1.12	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00[d]
14	64,000.00	9,582.59	5,989.12	0.05[d]	0.00	1.15	+199.64	3,593.47	0.00	0.00	1.42	0.00	+199.64[d]
15	64,000.00	9,582.59	5,989.12	0.00[d]	0.00	1.15	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00[d]
16	64,000.00	9,582.59	5,989.12	0.05[d]	0.00	1.18	+199.64	3,593.47	0.00	0.00	1.42	0.00	+199.64[d]
17	64,000.00	9,582.59	5,989.12	0.00[d]	0.00	1.18	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00[d]
18	64,000.00	9,582.59	5,989.12	0.05[d]	0.00	1.22	+199.64	3,593.47	0.00	0.00	1.42	0.00	+199.64[d]
19	64,000.00	9,582.59	5,989.12	0.00[d]	0.00	1.22	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00[d]
20	64,000.00	9,582.59	5,989.12	0.05[d]	0.00	1.25	+199.64	3,593.47	0.00	0.00	1.42	0.00	+199.64[d]
21	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
22	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
23	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
24	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
25	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
26	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00

Years Since Harvest	Total Harvest (Acres)	Oak-Hickory Harvest (Acres) [b]	Final Harvest: Affected Area Final Harvest (Acres)	Final Harvest: Magnitude of Effect: Roosting Quality	Final Harvest: Magnitude of Effect: Foraging Quality	Final Harvest: Roosting and Habitat Quality	Final Harvest: Habitat Impacts (Acres) [c]	Partial Harvest: Affected Area Partial Harvest (Acres)	Partial Harvest: Magnitude of Effect: Roosting Quality	Partial Harvest: Magnitude of Effect: Foraging Quality	Partial Harvest: Roosting and Habitat Quality	Partial Harvest: Habitat Impacts (Acres) [c]	Total Habitat Impacts (Acres) [c]
27	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
28	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
29	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
30	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
31	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
32	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
33	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
34	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
35	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
36	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
37	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
38	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
39	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
40	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
41	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
42	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
43	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
44	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
45	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
46	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
47	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
48	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
49	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
50	64,000.00	9,582.59	5,989.12	0.00	0.00	1.25	0.00	3,593.47	0.00	0.00	1.42	0.00	0.00
Total	64,000.00	9,582.59	5,989.12	-	-	-	+1,497.28	3,593.47	-	-	-	+1,497.28	+2,994.56

Notes:
[a] Assumes a residual and successful regeneration.
[b] Proportion of State Forestlands of Oak-Hickory derived from FIA data.
[c] Habitat impacts represent the level of change in habitat quality relative to baseline for the species. Positive numbers indicate an increase in habitat value while negative numbers indicate a decrease in habitat value.
[d] 0.05 (trace effects) is the smallest increment used in the model outputs. Although real effects are occurring continually throughout time, in these results it is shown as a trace output every other year.
N/A = not applicable

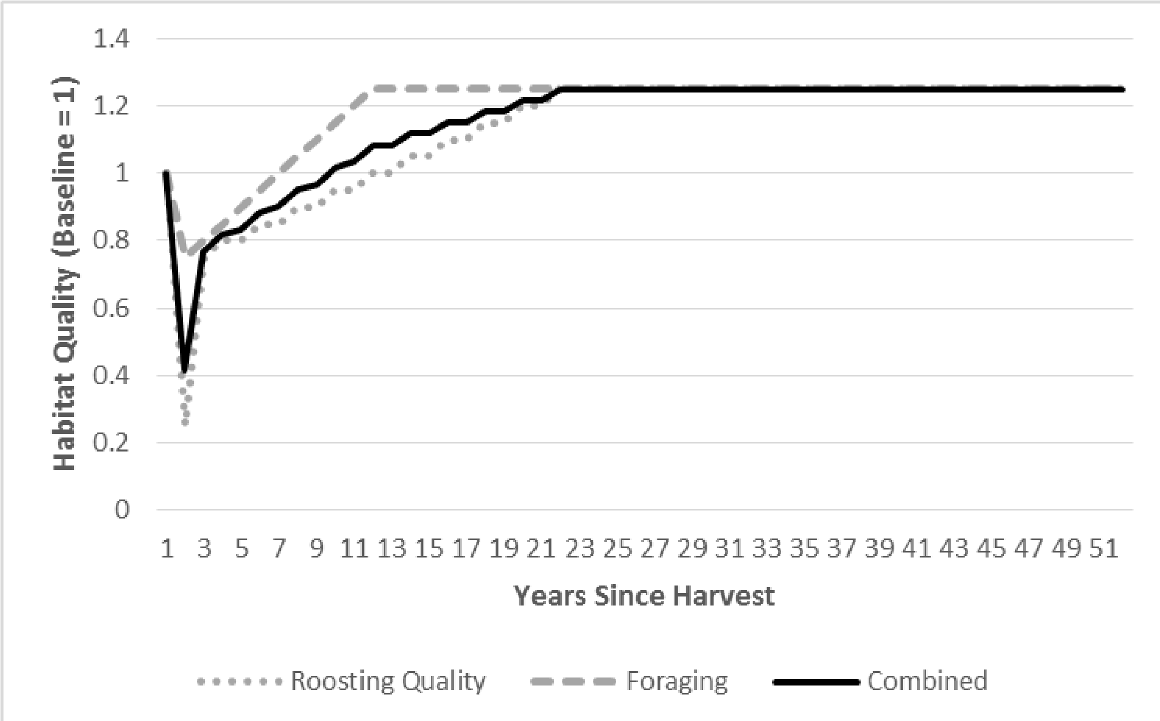


Figure 4-3. Direct and Indirect Effects of Final Harvest on Habitat Quality for Northern Long-Eared Bats

Roosting Habitat

For northern long-eared bats, a final harvest is estimated to significantly decrease the roosting quality of a stand by removing potential roost trees. This initial negative, direct effect (Figure 4-3) is captured in Section 4.2.1, *Direct Effects*. Retained trees have value as roosting habitat for bats, especially those trees with extensive systems of cracks and hollows. The year following harvest, roosting habitat quality begins to increase. These initial changes in roosting habitat quality are the result of 1) increased solar exposure to residual trees (bats typically prefer warmer temperatures); 2) accelerated decline of these trees due to damage occurring during harvest or increased exposure to storms (dead and declining trees provide more roosting opportunities for bats); and 3) subsequent increase in size and age of surviving residual trees, all of which increase roosting quality for the first 20 years. From years 21 through 50, no additional changes to roosting habitat quality are predicted for northern long-eared bats if the stand is left untouched.

Foraging Habitat

Many bats preferentially forage at the forest edges where more densely forested areas are adjacent to more open areas (Sparks et al. 2004; O'Keefe 2009). This leads to a selection of forests with some degree of openness (Brack 2006; O'Keefe 2009), although northern long-eared bats are among the most clutter-adapted of eastern species (Owen et al. 2003; Schirmacher et al. 2007; O'Keefe 2009; Pauli 2014). A final harvest initially results in a minor decline in foraging quality for this species due to its reliance on forested areas for foraging (Figure 4-3). Habitat quality for northern long-eared bats gradually increases (effectively coming back to baseline) during the first 10 years post-harvest as the understory recovers and new edges develop. Residual trees that fall create tip-up mounds, which often capture water and create small ponds similar to those that are widely used by foraging bats in the region (Francl 2008).

Partial Harvest

Because partial harvests leave substantial numbers of trees including many with damage (MacGregor et al. 1999) on the landscape, the initial impacts on roosting and foraging habitat are less intense (Figures 4-4). The forest begins to recover habitat value within a year of harvest, and, over time, the stand's quality improves to be either the same or greater than it was prior to harvest. Trees that are removed are replaced, and the stand again becomes filled with trees unless the stand is manipulated or otherwise disturbed again.

Roosting Habitat

A partial harvest removes some roost trees, but other silvicultural practices such as retention of large cull trees for wildlife benefit, retention of legacy trees, and incidental residual tree damage occurring during harvest also create roosting opportunities. In fact, telemetered northern long-eared bats in Kentucky moved into a partial harvest before it was even completed (MacGregor et al. 1999). As such, the effect on roosting habitat on northern long-eared bats is positive at the stand level (Figure 4-4). Some of the residual trees die over time and become higher-quality roost trees, and some that were damaged remain living but also offer higher-quality roosting opportunities with greater solar exposure, although this benefit is less pronounced for northern long-eared bats than other covered bat species. Therefore, roosting habitat quality at the stand level shows trace improvements throughout the first 10 years. Stand improvement declines over time, and no changes are seen in years 10 to 50, although benefits gained in the first 10 years remain on the landscape.

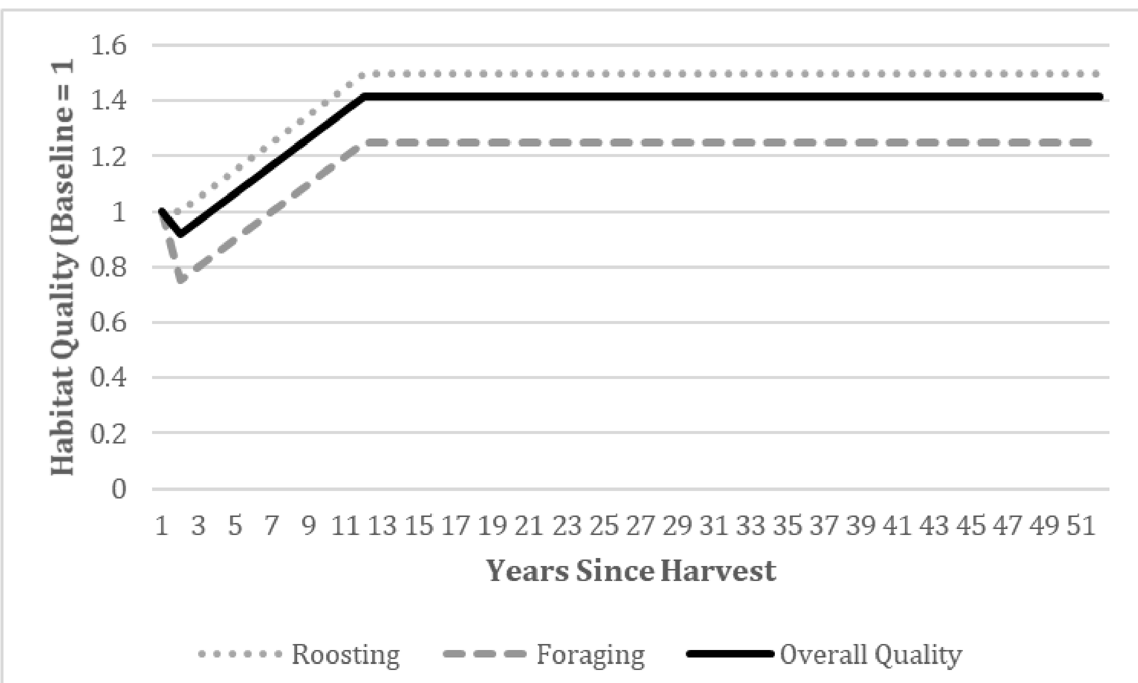


Figure 4-4. Direct and Indirect Effects of Partial Harvest on Habitat Quality for Northern Long-Eared Bats

Foraging Habitat

As with roosting habitat, the initial impacts of partial harvest on foraging habitat for northern long-eared bats are slightly negative at the stand level (Figure 4-4). Regeneration in the understory adds forest complexity and increases foraging habitat quality in years 1 to 10, an effect that becomes less noticeable as the regenerating stand becomes increasingly cluttered. By year 13, the quality of foraging habitat in the stand has improved and remains stable until subsequent manipulations.

Results

To synthesize results of changes to roosting and foraging habitat over time (based on the discussions and figures above), a simple metric was developed on a scale of 0 to 1 for positive effects and 0 to -1 for negative effects (see Section 4.2.2, *Indirect (Beneficial) Effects,* for details). Table 4-25 quantifies these improvements or declines to roosting and foraging habitat using these positive or negative magnitude-of-effect scores for each harvest type (final versus partial) and each habitat type (roosting versus foraging) over time. Calculating the positive and negative effects for each year over a 50-year period (length of the permit term) results in an overall improvement in habitat quality for northern long-eared bats for 2,995 suitable acres in Oak-Hickory forest (Table 4-26) based on the assumption that roosting habitat is roughly twice as valuable as foraging habitat to the species.

This approach (the magnitude of effect and the relationship between roosting and foraging) was used in the Forestry HCP for Bats on Pennsylvania State Game Lands, State Forests, and State Parks (Pennsylvania Game Commission and Department of Conservation and Natural Resources 2020).

4.4.1.3 Qualitative Examples of Habitat Changes Associated with Common Management Systems of the Lake States

In addition to the indirect beneficial effects quantified in Section 4.4.1.2, *Case Study of Indirect Effects in High-Quality Forest*, there are many additional beneficial effects of forest management on habitat quality. This section provides examples of forest management practices for different types of forest and describes how they can benefit bats. Potential benefits are generated through the creation of edge habitat that is valuable for foraging bats in a forest matrix and through the long-term creation of roost trees (through the maturation of trees retained after harvest). Existing roost trees are also enhanced due to greater solar exposure, which allows more rapid growth of live trees and greater solar warming of potential roosts.

Oak/Hickory

Depending on species and site-specific growth conditions, oak/hickory stands may be managed using a combination of partial and complete harvests. These stands also provide excellent examples of how forest management activities can influence future habitat quality for bats.

Oak/hickory systems are often harvested at 80 years or older. At the time of harvest, these stands often contain multiple dead and damaged trees per acre, and oaks and hickories are preferentially used by tricolored bats. Some species, especially shagbark hickory, can provide bark roosts even when living, and damaged oaks and hickories can live for many years with broken tops, cavities, and retained dead limbs. Under natural conditions, these communities are maintained by understory fires and grazing—without such disturbance they succeed to beech/maple systems. Thus, at the time of harvest many oak/hickory systems contain a dense understory of shrubs including pole-sized representatives of beech and maple. Quality of foraging habitat for all covered species is reduced in areas of high clutter, although northern long-eared bats are more tolerant than the other three species. In all cases, woodlands with a relatively open understory provide higher quality foraging than sites with dense clutter.

Clear cuts with residuals (a type of complete harvest) are often used to manage oak/hickory stands. Harvest removes the majority of potential roosts and, thus, greatly reduces roosting potential. Residual trees, including wildlife trees and any damaged during harvest, now have substantial solar exposure. As such, these individual trees are more suitable for roosting than before. Within a year after harvest, the open understory begins to produce an abundance of vegetation including coppice (stump) sprouts of the harvested trees. This provides an abundant foraging resource and provides bats with a high-quality foraging habitat. Oaks and hickories grow more slowly than aspen/birch and, thus, the stand fills in slowly and some of the residual is lost to wind events and entropy. These stands provide relatively low value roosting and foraging habitat when at pole stage, although a thinning or timber stand improvement (types of partial harvests) can both significantly increase the value for bats and increase the rate of growth in the remaining trees.

Shelterwood systems (a type of partial harvest) are also used to manage oak/hickory communities. The preparatory and seeding cuts (stages of the shelterwood system) reduces clutter which can increase foraging quality for bats. Unlike clear cuts, shelterwood practices leave a significant number of potential roost trees and can also result in damage (such as broken limbs) to the remaining trees (MacGregor et al. 1999). Thus, the stand increases in foraging quality and roosting quality remains similar. In most cases, a final harvest (i.e., removal harvest a type of complete harvest) is completed and leaves the site for several years in a situation similar to a completed clear cut.

Many private landowners choose to either not harvest oak and hickory stands or do so using a technique known as a diameter-limit harvest. Both approaches eventually lead to the replacement of oak/hickory stands with later successional types such as beech/maple forest. These forests are valuable to bats but are not typically viewed as being as beneficial as oak/hickory stands.

Pine Plantations

Pine plantations are a forestry practice whereby a stand often contains a single species of pine. In the Lake States, the common plantation species are red and jack pine. At the time of harvest (approximately 50 to 90 years), pine plantations typically consist of trees that are large and relatively healthy. Trees are typically of a single height class. The stands have a nearly continuous canopy, but the level of understory clutter and roosting potential differs between species and sites. Pine plantations are entirely anthropogenic in their origin and maintenance. This class accounts for 4.5% of the project acreage, or 6.9% of the acreage in Michigan, 5.3% in Wisconsin, and 2.4% in Minnesota (mainly in the northeast).

At final harvest, the understory of a red pine plantation is typically open and allows foraging bats to fly through the understory and provides a substantial air/vegetation interface for foraging bats. Bark and cavity roosting bats are restricted to using the few trees that have died or been damaged by weather events, whereas foliage roosting bats (such as the tricolored bat) have many available roosting options, but all are heavily shaded. At the time of harvest, a typical stand of red pine provides low-to-moderate-quality foraging habitat and very low-quality roosting habitat.

Jack pine, conversely, retain dead lower branches. The result is a thick layer of dead limbs that limits the ability of bats to forage in the area but provides an abundance of locations for individual bats to roost. At the time of harvest a typical stand of jack pine provides very low-quality foraging habitat and low-quality roosting habitat for bats.

Harvesting of pine plantations occurs via a series of predictable steps, the final of which is usually a clear cut (i.e., final harvest). The resulting open stand creates a substantial edge for the foraging bats, which may also access the surrounding stands via the remaining forest roads. After replanting, the former clear cut begins to fill in with young healthy trees that provide no roosting habitat for bark and cavity roosting bats, and limited opportunities for foliage roosting bats. Larger trees of the adjacent stands (especially if damaged during harvest) have higher solar exposure and may provide high-quality roosts. Foraging habitat remains high quality along the borders, and bats will forage in between the regenerating trees, as long as there is space between the rows. As the woodland reaches pole stage it provides little habitat for bats. Thinning, especially the third-row approach that is common in red pine stands (Tibbels and Kurta 2003), can reopen the understory and leads to a significant increase in foraging activity by the covered bats. Trees damaged during the thinning process may provide limited roosting habitat. Within several years the stand returns to its mature condition.

Notably, many pine plantations in the Lake States are the result of restoration efforts completed by the Civilian Conservation Corps in the Great Depression. These plantings mainly occurred on land so damaged that could no longer support other forest. Some of these plantings now have an understory of northern hardwoods. Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*, provides an example of a pine plantation that was clear cut by Michigan DNR to release the northern hardwoods. Such a harvest will eventually turn an area of low-quality habitat (pine plantation) into an area of high-quality habitat dominated by northern hardwoods.

Aspen/Birch

Like pine plantations, aspen/birch stands are often harvested using clear cuts (i.e., final harvests), are harvested at a young age, and are not typically thinned. At the time of harvest these stands are densely packed with most trees being healthy, which allows high volumes of commercially viable trees to be obtained on relatively short rotations. Older aspen are prone to cavity formation. A few trees develop cavities early and broken trees are common especially in regions with extensive snowfall. As such, an aspen stand provides some potential roosts and low-quality foraging habitat. Unlike pine plantations, aspen/birch regenerate rapidly following harvest, and those trees with potential roosts are often part of the residual. A newly harvested aspen stand provides high-quality foraging habitat along its margins, especially for those stands that grow on moist sites where aquatic insects can thrive. Even the center of the clear cut is likely to be used by foraging little brown and tricolored bats. Within and along the borders of harvested stands are trees left as part of the residual. These trees are now exposed to more sunlight and may have damage, making them potential roosts for all covered species. Aspen/birch stands fill in rapidly and within 5 years foraging quality begins to diminish. By 20 years of age, an aspen/birch stand has little value for bats. This value increases only slightly until the stand is harvested again. Aspen/birch stands that are not harvested until later become more open with time and a greater proportion of trees in these stands are hollow. The taller trees are also more likely to be used by tricolored bats. Thus, over-mature aspen/birch stands (and even individual trees) may provide hot spots of bat roosting habitat.

4.4.1.4 Summary of Habitat Effects of Timber Harvest

On a stand-by-stand basis, the indirect effects of timber harvest range widely and depend greatly on when the site is analyzed. At the landscape-level, forest management, including timber harvest, is likely to have a neutral to positive effect on bats and bat habitat. However, the economic benefits of timber harvest also provide an incentive to retain forestland as forest, rather than converting it to nonforest uses including residential or commercial development (Radeloff et al. 2005; Kobilinsky 2019; Miller et al. 2019). Taking this factor into account, timber harvest has a strong positive effect on bats and bat habitat.

4.4.2 Roads and Trails Maintenance and Use

While large roads with abundant traffic can have important negative impacts on bats and their habitat (Zurcher et al. 2010; Bennett et al. 2013), the small roads used in forestry are attractive to bats as they provide bats with the type of linear landscape element that serves as foraging and commuting corridors (Murray and Kurta 2004; Sparks et al. 2004; Menzel et al. 2005). In fact, small roads are considered important enough that USFWS recommends their use as trapping locations during presence/absence surveys (Brown and Brack 2003; Kiser and MacGregor 2004; U.S. Fish and Wildlife Service 2016c). This suggests that the small roads built and maintained under the Lake States HCP will provide a long-term positive benefit to bats.

4.4.3 Prescribed Fire

The use of fire to manage vegetation and wildlife dates to presettlement times, when native people routinely used fire to manage both wildlife and their habitats (Trefethen 1975). Modern prescribed fires in the Lake States are primarily used to maintain or restore fire-dependent communities and remove leftover debris following harvest. Fire is also used as a silvicultural tool, especially in oak management. A number of studies have addressed potential effects of fire on bat species and their habitat (Carter et al. 2000; Boyles and Aubrey 2006; Dickinson et al. 2009, 2010; Lacki et al. 2009; Johnson et al. 2010, 2012; Zuckerberg et al. 2012). The broad consensus among the authors of these studies is that prescribed fire is a tool that can greatly improve habitat for bats, but one that bears a risk (although relatively low) of wounding or killing individual bats.

The effects of prescribed fire on habitat are difficult to predict due to the multitude of variables surrounding the characteristics of a single fire, fire regimes, and environmental conditions across time and space. All components of an ecosystem could be affected either by direct exposure to a fire's flames or through interactions with the changed environment as a site recovers from fire. Regarding bat habitat, effects from prescribed fires include facilitation of foraging from reduced clutter, increased roost availability, and increased prey productivity. Opening the understory reduces clutter around roost trees, which improves the microclimate and travel and foraging conditions. Early pole stands and shrub-scrub habitats are usually too cluttered for Indiana bats to forage in, but prescribed fire can open these habitats to allow bats to access the habitat. Without periodic fire, forest understories can become dominated by shrubs and saplings, resulting in a cluttered forest that inhibits bat movement and foraging.

Prescribed fires can create roost trees from trees that are immediately killed but remain standing from trees that continue to succumb to fire damage up to a decade after the fire. Similarly, trees that survive a fire may have wounds that result in them becoming hollow over time. Intentional use of prescribed fire can also increase regeneration of oaks, hickories, and other species of trees used as roosts.

Although prescribed fires can result in an immediate decrease in prey (insect) abundance, fires can produce a rapid growth of the herbaceous community, which can lead to an increase in prey abundance (Dodd et al. 2012). For some time following a prescribed fire (ranging from months to years), insect abundance in the area increases (Jackson and Buckley 2004). While this effect depends on location and/or time of year, it could lead to higher quality and quantity of insect prey. In one of the studies (Lacki et al. 2009) where bats likely switched roosts during a prescribed fire, these same bats preferentially foraged in burned areas after the fire. Several studies have documented extensive use of burned areas by cavity and bark roosting bats, including the Indiana bat (Boyles and Aubrey 2006; Dickinson et al. 2009; Lacki et al. 2009; Johnson et al. 2010, 2012).

These observations indicate that the continued use of prescribed fire in the Lake States is expected to provide habitat benefits despite the relatively small amount of forest that is burned.

4.5 Direct and Indirect Effects Summary

Direct effects on habitat must be considered in light of 1) the relatively small portion of the landscape that is actively managed every year; 2) the fact that many of the covered activities occur when bats are hibernating; 3) the fact that intensively managed stands are often of limited value for bats; and 4) the ability of forest to regenerate following harvest. Direct effects are summarized in Table 4-27.

Due in large part to the small amount of land that is harvested during the active season for covered bats and the current low populations of bats, very few bats are expected to be directly affected by forestry practices each year (Tables 4-6 through 4-10, 4-14 through 4-17, and 4-21 through 4-24). Direct effects on individual bats are relatively minor: mortality often approximates 0.01% of the current population during a year, and less than 1% of the bats are harmed per year. Areas where mortality and disturbance are concentrated include fall/spring habitat, especially in the Upper Peninsula of Michigan and three large mines in Wisconsin. Each year, the majority of little brown, northern long-eared, and tricolored bats can be found in and around these hibernacula entrances. Table 4-28 summarizes the estimated number of maternity colonies exposed to risk each year for all states. Notably, the estimated number of colonies impacted will increase if colony size is underestimated in Table 4-28 and will decrease if Table 4-28 underestimates colony size.

Indirect effects are generally positive in the case of timber harvest and largely positive in the case of prescribed fire.

Table 4-27. Summary of Direct Effects Associated with Covered Activities on Covered Lands [a] by State

States and Bats	Timber Harvest				Prescribed Fire [d]				All Impacts	
	Acres Harvested/Year		Bats Impacted/Year		Acres Burned		Bats Impacted		Bats Impacted	
	Total Acres [b]	While Bats Present [c]	Killed	Disturbed	All Fires	Forest	Killed	Disturbed	Killed	Disturbed
Michigan										
Indiana										
Annual	176,378	7,154	0.04	0.88	8,400	2,907	< 0.01	0.11	< 1	1
50 Years	8,818,920	357,677	2.10	44.24	420,000	145,338	0.07	5.63	2	50
Northern Long-Eared										
Annual	176,378	38,256	1.93	50.14	8,400	2,907	0.06	1.06	2	51
50 Years	8,818,920	1,912,790	96.33	2,506.79	420,000	145,338	3.15	53.13	99	2,560
Little Brown										
Annual	176,378	38,607	7.48	235.59	8,400	2,907	0.25	4.80	8	240
50 Years	8,818,920	1,930,359	374.19	11,779.47	420,000	145,338	12.25	239.94	386	12,019
Tricolored										
Annual	176,378	22,435	<0.01	0.05	8,400	2,907	< 0.01	0.02	< 1	< 1
50 Years	8,818,920	1,121,772	0.13	2.69	420,000	145,338	<0.01	0.98	< 1	4
Minnesota										
Northern Long-Eared										
Annual	138,131	13,462	0.65	12.86	38,241	6,995	0.14	2.34	1	15
50 Years	6,906,535	673,119	32.56	643.16	1,912,050	349,739	6.96	117.20	40	760
Little Brown										
Annual	138,131	13,223	1.29	21.49	38,241	6,995	0.28	4.09	2	26
50 Years	6,906,535	661,136	64.55	1,074.30	1,912,050	349,739	13.81	204.46	78	1,279
Tricolored										
Annual	138,131	8,518	0.01	0.17	38,241	6,995	< 0.01	0.55	< 1	1
50 Years	6,906,535	425,906	0.54	8.50	1,912,050	349,739	0.12	27.38	1	36

	Timber Harvest				Prescribed Fire [d]				All Impacts	
	Acres Harvested/Year		Bats Impacted/Year		Acres Burned		Bats Impacted		Bats Impacted	
States and Bats	Total Acres [b]	While Bats Present [c]	Killed	Disturbed	All Fires	Forest	Killed	Disturbed	Killed	Disturbed
Wisconsin										
Northern Long-Eared										
Annual	185,803	40,673	0.39	10.60	30,800	5,080	0.03	0.42	< 1	11
50 Years	9,290,139	2,033,642	19.60	529.87	1,540,000	253,992	1.26	21.23	21	551
Little Brown										
Annual	185,803	40,389	6.02	187.07	30,800	5,080	0.39	7.29	6	194
50 Years	9,290,139	2,019,430	300.90	9,353.57	1,540,000	253,992	19.40	364.47	320	9,718
Tricolored										
Annual	185,803	19,663	0.06	1.35	30,800	5,080	< 0.01	0.26	< 1	2
50 Years	9,290,139	983,130	3.14	67.34	1,540,000	253,992	0.20	12.80	3	80
Lake States Total										
Indiana										
Annual	176,378	7,154	0.04	0.88	8,400	2,907	< 0.01	0.11	< 1	1
% Regional Population		-	0.01%	0.28%	-	-	< 0.01%	0.04%	0.01%	0.31%
50 Years	8,818,920	357,677	2.10	44.24	420,000	145,338	0.07	5.63	2	50
Northern Long-Eared										
Annual	500,312	92,391	2.97	73.60	77,441	14,981	0.23	3.83	3	77
% Regional Population		-	0.01%	0.34%	-	-	< 0.01%	0.02%	0.01%	0.36%
50 Years	25,015,594	4,619,550	148.49	3,679.82	3,872,050	749,069	11.37	191.56	160	3,871
Little Brown										
Annual	500,312	92,219	14.79	444.15	77,441	14,981	0.91	16.18	16	460
% Regional Population		-	0.01%	0.31%	-	-	< 0.01%	0.01%	0.01%	0.32%
50 Years	25,015,594	4,610,925	739.65	22,207.34	3,872,050	749,069	45.46	808.87	785	23,016
Tricolored										
Annual	500,312	50,616	0.08	1.57	77,441	14,981	0.01	0.82	< 1	2
% Regional Population		-	0.02%	0.46%	-	-	< 0.01%	0.24%	0.02%	0.70%
50 Years	25,015,594	2,530,807	3.82	78.54	3,872,050	749,069	0.32	41.16	4	120

Notes:

[a] All covered lands include DNR, county and municipal, and private (including Tribal) lands.

[b] A sum of all harvest in high-quality and low-quality habitats. DNR total acres of harvest can be found in Chapter 2, Tables 2-6 (Michigan), 2-11 (Minnesota), and 2-17 (Wisconsin). Total acres of harvest on other lands based on FIA data can be found in Tables 2-9 (Michigan), 2-14 (Minnesota), and 2-20 (Wisconsin). These numbers were then adjusted to account for spatial conversion to NLCD data and Land Enrollment Program. Seasonal harvest numbers for Michigan from Tables 4-2 through 4-5; for Minnesota from Tables 4-11 through 4-13; for Wisconsin from Tables 4-18 through 4-20. Annual totals for seasonal habitat harvested are adjusted to account for geographical overlap between winter, fall/spring, and summer habitats.
[c] A sum of all harvest in high-quality and low-quality habitats when the bats are present. Seasonal harvest numbers for Michigan from Tables 4-6 through 4-9; for Minnesota from Tables 4-14 through 4-16; for Wisconsin from Tables 4-21 through 4-23.
[d] Acres burned are the total anticipated amount of prescribed fire on all covered lands for all landcover types (All Fires) and amount limited to forest/brushland landcover types (Forest). Acres burned and bats impacted values can be found in Tables 4-10 (Michigan), 4-17 (Minnesota), and 4-24 (Wisconsin).

Table 4-28. Annual Expected Colonies Impacted Adjusted for Female Proportion of Summer Population

Species	Estimated Adult Female Bats Encountered [a]			Colony Size	Source	Number of Projected Colonies Affected [b]		
	Michigan	Minnesota	Wisconsin	-	-	Michigan	Minnesota	Wisconsin
Indiana bat	1.10	0	0	30	Kurta 2008, Michigan	0.04	0	0
Little brown bat	160.80	14.97	127.72	24	Barclay and Kurta 2007, Review	6.70	0.62	5.32
Northern long-eared bat	34.39	8.90	7.26	39	USFWS 2016b, Michigan Value	0.88	0.23	0.19
Tricolored bat	0.04	0.12	0.93	8	Veilleux and Veilleux 2004, Indiana	0.00	0.01	0.12

Notes:

[a] Female bat population adjusted for state- and species-specific sex ratios. Indiana bat sex ratio in Michigan is estimated to contain 9:1 females to males. Remainder of species and states assume a 50:50 sex ratio.

[b] Potential colonies include bats from all forest types across all ownership categories. Impacts on private lands are adjusted to reflect expected landowner enrollment.

4.6 Avoided Effects

As described throughout this chapter, the covered activities have long-term beneficial effects (indirect effects). In addition, most impacts from covered activities are avoided. Tables 4-29 through 4-31 demonstrate the amount of impacts, the amount of avoidance, and the expected acres of enhancement due to the forest management activities.

Table 4-29. Annual Impacts from Harvest/Forest Management in Michigan When Bats Are Present and Avoided Impacts

Seasonal Habitat	High-Quality Habitat	Annual High-Quality Habitat Impacted When Bats Are Present		% of High-Quality Habitat Avoided	Annual High-Quality Habitat Managed/Enhanced	
	Acres	Acres	% of All High-Quality Habitat	% of All High-Quality Habitat	Acres	% of All High-Quality Habitat
Indiana Bat						
Winter	26	0	0%	100%	0	0%
Fall/Spring	31,957	50	0.16%	99.84%	254	0.79%
Summer	3,780,278	5,882	0.16%	99.84%	29,991	0.79%
Little Brown Bat [a]						
Winter	37,102	0	0%	100%	0	0%
Fall/Spring	1,322,805	2,058	0.16%	99.84%	10,494	0.79%
Summer	16,171,003	25,159	0.16%	99.84%	128,291	0.79%
Northern Long-Eared Bat [a]						
Winter	197,010	0	0%	100%	0	0%
Fall/Spring	1,365,162	2,124	0.16%	99.84%	10,830	0.79%
Summer	16,171,003	25,159	0.16%	99.84%	128,291	0.79%
Tricolored Bat						
Winter	4,055	0	0%	100%	0	0%
Fall/Spring	312,837	487	0.16%	99.84%	2,482	0.79%
Summer	9,908,015	15,415	0.16%	99.84%	78,605	0.79%

Notes:
[a] Totals include values for large and small hibernacula.

Table 4-30. Annual Impacts from Harvest/Forest Management in Minnesota When Bats Are Present and Avoided Impacts

Seasonal Habitat	High-Quality Habitat	Annual High-Quality Habitat Impacted When Bats Are Present		% of High-Quality Habitat Avoided	Annual High-Quality Habitat Managed/Enhanced	
	Acres	Acres	% of All High-Quality Habitat	% of All High-Quality Habitat	Acres	% of All High-Quality Habitat
Little Brown Bat [a]						
Winter	140	0	0%	100%	0	0%
Fall/Spring	284,130	185	0.07%	99.93%	1,867	0.66%
Summer	13,661,487	8,915	0.07%	99.93%	89,756	0.66%
Northern Long-Eared Bat [a]						
Winter	7,952	0	0%	100%	0	0%
Fall/Spring	466,708	305	0.07%	99.93%	3,066	0.66%
Summer	13,661,487	8,915	0.07%	99.93%	89,756	0.66%
Tricolored Bat						
Winter	1,218	0	0%	100%	0	0%
Fall/Spring	266,218	174	0.07%	99.93%	1,749	0.66%
Summer	8,345,931	5,446	0.07%	99.93%	54,833	0.66%

Notes:
[a] Totals include values for large and small hibernacula.

Table 4-31. Annual Impacts from Harvest/Forest Management in Wisconsin When Bats Are Present and Avoided Impacts

Seasonal Habitat	High-Quality Habitat	Annual High-Quality Habitat Impacted When Bats Are Present		% of High-Quality Habitat Avoided	Annual High-Quality Habitat Managed/Enhanced	
	Acres	Acres	% of All High-Quality Habitat	% of All High-Quality Habitat	Acres	% of All High-Quality Habitat
Little Brown Bat [a]						
Winter	5,864	0	0%	100%	0	0%
Fall/Spring	837,246	1,322	0.16%	99.84%	7,159	0.86%
Summer	14,380,649	22,705	0.16%	99.84%	122,957	0.86%
Northern Long-Eared Bat [a]						
Winter	32,510	0	0%	100%	0	0%
Fall/Spring	940,851	1,485	0.16%	99.84%	8,044	0.86%
Summer	14,380,649	22,705	0.16%	99.84%	122,957	0.86%
Tricolored Bat						
Winter	25,017	0	0%	100%	0	0%
Fall/Spring	788,739	1,245	0.16%	99.84%	6,744	0.86%
Summer	6,431,046	10,154	0.16%	99.84%	54,987	0.86%

Notes:
[a] Totals include values for large and small hibernacula.

Chapter 5
Conservation Strategy

5.1 Overview

The conservation strategy for the Lake States Habitat Conservation Plan (Lake States HCP), also referred to as the conservation program, is designed to avoid, minimize, and mitigate impacts from covered activities on Indiana bats, northern long-eared bats, little brown bats, and tricolored bats (covered species or covered bats). A description of these covered species is presented in Chapter 3, *Environmental Setting.* The conservation program meets the Endangered Species Act (ESA) regulatory requirements to streamline compliance with other applicable environmental regulations (Chapter 1, *Introduction*). The conservation program was developed using the best available science at the time of plan preparation, including the following sources.

- *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016).
- Indiana bat, northern long-eared bat, little brown bat, and tricolored bat species descriptions, ecosystems, and vegetation data (Chapter 3).
- *Indiana Bat* (Myotis sodalis) *Draft Recovery Plan: First Revision* (U.S. Fish and Wildlife Service 2007).
- *Indiana Bat* (Myotis sodalis) *5-Year Review: Summary and Evaluation* (U.S. Fish and Wildlife Service 2009).
- *Northern Long-Eared Bat Interim Conference and Planning Guidelines* (U.S. Fish and Wildlife Service 2014).
- *Programmatic Biological Opinion on Final 4(D) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions* (U.S. Fish and Wildlife Service 2016a).
- Information on using forestry to manage bat habitat contained in three recent reviews (Guldin et al. 2007; Sheets et al. 2013a, 2013b; Silvis et al. 2016).
- *National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats* (U.S. Fish and Wildlife Service 2011).
- *Beneficial Forest Management Practices for WNS-Affected Bats: Voluntary Guidance for Land Managers and Woodland Owners in the Eastern United States* (Johnson and King 2018).
- Input from resource specialists, State Departments of Natural Resources (State DNRs), and U.S. Fish and Wildlife Service (USFWS) staff.

5.1.1 Conservation Strategy Overview

The conservation strategy focuses on reducing negative effects on bats and bat habitat from forest management, increasing positive effects, and mitigating for unavoidable impacts. The strategy is built on biological goals and objectives and their associated conservation measures. Collectively, the avoidance, minimization, and mitigation measures outlined in the conservation strategy fully offset any adverse impacts on covered species and their habitat associated with covered activities.

Chapter 4, *Potential Effects of Covered Activities,* evaluates impacts on covered bat species resulting from covered activities. This effects analysis used a habitat-based approach to quantify the potential for injury and mortality of bats from covered activities. The chapter also includes an analysis of effects on individual bats and bat populations. The effects on individual bats and bat populations were provided for context and to allow USFWS to evaluate the impact of the taking. Because the Lake States HCP occurs over a very large area and over a long timeframe, it will be impractical to track the number of individual bats taken by covered activities, particularly as numbers decline because of white-nose syndrome (WNS). The potential for take only exists when a bat is (or could be) present. Because bats are present on the landscape in different areas during different seasons, only a portion of the activities have potential to injure or kill bats. During the winter when bats are hibernating, covered activities will not disturb individuals directly because they are not present on the larger landscape and because hibernating bats are protected by winter buffers around hibernacula entrances (see Objective 4.2). During spring, summer, and fall, when individuals are active across the landscape, there is potential for covered activities to result in injury or mortality.

Despite the potential for these adverse impacts, forest management generally produces long-term habitat effects that benefit bats. Forest management prevents the conversion of forest to other uses, preserving bat habitat across the landscape, and can result in the improvement of habitat over time. While unknown and unidentified roost trees may be lost, the covered activities create roost trees on the landscape, resulting in a net increase in roost trees relative to areas under other ownership types (Guldin et al. 2007; Pauli et al. 2015; Sheets et al. 2013a, 2013b; Silvis et al. 2016). Implementation of effective retention programs maintains many of the existing snags and cavity trees, individual large (super canopy) trees, and patches of forest. Over time, these become large trees that senesce and become high-quality roosts.

