

5.1 Introduction

The conservation strategy for the Lake States Habitat Conservation Plan (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 and requirements to streamline compliance with other applicable environmental regulations (see 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 (see 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 Excluded from Take Prohibitions* (U.S. Fish and Wildlife Service 2016b).
- Information on using forestry to manage bat habitat contained in three recent reviews (Guldin et al. 2007; Sheets et al. 2013; 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 (DNRs), and U.S. Fish and Wildlife Service (USFWS) staff.

This chapter is organized into five sections.

- **Section 5.1, *Introduction***, describes chapter content.
- **Section 5.2, *Biological Goals and Objectives***, provides the biological goals and objectives and associated conservation measures that are the foundation of the conservation strategy. This section is organized into four topical areas: forest landscape conservation, site-level

conservation, non-forestry measures for bats, and additional avoidance and minimization measures.

- **Section 5.3, *Offsetting the Effects of the Take***, describes the conservation strategy relative to effects from covered activities.
- **Section 5.4, *Adaptive Management***, describes how the biological objectives and their associated conservation measures will be implemented using an adaptive management approach.
- **Section 5.5, *Monitoring***, describes the long-term monitoring program that will be used to measure progress toward achieving the biological goals and objectives and to inform adaptive management.

5.1.1 Conservation Strategy Overview

The effects analysis (see Chapter 4, *Potential Effects of Covered Activities*) quantifies the amount of take of covered bat habitat absent measures to protect covered bats. 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 associated with covered activities.

Chapter 4 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. These numbers were provided for context and to allow USFWS to evaluate the impact of the taking. Because population numbers are highly unstable over time (due to white-nose syndrome [WNS]), acres rather than numbers of individuals were used to quantify impacts. 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 (see Objective 4.2). During the 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 both 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 some 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. 2013; Silvis and Ford 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 high 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; Sheets et al. 2013b; Weber and Sparks 2013).

Collectively, the sustainable forest management activities practiced by the 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.

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:** 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 an HCP, biological goals are large-scale, guiding principles that tie directly to desired conservation outcomes for the covered species. (See Section 5.2 for additional details).
- **Biological objectives:** Within the context of an HCP, biological objectives, support biological goals. They describe how the biological goals will be accomplished. (See Section 5.2 for additional details).
- **Conservation measures:** Avoidance, minimization, and mitigation measures that implement the biological objectives of this HCP.
- **Enhancement:** The improvement of an existing habitat condition for species.
- **Forestland:** Land where current and past vegetation evidence demonstrates that trees cover (or covered) over 10% of the ground.
- **Leave tree:** A tree left standing for wildlife, seed production, or other purposes, in an area where it might otherwise be felled.
- **Legacy trees:** 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:** Actions meant to offset environmental impacts by compensating for adverse effects.

- **Retention:** Trees that are maintained at the site during regeneration harvest.
- **Seasonal restriction:** A time-of-year restriction on a given activity to avoid or minimize incidental take.
- **Fall/spring habitat:** Modeled habitat is defined in Chapter 3, Table 3-3. High and low-quality habitat is defined in Table 3-2. Fall/spring habitat occurs within 5 miles of known hibernacula. For hibernacula that support more than 10,000 bats, fall/spring habitat occurs within 10 miles of known hibernacula. 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, *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 (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, *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.

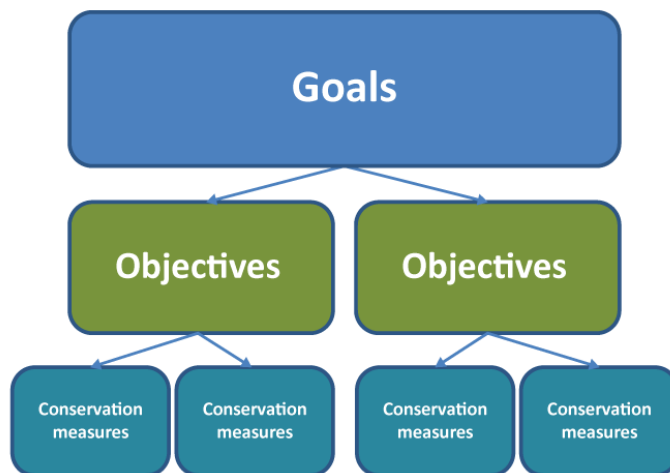
Each objective is designed to meet the following “SMART” criteria outlined in the HCP Handbook.