Foraging habitat can also be improved through forest management; this is especially beneficial to bats in areas where open habitat is limited (Sheets 2010; Sheets et al. 2013a) or where the stands in question are highly cluttered as is typical of sapling and pole-stage stands (Blakey et al. 2016). Roads and trails also provide bats with access to corridors that are especially important for commuting and foraging (Brown and Brack 2003; Duchamp et al. 2004; Sparks et al. 2004; Menzel et al. 2005; Sparks et al. 2005; Sheets et al. 2013a, 2013b; Weber and Sparks 2013).

Collectively, the sustainable forest management activities practiced by the State DNRs result in long-term enhancement of both roosting and foraging habitat for covered species. These enhancements will ensure that high-quality habitat remains on the landscape over the permit term and ensures that—should the covered species begin to rebound from the effects of WNS—they will have suitable habitat for use. Indeed, enhancement of summer roosting habitat has been identified as a priority response to a range of threats affecting bats, including WNS (Wilcox and Willis 2016).

While the potential for adverse effects on bats from covered activities is low, and the covered activities themselves improve foraging and roosting habitat over time, the conservation strategy described herein contains measures to further avoid and minimize impacts on individual bats and important habitat features, such as caves and roost trees. In addition, the conservation strategy proposes a suite of mitigation ranging from active protection of caves to enhancement of future roosting habitat to the enrollment of nonfederal landowners in the Landowner Enrollment Program to public outreach and education on bats. Collectively, these conservation measures further avoid the already low impacts on covered bats and fully offset any remaining impacts resulting from covered activities.

5.1.2 Key Terms and Definitions

Specific terms are used to describe the level of activities that will be permitted under the conservation program. For the purposes of the Lake States HCP, these terms are defined as follows.

- **Avoidance measures.** Avoidance measures are actions that reduce or eliminate the negative impacts of covered activities on bats. Avoidance measures are one kind of conservation measure.
- **Biological goals.** Within the context of a habitat conservation plan (HCP), biological goals are large-scale, guiding principles that tie directly to desired conservation outcomes for the covered species (see Section 5.2, *Biological Goals and Objectives*, for additional details).
- **Biological objectives.** Within the context of an HCP, biological objectives support biological goals and describe how the biological goals will be accomplished (see Section 5.2, *Biological Goals and Objectives*, for additional details).
- **Conservation measures.** Conservation measures are avoidance, minimization, and mitigation measures that can be implemented to achieve the biological objectives of an HCP.
- **Enhancement.** Enhancement refers to the improvement of an existing habitat condition for species.
- **Forestland.** Forestland is land where current and past vegetation evidence demonstrates that trees cover (or covered) over 10% of the ground.
- **Geolocate:** In the Lake States HCP, *geolocate* trees means to map which trees are known with a high enough level of accuracy to map their locations. The resulting protective buffer will be centered on these locations. Note the location of roosts identified by radio-triangulation may not be accurate enough to include within this database; additional efforts would need to be used to confirm the presence of a known roost before it is mapped.
- **Known occupied maternity roost tree.** A known occupied maternity roost tree is a specific tree or forested area at which at least one roosting adult female bat or juvenile bat of either sex has been confirmed.
- **Leave tree.** A leave tree is a tree left standing for wildlife, seed production, or other purposes, in an area where it might otherwise be felled.
- **Legacy tree.** A legacy tree is an individual tree of a long-lived species, usually mature or remnant of old growth, which provides a biological legacy. It is an individual, old tree (or occasionally a small group of old trees) that function(s) as a refuge or provides other important structural habitat values.
- **Mitigation.** Mitigation refers to actions meant to offset environmental impacts by compensating for adverse effects.
- **Retention.** Retention refers to trees that are maintained at the site during regeneration harvest.
- **Seasonal restriction.** Seasonal restriction refers to a time-of-year restriction on a given activity to avoid or minimize incidental take.
- **Snag.** A snag is a standing dead tree.
- **Fall/spring habitat.** Modeled habitat is defined in Chapter 3, Table 3-3. High- and low-quality habitat is defined in Chapter 3, Table 3-2. Fall/spring habitat occurs within 5 miles of known

hibernacula entrances. For hibernacula entrances that support more than 10,000 bats, fall/spring habitat occurs within 10 miles of known hibernacula entrances. As described for summer habitat, high-quality fall/spring habitat is confined to certain forest types within these buffers.

- **Summer habitat.** Modeled summer habitat includes all forest and shrub/scrub lands (see Chapter 3, Section 3.2.5, *Modeled Species Distribution*, and Table 3-3 for additional details). High-quality summer habitat for covered bats includes the following forest types: oak/pine, oak/hickory, maple/beech/birch, aspen/birch (greater than 9 inches diameter at breast height [dbh]), other hardwoods, and elm/ash/cottonwood (Chapter 3, Table 3-2).
- **Winter habitat.** Modeled winter habitat includes forest and scrub/shrub within a 0.25-mile radius around entrances to known hibernacula entrances (see Chapter 3, Section 3.2.5, *Modeled Species Distribution*, and Table 3-3 for additional details).

5.2 Biological Goals and Objectives

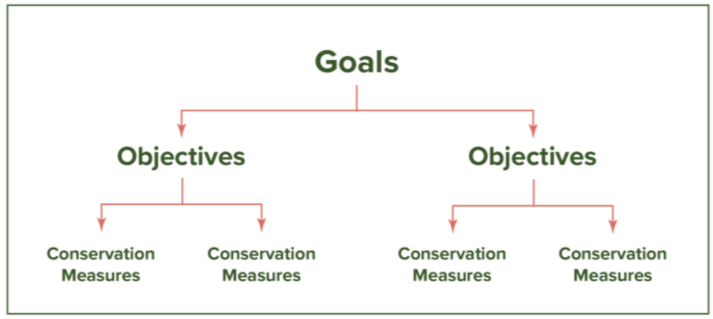
As outlined in the *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (HCP Handbook) (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016), biological goals and objectives are required elements of HCPs that are the foundation of the conservation strategy. *Biological goals* are large-scale, guiding principles that tie directly to desired conservation outcomes for the covered species. *Biological objectives* are tactical and describe how the biological goals will be accomplished.

Each objective is designed to meet the following “SMART” criteria outlined in the HCP Handbook.

- **S**pecific
- **M**easurable
- **A**chievable
- **R**esult-oriented
- **T**ime-fixed

The biological objectives that support the biological goals are implemented through actions referred to as *conservation measures*. The relationships between goals, objectives, and conservation measures are shown in Figure 5-1.

For the Lake States HCP, the biological objectives will be tracked, monitored, and used to demonstrate compliance. The conservation measures are specific actions that can be used to achieve each biological objective. The conservation measures are tools to achieve the biological objectives. As such, they can be adapted over time, as long as the objectives are met. Achieving the biological objectives is required as part of plan implementation; while the conservation measures are not plan requirements individually, they contribute to achieving the biological objectives.



Source: Adapted from U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016

Figure 5-1. Relationship between Biological Goals, Objectives, and Conservation Measures

Table 5-1 summarizes the biological goals and objectives and provides a rationale for each objective. While this table summarizes the goals and objectives for the three states, the accompanying text (Sections 5.2.1, *Forest Landscape Conservation*, through 5.2.4, *Additional Avoidance and Minimization Measures*) provides details and state-specific obligations.

In the Lake States HCP, the biological objectives and their associated conservation measures have been designed with enough detail and specificity to allow for implementation yet remain flexible enough to allow for the multistate scale of this HCP and the 50-year permit term. The conservation strategy is based on the concept that forestry is different from other activities typically permitted under an HCP. Over time, forest management activities maintain a landscape that is suitable for use by covered bats (e.g., Blakey et al. 2016; Guldin et al. 2007; Pauli et al. 2015; Silvis et al. 2012). However, as outlined in Chapter 4*, Potential Effects of Covered Activities*, individual bats may be incidentally taken during these forestry operations, even as forested landscapes are maintained and enhanced.

Table 5-1. Summary of Lake States HCP Biological Goals, Objectives, and Conservation Measures

Goal	Objective	Conservation Measures
Biological Goal 1: Maintain healthy forests that provide habitat for bats on State DNR lands.	Objective 1.1: Manage DNR-administered forestlands (currently over 9 million acres) sustainably such that habitat for covered bats is maintained over the permit term.	• Sustainably manage existing forestlands as part of the DNR system. • Continue practicing sustainable forestry on State DNR lands and avoid conversion of forestlands to other land uses.
Biological Goal 2: Protect and enhance roosting and foraging habitat for bats.	Objective 2.1: Implement retention guidelines (as described in Section 5.2.2.1) in all forest habitat for bats beginning in year 1 and continuing throughout the permit term.	• Develop a guidance document for use by field staff. • Implement each state's retention guidelines in forests.
	Objective 2.2: Minimize impacts on roosting bats by implementing a 150-foot buffer around all known occupied maternity roost trees.	• Implement seasonal restrictions on prescribed fire and year-round restrictions on timber harvest. • Protect known occupied maternity roost trees within the buffer on DNR-administered lands and lands enrolled in the Lake States HCP.
	Objective 2.3: Minimize impacts on roosting Indiana bats by restricting activities around all known occupied maternity roost trees	• Implement 2.5-mile buffer around known Indiana bat maternity roost trees and captures.
	Objective 2.4: Minimize impacts on other covered bats by establishing bat protection zones.	• Establish Bat Protection Zones (specific to each DNR) with high-quality bat habitat with restrictions on timber harvest to ensure forests are managed to benefit bats.
Biological Goal 3: Promote stewardship on other nonfederal lands.	Objective 3.1: Increase bat conservation by providing the Landowner Enrollment Program on eligible lands throughout the permit term.	• Provide opportunity to eligible forest owners to receive take authorization through the Lake States HCP in exchange for improving bat conservation on their lands. [a]
	Objective 3.2: Develop and implement a communication plan for educating the public on covered bats and their conservation.	• Develop a communication plan about bats. • Implement the communication plan through publication of press releases, development and publication of web content, development of a brochure, speaking engagements, webinars, and other public outreach.
Biological Goal 4: Protect and enhance hibernacula entrances and associated wintering bats.	Objective 4.1: Remove undesirable obstructions at known hibernacula entrances [b] on State DNR lands by year 5 and continue throughout the permit term.	• Determine the status of entrances around known hibernacula. • Trim vegetation around hibernacula entrances. • Remove other obstructions. • Maintain hibernacula entrances through time. • Identify potential sites for creation or rehabilitation.

Goal	Objective	Conservation Measures
	Objective 4.2: Protect known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term.	• Implement a 0.25-mile buffer around known hibernacula entrances with harvest and noise restrictions. [b] • Identify additional known hibernacula entrances on other nonfederal lands enrolled in the Lake States HCP. • Enhance areas around the hibernaculum entrance. • When necessary, pump mines that are known hibernacula entrances to preserve the integrity of the mine.
	Objective 4.3: Maintain gates on all known entrances [b] to occupied hibernacula on State DNR lands and the lands of willing partners (unless determined to be not needed or detrimental) throughout the permit term.	• Document gated hibernaculum entrance sites. • Prioritize sites for gating. • Gate any sites determined to be beneficial to covered bats. • Maintain existing and future gates throughout the permit term.
	Objective 4.4: Promote awareness and understanding of WNS through collaboration with researchers throughout the permit term.	• Collaborate with USFWS and other entities involved in bat research. • Participate in regional communication and information sharing related to WNS research. • Continue DNR surveys and technical assistance. • Provide permits (as appropriate) to continue WNS research on State DNR lands.
Biological Goal 5: Avoid and minimize effects from covered activities on covered species.	Objective 5.1: Minimize impacts of prescribed fire on roosting and hibernating bats beginning at permit issuance and continuing throughout the permit term.	• Incorporate impact minimization provisions into prescribed burn plans. • Seasonally implement prescribed burn plans on modeled habitat (Chapter 3, Figures 3-10 through 3-13 show modeled habitat for each covered species).
	Objective 5.2: Minimize impacts on covered bats associated with roads and trails throughout the permit term.	• Seasonally restrict tree removal associated with road and trail construction and maintenance in modeled habitat. • Restrict construction of new roads and trails in modeled habitat.

Notes:

[a] See Chapter 6, Section 6.2, *Permit Structure*, and Appendix B, *Landowner Enrollment Program*, for more information on the Lake States' HCP Landowner Enrollment Program.

[b] There are 25 known hibernacula entrances on State DNR lands, but some hibernacula have multiple entrances. Current records document 30 hibernacula entrances on State DNR lands (distributional data provided for Chapter 3, *Environmental Setting*, reviewed by the State DNRs and then overlaid on state lands layer for each state).

DNR = Department of Natural Resources; HCP = habitat conservation plan; WNS = white-nose syndrome

5.2.1 Forest Landscape Conservation

Combined, the State DNRs own, manage, and/or administer more than 9.2 million acres of forestland (Chapter 2, Table 2-1). Each DNR is committed to protecting and maintaining vital ecosystem services associated with this significant assemblage of forestland. This is accomplished through the DNRs' approach to sustainable forestry and multiple programs, as described in Chapter 3, Section 3.3.3, *Forest Management Programs.* Specifically, all three State DNRs manage the land under their respective statutory control according to refined and comprehensive forestry best management practices (BMPs) that include the protection of water quality, harvesting guidelines that encompass overstory retention targets important to wildlife, and sustainable forestry standards that ensure forests are managed to meet multiple needs today without jeopardizing those in the future. As such, multiple resources (trees, other vegetation, water, soil, air, and wildlife) are key factors in the development of site- and landscape-level goals during forest management planning cycles in each state.

Collectively, these DNR forest management practices help ensure that forestland in the Lake States remains forested. This is of significant conservation value, as forests are the preferred landcover type for many wildlife species, including the covered bats (Kurta 2008). In addition, this abundance of forestland often comprises large, contiguous areas, allowing diverse habitat conditions to be present across the landscape at any point in time, from mixed-species late successional deciduous stands to early successional conifer plantations. Each habitat condition provides unique ecosystem services that will change through time and the process of forest succession.

Active forest management (e.g., harvesting timber) is a proven and objective-based way to accelerate or redirect forest successional development. Bats respond and adapt to changing conditions in forest structure and composition. The State DNRs' active management of forests retains a landscape of diverse forest conditions and maintains a balance between protecting water resources, producing merchantable products, providing habitat for multiple bat species, and managing other wildlife.

Each of the State DNRs, according to their statutory authority, manages forestlands for multiple values. Some forestlands have been designated for the purpose of conserving habitat for wildlife, maintaining biodiversity, and promoting outdoor recreation. These areas, when coupled with working forests, represent a diverse coarse-scale approach to conservation, wherein some lands are managed using timber harvest, and some lands are reserved from harvest. This mosaic approach to conservation includes special management areas such as scientific and natural areas, wilderness or primitive recreation areas, protected lands around lakes and streams, old growth networks, and special management areas for rare species.

In Michigan, more than 150,000 acres are currently managed such that no harvest is allowed. In Minnesota, more than 1.5 million acres are managed in state scientific and natural areas and state parks combined, where no harvest is allowed (except in some cases where timber harvest is used as a resource/habitat management tool). In Wisconsin, over 252,000 acres are managed as wild rivers, wild areas, or for conservation values, where timber harvest is used only when necessary to accomplish habitat management objectives.

Other forest landowners in Michigan, Minnesota, and Wisconsin play important roles in managing forests that they own and/or administer. Chapter 2, *Covered Lands and Activities*, describes the geographical extent and importance of these various types of landowners, and Objective 3.1 describes the Landowner Enrollment Program for participating landowners.

5.2.1.1 Biological Goal 1: Maintain healthy forests that provide habitat for bats on State DNR lands

While management objectives may change over time, each DNR will maintain forestlands under their administration as forest. These lands will collectively form a mosaic of habitat types across large portions of the three states; this mosaic of contiguous or semicontiguous forest provides foundational habitat for all four covered bats (Kurta 2008; Sheets et al. 2013a, 2013b; Silvis et al. 2016).

The following objective will be implemented to promote healthy forest on State DNR lands.

Objective 1.1: Manage DNR-administered forestlands (currently over 9 million acres) sustainably such that habitat for covered bats is maintained over the permit term

Forests provide important habitat elements for all four covered bat species (Kurta 2008; Sheets et al. 2013a, 2013b; Silvis et al. 2016) and forested landscapes are critical for bats. The covered bat species make extensive use of forests during commuting and foraging (Owen et al. 2003; Sparks et al. 2004; Helms 2010; Bergeson et al. 2013). The covered bat species raise their pups in maternity roosts, often located in trees; in addition, forested landscapes provide roosts during migration, fall swarming, and spring staging (Gumbert et al. 2002; Judy et al. 2010; Lowe 2012). Contiguous forested habitat provides the habitat features used by covered species for these daily activities. This objective ensures that forestland owned and managed by the State DNRs will remain as managed forests and provide the habitat around which conservation efforts can be planned. Each state will continue to administer forestland as sustainable forest (Chapter 1, Table 1-1). The precise acreages of forestland will change over time. This conservation objective and associated measures do not preclude the State DNRs from purchasing or selling forest (or other) lands. Current levels of forestland are as follows.[1]

- **Michigan DNR** currently administers over 4.2 million acres of forestland.
- **Minnesota DNR** currently administers over 3.8 million acres of forestland.[2]
- **Wisconsin DNR** currently administers almost 1.2 million acres of forestland.

The commitment under the Lake States HCP is to continue to manage DNR-administered forestlands sustainably.

Conservation Measures. The conservation measures associated with this objective are to sustainably manage existing forestlands as part of the DNR system, to continue practicing sustainable forestry on State DNR lands, and to avoid conversion of forestlands to other land uses.

[1] These acres have been and will be measured using U.S. Forest Service (USFS) Forest Inventory and Analysis (FIA) data as described in Chapter 3, *Environmental Setting*.

[2] The USFS FIA data used in Chapter 1, Table 1-1, report 3.8 million acres of forestland are managed by the State of Minnesota. This figure is less than the acres reported as administered by the State of Minnesota in Chapter 2, Table 2-10, which includes nonforestland and also lands that USFS FIA data analysts do not report as being managed as forestland by the State of Minnesota.

5.2.2 Site-Level Conservation

While the maintenance of working forests across the landscape is a significant benefit of the DNR forest management programs, site-specific management also protects and enhances habitat for covered bats and minimizes impacts on tree-roosting bats when they are present.

It is standard practice to retain certain live and dead trees during the course of timber harvest for all the wildlife and environmental benefits they provide. A retained or *leave tree* enhances biodiversity by its contribution to the next stand of trees and by providing an element of structural complexity, which influences the plant community. At the site or stand level, snags, cavity, legacy, and mast-producing trees, as well as trees with loose bark or cracks/open seams all provide important roosting elements for covered bat species. State tree-retention guidelines provide a mechanism for perpetuating these critical structural features within and across upland, wetland, and riparian stands comprising various sizes, shapes, and seral stages of trees. Tree retention guidelines are applied to all DNR-administered lands. Collectively, tree-retention guidelines focus on retaining snags (dead standing trees), trees with cavities (which could include snags), hollow trees, and healthy trees that are representative of the forest stand subject to harvest. Depending upon current stand conditions and species composition, recruitment of live trees may be required to increase the pool of future snags and mast producers. Additional detail on tree retention is provided in Objective 2.1.

Forestry BMPs also protect habitat at the site level by safeguarding water quality in wetlands, streams, and lakes and promoting terrestrial and aquatic resources (National Association of State Foresters 2018a; Warrington et al. 2017; Cristan et al. 2016; Fulton and West 2002). Water availability is important for bats (Yates and Muzika 2006) as is a reliable source of insects (Stahlshmidt et al. 2012). Streams provide water, serve as travel corridors for bats, and harbor aquatic insects important to bats' diets (Palik et al. 2000). Wetlands can serve as water sources and foraging areas. Managed riparian areas often provide late-successional stands and roost trees for bats. All three states have resource protection programs (BMP manuals, forest management and silviculture guidance documents, and timber sale contracts [Michigan]) that provide specific guidance on how to avoid and minimize impacts on aquatic resources from DNR activities. BMP implementation rates consistently average 91% nationally across multiple land ownership categories (National Association of State Foresters 2018b). As such, BMPs provide valuable, widespread protections that benefit bats. The BMP program guidelines can be found on each State DNR's website.[3]

Along with bat-specific objectives, site-level conservation in the Lake States will continue to provide lands that support and enhance habitat for covered bats.

[3] Michigan: https://www.michigan.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf.
Minnesota: http://mn.gov/frc/documents/council/site-level/MFRC_Revised%20Forest%20Management%20Guidelines%20(2012).pdf.
Wisconsin: https://dnr.wisconsin.gov/topic/forestmanagement/bmp.

5.2.2.1 Biological Goal 2: Protect and enhance roosting and foraging habitat for bats

During the summer months, covered bat species forage at night and spend their days resting in trees or other structures. In particular, female bats roost in large maternity colonies where they congregate together each summer to raise their young (Kurta 2008). Bat colonies exhibit fission/fusion social dynamics, which means that a colony of bats may inhabit several roosts at a time, and bats frequently move among the various roost trees (Silvis et al. 2014).

Tree characteristics and landscape context that contribute to high-quality roost trees are shown in Table 5-2. Tree types and features that bats prefer are covered in Appendix A, *Attributes of High-Quality Covered Bat Habitat in Managed Lake State Forests*. Table 5-3 describes specific roost tree characteristics desired by each covered bat species. Summer-roosting bats are known to move between roosts regularly and also to flee roosts when faced with disturbance. Nonetheless, bats may be killed or injured when their roost trees are cut as part of forestry operations. In addition to direct mortality, adult bats fleeing their daytime roosts are at an increased risk of predation by birds, and juvenile bats risk being abandoned by their mothers and dying from lack of care (Veilleux et al. 2003; Sparks et al. 2000; Belwood 2002; U.S. Fish and Wildlife Service 2007). Cutting a roost tree occupied by bats is considered by the Lake States HCP to be harm (i.e., take) as defined by ESA. If any dead or injured are discovered during the course of covered activities, the DNR will notify USFWS within 5 business days of the applicable State DNR receiving a report. Instructions for reporting dead bats to the State DNRs will be provided through trainings to relevant parties.

Table 5-2. Characteristics and Description of Factors that Contribute to High-Quality Tree Roosts for Covered Bats

Characteristics	Description
Solar exposure	Trees with roosts that are exposed to the sun are able to heat and provide high-quality roosts. This is often tied to the following factors. • The height of the tree relative to the rest of the canopy, with tall trees getting more sun. • The location of the tree in the forest, with edge trees receiving more sun. (Note that timber harvests can result in increased solar exposure in stand edges and for leave trees.)
Wind and rain	Exposure to wind and rain weathers trees, which helps provide high-quality characteristics of the roosting structure such as size and number of openings. (Note that timber harvests can result in increased weathering exposure in stand edges and for leave trees.)
Topographic position	Trees near the top of a high point receive greater exposure to both sun and weather, which helps create openings that improve roost quality. In addition, areas prone to natural disturbance events (i.e., fire, storms, periodic flooding) are likely to contain high-quality roosts because these events accelerate snag creation and promote structural complexity of the forest understory. Proximity to water features also improves roost quality for foraging bats.
Size and condition	Trees with cavities, cracks, crevices and loose bark provide higher-quality habitat for bats. In general, larger trees are more beneficial to bats than smaller trees because larger trees are more likely to have these preferred habitat structures. Also, the water contained in living trees acts as a thermal mass so larger trees heat and cool more slowly than smaller trees.

Table 5-3. Description of Roosting and Foraging Habitat by Covered Bat Species

Bat Species	Roosting and Foraging Habitat
Indiana bat	**Typical roosts:** Under the hanging, loose bark of dead or partially dead trees. Larger trees are used by more bats and those used most intensely are often very large (16-inch or greater dbh) and get several hours of direct sunlight per day.
	Other roosts: Occasionally in cracks in trees, in bat boxes, or other artificial roosts that resemble sloughing bark.
	Typical foraging habitat: Associated with edge habitats, especially where forest meets open habitats, especially waterways. Bats will also forage above and below the canopy of forests especially when those forests have a relatively open understory. Riparian zones of streams are extensively used.
Northern long-eared bat	**Typical roosts:** In the cavities of hollow trees. Large (12-inch or greater dbh), live or dead hollow trees or those with hollow limbs serve multiple bats over many years and may be the node of a network of roosts.
	Other roosts: While typical roosts are tree cavities and cracks, northern long-eared bats are also found under loose bark, in bat boxes, and in buildings.
	Typical foraging habitat: Associated with forested habitats even in areas where the woodland is choked with understory vegetation. Bats also make use of edge habitats, especially for commuting. Wetlands and waterways provide access to aquatic insects.
Little brown bat	**Typical roosts:** Anthropogenic structures, including attics of buildings, expansion cracks of bridges, and bat boxes.
	Other roosts: Tree cavities or under the loose bark. As with Indiana bats, maternity colonies tend to use large, dead trees with substantial solar exposure.
	Typical foraging habitat: Associated with wetlands and waterways, although bats also use forest edges and clearcuts in heavily forested landscapes.
Tricolored bat	**Typical roosts:** Clusters of dead (or live) leaves. Maternity colonies often select roosts with substantial solar exposure that are open from the bottom so bats can drop directly into flight.
	Other roosts: In early spring (prior to leaf-out), colonies use partially enclosed buildings such as under awnings, picnic shelters, and overhangs for covered porches. Occasionally found in hollow trees.
	Typical foraging habitat: Associated with generalized forest and edge habitats, including forested streams and edges of wetlands. Small openings are readily used, but large multi-acre open spaces and developed landscapes are typically avoided.

Notes:
dbh = diameter at breast height

Stand- or site-level practices can minimize impacts on roosting bats, preserve and/or create trees valuable for roosting, and maintain foraging habitat. Effective management of forests for bats should focus on the generation and maintenance of bat roosts through the natural processes of growth, decline, and death of individual trees within a single stand and among multiple stands that make up the home range of a bat colony.

Objective 2.1: Implement retention guidelines in all forest habitat for bats beginning in year 1 and continuing throughout the permit term

All three Lake States have given considerable attention to retention of live trees and have provisions in state guidelines to both reserve and ultimately create snags and trees with cavities (Michigan Department of Natural Resources 2012; Minnesota Forest Resources Council 2013; Wisconsin Department of Natural Resources 2012). Even though each state takes a slightly different approach in identifying retention targets (e.g., number of trees to retain, size ranges, locations within a stand, species mixes), all share the goal of increasing biological diversity while considering and accommodating safety, long-term stand management, overall stand and forest health, and wildlife habitat. Some core characteristics are common to all three states, including snag retention and retention of patches of forest in stands that are entering harvest windows.

Retention guidelines apply to all harvest types (regeneration, intermediate, and salvage harvests). Regeneration harvest is a timber harvest conducted to promote tree regeneration, balance forest age classes, and extract usable or merchantable timber. Intermediate harvest involves the removal of trees between stand initiation and regeneration harvest to enhance the value for wildlife habitat and/or timber. Salvage harvest removes dead, dying, or damaged trees after a widespread wind or fire event while the tree is still merchantable (Chapter 2, Section 2.3.1.2*, Harvest Types*). Table 5-4 outlines each Lake State's retention guidelines compared to the Johnson and King 2018 recommendation. Although the three states' retentions guidelines differ slightly from each other, they all are consistent with or exceed the Johnson and King 2018 recommendation. The Lake States will be able to use these retention guidelines to consistently manage their forests. It is also important to note that the incidental take permit is severable and that each of the Lake States' retention guidelines is robust enough to stand alone if that should be needed.

Table 5-4. Retention Guidelines for Each of the Lake States Compared to the Johnson and King 2018 Recommendations

Johnson and King 2018 Recommendations	Michigan	Minnesota	Wisconsin
Snag retention			
For all harvests, retain all snags except where public or worker safety concerns exist or where catastrophic weather events or disease or insect outbreaks in a stand constitute a threat to the health of the surrounding forest.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, all snags are protected via standard timber sale contract specifications which states, "Standing dead trees shall be protected and left standing unless they are a safety hazard or otherwise designated in this contract. Individual live trees not previously designated for cutting which are determined to be a safety hazard will be designated by the DNR for felling. Hazard trees that are felled shall be left on site unless designated as included timber and paid for at contract rates."	**CONSISTENT WITH JOHNSON AND KING 2018.** For even-aged harvests, leave all snags possible standing in the general harvest area. Retain at least 6 trees per acre to develop into large old trees to complete their natural lifespan. Species retention should consider wildlife preference values. For uneven-aged harvests, be sure that the remaining stand includes a minimum of 6 cavity trees, potential cavity trees and/or snags per acre.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, retain as many snags as possible, but ≥3 (if available) preferably large snags (> 12 inches dbh) per acre. Encourage snag diversity (species and size) to provide the greatest array of benefits. Consider retaining ≥3 trees per acre to develop into large, old trees and to complete their natural lifespan. These trees will often become large snags and course wood debris.
Percent of Harvest to Remain in Uncut Patches			
For even-aged harvests, retain uncut patches totaling at least 5% of the harvested area. For uneven-aged harvests, maintain a minimum basal area of 30 ft^2 and where possible retain at least 16 live trees greater than 9 inches dbh per acre (with at least 6 trees per acre of the largest available trees of species favored by roosting bats, which will vary by bat species and geographic location).	**RANGE OF AREA RETENTION OVERLAPS JOHNSON AND KING 2018 THOUGH THERE MAY BE INSTANCES WHERE AREA RETENTION IS BELOW 5%.** For even-aged harvests, retain 3% - 10% of the harvest area (acreage). For uneven-aged harvests, retention should focus on maintaining cavity trees, standing dead, and downed wood; retaining and encouraging underrepresented tree species; retaining and encouraging mast producing trees; and improving vertical and horizontal structural diversity, and may increase species diversity by encouraging growth of shade intolerant and mid-tolerant species.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, retain either 6–12 leave trees per acre or 5% of stand area in leave tree clumps with at least 80 ft^2/acre of basal area.	**CONSISTENT WITH JOHNSON AND KING 2018.** For even-aged harvests, encouraged in all stands, but recommended that in stands greater than 10 acres, retain 5–15% of crown cover or stand area. For uneven-aged harvests, retain ≥3 (if available) preferably large, cavity trees per acre. Retain ≥3 (if available) preferably large, mast trees per acre. Consider retaining ≥3 trees per acre to develop into large, old trees and to complete their natural lifespan.

Johnson and King 2018 Recommendations	Michigan	Minnesota	Wisconsin
Retention Tree Patch Size			
For even-aged harvests: Create leave-tree patches that are variable in size (but a minimum of 0.25 acre). For uneven-aged harvests: Where insufficient large trees (9 inches in diameter or greater) are available to meet silvicultural management needs while providing the number and size of trees noted above, use the 16 largest trees available per acre, to provide adequate canopy cover and roost-tree availability.	**CONSISTENT WITH JOHNSON AND KING 2018.** For even-aged harvests, maintain live trees in various patch sizes. Retention patch size, configuration, and location are determined on a case-by-case basis by foresters and wildlife biologists and are informed by minimum requirements, specific cover type considerations, landscape context, and protection of existing rare and sensitive features. For uneven-aged harvests, retention should focus on maintaining cavity trees, standing dead, and downed wood; retaining and encouraging underrepresented tree species; retaining and encouraging mast producing trees; and improving vertical and horizontal structural diversity, and may increase species diversity by encouraging growth of shade intolerant and mid-tolerant species.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, retention tree patches will vary in size, with a minimum of 0.25 acre per clump. The basal area is not to be reduced below 80 ft^2/acre in trees 6 inches dbh or larger to retain the functionality of the clump. Retain at least 6 trees per acre to develop into large old trees to complete their natural lifespan.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, trees retained can be scattered uniformly throughout a stand or irregularly dispersed, as single trees, groups, and patches. Groups and patches in even-aged harvests should be >0.1 acres and generally <2 acres, but they can be larger as well. Patches larger than 2 acres should be documented.

Johnson and King 2018 Recommendations	Michigan	Minnesota	Wisconsin
Retention Tree Patch Location			
For all harvests, retention tree patches are to be located throughout the harvest unit. Locate leave-tree patches near or adjacent to riparian management zones, wetlands, or seasonal pools. Wildlife openings are encouraged; however, riparian buffers should not be used for all reserve islands because snag and leave-tree patches are also important in upland forest treatments. Locate patches in draws and along protected slopes, near the edge of the stand on ridge-top locations, or just below the ridge, if possible, to reduce the potential for windthrow. Focus patches to coincide with such features as wetland inclusions, ponds, one or more active dens trees or cavity trees, or at least good candidates for potential cavities.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, retention patch size, configuration, and location are determined on a case-by-case basis by foresters and wildlife biologists and are informed by minimum requirements, specific cover type considerations, landscape context, and protection of existing rare and sensitive features.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, retention tree patched are to be distributed in a configuration that achieves wildlife and silvicultural objectives and maintains efficient harvesting operations. Leave tree patches should center around or coincide with such features as: non-open water wetlands and seasonal ponds; one or more large (> 18 inches dbh) active den trees or cavity trees; mast trees; preferred tree species (such as large white pine); raptor nests or rookeries; and sensitive communities or sites. To retain the functionality of the clump, do not reduce the basal area below 80 ft^2/acre in trees 6 inches dbh or larger.	**CONSISTENT WITH JOHNSON AND KING 2018.** For all harvests, retention tree patches should be located to complement management objectives or to respond to stand conditions, such as along RMZs, to increase connectivity between stands, or to protect sensitive sites or endangered resources.
Riparian Corridor Tree Retention			
When working in a riparian corridor in an even-aged harvest, always leave at least one-third of the typical-sized trees and 40 ft^2 of basal area or greater but not below C-level stocking. One-half to two-thirds of typical-sized trees is recommended. When working in a riparian corridor in an uneven-aged harvest, always leave at least one-third of the typical-sized trees.	**EXCEEDS JOHNSON AND KING 2018.** For all harvests, where harvesting is planned within a Riparian Management Zone (<=100 feet), cutting specifications should be modified to retain a sufficient number of trees (60–80 ft^2 basal area per acre is often used as a benchmark) to maintain shading of streams and to leave a relatively stable and undisturbed forest floor (less than 10% bare soil exposure).	**EXCEEDS JOHNSON AND KING 2018.** For all harvests, center retention patched around or coincide with such features as non-open water wetlands and seasonal ponds. RMZ (defined portion of the riparian area adjacent to a stream, lake, or open water wetland) guidelines include retaining a minimum of 60 ft^2 basal area per acre distributed relatively continuously in the RMZ, creating or retaining at least 4 leave logs per acre in harvested portions of the RMZ, and avoiding creating greater than 5% exposed mineral soil in filter strips and RMZs.	**EXCEEDS JOHNSON AND KING 2018.** For all harvests, retention tree patches can be placed near Riparian Management Zones and to protect sensitive sites (e.g., vernal pools) or endangered resources. RMZ (i.e., 100 feet from lakes, designated trout streams, streams ≥3 feet wide; 35 feet from streams ≤ 3 feet wide) guidelines include retention of at least 60 ft^2 basal area per acre in evenly distributed trees 5 inches dbh and larger along all lakes and streams ≥1 foot wide.

Johnson and King 2018 Recommendations	Michigan	Minnesota	Wisconsin
Other Preferred Retention Tree Characteristics			
	For even-aged harvests, retain all snags that do not pose a safety risk and live trees in various patch sizes, with preference to the following elements where they exist: trees representative of the dominant species naturally found on the site, legacy trees, where present, are not harvested, under-represented species, conifer/deciduous diversity, mast trees > 10 inches dbh where feasible (hickory, oak, American beech, black cherry, basswood and ironwood are preferred in descending order). For uneven-aged harvests: retain cavity trees, standing dead, and downed wood; retaining and encouraging underrepresented tree species; retaining and encouraging mast producing trees; and improving vertical and horizontal structural diversity, and may increase species diversity by encouraging growth of shade intolerant and mid-tolerant species.	For all harvests, retain some snags and trees with cavities on a site or maintain the potential to produce such as a stand grows and develops. Center or coincide leave tree clumps around features such as: mast trees, preferred tree species based on longevity, wind firmness, and cavity potential (white pine, oaks, elms, ashes, sugar maple, yellow birch, basswood, and aspen), and sensitive communities or sites. To retain the functionality of the clump, do not reduce the basal area below 80 ft^2/acre in trees 6 inches dbh or larger. Avoid isolating or eliminating populations of tree species at the edge of their range. Favor such species by promoting natural regeneration (as leave trees) or through other suitable methods to perpetuate them on site. Provide for perpetuation of genetic diversity within tree species and maximization the potential for tree species to shift their geographic ranges in response to possible rapid climatic changes.	For all harvests, retention of both vigorous and decadent trees will provide an array of benefits. Retain older trees with large size and rough bark. Species diversity is generally encouraged, including locally uncommon species and mast trees. Trees retained can be scattered uniformly throughout a stand or irregularly dispersed, as single trees, groups, and patches. The general recommended strategy is to retain irregularly distributed patches along with scattered groups and individuals. Retention in aggregated patches generally provides the most benefits to wildlife and biodiversity.

Source: Johnson and King 2018; Michigan Department of Natural Resources 2012; Minnesota Forest Resources Council 2013; Wisconsin Department of Natural Resources 2012

ft^2 square feet; dbh = diameter at breast height; RMZ = Riparian Management Zone

This objective requires the continuation of individual state tree retention guidelines that maintain snags on the landscape, maintain legacy trees, and retain larger, older trees during the course of harvest throughout the permit term. These retention guidelines will be applied to State DNR lands and any other lands enrolled in the Lake States HCP. The specific retention guidelines for each state can be found on the applicable DNR website (Michigan Department of Natural Resources 2012; Minnesota Forest Resources Council 2013; Wisconsin Department of Natural Resources 2012). In some cases, the guidelines allow variances when tree retention goals conflict with management needs for other biological resources (such as restoring barrens or savanna, forest health concerns) and these variances would continue to be followed when applicable. Current retention guidelines incorporate flexibility such that objectives are achieved at the landscape level even if they are not always achieved or possible at the stand level (e.g., snags will eventually fall and replacements may not exist uniformly across a given stand, trees or snags potentially hazardous to loggers may need to be removed to comply with human safety requirements).[4] Tables 5-2 and 5-3 and Appendix A, *Attributes of High-Quality Covered Bat Habitat in Managed Lake State Forests*, provide additional context for implementing retention guidelines at the landscape level.

The State DNRs will create or modify existing guidance to advise field staff on how to apply retention guidelines to benefit bats. Tree retention for bats will focus on providing cavities, shaggy bark, high levels of solar exposure, and a variety of roost trees over multiple years. A list of tree species preferred by bats include the following: oaks, hickories, walnuts, basswood and maples (for a full list of preferred bat species see Appendix A). The State DNRs are expected to change retention guidelines over the permit term in response to changing state forestry regulations and other needs. Changes to state retention guidelines are not anticipated to reduce protections for bat habitat (i.e., changes will either be neutral or increase protections). If the retention guidelines are changed in a way that reduces protection of bat habitat, the DNR will implement measures—outside of the retention guideline process—to achieve the same level of protective management that exists as of HCP permitting.

While the development of new retention guidelines occurs at the state level as part of a process that HCP implementers cannot control, the Lake States HCP commits the State DNRs to maintaining the current level of protections either through the retention guidelines *per se* or through the development of additional measures.

The commitment for this objective is the implementation of current and future retention guidelines.

Conservation Measures. The conservation measures associated with this objective are the development of a guidance document for use by field staff and, more broadly, implementation of each state's retention guidelines for the following elements: snags, cavity trees, recruitment trees, reserve trees, mast and legacy trees, and hardwood inclusions.

Objective 2.2: Minimize impacts on roosting bats by implementing a 150-foot buffer around all known occupied maternity roost trees

As of publication of the Lake States HCP, the 4(d) rule for northern long-eared bats protects known occupied maternity roost trees for this species during the summer. This objective extends the same 4(d) rule protections to known occupied maternity roost trees year-round for timber harvest and during pup season (June 1–July 31) for prescribed fire, and for all covered bat species (Table 5-5).

[4] Where states allow variances from their guidelines, they can continue to do that.

Consistent with this rule, no tree-cutting is allowed year-round, and no prescribed fires are allowed during pup season (June 1–July 31) within 150 feet (an area of approximately 1.6 acres) of a known and occupied maternity roost tree. Harvest restrictions have been expanded because bats and their female young return to roost in the same small area each year (Veilleux and Veilleux 2004). Research has shown that bats use a cluster of multiple roost trees within a small area and that they return to the same area each year with daughters returning to the areas in which they were reared (Swingen et al. 2018; Veilleux and Veilleux 2004). Therefore, this measure is intended to protect the multiple roost trees used during maternity season and to reduce stress during the sensitive spring emergence period that would result from loss of a known roosting area. The process delineated in Section 5.5.3, *Addition or Removal of Maternity Roost Trees as Known and Occupied*, protects other trees in the 150-foot buffer even if the original roost tree is removed through natural events. Additional details are also provided in that section.

Table 5-5. Distribution of Known Summer Roost Trees for All Covered Bats by State and Land Ownership Type [a]

State	Federal [b]	State [c]	Other Noncorporate [d]	County/ Municipal	Private and Tribal [e]	Total
Michigan	36	2	1	0	56	95
Minnesota	105	124	0	23	84	336
Wisconsin	13	84	2	1	59	159
Total [f]	**154**	**210**	**3**	**24**	**199**	**590**

Notes:

[a] Data sources: DePue pers. comm. 2019a; Baker pers. comm. 2020; Herrick pers. comm. 2018a. This table excludes known artificial roosts.

[b] Column for roost trees in federal ownership was included in total to provide context. Lands under federal ownership are not covered by the Lake States HCP.

[c] Includes DNR and other non-DNR state lands

[d] Includes information provided in dataset as University lands. Also includes roost trees labeled as occurring on tribal land from Wisconsin. Renamed for consistency with previous categories.

[e] Tribal lands are only broken out in the USFS FIA data at the land ownership level (in the Native American owner land code). In subsequent Lake States HCP analyses involving levels of harvest, Tribal lands are included as part of the private lands total.

[f] Does not account for locational uncertainty (i.e., GPS error).

In year 1, the State DNRs will geolocate known occupied maternity roost trees in each state on DNR lands. Any landowners enrolled in the Lake States HCP through the Landowner Enrollment Program will also work with the State DNRs to geolocate known occupied maternity roost trees on all enrolled lands within 5 years of enrollment and prior to any harvest activities. When a landowner enrolls in the Lake States HCP conservation program through the Landowner Enrollment Program, and is planning a forest management activity, the DNR will provide the landowner with the location of any known occupied maternity roost trees, hibernacula entrances, or protective buffers that may intersect with the activity. Most known occupied maternity roosts were documented when biologists captured and radio-tagged bats. Biologists then returned and tracked bats to a specific tree and provided coordinates to the DNR. In some cases, bats may be observed at roost trees via other means including direct visual observation. Regardless of how such bats are located, the roost is considered a known roost tree for purposes of the HCP when a specific tree or localized set of trees (several candidate trees with roost tree characteristics within crown's length of each other) was identified. In some cases, biologists radio-tagged a bat but could not access the property for purposes of study. In these cases, radio-triangulation was used to estimate the location of the roost from within a generalized area. These triangulated roosts are not known with precision and, thus, are not considered known roosts for the purposes of the HCP. This measure does not include any obligation to identify new occupied roost trees on DNR or other nonfederal lands through surveys, although new occupied roost trees that are identified through other bat survey efforts will be incorporated into the objective.

Additions and removals of known occupied maternity roost trees are described in Section 5.5.3, *Addition or Removal of Maternity Roost Trees as Known and Occupied*. This section also describes protections that may remain if and when a known, occupied maternity roost tree falls.

Each known occupied maternity roost tree will include the surrounding 150-foot radius (1.6-acre) buffer, which will serve as a disturbance buffer between the roost tree and activities that would otherwise adversely affect the roost.

The State DNRs commit to this level of protection for all known occupied maternity roost trees on State DNR lands and on lands enrolled in the Lake States HCP through the Landowner Enrollment Program. New known occupied maternity roost trees will be incorporated into this objective as they are discovered and geolocated. Known occupied maternity roost trees will be removed from this objective if they fall, are severely damaged due to natural events (i.e., wildfire, windthrow, disease), or when they are demonstrated to be unoccupied. See Section 5.5.3, *Addition or Removal of Maternity Roost Trees and Known and Occupied*, for details.

The commitment for this measure is the protection of all known occupied maternity roost trees on State DNR lands and lands enrolled in the Lake States HCP, including a 150-foot buffer around the known occupied maternity roost tree year-round for timber harvest and during pup season (June 1–July 31) for prescribed fire.

Conservation Measures. The conservation measure associated with this objective is protection of known occupied maternity roost trees within the buffer on DNR-administered lands and lands enrolled in the Lake States HCP.

Objective 2.3: Minimize impacts on roosting Indiana bats by restricting activities around all known occupied maternity roosts

Indiana bats roost in trees with loose bark, hollows, cracks, and crevices and prefer larger trees and snags. Such trees are preserved on the landscape through the guidelines included in both Objectives 2.1 and 2.2. However, Indiana bats have more roost specificity compared to other covered species such as preference for larger diameter trees (≥ 12-inch dbh), high daily solar exposure (≥ 10 hours), and higher specificity to roosting under large slabs of loose bark (Kurta et al. 2002). Indiana bats have also been extensively studied in Michigan compared to the other covered species, and colony locations are considered better known within the plan area than for other species. Nonetheless, some impacts on potential Indiana bat maternity roost trees may still occur under Objectives 2.1 and 2.2. Trees that are 12 inches dbh or more are most likely to provide roosts for Indiana bat maternity colonies and are the most difficult to replace; therefore, retention of these larger trees will be prioritized in Michigan.[5]

[5] In the Lake States, Indiana bats are only known to occur in Michigan (Chapter 3, Section 3.2.5.2, *Indiana Bat*).

To minimize the potential to affect known Indiana bat maternal roost trees, timber harvest and prescribed fire in forests will be restricted within a 2.5-mile buffer of suitable Indiana bat maternal roost trees (dead or dying trees or trees with loose bark ≥12 inches dbh) during the pup season (June 1 to July 31). Open land fires will not be prohibited. This objective applies to both known occupied maternity roost trees and known capture locations (absent roosting data). The 2.5-mile buffer distance is consistent with standard USFWS guidance on Indiana bat protections (U.S. Fish and Wildlife Service 2020). The buffer distance and associated protections, established from a small number of relatively recent (within the last 25 years) known maternity roost trees or summer capture locations (15 May to 15 August; male or female), both reflect the threshold used to delineate the typical foraging distance of Indiana bat and acknowledges that while Indiana bats are highly philopatric, maternity colonies may gradually shift their use over time as natural-caused changes to their habitat occur. Data used to establish the 2.5-mile buffer will be point data. If point data are not available, a point will be used based on the centroid of a polygon or the centroid of the best available habitat within a polygon. Data for establishing buffers will be no more than 25 years old.

See Butchkoski and Hassinger 2002; Kurta and Murray 2002; Kurta et al. 2002; and Murray and Kurta 2004 for further justification of this measure.

This measure differs, in part, from the buffers of other covered bat species to supplement the Bat Protection Zones described in Objective 2.4, which are focused on protections for tricolored bat, little brown bat, and northern long-eared bat.

Conservation Measures. The conservation measures for this objective are the implementation of a 2.5-mile buffer around known occupied maternity roost trees and capture locations for Indiana bats.

Objective 2.4. Minimize Impacts on Other Covered Bats by Establishing Bat Protection Zones

In addition to protecting individual roost trees, the Lake States will further minimize impacts on other covered bats (northern long-eared bats, tricolored bats, and little brown bats) by establishing Bat Protection Zones on state lands. These Bat Protection Zones contain high-quality bat habitat that will likely protect additional bats and/or roosts that have not yet been identified given the low bat population numbers due to WNS. Within these Bat Protection Zones, no timber harvest will be allowed during pup season (June 1–July 31). During the rest of the year, the only timber harvest that will be allowed is that which will be beneficial to bats. Locations and descriptions of the Bat Protection Zones in each Lake State are found in Appendix E, *Bat Protection Zones*. These Bat Protection Zones are entirely on DNR forestlands. The creation of Bat Protection Zones is not required for private forestland owners The purpose of these zones is to provide high-quality forest where bats are fully protected during pup season, to provide areas where bats are protected during fall staging and swarming given the zones' locations to known hibernacula, and to provide overall high-quality habitat where forests are managed to benefit bats year-round.

Notably, the Bat Protection Zone in Michigan occurs in the Porcupine Mountains, which is considered outside the known range of Indiana bats. However, as outlined under Objective 2.3, colony areas occupied by Indiana bats are better known than other species and, thus, are better protected by the 2.5-mile buffers described in that objective. Functionally, Objective 2.3 provides protections to the Indiana bat similar to a Bat Protection Zone.

Conservation Measure. The establishment of state-specific Bat Protection Zones on state lands and the memorialization of these zones as areas dedicated to bat protection over the lifetime of the permit.

5.2.2.2 Biological Goal 3: Promote stewardship on other nonfederal lands

Most forests across the plan area are in county, municipal, and private (including Tribal) ownership. The State DNRs manage only a portion (17% overall) of the forested lands across the three states. The Lake States HCP represents a commitment on behalf of the State DNRs to promote forested landscapes (with a focus on managed forests) on enrolled lands. The Lake States HCP will accomplish this by allowing eligible landowners to enroll in the HCP. Enrollment will provide limited take authorization to these landowners in exchange for their commitment to implement applicable conservation measures in the HCP. This will encourage sustainable forestry and the maintenance of forest on the landscape across other land ownerships in the Lake States. This goal also addresses the implementation of outreach programs aimed at increasing stewardship on private lands and the protection of bats and bat habitat features.

Objective 3.1: Increase bat conservation by providing the Landowner Enrollment Program on eligible lands throughout the permit term

Eligible landowners (Appendix B, *Landowner Enrollment Program*) can enroll in the Lake States HCP through the Landowner Enrollment Program and receive take coverage in exchange for their commitment to implement relevant conservation actions. This program is described in detail in Appendix B.

The commitment for this objective is the development of a program for enrolling other nonfederal landowners into the Lake States HCP and the administration of that program. All county forestlands are assumed to be eligible for enrollment. Eligible lands include an assumption of 80% of private and Tribal lands in Michigan and Wisconsin and 30% of private and Tribal lands in Minnesota. This results in an estimated 111,187 acres in Michigan, 88,785 acres in Minnesota, and 168,301 acres in Wisconsin considered eligible for enrollment under the Landowner Enrollment Program.

Conservation Measures. The conservation measures associated with this objective are the implementation and management of the Landowner Enrollment Program and the adoption of certain Lake States HCP conservation actions on other nonfederal lands through the program.

Objective 3.2: Develop and implement a communication plan for educating the public on covered bats and their conservation

Educating members of the public such as visitors, private landowners, cavers, and loggers about threats to covered bat species can promote conservation efforts across all three states. Informing the public about WNS will promote awareness of the species and the importance of protecting bats. In addition, education and outreach efforts can encourage loggers and private landowners to voluntarily implement practices on private lands that benefit covered bats. Given that most suitable habitat—and, therefore, most covered bats—are wholly or partly on private lands, this objective provides an important benefit to covered bats in the plan area.

To promote these conservation practices, each DNR will develop and implement an outreach program for the public that provides information on how to take the following actions.

- Identify, recognize, and protect covered bat hibernacula entrances on private lands.
- Identify and avoid impacts on potential roost trees in areas where bats are known to occur.
- Provide high-quality summer habitat for covered bats.
- Limit transmission of WNS.

The communication plan will include a strategy for press releases, web content development, social media outreach, and other methods of delivery including public meetings and speaking engagements. For example, the State DNRs may exhibit and provide outreach materials at public events such as the Great Lakes Bat Festival and state fairs held each year. The State DNRs will also coordinate efforts with other outreach programs to maximize program reach and effectiveness. These outreach programs will be developed and implemented within 2 years of permit issuance and will continue throughout the rest of the permit term.

The commitment for this objective is the development and implementation of a communication plan for bats.

Conservation Measures. The conservation measures associated with this objective include developing and implementing a communication plan through the publication of press releases, development and publication of web content, development of a brochure, speaking engagements, webinars, and other public outreach.

5.2.3 Nonforestry Measures for Bats

While the Lake States HCP is focused on minimizing the impact of forest management activities on covered bats, nonforestry conservation measures are also important to conserving bat populations in the Lake States. Covered bats hibernate in caves and mines during winter, often in large numbers. Protecting hibernating bats and improving winter habitat can provide an important benefit for covered bats during this critical stage of their life cycle.

5.2.3.1 Biological Goal 4: Protect and enhance hibernacula entrances and associated wintering bats

Each covered bat species spends winter in underground hibernacula. Hibernacula entrances are the centroid (geographic center of a delineated buffer) around which fall/spring habitat is described. During both periods, bats use habitat near the hibernacula entrances to feed in preparation for and recovery from hibernation. Finally, some bats visit hibernacula entrances throughout summer (Mumford and Whitaker 1975; Caire et al. 1979; LaVal and LaVal 1980; Whitaker and Rissler 1992; Whitaker and Brack 2002). As such, hibernacula entrances represent a crucial habitat element and are a focus of this biological goal. All currently known and any new hibernacula entrances identified during the permit term will be protected by the following objectives (Section 5.5.2, *Addition or Removal of Hibernacula as Protected Resources*).

Objective 4.1: Remove undesirable obstructions at known hibernacula entrances on State DNR lands by year 5 and continue throughout the permit term

Vegetation and other obstructions, such as dirt and debris, can obscure or cause excessive clutter near hibernacula entrances, altering airflow into the hibernaculum entrance, affecting winter temperature regimes and humidity, and thereby affecting the suitability of the hibernaculum entrance for over-wintering bats. In addition, altered entrances can divert water and/or debris into the hibernaculum entrance, which can lead to flooding or make some areas of the hibernaculum entrance inaccessible. Bats of many species (Sparks and Choate 2000) have been found impaled on thorny vegetation (e.g., burdock, multiflora rose, locusts, and hawthorns). Finally, in rare instances, predators can use this vegetation to ambush bats as they maneuver into the entrance of caves and mines (Sparks et al. 2000).

This objective applies to the 33 hibernacula entrances (for 25 hibernacula) that are known or are thought to exist on State DNR lands. Newly discovered hibernacula entrances will be protected by this measure if discovered. Each hibernaculum entrance will be checked for obstructions at least once in year 1 or year 2. Debris checks will occur at each hibernaculum entrance at least every 5 years. Obstructions that that may negatively affect access to or conditions within the cave will be removed.[6] This conservation measure does not apply to lands covered under the Landowner Enrollment Program; however, the State DNRs will conduct outreach to landowners regarding the benefits of maintaining hibernacula entrances. Funding may be coordinated by the State DNRs.

The commitment for this objective is to remove debris, vegetation, and other obstructions from known hibernacula entrances throughout the permit term when it is possible to do so (some hibernacula entrances cannot be physically reached by humans without significant effort). This objective also includes State DNR activities that are needed to keep hibernacula viable for the covered species.

Conservation Measures. The conservation measures associated with this objective include determining the status of entrances around known hibernacula, trimming vegetation around hibernacula entrances, removing other obstructions, maintaining hibernacula entrances through time, and identifying potential sites for creation or rehabilitation.

Objective 4.2: Protect known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term

Hibernating bats are sensitive to disturbance from a variety of sources. Hibernating bats are unconscious and, even when aroused, must warm themselves sufficiently to flee. Thus, hibernating bats may suffer direct mortality from being killed by vandals, suffocated by smoke entering the hibernacula, or being entombed if the hibernaculum entrance is sealed. When disturbed, bats arouse and become active. The arousal and subsequent period spent at normal body temperature is energetically expensive (Thomas et al. 1990; Boyles and Brack 2009). Repeated arousals can waste limited fat reserves and indirectly cause mortality and reduced reproduction (Thomas 1995). Such arousals are even more devastating when combined with arousals and other impacts of WNS (Boyles and Brack 2009). Further, during fall and spring, bats often congregate near cave and mine entrances and covered activities within this buffer area have the potential to harm bats. The 0.25-mile buffer around hibernacula entrances is contained in several regulatory documents including the programmatic biological opinions for the current 4(d) rule[7] for the northern long-eared bat (U.S.

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[6] In Michigan, the Michigan DNR must work with County Mine Safety Inspectors to remove obstructions to hibernacula entrances.

[7] Under the 4(d) rule, incidental take resulting from tree removal is only prohibited if it occurs within 0.25-mile (0.4 kilometer) of known northern long-eared bat hibernacula entrances or cuts or destroys known occupied maternity roost trees or any other trees within a 150-foot (45-meter) radius around the known occupied maternity

Fish and Wildlife Service 2016b) and for forest removal in Kentucky and Tennessee (U.S. Fish and Wildlife Service 2015, 2016b). The goals of this buffer are as follows.

- Protect and, if necessary, manage the entrance (or entrances) of the hibernaculum (see Objective 4.1).
- Designate a core area of habitat consisting of lands within a 0.25-mile radius of the entrance of the hibernaculum within which restrictions apply. The hibernaculum entrance itself would be protected and any known, occupied maternity roost trees within the core area.
- Timber harvests within this core area will not be permitted at any time of year unless they are done with the express objective of improving habitat for covered bats.
- Limit disturbance from noise (85 decibels at distance of 50 feet[8]) and vibrations within this core area from activities such as pile-driving and blasting (U.S. Fish and Wildlife Service 2016e). If necessary, such activities will occur during summer, when most bats are away from the hibernacula entrances.[9]

Machinery used for the express purpose of maintaining or manipulating conditions within a hibernaculum so that it retains or increases its suitability for use by hibernating bats are exempted but should try to minimize impacts to the extent practicable. Most hibernacula entrances in the Lake States are mines, some of which require additional management (pumping) to ensure they do not flood at a time when it would be harmful to people or bats. Pumping to protect these mines (as needed) is an additional conservation measure. These pumps may exceed the noise requirement listed above; however, they are essential to protect the integrity of the mine and to protect bats using the mine. In addition, the new *Guidelines for Beneficial Forest Management Practices for WNS-Affected Bats* specify that core areas around known hibernacula entrances should be protected and enhanced (Johnson and King 2018).

In year 1, the State DNRs will geolocate known hibernacula entrances on State DNR lands (Table 5-6). Eligible landowners that enroll in the Landowner Enrollment Program will be notified if their lands are within a 0.25-mile buffer of a hibernacula entrance (see Appendix B, *Landowner Enrollment Program*, for details). Timber harvests within this buffer area will not be permitted at any time of year unless they are done with the express objective of improving habitat for covered bats. Should one hibernaculum contain multiple entrances, the buffer will be drawn around any of the entrances known to be used by bats. Sites (and entrances) will be considered unoccupied if and when they have been verified as unoccupied using the methods described in Section 5.5.2, *Addition or Removal of Hibernacula as Protected Resources*.

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roost tree during the pup season (June 1 to July 31). This effectively exempts take that might result from forest management activities in a large portion of the species' range (Chapter 1, *Introduction*).

[8] Not to be exceeded more than 10% of the time for a 1-hour survey.

[9] These restrictions do not apply to low-intensity management activities such as road grading, snow plowing, or 1-day road maintenance activities.

Table 5-6. Number of Hibernacula Entrances in Each State Overall and on State DNR Lands

State	Total Entrances	Entrances on State DNR Lands
Michigan	111	10
Minnesota [a]	53	11
Wisconsin	119	12
Total	**283**	**33 [b]**

Notes:
[a] Includes four entrances to Soudan Underground Mine.
[b] These entrances lead to 25 hibernacula, including some that are on both DNR and private lands.
Sources: DePue pers. comm. 2019b; Baker pers. comm. 2019; Herrick pers. comm. 2018b

In addition, some caves, mines, or other subterranean habitats may benefit from enhancement. A narrow range of climate and microenvironmental variables makes hibernacula entrances suitable for winter use by bats. High-quality hibernacula entrances have areas with stable, predictable temperatures of 40 to 50 degrees Fahrenheit (°F). Colder temperatures (in the range of 35 to 41°F) have been shown to lower mortality rates from WNS (Johnson et al. 2016). One conservation measure in support of this objective is to identify a hibernaculum entrance for modification of microclimate conditions to increase winter survival by bats. Sites can include areas that currently have inappropriate temperatures. For example, Kurta and Smith (2014) noted five sites in the Upper Peninsula of Michigan that have multiple entrances, with the result that temperatures throughout the mines are overall too cold to support winter populations of bats. Other potential locations include warmer hibernacula entrances where bats hibernated historically before modifications changed the thermal regime. This conservation measure is not a requirement of meeting this objective but rather one option for further supporting the objective of habitat enhancement for bats.

The commitment for this objective is the development of a core area of protection around known hibernacula entrances on lands covered by the Lake States HCP.

Conservation Measures. The conservation measures associated with this objective are the designation of a 0.25-mile buffer around known hibernacula entrances; the identification of additional known hibernacula entrances other nonfederal lands adopt conservation measures associated with the Lake States HCP; implementation of harvest and noise restrictions within the 0.25-mile buffer; pumping of mines that are known hibernacula to preserve the integrity of the mine; and the possible enhancement of core areas around known hibernacula entrances.

Objective 4.3: Maintain gates on all known entrances to occupied hibernacula entrances on State DNR lands and the lands of willing partners (unless determined to be not needed or detrimental) throughout the permit term

Gates are designed to prevent people from accessing caves and mines at times when these hibernacula entrances are occupied by bats. Gates are typically targeted at sites where human disturbance limits the value of the site for bats. In some cases, gates have been used to limit public access to dangerous underground areas. Gates must be maintained to ensure they are properly functioning to protect bats from human threats such as vandalism that may result in bat mortality or render the hibernaculum unusable by bats. Gate maintenance is also necessary to address damage caused by natural forces such tree falls, rock falls, siltation, freezing and thawing, aging (rust), and running water. In addition, maintenance is necessary to remove any vegetation growth at the entrance that may be of harm to bats, such as burdock and thorny shrubs in which bats can get caught. Approximately 45% of the 33 known hibernacula entrances on State DNR lands are currently gated.

Modern gates are typically built of angle iron and designed to allow bats and air to pass with limited obstruction. However, despite several advances in design, gates can still have negative impacts on bats. Based on published literature (Richter et al. 1993; Currie 2002; Crimmins et al. 2014; Tobin and Chambers 2017), sites with the following conditions should not be gated.

- Sites where human disturbance is not expected to be a problem.
- Sites where the gate may disrupt normal bat behavior for the following reasons:
  - The bats using the cave/mine have long, narrow wings (not an issue for the Lake States species).
  - Bats regularly use the entrance area for roosting—this can often occur at night during swarming.
  - Site-specific conditions expose bats to predators as they pass through the gate.

This objective can be completed at any hibernaculum entrance known to have been used by one of the covered species within the past 10 years. For hibernacula entrances that have already been gated the objective is to maintain the gate in good condition. The goal is to gate and/or protect and maintain all priority hibernacula entrances on State DNR lands by year 5 of the permit term, and to gate or protect and maintain all safely accessible known hibernacula entrances on State DNR lands by year 15 of the permit term. At the beginning of the permit term, each DNR will submit a list of those sites considered priority hibernacula. With respect to the protection of bats, priorities in each state will be based on any of the following criteria.

- Level of protection at the site (prioritize sites that are protected by state ownership or other binding legal document such as a conservation easement).
- Number of covered species occupying a site (prioritize sites that contain multiple covered species).
- Number of individuals bats at an individual site at the time (prioritize sites that contain many bats).
- Level of need (prioritize sites where human disturbance is a problem).
- Other conservation priorities, including other rare species or other bats.
- Availability of willing landowners.

As noted, not all hibernacula entrances are suitable for gating. For example, only two of the four entrances to Soudan Mine, Minnesota, are accessible enough to warrant gating. The State DNRs will provide USFWS with documentation of any such sites as part of the assessment process. Finally, poorly designed gates can have significant, negative impacts on bat populations. Should such sites be located in the Lake States, the replacement of an existing gate with an improved design can be counted as a new gate.

The following benchmarks will ensure ongoing progress toward compliance.

- Within the first 5 years of the permit, the State DNRs will complete an assessment of all known hibernacula entrances on State DNR lands. This assessment will provide the following data.

- Information about current condition of hibernacula entrances on State DNR lands (number and type of bats present; if no longer occupied, the time since last occupancy; documentation of specific issues at a site, such as vandalism or potential for collapse or flooding).
- Information about what sites are currently gated and about the status of those gates.
- A prioritized list of sites on State DNR lands.
- A list of sites where additional data is needed to determine if a gate is appropriate.

Data provided by the State DNRs indicate that as of January 2020, the State DNRs maintain 18 gates on their lands (3 in Michigan, 9 in Minnesota, and 6 in Wisconsin) on lands they own and manage. The State DNRs also maintain 26 additional gates on lands owned by cooperating landowners (11 in Michigan, 2 in Minnesota, and 13 in Wisconsin). Several of these gates were purchased and installed with a mix of federal, state, and private funds, but the State DNRs now maintain them. Future gates are likely to be purchased with a similar mix of federal and nonfederal funding; only the nonfederal contribution of gate purchase and future maintenance of these gates constitute a conservation measure under the Lake States HCP (i.e., the federal contribution to the gating is not counted as an offset in this HCP). As noted in Objective 4.1, hibernacula entrances can be damaged by both natural and anthropogenic factors, and these issues are particularly important when a gate is present.

With time, it is expected that some new sites will be discovered. These will be assessed, prioritized, and added to the list to be gated as they are discovered. County, municipal, and private landowners are not required to gate hibernacula entrances as part of Objective 4.3, but the State DNRs will communicate with landowners regarding the benefits of gating. Technical assistance and access to funding may be provided by the State DNRs.

As appropriate, the State DNRs will add signage to gates likely to experience unwanted entry. In most states, a posted sign denying entrance to a site allows local law enforcement officers to enforce violations based on trespass laws—a much lower burden of proof than prosecuting a rare species violation. New gates and gate maintenance will occur in the summer to minimize disturbance to bats.

The commitment for this objective is the maintenance of gates, as needed, on State DNR lands, and to provide technical assistance and funds (when available) to landowners who are willing to have hibernacula entrances on their lands gated.

Conservation Measures. The conservation measures associated with this objective are the documentation of gated sites, prioritization of sites for gating, gating of any sites determined to be beneficial, and maintenance of existing and future gates.

Objective 4.4: Promote awareness and understanding of WNS through collaboration with researchers throughout the permit term

WNS is the primary threat to all four covered species, and little is known to be effective against the disease. The Lake States HCP recognizes this primary threat to the species and as such includes an objective to foster recovery from WNS.

While a widespread cure or treatment of WNS is not available for free-ranging bats, several experimental efforts are showing promise (U.S. Fish and Wildlife Service 2016c). All three states already work with USFWS and other entities involved in bat research. This cooperation includes providing samples from DNR surveys, technical assistance to researchers in each state, and permits needed to complete the work. Each state commits to continuing these efforts as part of this objective and to develop guidelines for future research requests.

The commitments for this objective is continued collaboration with WNS researchers on State DNR lands.

Conservation Measures. The conservation measures associated with this objective are the collaboration with USFWS and other entities involved in bat research; participation in a regional communication and information sharing related research; continuation of DNR surveys and technical assistance; and provision of permits (as appropriate) to continue WNS research on State DNR lands.

5.2.4 Additional Avoidance and Minimization Measures

Landscape-level and site-level forestry practices, as well as practices to protect and maintain hibernacula entrances, are the primary means of avoiding and minimizing take of covered bats. However additional avoidance and minimization measures serve an important role in minimizing take from other covered activities, such as prescribed fire.

5.2.4.1 Biological Goal 5: Avoid and minimize effects from covered activities on covered species

Avoidance measures associated with timber harvest are integrated with objectives previously described (Objectives 2.1, 2.2, and 4.3). Avoidance measures are also associated with other covered activities.

Objective 5.1: Minimize impacts of prescribed fire on roosting and hibernating bats beginning at permit issuance and continuing throughout the permit term

During fall and spring, bats use daily torpor as an energy-saving strategy. The time it takes for a bat to warm up to active temperatures delays it responsiveness to threats, such as fire. Relative to summer, bats concentrate in higher densities (near hibernacula entrances) during fall and spring. The State DNRs will ensure following minimization measures when implementing prescribed burns.

- To avoid killing or injuring maternity colonies or other summer roosting bats, prohibit prescribed burns within 150 feet of known occupied maternity roost trees during pup season (June 1–July 31).
- To avoid killing or injuring swarming bats in fall/spring habitat, reduce fire intensity within 0.25 mile of hibernacula entrances during spring and fall, unless the goal of the fire prescription is creating high-quality habitat for bats.
- To avoid killing or disturbing bats, especially in fall and spring when bats are most dense, ensure wind will carry smoke away from the entrance(s) of the hibernacula.

Note that burn plans take time to implement and are approved and valid for a period of time. The DNRs will begin incorporating these measures in all new burn plans once the permit is issued and will continue to revise older burn plans (if logistically feasible) within the first 5 years of implementation. All burn plans created prior to permit issuance that can be revised will be revised by Year 5.

Conservation Measures. The conservation measures associated with this objective are the implementation of impact minimization provisions in prescribed burns.

Objective 5.2: Minimize impacts on covered bats associated with roads and trails throughout the permit term

The Lake States HCP covers construction, maintenance, and use of roads and trails as described in Chapter 2, *Covered Lands and Activities*. U.S. Department of Transportation or other public agencies' roads and/or trails and permanent roads on private lands are not addressed in this HCP unless the State DNRs are responsible for conducting or administering the associated tree-cutting activities. In cases when the State DNRs are responsible for conducting or administering tree-cutting activities for other organizations, those tree-cutting activities are covered by this HCP. Coverage under the HCP does not replace the requirement for ESA Section 7 consultation with USFWS for actions with a federal nexus. Note that, as described in Chapter 2, roads and trails that are not on state DNR or enrolled county lands are not covered under this HCP unless they are temporary roads associated with timber harvest. Such temporary roads are covered through the forestry activities with which they are associated.

Activities associated with roads and trails are subject to the seasonal restrictions in Table 5-7. Hazard tree removal that is needed for public safety may occur year-round. Emergency road repairs are also exempt from the provisions of this objective.

Note that speeds on forest roads are by nature low due to the condition of these (unpaved) roads. The maximum speeds on these roads make vehicles unlikely to strike a bat.

Table 5-7. Seasonal Restrictions for Activities Associated with Roads and Trails

Maintenance of Existing Roads and Trails	
Known Occupied Maternity Roost Trees	• No tree removal within 150 feet of a known occupied maternity roost tree during the summer (April 15–October 15). • *For Indiana bat only,* no tree removal within 2.5 miles of a known occupied maternity roost tree (or associated capture locations as described in Objective 2.3) during pup season (June 1–July 31).
Hibernacula Entrances	• No tree removal within 2.5 miles of a known hibernaculum entrance in the fall (August 16–October 15) or spring (April 15–May 14). • No tree removal within 0.25 miles of a known hibernaculum entrance year round, unless tree removal is necessary for hazard trees or road maintenance for public safety, in which case it will occur when impacts are lowest (i.e., during the winter [November 1–March 15] or early summer [May 15–June 1]).
Construction of New Roads and Trails	
Known Occupied Maternity Roost Trees	• No new roads and trails within 150 feet of a known occupied maternity roost tree. [a] • *For Indiana bat only,* no tree removal for the purposes of construction within 2.5 miles of a known occupied maternity roost tree (or associated capture locations as described in Objective 2.3) during the pup season (June 1–July 31).
Larger-diameter Trees	• No removal of large-diameter trees (i.e., 9 inches dbh) during pup season (June 1–July 31). If a large-diameter tree must be removed during the pup season, a survey can be done to ascertain whether the tree is occupied.
Hibernacula Entrances	• No new roads or trails within 0.25 mile of a known hibernaculum entrance year-round. [a] • No tree removal for the purposes of construction within 2.5 miles of a known hibernaculum entrance in the fall (August 16–October 15) or spring (April 15–May 14).

Notes:

[a] New roads and trails within the buffers are possible with additional consultation and approval of USFWS to accommodate specific circumstances.

For activities associated with culverts greater than 36 inches in diameter or bridges during the active season (spring, summer, or fall), the structure should be inspected to determine presence or absence of covered bat species. If covered species are absent from the structure, no additional conservation measures are required. If covered species are present, additional consultation with USFWS is required for the activity to proceed during the active season.

For Indiana bats, this objective is in addition to the seasonal avoidance requirements described in Objective 2.3 for timber harvest and prescribed burns during the pup season (June 1 – July 31).

Conservation Measures. The conservation measures associated with this objective is the implementation of seasonal restrictions within these areas as described above.

5.3 Offsetting the Effects of the Take

This section summarizes how achievement of the goals and objectives of the conservation strategy offsets the take of covered species described in Chapter 4, *Potential Effects of Covered Activities*.

The estimated annual impact of covered activities on individual covered bats derived from the analysis in Chapter 4 is presented in Table 5-8. As discussed in Chapter 4, these affected acres shelter a low density of bats, and the risk of taking a bat from a given covered activity is expected to decrease over the foreseeable future as local populations of bats continue to decline from WNS (Frank et al. 2019).

The conservation strategy described in Section 5.2, *Biological Goals and Objectives*, is aimed at avoiding, minimizing, and mitigating the impacts of covered activities such that take is fully offset.

5.3.1 Take Minimized through Avoidance Measures

Some of the avoidance measures described in this chapter, such as implementation of retention guidelines and prescribed fire avoidance measures, have quantifiable benefits on covered bats. The retention guidelines associated with Objective 2.1 minimize impacts on potential roost trees, hollow trees, and snags retained from clearcuts and shelterwood harvests. Seasonal restrictions and other avoidance measures associated with prescribed fire (Objective 5.1) also minimize impacts on bats and bat habitat. The DNR foresters determined that an average clearcut in an aspen/birch forests retain 10% of snags; clearcuts in non-aspen forests are estimated to retain 15% of snags and 10% of live hollow trees. Shelterwood harvests are estimated to retain 33% of snags and 35% of live hollow trees. These estimates were derived from expert opinions, supplemental state data sources, and USFS FIA data (Appendix C, Section C.4, *Expert Process*). Coordination with the prescribed fire practitioners in the State DNRs indicated that 95% of potential roost trees (of all types) are retained following a prescribed fire. The number of bats killed in a harvested stand can be reduced by the percentage of species-appropriate roost trees that are avoided. Indiana bats and little brown bats are primarily associated with snags, while northern long-eared bats and tricolored bats use both snags and hollow trees. Thus, the number of appropriate roost trees avoided was used to reduce the level of impact. Table 5-8 displays the annual take of covered bats, derived in Chapter 4 (column A). Subsequent analysis quantified the avoided take associated with Objectives 2.1 and 5.1 (columns B and C). The remaining take, after implementation of these avoidance measures (column D), is quantified in column E.

Note that additional avoidance measures minimize impacts on covered bats (i.e., Objective 2.2, Objective 2.3, and Objective 5.2). The benefits of these conservation measures are described for each measure qualitatively. These benefits could not be quantified because of a lack of data on the effects of these types of minimization and avoidance measures on species health, survival, or reproduction.

Table 5-8. Annual Take Minimized through Implementation of Lake States HCP Avoidance Measures [a]

	Bats/Year				
	A	B	C	D (B plus C)	E (A minus D)
Species	**Take from Covered Activities [b]**	**Take Avoided through Timber Harvest Retention Guidelines [c]**	**Take Avoided through Prescribed Fire Avoidance Measures [d]**	**Total Take Avoided through HCP Biological Objectives**	**Take Remaining After Implementation of HCP Biological Objectives**
Indiana Bats					
Michigan	0.04	0.01	< 0.01	0.01	0.03
Minnesota	0	0	0	0	0
Wisconsin	0	0	0	0	0
Total Indiana Bats	0.04	0.01	< 0.01	0.01	0.03
Northern Long-Eared Bats					
Michigan	1.99	0.54	0.06	0.60	1.39
Minnesota	0.79	0.17	0.13	0.30	0.49
Wisconsin	0.42	0.10	0.02	0.12	0.29
Total Northern Long-Eared Bats	3.20	0.81	0.22	1.02	2.18
Tricolored Bats					
Michigan	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Minnesota	0.01	< 0.01	< 0.01	< 0.01	0.01
Wisconsin	0.07	0.02	< 0.01	0.02	0.05
Total Tricolored Bats	0.08	0.02	0.01	0.02	0.06
Little Brown Bats					
Michigan	7.73	2.11	0.23	2.34	5.39
Minnesota	1.57	0.34	0.25	0.59	0.98
Wisconsin	6.41	1.54	0.37	1.91	4.50
Total Little Brown Bats	15.70	3.99	0.85	4.84	10.86

Notes:

[a] Only includes those biological objectives that can be reasonably quantified. A qualitative discussion of the effects of the other biological objectives is included in Section 5.3.2, *Take Offset through Conservation Strategy.*

[b] Summarized in Chapter 4, Table 4-27.

[c] See Objective 2.1.

[d] See Objective 5.1.

5.3.2 Take Offset through Conservation Strategy

As outlined in Table 5-8, incorporation of existing DNR procedures (retention guidelines and fire plans) can avoid much, but not all, of the take associated with covered activities. Measures aimed at creating, retaining, and promoting high-quality roost trees are expected to increase fecundity and survival of covered bats, especially in cases where roost trees are limiting (Sparks et al. 2009) or where bats are recovering from WNS infections (Wilcox and Willis 2016). Similarly, restoration and protection of hibernacula entrances can lead to dramatic increases in population (Johnson et al. 2002; Kath 2002a, 2002b). The most effective way to demonstrate the value of maintaining gates and hibernacula entrances is when failures occur (Johnson et al. 2002). Notably, the 45 gates currently maintained by the State DNRs are estimated to protect more than 260 northern long-eared bats, 14,000 little brown bats, and 50 tricolored bats—an order of magnitude more bats than are expected to be taken by the plan. Most data available to demonstrate the effectiveness of cave gates assume the gates are present and maintained. The Lake States HCP team is aware of no publicly available data on the value of gate and vegetation maintenance. However, bats are known to become impaled on spiny plants, such as Burdock (Lyon 1925). All three State DNRs routinely inspect and maintain (as needed) existing bat gates and gates in all three states are expected to need repair. An informal survey of colleagues brought one especially notable response. On December 16, 2021, Mr. Greg Turner of the Pennsylvania Game Commission noted that his annual budget request to repair breached gates (where the public can readily bypass a gate and gain access to bats) is $20,000.00 per year, and most breeches are associated with most being a result of vandalism. Mr. Turner further noted that a typical gate lasts for 20 to 30 years before replacement or major repair. Thus, most gates currently protecting hibernacula in the Lake States will require significant maintenance or repair within the 50-year permit term.

The remaining take described in Table 5-8 is offset through other conservation measures included as part of this conservation strategy.

5.4 Beneficial and Net Effects

The conservation strategy described in Section 5.2, *Biological Goals and Objectives*, avoids, minimizes, and mitigates the impacts of covered activities such that the take described in Chapter 4, *Potential Effects of Covered Activities*, is fully offset. As noted here, quantifying the offset is difficult because the exact location of bats is often unknown (making it difficult to quantify avoidance), and efforts to understand fecundity and recruitment of bats are in their infancy. For example, efforts to understand recruitment of little brown bat (Humphrey and Cope 1976; Szymanski 2013) or Indiana bat (Humphrey and Cope 1977; Sparks et al. 2008; Oyler-McCance et al. 2018) have produced varying estimates. However, the covered activities support the creation of high-quality bat habitat (Yates and Muzika 2006; Sparks et al. 2009; Womack et al. 2013; Starbuck et al. 2015; Womack 2017). Where feasible, (Table 5-8) the effect of avoidance has been quantified. Otherwise beneficial and net effects are discussed qualitatively. As described under Objective 1.1, the Lake States protect and sustainably manage over 9 million acres of natural land owned by the State DNRs. Management of working forests protects potential habitat for bats, keeps lands out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level.