- Specific
- Measurable
- Achievable
- Result-oriented
- Time-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 this Plan, 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.

Figure 5-1. Relationship between Biological Goals, Objectives, and Conservation Measures



Source: U.S. Fish and Wildlife Service and National Marine Fisheries Service 2016

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, individual bats may be incidentally taken during these forestry operations, even as forest habitat is maintained and enhanced.

Table 5-1. Summary of HCP Biological Goals, Objectives, and Conservation Measures (additional details found in Section 5.2.1 through 5.2.4)

Goal	Objective	Conservation Measures
Biological Goal 1: Maintain a healthy forest on 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.	<ul style="list-style-type: none"> • Sustainably manage existing forestlands as part of the DNR system. • Continue practicing sustainable forestry on 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 in all forest habitat for bats beginning in year 1 and continuing throughout the permit term.	<ul style="list-style-type: none"> • 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 roost trees.	<ul style="list-style-type: none"> • Implement restrictions on harvest and prescribed fire . • Where feasible, protect roost trees when designing harvest plans.
	Objective 2.3: Minimize impacts on roosting Indiana bats by restricting activities around all known roosts	<ul style="list-style-type: none"> • Implement 2.5-mile buffer around known Indiana bat roost trees and captures.
Biological Goal 3: Promote stewardship on private, county, and municipal lands.	Objective 3.1: Increase bat conservation by providing a land enrollment program on private, county, and municipal lands throughout the permit term.	<ul style="list-style-type: none"> • Provide opportunity to private and local forest owners to receive take authorization through the HCP in exchange for improving bat conservation on their lands.^a • Adopt HCP conservation measures on lands (e.g., certain county lands) under the direct authority of the DNRs.
	Objective 3.2: Develop and implement a communication plan for educating the public on covered bats and their conservation.	<ul style="list-style-type: none"> • 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 and associated wintering bats.	Objective 4.1: Remove obstructions at known hibernacula entrances ^a on DNR lands by year 5 and continue throughout the permit term.	<ul style="list-style-type: none"> • 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.
	Objective 4.2: Protect known hibernacula on DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term.	<ul style="list-style-type: none"> • Implement a 0.25-mile buffer around known hibernacula.^b • Geolocate additional known hibernacula on private and local forest lands enrolled in the HCP. • Enhance core areas around the hibernaculum.

Goal	Objective	Conservation Measures
	Objective 4.3: Maintain gates on all known entrances ^b to occupied hibernacula on DNR lands and the lands of willing partners (unless determined to be not needed or detrimental) throughout the permit term.	<ul style="list-style-type: none"> ● Pumping of mines that are known hibernacula to preserve the integrity of the mine. ● Document gated sites. ● Prioritize sites for gating. ● Gate any sites determined to be beneficial. ● Maintain existing and future gates throughout the permit term.
	Objective 4.4: Promote awareness and understanding of WNS through distribution of state-specific WNS response plans and collaboration with researchers throughout the permit term.	<ul style="list-style-type: none"> ● Develop and distribute state-specific WNS response plans through a website or other means accessible to the public. ● Collaborate with USFWS and other entities involved in bat research. ● Establish a regional clearinghouse and develop guidelines for future research requests. ● Continue DNR surveys and technical assistance. ● Provide permits (as appropriate) to continue WNS research on DNR lands.
Biological Goal 5: Avoid and minimize effects from covered activities on covered species.	Objective 5.1: Incorporate criteria within prescribed burn plans that minimize impacts on roosting and hibernating bats by year 5 and continue throughout the permit term.	<ul style="list-style-type: none"> ● Develop prescribed burn plans. ● Seasonally implement prescribed burn plans on modeled habitat.
	Objective 5.2: Minimize impacts on covered bats from tree removal associated with construction of new, permanent roads and trails throughout the permit term.	<ul style="list-style-type: none"> ● Seasonally restrict road and trail construction in modeled habitat.