The conservation strategy increases stewardship outside DNR lands by promoting forestry practices that enhance habitat for bats through their Landowner Enrollment Program and engaging in educational outreach efforts (Objectives 3.1 and 3.2).

Minimization of the injury and mortality of bats during forestry management activities is achieved by leaving snag trees undisturbed (except in cases that threaten forest health and human safety), protecting known occupied maternity roosts with seasonal avoidance buffers, minimizing impacts within Bat Protection Zones, and implementing burn strategies that minimize impacts on bats while enhancing bat habitat (Objectives 2.1, 2.2, 2.3, 2.4, and 5.1). Minimization of impacts will also be implemented during road and trail construction and building demolition (Objective 5.2).

Note that Indiana bats are only known to occur in Michigan; however, northern long-eared bats, tricolored bats, and little brown bats are known to occur in all three Lake States (Chapter 3, Tables 3-7, 3-8, 3-11, 3-12, 3-15, and 3-16). The following sections summarize the beneficial effects of the conservation strategy and also include the net effects of conservation and impacts.

5.4.1 Indiana Bat

In the Lake States, Indiana bats are only known to occur in Michigan (Chapter 3, Section 3.2.5.2, *Indiana Bat*), as such, the potential take of Indiana bats is not anticipated in Minnesota or Wisconsin. Therefore, the net effects and benefits to Indiana bats are focused only on Michigan efforts. As described under Objective 1.1, Michigan protects and sustainably manages over 4.2 million acres of DNR-administered forestlands, approximately 339,818 acres of which are summer habitat for Indiana bats (Chapter 3, Table 3-8). Management of working forests protects potential habitat for bats, keeps lands out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level. Michigan also uses prescribed burning (Objective 5.1) to improve habitat for bats on 2,907 acres of modeled forest habitat per year. In addition, the conservation strategy increases stewardship outside Michigan DNR-administered forestlands by promoting forestry practices that enhance habitat for bats on an estimated 22,204 acres per year through their Landowner Enrollment Program and engaging in public educational outreach efforts (Objectives 3.1 and 3.2).

Managing 13,360 acres per year of modeled habitat for Indiana bats through timber harvest with retention and implementation of avoidance and minimization measures will improve roosting and foraging habitat for Indiana bats over the long term (Objective 2.1). Avoidance and minimization of the injury and mortality of bats during forestry management activities is achieved by implementing retention guidelines, protecting known roosts with seasonal avoidance buffers, and implementing bat- friendly prescribed fires (Objectives 2.1, 2.2, 2.3, and 5.1). Michigan will also promote awareness and understanding of WNS through collaboration with researchers (Objective 4.4).

5.4.1.1 Beneficial Effects

While addressed as covered activities, the forest management actions covered by the Lake States HCP will have a net long-term positive effect on bat habitat. Further, the Lake States HCP will benefit Indiana bats by providing 50 years of guaranteed protection and management for the 4.2 million acres of forestland under management by Michigan DNR (Objective 1.1). The HCP represents a commitment by Michigan to maintain and manage these lands for the 50-year permit term—an important assurance at a time when some states are considering divestment of public lands. The HCP also provides a means by which Michigan can support private landowners that seek to implement habitat management efforts to maintain these landscapes in habitat that is suitable for use by bats. Michigan has committed to provide a Landowner Enrollment Program for nonfederal lands (which make up approximately 75% of forestlands in Michigan) to gain take coverage and implement conservation activities. This is estimated to add an additional 22,204 acres per year (Objective 3.1).

Within the 4.2 million acres of forestland managed by Michigan DNR, there are 339,818 acres of summer Indiana bat habitat (Chapter 3, Table 3-8) and no acres of winter or spring/fall habitat. Approximately, 13,360 acres of timber harvest are managed annually with retention guidelines (Objective 2.1) and approximately 2,907 acres are managed with prescribed fire strategies that minimize impacts on bats (Objective 5.1) while enhancing bat habitat and providing an overall benefit for Indiana bats (Chapter 4, Table 4-27).

These values (acres of summer habitat managed with timber harvest and prescribed fire management per year) correspond to approximately 5% of summer habitat on Michigan DNR–administered forestlands each year, making these conservation measures highly relevant for the species.

Prescribed Fire

Approximately 2,907 acres per year of prescribed fires in forestlands are anticipated to create forest conditions that are desirable for covered bats (Objective 5.1). Of the 2,907 acres, all will occur in summer habitat. Prescribed fires provide multiple benefits for Indiana bats, such as the creation of high-quality foraging habitat and high-quality roosting habitat by killing and damaging trees such that future snags are created or roosting opportunities (e.g., crevices, cracks, dead limbs) on living trees are enhanced. The creation and conservation of roosts is regularly recommended as a strategy to decrease the risk of threats to local bat populations (e.g., WNS) (Neubaum et al. 2017). Enhanced roosting conditions reduce energetic costs, increase survival, and enhance recovery from WNS (Wilcox and Willis 2016).

Studies in other states have also provided evidence for the benefits of prescribed fire (Ford et al. 2016). By creating more and better roosts with increased solar exposure within a landscape that contains high-quality foraging habitat, prescribed fire provides a means of limiting post-emergence mortality from WNS and increasing survivorship and reproductive success in summer.

Tree Removals

Tree removals (especially limited timber harvest) are anticipated to impact individual bats over the short term but provide benefits for bats over the long term. On Michigan DNR–administered lands, tree removals (final and partial tree removal combined) will affect approximately 13,360 acres of summer Indiana bat habitat annually, divided as follows (Chapter 4, Table 4-2).

- Approximately 11,841 acres are high-quality Indiana bat summer habitat.
- Approximately 1,519 acres are low-quality Indiana bat summer habitat.

Note that fall/spring habitat is a subset of the summer habitat.

Over 50 years, these activities are expected to promote a diversity of forest types and ages and, thus, promote a diversity of suitable Indiana bat foraging and roosting habitat, across the state. Assuming activities do not overlap (which they do), over 50 years of the permit, forestry management would occur across approximately 42% of the modeled forested habitat in Michigan that Indiana bats may use. As illustrated in Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*, covered activities overlap both spatially and temporally and will, therefore, affect a smaller percentage of total modeled habitat. Most tree removal conducted by Michigan is aimed at directing the long-term growth and development of a stand as it relates to the surrounding landscape. Different management techniques result in optimal conditions (e.g., low subcanopy clutter, diversity of snag-decay classes/sizes, higher solar exposure for roost trees, enhanced herbaceous vegetation promoting insect abundance and diversity) for Indiana bat. Management techniques implemented promote heterogeneity in forests across Michigan, providing appropriate species composition and forest structure necessary to maintain long-term viability of bat populations. Forests with greater diversity, which more closely reflect natural conditions due to variations in size, class, and species, are more capable of coping with fluctuations in environmental conditions than even-aged forests composed of relatively few tree species. Such resilience can help buffer against climate change and its potential effects on Michigan's forests (e.g., increased risk of novel forest pathogens) (Brockerhoff et al. 2017). Contemporary management of forests enhances future habitat quality, improving survival rates for Indiana bats.

As mentioned, forest management activities—implemented in conjunction with conservation measures—improve conditions for covered bats. Most trees removed during timber sales are mature, healthy trees that provide minimal roosting opportunities for Indiana bats. Snags and other suitable roosting trees specifically retained within harvested stands will have increased solar exposure and consequently improved quality (U.S. Fish and Wildlife Service 2007; Johnson and King 2018). Over time, as the forest regenerates, the older trees retained during the harvest die and provide roosting opportunities in stands that otherwise are dominated by younger trees. In addition to improving the quality of retained roosts, the quality of foraging habitat is also improved after tree removal. Forest-management practices that create small forest openings reduce canopy cover, thus, increasing light penetration to the forest floor. Increased light promotes growth of herbaceous vegetation, which contributes to increased diversity and abundance of insect populations that make up the diet of Indiana bat. Newly managed stands may also provide the edge habitat for foraging Indiana bats roosting in adjacent stands, which can be important in areas where access to edge is limited (Sparks et al. 2004; Taylor 2006).

Roost Buffers

No tree-cutting or prescribed fires are allowed within 150 feet (an area of approximately 1.6 acres) of known and occupied maternity roost trees (Objectives 2.2 and 5.1). This protective buffer is implemented year-round for timber harvest and during pup season (June 1–July 31) for prescribed fires to protect the multiple roost trees used during the maternity season and to reduce stress during the sensitive spring emergence period that would result from loss of a known roosting area. This buffer protects other trees in the 150-foot buffer even if the original roost tree is removed through natural events. The State DNRs will geolocate known occupied maternity roost trees on DNR lands and those located on all private landowners enrolled in the Lake States HCP through the Landowner Enrollment Program. This measure will reduce the potential loss of bats associated with covered activities near known occupied maternity roost trees, thereby reducing impacts on juvenile and adult bats, resulting in increased juvenile survival than without buffers.

In addition to the 150-foot buffer around known occupied maternity roosts, timber harvest and prescribed fire in forests will be restricted within a 2.5-mile buffer of suitable Indiana bat maternal roost trees will be seasonally restricted (Objective 2.3). The 2.5-mile buffer will only be implemented during pup season (June 1–July 31), when the pups are nonvolant. The 2.5-mile buffer will be implemented around known occupied maternity roost trees and capture locations of Indiana bats to protect their typical foraging distance and to protect maternity colonies may gradually shift over time as natural-cause changes to their habitat. This measure reduces the potential loss of bats associated with covered activities over the life of the permit resulting in a greater number of reproductive individuals on the landscape.

Cave Protections

No Indiana bat hibernacula are located within Michigan State DNR lands.[10] However, known all hibernacula entrances are provided a 0.25-mile protective buffer and these buffers are anticipated to intersect with State DNR lands. Hibernacula buffers will be maintained or have habitat enhanced throughout the permit term (Objective 4.2). The State DNRs will maintain gates on all known entrances to occupied bat hibernacula on State DNR lands and the lands of willing partners (Objective 4.3).

Private Land Enrollment Program

An additional estimated 22,204 acres per year of forested habitat in Michigan can be managed for bats in forest covered by the Land Enrollment Program (Objective 3.1). Since private and county/municipal lands contain over 75% of the nonfederal forests in the state, this measure provides a means by which landowners can implement practices that will benefit bats. Protecting lands for bats ensures these habitats remain out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level, which results in more bats (increased fecundity and survivorship) than if the same lands were unmanaged.

Outreach

Michigan is committed to developing and implementing a communication plan to educate the public on covered bats and their conservation (Objective 3.2). The targeted public includes visitors, private landowners, cavers, and loggers as bat habitat is located on both public and private lands. Private landowners and the public have an important role to play in bat conservation especially since approximately 75% of nonfederal forest in Michigan are located on private or county/municipal lands. Public outreach can also help reduce the spread of WNS by educating cavers about how WNS is spread. This objective can also inform the public to avoid entering caves during hibernation periods when bats could be roused and use up critical energy reserves, thereby reducing winter mortality resulting from disturbance.

Michigan has committed to collaborate with entities involved in bat research and continued research and surveying to promote the awareness and understanding of WNS (Objective 4.4). The collaboration with other entities involved in bat research, and continued research and surveying will further reduce the relative impacts from covered activities by helping to ameliorate the effects of WNS on bat populations throughout the state.

5.4.1.2 Net Effects

Implementation of the Lake States HCP will allow harvest of approximately 3,340 acres of modeled summer habitat per year when Indiana bats may be present on Michigan DNR lands (166,998 acres

[10] Tippy Dam is located on private lands.

over the permit term) (Chapter 3, Table 3-8 and Chapter 4, Table 4-2).[11] This equates to less than 1% of the summer Indiana bat habitat on Michigan DNR lands per year (i.e., avoidance of 99% of Indiana bat summer habitat per year). On Michigan DNR lands, prescribed fire will occur on 2,100 acres of summer habitat annually when bats are present totaling less than 1% of summer Indiana bat habitat across Michigan DNR lands (105,000 acres over the permit term) (Chapter 4, Table 4-10).

The covered activities permitted by the Lake States HCP (e.g., prescribed fire and tree removal for habitat restoration and management) maintain and improve habitat on the landscape over the long term but may take up to 0.4 Indiana bats per year (Chapter 4, Table 4-27 and Table 5-7). These covered activities will affect up to 15,460 acres of forested lands within summer habitat on Michigan DNR lands and 23,011 acres of forested lands within summer Indiana bat habitat on other nonfederal lands (Chapter 4, Tables 4-2 and 4-10). The retention guidelines as described in Objective 2.1 are anticipated to avoid and minimize impacts on Indiana bat and improve foraging and roosting habitat over the long term. The implementation of timber harvest retention guidelines will benefit bats by creating foraging and roosting habitat, consistent with cited literature on the benefits of active management for bats (Taylor 2006; Silvis et al. 2012; Sheets et al. 2013a, 2013b; Pauli et al. 2015; Ford et al. 2016; Neubaum et al. 2017; Pauli et al. 2017; Johnson and King 2018). The covered activities, as implemented with the conservation measures described in Section 5.2, *Biological Goals and Objectives*, enhance foraging habitat by creating edge or by opening a stand so that it is easier for Indiana bats to fly (Taylor 2006; Sheets 2010; Neubaum et al. 2017). Forest treatments (especially timber harvest) also play a key role in directing the growth of young forest, some of which will become highly suitable roosting habitat during the permit term. Over time, this would be expected to result in a net increase in fecundity and reproduction (Silvis et al. 2012; Pauli et al. 2015).

Avoidance and minimization measures will greatly reduce the potential loss of bats associated with implementation of the covered activities. This includes the implementation of a 2.5-mile protective buffer around known occupied Indiana bat maternity roost trees and capture locations during pup season (June 1–July 31).

Roosting habitat for Indiana bats is also protected by the year-round 150-foot buffers around known occupied maternity roost trees and the 2.5-mile buffer around known Indiana maternity roost trees and capture locations during pup season. The protective roost buffers combined with the retention of potential roost trees (snags and cavity trees) will greatly reduce the number of bats killed or harmed by forestry operations. Even when a tree containing bats is disturbed or felled, the presence of other suitable roost trees in the surrounding landscape should allow these bats to rapidly move to a new roost and minimize the potential for these bats to be taken by predators (Sparks 2008).

If bats are killed, this impact will be offset by increased bat fecundity and survivorship that is accomplished through habitat management. With the implementation of the Lake States HCP, 179,285 acres (4%) of summer Indiana bat habitat in Michigan will be enhanced through forest management every year. In keeping with USFWS recommendations (Johnson and King 2018), this includes efforts to provide exceptional habitat for Indiana bats in areas where the species is known or suspected to concentrate. These enhancements will also include fall/spring habitats all of which are a subset of summer habitat.

[11] Summer habitat impacts are cited because summer habitat is inclusive of fall/spring habitat.

In summary, the following measures highlight the beneficial effects on bats and contribute to the net effects analysis.

- Protect and sustainably manage 4.2 million acres of forestland in Michigan that cannot be developed. In addition, no timber harvest is allowed on 150,000 acres of these forestlands.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 15,460 acres of summer habitat each year on Michigan DNR lands.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 23,011 acres per year on other nonfederal forest in Michigan located on private or county/municipal lands.
- Year-round protective buffers (150 feet) around all known Indiana bat maternity roosts, i.e., 1.6 acres.
- Seasonal 2.5-mile buffers around known Indianan bat maternity roost trees and capture locations that provide additional protection for maternity roosts during the pup season.
- Public outreach, WNS research, and training associated with Indiana bats and WNS.

Noting that the estimates of take in Chapter 4, *Potential Effects of Covered Activities*, are designed to overestimate impacts. Over the permit term the conservation strategy fully offsets the impact of the annual taking of less than 1% (0.01%) of the Indiana bat population within Michigan and less than 1% of occupied (i.e., when bats are present) habitat for Indiana bats per year (Chapter 4, Table 4-27).

5.4.2 Northern Long-eared Bat

As described under Objective 1.1, the Lake States protect and sustainably manage over 9 million acres of DNR-administered forestlands. Management of working forests protects potential habitat for northern long-eared bats, keeps lands out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level. The Lake States also use prescribed burning (see Chapter 2, *Covered Lands and Activities*, and Objective 5.1) which improves habitat for northern long-eared bats. The conservation strategy increases stewardship outside DNR lands by promoting forestry practices that enhance bat habitat through their Landowner Enrollment Program and engaging in public educational outreach efforts (Objectives 3.1 and 3.2).

Managing habitat for northern long-eared bats through timber harvest with retention and implementation of avoidance and minimization measures will improve roosting and foraging habitat for northern long-eared bats over the long term (Objective 2.1). Avoidance and minimization of the injury and mortality of northern long-eared bats during forestry management activities are achieved by implementing retention guidelines, protecting known roosts with year-round avoidance buffers, implementing seasonal minimization measures on burning, and bat protection zones where harvest is prohibited during the pup season and only targeted enhancement for bats are allowed during other times of year (Objectives 2.1, 2.2, and 5.1).

All of the Lake States will protect hibernacula and enhance access for wintering bats by removing obstructions at known hibernacula entrances on State DNR lands (Objective 4.1). The Lake States will also promote awareness and understanding of WNS through collaboration with researchers (Objective 4.4). In addition, the Lake States will implement, maintain, and enhance protective buffers around known northern long-eared bat hibernacula entrances (Objective 4.2) and maintain gates on all known entrances to occupied northern long-eared bat hibernacula on State DNR and the lands of willing partners (Objective 4.3).

5.4.2.1 Beneficial Effects

While addressed as covered activities, the forest management actions covered by the Lake States HCP have a net long-term positive effect on northern long-eared bat habitat. Further, the Lake States HCP will benefit northern long-eared bats by providing 50 years of guaranteed protection and sustainable management for the over 9 million acres (4.2 million acres in Michigan, 3.8 million acres in Minnesota, and 1.2 million acres in Wisconsin) of DNR-administered forestlands (Objective 1.1). The Lake States have a long history of managing forests sustainably through a robust policy and planning system, silvicultural and forest health decision making, and the desire to provide a sustainable supply of forest resources. Objective 1.1 commits the Lake States to continue to manage DNR-administered forestlands sustainably because such management results in providing habitat for the many forest-dwelling species found in the Lake States. The sustainable management of working forestlands conserves habitat for bats by keeping forestlands forested, reducing habitat fragmentation, and maintaining foraging and roosting habitat over time at the landscape level. This results in more bats (increased fecundity and survivorship) than if the same lands were protected (subject to development) and unmanaged.

The 9.2 million acres of DNR-administered forestland in the Lake States include the following acres modeled as northern long-eared bat habitat as shown in Table 5-9 (Chapter 3, Tables 3-8, 3-12, and 3-16).

Table 5-9. Winter, Falls/Spring, and Summer Modeled Northern Long-eared Bat Habitat Acres on DNR Forestland

State	Winter (acres) [a]	Fall/Spring (acres) [a]	Summer (acres) [a]
Michigan	512	204, 473	4,200,000
Minnesota	184	57,490	3,800,000
Wisconsin	585	64,389	1,200,000
Total	**1,281**	**326,352**	**9,200,000**

Notes:
[a] Winter, fall/spring, and summer habitats overlap in some areas.

Approximately, 133,500 acres (64,000 acres Michigan, 49,500 acres Minnesota, and 20,00 acres Wisconsin) of timber harvest are managed annually with retention guidelines (Objective 2.1). The Lake States have long been implementing these site-level guidelines and are committed to continuing to implement current (and future iterations) of these site-level guidelines to provide habitat features for forest-dwelling species. Forest management (especially timber harvest) plays a key role in directing the growth of young forest, some of which will become highly suitable roosting habitat during the permit term. Over time, this is expected to result in a net increase in fecundity and reproduction (Silvis et al. 2012; Pauli et al. 2015). In addition, retention guidelines and additional avoidance measures in the Lake States HCP will create and maintain roosts. The creation and conservation of roosts are regularly recommended as a strategy to decrease the risk of threats to local bat populations (e.g., WNS) (Neubaum et al. 2017). Enhanced roosting conditions reduce energetic costs, increase survival, and enhance recovery from WNS (Wilcox and Willis 2016).

Impacts on roosting and hibernating northern long-eared bats are minimized (Objective 5.1) during prescribed fires on 14,982 acres of forestlands (2,907 acres in Michigan, 7,120 acres in Minnesota, and 5,250 acres in Wisconsin) per year (Chapter 4, Table 4-27). These values (acres of timber harvest and prescribed fire per year) correspond to less than 2% of northern long-eared bat summer habitat in the Lakes States DNR–administered forestlands each year.

Prescribed Fire

Approximately 14,982 acres per year of prescribed fires in forestlands, (2,907 acres in Michigan, 6,995 acres in Minnesota, and 5,080 acres in Wisconsin) are anticipated to create forest conditions that are desirable for covered bats (see Chapter 2, *Covered Lands and Activities*, and Objective 5.1). Prescribed fire may occur in all northern long-eared bat habitats (summer, fall/spring, and/or winter). The Lake States will implement the prescribed fire impact minimization measures. Doing so will reduce the direct impacts of prescribed fire to known occupied maternity roost trees, hibernacula entrances, and bats themselves. Prescribed fires provide multiple benefits for northern long-eared bats, such as the creation of high-quality foraging habitat and high-quality roosting habitat by killing and damaging trees such that future snags are created or roosting opportunities (e.g., crevices, cracks, dead limbs) on living trees are enhanced. The creation and conservation of roosts is regularly recommended as a strategy to decrease the risk of threats to local bat populations (e.g., WNS). While this is not a conservation measure in the Lake States HCP (the State DNRs are not able to commit to prescribed fire targets year to year), this covered activity is anticipated to have significant conservation benefit.

Tree Removals

Tree removals (especially limited timber harvest) are anticipated to impact individual bats over the short term but provide benefits to bats over the long term. On Lake States DNR lands, tree removals (final and partial tree removal combined) will affect northern long-eared bat habitat annually as follows (Chapter 4, Tables 4-3, 4-11, and 4-18).

- Approximately 133,500 acres (64,000 acres in Michigan, 49,500 acres in Minnesota, and 20,000 acres in Wisconsin) of timber harvest are managed annually with retention guidelines. The 133,500 acres include the following:
  - Approximately 103,896 acres of high-quality summer habitat (50,651 acres in Michigan, 36,487 acres in Minnesota, and 16,758 acres in Wisconsin).
  - Approximately 29,604 acres of low-quality summer habitat (13,349 acres in Michigan, 13,013 acres in Minnesota, and 3,242 acres in Wisconsin).

Note that fall/spring habitat is a subset of summer habitat.

Over 50 years, these activities are expected to promote a diversity of forest types and ages and, thus, promote a diversity of suitable northern long-eared bat foraging and roosting habitat, across the state. Assuming activities do not overlap (which they do), over 50 years of the permit, forestry management would occur across approximately 45% of the modeled forested habitat that northern long-eared bat may use in the Lake States. As illustrated in Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*, covered activities overlap both spatially and temporally and will, therefore, affect a smaller percentage of total modeled habitat. Most tree removal conducted by the Lake States is aimed at directing the long-term growth and development of a stand as it relates to the surrounding landscape. Different management techniques result in optimal conditions (e.g., low subcanopy clutter, diversity of snag-decay classes/sizes, higher solar exposure for roost trees, enhanced herbaceous vegetation promoting insect abundance and diversity) for northern long-eared bats. Implemented management techniques promote heterogeneity in forests across the Lake States, providing appropriate species composition and forest structure necessary to maintain long-term viability of bat populations. Forests with greater diversity, which more closely reflect natural conditions due to variations in size, class, and species, are more capable of coping with fluctuations in environmental conditions than even-aged forests composed of relatively few tree species. Such resilience can help buffer against climate change and its potential effects on the Lake States' forests (e.g., increased risk of novel forest pathogens) (Brockerhoff et al. 2017). Contemporary management of forests enhances future habitat quality, improving survival rates for northern long-eared bats.

As mentioned above, forest management activities—implemented in conjunction with conservation measures—improve conditions for covered bats. Most trees removed during timber sales are mature, healthy trees that provide minimal roosting opportunities for northern long-eared bats. Snags and other suitable roosting trees specifically retained within harvested stands will have increased solar exposure and consequently improved quality (U.S. Fish and Wildlife Service 2007; Johnson and King 2018). Over time, as the forest regenerates, the older trees retained during the harvest die and provide roosting opportunities in stands that otherwise are dominated by younger trees. In addition to improving the quality of retained roosts, the quality of foraging habitat is also improved after tree removal. Forest-management practices that create small forest openings reduce canopy cover, thus, increasing light penetration to the forest floor. Increased light promotes growth of herbaceous vegetation, which contributes to increased diversity and abundance of insect populations that make up the diet of northern long-eared bats. Newly managed stands may also provide the edge habitat for foraging northern long-eared bats roosting in adjacent stands, which can be important in areas where access to edge is limited (Sparks et al. 2004; Taylor 2006).

Roost Buffers

No tree-cutting or prescribed fires are allowed within 150 feet (an area of approximately 1.6 acres) of known and occupied maternity roost trees (Objective 2.2 and Objective 5.1). This protective buffer is implemented year-round for timber harvest and during pup season (June 1–July 31) for prescribed fires to protect the multiple roost trees used during the maternity season and to reduce stress during the sensitive spring emergence period that would result from loss of a known roosting area. This buffer protects other trees in the 150-foot buffer even if the original roost tree is removed through natural events. State DNRs will geolocate known occupied maternity roost trees on DNR lands and those located on all private landowners enrolled in the Lake States HCP through the Landowner Enrollment Program. This measure will reduce the potential loss of bats associated with covered activities near known occupied maternity roost trees, thereby reducing impacts on juvenile and adult bats, resulting in increased juvenile survival than without buffers.

Bat Protection Zones

Each state has designated portions of DNR lands to serve as a reserve system for the covered species (called Bat Protection Zones, Objective 2.4) based on their unique situations. Additional details on the Bat Protection Zones are found in Appendix E, *Bat Protection Zones*.

For Michigan, the challenge of the Lake States HCP was addressing timber management efforts in the Upper Peninsula, where there are numerous mines, which contained very large numbers of bats within the past decade. Thus, Michigan DNR identified 44,363 acres in the Porcupine Mountains of Michigan, an area where 84% of forests are high-quality habitat and an area known to contain hibernacula buffers and their associated fall/spring habitats. This area is expected to provide summer habitat for many of the bats that hibernate in nearby mines.

Minnesota's timber program is heavily skewed toward winter harvests, which reduces the risk of direct impact but places a greater emphasis on potential indirect effects associated with winter removal of roost trees. Thus, Minnesota identified approximately 25,000 acres throughout the state that are dominated by older forest types that provide exclusively high-quality bat habitat, which will be managed as old growth forest. Minnesota's Bat Protection Zones are spread among stands that will be harvested. Thus, in addition to providing bat habitat themselves, they also provide a refuge should a nearby colonies roosting area be harvested. The designated 25,000 acres will include areas near 49 known occupied maternity roost trees of northern long-eared bats and more than 1,300 acres of fall/spring habitat.

Prior to the spread of WNS, Wisconsin was home to three of the largest known hibernacula in the world and, although populations are greatly reduced, bats are still expected to be spread across a large portion of Wisconsin's forests. Thus, Wisconsin DNR identified numerous areas where commercial timber harvest will not occur to provide islands of protected habitat within a more intensively managed matrix. Wisconsin has designated 79,424 acres as Bat Protection Zones, of which 83% are of a high-quality habitat and overlap with areas known to contain hibernacula and associated fall/spring habitats.

Cave Protections

The Lake States have committed to providing protection and enhancement of all 33 known hibernacula entrances located on State DNR–administered lands (10 in Michigan, 11 in Minnesota, and 12 in Wisconsin, [Table 5-6]). The protection of these 33 hibernacula entrances represents 12% of the total number of hibernacula entrances within the Lake States and 100% of the known hibernacula entrances found on DNR–administered lands in the Lake States. In Michigan there are 15 cave gates, 4 of which are on Michigan DNR–administered lands, that contain approximately 255 northern long-eared bats. In Minnesota, 9 of the 11 known hibernacula entrances are on Minnesota State DNR lands, that contain approximately 3 northern long-eared bats. In Wisconsin there are 19 cave gates, including 6 on Wisconsin DNR lands, that contain approximately 5 northern long-eared bats.

Objective 4.1 provides conservation measures (e.g., through removal of obstructions, trimming vegetation, and maintaining hibernacula entrances) that the Lake States will undertake designed to protect and improve conditions at known bat hibernacula entrances. Objective 4.2 provides protection to known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term. Finally, Objective 4.3 commits the Lakes States to maintain existing gates on all known hibernacula entrances on DNR-administered lands and lands of willing partners (unless determined to be not needed or detrimental).

Implementing these objectives will protect and improve conditions at known northern long-eared bat hibernacula entrances. Protection of entrances to known hibernacula keep these areas out of the development stream. Enhancement helps to stabilize entrances and ensures that these entrances do not collapse and also helps to maintain microclimates inside the hibernacula so that they remain favorable for hibernating bats. By maintaining existing entrances, bat mortality due to changing microclimates is reduced and fitness is improved. Over time, this is expected to result in an increase in fecundity and reproduction resulting in more bats. Protection and maintenance of existing cave gates helps to prevent unauthorized access into the cave.

Private Land Enrollment Program

An additional estimated 368,273 acres per year of forested bat habitat (111,187 acres in Michigan, 88,785 acres in Minnesota, and 168,301 acres in Wisconsin) can be managed for bats in forest covered by the Land Enrollment Program (Objective 3.1). Since private and county/municipal lands contain over 75% of the nonfederal forests in Michigan, 74% of the nonfederal forests in Minnesota, and 92% of the nonfederal forests in Wisconsin, this measure provides a means by which landowners can implement practices that will benefit bats. Protecting lands for bats ensures these habitats remain out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level, which results in more bats (increased fecundity and survivorship) than if the same lands were unmanaged.

Outreach

The Lake States are committed to developing and implementing a communication plan to educate the public on covered bats and their conservation (Objective 3.2). The targeted public includes visitors, private landowners, cavers, and loggers as bat habitat is located on both public and private lands. Private landowners and the public have an important role to play in bat conservation especially since approximately 75% of the nonfederal forests in Michigan, 74% of the nonfederal forests in Minnesota, and 92% of the nonfederal forests in Wisconsin are located on private or county/municipal lands. Public outreach can also help reduce the spread of WNS by educating cavers about how WNS is spread. This objective can also inform the public to avoid entering caves during hibernation periods when bats could be roused and use up critical energy reserves, thereby reducing winter mortality resulting from disturbance.

The Lakes States have committed to collaborate with entities involved in bat research, and continued research and surveying to promote the awareness and understanding of WNS (Objective 4.4). The collaboration with other entities involved in bat research, and continued research and surveying will further reduce the relative impacts from covered activities by helping to ameliorate the effects of WNS on bat populations throughout the state.

5.4.2.2 Net Effects

Implementation of the Lake States HCP will allow harvest of approximately 25,641 acres of modeled summer forested habitat per year when northern long-eared bats may be present on Lake State DNR– administered lands (1,282,031 acres over the permit term) (Chapter 4, Tables 4-3, 4-11, and 4-18). This equates to less than one 1% of the summer habitat for northern long-eared bat in the Lake States per year. Prescribed fire will occur on 12,900 acres of summer forested habitat per year during the active season on Lake State DNR–administered lands equally less than 1% of summer northern long-eared bat habitat across Lake State DNR lands (Chapter 4, Tables 4-10, 4-17, and 4-24).

The covered activities permitted by the Lake States HCP (e.g., prescribed fire and tree removal for habitat restoration and management) maintain and improve habitat on the landscape over the long term but may take up to 3.20 northern long-eared bats per year (Chapter 4, Table 4-27 and Table 5-7). These covered activities will affect up to 146,400 acres of forested lands within summer habitat on Lake States DNR–administered lands and 370,354 acres of forested lands within summer northern long-eared bat habitat on nonfederal lands owned by private or county/municipal landowners (Chapter 4, Tables 4-3, 4-11, 4-18, 4-10, 4-17, and 4-24). The retention guidelines as described in Objective 2.1 are anticipated to avoid and minimize impacts on northern long-eared bats and improve foraging and roosting habitat over the long term. The implementation of timber harvest retention guidelines will benefit bats by creating foraging and roosting habitat, consistent with cited literature on the benefits of active management for bats (Taylor 2006; Silvis et al. 2012; Sheets et al. 2013a, 2013b; Pauli et al. 2015; Ford et al. 2016; Neubaum et al. 2017; Pauli et al. 2017; Johnson and King 2018). The covered activities, as implemented with the conservation measures described in Section 5.2, *Biological Goals and Objectives*, enhance foraging habitat by creating an edge or by opening a stand so that it is easier for northern long-eared bats to fly (Taylor 2006; Sheets 2010; Neubaum et al. 2017). Forest treatments (especially timber harvest) also play a key role in directing the growth of young forest, some of which will become highly suitable roosting habitat during the permit term. Over time, this would be expected to result in a net increase in fecundity and reproduction (Silvis et al. 2012; Pauli et al. 2015).

Avoidance and minimization measures will greatly reduce the potential loss of bats associated with implementation of the covered activities. Roosting habitat for northern long-eared bats is protected by year-round 150-foot buffers around known occupied maternity roost trees. In addition, the retention of potential roost trees (snags and cavity trees) will greatly reduce the number of bats killed or harmed by forestry operations. Even when a tree containing bats is disturbed or felled, the presence of other suitable roost trees in the surrounding landscape should allow these bats to rapidly move to a new roost and minimize the potential for these bats to be taken by predators (Sparks 2008).

The few bats killed will be offset by increased bat fecundity and survivorship that is accomplished through habitat management. With implementation of the Lake States HCP, 515,293 acres (<1 %) of northern long-eared bat habitat in the Lake States will be enhanced every year.

In summary, the following measures highlight the beneficial effects on bats and contribute to the net effects analysis.

- State DNRs protect and sustainably manage 9.2 million acres of forestland in the Lake States that cannot be developed. In addition, no timber harvest is allowed on over 200,000 acres of these forestlands.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 146,400 acres of summer habitat each year for northern long-eared bats on Lake States DNR–administered lands.

- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 370,354 acres per year on nonfederal forest in the Lake States located on private or county/municipal lands.
- State DNRs implement protective buffers (150 feet) around all known occupied bat maternity roosts, 1.6 acres around each roost.
- State DNRs implement protective buffers (0.25 mile) around all 33 known bat hibernacula entrances.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on 33 known northern long-eared bat hibernacula entrances (15 in Michigan, 11 in Minnesota, and 19 in Wisconsin).
- State DNRs continue efforts in public outreach, WNS research, and training associated with northern long-eared bats and WNS.

Noting that the estimates of take in Chapter 4, *Potential Effects of Covered Activities*, are designed to overestimate impacts, the conservation strategy fully offsets the impact of the taking on less than 1% (0.01%) of the northern long-eared bat population within in the Lake States and less than 1% of occupied habitat for northern long-eared bats per year, respectively (Chapter 4, Table 4-27).

5.4.3 Tricolored Bat

As described under Objective 1.1, the Lake States protect and sustainably manage over 9 million acres of DNR–administered forestlands. Management of working forests protects potential habitat for tricolored bats, keeps lands out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level. The Lake States also use prescribed burning (Objective 5.1) to improve habitat for tricolored bats. The conservation strategy increases stewardship outside DNR-administered forestlands by promoting forestry practices that enhance bat habitat through their Landowner Enrollment Program and engaging in public educational outreach efforts (Objectives 3.1 and 3.2).

Managing habitat for tricolored bats through timber harvest with retention and implementation of avoidance and minimization measures will improve roosting and foraging habitat for tricolored bats over the long term (Objective 2.1). Avoidance and minimization of the injury and mortality of tricolored bats during forestry management activities is achieved implementing retention guidelines, protecting known roosts with seasonal avoidance buffers, and implementing bat-friendly burn plans (Objectives 2.1, 2.2, and 5.1).

All of the Lake States will protect and enhance tricolored hibernacula entrances and associated wintering bats by removing obstructions at known hibernacula entrances on State DNR lands (Objective 4.1) and promote awareness and understanding of WNS through collaboration with researchers (Objective 4.4). In addition, the Lake States will implement, maintain, and enhance protective buffers around known tricolored bat hibernacula entrances (Objective 4.2) and maintain gates on all known entrances to occupied tricolored bat hibernacula on State DNR and the lands of willing partners (Objective 4.3).

5.4.3.1 Beneficial Effects

While addressed as covered activities, the forest management actions covered by the Lake States HCP have a net long-term positive effect on tricolored bat habitat. Further, the Lake States HCP will benefit tricolored bats by providing 50 years of guaranteed protection and sustainable management for the over 9 million acres (4.2 million acres in Michigan, 3.8 million acres in Minnesota, and 1.2 million acres in Wisconsin) of DNR-administered forestlands (Objective 1.1). The Lake States have a long history of managing forests sustainably through a robust policy and planning system, silvicultural and forest health decision-making, and the desire to provide a sustainable supply of forest resources. Objective 1.1 commits the Lake States to continue to manage DNR-administered forestlands sustainably because such management results in providing habitat for the many forest-dwelling species found in the Lake States. The sustainable management of working forestlands conserve habitat for bats by keeping forestlands forested, reducing habitat fragmentation, and maintaining foraging and roosting habitat over time at the landscape level. This results in more bats (increased fecundity and survivorship) than if the same lands were protected (subject to development) and unmanaged.

The 9 million acres of DNR-administered forestland in the Lake States include the following acres of tricolored bat habitats as shown in Table 5-10 (Chapter 3, Tables 3-8, 3-12, and 3-16).

Table 5-10. Winter, Falls/Spring, and Summer Modeled Tricolored Bat Habitat Acres on DNR-Administered Forestland

State	Winter (acres) [a]	Fall/Spring (acres) [a]	Summer (acres) [a]
Michigan	172	51, 966	1,112,076
Minnesota	268	36,227	628,957
Wisconsin	193	46,050	51,966
Total	**633**	**82,277**	**1,792,999**

Notes:
[a] Winter, fall/spring, and summer habitats overlap in some areas.

Approximately, 79,467 acres (39,033 acres in Michigan, 31,354 acres in Minnesota, and 9,080 acres in Wisconsin) of timber harvest are managed annually with retention guidelines (Objective 2.1). The Lake States have long been implementing these site-level guidelines and are committed to continuing to implement current (and future iterations) of these site-level guidelines to provide habitat features for forest-dwelling species. Forest management (especially timber harvest) plays a key role in directing the growth of young forest, some of which will become highly suitable roosting habitat during the permit term. Over time, this is expected to result in a net increase in fecundity and reproduction (Silvis et al. 2012; Pauli et al. 2015). In addition, retention guidelines and additional avoidance measures in the Lake States HCP will create and maintain roosts. The creation and conservation of roosts is regularly recommended as a strategy to decrease the risk of threats to local bat populations (e.g., WNS) (Neubaum et al. 2017). Enhanced roosting conditions reduce energetic costs, increase survival, and enhance recovery from WNS (Wilcox and Willis 2016).

In addition, impacts on roosting and hibernating tricolored bats are minimized (Objective 5.1) during prescribed fires on 14,982 acres of forestlands (Chapter 4, Table 4-27). These values (acres of summer habitat managed with timber harvest and prescribed fire management per year) correspond to approximately 5% of tricolored bat summer habitat in the Lakes States DNR–

administered forestlands each year, making these conservation measures highly relevant for the species.

Prescribed Fire

Approximately, 14,982 acres per year of prescribed fires in forestlands, (2,907 acres in Michigan, 6,995 acres in Minnesota, and 5,080 acres in Wisconsin) are anticipated to create forest conditions that are desirable for covered bats (Objective 5.1). Prescribed fire may occur in all tricolored bat habitats (summer, fall/spring, and/or winter). The Lake States will implement the prescribed fire impact minimization measures to the extent possible. Doing so will reduce the direct impacts of prescribed fire to known occupied maternity roost trees, hibernacula entrances, and bats themselves. Prescribed fires provide multiple benefits for tricolored bats, such as the creation of high-quality foraging habitat and high-quality roosting habitat by killing and damaging trees such that future snags are created or roosting opportunities (e.g., crevices, cracks, dead limbs) on living trees are enhanced. The creation and conservation of roosts is regularly recommended as a strategy to decrease the risk of threats to local bat populations (e.g., WNS). While this is not a conservation measure in the Lake States HCP (the State DNRs are not able to commit to prescribed fire targets year to year), this covered activity is anticipated to have conservation benefit.