Notes:

^a See Chapter 6, Section 6.2, and Appendix F, *Landowner Enrollment Program*, for more information on the Lake States' HCP Landowner Participation Program.

^b There are 25 known hibernacula on DNR lands, but some hibernacula have multiple entrances. Current records document 30 hibernacula entrances on DNR lands (distributional data provided for Chapter 3, reviewed by the 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

The Michigan, Minnesota, and Wisconsin DNRs own, manage, and/or administer more than 9.2 million acres of forestland (Chapter 2, *Covered Lands and Activities*, 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 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 land cover 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 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.

Beyond working forestlands, each of the DNRs, according to their statutory authority, manages some forestlands for non-timber values. This includes lands 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.

Together these non-timber management areas represent a significant portion of the landscape. 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. 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.

5.2.1.1 Biological Goal 1: Maintain a healthy forest on 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. 2013; Silvis et al. 2016).

The following objective will be implemented to promote healthy forest on 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. 2013; 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 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 (Table 1-1). 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 this plan 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 DNR lands, and to avoid conversion of forestlands to non-natural land uses.

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.

¹ These acres have been and will be measured using Forest Inventory and Analysis (FIA) data as described in Chapter 3.

² The FIA data used in Chapter 1, Table 1-1, reports 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 non-forestland and also lands that FIA data analysts do not report as being managed as forestland by the State of Minnesota.

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 and all county lands. Collectively, tree-retention guidelines focus on retaining snags (dead standing trees), trees with cavities (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.

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).

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](http://mn.gov/frc/documents/council/site-level/MFRC_Revised%20Forest%20Management%20Guidelines%20(2012).pdf).

Wisconsin: <https://dnr.wi.gov/files/pdf/pubs/fr/FR0093.pdf>.

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 E, *Attributes of High-Quality Bat Habitat in Managed Lake State Forests*. Table 5-3 displays 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 this HCP to be harm (i.e., take) as defined by the ESA.

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 quickly and provide high-quality roosts. This is often tied to the following factors: <ul style="list-style-type: none"> • 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.
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.
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	<p>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.</p> <p>Other roosts: Occasionally in cracks in trees, in bat boxes or other artificial roosts that resemble sloughing bark.</p> <p>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.</p>
Northern long-eared bat	<p>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.</p>

Bat Species	Roosting and Foraging Habitat
	<p>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.</p> <p>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.</p>
<p>Little brown bat</p>	<p>Typical roosts: Anthropogenic structures, including attics of buildings, expansion cracks of bridges, and bat boxes.</p> <p>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.</p> <p>Typical foraging habitat: Associated with wetlands and waterways, although bats also use forest edges and clear cuts in heavily forested landscapes.</p>
<p>Tricolored bat</p>	<p>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.</p> <p>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.</p> <p>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.</p>

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 states have given considerable attention to retention of live trees and have provisions in state guidelines to create snags and 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.

The following are examples of current retention guidelines for the three states. Retention guidelines apply to all harvest types (regeneration, intermediate, and salvage harvests). Regeneration harvest is 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 (see Chapter 2, Section 2.1.3.2, *Harvest Types*).

- **Snags:** Snags shall be protected and left standing unless they are a safety hazard (Minnesota and Michigan). In Wisconsin, DNR guidelines require retention of more than three snags per acre. When applicable, larger snags (from more than 10 inches to more than 18 inches dbh) are preferred over smaller ones (Minnesota).
- **Leave Trees:** On a stand basis, retain aggregations of leave trees, which are generally preferred over a scattered distribution. Aggregations of leave trees per state guidelines are typically configured based on stand area (3 to 15%) (5% in Minnesota), crown cover (5 to 15% in Wisconsin), and/or basal area (3 to 10% in Michigan).
- **Cavity Trees:** Retain multiple cavity trees (more than three per acre in Michigan and Wisconsin). As a part of the leave tree guidelines, retain a minimum of 6 cavity/ potential cavity trees per acre or 5% of the total harvest area in patches. Choose leave trees based on tree species, longevity, wind firmness, and cavity potential (Minnesota).
- **Legacy Trees:** Recruit approximately three or more (when available or applicable) hard and/or soft mast trees and legacy trees per acre (Michigan; density target not specified in Minnesota). Retain legacy trees when available. Larger trees (from more than 10 inches to more than 26 inches dbh) are preferred over smaller ones (Minnesota).

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 DNR lands and any other lands enrolled in the HCP. The specific retention guidelines for each state can be found on the DNR website.⁴ 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) 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)⁵. Tables 5-2 and 5-4 and Appendix E, *Attributes of High-Quality Bat Habitat in Managed Lake State Forests*, provide additional direction for implementing retention guidelines at the state level. 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 roosts 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 E. The 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

⁴ Michigan Department of Natural Resources. 2012. Within-Stand Retention Guidance. Available: https://www.michigan.gov/documents/dnr/WithinStandRetentionGuidelines-IC4110_175766_7.pdf;

Wisconsin Department of Natural Resources. 2012. Silviculture Handbook, 24315.24, Chapter 24 (dated November 2012). Available: <https://dnr.wi.gov/topic/ForestManagement/silviculture.html>;

Minnesota Forest Resources Council. 2013. Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers. Minnesota Forest Resources Council, St. Paul, Minnesota. Available: <https://www.minnesotaforests.com/forest-management>

⁵ Where states allow variances from their guidelines they can continue to do that.

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 HCP commits the 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 roost trees

As of publication of the Lake States HCP, the 4(d) rule for northern long-eared bats protects known roosts for this species during the summer. Consistent with this rule, no tree-cutting or prescribed fires are allowed within 150-feet (an area of approximately 1.6 acres) of a known and occupied⁶ maternity roost tree during the pup season (June 1 to July 31). This objective extends the same 4(d) rule protections to known roost trees year-round and for all covered bat species (Table 5-4).

In year 1, the DNRs will geolocate⁷ known maternity roost trees in each state on DNR lands. Any private landowners enrolled in the HCP through the Landowner Enrollment Program will also geolocate known maternity roost trees on all enrolled lands within 5 years of enrollment. When a private landowner enrolls in the HCP conservation program through the LEP, and is planning a forest management activity, the DNR will provide the landowner with the location of any maternity roost trees, hibernacula or protective buffers that may intersect with the activity. This measure does not include any obligation to identify new roost trees on DNR or other nonfederal lands through surveys, although new roost trees that are identified through other bat survey efforts will be incorporated into the objective.

⁶ Maternity roosts are considered occupied for a period of 5 years or until the roost is no longer present (e.g., roost tree falls down and is determined to be no longer useable by covered bats). After 5 years, absence of the target bat species is demonstrated by both an emergence count at the roost tree (if a specific tree is known) and a survey for bats in accordance with current USFWS guidelines, as supplemented by the DNRs.

⁷ In this HCP, *geolocate* means to determine 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; other methods will need to be used to confirm the presence of a known roost before it is mapped.

Table 5-4. Distribution of Known Summer Roost Trees for All Covered Bats by State and by Land Ownership Type^a

State	Federal	DNR	Other Noncorporate ^b	County/Municipal	Private	Total
Michigan	36	2	1	0	56	95
Minnesota	115	171	36	0	113	435
Wisconsin	13	84	2	1	59	159
Total ^{c,d}	164	257	39	1	228	689

Notes:

^a Data sources: Michigan (e-mail from M. Rable 12/2/2019), Minnesota (table attached to e-mail from R. Baker 10/25/2019), Wisconsin (email from Sarah Herrick 10/31/2018). This table excludes known artificial roost trees.

^b 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.

^c Does not account for locational uncertainty (i.e., GPS error).

^d Column for roost trees in federal ownership was included in total to provide context. Lands under federal ownership are not covered by this HCP.