Tree Removals

Tree removals (especially limited timber harvest) are anticipated to impact individual bats over the short term but provide benefits to bats over the long term. On Lake States DNR lands, tree removals (partial and final tree removal combined) will affect tricolored bat habitat annually as follows (Chapter 4, Tables 4-5, 4-13, and 4-20).

- Approximately 79,467 acres (39,033 acres in Michigan, 31,354 acres in Minnesota, and 9,080 acres in Wisconsin) of timber harvest are managed annually with retention guidelines. The 79,467 acres include:
    - Approximately 60,818 acres of high-quality summer habitat (31,034 acres in Michigan, 22,290 acres in Minnesota, and 7,494 acres in Wisconsin).
    - Approximately 18,649 acres of low-quality summer habitat (8,000 acres in Michigan, 9,064 acres in Minnesota, and 1,585 acres in Wisconsin).

Note that fall/spring habitat is a subset of summer habitat.

Over 50 years, these activities are expected to promote a diversity of forest types and ages and, thus, promote a diversity of suitable tricolored bat foraging and roosting habitat across the state. Assuming activities do not overlap (which they do), over 50 years of the permit, forestry management would occur across approximately 44% of the modeled forested habitat that tricolored bat may use in the Lake States. As illustrated in Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*, covered activities overlap both spatially and temporally and will, therefore, affect a smaller percentage of total modeled habitat. Most tree removal conducted by the Lake States is aimed at directing the long-term growth and development of a stand as it relates to the surrounding landscape. Different management techniques result in optimal conditions (e.g., low subcanopy clutter, diversity of snag-decay classes/sizes, higher solar exposure for roost trees, enhanced herbaceous vegetation promoting insect abundance and diversity) for tricolored bats. Implemented management techniques promote heterogeneity in forests across the Lake States, providing appropriate species composition and forest structure necessary to maintain long-term viability of bat populations. Forests with greater diversity, which more closely reflect natural conditions due to variations in size, class, and species, are more capable of coping with fluctuations in environmental conditions than even-aged forests composed of relatively few tree species. Such resilience can help buffer against climate change and its potential effects on the Lake States' forests (e.g., increased risk of novel forest pathogens) (Brockerhoff et al. 2017). Contemporary management of forests enhances future habitat quality, improving survival rates for tricolored bats.

As mentioned, forest management activities—implemented in conjunction with conservation measures—improve conditions for covered bats. Most trees removed during timber sales are mature, healthy trees that provide minimal roosting opportunities for the other covered bats however, tricolored bat roost in the leaves of both dead and live trees. To ensure potential tricolored roosts were also being retained, the Lake States retention guidelines include provisions to retain large live trees as well as aggregations of leave trees. Snags and other suitable roosting trees specifically retained within harvested stands will have increased solar exposure and consequently improved quality (U.S. Fish and Wildlife Service 2007; Johnson and King 2018). Over time, as the forest regenerates, the older trees retained during the harvest die and provide roosting opportunities in stands that otherwise are dominated by younger trees. In addition to improving the quality of retained roosts, the quality of foraging habitat is also improved after tree removal. Forest-management practices that create small forest openings reduce canopy cover, thus, increasing light penetration to the forest floor. Increased light promotes growth of herbaceous vegetation, which contributes to increased diversity and abundance of insect populations that make up the diet of tricolored bats. Newly managed stands may also provide the edge habitat for foraging tricolored bats roosting in adjacent stands, which can be important in areas where access to edge is limited (Sparks et al. 2004; Taylor 2006).

Roost Buffers

No tree-cutting or prescribed fires are allowed within 150 feet (an area of approximately 1.6 acres) of known and occupied maternity roost trees (Objectives 2.2 and 5.1). This protective buffer is implemented year-round for timber harvest and during pup season (June 1–July 31) for prescribed fires to protect the multiple roost trees used during the maternity season and to reduce stress during the sensitive spring emergence period that would result from loss of a known roosting area. This buffer protects other trees in the 150-foot buffer even if the original roost tree is removed through natural events. State DNRs will geolocate known occupied maternity roost trees on DNR lands and those located on all private landowners enrolled in the Lake States HCP through Landowner Enrollment Program. This measure will reduce the potential loss of bats associated with covered activities near known occupied maternity roost trees, thereby reducing impacts on juvenile and adult bats, resulting in increased juvenile survival than without buffers.

Bat Protection Zones

Each state has designated portions of DNR-managed lands to serve as a reserve system for the covered species, which includes more than 3,300 acres of fall/spring habitat for tricolored bats in Wisconsin. See Section 5.2.2.1, *Biological Goal 2: Protect and enhance roosting and foraging habitat for bats*, and Appendix E, *Bat Protection Zones*.

Cave Protections

The Lake States have committed to providing protection and enhancement of all 33 known hibernacula entrances located on State DNR–administered lands (10 in Michigan, 11 in Minnesota, and 12 in Wisconsin [Table 5-6]). The protection of these 33 hibernacula entrances represents 12% of the total number of hibernacula entrances within the Lake States and 100% of the known hibernacula entrances found on DNR–administered lands in the Lake States. In Michigan there are 15 cave gates, 4 of which are on Michigan DNR–administered lands, that contain approximately 2 tricolored bats. In Minnesota, 9 of the 11 known hibernacula entrances are on Minnesota State DNR lands, that contain approximately 24 tricolored bats. In Wisconsin there are 19 cave gates, including 6 on Wisconsin DNR lands, that contain approximately 31 tricolored bats.

Objective 4.1 provides conservation measures (e.g., through removal of obstructions, trimming vegetation, and maintaining hibernacula entrances) that the Lake States will undertake designed to protect and improve conditions at known bat hibernacula entrances. Objective 4.2 provides protection to known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term. Finally, Objective 4.3 commits the Lakes States to maintain existing gates on all known hibernacula entrances on State DNR-administered lands and lands of willing partners (unless determined to be not needed or detrimental).

Implementing these objectives will protect and improve conditions at known tricolored bat hibernacula entrances. Protection of entrances to known hibernacula keeps these areas out of the development stream. Enhancement helps to stabilize entrances and ensures that these entrances do not collapse and also helps to maintain microclimates inside the hibernacula so that they remain favorable for hibernating bats. By maintaining existing entrances, bat mortality due to changing microclimates is reduced and fitness is improved. Over time, this is expected to result in an increase in fecundity and reproduction resulting in more bats. Protection and maintenance of existing cave gates helps to prevent unauthorized access into the cave.

Private Land Enrollment Program

An additional estimated 204,058 acres per year of forested bat habitat (68,916 acres in Michigan, 57,281 acres in Minnesota, and 77,861 acres in Wisconsin) can be managed for bats in forest covered by the Land Enrollment Program (Objective 3.1). Since private and county/municipal lands contain over 75% of the nonfederal forests in Michigan, 74% of the nonfederal forests in Minnesota, and 92% of the nonfederal forests in Wisconsin, this measure provides a means by which landowners can implement practices that will benefit bats. Protecting lands for bats ensures these habitats remain out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level, which results in more bats (increased fecundity and survivorship) than if the same lands were unmanaged.

Outreach

The Lake States are committed to developing and implementing a communication plan to educate the public on covered bats and their conservation (Objective 3.2). The targeted public includes visitors, private landowners, cavers, and loggers as bat habitat is located on both public and private lands. Private landowners and the public have an important role to play in bat conservation especially since approximately 75% of the nonfederal forests in Michigan, 74% of the nonfederal forests in Minnesota, and 92% of the nonfederal forests in Wisconsin are located on private or county/municipal lands. Public outreach can also help reduce the spread of WNS by educating cavers about how WNS is spread. This objective can also inform the public to avoid entering caves during hibernation periods when bats could be roused and use up critical energy reserves, thereby reducing winter mortality resulting from disturbance.

The Lakes States have committed to collaborate with entities involved in bat research, and continued research and surveying to promote the awareness and understanding of WNS (Objective 4.4). The collaboration with other entities involved in bat research, and continued research and surveying will further reduce the relative impacts from covered activities by helping to ameliorate the effects of WNS on bat populations throughout the state**.**

5.4.3.2 Net Effects

Implementation of the Lake States HCP will allow harvest of approximately 14,968 acres of modeled summer forested habitat per year when tricolored bats may be present on Lake State DNR–administered lands (748,386 acres over the permit term) (Chapter 4, Tables 4-5, 4-13, and 4-20). This equates to less than 1% of the summer habitat for tricolored bat in the Lake States per year. Prescribed fire will occur on 12,900 acres of summer forested habitat per year during the active season on Lake State DNR–administered lands equally less than 1% of summer tricolored bat habitat across Lake State DNR lands (Chapter 4, Tables 4-10, 4-17, and 4-24).

The covered activities permitted by the Lake States HCP (e.g., prescribed fire and tree removal for habitat restoration and management) maintain and improve habitat on the landscape over the long term but may take up to 0.08 tricolored bats per year (Chapter 4, Tables 4-27 and 5-7). These covered activities will affect up to 92,367 acres of forested lands within summer habitat on Lake States DNR–administered lands and 206,139 acres of forested lands within summer tricolored bat habitat on nonfederal lands owned by private or county/municipal landowners (Chapter 4, Tables 4-5, 4-10, 4-13, 4-17, 4-20, and 4-24). The retention guidelines as described in Objective 2.1 are anticipated to avoid and minimize impacts on tricolored bats and improve foraging and roosting habitat over the long term. The implementation of timber harvest retention guidelines will benefit bats by creating foraging and roosting habitat, consistent with cited literature on the benefits of active management for bats (Taylor 2006; Silvis et al. 2012; Sheets et al. 2013a, 2013b; Pauli et al. 2015; Ford et al. 2016; Neubaum et al. 2017; Pauli et al. 2017; Johnson and King 2018). The covered activities, as implemented with the conservation measures described in Section 5.2, *Biological Goals and Objectives*, enhance foraging habitat by creating an edge or by opening a stand so that it is easier for tricolored bats to fly (Taylor 2006; Sheets 2010; Neubaum et al. 2017). Forest treatments (especially timber harvest) also play a key role in directing the growth of young forest, some of which will become highly suitable roosting habitat during the permit term. Over time, this would be expected to result in a net increase in fecundity and reproduction (Silvis et al. 2012; Pauli et al. 2015).

Avoidance and minimization measures will greatly reduce the potential loss of bats associated with implementation of the covered activities. Known occupied maternity roost trees for tricolored bats are protected by year-round 150-foot buffers. In addition, the retention of potential roost trees (snags and cavity trees) will greatly reduce the number of bats killed or harmed by forestry operations. Even when a tree containing bats is disturbed or felled, the presence of other suitable roost trees in the surrounding landscape should allow these bats to rapidly move to a new roost and minimize the potential for these bats to be taken by predators (Sparks 2008).

The few bats killed will be offset by increased bat fecundity and survivorship that is accomplished through forest management. With the implementation of the Lake States HCP, 515,293 acres (2%) of tricolored bat habitat in the Lake States will be enhanced every year.

In summary, the following measures highlight the beneficial effects on bats and contribute to the net effects analysis.

- State DNRs protect and sustainably manage 9.2 million acres of forestland in the Lake States that cannot be developed. In addition, no harvest is allowed on over 200,000 acres of these forestlands.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 92,367 acres of summer habitat for tricolored bat each year on Lake States DNR lands.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 206,139 acres per year on nonfederal forest in the Lake States located on private or county/municipal lands.
- State DNRs implement protective buffers (150 feet) around all known occupied bat maternity roosts, 1.6 acres around each roost.
- State DNRs implement protective buffers (0.25 mile) around all 33 known bat hibernacula entrances.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on 33 known bat hibernacula entrances (10 in Michigan, 11 in Minnesota, and 12 in Wisconsin).
- State DNRs continue public outreach, WNS research, and training associated with tricolored bats and WNS.

Noting that the estimates of take in Chapter 4, *Potential Effects of Covered Activities*, are designed to overestimate impacts. The conservation strategy fully offsets the impact of the taking on less than 1% (0.02%) of the tricolored bat population within in the Lake States and less than 1% of occupied habitat for tricolored bats per year (Chapter 4, Table 4-27).

5.4.4 Little Brown Bat

As described under Objective 1.1, the Lake States protect and sustainably manage over 9 million acres of DNR-administered forestlands. Management of working forests protects potential habitat for little brown bats, keeps lands out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level. The Lake States also use prescribed burning (Objective 5.1) to improve habitat for little brown bats. The conservation strategy increases stewardship outside DNR-administered forestlands by promoting forestry practices that enhance bat habitat through their Landowner Enrollment Program and engaging in public educational outreach efforts (Objectives 3.1 and 3.2).

Managing habitat for little brown bats through timber harvest with retention and implementation of avoidance and minimization measures will improve roosting and foraging habitat for little brown bats over the long term (Objective 2.1). Avoidance and minimization of the injury and mortality of little brown bats during forestry management activities is achieved implementing retention guidelines, protecting known roosts with seasonal avoidance buffers, and implementing bat-friendly burn plans (Objectives 2.1, 2.2, and 5.1).

All of the Lake States will protect and enhance little brown bat hibernacula entrances and associated wintering bats by removing obstructions at known hibernacula entrances on State DNR lands (Objective 4.1) and promote awareness and understanding of WNS through collaboration with researchers (Objective 4.4). In addition, the Lake States will implement, maintain, and enhance protective buffers around known little brown bat hibernacula entrances (Objective 4.2) and maintain gates on all known entrances to occupied little brown bat hibernacula on State DNR and the lands of willing partners (Objective 4.3).

5.4.4.1 Beneficial Effects

While addressed as covered activities, the forest management actions covered by the Lake States HCP have a net long-term positive effect on little brown bat habitat. Further, the Lake States HCP will benefit little brown bats by providing 50 years of guaranteed protection and sustainable management for the over 9 million acres (4.2 million acres in Michigan, 3.8 million acres in Minnesota, and 1.2 million acres in Wisconsin) of DNR-administered forestlands (Objective 1.1). The Lake States have a long history of managing forests sustainably through a robust policy and planning system, silvicultural and forest health decision-making, and the desire to provide a sustainable supply of forest resources, Objective 1.1 commits the Lake States to continue to manage DNR-administered forestlands sustainably because such management results in providing habitat for the many forest-dwelling species found in the Lake States. The sustainable management of working forestlands conserve habitat for bats by keeping forestlands forested, reducing habitat fragmentation, and maintaining foraging and roosting habitat over time at the landscape level. This results in more bats (increased fecundity and survivorship) than if the same lands were protected (subject to development) and unmanaged.

Of the 9 million acres of DNR-administered forestland in the Lake States include the following acres of little brown bat habitats as shown in Table 5-11 (Chapter 3, Tables 3-8, 3-12, and 3-16).

Table 5-11. Winter, Falls/Spring, and Summer Modeled Little Brown Bat Habitat Acres on DNR-Administered Forestland

State	Winter (acres) [a]	Fall/Spring (acres) [a]	Summer (acres) [a]
Michigan	494	201, 231	4,200,000
Minnesota	235	57,913	3,800,000
Wisconsin	572	69,831	1,200,000
Total	**1,301**	**328,975**	**9,200,000**

Notes:
[a] Winter, fall/spring, and summer habitats overlap in some areas.

Approximately, 133,500 acres (64,000 acres in Michigan, 49,500 acres in Minnesota, and 20,00 acres in Wisconsin) of timber harvest are managed annually with retention guidelines (Objective 2.1). The

Lake States have long been implementing these site-level guidelines and are committed to continuing to implement current (and future iterations) of these site-level guidelines to provide habitat features for forest-dwelling species. Forest management (especially timber harvest) plays a key role in directing the growth of young forest, some of which will become highly suitable roosting habitat during the permit term. Over time, this is expected to result in a net increase in fecundity and reproduction (Silvis et al. 2012; Pauli et al. 2015). In addition, retention guidelines and additional avoidance measures in the Lake States HCP will create and maintain roosts. The creation and conservation of roosts is regularly recommended as a strategy to decrease the risk of threats to local bat populations (e.g., WNS) (Neubaum et al. 2017). Enhanced roosting conditions reduce energetic costs, increase survival, and enhance recovery from WNS (Wilcox and Willis 2016).

In addition, impacts on roosting and hibernating little brown bats are minimized (Objective 5.1) during prescribed fires on 14,982 acres of forestlands (2,907 acres in Michigan, 6,995 acres in Minnesota, and 5,080 acres in Wisconsin) per year (Chapter 4, Table 4-27). These values (acres of summer habitat managed with timber harvest and prescribed fire) correspond to approximately 2 % of little brown bat summer habitat in the Lakes States DNR-administered forestlands each year, making these conservation measures highly relevant for the species.

Prescribed Fire

Approximately 14,982 acres per year of prescribed fires in forestlands (2,907 acres in Michigan, 6,995 acres in Minnesota, and 5,080 acres in Wisconsin) are anticipated to create forest conditions that are desirable for covered bats (Objective 5.1). Prescribed fire may occur in all little brown bat habitats (summer, fall/spring, and/or winter). The Lake States will implement the prescribed fire impact minimization measures to the extent possible. Doing so will reduce the direct impacts of prescribed fire to known occupied maternity roost trees, hibernacula entrances, and bats themselves. Prescribed fires provide multiple benefits for little brown bats, such as the creation of high-quality foraging habitat and high-quality roosting habitat by killing and damaging trees such that future snags are created or roosting opportunities (e.g., crevices, cracks, dead limbs) on living trees are enhanced. The creation and conservation of roosts is regularly recommended as a strategy to decrease the risk of threats to local bat populations (e.g., WNS). While this is not a conservation measure in the Lake States HCP (the State DNRs are not able to commit to prescribed fire targets year to year), this covered activity is anticipated to have conservation benefit.

Tree Removals

Tree removals (especially limited timber harvest) are anticipated to impact individual bats over the short term but provide benefits to bats over the long term. On Lake States DNR-administered lands, tree removals (partial and final tree removal combined) will affect little brown bat habitat annually as follows and as shown in Table 5-12 (Chapter 4, Tables 4-4, 4-12, and 4-19).

- Approximately 133,500 acres (64,000 acres in Michigan, 49,500 acres in Minnesota, and 20,000 acres in Wisconsin) of timber harvest are managed annually with retention guidelines.
- The 133,500 acres include high-and low-density habitat, as well as high- and low-quality habitat (Table 5-12). Unlike other covered species, the model for summer habitat of little brown bat (Chapter 3, Figure 3-12) is focused on hibernacula entrances.

Note that fall/spring habitat is a subset of these summer habitat acres.

Table 5-12. High- and Low-Quality Little Brown Bat Summer Habitat by State in Low and High-Density Areas

Summer Habitat Location	Michigan (acres)		Minnesota (acres)		Wisconsin (acres)		Lake States Total (acres)		Total Acres of Summer Habitat
	High	Low	High	Low	High	Low	High	Low	
General landscape (e.g., low density)	7,702	7,052	25,119	7,874	6,091	1,190	58,912	16,116	75,028
Near hibernacula entrances (e.g., high density)	22,949	6,297	11,368	5,139	10,667	2,052	44,984	13,488	58,472
Total	**50,651**	**13,349**	**36,487**	**13,013**	**16,758**	**3,242**	**103,896**	**29,604**	**133,500**

Over 50 years, these activities are expected to promote a diversity of forest types and ages and, thus, promote a diversity of suitable little brown bat foraging and roosting habitat, across the state. Assuming activities do not overlap (which they do), over 50 years of the permit, forestry management would occur across approximately 45% of the modeled forested habitat that little brown bats may use in the Lake States. As illustrated in Appendix D, *Example of Spatial and Temporal Distribution of Covered Activities within Hypothetical Home Range for Bats*, covered activities can overlap both spatially and temporally and will, therefore, affect a smaller percentage of total modeled habitat. Most tree removal conducted by the Lake States is aimed at directing the long-term growth and development of a stand as it relates to the surrounding landscape. Different management techniques result in optimal conditions (e.g., low subcanopy clutter, diversity of snag-decay classes/sizes, higher solar exposure for roost trees, enhanced herbaceous vegetation promoting insect abundance and diversity) for little brown bats. Management techniques implemented promote heterogeneity in forests across the Lake States, providing appropriate species composition and forest structure necessary to maintain long-term viability of bat populations. Forests with greater diversity, which more closely reflect natural conditions due to variations in size, class, and species, are more capable of coping with fluctuations in environmental conditions than even-aged forests composed of relatively few tree species. Such resilience can help buffer against climate change and its potential effects on the Lake States' forests (e.g., increased risk of novel forest pathogens) (Brockerhoff et al. 2017). Contemporary management of forests enhances future habitat quality, improving survival rates for little brown bats.

As mentioned, forest management activities—implemented in conjunction with conservation measures—improve conditions for covered bats. Most trees removed during timber sales are mature, healthy trees that provide minimal roosting opportunities for little brown bats. Snags and other suitable roosting trees specifically retained within harvested stands will have increased solar exposure and consequently improved quality (U.S. Fish and Wildlife Service 2007; Johnson and King 2018). Over time, as the forest regenerates, the older trees retained during the harvest die and provide roosting opportunities in stands that otherwise are dominated by younger trees. In addition to improving the quality of retained roosts, the quality of foraging habitat is also improved after tree removal. Forest-management practices that create small forest openings reduce canopy cover, thus, increasing light penetration to the forest floor. Increased light promotes growth of herbaceous vegetation, which contributes to increased diversity and abundance of insect populations that make up the diet of little brown bats. Newly managed stands may also provide the edge habitat for foraging little brown bats roosting in adjacent stands, which can be important in areas where access to an edge is limited (Sparks et al. 2004; Taylor 2006).

Roost Buffers

No tree-cutting or prescribed fires are allowed within 150 feet (an area of approximately 1.6 acres) of known and occupied maternity roost trees (Objectives 2.2 and 5.1). This protective buffer is implemented year-round for timber harvest and during pup season (June 1–July 31) for prescribed fires to protect the multiple roost trees used during the maternity season and to reduce stress during the sensitive spring emergence period that would result from loss of a known roosting area. This buffer protects other trees in the 150-foot buffer even if the original roost tree is removed through natural events. State DNRs will geolocate known occupied maternity roost trees on DNR lands and those located on all private landowners enrolled in the Lake States HCP through the Landowner Enrollment Program. This measure will reduce the potential loss of bats associated with covered activities near known occupied maternity roost trees, thereby reducing impacts on juvenile and adult bats, resulting in increased juvenile survival than without buffers.

Bat Protection Zones

Each state has designated portions of DNR lands to serve as a reserve system for the covered species. For a description of all Bat Protection Zones, see Section 5.2.2.1, *Biological Goal 2: Protect and enhance roosting and foraging habitat for bats*, and Appendix E, *Bat Protection Zones*.

Cave Protections

The Lake States have committed to providing protection and enhancement of all 33 known hibernacula entrances located on State DNR–administered lands (10 in Michigan, 11 in Minnesota, and 12 in Wisconsin [Table 5-6]). The protection of these 33 hibernacula entrances represents 12% of the total number of hibernacula entrances within the Lake States and 100% of the known hibernacula entrances found on DNR-administered lands in the Lake States. In Michigan there are 15 cave gates, 4 of which are on Michigan DNR-administered lands, that contain approximately 14,350 little brown bats. In Minnesota, 9 of the 11 known hibernacula entrances are on Minnesota State DNR lands, that contain approximately 1,535 little brown bats. In Wisconsin, there are 19 cave gates, including 6 on Wisconsin DNR lands, that contain approximately 78 little brown bats.

Objective 4.1 provides conservation measures (e.g., through removal of obstructions, trimming vegetation, and maintaining hibernacula entrances) that the Lake States will undertake designed to protect and improve conditions at known bat hibernacula entrances. Objective 4.2 provides protection to known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term. Finally, Objective 4.3 commits the Lakes States to maintain existing gates on all known hibernacula entrances on DNR-administered lands and lands of willing partners (unless determined to be not needed or detrimental).

Implementing these objectives will protect and improve conditions at known little brown bat hibernacula entrances. Protection of entrances to known hibernacula keep these areas out of the development stream. Enhancement helps to stabilize entrances and ensures that these entrances do not collapse and also helps to maintain microclimates inside the hibernacula so that they remain favorable for hibernating bats. By maintaining existing entrances, bat mortality due to changing microclimates is reduced and fitness is improved. Over time, this is expected to result in an increase in fecundity and reproduction resulting in more bats. Protection and maintenance of existing cave gates helps to prevent unauthorized access into the cave.

Private Land Enrollment Program

An additional estimated 368,273 acres per year of forested bat habitat (111,187 acres in Michigan, 88,785 acres in Minnesota, and 168,301 acres in Wisconsin) can be managed for bats in forest covered by the Land Enrollment Program (Objective 3.1). Since private and county/municipal lands contain over 75% of the nonfederal forests in Michigan, 74% of the nonfederal forests in Minnesota, and 92% of the nonfederal forests in Wisconsin, this measure provides a means by which landowners can implement practices that will benefit bats. Protecting lands for bats ensures these habitats remain out of the development stream, prevents habitat fragmentation, and maintains foraging and roosting habitat in high quality over time at the landscape level, which results in more bats (increased fecundity and survivorship) than if the same lands were unmanaged.

Outreach

The Lake States are committed to developing and implementing a communication plan to educate the public on covered bats and their conservation (Objective 3.2). The targeted public includes visitors, private landowners, cavers, and loggers as bat habitat is located on both public and private lands. Private landowners and the public have an important role to play in bat conservation especially since approximately 75% of the nonfederal forests in Michigan, 74% of the nonfederal forests in Minnesota, and 92% of the nonfederal forests in Wisconsin are located on private or county/municipal lands. Public outreach can also help reduce the spread of WNS by educating cavers about how WNS is spread. This objective can also inform the public to avoid entering caves during hibernation periods when bats could be roused and use up critical energy reserves, thereby reducing winter mortality resulting from disturbance.

The Lakes States have committed to collaborate with entities involved in bat research, and continued research and surveying to promote the awareness and understanding of WNS (Objective 4.4). The collaboration with other entities involved in bat research, and continued research and surveying will further reduce the relative impacts from covered activities by helping to ameliorate the effects of WNS on bat populations throughout the state.

5.4.4.2 Net Effects

Implementation of the Lake States HCP will allow harvest management of approximately 25,641 acres of modeled forested summer habitat per year when tricolored bats may be present on Lake State lands (1,282,031 acres over the permit term) (Chapter 4, Tables 4-4, 4-12, and 4-19). This equates to less than 1% of the summer habitat for little brown bats in the Lake States per year. Prescribed fire will occur on 12,900 acres of summer forested habitat per year during the active season on Lake States DNR-administered lands equally less than 1% of summer little brown bat habitat across Lake States DNR lands (Chapter 4, Tables 4-10, 4-17, and 4-24).

The covered activities permitted by the Lake States HCP (e.g., prescribed fire and tree removal for habitat restoration and management) maintain and improve habitat on the landscape over the long term but may take up to 15.70 little brown bats per year (Chapter 4, Table 4-27 and Table 5-7). These covered activities will affect up to 146,400 acres of forested lands within summer habitat on Lake States DNR-administered lands and 372,427 acres of forested lands within summer little brown bat habitat on nonfederal lands owned by private or county/municipal landowners (Chapter 4, Tables 4-4, 4-10, 4-12, 4-17, 4-19, and 4-24). The retention guidelines as described in Objectives 2.1 are anticipated to avoid and minimize impacts on little brown bats and improve foraging and roosting habitat over the long term. The implementation of timber harvest retention guidelines will benefit bats by creating foraging and roosting habitat, consistent with cited literature on the benefits of active management for bats (Taylor 2006; Silvis et al. 2012; Sheets et al. 2013a, 2013b; Pauli et al. 2015; Ford et al. 2016; Neubaum et al. 2017; Pauli et al. 2017; Johnson and King 2018). The covered activities, as implemented with the conservation measures described in Section 5.2, *Biological Goals and Objectives*, enhance foraging habitat by creating edge or by opening a stand so that it is easier for little brown bats to fly (Taylor 2006; Sheets 2010; Neubaum et al. 2017). Forest treatments (especially timber harvest) also play a key role in directing the growth of young forest, some of which will become highly suitable roosting habitat during the permit term. Over time, this would be expected to result in a net increase in fecundity and reproduction (Silvis et al. 2012; Pauli et al. 2015).

Avoidance and minimization measures will greatly reduce the potential loss of bats associated with implementation of the covered activities. Known roosting habitat for little brown bats is protected by the year-round 150-foot buffers around known maternity roost trees. In addition, the retention of potential roost trees (snags and cavity trees) will greatly reduce the number of bats killed or harmed by forestry operations. Even when a tree containing bats is disturbed or felled, the presence of other suitable roost trees in the surrounding landscape should allow these bats to rapidly move to a new roost and minimize the potential for these bats to be taken by predators (Sparks 2008).

The few bats killed will be offset by increased bat fecundity and survivorship that is accomplished through habitat management. With the implementation of the Lake States HCP, 515,293 acres (<1 %) of summer little brown bat habitat in the Lake States will be enhanced every year.

In summary, the following measures highlight the beneficial effects on little brown bats and contribute to the net effects analysis.

- State DNRs protect and sustainably manage 9.2 million acres of forestland in the Lake States that cannot be developed. In addition, no harvest is allowed on over 200,000 acres of these forestlands.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 146,400 acres of summer habitat for little brown bat each year on Lake States DNR lands.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on approximately 372,427 acres per year on nonfederal forest in the Lake States located on private or county/municipal lands.
- State DNRs implement protective buffers (150 feet) around all known occupied maternity roosts, i.e., 1.6 acres around each roost.
- State DNRs implement protective buffers (0.25 mile) around all 33 known bat hibernacula entrances.
- State DNRs manage forestlands and ultimately enhance habitat for bats by increasing foraging habitat and improving roosting habitat in many forest types over time. This management and enhancement that takes place as part of the covered activities will occur on 33 known bat hibernacula entrances (10 Michigan, 11 Minnesota, and 12 Wisconsin).

- State DNRs continue public outreach, WNS research, and training associated with little brown bats and WNS.

Noting that the estimates of take in Chapter 4, *Potential Effects of Covered Activities*, are designed to overestimate impacts, the conservation strategy fully offsets the impact of the taking on less than 1% (0.01%) of the little brown bat population within in the Lake States and less than 1% of occupied habitats for little brown bats per year (Chapter 4, Table 4-27).

5.5 Adaptive Management

Adaptive management, as described by the HCP Handbook, is a tool to address uncertainty in the conservation strategy of an HCP. Proposed adaptive management measures must be documented up front so they can subsequently affect changes to the operating conservation program, as needed.

Based on the best scientific information available, it is expected that the Lake States HCP biological goals and objectives will fully offset the effects of the take. However, the status of covered bats in Michigan, Minnesota, and Wisconsin could change during HCP implementation. Global climate change may result in shifts in bat distribution, and the location of roosts and hibernacula entrances may shift (see Chapter 6, *HCP Implementation and Assurances*, for description of climate change and changed circumstances). In addition, it is possible that additional and different management measures not identified in the Lake States HCP will be identified and shown to be more effective in achieving biological goals and objectives than those currently being implemented. The adaptive management program describes processes for addressing these specific uncertainties. The program allows for flexibility should monitoring reveal that specific habitat objectives proposed in the conservation strategy are not being met.

The Lake States HCP adaptive management program incorporates the adaptive management approach recommended by USFWS (U.S. Fish and Wildlife Service 2016f). Figure 5-2 shows the overall model of adaptive management.

The Lake States HCP incorporates the concepts of passive and active adaptive management advocated and defined by USFWS for implementing HCPs (U.S. Fish and Wildlife Service 2016f). Through passive adaptive management, the State DNRs will learn how to ensure better attainment of the Lake States HCP biological goals and objectives based on the measured success of various approaches to implementing the HCP (as indicated by effectiveness monitoring results). The State DNRs will also take an active adaptive management approach to resolve uncertainties related to the best approaches for achieving specific objectives.

In support of the adaptive management program, the State DNRs have identified critical uncertainties associated with the conservation program. New critical uncertainties could also be identified when effectiveness monitoring yields unexpected results or when status and trends monitoring show a decline in bat abundance that is not well understood. In these cases, the State DNRs will work with USFWS to resolve these uncertainties.

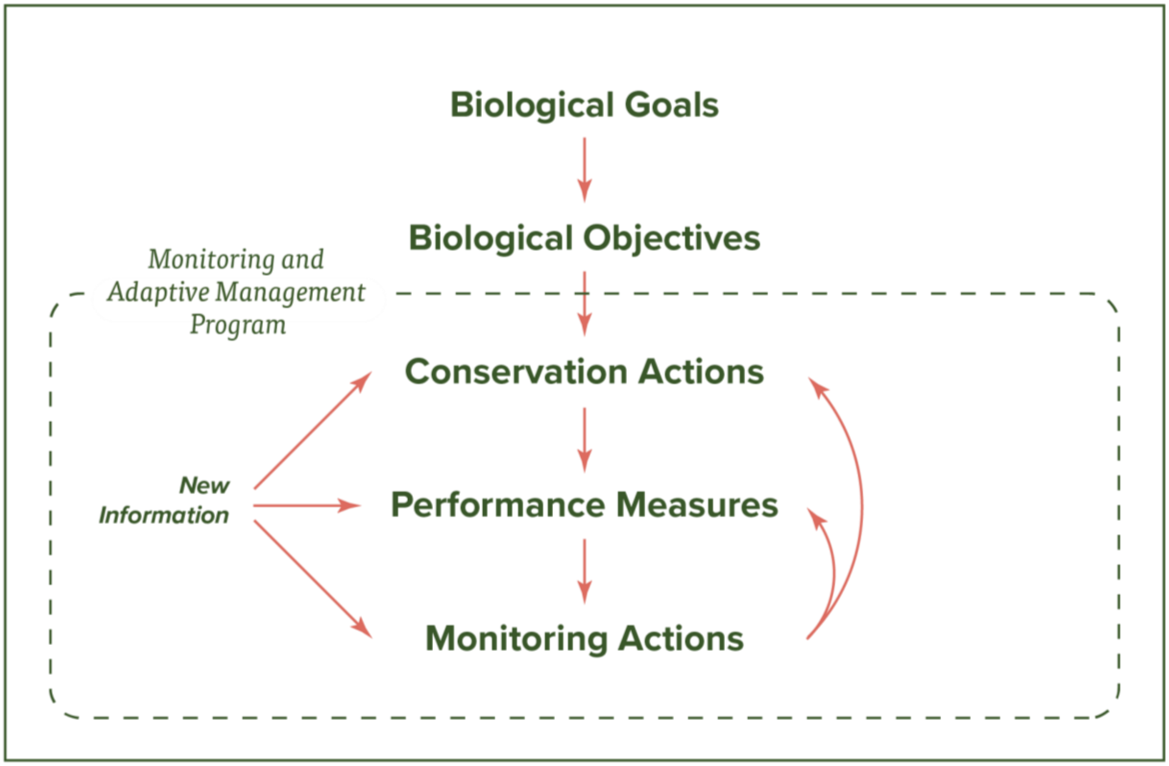

Figure 5-2. Adaptive Management Concept Model

5.5.1 Climate Change Leading to Shifts in Distribution

Climate change refers to the long-term warming of the planet and subsequent impacts on climate patterns (e.g., temperature, precipitation) due to increases in greenhouse gas and aerosol emissions from industrialization and land use change. The potential effects of climate change across the Great Lakes region can be modeled by downscaling the Atmosphere-Ocean General Circulation Model (AOGCM). In the Lake States plan area, annual temperatures are predicted to increase by 2.52±1.08 °F (1.4±0.6 degrees Celsius [°C]) over the near term (2010–2039). Winter and spring precipitation is predicted to increase by 20% to 30% by 2100 (Hayhoe et al. 2010). Summers for any particular state are expected to feel more like current temperatures of states to the south and west. To illustrate, by 2050, Michigan summers are expected to feel more like Ohio or even southern Illinois and Tennessee summers (Hayhoe et al. 2010; Wuebbles and Hayhoe 2004). In general, current evidence for the Great Lakes region suggests that (1) winters are getting shorter; (2) annual average temperatures are growing warmer, especially during winter months; (3) duration of lake ice cover is decreasing as air and water temperatures rise; and (4) heavy precipitation events are becoming more frequent and severe (Kling et al. 2003). Despite increased precipitation, land surfaces are expected to become drier overall due to the combination of increasing temperatures and evaporation rates (Great Lakes Integrated Sciences + Assessments 2018).

A warming climate has the potential to alter conditions for covered bats through several mechanisms (Humphries et al. 2004; Root et al. 2003). First, climate change can directly and indirectly affect the insect prey base (Sherwin et al. 2012) as insect food supplies are directly tied to weather conditions and indirectly to habitats such as wetlands, which may decrease in response to climate change (Frick et al. 2010; Lookingbill et al. 2010). Ambient temperature and precipitation directly alter bat foraging success by influencing insect behavior and life cycle in ways that could positively or negatively affect foraging opportunities (Baerwald and Barclay 2009; Erickson and West 2002). Second, forest structure and composition can be affected by several factors related to climate change. These include the expansion of southern plant species at the expense of northern species (Dukes et al. 2009; Frelich and Reich 2010; Great Lakes Integrated Sciences + Assessments 2018; Weed et al. 2013) and increased competition from invasive species. These forest community changes have the potential to affect the number of available roost trees (Barclay and Kurtan 2007; Hellmann et al. 2008; Perkins 1996; Timpone et al. 2010). Third, suitability of hibernacula entrances may be affected by changes in the surrounding forest. Forest community changes, combined with rising ambient temperatures, can interact with landcover to influence surface temperature and air flow (Mentzel et al. 2001). Changes in ambient temperature of hibernacula entrances can improve the suitability of hibernacula entrances throughout the region. As discussed above, increased periods of warm temperatures due to climate change may eventually reduce the transmission rate of WNS among bats. A shorter hibernation period may reduce the spread of WNS between individuals (Maher et al. 2012).

While several potential effects from climate change are possible, the primary effect of climate change on the conservation strategy is expected to be the shifting of species distribution associated with changes in vegetation, microclimate, and the suitability of cave/mine habitat. Conservation and recovery efforts of many rare species are hampered by the species' inability to disperse to new habitats, and this is especially problematic in a rapidly changing climate (Loarie et al. 2009). Climate change models have been completed for Indiana bats in summer (Loeb and Winters 2013) and little brown bats in winter (Humphries et al. 2002). All four of the covered species share many similarities in habitat that make it possible to generalize the models' conclusions across these species.

Humphries et al. (2002) developed a model that identified areas of North America that would provide suitable hibernacula entrances for little brown bats. This model was then rerun based on predicted changes in climate. The resulting model predicted that the species would be able to expand its range into more northern sites in response to a longer growing season (i.e., when insects are available) and because of warmer conditions within hibernacula entrances. Similarly, Loeb and Winters (2013) developed a model of summer habitat and compared that to multiple models of future climatic conditions. The results indicated Indiana bats would abandon much of their current range in the corn belt and shift farther north into the Lake States and into the northeastern United States.

Among the covered species, the Indiana bat has the most restrictive range and is most reliant on unusual habitat conditions, such as hibernacula entrances with areas of cold and stable temperatures, as well as warm summer roosts. The models provided by Loeb and Winters (2013) predict some areas of the Lake States that are now too cold will become viable summer habitat for Indiana bats during the 21st century. Such a shift in habitat could allow Indiana bats to begin using hibernacula entrances across the Lake States that are currently used by the other three covered bats species. Based on these model results, climate change may make the Lake States more suitable habitat for the Indiana bat. All else being equal, this may result in an expanded range of Indiana bat in the Lake States and possibly an increase in population in the Lake States.

Like the Indiana bat, the tricolored bat has historically been rare in the Lake States and more abundant to the south. However, the species has clearly become more abundant in the region following the excavation of mines in areas where hibernacula entrances were previously rare (Kurta

2008). Once again, a warming climate and the recent increased colonization of the region suggest climate change may increase bat distribution in the Lake States during the permit duration.