Each known roost will include the surrounding 150-foot (1.6-acre) circle avoidance area, which will serve as a disturbance buffer between the roost and activities that would otherwise adversely affect the roost.

The DNRs commit to this level of protection for all known roost trees on DNR lands and on private forest lands enrolled in the HCP through the Landowner Enrollment Program. Protections of known roost trees on private, county, and municipal lands will be incorporated as these lands are included for coverage. New roost trees will be incorporated into this objective as they are discovered and geolocated. Roost trees will be removed from this objective if they fall or are severely damaged due to wildfire, windthrow, disease, or other natural events. See Section 5.4.4, *Addition and Subtraction of Known Roosts*, for details.

The commitment for this measure is the year-round protection of all known roost trees on DNR lands and lands enrolled in the HCP, including a 150-foot buffer around the known roost tree.

Conservation Measures. The conservation measures associated with this objective are identification of known roost trees, and year-round protection of known roost trees within the buffer on DNR-administered lands and private and local forest lands enrolled in the HCP.

Objective 2.3: Minimize impacts on roosting Indiana bats by restricting activities around all known 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, some impacts on potential Indiana bat roost trees may still occur under these objectives. 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.⁸

⁸ In the Lake States, Indiana bats are only known to occur in Michigan (see Chapter 3, Section 3.2.5.2, *Indiana Bat (Myotis sodalis)*).

To minimize the potential to affect known Indiana bat roosts, tree-cutting and prescribed fire will be restricted within a 2.5-mile buffer of suitable Indiana bat roosts (dead or dying trees or trees with loose bark ≥ 12 inches dbh) during the pup season (June 1 to July 31). This objective applies to both known roosts (locations of known roost trees) and known capture locations (absent roosting data).

Conservation Measures. The conservation measures for this objective is the implementation of a 2.5-mile buffer around known roosts and capture locations for Indiana bats.

5.2.2.2 Biological Goal 3: Promote stewardship on private, county, and municipal lands

Most forests across the plan area are in county, municipal, and private ownership. The 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 DNRs to promote forested landscapes (with a focus on managed forests) on these county, municipal, and private lands. The Lake States HCP will accomplish this by allowing eligible county, municipal, and private forest owners 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 a land enrollment program in private, county, and municipal lands throughout the permit term

The Lake States HCP provides a vehicle by which the conservation measures developed for DNR lands are extended to eligible nonfederal landowners who choose to enroll in the plan. Eligible nonfederal landowners can enroll in the HCP through the Landowner Enrollment Program and receive take coverage along with their commitment to implement relevant conservation actions. This program is described in detail in Appendix F, *Landowner Enrollment Program*.

The commitment for this objective is the development of a program for enrolling other nonfederal lands into the HCP and the administration of that program.

Conservation Measures. The conservation measures associated with this objective are the implementation and management of the Landowner Enrollment Program and the adoption of Lake States HCP conservation actions for lands under the direct authority of the DNRs and on any other lands enrolled in the HCP through the Landowner Enrollment Program.

Objective 3.2: Develop and implement a communication plan to educate 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 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/or other methods of delivery, including public meetings and speaking engagements. For example, DNRs may exhibit and provide outreach materials at public events such as the Great Lakes Bat Festival and state fairs held each year. The DNRs will also coordinate efforts with other outreach programs to maximize program reach and effectiveness. These outreach programs will be developed and implemented within two 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 an implementation 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 Non-forestry Measures for Bats

While the Lake States HCP is focused on minimizing the impact of forest management activities on covered bats, non-forestry 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 and associated wintering bats

Each covered bat species spends winter in underground hibernacula. These hibernacula also 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 to feed in preparation for and recovery from hibernation. Finally, some bats visit hibernacula throughout summer (Mumford and Whitaker 1975; Caire et al. 1979; LaVal and LaVal 1980; Whitaker and Rissler 1992; Whitaker and Brack Jr. 2002). As such, hibernacula represent a crucial habitat element and are a focus of this biological goal. All currently known and any new hibernacula identified during the permit term will be protected by the following objectives (see also Section 5.4.3, *Addition and Subtraction of Hibernacula*).