The little brown and northern long-eared bats both have large distributions, including areas to the south and north of the Lake States. As such, changes in habitat suitability are most likely to occur on the scale of individual sites.

The species distribution models, as described in Chapter 3, *Environmental Setting*, will be rerun during year 30 of the permit term. Results of the model will be reviewed to determine if climate change has altered species distribution from the initial outputs. If results of the updated model indicate a potential increase in the level of permitted take, the permittee(s) will coordinate with USFWS as described in Chapter 6, Section 6.6.2, *Amendments*. While the Lake States may become more suitable for the covered species, bats may not necessarily be present to occupy these sites. At present, WNS is a much greater driver than climate change for the population status and range of these species. Regardless, sustainable forest management is an important means to mitigate climate change impacts. The State DNRs will respond to changes in distribution, from climate change or other factors, by adding protections to new hibernacula entrances and roosts, as outlined in Sections 5.5.2, *Addition or Removal of Hibernacula as Protected Resources*, and 5.5.3, *Addition and Subtraction of Known Maternity Roost Trees*.

5.5.2 Addition or Removal of Hibernacula as Protected Resources

A hibernaculum and its associated entrance may be discovered and thus added to the list of protected resources during the permit term. Hibernacula and their entrances are protected by Objectives 4.1, 4.2, and 4.3. Similarly, hibernacula demonstrated to be unoccupied may be reclassified and removed from the list of resources subject to Lake States HCP conservation measures during the permit term.

5.5.2.1 Discovery of New Hibernaculum and its Entrance

The discovery of new hibernacula across the Lake States may continue as long as the covered bat species do not become locally extirpated or extinct. If a new hibernaculum (a location where one or more covered bats are found hibernating) or hibernaculum entrance is discovered on State DNR lands, the DNR will incorporate these sites as managed resources under the Lake States HCP and will apply any relevant conservation objectives or measures.

If a new hibernaculum or hibernaculum entrance is discovered on enrolled lands, the applicable DNR will have 60 days from discovery or notification of the new site to notify enrolled landowners and discuss how to address the resource under the Lake States HCP. County, municipal, tribal, and private landowners will be responsible for implementing any changes in management within 30 days of being notified of the change. These wait times allow the State DNRs to identify property owners of enrolled lands and to ensure that property owners have time to receive the notification and to understand and implement the changes.

5.5.2.2 Reclassification of Hibernacula as Unoccupied

The WNS threat makes it all but certain that bats will also cease to be found within some hibernacula entrances despite suitability.

Once identified, a hibernaculum is presumed to be occupied until demonstrated to be unoccupied. Absence of the target bat species can be demonstrated by both an emergence count at the hibernaculum entrance and/or a survey for bats in the area (U.S. Fish and Wildlife Service 2018). If no covered bats are detected for 5 consecutive years, the site will be considered unoccupied for the purposes of the Lake States HCP. Historic hibernacula and their entrances will be recorded and resurveyed every 5 years to confirm that they remain unoccupied. Sites considered unoccupied will not be subject to HCP restrictions (Objectives 4.1, 4.3, 4.4). If bats are subsequently detected, it will again be considered occupied and HCP restrictions will apply again.

5.5.3 Addition or Removal of Maternity Roost Trees as Known and Occupied

5.5.3.1 Discovery of Occupied Maternity Roost Tree

The DNRs do not have the resources to comprehensively identify new known occupied maternity roost trees in the plan area. However, other projects (separate from the Lake States HCP) in and around DNR or enrolled lands are anticipated to identify new known occupied maternity roost trees over the permit term. These new occurrences will be incorporated into existing protections. As described for hibernacula and their entrances above, if a new occupied maternity roost tree is discovered on State DNR lands, the DNR will incorporate these sites as managed resources under this HCP and will apply relevant conservation objectives or measures, including implementation of a year-round buffer as described in Objective 2.2. If a new occupied maternity roost tree is discovered on enrolled lands, the DNRs will use the same notification process and timelines described for hibernacula above. For Indiana bats, an additional 2.5-mile buffer around known occupied maternity roost trees is required during the pup season (Objective 2.3). This objective applies to both known occupied maternity roost trees and known capture locations (absent roosting data). For capture locations, data that are over 25 years old will be reclassified as unoccupied unless another known capture location within the buffer is recorded during the permit term. Indiana bat buffers based on specific known occupied maternity roost trees (as opposed to capture locations) can be reclassified using the same criteria described above. In other words, a buffer of 150 feet would be surveyed to identify whether habitat is no longer present, or the known maternity roost tree and the buffer are unoccupied. The reclassification is based on survey data within 150 feet (not within 2.5 miles).

Should any *new* occupied maternity roost trees for Indiana bat be identified outside the current summer distribution model developed for the HCP, that map will be revised and conservation associated with summer habitat/roost trees for Indiana bats will apply in the newly mapped area.

5.5.3.2 Reclassification of Known Occupied Maternity Roost Tree and its Buffer as Unoccupied

A known occupied maternity roost tree and its buffer are considered occupied for the length of the permit term unless a) the known occupied maternity roost tree and all roosting habitat within the buffer are no longer present (e.g., due to tree fall, wildfire, windthrow, disease) or b) surveys demonstrate that the known maternity roost tree and its buffer are unoccupied. A known occupied maternity roost tree and its buffer may be demonstrated to be unoccupied if a) an emergence count at the known occupied maternity roost tree (if a specific tree is known) demonstrates that there are no covered bats present and b) an acoustic survey for bats in accordance with current USFWS guidelines, as supplemented by the State DNRs, demonstrates that no covered bats are present. For the acoustic survey, a bat detector must be placed near the known occupied roosting tree for seven weather-appropriate nights.

For Indiana bats, the 2.5-mile pup-season buffers for known occupied maternity roost tree may also be based on known capture locations (see Objective 2.3 for details). Buffers based on known capture location data that are over 25 years old will be reclassified as unoccupied unless another known capture location within the buffer is recorded. Buffers based on specific known occupied maternity roost trees for Indiana bats are considered occupied using the same criteria as for other covered bats described above.: a buffer of 150 feet would be surveyed to identify whether habitat is no longer present or whether the known maternity roost tree and the buffer are unoccupied. This smaller buffer would be used as opposed to the 2.5-mile buffer that is protected from timber harvest during the pup season for Indiana bats.

If deemed unoccupied, sites will be resurveyed by bat biologist(s) at least once, no more than 5 years later, to confirm that they remain inactive. At this point, the site will be removed from the list of known occupied maternity roost trees. Sites that have been removed from the list of known occupied maternity roost trees because all roosting habitat within the buffer was no longer present do not need to be resurveyed after 5 years.

If subsequent surveys demonstrate presence of covered species at a previously identified maternity roost tree, and the original roost tree is still standing and fits qualifications of a roost tree, the original 150-foot buffer would be reinstated. However, if the original roost tree is no longer present, the 150-foot buffer would be implemented around the high-quality roost tree located closest to the location of the original roost tree.

5.5.4 Eligibility for Landowner Enrollment Program

As described in Appendix B, Section B.2.1, *Eligibility*, one of the eligibility criteria for enrollment in the program is that landowners must own a large enough parcel of land such that take of a covered species is reasonably certain to occur. Specifically, eligibility for the Landowner Enrollment Program was based on the amount of forestry activities expected to result in the take of 0.5 bats or more of any of the covered species per year. The threshold ownership sizes on which take of covered bats is reasonably certain to occur are provided in Tables B-1 through B-10 in Appendix B, Section B.3, *Methodology Used to Determine Program Eligibility* as is the methodology used to calculate these thresholds. Because this methodology is based on existing populations of covered species in the Lake States, it will need to be periodically recalculated to account for changes in bat populations over the permit term (for example, continuing population declines due to WNS). As a result, the State DNRs will ensure that this analysis is recalculated every 5 years throughout the permit term and that the values in Tables B-1 through B-10 are adjusted, as needed, to reflect changes in bat populations.

5.6 Monitoring

Monitoring the implementation and outcomes of conservation measures is the foundation of an adaptive approach and can help advance scientific understanding and modify management actions iteratively.

The HCP Handbook states the following.

> When properly designed and implemented, the [monitoring and reporting] should provide us with the information we need to determine whether or not:
>
> - a permittee is in compliance with their incidental take permit and HCP,
> - progress is being made toward meeting an HCP's biological goals and objectives,
> - the HCP's conservation program is effective at minimizing and/or mitigating impacts, and
> - there is a need for adjusting measures to improve the HCP's conservation strategy.

This section describes both compliance and effectiveness monitoring activities as defined by the HCP Handbook (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016). This section also describes critical components of the monitoring program: staff training, status and trends monitoring, WNS protocols, and monitoring the biological goals and objectives. Table 5-13 summarizes the monitoring actions (both compliance and effectiveness) for each objective.

5.6.1 Types of Monitoring

5.6.1.1 Compliance Monitoring

Compliance monitoring tracks the status of Lake States HCP implementation and documents that requirements of the HCP are met. Compliance monitoring verifies that the State DNRs are implementing the terms of the HCP, the incidental take permits, and the authorized level of incidental take. Management activities associated with conservation strategy actions will be documented to demonstrate that the HCP and the required commitments of the conservation strategy are being properly implemented (e.g., implementation of retention guidelines, gate maintenance). Documentation of compliance monitoring will be included in an annual report submitted to USFWS (Table 5-13).

5.6.1.2 Effectiveness Monitoring

Effectiveness monitoring assesses the biological success of the Lake States HCP. Effectiveness monitoring evaluates whether the effects of implementing the conservation program are consistent with the assumptions and predictions made when the HCP was developed and approved. Effectiveness monitoring is used to determine if the biological goals and objectives in the HCP are being realized (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016).

Effectiveness monitoring has two components: monitoring effects of conservation measures and monitoring the status and trends of the covered bat populations and habitat. Because of the uncertain future of bats affected with WNS, most of the effectiveness monitoring will focus on habitat quality (e.g., number and quality of roosts) with the goal of providing high-quality habitat should the species begin to recover.

5.6.2 Monitoring Program

The status of covered bats will be monitored during the 50-year permit term. Parameters for the existing habitat distribution model will be refined and revised as more information becomes available. State DNRs will use the habitat distribution model to update modeled habitat for covered bat species every 5 years.

As stated in the HCP Handbook, "The development of a monitoring program should be tailored to answer specific questions needed for the decisions that need to be made" (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016). The questions driving the monitoring program for the Lake States HCP are listed below.

1. Are the State DNRs complying with the terms of the HCP (e.g., gates are maintained, conservation measures are implemented, the communication plans are developed and used)?
2. What is the status (approximate number and distribution) of the covered species in each of the Lake States? (This will include an assessment of the effect of WNS on the populations.) This will be accomplished as nonfederal funds are available via counts of bats in hibernacula supplemented with other techniques during the active season.
3. Are objectives (e.g., Objectives 2.1, 2.2, and 2.3) to maintain and/or enhance roosting and foraging habitat creating the desired conditions?

Monitoring will begin once the Lake States HCP incidental take permit is issued by USFWS. DNRs will contribute bat data collected during implementation of the Lake States HCP to the North American Bat Program throughout the permit term.

5.6.2.1 Staff Training

DNR staff members are responsible for planning and implementing the covered activities and will be responsible for implementing the objectives and associated conservation measures. DNR staff members can provide observations of bat sightings and behavior and will share their knowledge of bat conservation with private landowners, loggers, and members of the public.

To ensure that DNR staff members have the knowledge they need to implement the Lake States HCP and to communicate important information about covered bat conservation to the public, the State DNRs will develop new or document existing training programs for staff within 24 months of permit issuance. The content of the training programs will vary based on the role of the staff in HCP implementation. At a minimum, training programs will cover bat natural history, important habitats for covered bats, WNS, BMPs, legacy trees and retention guidance for bats, and the management implications of the HCP. Of particular importance, staff training aims to increase DNR staff awareness about WNS and bats.

Trainings will be held annually in year 3 and year 4, then every 5 years, and will be provided to all staff responsible for making and implementing management decisions on State DNR lands. Additionally, a continuing education class on bats, which will include all covered bats, will be developed within 24 months of permit issuance for loggers who operate on State DNR lands.

5.6.2.2 Status and Trends Monitoring

Baseline data for covered bats on covered lands is documented in the Lake States HCP (Chapter 3, *Environmental Setting*). Any changes to the State DNRs' understanding of species numbers and distribution will be compiled by the end of year 1. Collectively, this information will provide the baseline of the status of all species and associated modeled habitat at the beginning of the permit term and will also provide a reference point for future status and trends monitoring. The State DNRs will leverage existing monitoring programs to ensure continuity and comparability of data. All three states conduct regular counts within major hibernacula. These are expected to continue and will provide the primary means of understanding population trends over time. These statewide monitoring programs will continue to be evaluated and adjusted based on available resources, changes in techniques, nondetections in hibernacula over multiple years, or adverse effects of monitoring actions on the covered bats and other factors. The State DNRs will leverage this ongoing monitoring to report on the status and trends of bats within the plan area.

The Wisconsin DNR will continue to coordinate the annual roost monitoring program. This program leverages citizen science to obtain two related measures of bat populations. The first is a general count of known roosts in which people conduct emergence counts at known bat roosts between March and October. In 2017, this program provided data on 145 roosts in 56 counties (Kaarakka 2017). A targeted subset of these counts provides a more comprehensive assessment not only of the number of bats present, but also on the number of pups produced by a particular colony. This second dataset is termed the Great Wisconsin Bat Count. During this effort, people count the number of bats in a known roost twice. The first time during the last weekend in June (before pups are volant) and the second in late July (when pups are flying). Many of these data are collected each year by the same people, using the same techniques, at the same roosts, which can then be used to assess long-term population trends.

Results of status and trend monitoring will be included in the annual reports. Should any known take of bats occur, this will be reported along with information on status and trends.

5.6.2.3 White-Nose Syndrome Protocols

To minimize the potential for the transmission of WNS as part of monitoring activities, all State DNR staff, researchers, and consultants who perform cave/mine and mist-netting survey work will adhere to the most current version of the National White-Nose Syndrome Decontamination Protocol available at the time monitoring is undertaken (U.S. Fish and Wildlife Service 2016d). This protocol provides instructions on how to reduce the risk of transferring the WNS fungus through the following strategies (U.S. Fish and Wildlife Service 2011).

These protocols include (but are not limited to) the following measures.

- Develop a clean caving strategy before each cave/mine visit.
- Using appropriate treatments to clean and disinfect exposed gear following each cave/mine visit.
- Implement additional requirements if signs of WNS are observed during the course of a cave/mine visit.

5.6.2.4 Monitoring the Biological Goals and Objectives

In addition to the requirements for status and trends monitoring (Section 5.6.2.2, *Status and Trends Monitoring*), all other monitoring is tied directly to the biological goals and objectives, as described in Table 5-13.

Table 5-13. Biological Goals, Objectives, and Associated Monitoring Actions [a]

Biological Goal	Biological Objective	Monitoring Action
Biological Goal 1: Maintain healthy forests that provide habitat or bats on State DNR lands.	Objective 1.1: Manage DNR-administered forestlands (currently over 9 million acres) sustainably such that habitat for covered bats is maintained over the permit term.	The State DNRs will track the estimated total acres of State DNR lands, including the number of hibernacula entrances or known occupied maternity roost trees sold or acquired annually. In addition, every 5 years, the State DNRs will revisit assumptions made about the distribution and seasonality of harvest for each state to ascertain whether these assumptions are still accurate.
Biological Goal 2: Protect and enhance roosting and foraging habitat for bats.	Objective 2.1: Implement retention guidelines in all forest habitat for bats beginning in year 1 and continuing throughout the permit term.	Assess a subset (1–3%) of harvested units for adherence to retention standards as part of internal programs (Minnesota) or forest certification programs (Michigan, Minnesota, Wisconsin).
	Objective 2.2: Minimize impacts on roosting bats by implementing a 150-foot buffer around all known occupied maternity roost trees.	Generate a list of all sites with known occupied maternity roost trees on State DNR lands and map those sites by year 1. Monitor processes set in place to avoid covered activities in these areas.
	Objective 2.3: Minimize impacts on roosting Indiana bats by restricting activities around all known occupied maternity roost trees.	Generate a list of all sites with known occupied maternity roost trees on State DNR lands and map those sites by year 1. Monitor processes set in place to avoid covered activities in these areas.
	Objective 2.4: Minimize impacts on other covered bats by establishing Bat Protection Zones.	Provided documentation that Bat Protection Zones (specific to each State DNR) have been established by year 1. Monitor processes set in place to ensure timber harvest restrictions are being implemented.
Biological Goal 3: Promote stewardship on other nonfederal lands.	Objective 3.1: Increase bat conservation by providing the Landowner Enrollment Program on lands throughout the permit term.	Develop and administer a Landowner Enrollment Program for private, Tribal, county, and municipal lands in each state. The amount of land (in acres) and the number of program participants will be tracked annually. Compliance with conservation strategy requirements will be achieved through annual self-reporting from enrollees on adherence to relevant conservation activities. If enrollees participate in forest certification programs, audits under this process may satisfy the self-monitoring requirement.
	Objective 3.2: Develop and implement a communication plan for educating the public on covered bats and their conservation.	Develop and begin implementation of a communication plan by year 2 of plan implementation. The communication plan will be provided to USFWS.

Biological Goal	Biological Objective	Monitoring Action
Biological Goal 4: Protect and enhance hibernacula entrances and associated wintering bats.	Objective 4.1: Remove undesirable obstructions at known hibernacula entrances on State DNR lands by year 5 and continue throughout the permit term.	Check all known hibernacula entrances for obstructions at least once in the first 5 years. Additional checks will occur at each hibernaculum entrance at least every 10 years.
	Objective 4.2: Protect known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term.	Ensure that processes are in place to protect these buffers Harvest specifically geared at enhancement is allowed and will be documented as part of an enhancement plan. Audits before and after enhancement will ensure that removal criteria have been met. Trespass will be monitored when hibernacula entrances are visited as part of species monitoring.
	Objective 4.3: Maintain gates on all known entrances to occupied hibernacula on State DNR lands and the lands of willing partners (unless determined to be not needed or detrimental) throughout the permit term.	Within the first 5 years of the permit term, complete an assessment of all known hibernacula entrances on State DNR lands. This assessment will provide the following: • Information about current condition of hibernacula entrances on State DNR lands (number and type of bats present; if no longer occupied, the time since last occupancy; documentation of specific issues at a site, such as vandalism or potential for collapse or flooding). • Information about what sites are currently gated and about the status of those gates. • A prioritized list of sites on State DNR lands. • A list of sites where additional data are needed to determine if a gate is appropriate. New and existing gates will be visited at least every 5 years, and photo-documentation of gate condition will be collected.
	Objective 4.4: Promote awareness and understanding of WNS through collaboration with researchers throughout the permit term.	Collaborate with USFWS and other entities involved in bat research. Provide annual regional communication and information updates related to WNS research.

Biological Goal	Biological Objective	Monitoring Action
Biological Goal 5: Avoid and minimize effects from covered activities on covered species.	Objective 5.1: Minimize impacts of prescribed fire on roosting and hibernating bats beginning at permit issuance and continuing throughout the permit term.	Track the incorporation of minimization criteria into burn plans. Provide training of prescribed fire staff on new criteria.
	Objective 5.2: Minimize impacts on covered bats associated with roads and trails throughout the permit term.	Because the DNRs do not track the construction or location of State DNR roads internally, and because this impact is a small portion of overall impacts, there are no monitoring requirements for roads generally. For Indiana bats only, Michigan DNR will create internal processes that ensure covered tree removal associated with road and trail construction and maintenance within a 2.5-mile buffer of a known occupied maternity roost tree is avoided during the pup season. Any hazard tree removal (which is excepted from this provision) that occurs during this time would be reported, to the extent that this information is available.

Notes:

[a] There are 26 known hibernacula entrances on State DNR lands, but some hibernacula have multiple entrances. Current records document 33 hibernacula entrances on State DNR lands.

DNR = Department of Natural Resources; HCP = habitat conservation plan; USFWS = U.S. Fish and Wildlife Service

Chapter 6
HCP Implementation and Assurances

6.1 Overview

Under the federal Endangered Species Act (ESA), habitat conservation plan (HCP) implementation begins when the Section 10(a)(1)(B) incidental take permit is issued. Primary responsibility for HCP implementation rests with the Michigan, Minnesota, and Wisconsin Departments of Natural Resources (DNRs) (collectively referred to as the State DNRs).

This chapter describes the implementation framework of the Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP), including the organizational structure, agencies' roles and responsibilities, and the assurances requested by the State DNRs through permit coverage.

6.2 Permit Structure

The State DNRs will apply for three separate permits that the U.S. Fish and Wildlife Service (USFWS) will issue individually based on the Lake States HCP. As described in Chapter 1, Section 1.3.4, *Permittees*, the individual State DNRs are the permittees. For the purposes of the Lake States HCP, the State DNRs are jointly referred to as the permittees, although the text may specify an individual State DNR when necessary. This permit structure will allow for independent implementation of the covered activities and conservation and monitoring measures. These permits are severable, meaning that the revocation or suspension of one permit will not jeopardize the take authorization of the other permittees.

Additionally, each State DNR may extend its take authorization to other nonfederal landowners in its state that conduct covered activities that have the potential to result in take of covered bats. This authorization will be extended through participation in the Landowner Enrollment Program, described in detail in Appendix B, *Landowner Enrollment Program.*

6.3 Implementation Structure and Responsibilities

Each State DNR will oversee HCP implementation and will retain all program records. State DNR staff includes biologists, foresters, administrators, and other natural resource specialists who will carry out planning and design, monitoring, adaptive management programs, and periodic coordination with and reporting to USFWS. To form a functional unit for carrying out this program, each State DNR will assign HCP implementation responsibilities to specific individuals as described in Section 6.3.2, *DNR Implementation Structure.* The day-to-day implementation of the Lake States HCP will be managed by staff of each State DNR; however, the State DNRs will also coordinate with other resource agencies, tribes, other nonfederal landowners, foresters, biologists, science advisors, and the public, as needed, to ensure adequate and systematic implementation of their responsibilities under the HCP.

6.3.1 Lake States Advisory Committee

A Lake States Advisory Committee will consist of representatives of the State DNRs. This committee will distribute information among the states during HCP implementation. The primary function of this committee will be to share new research, best practices, and coordinate the resolution of regional matters related to the HCP, as needed. As mentioned previously, the Lake States Advisory Committee will consist of key State DNR representatives (such as, but not limited to, HCP administrator, HCP Implementation team member, or other DNR staff), as well as other key stakeholders as needed. This committee will meet semi-annually for the first 5 years of plan implementation. Meeting frequency may be reduced as necessary after the first 5 years of implementation, but the committee will continue to meet at least once a year throughout the permit term. Informal communication among members will take place, as needed, in between official meetings.

6.3.2 DNR Implementation Structure

This section describes the implementation structure for each DNR. Table 6-1 crosswalks the different titles and tasks to the states.

Table 6-1. General and State-Specific Implementation Titles and Key Tasks

General Title	Description	State Specific Titles
HCP Point of Contact	A coordinator who serves as the point of contact for the HCP for each state (includes maintaining budgets, overseeing Land Enrollment Program, and coordinating trainings, surveys, monitoring, and reporting)	MI = HCP Coordinator MN = HCP Administrator WI = HCP Coordinator
Implementation Support Team	If needed, additional staff that supports the HCP Point of Contact. This support team will include representatives of key divisions within each DNR as described in state-specific sections	MI = N/A MN = Implementation Team WI = Implementation Committee
GIS technician	A GIS specialist that compiles, organizes, and tracks spatial data within the HCP (including location and extent of covered bat habitat and location of timber harvests)	All = DNR GIS Technician
Biologists	DNR biologist that implements survey work and HCP activities as described in HCP state-specific sections	All = DNR Biologists
Forestry Staff	DNR foresters or other forestry staff that implements forestry related conservation measures and other activities as described in the HCP state-specific sections	All = DNR Forestry Staff
Public Outreach Staff	As needed, communications and outreach staff associated with communication tasks within the HCP (such as a communication plan)	MI = Community Liaison MN = DNR Communications and Outreach Staff WI = DNR Biologists
Consultants and Contractors	Outside consultants and contractors that assist with the implementation of the HCP, as needed	All = Consultants and Contractors

6.3.2.1 Michigan

HCP Coordinator

The Michigan DNR will assign HCP implementation responsibilities to a specific individual within the Forest Resources Division who will serve full-time as the Michigan HCP Coordinator. The HCP Coordinator will collaborate with staff from the Wildlife Division and Forest Resources Division, as needed, and will serve as a point of contact for HCP-related issues for other State DNRs and for USFWS. The HCP Coordinator will also provide support for and oversee the following tasks within the Michigan DNR.

- Answer internal HCP-related questions.
- Develop and maintain annual budgets and work plans.
- Coordinate any bat surveys with supervising biologists.
- Coordinate related training program(s) for Michigan DNR staff.
- Coordinate communication and decision-making between Wildlife Division and Forest Resources Division management staff, as needed.
- Coordinate monitoring activities for compliance with the Lake States HCP.
- Maintain effectiveness and compliance monitoring and survey data reports and archives, including monitoring results, and produce an annual report.
- Oversee enrollment in the Landowner Enrollment Program and compliance with program requirements.

Implementation of Conservation Program

As noted in Chapter 1, *Introduction*, all activities covered under the Lake States HCP are ongoing activities conducted in accordance with the Michigan DNR's guidelines for sustainable forest management. Existing restrictions on timber harvest are communicated to staff through the Michigan DNR's Within-Stand Retention Guidance (Michigan Department of Natural Resources 2012) and regular staff trainings, including New Forester Orientation, Timber Sale Administration, Biodiversity Training, and In-Service Trainings. These trainings may be made available to partner organizations, contractors, Landowner Enrollment Program participants, and other interested parties as budgets allow. These same tools will be revised to reflect HCP commitments.

The Michigan DNR also uses consolidated, dynamic policies and procedures for State Forest lands, called Work Instructions, which will be updated to reflect HCP requirements. In addition, Timber Sale Contract Specifications will be updated upon permit issuance as part of the Michigan DNR annual Management Review Process.

Michigan DNR Staff Responsibilities

DNR Geographic Information System Technician

This technician will use a geographic information system (GIS) and other database systems to collect, store, and use spatial data necessary for HCP implementation. Data to be tracked in this manner will include the following.

- The location and extent of modeled habitat for covered bats.
- The location, extent, and timing of implementation of conservation measures (e.g., creating potential hibernacula) to support the monitoring requirements (see Chapter 5, Table 5-13: *Biological Goals, Objectives, and Associated Monitoring Actions*) and reporting requirements (see Section 6.4.2, *Reporting*) described in the HCP.
- The location (if available) of timber harvest covered by the HCP on State DNR lands for sales completed during the reporting period.
- The location of lands in the Landowner Enrollment Program.

When electronic archiving is not available or is infeasible, the Michigan DNR will retain hard copy records, which, along with electronic records, will be available for inspection by USFWS. Records will be maintained in accordance with Michigan's record-retention policies.

DNR Biologists

The HCP Coordinator will work with staff in the Wildlife Division to train staff on implementing HCP conservation measures and to produce any protocols needed to further HCP implementation. Wildlife Division biologists will implement survey work and oversee HCP activities related to bat research and monitoring, as described in Chapter 5, Section 5.6, *Monitoring*. Staff biologist(s) will also participate, as necessary, in the implementation of conservation measures focused on improving bat habitat (especially for Objectives 4.1, 4.2, and 4.3).

DNR Forestry Staff

The HCP Coordinator will work with Forest Resources Division staff to train staff on HCP requirements within the first year of HCP implementation. Forestry staff will plan and implement forestry-related HCP conservation measures. Supervisory staff will ensure that field crews are trained in implementing the terms of the Lake States HCP and will assist in gathering the data needed to demonstrate compliance with the HCP (Chapter 5, Table 5-13).

Consultants and Contractors

HCP requirements will become a part of standard contract specifications. Specifications will be monitored by the Michigan DNR on-site contract administrator, and broader compliance will be evaluated through annual auditing of forest operations.

6.3.2.2 Minnesota

HCP Administrator and Implementation Team

The Minnesota DNR will assign HCP implementation responsibilities to either a specific individual who will serve as the Minnesota HCP Administrator or to existing DNR staff whose job responsibilities include similar duties as described in this section. The HCP Administrator (or equivalent existing staff) will serve as a point of contact for HCP-related issues within the DNR, for other State DNRs, and for USFWS. The HCP Administrator will also provide support for and oversee the following tasks within the Minnesota DNR.

- Answer internal HCP-related questions.
- Develop and maintain annual budgets and work plans.
- Report and maintain results of any bat surveys.
- Coordinate related training program(s) for Minnesota DNR staff.
- Coordinate monitoring activities for compliance with the Lake States HCP.
- Maintain monitoring and survey data reports and archives, including monitoring results, and produce an annual report.
- Coordinate communication and decision making between Minnesota DNR divisions (and external partners when applicable), as needed.
- Coordinate the development of policy(ies) needed to communicate HCP expectations and requirements to staff.
- Coordinate updates to existing policies, guidelines, business practices, etc. to align with HCP requirements, as needed.
- Administer the Landowner Enrollment Program, including compiling annual reporting forms and ensuring compliance with program requirements.

The Minnesota DNR will establish an Implementation Team comprising representatives from divisions within the Minnesota DNR, including the Division of Forestry and the Division of Ecological and Water Resources. The team will provide support to the HCP Administrator for the HCP-related tasks within their division. This team will meet as needed to coordinate tasks associated with HCP implementation. If policy direction is needed, existing committees that regularly work with the DNR policy system may be engaged.

Implementation of Conservation Program

As noted in Chapter 1, *Introduction*, all activities covered under the Lake States HCP are ongoing activities conducted in accordance with the Minnesota DNR's policies for sustainable forest management. Existing direction on timber harvest are communicated to staff through guidance documents consistent with the DNR's policies and regular staff trainings. A stand-alone guidance document will be developed and used to communicate HCP expectations and requirements to staff. Initial communication (e.g., a departmental memo) will occur to make staff aware of the policy and a training will be made available for staff. This training may be made available to partner organizations, contractors, Landowner Enrollment Program participants, and other interested parties as budgets allow. Existing policies, guidelines, and business practices will be updated as needed to comply with the incidental take permit terms.

Minnesota DNR Staff Responsibilities

All of the following staff responsibilities may be assigned to a specific individual or may be shared by staff whose job responsibilities include similar duties.

DNR Geographic Information System Technician

This staff person will use GIS and other database systems to collect and store spatial data necessary for HCP implementation. Data to be tracked in this manner will include the following.

- The location and extent of modeled habitat for covered bats.
- The location, extent, and timing of implementation of conservation measures to support the monitoring requirements (see Chapter 5, Table 5-13: *Biological Goals, Objectives, and Associated Monitoring Actions*) and reporting requirements (see Section 6.4.2, *Reporting*) in the HCP.
- The location (if available) of timber harvest covered by the HCP on State DNR lands for sales completed during the reporting period.

When electronic archiving is not available or infeasible, the Minnesota DNR will retain hard copy records, which, along with electronic records, will be available for inspection by USFWS. Records will be maintained in accordance with Minnesota's record-retention policies.

DNR Biologists

Minnesota DNR staff wildlife biologists will implement survey work and oversee HCP activities related to bat research and monitoring, as described in Chapter 5, Section 5.6, *Monitoring*. Staff biologists will participate, as necessary, in the implementation of conservation measures. Staff biologist(s), in consultation with other DNR staff and researchers, will promote the understanding of white-nose syndrome (WNS) (Chapter 5, Table 5-13) as described in Objective 4.4. of the HCP.

DNR Forestry Staff

Forestry staff will plan and implement forestry-related HCP conservation measures and consult with other divisions as needed for forest management activities. Supervisory staff will ensure that field crews are trained in implementing the terms of the Lake States HCP and will assist in gathering the data needed to demonstrate compliance with the HCP.

DNR Communications and Outreach Staff

Communications and outreach staff will develop and implement a communications plan and associated communications products (such as a website, brochures) by year 2 (Chapter 5, Table 5-13) for educating the public on bats, WNS, etc. Communications and outreach staff may also be tasked with assisting the HCP Administrator with the Landowner Enrollment Program website and communications.

Consultants and Contractors

The Minnesota DNR will ensure that work done by consultants or contractors on State DNR forestlands follows HCP requirements by incorporating such measures into contractual obligations (such as bat surveys and timber harvest permits).

6.3.2.3 Wisconsin

HCP Coordinator and Implementation Committee

The Wisconsin DNR will assign HCP implementation responsibilities to a specific individual within the Natural Heritage Conservation Program who will serve as the Wisconsin HCP Coordinator. The HCP Coordinator will collaborate with staff from the Divisions of Forestry and Fish and Wildlife and

Parks, as needed, and will serve as a point of contact for HCP-related issues for other State DNRs and for USFWS. The HCP Coordinator will also provide support for and oversee the following tasks within the Wisconsin DNR.

- Answer internal HCP-related questions.
- Develop and maintain annual budgets and work plans.
- Report and maintain results of any bat surveys conducted by WDNR biologists.
- Chair DNR HCP-related committees, as needed.
- Coordinate related training program(s) for Wisconsin DNR staff.
- Compile and report on monitoring activities for compliance with the Lake States HCP (Chapter 5, Section 5.6, *Monitoring*).
- Maintain monitoring and survey data reports and archives, including monitoring results, and produce an annual report.
- Oversee landowner enrollment in the Landowner Enrollment Program and compliance with program requirements.

The Wisconsin DNR will set up a committee to oversee the first 5 years of HCP implementation. This Implementation Committee will be chaired by the HCP Coordinator and will include representatives from the Divisions of Forestry (e.g., State Lands specialist, Managed Forest Law foresters, the Sustainable Forestry Certification coordinator, County Forest and Public Lands specialist) and Fish, Wildlife and Parks (e.g., Wildlife Management, Natural Heritage Conservation, Parks and Recreation Management, and Fisheries Management), as well as any key stakeholders identified during early implementation. This committee will collaborate to ensure that all training needs are met and that the HCP conservation measures are being applied consistently throughout the DNR. The Implementation Committee will meet quarterly during the first year of plan implementation and at least annually in years 2 through 5.

Implementation of Conservation Program

As noted in Chapter 1, *Introduction*, all activities covered under the Lake States HCP are ongoing activities conducted in accordance with the Wisconsin DNR's guidelines for sustainable forest management. Existing guidelines on timber harvest are communicated to staff through the Wisconsin DNR's Silviculture Handbook (Wisconsin Department of Natural Resources 2012), program newsletters, departmental memos, staff training, and internal guidance. These same tools will be revised to reflect HCP commitments.

Additional tools used to communicate HCP commitments will include briefings with administrators and program directors, and development of HCP focused training materials. These materials may be incorporated into existing DNR training programs to be delivered continuously throughout the permit term. Training materials will address all changes to agency practice that result from implementation of the HCP, all new conservation measures that must be implemented, how these activities must be tracked and reported, and which staff are responsible for implementing and tracking HCP metrics. It will also provide staff with the contact information for the HCP coordinator for any questions related to HCP implementation. This training may be made available to partner organizations, contractors, Landowner Enrollment Program participants, and other interested parties as budgets allow.

Additionally, the Wisconsin DNR uses an Endangered Resources Review screening process to determine if any proposed activities that the DNR will conduct, fund, or approve comply with state and federal endangered species laws. The Wisconsin DNR will incorporate HCP requirements into this screening process; this will allow DNR staff to communicate with foresters and property managers when their proposed sale/project will be subject to HCP requirements due to the known presence of a listed species.

Wisconsin DNR Staff Responsibilities

DNR Geographic Information System Technician

This technician will use GIS and other database systems to collect and store spatial data necessary for HCP implementation. Data to be tracked in this manner may include the following.

- The location and extent of modeled habitat for covered bats.
- The location, extent, and timing of implementation of conservation measures (e.g., creating potential hibernacula) to support the monitoring requirements (see Chapter 5, Table 5-13: *Biological Goals, Objectives, and Associated Monitoring Actions*) and reporting requirements (see Section 6.4.2, *Reporting*) in the HCP.
- The location of timber harvest (if available) covered by the HCP on State DNR lands for sales completed during the reporting period.

The Wisconsin DNR will retain records that will be available for inspection by USFWS. Records will be maintained in accordance with Wisconsin's record-retention policies.

DNR Biologists

The HCP Coordinator will work with staff in the Division of Fish, Wildlife and Parks to train staff on HCP conservation measures and to produce any protocols needed to further HCP implementation. Wisconsin DNR biologists will implement survey work and oversee HCP activities related to bat research and monitoring, as described in Chapter 5, Section 5.6, *Monitoring*. Biologist(s) will also participate, as necessary, in the implementation of conservation measures focused on improving bat habitat.

DNR Forestry Staff

The HCP Coordinator will work with DNR forestry staff to train staff on implementation of HCP conservation measures and to make any needed updates to the Silvicultural Handbook or other guidance within the first year of HCP implementation. Forestry staff will plan and implement forestry-related HCP conservation measures. Supervisors will ensure that field staff are trained in implementing the terms of the Lake States HCP and will assist in gathering the data needed to demonstrate compliance with the HCP.

Consultants and Contractors

The Wisconsin DNR will ensure that work done by consultants or contractors on State DNR forestlands follows HCP requirements by incorporating such measures into contractual obligations (such as timber harvest contracts with loggers).

6.3.3 Role of U.S. Fish and Wildlife Service

The State DNRs will coordinate with USFWS and provide annual reports concerning HCP implementation. USFWS is the regulatory agency that issues the incidental take permit and ensures that the permittees are in compliance with their incidental take permits and are implementing the HCP effectively and appropriately. USFWS will designate a lead for the Lake States HCP to be the State DNRs' primary point of contact during plan implementation. Successful execution of the conservation program by the State DNRs—including monitoring, reporting, and adaptive management actions that are part of the Lake States HCP—may at times require USFWS review and approval. Each State DNR provides USFWS with annual reports concerning HCP implementation in its state. The USFWS will review reports to ensure they contain the information required to ensure the permittee is complying with the HCP and terms and conditions of the permit, and to evaluate whether or not the HCP is meeting biological objectives.

Lake States Advisory Committee meetings (Section 6.3.1, *Lake States Advisory Committee*) may also help keep USFWS apprised of progress toward conservation goals and objectives, funding, monitoring, adaptive management, and other relevant topics. The meetings will serve as a means for the states to alert USFWS of key conservation actions, such as adaptive management, and monitoring prior to finalization of the final report. Meetings will also serve as a forum to troubleshoot potential issues before they affect permit compliance. USFWS will have the option to participate in these meetings only in a technical capacity and will not have voting rights. USFWS participation in these meetings will not be construed as its endorsement of any resulting decision the Advisory Committee recommends.

6.3.4 HCP Staff Training

Each State DNR will be responsible for training staff in the implementation of HCP requirements following permit issuance. Existing trainings will be updated to reflect HCP commitments and new trainings will be developed, as needed, to ensure that staff is aware of and equipped to implement the HCP. Each State DNR will ensure that HCP training materials are updated and deployed during year 1 of the permit term.

6.3.5 Public Outreach

Each state will inform the public as part of implementation of the Lake States HCP. Each State DNR will maintain a publicly accessible communication tool (e.g., website), which will be maintained throughout implementation and used as the primary means of engaging the public in HCP implementation. This will include the application process for the Landowner Enrollment Program and related enrollment information, annual reports to USFWS, and contact information for each State DNR's HCP Administrator or Coordinator. The tool will also allow members of the public to register to receive communications on HCP implementation.

6.4 Administration

6.4.1 Data Tracking

Each State DNR will establish and maintain data from which HCP information will be managed, stored, and made available to staff, decision makers, USFWS, and others, as appropriate. The database will be used to track HCP compliance and effectiveness and may include the following elements.

- Progress toward achieving the biological goals and objectives by implementation of conservation measures, including avoidance, minimization, and mitigation (see Chapter 5, Table 5-13, and Section 6.4.2, *Reporting*).
- Implementation of covered activities, including the extent of each activity.
- Results of all monitoring actions described in Chapter 5, Table 5-13.

6.4.2 Reporting

Each State DNR will prepare and submit an annual report for the duration of the permit term including, among other things, compliance, impacts, conservation actions, management actions, and monitoring results. Annual reports will require synthesis of data and reporting on important trends (e.g., snag retention, status and trends of covered species, and outcome of enhancement actions). The annual reports will summarize the previous year's implementation activities and will be provided to USFWS from the State DNRs in the following reporting year. The first annual report will be due in year 2 of the permit term to allow time to assemble the first year of data and develop an appropriate template for the report. In addition to being submitted to USFWS, annual reports will be made available to the public.

The time periods covered in each annual report and the deadline for providing to USFWS for each State DNR are as follows. Each State DNR's reporting period is based on their fiscal year.

- Michigan DNR's annual reports will cover implementation activities from October 1 to September 30 and be provided to USFWS by March 31 of the following year.
- Minnesota DNR's Annual reports will cover implementation activities from July 1 to June 30 and be provided to USFWS by December 31 of the same year.
- Wisconsin DNR's annual reports will cover implementation activities from January 1 to December 31 and be provided to USFWS by June 31 of the following year.

The goals of the annual reports are as follows.

- Provide the information and data necessary for the State DNRs to demonstrate to USFWS and the public that the Lake States HCP is being implemented properly.
- Disclose any problems with HCP implementation and the corrective measures planned or implemented to address the problem.
- Identify administrative changes to the HCP, including those that will increase the success of conservation objectives or adaptive management program.

The minimum required content of the annual reports are as follows. Unless otherwise specified, all content should be updated and included annually.

- Description of the covered activities implemented during the reporting period, as well as a cumulative total (i.e., from the start of the permit term). This will include the following.
  - Total acreage of timber harvest completed on State DNR lands, including the type and amount of harvest on State DNR lands based on sales completed during the reporting period. If available in the future, location information for timber harvest on State DNR lands will be overlaid on the bat species distribution models in GIS to identify assumed impacts. Currently, spatially explicit information on where timber harvest occurs and information on the seasonality of harvest are not available. However, Appendix E, *Bat Protection Zones*, has been created that describes harvest patterns (spatially and over time). The assumptions used in the HCP regarding the seasonality and general distribution of harvest will be used to estimate impacts on occupied habitat. These assumptions will be audited by the DNRs every 5 years to ascertain whether they are still applicable. If practices have shifted and the assumptions need to be revisited, the DNRs will ensure that no additional impacts on high-quality habitat when bats are present are allowed under the permit. Every 5 years, the process for verifying assumptions and, if needed, adapting the location and timing of covered activities will be provided as part of that year's annual report, For enrolled lands, the location and timing of harvest will be reported. Appendix F, *Impact Assumption Validation Assessment*, provides additional details.
  - Total acres of prescribed fire in forest and brush lands. Every 5 years, assumptions made about the distribution of prescribed burning will be revisited to ascertain whether they are still accurate.
  - Confirmation that the 150-foot buffer for known occupied maternity roost trees and the 0.25-mile buffer for hibernacula entrances were not affected by covered activities and/or a description of process used generally to avoid these areas.
- Reporting of any dead or injured Indiana, northern long-eared, little brown, or tricolored bats identified and documented during the reporting year and discovered incidentally from covered activities. Dead or injured bats would initially be reported to USFWS within 5 business days of the applicable State DNR receiving a report.
- Documentation that Bat Protection Zones (specific to each DNR) were established in year 1. In all years, a statement confirming whether timber harvest restrictions were implemented.
- At least once every 5 years, an assessment of all known hibernacula entrances on State DNR lands, and photo documentation of gate condition.
- Summary of any surveys conducted during the reporting period, including description of surveys conducted, protocols used, and survey results. If applicable, recommendations for changes to the monitoring program based on interpretation of results.
- As available, an assessment of the impact of WNS on covered species in the plan area. This might include reference to relevant reports or publications about WNS and covered bats released over the reporting year and the total number of hibernacula that may have been surveyed (including both known and potential habitat for covered species).
- A list of all State DNR directives or guidance updated to reflect HCP requirements during the reporting year.

- The total (approximate) acres of State DNR-owned lands.
- Explanation of any substantial deviations in spending relative to expected HCP costs.
- The acquisition or disposal of parcels with known occupied maternity roost trees or hibernacula entrances.
- Results of audit reports for internal programs and/or external forest certification programs.
- Total acreage and number of landowners participating in the Landowner Enrollment Program. A summary of monitoring documentation submitted under the Landowner Enrollment Program, and a list of any participants in noncompliance and the corrective actions taken to bring them back into compliance.
- Provide progress made on State DNRs' communication plans for educating the public on covered bats and their conservation and any subsequent actions specifically associated with the plan (the full communication plan is due to USFWS by year 2).
- Description of any changes in HCP implementation resulting from the adaptive management process during the reporting period, as applicable. This description will include the information that triggered the change, the rationale for the planned responses, and the results of any applicable monitoring actions.
- If applicable, documentation of any changed circumstances that were triggered during the year (Section 6.5.1, *Changed Circumstances*) and any unforeseen circumstances.
- If applicable, a summary of any administrative changes proposed or approved during the reporting year that affect the implementation of the HCP (Section 6.6, *Modifications to the Plan or Permit[s]*).

6.5 Assurances Requested

This section discusses the No-Surprises Assurances requested by the State DNRs that are part of the ESA Section 10(a)(1)(B) permit issued by USFWS. These assurances require defining circumstances affecting the covered species that may change over the course of the permit term, as well as those that are unforeseen. Sections 6.5.1, *Changed Circumstances*, and 6.5.2, *No Surprises Regulation,* describe these circumstances.

6.5.1 Changed Circumstances

Under ESA Section 10, an HCP must identify anticipated and possible circumstances that could change during implementation. Identifying strategies and protocols for addressing such anticipated changes allows for appropriate program adjustments.

The changed and unforeseen circumstances and their contingency actions, if applicable, are described in the following section.

6.5.1.1 Additional Species Listed or Impacted

Over the course of the 50-year permit term, USFWS could list species as threatened or endangered under ESA that are not covered under the Lake States HCP. Note that the reclassification of species covered by the HCP (such as the uplisting of a species from threatened to endangered or from unlisted to listed) requires no additional action; all covered species are fully addressed by the HCP. However, species not covered by the plan will trigger changed circumstances. When a new species (not exclusive to bats) has been proposed for classifying and its habitat is associated with covered lands, USFWS will notify the State DNRs. Additionally, impacts from covered activities on species already listed due to range expansion will trigger similar measures. Following such notification, the State DNRs will take the following steps.

1. **Determine the potential for State DNR covered activities to affect candidate species.** Within 1 year of classifying as a candidate species, the State DNRs will determine to what extent the candidate species occurs or could occur on covered lands and, therefore, whether coordination with USFWS will be required. Species classified as candidates at the time of permitting have already been evaluated and require no further review.
2. **Once a new, currently noncovered species is classified as threatened or endangered, the State DNRs may initiate coordination[1] with USFWS within 2 weeks of publication of the final listing rule.** If the State DNRs and USFWS determine that the newly classified species occurs on covered lands and could be affected by activities covered under the Lake States HCP, they can identify and implement necessary measures to avoid the take of the newly classified species, in consultation with other stakeholders, if appropriate.
3. **Apply for permit amendment or alternative take coverage.** If the agencies wish to proceed with activities that will cause take of the newly listed species, they will begin the process to amend the Lake States HCP permit to include these species or, alternatively, the State DNRs can apply for a new and separate permit.

The agencies will implement the interim take avoidance guidelines identified under Step 2 for the species until the permit amendment is finalized or an alternate permit is issued to prevent being out of compliance with ESA. Permit amendments to include additional covered species will require an amendment to the Lake States HCP and the permit, including the re-initiation of the internal Section 7 consultation and supplemental National Environmental Policy Act (NEPA) work.

6.5.1.2 Wildfire

Description

Wildfires, either ignited by natural (e.g., lightening) or human causes, can occur across the Lake States and are most frequent after snow cover recedes in the spring and after the growing season ends in the fall (Williams 2000). Wildfires usually occur under hot, dry conditions, which can lead to large, intense, and difficult-to-control wildfires (Kimmerer and Lake 2001). Uncontrolled and particularly intense wildfires can negatively affect covered bats through smoke exposure, by reducing roost availability, or by creating unsuitable conditions at existing roost sites. A stand-replacing fire that eliminates forest and favors shrub/scrub and grassland will reduce local roosting and foraging habitat for covered bats. Alternatively, wildfire also has the potential to provide additional roosting resources for bats through the creation of decaying trees and snags. Research in Appalachian forests has shown that these types of large-scale natural disturbance in hardwood

[1] Note the timing of coordination on newly listed species, is identified here as the latest coordination would occur. In reality the coordination would likely occur much earlier, such as during the USFWS' 90-day finding period or the public comment period on a proposed listing rule.

forests can increase snag abundance several-fold over preexisting conditions (Johnson et al. 2010). In fact, targeted prescribed fire is an objective in the conservation strategy.

In the Lake States, wildfires are not anticipated to be distributed evenly across forest types (Cardille and Ventura 2001). The development and spread of wildfires is related to fuel abundance and connectivity, soil and vegetation moisture, and weather and climate patterns (Cardille et al. 2001). Soil moisture has been identified as a very important factor in wildfires in the Upper Midwest (Heinselman 1973; Vogl 1971), through its influence on available water capacity, i.e., volume of water available to plants (Cardille et al. 2001). Large fires occur most often in the aspen parkland region of northwest Minnesota and in the sand plains of central Minnesota and northeast lower Michigan. Fire conditions are exacerbated by drought and, therefore, are likely to worsen in the future if drought conditions become more prevalent due to climate change.

Conservation Objectives and Monitoring

Prescribed fire is used throughout the Lake States as a habitat management tool for numerous species and as means of reducing fuel load and preventing wide-scale wildfire. Objective 5.1 develops and implements prescribed burn plans in modeled bat habitat to minimize impacts of such burns. Objective 2.2 restricts the timing of prescribed burning in areas identified as known occupied maternity roost trees. While these objectives address prescribed burning, they are not specific to wildfires.

Thresholds

To set thresholds for changed circumstances, data on wildfire occurrence on State DNR lands for each of the three states were examined. The analysis was limited to wildfire occurrence on State DNR lands because differences in land management on public versus private lands may result in different frequencies and intensities of wildfire.

Data were procured for wildfires on State DNR lands for each of the three states. Michigan data were obtained from the 2016 Annual Report (Michigan Department of Natural Resources 2016), Minnesota data were provided by a contact in the Minnesota DNR (Verdegan pers. comm.), and Wisconsin data were provided by a contact in the Wisconsin DNR (Barnier pers. comm.). These data were compared to publicly available datasets for federal lands (U.S. Geological Survey 2018) to verify trends across land ownership such as size, number, and intensity of fires. In general, the overall trends across federal versus State DNR datasets were similar.

Data on wildfire occurrence on State DNR lands were available for all three states for the period of 2007 through 2016 (Table 6-2). Other periods were not consistently available across the three states. To substantiate the use of this period, this dataset was compared to larger datasets from previous decades, and no statistically significant differences were found in terms of the frequency, size, and intensity of fires. There is a high degree of variability in the size and number of fires. In general, fires affecting known occupied maternity roost trees and known hibernacula entrances are considered foreseen and would be addressed as a changed circumstance. For each state, annual fire totals greater than the maximum annual acres burned plus one standard deviation are unforeseen.

Table 6-2. Projected Maximum Annual Acreage of Wildfires on All State Lands, by State (2007–2016)

State	Maximum Acres Burned Annually (2007–2016)	Projected Maximum Acres Burned [a]
Michigan	23,813	32,469
Minnesota	28,975	29,856
Wisconsin	3,161	3,432

[a] The Projected Maximum Acres Burned column is calculated as the annual 2007-2016 average plus the standard deviation for those years.
Sources: Michigan Department of Natural Resources 2016; Verdegan pers. comm.; Barnier pers. comm.

Responsive Measures

Like prescribed fires, low-intensity wildfires likely improve bat habitat (Boyles and Aubrey 2006; Ford et al. 2016), However, wildfires in areas where a known occupied maternity roost tree or hibernaculum entrance is present could remove active roosts (Ford et al. 2016) or kill/harm bats (Dickenson et al. 2010). Catastrophic fire could remove all or most roosts in an area. To ensure that known occupied maternity roost trees and hibernacula entrances addressed by the conservation strategy continue to provide habitat value in burned areas, fires in stands with known occupied maternity roost trees or hibernacula entrances will be analyzed within 1-year post fire. If a fire occurs in any area with a known occupied maternity roost tree or hibernaculum entrance, a reasonable effort will be made to notify USFWS within 90 days of the fire. Additionally, a post-fire plan will be conducted. If this analysis indicates a degradation in habitat quality (e.g., known occupied maternity roost trees have been destroyed), the State DNRs will develop and implement a site-specific plan addressing rehabilitation needs. Short-term responsive measures can include measures such as the use of bat boxes if determined to be a beneficial response. Other response measures may be pursued if they are determined to contribute to habitat recovery after fires that have destroyed known occupied maternity roost trees or hibernacula entrances. These actions will be included in the annual report.

6.5.1.3 White-Nose Syndrome

Description

As indicated in Chapter 3, Section 3.3.1, *White-Nose Syndrome*, it is likely that WNS will continue to affect bats in Michigan, Minnesota, and Wisconsin throughout the permit term. While the long-term effects of WNS remain largely unknown, under the most conservative scenario, mortality rates will continue to be unsustainably high for all covered bats.

Federal, state, local, and private entities are investing significant time and funding into research aimed at reducing effects from WNS (Michigan Department of Natural Resources and Environment 2010; Minnesota Department of Natural Resources 2013; Wisconsin Department of Natural Resources 2011), but efforts for treatment or prevention remain experimental.

Through their monitoring program, the State DNRs will continue to monitor the effect of WNS on covered bats in each of the Lake States. The results of such monitoring activities will be used to update the habitat distribution model and to reflect changes in fall/spring and winter use habitat for all species, including identification of major hibernacula entrances, active maternity colonies, and known roosting areas.

Thresholds

Threshold 1. Contraction of Covered Bat Populations to a Limited Number of Sites

The Lake States HCP's protections are based on the assumption that surviving bats are spread widely across the landscape. However, a predictable result of continued population declines due to WNS is a concentration of bats within a very small number of hibernacula during winter along with an abandonment of other hibernacula and their associated fall/spring habitat. Further, some of the covered species are highly social and derive many benefits from communal living. Therefore, it is also foreseeable that the summer ranges may collapse into areas near the last few occupied hibernacula.

This changed circumstance will be triggered when the Lakes States determine that populations have collapsed such that covered bat species (northern long-eared, tricolored, and little brown bat) are only present in one-third of hibernacula in each state (i.e., reduced to 3 hibernacula in Michigan, 3 hibernacula in Minnesota, and 4 hibernacula in Wisconsin).

Threshold 2. Bat Populations Show Signs of Recovery from WNS

While not presently occurring, the covered species could begin to adapt to WNS, resulting in an increase in populations of covered species over the permit term. This changed circumstance will be triggered when the results of survey data show that a some hibernaculum has a population of more than 30,000 covered bats (of any one or a combination of any of the covered bat species) and, thus, shows signs of recovery from WNS.

Threshold 3. Measures to Treat WNS are Proven Effective

Although no known large-scale means of treating bats infected with WNS is known, the State DNRs will review current research and will coordinate with USFWS regarding the testing or use of treatment methods should they become available over the permit term. This changed circumstance will be triggered if measures that are proven effective for treatment of bats with WNS become available over the permit term.

Responsive Measures

Response to Threshold 1

If one of the changed circumstances in threshold 1 is triggered, the Lake States will work with USFWS to determine if it may be necessary to shift existing protective measures to target these populations. Potential measures may include the following.

- Abandoning the use of seasonal avoidance around hibernacula entrances where survey data (internal surveys and/or entrance trappings) indicate the absence of covered species for a period of 5 years.
- Extending the buffer around remaining hibernacula entrances.
- Extending buffer around remaining roost areas.
- Applying all HCP restrictions that apply to winter habitat and known maternity roost trees within extended buffers, as well as any additional avoidance measures agreed to by USFWS and the State DNRs.

Response to Threshold 2

If the changed circumstance for threshold 2 is triggered, the State DNRs will notify USFWS via email within 72 hours (3 business days) of the changed circumstance being triggered. In coordination with USFWS, the State DNRs will ensure that existing conservation measures are prioritized to support that recovery.

Response to Threshold 3

If changed circumstance for threshold 3 is triggered, the State DNRs will coordinate with USFWS to determine whether and to what extent these measures could be incorporated into the Lake States HCP. Implementation of such measures is subject to the approval of USFWS. Because a discrete contingency has yet to be identified, the addition of new WNS-related conservation measures into the HCP, or discontinuance of those that prove to be ineffective, will follow the HCP or permit amendment process described in Section 6.6, *Modifications to the Plan or Permit(s)*. The State DNRs will update their cost estimates and funding assurances to include WNS treatments at the time they seek an amendment.

6.5.2 No Surprises Regulation

This section describes the context of the federal No Surprises regulation as it relates to the Lake States HCP and the individual states' incidental take permits. The No Surprises regulation was established by the Secretary of the Interior on March 25, 1998, and is codified at 50 Code of Federal Regulations (CFR) § 17.22(b)(5) (endangered species) and Section 17.32(b)(5) (threatened species). As long as the permittees are properly implementing the HCP and the incidental take permits, the regulations provide assurances to Section 10 permit holders that no additional money, commitments, or restrictions of land or water will be required should unforeseen circumstances requiring additional mitigation arise once the permit is in place. The No Surprises regulation states that if the Lake States are properly implementing an HCP that has been approved by USFWS, no additional commitment of resources, beyond those already specified in the HCP will be required.

As stated at 50 CFR § 17.22(b)(5):

> **(5) Assurances provided to permittee in case of changed or unforeseen circumstances.** The assurances in this paragraph (b)(5) apply only to incidental take permits issued in accordance with paragraph (b)(2) of this section where the conservation plan is being properly implemented, and apply only with respect to species adequately covered by the conservation plan. These assurances cannot be provided to Federal agencies. This rule does not apply to incidental take permits issued prior to March 25, 1998. The assurances provided in incidental take permits issued prior to March 25, 1998 remain in effect, and those permits will not be revised as a result of this rulemaking.
>
>> ***(i) Changed circumstances provided for in the plan.*** If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and were provided for in the plan's operating conservation program, the permittee will implement the measures specified in the plan.
>>
>> ***(ii) Changed circumstances not provided for in the plan.*** If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and such measures were not provided for in the plan's operating conservation program, the Director will not require any conservation and mitigation measures in addition to those provided for in the plan without the consent of the permittee, provided the plan is being properly implemented.

(iii) Unforeseen circumstances.

(A) In negotiating unforeseen circumstances, the Director will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the conservation plan without the consent of the permittee.

(B) If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Director may require additional measures of the permittee where the conservation plan is being properly implemented, but only if such measures are limited to modifications within conserved habitat areas, if any, or to the conservation plan's operating conservation program for the affected species, and maintain the original terms of the conservation plan to the maximum extent possible. Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

(C) The Director will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. These findings must be clearly documented and based upon reliable technical information regarding the status and habitat requirements of the affected species. The Director will consider, but not be limited to, the following factors:

(1) Size of the current range of the affected species;

(2) Percentage of range adversely affected by the conservation plan;

(3) Percentage of range conserved by the conservation plan;

(4) Ecological significance of that portion of the range affected by the conservation plan;

(5) Level of knowledge about the affected species and the degree of specificity of the species' conservation program under the conservation plan; and

(6) Whether failure to adopt additional conservation objectives would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

6.6 Modifications to the HCP or Permit(s)

The Lake States HCP and associated incidental take permits may be modified in accordance with ESA, USFWS implementing regulations, and the provisions outlined in this chapter. Regular HCP and permit modifications are not anticipated; however, modifications to the HCP or permits may be requested by either the State DNRs or USFWS. USFWS also may amend the permits at any time for just cause, and upon a written finding of necessity, during the permit term in accordance with 50 CFR § 13.23(b). The categories of modifications are administrative changes and amendments.

Any administrative changes arising during a given year will be submitted to USFWS as addenda to the next annual report. Amendments will be documented by providing USFWS with a redline version of the Lake States HCP containing the relevant text change(s). Upon request from USFWS, the State DNRs will provide a complete revised version of the Lake States HCP, including the revisions resulting from all administrative changes and amendments to date, every 5 years during the permit term.

As with any permit, noncompliance with the expressed requirements can result in revocation of the permit. Repeated and pervasive noncompliance that is unaddressed by the DNRs may result in revocation of the State DNR's incidental take permit. Noncompliance of Landowner Enrollment Program participants is addressed in Appendix B, Section B.2.6, *Noncompliance.*

6.6.1 Administrative Changes

Administrative changes are internal changes or corrections to the Lake States HCP that may be made by the State DNRs, at their own initiative, or approved by the State DNRs in response to a written request submitted by USFWS. Requests from USFWS will include an explanation of the reason for the change and any supporting documentation.

Each revision of the Lake States HCP will not necessarily result in amending the incidental take permits. The need to amend the permits depends on how the HCP has changed, how those changes need to be reflected in the permits, and whether the changes would trigger additional Section 7 or NEPA review. Administrative changes to the HCP must be consistent with the scope of the analysis already in the HCP and presented to the public as part of the NEPA process. Administrative changes will address small errors, omissions, or language that may be too general or too specific for practical application.

Examples of administrative changes to the Lake States HCP are listed as follows.

- Corrections of typographical, grammatical, and similar editing errors that do not change the intended meaning or obligations.
- Corrections of any minor errors in maps or exhibits.
- Corrections of any maps, tables, or appendices to reflect approved amendments (Section 6.6.2, *Amendments*) to the HCP or incidental take permit.
- Changes to the State DNR staff or changes to membership of the HCP Advisory Committee without changing the representation of the State DNRs.

In addition, the threshold for participation in the Landowner Enrollment Program may change over time as densities of bats diminish on the landscape. Details on how these thresholds are established are provided in Appendix B, *Landowner Enrollment Program*.

6.6.2 Amendments

The Lake States HCP, incidental take permit, and implementing document amendments are not anticipated on a regular basis; however, these modifications may be requested by either the Lake States or USFWS. Once an amendment is requested, it is up to USFWS to decide the level of review needed to satisfy ESA and regulatory requirements. USFWS also may amend the incidental take permit at any time for just cause, and upon a written finding of necessity, during the permit term in accordance with 50 CFR § 13.23(b).

Amendments to the HCP can be approved through an exchange of formal correspondence, addenda to the HCP, revisions to the HCP, or permit amendments. Modifications to the projects and activities described in the HCP that meet the following criteria must comply with applicable permitting requirements, including the compliance with NEPA, the National Historic Preservation Act, and ESA Section 7.

- Modifications that significantly affect the impact analysis or conservation strategy of the HCP.
- Modifications that significantly affect other environmental resources or other aspects of the human environment in a manner not already analyzed.
- Modifications that result in a change for which public review is required, such as revising the Permit Area or adding covered species (see bulleted list of examples below).

The specific document requirements for the amendment may vary, however, based on the substance of the amendment. For instance, if the amendment involves an action that was not addressed in the original HCP or NEPA analysis, the documents may need to be revised or new versions prepared to address the proposed amendment. If circumstances necessitating the amendment were adequately addressed in the original documents, an amendment of the incidental take permit might be sufficient. Upon submission of complete amendment documentation, USFWS will publish a notice of the receipt of the application in the *Federal Register*, initiating the NEPA and HCP public comment process. After the close of the public comment period, USFWS may approve or deny the proposed amendment application. Examples of changes that would require an amendment include the following actions.

- Addition of covered species to the HCP.
- Increase in the allowable take limit of existing covered activities or addition of new covered activities to the HCP.
- Modifications of any important action or component of the conservation strategy under the HCP, including funding, that may substantially affect levels of authorized take, effects of the covered activities, or the nature or scope of the conservation strategy.
- A major change in the biological goals and objectives or conservation actions if monitoring or research indicates that they are not attainable because technologies to attain them are either unavailable or infeasible.

From time to time USFWS may propose an amendment. Any Lake States' permittee[2] may, at their sole discretion, reject any amendment proposed by USFWS. If USFWS proposes an amendment to ensure issuance criteria continue to be met and the Lake States reject the proposed amendment, USFWS may exercise its authority to suspend or revoke the permit, in whole or in part, for cause in accordance with 50 CFR §§ 13.27, 13.28–13.29, 17.22(b)(8), and 17.32 (b)(8) and other applicable laws and regulations in force at the time of such suspension or revocation. Except where USFWS determines that emergency action is necessary to avoid irreparable harm to a covered species, it will not suspend the federal permit without 1) attempting to resolve any disagreements regarding the implementation or interpretation of the HCP; 2) requesting the State DNRs to take appropriate remedial actions; and 3) providing the State DNRs with written notice of the facts or conduct, which may warrant the suspension and an adequate and reasonable opportunity for the permittees to demonstrate why suspension is not warranted.

[2] The Lake States HCP is designed to accommodate three individual and severable permits (one for each state). As a result, action or inaction taken by one State DNR does not affect the other two State DNRs' permits. For example, if USFWS proposes and amendment to ensure issuance criteria continue to be met, and two states accept the amendment and one state rejects the amendment, USFWS may exercise its authority to suspect or revoke the one state permit while the other two state permits remain unaffected.

Chapter 7
Cost and Funding

7.1 Overview

The federal Endangered Species Act (ESA) requires that habitat conservation plans (HCPs) specify, "the funding that will be available to implement" conservation actions that minimize and mitigate impacts on covered species (16 United States Code [U.S.C.] § 1539(a)(2)(A)). ESA also requires the U.S. Fish and Wildlife Service (USFWS) determine that the applicant will ensure adequate funding is available to implement the HCP.[1] This chapter outlines the estimated costs to implement the Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP) over the proposed 50-year permit term and provides assurances that the Michigan, Minnesota, and Wisconsin Departments of Natural Resources (collectively referred to as the State DNRs) will pay for those costs.

The costs outlined in this chapter reflect the estimated costs to implement the Lake States HCP during year 1 of the permit term based on 2019 dollars. These values are not adjusted for inflation because HCP costs are expected to increase due to inflation at the same rate as increases in HCP funding sources. For example, any revenue sources that fund agency operations are reevaluated each year and adjusted for actual or predicted inflation, as necessary. Similarly, each state's annual budget process will adjust budget requests for inflation at the same rate that HCP costs will increase due to inflation.

7.2 Cost to Implement the Habitat Conservation Plan

As described in Chapter 6, *HCP Implementation and Assurances*, DNR staff will be responsible for and oversee implementation of the Lake States HCP in each of their respective states. DNR staff members include administrators, geographic information system (GIS) and database managers, biologists, foresters, and other natural resource specialists who will carry out planning and design, monitoring, adaptive management, and periodic coordination with and reporting to USFWS.

Costs to implement the Lake States HCP are divided into three categories, each of which is summarized below for each state separately.

- Program administration
- Conservation program and monitoring actions
- Adaptive management and changed circumstances

All costs were estimated based on information provided by DNR staff for the same or similar actions conducted currently. For Lake States HCP tasks that are new to the agency, costs were estimated based on similar actions conducted by other entities in the participating states, or with data from comparable HCPs in other states. These amounts were crosschecked with State DNR staff to ensure the appropriateness and accuracy of the estimation. These cost estimates are planning-level

[1] 16 U.S.C. § 1539(a)(2)(B)(iii).

estimates only for the purpose of demonstrating assured funding for the HCP. Each DNR will prepare annual budgets to implement the HCP that may differ from (be greater or less than) these cost estimates. The cost estimates are not requirements of what each DNR must spend, but rather reasonable estimates of total HCP costs over the entire permit term.

7.2.1 Program Administration

This section describes the program administration and ongoing or yearly costs associated with staff time for coordination, agency meetings, database tracking, and reporting. The State DNRs will each provide their own HCP administrator, who will be responsible for compiling their state's HCP Annual Report, coordinating HCP implementation, and performing other HCP administration tasks, as needed. Additional qualified staff provided by each State DNR, such as biologists or foresters, will also help with administration. GIS staff at each State DNR will maintain and update a database(s) that houses spatial information necessary for tracking compliance with the Lake States HCP. See Chapter 6, Section 6.3.2, *DNR Implementation Structure*, for a description of the roles of each state's HCP staff.

7.2.1.1 Michigan

Program administration costs for Michigan are estimated to be $127,084 per year over the life of the permit (Table 7-1).

Table 7-1. Michigan Program Administration Costs

HCP Staff	Michigan DNR FTEs [a]	Years Needed	Staff Rate [b]	Annual Cost in Year [c]	Cost Over 50-Year Permit Term [c]
HCP Administrator	0.50	50	$164,486	$82,243	$4,112,160
HCP Implementation Team	0.20	50	$164,486	$32,897	$1,644,864
GIS Technician	0.10	50	$119,434	$11,943	$597,168
			TOTAL COST	**$127,084**	**$6,354,192**

Notes:
[a] FTEs = full-time employees (proportion of full-time workload of 1 employee per 1 year)
[b] Rate for staff time includes staff base salary plus an overhead cost.
[c] Costs may not add up due to rounding. Costs over 50-year permit term are annual cost in year 1 x 50.

7.2.1.2 Minnesota

Program administration costs for Minnesota are estimated to be $73,038 per year over the life of the permit (Table 7-2).

Table 7-2. Minnesota Program Administration Costs

HCP Staff	Minnesota DNR FTEs [a]	Years Needed	Staff Rate [b]	Annual Cost in Year [c]	Cost Over 50-Year Permit Term [c]
HCP Administrator	0.40	50	$110,873	$44,349	$2,217,456
HCP Implementation Team	0.15	50	$107,323	$16,098	$804,924
GIS Technician	0.15	50	$83,938	$12,591	$629,532
			TOTAL COST	**$73,038**	**$3,651,912**

Notes:
[a] FTEs = full-time employees (proportion of full-time workload of 1 employee per 1 year)
[b] Rate for staff time includes staff base salary plus an overhead cost.
[c] Costs may not add up due to rounding. Costs over the 50-year permit term are the annual cost in year 1 x 50.

7.2.1.3 Wisconsin

Program administration costs for Wisconsin are estimated to be $79,035 per year over the life of the permit (Table 7-3).

Table 7-3. Wisconsin Program Administration Costs

HCP Staff	Wisconsin DNR FTEs [a]	Years Needed	Staff Rate [b]	Annual Cost in Year 1[c]	Cost Over 50-Year Permit Term [c]
HCP Administrator	0.50	50	$101,053	$50,526	$2,526,320
HCP Implementation Team	0.20	50	$101,053	$20,211	$1,010,528
GIS Technician	0.10	50	$82,977	$8,298	$414,885
			TOTAL COST	**$79,035**	**$3,951,733**

Notes:
[a] FTEs = full-time employees (proportion of full-time workload of 1 employee per 1 year)
[b] Rate for staff time includes staff base salary plus an overhead cost.
[c] Costs may not add up due to rounding. Costs over the 50-year permit term are the annual cost in year 1 x 50.

7.2.2 Conservation Program and Monitoring Actions

As stated in Chapter 5, *Conservation Strategy*, the conservation program implements the biological goals and objectives and fulfills the Lake States HCP requirement to avoid, minimize, and mitigate impacts of forest management on bats to the maximum extent practicable. Costs associated with the conservation program include implementation of avoidance and minimization measures, mitigation, and monitoring actions, as well as the staff time associated with tracking these elements. The cost associated with each of these program elements is described below.

7.2.2.1 Staff Costs

Lake States HCP staff will implement the conservation program, design, and monitoring actions. Each of the biological objectives within the conservation program has associated actions that may require additional staff time and direct costs. Natural resources professionals in the State DNRs, such as biologists, foresters, and planners, will oversee and assist with implementation of the conservation program; therefore, a portion of a full-time salary was allocated across the agencies to account for these costs (Tables 7-4 to 7-6).

7.2.2.2 Conservation Measures

The Lake States HCP commits the State DNRs to continue some conservation measures that they already implement. In other cases, the State DNRs will incorporate new measures into currently established programs or practices. Implementation of ongoing measures will require minimal new staff time or materials. Ongoing or existing costs are not estimated for the purposes of costing this HCP. However, the Lake States HCP will require the communication of new and different measures, as well as some new activities. Staff time, direct costs, and materials for conservation measures were estimated only for new actions (Tables 7-4 to 7-6).

7.2.2.3 Monitoring Actions

The Lake States HCP monitoring program is described in Chapter 5, Section 5.6, *Monitoring*. Monitoring the outcomes of conservation measures is the foundation of the HCP's conservation program and adaptive management approach and can help advance scientific understanding to better achieve the HCP's biological goals and objectives. As with the conservation measures, many monitoring actions will be implemented by continuing existing practices. The costs of existing monitoring programs and actions is not included as an HCP cost. Those new HCP monitoring actions that will result in additional costs are included in Tables 7-4 to 7-6.

Table 7-4. Michigan Conservation Program Costs

Biological Objectives	Potential associated action(s)	Additional Staff Time Needed to Implement the Lake States HCP – Michigan FTEs: HCP Administrator	HCP Implementation Team Member	Clerical Worker/ Web Admin	GIS Technician	Community Liaison	Senior Biologist	Forest Assistant Manager	Biologist	Field Supervisor	Field Crew Member	New Commitment	Annual Cost in Year 1	# of Years	Over Permit Term	Direct Costs: Set Up Cost	Cost per Event	# of actions	Annual Cost in Year 1	Over Permit Term	Total Annual Costs: Michigan	Total Over Permit Term: Michigan
Objective 1.1: Manage DNR-administered forestlands (currently over 9 million acres) sustainably such that habitat for covered bats is maintained over the permit term	Continue existing management actions	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Maintain forestland as forest	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Document high level forestry approach used by the DNR over the last reporting year for use in annual report	-	-	-	-	-	0.077	-	-	-	-	✓	$10,989	50	$549,440	-	-	-	$0	$0	$10,989	$549,440
	Document any updates to FIA data for annual report	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	10	$27,472	-	-	-	$0	$0	$549	$27,472
Objective 2.1: Implement retention guidelines in all forest habitat for bats beginning in year 1 and continuing throughout the permit term	Develop a guidance document for use by field staff	-	-	-	-	-	0.058	-	-	-	-	✓	$8,242	1	$8,242	-	-	-	$0	$0	$165	$8,242
	Implement retention guidelines	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0.00
	Audit a subset of harvested units annually	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0.00
	Document audits for the annual report	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	50	$137,360	-	-	-	$0	$0	$2,747	$137,360
Objective 2.2: Minimize impacts to roosting bats by implementing a 150-foot buffer around all known occupied maternity roost trees	Geolocate known occupied maternity roost trees on State DNR lands within year 1	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0.00
	Incorporate new known occupied maternity roost trees on DNRs lands into state database as they are identified/geolocated	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	50	$137,360	-	-	-	$0	$0	$2,747	$137,360
	Incorporate new known occupied maternity roost trees identified on private lands into state database as they are identified/geolocated	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	50	$137,360	-	-	-	$0	$0	$2,747	$137,360
Objective 3.1: Increase bat conservation by providing the Landowner Enrollment Program on lands throughout the permit term.	Develop and administer Landowner Enrollment Program	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	50	$137,360	$2,500	-	1	$50	$2,500	$2,797	$139,860
	Document participation in Landowner Enrollment Program and acreage of enrolled private lands for annual report	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	50	$137,360	-	-	-	$0	$0	$2,747	$137,360
	Monitor Landowner Enrollment Program adherence to relevant conservation measures	-	-	-	-	-	0.340	-	-	-	-	✓	$48,625	50	$2,431,272	-	-	-	$0	$0	$48,625	$2,431,272
Objective 3.2: Develop and implement a communication plan for educating the public on covered bats and their conservation	Develop a communication plan for bats and implement within 2 years	-	-	-	-	0.019	0.019	-	-	-	-	✓	$5,310	2	$10,619	$5,000	-	1	$100	$5,000	$312	$15,619
	Produce and update online content	-	-	0.010	-	-	0.010	-	-	-	-	✓	$2,333	50	$116,630	-	-	-	$0	$0	$2,333	$116,630
	Development of a brochure, speaking engagements, webinars, and other public outreach	-	-	-	-	0.038	0.038	-	-	-	-	✓	$10,619	50	$530,960	$10,000	-	1	$200	$10,000	$10,819	$540,960
Objective 4.1: Remove undesirable obstructions at known hibernacula entrances on State DNR lands by year 5 and continue throughout the permit term	Visit hibernacula entrances to trim vegetation and remove obstructions once in first 5 years then every 10 years	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Identify potential sites for creation or rehabilitation (optional [a])	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0

Biological Objectives	Potential associated action(s)	Additional Staff Time Needed to Implement the Lake States HCP: Michigan FTEs: HCP Administrator	HCP Implementation Team Member	Clerical Worker/ Web Admin	GIS Technician	Community Liaison	Senior Biologist	Forest Assistant Manager	Biologist	Field Supervisor	Field Crew Member	New Commitment	Annual Cost in Year 1	# of Years	Over Permit Term	Direct Costs: Set Up Cost	Cost per Event	# of actions	Annual Cost in Year 1	Over Permit Term	Total Annual Costs: Michigan	Total Over Permit Term: Michigan
Objective 4.2: Protect known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term	Implement a 0.25-mile buffer around known hibernacula entrances	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Document that no harvest has occurred unless specifically conducted to benefit bats within the specified protective buffer for annual report	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Document additional known hibernacula entrances on private forestlands enrolled in the HCP in state database	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	50	$137,360	-	-	-	$0	$0	$2,747	$137,360
	Document any enhancements to core areas around hibernaculum on State DNR lands and provide a before and after assessment in the annual report	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	50	$137,360	-	-	-	$0	$0	$2,747	$137,360
Objective 4.3: Maintain gates on all known entrances to occupied hibernacula on State DNR lands and the lands of willing partners (unless determined to be not needed or detrimental) throughout the permit term.	Assess all known hibernacula entrances on State DNR lands and prioritize gating efforts	-	-	-	-	-	0.038	-	-	-	-	✓	$5,494	5	$27,472	-	-	-	$0	$0	$549	$27,472
	Install gates on any non-gated hibernacula entrances where applicable	-	-	-	-	-	0.038	-	-	-	-	✓	$5,494	1	$5,494	-	-	-	$0	$0	$110	$5,494
	Repair existing gates	-	-	-	-	-	0.038	-	-	-	-	✓	$5,494	20	$109,888	$1,000	-	20	$400	$20,000	$2,598	$129,888
	Survey hibernacula for covered bats	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0.00
Objective 4.4: Promote awareness and understanding of WNS through collaboration with researchers throughout the permit term	Add content to website	-	-	-	-	-	-	-	-	-	-	▤	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	0.010	-	-	-	-	✓	$1,374	50	$68,680	-	-	-	$0	$0	$1,374	$68,680
	Establish a regional clearing house and collaborate with USFWS and other entities on research	-	-	-	-	-	0.038	-	-	-	-	✓	$5,494	50	$274,720	-	-	-	$0	$0	$5,494	$274,720
	Provide permits (as appropriate) to continue WNS research on State DNR lands	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0.00
Objective 5.1: Minimize impacts of prescribed fire on roosting and hibernating bats beginning at permit issuance and continuing throughout the permit term	Update prescribed burn plans to reflect impact minimization criteria by year 5 and continue throughout permit term	-	-	-	-	-	0.019	-	-	-	-	✓	$2,747	5	$13,736	-	-	-	$0	$0	$275	$13,736
	Document training of prescribed fire staff on new criteria	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0.00
	Seasonally implement prescribed burn plans on modeled habitat	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0.00
Objective 5.2. Minimize impacts on covered bats associated with roads and trails throughout the permit term	Identify and locate areas (e.g., hibernacula and roost tree buffers) where seasonal restrictions apply	-	-	-	-	-	0.058	-	-	-	-	✓	$8,242	50	$412,080	-	-	-	$0	$0	$8,242	$412,080
	Communicate seasonal restrictions to relevant DNR staff	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0.00
	Report any road construction on State DNR lands as well as the season and location of activity	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0.00
-	**Total**	0.000	0.000	0.010	0.000	0.058	0.937	0.000	0.000	0.000	0.000	-	$142,435	-	$5,548,225	$18,500	$0	-	$750	$37,500	$111,715	$5,585,725
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Total MI Cost**			**$111,715**	**$5,585,725**

FIA = Forest Inventory and Analysis; FTEs = full-time employees (proportion of full-time workload of 1 employee per 1 year); GIS = geographic information system; WNS = white-nose syndrome

[a] This is not required but will allow the State DNRs to add value to bats for existing or new hibernacula and associated entrances through additional actions.