Objective 4.1: Remove obstructions at known hibernacula entrances on 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 openings, altering airflow into the hibernaculum, affecting winter temperature regimes and humidity, and thereby affecting the suitability of the hibernaculum for over-wintering bats. In addition, altered entrances can divert water and/or debris into the hibernaculum, which can lead to flooding or make some areas of the hibernaculum 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 hibernaculum entrances (25 hibernacula total) that are known or are thought to exist on DNR lands. Newly discovered hibernacula will be protected by this measure if discovered. Each hibernaculum will be checked for obstructions at least once in year 1 or year 2. Debris checks will occur at each hibernaculum at least every 5 years. Obstructions that may negatively impact access or conditions within the cave will be removed⁹. This conservation measure does not apply to lands covered under the Landowner Participation Program; however, DNRs will outreach to landowners regarding the benefits of maintaining hibernacula entrances. Funding may be coordinated by the DNRs.

The commitment for this objective is to remove debris, vegetation, and other obstructions from known hibernacula entrances throughout the permit term.

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 on 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 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 is contained in several regulatory documents including the

⁹ In Michigan, the Michigan DNR must work with County Mine Safety Inspectors in order to remove obstructions to hibernacula entrances.

programmatic biological opinions for the current 4(d) rule¹⁰ for the northern long-eared bat (U.S. Fish and Wildlife Service 2016b) and for forest removal in Kentucky and Tennessee (U.S. Fish and Wildlife Service 2015; U.S. Fish and Wildlife Service 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.
- 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) 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 hibernacula¹¹.
- Protect known roost trees within the core area and near the hibernaculum entrance.

Most hibernacula 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 should be protected and enhanced (Johnson and King 2018). In year 1, the DNRs will geolocate known hibernacula entrances on DNR lands (Table 5-5). As county, municipal, and private lands incorporate measures from the Lake States HCP, the DNRs in each state will work with appropriate entities to identify and inform property owners within a 0.25-mile buffer and to geolocate hibernacula entrances on county, municipal, and private lands enrolled in the HCP. 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 (unused) as described in Section 5.4.3.

¹⁰ 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 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 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).

¹¹ These restrictions do not apply to low-intensity management activities such as road grading, snow plowing, or 1-day road maintenance activities.

Table 5-5. Number of Hibernacula Entrances in Each State Overall and on DNR Lands

State	Total Entrances	Entrances on DNR Lands
Michigan	111	10
Minnesota	53 ^a	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 under both DNR and private lands.

Source: Michigan (e-mail from J. DePue 12/2/2019), Minnesota (table attached to e-mail from R. Baker 10/25/2019), Wisconsin (email from Sarah Herrick 10/31/2018).

In addition, some caves, mines, or other subterranean habitats may benefit from enhancement. A narrow range of climate and microenvironmental variables makes hibernacula suitable for winter use by bats. High-quality hibernacula have areas with stable, predictable temperatures of 40 to 50°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 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 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 on lands covered by the HCP.

Conservation Measures. The conservation measures associated with this objective are the designation of a 0.25-mile buffer around known hibernacula; the identification of additional known hibernacula as county, municipal, and private lands adopt conservation measures associated with the Lake States HCP; harvest and noise restrictions within the buffer; pumping of mines that are known hibernacula to preserve the integrity of the mine; and the possible enhancement of core areas around the hibernaculum.

Objective 4.3: Maintain gates on all known entrances to occupied hibernacula on 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 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.

Modern gates are typically built of angle iron and designed to allow bats and air to pass with limited obstruction. Further, 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 known to have been used by one of the covered species within the past 10 years. For hibernacula 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 33 known hibernacula entrances on DNR lands by year 25. 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.

As noted, not all hibernacula are suitable for gating. For example, only two of the five entrances to Soudan Mine, Minnesota, are accessible enough to warrant gating. The 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 3 years of the permit, the DNRs will complete an assessment of all known hibernacula on DNR lands. This assessment will provide the following data.
 - Information about current condition of hibernacula on 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 DNR lands.
 - A list of sites where additional data is needed to determine if a gate is appropriate.

Data provided by the DNRs indicate that as of January 2020, the DNRs maintain 18 gates on their lands (3 in Michigan, 9 in Minnesota, and 6 in Wisconsin) on lands they own and manage. The DNRs also maintain 26 additional gates on lands owned by cooperating landowners (11 in Michigan, 2 in Minnesota, and 13 in Wisconsin). Although several of these gates were purchased and installed with a mix of state, private, and federal funds, maintenance of the gates is primarily a DNR function. As noted in Objective 4.1, entrances to hibernacula 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 as part of Objective 4.3, but DNRs will communicate with landowners regarding the benefits of gating. Technical assistance and access to funding may be provided by the DNRs.

As appropriate, the 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 DNR lands, and to assist landowners with suitable hibernacula on their lands.

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 distribution of state-specific WNS response plans and 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.

Michigan and Wisconsin DNRs have developed WNS response plans (Michigan Department of Natural Resources and Environment 2010; Wisconsin Department of Natural Resources 2011) that include implementation of U.S. national WNS decontamination guidelines, which can also be reached via the Minnesota DNR's website (<https://www.dnr.state.mn.us/wns/index.html>). These plans guide the response of the DNRs to WNS and provide a publicly available resource for other interested parties. Both Michigan and Wisconsin have publicly available decontamination guidelines.¹² All three states will work with USFWS to develop and/or ensure availability of the most recent edition of the WNS response plans or any replacement that becomes available during the permit term. A regional clearinghouse will be set up to disseminate bat information and research findings applicable to land managers.

¹² Michigan WNS decontamination guidelines: <https://www.whitenosesyndrome.org/state-response-plans>.
Wisconsin WNS decontamination guidelines: https://dnr.wi.gov/topic/WildlifeHabitat/documents/WNS_DeconProtocols.pdf

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 are the development (if none currently exist) and distribution of state-specific WNS response plans and continued collaboration with WNS researchers on DNR lands.

Conservation Measures. The conservation measures associated with this objective are the development and distribution of response plans through a website or other means accessible to the public, collaboration with USFWS and other entities involved in bat research, establishment of a regional clearinghouse and development of guidelines for future research requests, continuation of DNR surveys and technical assistance, and provision of permits (as appropriate) to continue WNS research on 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, 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: Incorporate criteria within prescribed burn plans that minimize impacts on roosting and hibernating bats by year 5 and continue 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 its responsiveness to threats, such as fire. Relative to summer, bats concentrate in higher densities (near hibernacula) during fall and spring. This objective requires minimization measures in high-quality fall/spring habitat during the fall and spring¹³ and within 1 mile of any known roost tree during the pup season DNRs will incorporate into a burn plan the following minimization measures.

- To avoid killing or injuring bats, reduce fire intensity and flame length so that the critical plume temperature at which bats could be injured (140 degrees Fahrenheit [°F]) does not reach roost height (at least 15 feet above the ground) in known roost trees or within hibernaculum buffers during pup season (June 1–July 31) wherever possible .

¹³ High-quality modeled habitat is defined in Chapter 3, Table 3-2.

- To avoid killing or disturbing bats within the hibernacula, ensure wind will carry smoke away from the entrance(s) of the hibernacula.

Conservation Measures. The conservation measures associated with this objective are the development of prescribed burn plans and the seasonal implementation of these burn plans on modeled habitat. This objective applies to high-quality modeled habitat during the season when bats are likely to be present, for example, burning in high-quality fall/spring habitat during the fall and spring.

Objective 5.2: Minimize impacts on covered bats from tree removal associated with construction of new, permanent roads and trails throughout the permit term

In addition to the temporary access routes associated with timber harvest, this HCP covers construction and use of permanent roads for motorized travel and permanent trails for nonmotorized travel. Department of Transportation (DOT) roads and roads on private lands are not addressed in this HCP. See Chapter 2, Section 2.1.4, *Roads and Trails Construction, Maintenance, and Use*, for additional detail on covered roads). Tree removal for road and trail construction can be completed at any time of year except when the proposed road/trail intersects an area where bats are likely to be present. In these cases, the DNRs will adhere to the following clearing windows to avoid and minimize impacts associated with felling an occupied roost tree:

- Remove trees from October 1 to March 1 within 150 feet of a known maternity roost.
- Remove trees from October 15 to March 31 or from May 15 to August 15 within 2.5 miles¹⁴ of a known hibernaculum.