Table 7-5. Minnesota Conservation Program Costs

		Additional Staff Time Needed to Implement the Lake States HCP														Direct Costs					Total Annual Costs	Total Over Permit Term
		Minnesota FTEs																				
Biological Objectives	Potential associated action(s)	HCP Administrator	HCP Implementation Team Member	Clerical Worker/ Web Admin	GIS Technician	Community Liaison	Senior Biologist	Forest Assistant Manager	Biologist	Field Supervisor	Field Crew Member	New Commitment	Annual Cost in Year 1	# of Years	Over Permit Term	Set Up Cost	Cost per Event	# of actions	Annual Cost in Year 1	Over Permit Term	Minnesota	Minnesota
Objective 1.1: Manage DNR-administered forestlands (currently over 9 million acres) sustainably such that habitat for covered bats is maintained over the permit term	Continue existing management actions	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Maintain forestland as forest	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Document high level forestry approach used by the DNR over the last reporting year for use in annual report	0.019	-	-	-	-	-	-	-	-	-	✓	$3,198	50	$159,913	-	-	-	$0	$0	$3,198	$159,913
	Document any updates to FIA data for annual report	0.019	-	-	-	-	-	-	-	-	-	✓	$3,198	50	$159,913	-	-	-	$0	$0	$3,198	$159,913
Objective 2.1: Implement retention guidelines in all forest habitat for bats beginning in year 1 and continuing throughout the permit term	Develop a guidance document for use by field staff	0.038	-	-	-	-	-	-	-	-	-	✓	$6,397	50	$319,825	$10,000	-	1	$0	$10,000	$6,597	$329,825
	Training for staff	0.019	-	-	-	-	-	-	-	-	-	✓	$3,198	-	$159,913	$12,000	-	1	$0	$12,000	$3,438	$171,913
	Implement retention guidelines	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Audit a subset of harvested units annually	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Document audits for the annual report	0.010	-	-	-	-	-	-	-	-	-	✓	$1,599	50	$79,956	-	-	-	$0	$0	$1,599	$79,956
Objective 2.2: Minimize impacts to roosting bats by avoiding 150 feet around all known occupied roost trees	Geolocate known occupied maternity roost trees on State DNR lands within year 1	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	$500	1	$500	$500	-	$500
	Implement 150-foot buffer	0.010	-	-	-	-	-	-	-	-	-	✓	$1,599	50	$79,956	-	-	-	$0	$0	$1,599	$79,956
	Incorporate new known occupied maternity roost trees on DNRs lands into state database as they are identified/geolocated	-	-	-	0.004	-	-	-	-	-	0.005	✓	$1,068	50	$53,414	-	-	-	$0	$0	$1,608	$53,414
	Incorporate new known occupied maternity roost trees identified on private lands into state database as they are identified/geolocated	-	-	-	-	-	-	-	-	-	0.005	✓	$565	50	$28,233	-	-	-	$0	$0	$565	$28,233
Objective 3.1: Increase bat conservation by providing the Landowner Enrollment Program on lands throughout the permit term	Develop and administer Landowner Enrollment Program	0.019	-	-	-	-	-	-	-	-	-	✓	$3,229	50	$161,471	$20,000	-	1	$0	$20,000	$3,629	$181,471
	Document participation in Landowner Enrollment Program and acreage of enrolled private lands for annual report	0.010	-	-	-	-	-	-	-	-	-	✓	$1,599	50	$79,956	-	-	-	$0	$0	$1,599	$79,956
	Monitor Landowner Enrollment Program adherence to relevant conservation measures	0.010	-	-	-	-	-	-	-	-	-	✓	$1,599	50	$79,956	$531	-	1	$0	$531	$1,610	$80,487
Objective 3.2: Develop and implement a communication plan for educating public on covered bats and their conservation	Develop a communication plan for bats and implement within 2 years	0.004	-	0.004	-	-	-	-	-	-	-	✓	$1,138	50	$56,918	$12,000	-	1	$0	$12,000	$1,378	$68,918
	Produce and update online content	-	-	0.010	-	-	-	-	-	-	-	✓	$1,247	50	$62,339	-	-	-	$0	$0	$1,247	$62,339
	Development of a brochure, speaking engagements, webinars, and other public outreach	-	-	0.019	-	0.077	-	-	-	-	-	✓	$15,287	50	$764,328	$10,000	-	1	$0	$10,000	$15,487	$774,328
Objective 4.1: Remove undesirable obstructions at known hibernacula entrances on State DNR lands by year 5 and continue throughout the permit term	Visit hibernacula entrances to trim vegetation and remove obstructions once in first 5 years then every 10 years	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
	Identify potential sites for creation or rehabilitation (optional[b])	-	-	-	-	-	0.019	-	-	-	-	✓	$2,313	50	$115,643	$2,000	-	1	$0	$2,000	$2,353	$117,643

[b] This is not required, but will allow the State DNRs to add value to bats for existing or new hibernacula and associated entrances through additional actions.

Biological Objectives	Potential associated action(s)	Additional Staff Time Needed to Implement the Lake States HCP: Minnesota FTEs: HCP Administrator	HCP Implementation Team Member	Clerical Worker/ Web Admin	GIS Technician	Community Liaison	Senior Biologist	Forest Assistant Manager	Biologist	Field Supervisor	Field Crew Member	New Commitment	Annual Cost in Year 1	# of Years	Over Permit Term	Direct Costs: Set Up Cost	Cost per Event	# of actions	Annual Cost in Year 1	Over Permit Term	Total Annual Costs: Minnesota	Total Over Permit Term: Minnesota
Objective 4.2: Protect known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term	Implement a 0.25-mile buffer around known hibernacula entrances	0.010	-	-	0.004	-	-	-	-	-	-	✓	$2,103	50	$105,138	$804	-	1	$0	$804	$2,119	$105,942
	Document that no harvest has occurred unless specifically conducted to benefit bats within the specified protective buffer for annual report	0.004	-	-	-	-	-	-	-	-	-	✓	$640	50	$31,983	-	-	-	$0	$0	$640	$31,983
	Document additional known hibernacula entrances on private forestlands enrolled in the HCP in state database	0.005	-	-	-	-	-	-	-	-	-	✓	$800	50	$39,978	-	-	-	$0	$0	$800	$39,978
	Document any enhancements to core areas around hibernaculum on State DNR lands and provide a before and after assessment in the annual report	0.005	-	-	0.004	-	-	-	-	-	-	▤	$1,303	50	$65,159	-	-	-	$0	$0	$1,303	$65,159
Objective 4.3: Maintain gates on all known entrances to occupied hibernacula on State DNR lands and the lands of willing partners (unless determined to be not needed or detrimental) throughout the permit term.	Assess all known hibernacula entrances on State DNR lands and prioritize gating efforts	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0
	Install gates on any non-gated hibernacula entrances where applicable	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0
	Repair existing gates	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0
	Survey hibernacula for covered bats	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
Objective 4.4: Promote awareness and understanding of WNS through collaboration with researchers throughout the permit term	Add content to website	-	-	-	-	-	-	-	-	-	-	▤	-	-	-	-	-	-	-	-	-	-
		-	-	0.010	-	-	-	-	-	-	-	✓	$1,247	50	$62,339	-	-	-	$0	$0	$1,247	$62,339
	Establish a regional clearing house and collaborate with USFWS and other entities on research	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0
	Provide permits (as appropriate) to continue WNS research on State DNR lands	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
Objective 5.1: Minimize impacts of prescribed fire on roosting and hibernating bats beginning at permit issuance and continuing throughout the permit term	Update prescribed burn plans to reflect impact minimization criteria by year 5 and continue throughout permit term	0.004	-	-	-	-	-	-	-	-	-	✓	$640	50	$31,983	$6,000	-	1	$0	$6,000	$760	$37,983
	Develop and document training of prescribed fire staff on new criteria	0.010	-	-	-	-	-	-	-	-	-	▤	$1,599	50	$79,956	-	-	-	$0	$0	$1,599	$79,956
	Seasonally implement prescribed burn plans on modeled habitat	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	-	$0	$0	$0	$0
Objective 5.2. Minimize impacts on covered bats associated with roads and trails throughout the permit term	Identify and locate areas where seasonal restrictions apply	-	-	-	0.010	-	-	-	-	-	-	▤	$1,211	50	$60,532	-	-	-	$0	$0	$1,211	$60,532
	Communicate seasonal restrictions to relevant DNR staff	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	-	$0	$0	$0	$0
	Report any road construction on State DNR lands as well as the season and location of activity	0.004	-	-	-	-	-	-	-	-	-	✓	$640	50	$31,983	-	-	-	$0	$0	$640	$31,983
-	**Total**	0.198	0.000	0.043	0.022	0.077	0.019	0.000	0.000	0.000	0.010	-	$57,416	-	$2,870,786	-	-	-	-	$73,835	$58,892	$2,944,621
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Total MN Cost**			**$58,892**	**$2,944,621**

FIA = Forest Inventory and Analysis; FTEs = full-time employees (proportion of full-time workload of 1 employee per 1 year); GIS = geographic information system; WNS = white-nose syndrome

Table 7-6. Wisconsin Conservation Program Costs

		Additional Staff Time Needed to Implement the Lake States HCP														Direct Costs				Total Annual Costs	Total Over Permit Term
		Wisconsin FTEs																			
Biological Objectives	Potential associated action(s)	HCP Administrator	HCP Implementation Team Member	Clerical Worker/ Web Admin	GIS Technician	Community Liaison	Senior Biologist	Forest Assistant Manager	Biologist	Field Supervisor	Field Crew Member	New Commitment	Annual Cost in Year 1	# of Years	Over Permit Term	Cost per Event	# of actions	Annual Cost in Year 1	Over Permit Term	Wisconsin	Wisconsin
Objective 1.1: Manage DNR-administered forestlands (currently over 9 million acres) sustainably such that habitat for covered bats is maintained over the permit term	Continue existing management actions	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	$0	$0	$0	$0
	Maintain forestland as forest	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	$0	$0	$0	$0
	Document high level forestry approach used by the DNR over the last reporting year for use in annual report	-	-	-	-	-	-	-	-	0.004	-	✓	$486	50	$24,303	-	-	$0	$0	$486	$24,303
	Document any updates to FIA data for annual report	-	-	-	-	-	-	-	-	-	-	☐	$0	-	$0	-	-	$0	$0	$0	$0
Objective 2.1: Implement retention guidelines in all forest habitat for bats beginning in year 1 and continuing throughout the permit term	Develop a guidance document for use by field staff	-	-	-	-	-	-	0.058	-	-	-	✓	$4,552	1	$4,552	-	-	$0	$0	$91	$4,552
	Implement retention guidelines	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	$0	$0	$0	$0
	Audit a subset of harvested units annually	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	$0	$0	$0	$0
	Document audits for the annual report	-	-	-	-	-	-	-	-	0.004	-	✓	$486	50	$24,303	-	-	$0	$0	$486	$24,303
Objective 2.2: Minimize impacts to roosting bats by avoiding 150 feet around all known occupied maternity roost trees	Geolocate known occupied maternity roost trees on State DNR lands within year 1	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	$0	$0	$0	$0
	Incorporate new known occupied maternity roost trees on DNRs lands into state database as they are identified/geolocated	-	-	-	-	-	0.004	-	-	-	-	✓	$389	50	$19,433	-	-	$0	$0	$389	$19,433
	Incorporate new known occupied maternity roost trees identified on private lands into state database as they are identified/geolocated	-	-	-	-	-	0.004	-	-	-	-	✓	$389	50	$19,433	-	-	$0	$0	$389	$19,433
Objective 3.1: Increase bat conservation by providing the Landowner Enrollment Program on lands throughout the permit term	Develop and administer Landowner Enrollment Program	0.021	-	0.002	-	-	-	-	-	-	-	✓	$2,349	50	$117,460	$2,830	50	$15,478	$153,900	$5,427	$271,360
	Document participation in Landowner Enrollment Program and acreage of enrolled private lands for annual report	0.002	-	-	-	-	-	-	-	-	-	✓	$194	50	$9,717	-	-	$0	$0	$194	$9,717
	Monitor Landowner Enrollment Program adherence to relevant conservation measures	0.038	-	-	-	-	-	-	-	-	-	✓	$3,887	50	$194,332	-	-	$0	$0	$3,887	$194,332
Objective 3.2: Develop and implement a communication plan for educating public on covered bats and their conservation	Develop a communication plan for bats and implement within 2 years	-	-	-	-	-	-	-	0.077	-	-	✓	$5,826	2	$11,652	-	-	$0	$0	$233	$11,652
	Produce and update online content	-	-	0.010	-	-	-	-	-	-	-	✓	$1,040	50	$52,024	-	-	$0	$0	$1,040	$52,024
	Development of a brochure, speaking engagements, webinars, and other public outreach	0.865	-	-	-	-	-	-	-	-	-	✓	$87,450	1	$87,450	$10,000	1	$200	$10,000	$1,949	$97,450
Objective 4.1: Remove undesirable obstructions at known hibernacula entrances on State DNR lands by year 5 and continue throughout the permit term	Visit hibernacula entrances to trim vegetation and remove obstructions once in first 5 years then every 10 years	-	-	-	-	-	-	-	0.019	-	-	✓	$1,456	21	$30,586	$2,000	21	$840	$42,000	$1,452	$72,586
	Identify potential sites for creation or rehabilitation (optional[c])	-	-	-	-	-	-	-	0.038	-	-	✓	$2,913	1	$2,913	$10,000	1	$200	$10,000	$258	$12,913
Objective 4.2: Protect known hibernacula entrances on State DNR lands by implementing a 0.25-mile protective buffer and	Implement a 0.25-mile buffer around known hibernacula entrances	0.010	-	-	-	-	-	-	-	-	-	✓	$972	50	$48,583	-	-	$0	$0	$972	$48,583
	Document that no harvest has occurred unless specifically conducted to benefit bats within the specified protective buffer for annual report	-	-	-	0.077	-	-	-	-	-	-	✓	$6,383	50	$319,142	-	-	$0	$0	$6,383	$319,142

[c] This is not required, but will allow the State DNRs to add value to bats for existing or new hibernacula and associated entrances through additional actions.

Biological Objectives	Potential associated action(s)	Additional Staff Time Needed to Implement the Lake States HCP: Wisconsin FTEs: HCP Administrator	HCP Implementation Team Member	Clerical Worker/ Web Admin	GIS Technician	Community Liaison	Senior Biologist	Forest Assistant Manager	Biologist	Field Supervisor	Field Crew Member	New Commitment	Annual Cost in Year 1	# of Years	Over Permit Term	Direct Costs: Cost per Event	# of actions	Annual Cost in Year 1	Over Permit Term	Total Annual Costs: Wisconsin	Total Over Permit Term: Wisconsin
maintain or enhance habitat in those areas throughout the permit term	Document additional known hibernacula entrances on private forestlands enrolled in the HCP in state database	-	-	-	0.010	-	-	-	-	-	-	✓	$798	50	$39,893	-	-	$0	$0	$798	$39,893
	Document any enhancements to core areas around hibernaculum on State DNR lands and provide a before and after assessment in the annual report	0.019	-	-	-	-	-	-	-	-	-	✓	$1,943	50	$97,166	-	-	$0	$0	$1,943	$97,166
Objective 4.3: Maintain gates on all known entrances to occupied hibernacula on State DNR lands and the lands of willing partners (unless determined to be not needed or detrimental) throughout the permit term.	Assess all known hibernacula entrances on State DNR lands and prioritize gating efforts	-	-	-	-	-	-	-	0.010	-	-	✓	$728	5	$3,641	-	-	$0	$0	$73	$3,641
	Install gates on any non-gated hibernacula entrances where applicable	-	-	-	-	-	-	-	0.019	-	-	✓	$1,456	5	$7,282	$10,000	5	$1,000	$50,000	$1,146	$57,282
	Repair existing gates	-	-	-	-	-	-	-	0.019	-	-	✓	$1,456	20	$29,130	$3,000	20	$1,200	$60,000	$1,783	$89,130
	Survey hibernacula for covered bats	-	0.288	-	-	-	-	-	-	-	-	✓	$29,150	50	$1,457,492	$2,000	50	$2,000	$100,000	$31,150	$1,557,492
Objective 4.4: Promote awareness and understanding of WNS through collaboration with researchers throughout the permit term	Add content to website	-	-	-	-	-	-	-	-	-	-	▤	-	-	-	-	-	-	-	-	-
		-	-	0.010	-	-	-	-	-	-	-	✓	$1,040	1	$1,040	-	-	$0	$0	$21	$1,040
	Establish a regional clearing house and collaborate with USFWS and other entities on research	0.010	-	-	-	-	-	-	-	-	-	✓	$972	1	$972	-	-	$0	$0	$19	$972
	Provide permits (as appropriate) to continue WNS research on State DNR lands	0.019	-	-	-	-	-	-	-	-	-	✓	$1,943	1	$1,943	-	-	$0	$0	$39	$1,943
Objective 5.1: Minimize impacts of prescribed fire on roosting and hibernating bats beginning at permit issuance and continuing throughout the permit term	Update prescribed burn plans to reflect impact minimization criteria by year 5 and continue throughout permit term	-	-	-	-	-	-	-	-	-	-	▤	$0	-	$0	-	-	$0	$0	$0	$0
	Document training of prescribed fire staff on new criteria	0.010	-	-	-	-	-	-	-	-	-	✓	$972	5	$4,858	-	-	$0	$0	$97	$4,858
	Seasonally implement prescribed burn plans on modeled habitat	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0	-	-	$0	$0	$0	$0
Objective 5.2. Minimize impacts on covered bats associated with roads and trails throughout the permit term	Identify and locate areas where seasonal restrictions apply	0.010	-	-	-	-	-	-	-	-	-	✓	$972	50	$48,583	-	-	$0	$0	$972	$48,583
	Communicate seasonal restrictions to relevant DNR staff	0.004	-	-	-	-	-	-	-	-	-	✓	$389	50	$19,433	-	-	$0	$0	$389	$19,433
	Report any road construction on State DNR lands as well as the season and location of activity	0.004	-	-	-	-	-	-	-	-	-	✓	$389	50	$19,433	-	-	$0	$0	$389	$19,433
-	**Total**	1.011	0.288	0.022	0.087	0.000	0.008	0.058	0.183	0.008	0.000	New	$160,980	-	$2,696,751	$39,830	-	$20,918	$425,900	$62,453	$3,122,651
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Total WI Cost**			**$62,453**	**$3,122,651**

FIA = Forest Inventory and Analysis; FTEs = full-time employees (proportion of full-time workload of 1 employee per 1 year); GIS = geographic information system; WNS = white-nose syndrome

7.2.3 Adaptive Management and Changed Circumstances

In addition to costs associated with program administration and the conservation program, the Lake States HCP will also have additional costs associated with the adaptive management program. There may also be costs for remedial actions should any changed circumstances occur. These costs have a high degree of uncertainty because the level of adaptive management and the need for remedial measures is difficult to predict. Because of this uncertainty, these costs are estimated in this HCP as a percentage of the total cost of the conservation program and monitoring.

Chapter 5, Section 5.5, *Adaptive Management,* describes the processes for addressing the specific uncertainties associated with the conservation strategy. Proposed adaptive management measures must be documented in the Lake States HCP so they can subsequently affect changes to the operating conservation program, as needed. The cost of adaptive management measures is calculated as 8% of the cost of each state's HCP conservation program. As noted previously, this cost has a high degree of uncertainty; however, this assumption is consistent with the contingency amount that has been allocated in other HCPs and has been demonstrated to be adequate for these plans in implementation (Santa Clara Valley Habitat Agency 2018; East Contra Costa County Habitat Conservancy 2018).

Chapter 6, Section 6.5.1, *Changed Circumstances,* describes the actions and remedial measures associated with anticipated and possible circumstances that could change during implementation and that may affect the status of the covered species. Remedial measures may also be necessary if foreseeable changes occur that may alter the assumptions or information upon which the Lake States HCP is based (see Chapter 6, *HCP Implementation and Assurances*, for a description of changed circumstances). The cost of remedial measures is calculated as 5% of the cost of the HCP conservation program of each state. This assumption is consistent with the contingency amount that has been allocated in other HCPs and has been demonstrated to be adequate for these plans in implementation (Santa Clara Valley Habitat Agency 2018; East Contra Costa County Habitat Conservancy 2018).

7.2.4 Summary of HCP Implementation Costs

Table 7-7 summarizes the different cost elements and presents the total costs of Lake States HCP implementation. Note that all implementation costs were annualized over the permit term; however, not all implementation activities will occur on an annual basis and, therefore, not all costs will occur on an annual basis. In addition to the costs outlined previously, winter habitat for covered bats will be set aside and primarily managed for bat habitat. While not represented quantitatively in this chapter, these lands are associated with some loss of annual revenue due to the timber harvest restrictions outlined in the Lake States HCP.

Table 7-7. Summary of Lake States HCP Implementation Costs

	Annual Cost in Year 1 [a]			Annual Cost Over Permit Term		
Cost	**Michigan**	**Minnesota**	**Wisconsin**	**Michigan**	**Minnesota**	**Wisconsin**
Program admin. costs	$127,084	$73,038	$79,035	$6,354,192	$3,651,900	$3,951,733
Conservation program	$111,715	$58,892	$62,453	$5,585,725	$2,944,600	$3,122,650
Adaptive management [b]	$8,937	$4,711	$4,996	$446,858	$235,568	$249,812
Changed circumstances [c]	$5,586	$2,945	$3,123	$279,286	$147,230	$156,133
Total Cost Per State	**$253,321**	**$139,586**	**$149,607**	**$12,666,061**	**$6,979,298**	**$7,480,328**
Total Cost of HCP (All States Combined)			**$542,514**			**$27,125,687**

Notes:

[a] All implementation costs were annualized over the permit term; however, not all implementation activities will occur on an annual basis, therefore not all costs will occur on an annual basis.

[b] The cost of adaptive management is calculated as 8% of the cost of the HCP conservation program of each state. This assumption is consistent with the amount that has been allocated in other HCPs and has been demonstrated to be adequate for these plans in implementation (Santa Clara Valley Habitat Agency 2018; East Contra Costa County Habitat Conservancy 2018).

[c] The cost of remedial measures is calculated as 5% of the cost of the HCP conservation program of each state. This assumption is consistent with the contingency amount that has been allocated in other HCPs and has been demonstrated to be adequate for these plans in implementation (Santa Clara Valley Habitat Agency 2018; East Contra Costa County Habitat Conservancy 2018).

7.3 Funding Assurances

The State DNRs are funded through a legislative process and procedures that allow them to spend their money. This section describes the budgeting and appropriations process in each state and the authority given to each DNR to ensure adequate, sufficient, and reliable funding for the duration of the permit term.

7.3.1 Michigan

Michigan DNR had an annual budget of approximately $438 million dollars in fiscal year 2019. Michigan DNR is primarily funded by State Restricted Revenue (68%) through the sale of hunting and fishing licenses; camping and recreation fees; timber sales; watercraft fees; and oil, gas, and minerals revenue. In addition, Michigan DNR receives 11% of its budget through a General Revenue Fund (state taxes). Federal funding (19%) comes from the Pittman-Robertson Act [4] collected from an excise tax on sporting arms and ammunition and the Dingell-Johnson Act from sales of fishing equipment and boats. A small amount of private revenue (7%) comes from grants or reimbursements from private industry and gifts for specific programs or purposes.

[4] With respect to the use of federal funds, DNRs use of these funds is not unfettered or unlimited. For example, grants and license revenues under the Pittman-Robertson Wildlife Restoration Act are strictly regulated. Both the Act and the Service's regulations implementing it stipulate the purposes for which funds and license revenues can be used, and by which state entities (see 16 U.S.C. §§ 777-777n, except § 777e-1 and g-1; and 50 Code of Federal Regulations (CFR) Part 80. Given that misuse of these funds and diversion of license revenue affect each State DNR's eligibility for participation in the Wildlife Restoration Program, the DNRs will coordinate closely with USFWS prior to expending funds on permit implementation.

Michigan DNR spending authority is granted through an annual legislative process with fiscal years beginning October 1. At the beginning of each budgeting cycle, Michigan DNR submits the proposed budgets and spending request for the upcoming integration into the governor's annual budget. The Executive Budget is then reviewed by the joint subcommittees and then the House Appropriations Committee and Senate Appropriations Committee for possible revision and eventual passage by both the Michigan House and the Senate. Part of the Legislature's budgeting responsibilities is authorizing the expenditure of federal funds, including grants and appropriations. When the Legislature is not in session, the Office of the Budget reviews and approves spending authority for any new federal funds.

Because Michigan DNR's funding is not set by state law, and the state constitution mandates a balanced budget, a portion of funding depends on sufficient General Fund revenues. Budget deficits—either due to lower-than-expected revenues or unforeseen increased expenditures in other programs—may require state agencies, including Michigan DNR, to reduce spending to less than what was originally appropriated, thereby maintaining a balanced budget statewide. Conversely, for years in which revenues exceed budget needs, Michigan DNR may request and receive additional funds appropriated from the resulting available discretionary funds.

Michigan DNR cannot guarantee state funds, which are not yet appropriated by the Legislature, for the requirements set forth in the Lake States HCP over its permit term. However, as a commitment of this HCP, Michigan DNR will incorporate in its annual budget request to the Legislature a budget that will be adequate to fulfill its obligations under the Lake States HCP, including all costs associated with the administration of the HCP, implementation of the conservation program, monitoring, reporting, adaptive management, changed circumstances, and all contingency costs. Each year's requests will be adjusted for inflation, including salaries and benefits.

Michigan DNR will provide to USFWS evidence of both 1) its annual budget requests to the Legislature; and, 2) that the Legislature has appropriated sufficient funding to implement the Lake States HCP. In addition, HCP commitments will be reflected in the dedication of staff resources through Michigan DNR's annual budget and documented in the HCP Annual Report. Michigan DNR recognizes that failure to annually ensure adequate funding to implement the Lake States HCP may be grounds for suspension or partial suspension of the incidental take permit until adequate funding is restored.

7.3.2 Minnesota

The Minnesota Legislature enacts and Minnesota DNR implements budgets for a 2-year cycle (a biennium), beginning on July 1 of each odd-numbered year. The budget process begins in even-numbered years, with Minnesota Department of Management and Budget issuing Biennial Budget Instructions to state agencies in early summer. Minnesota DNR had a biennial budget of $1.1 billion in fiscal years 2018–2019. The Minnesota DNR budget is managed across 50 funds with most fiscal activity occurring in four primary funds: General Fund (26%), Game and Fish Fund (20%), Natural Resources Fund (18%), and Outdoor Heritage Fund (15%). Together, these account for 79% of Minnesota DNR spending. Included in these funds are federal grants and funds from the Pittman-Robertson Act and the Dingell-Johnson Act.

Minnesota DNR spending authority is granted through the biennial legislative process with fiscal years beginning July 1 of each odd-numbered year. At the beginning of each budgeting cycle, Minnesota DNR submits the proposed budget and spending request for integration into the governor's proposed budget. The Executive Budget is then reviewed by legislative committees for possible revision and eventual passage by both the Minnesota House and the Senate. Part of the Legislature's budgeting responsibilities is authorizing the expenditure of federal funds, including grants and appropriations. When the Legislature is not in session, the Department of Management and Budget reviews and approves spending authority for any new federal funds.

Because Minnesota DNR's funding is not set by state law, and the state constitution mandates a balanced budget, a portion of funding depends on sufficient General Fund revenues. Budget deficits—either due to lower-than-expected revenues or unforeseen increased expenditures in other programs—may require state agencies, including Minnesota DNR, to reduce spending to less than what was originally appropriated, thereby maintaining a balanced budget statewide. Conversely, for years in which revenues exceed budget needs, Minnesota DNR may request and receive additional funds appropriated by the legislature from the resulting available funds. As a result of state forecasts and other changes, it has become common for the Legislature to enact annual revisions to the state's biennial budget. These revisions are referred to as supplemental budgets.

Minnesota DNR cannot guarantee state funds, which are not yet appropriated by the Legislature, for the requirements set forth in the Lake States HCP over its permit term. However, as a commitment of this HCP, Minnesota DNR will incorporate in its budget request to the Legislature funding that will be adequate to fulfill its obligations under the Lake States HCP, including all costs associated with the administration of the HCP, implementation of the conservation program, monitoring, reporting, adaptive management, changed circumstances, and all contingency costs. Each biennial request will be adjusted for inflation, including salaries and benefits.

Minnesota DNR will provide to USFWS evidence of both 1) its annual budget requests to the Legislature; and, 2) that the Legislature has appropriated sufficient funding to implement the Lake States HCP. In addition, HCP commitments will be reflected in the dedication of staff resources through Minnesota DNR's annual budget, and documented in the HCP Annual Report. Minnesota DNR recognizes that failure to annually ensure adequate funding to implement the Lake States HCP may be grounds for suspension or partial suspension of the incidental take permit until adequate funding is restored.

7.3.3 Wisconsin

Wisconsin DNR also enacts budgets for a 2-year cycle (a biennium), beginning July 1 of each odd-numbered year. Wisconsin DNR had a biennial budget of $1.1 billion for years 2017–2019. Wisconsin DNR is primarily funded by the Conservation Fund (44%), through the sale of hunting and fishing licenses, camping and recreation fees, timber sales, watercraft fees, and other permit revenue. In addition, Wisconsin DNR receives 20% of its budget through General Purpose Revenues (state taxes). Federal funding (15%) comes from the Pittman-Robertson Act collected from an excise tax on sporting arms and ammunition and the Dingell-Johnson Act from sales of fishing equipment and boats. Funds from the Environmental Fund (12%) are generated from tipping fees from the disposal of waste.

Wisconsin DNR spending authority is granted through the biennial legislative process with fiscal years beginning July 1 of each odd-numbered year. Development of the biennial budget involves a nearly year-long process. In the fall of the even-numbered year, Wisconsin DNR submits a budget request to the Department of Administration for the upcoming integration into the governor's budget. The governor's state budget is then reviewed by the Joint Finance Committee for possible revision and eventual passage by both the Wisconsin State Assembly and the Senate. Part of the Legislature’s budgeting responsibilities is authorizing the expenditure of federal funds, including grants and appropriations. When the Legislature is not in session, the State Budget Office reviews and approves spending authority for any new federal funds.

Because Wisconsin DNR’s funding is not set by state law, and the state constitution mandates a balanced budget, a portion of funding depends on sufficient General Purpose revenues. Budget deficits—either due to lower-than-expected revenues or unforeseen increased expenditures in other programs—may require state agencies, including Wisconsin DNR, to reduce spending to less than what was originally appropriated, thereby maintaining a balanced budget statewide. Conversely, for years in which revenues exceed budget needs, Wisconsin DNR may request and receive additional funds appropriated from the resulting available discretionary funds. Once enacted by the Legislature, the budget can be modified in the "off-year" legislative session. As a result of state forecasts and other changes, it has become common for the Legislature to enact annual revisions to the state's biennial budget. These revisions are referred to as supplemental budgets.

Wisconsin DNR cannot guarantee state funds, which are not yet appropriated by the Legislature, for the requirements set forth in the Lake States HCP over its permit term. However, as a commitment of this HCP, Wisconsin DNR will incorporate in its annual budget request to the Legislature a budget that will be adequate to fulfill its obligations under the Lake States HCP, including all costs associated with the administration of the HCP, implementation of the conservation program, monitoring, reporting, adaptive management, changed circumstances, and all contingency costs. Each biennial request will be adjusted for inflation, including salaries and benefits.

Wisconsin DNR will provide to USFWS evidence of both 1) its annual budget requests to the Legislature; and, 2) that the Legislature has appropriated sufficient funding to implement the Lake States HCP. In addition, HCP commitments will be reflected in the dedication of staff resources through Wisconsin DNR’s annual budget and documented in the HCP Annual Report. Wisconsin DNR recognizes that failure to annually ensure adequate funding to implement the Lake States HCP may be grounds for suspension or partial suspension of the incidental take permit until adequate funding is restored.

Chapter 8
Alternatives to Take

8.1 Overview

The federal Endangered Species Act (ESA) requires that applicants for an incidental take permit specify what alternative actions to the take of federally listed species were considered and why those alternatives were not selected. The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration Fisheries Service 2016) identifies two alternatives commonly used in habitat conservation plans (HCPs).

- Any alternative that would reduce take below levels anticipated for the proposed project.
- An alternative that would avoid take and, therefore, not require a permit from U.S. Fish and Wildlife Service (USFWS).

The choice of a preferred alternative represents the best attempt to reduce significant impacts on the four bat species, while allowing the Departments of Natural Resources for Michigan, Minnesota, and Wisconsin (State DNRs) to conduct forest management activities.

In accordance with ESA, this chapter discusses alternatives that were considered but not selected and the reasons those alternatives were not selected for analysis.

8.2 Description of Alternatives

Three alternatives were considered but not selected for analysis in the Lake States Forest Management Bat Habitat Conservation Plan (Lake States HCP): no take, reduced covered activities, and reduced geographic coverage. These alternatives and the rationale for their elimination are discussed below. A comprehensive discussion and evaluation of these, as well as other potential alternatives considered, are also provided in the National Environmental Policy Act analysis for the Lake States HCP, which accompanies this document and will be publicly available with release of the public draft Lake States HCP.

8.2.1 No Take Alternative

Under the no take alternative, the State DNRs would not engage in forest management activities that result in the take of covered species, thereby removing the need for an incidental take permit from USFWS. This alternative was not selected because the State DNRs must continue to adhere to their mandates and missions to manage forests to benefit a variety of organisms, provide economic benefits to citizens, maintain ecosystem services, and provide recreational opportunities for residents in the states of Michigan, Minnesota, and Wisconsin (Chapter 1, Section 1.2, *Purpose*). Specifically, each State DNR's forestry division has a stated vision for how to manage their forests to serve these multiple mandates.

The mission statements for each State DNR's forestry division (or equivalent) are described below.

- **Michigan.** Michigan's state forests provide us with clean air and water, materials for a strong forest products industry, and places to hunt, fish, hike, and camp. We take forest management seriously. That means maintaining our sustainability certification and carefully planning out how we manage Michigan's state forests. These management strategies can include science-based methods such as harvesting trees, prescribed burning, and controlling invasive species (Michigan Department of Natural Resources 2018).
- **Minnesota.** The Division of Forestry protects and manages the trees, woodlands, and forests entrusted to us for the benefit of the people of Minnesota. In support of the DNR's mission, as forest stewards we strive to:
  - Provide our shared expertise to understand, sustain, and manage Minnesota's trees, woodlands, and forests.
  - Provide a sustainable supply of multiple forest resources and opportunities.
  - Protect lives and property from wildfires.
  - Fulfill responsibilities to the permanent school trust (Minnesota Department of Natural Resources 2018).
- **Wisconsin.** The 17.1 million acres of forests that cover nearly half of Wisconsin and the millions of trees in our communities are vital to the quality of life in Wisconsin. Our forests provide a wide range of social, cultural, ecological, and economic benefits we all use every day, from clean air and water to wildlife habitat to outdoor recreational opportunities to hundreds of wood and paper products. The Division of Forestry administers programs that protect and sustain these forested lands throughout the state, combining technical and financial assistance, planning, research, technology, education and policy to help meet the many demands on the forest both today and for many years to come (Wisconsin Department of Natural Resources 2018).

In most cases, these mandates are aligned with the need to protect and improve habitat for covered species. However, in some cases, the State DNRs' mandates to integrate use of the forest through timber harvest and prescribed fire for wildlife, recreation, and economic development can compete or conflict with using forests to maximize benefits for bats. In addition, activities that provide long-term benefits to bat habitat may have direct, short-term impacts on individual bats.

Chapter 2, *Covered Lands and Activities*, identifies the forest management activities that are necessary for the State DNRs to fulfill their mandates. Because these covered activities are necessary, take of Indiana bats, northern long-eared bats, little brown bats, and tricolored bats can be minimized but not entirely avoided. As a result, the no take alternative was rejected.

8.2.2 Reduced Covered Activities Alternative

Under the reduced covered activities alternative, select covered activities with some risk of take would not be covered under the Lake States HCP. While the elimination of these select activities could reduce or delay implementation of some covered activities under this alternative, the majority would continue to occur without significant limitations. The reduced activities considered for the Lake States HCP were road and trail construction, maintenance, and use on State DNR and county lands. Use of roads and trails in the Lake States HCP supports forest management and public use purposes. Construction and road maintenance require tree removal, generally with heavy timber harvest equipment, while trail construction and maintenance are at a much lower intensity. Road and trail maintenance and use have the potential to affect covered species roosting habitat in a manner similar to timber harvest.

This alternative was not selected because road and trail maintenance and use are necessary to the forest management practices covered under the Lake States HCP, so it would not be beneficial to consider these activities separately from forest management practices. Covering these activities under this HCP will lead to a more comprehensive, large-scale conservation strategy that will provide greater conservation benefit to covered bat species.

8.2.3 Reduced Geographic Coverage Alternative

Under this alternative, the State DNRs would only obtain take coverage for activities on land owned and managed by the State DNRs. Incidental take coverage would not be extended to counties, municipalities, or private (including Tribal) landholders in the Lake States.

State DNR forestlands account for approximately 9.2 million acres of covered lands and include state managed forestlands, wildlife or game areas, and parks. County and municipal forestlands account for approximately 5.4 million acres and include forests under county and municipal ownership and other local government lands. Private lands represent the largest acreage of forestlands (approximately 32.7 million acres) but only 12.6 million acres are eligible for enrollment and include large tracts of forestlands owned by corporations, private individuals, nonprofit conservation groups, and private clubs. For more information on the distribution of forestlands and ownership across the Lake States, see Chapter 2, Section 2.2, *Covered Lands Summary.*

Covered activities on county, municipal, and private (including Tribal) forestlands may need to comply with ESA requirements for take of the covered species. Establishing one HCP for the three states and statewide lands streamlines the permit process (one incidental take permit application from each state) and allows additional partners to participate while providing for a landscape-scale approach rather than a project-by-project approach (e.g., at the stand level) to conservation of the covered species.

Extending incidental take coverage to the eligible landowners will almost triple the covered lands (an increase of 17.9 million acres) compared to State DNR lands alone. The reduced geographic coverage alternative was rejected because the conservation strategy in the Lake States HCP offers the following advantages:

- Provides streamlined compliance by considering the impacts of forestry on the covered species at a landscape scale rather than on a project-by-project basis.
- Utilizes a landscape scale approach allows the State DNRs to meet their mandates and missions efficiently (see description of missions under Section 8.2.1, *No Take Alternative*).
- Incorporates a program of comprehensive, large-scale planning and conservation.

This alternative was not selected because, while it would reduce the amount of take associated with covered activities, it would also proportionally reduce the amount of conservation associated with the proposed alternative. Forest management activities on private lands would still occur and may result in take of federally listed species; this would leave individual private landowners to seek their own incidental take authorizations from USFWS as needed to conduct their own forest management activities. Project-by-project permitting would end up as a mosaic of smaller HCPs (potentially hundreds) with potentially less connectivity between the conservation areas. This can lead to a greater effect on covered species. Individual HCPs would not be coordinated between landowners within each state let alone across all three states, meaning covered activities (including implementation), covered species (individual landowners may not address non-listed species), effects analysis, and conservation strategies would all be different. Project-by-project permitting would also increase the financial burden on private landowners who elect to develop their own HCP and increase the USFWS workload in having to process individual permits on a case-by-case basis.

Chapter 9
References

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9.4 Chapter 3

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