Other road and trail activities may be completed at any time of year because the goal is to avoid taking an occupied roost tree. Unlike timber harvest, road and trail construction require seasonal restrictions because retention guidelines do not apply to road and trail construction. Hazard tree removal that is needed for public safety may occur year-round.

The commitment for this objective is the restriction of road construction activities near roosts or hibernacula during times of year when bats are likely to be present.

Conservation Measures. The conservation measures associated with this objective are the identification of areas near known roosts or hibernacula during times when bats are likely to be present on a map and 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.

The estimated annual impact of covered activities on individual covered bats derived from the analysis in Chapter 4 is presented in Table 5-6. As discussed in Chapter 4, these affected acres

¹⁴ According to analysis of the roosting data contained in Lowe (2012) this 2.5-mile buffer would protect 50% of roosting northern long-eared bats and approximately 70% of little brown bats. The other covered species are expected to be protected at similar levels.

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 roosts, hollow trees, and snags retained from clear cuts 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 clear cut in an aspen/birch forests retain 10% of snags; clear cuts 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. Coordination with the prescribed fire practitioners in the DNRs indicated that 95% of potential roosts (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 roosts 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 roosts avoided was used to reduce the level of impact. Table 5-6 below 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 to 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 5-6. Take Minimized through Implementation of HCP Avoidance Measures^a

Species	Bats/Year				
	A	B	C	D (B plus C)	E (A minus D)
	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	NA	NA	NA	NA	NA
Wisconsin	NA	NA	NA	NA	NA
<i>Total Indiana Bats</i>	0.04	0.01	< 0.01	0.01	0.03
Northern Long-Eared Bats					
Michigan	1.97	0.54	0.03	0.57	1.39
Minnesota	0.69	0.17	0.03	0.19	0.49
Wisconsin	0.36	0.09	0.01	0.10	0.26
<i>Total Northern Long-Eared Bats</i>	3.01	0.80	0.07	0.87	2.15
Tricolored Bats					
Michigan	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Minnesota	0.02	< 0.01	< 0.01	< 0.01	0.01
Wisconsin	0.06	0.01	< 0.01	0.01	0.04
<i>Total Tricolored Bats</i>	0.08	0.02	< 0.01	0.02	0.06
Little Brown Bats					
Michigan	7.64	2.11	0.12	2.23	5.41
Minnesota	1.36	0.34	0.06	0.40	0.96
Wisconsin	5.55	1.38	0.19	1.57	3.98
<i>Total Little Brown Bats</i>	14.55	3.83	0.37	4.20	10.36

Notes:

^a This table 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 Offsets through Conservation Strategies*.

^b Summarized in Chapter 4, Table 4-26.

^c See Section 5.2.2.1, Objective 2.1.

^d See Section 5.2.4.1, Objective 5.1.

5.3.2 Take Offset through Conservation Strategy

As outlined in Table 5-6, 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 roosts are expected to increase fecundity and survival of covered bats, especially in cases where roosts are limiting (Sparks et al. 2009) or where bats are recovering from WNS infections (Wilcox and Willis 2016). Similarly, restoration and protection of hibernacula can lead to dramatic increases in population (Johnson et al. 2002; Kath 2002a; Kath 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 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.

The remaining take described in Table 5-6 is offset through other conservation measures included as part of this conservation strategy (Table 5-7).

Table 5-7. Biological Objectives Targeted at Offsetting Remaining Take

Species	Estimated Take After Implementation of HCP Biological Objectives for Avoidance and Minimization (Bats/Year) ^a	Biological Objectives Targeted to Offset Remaining Take
Michigan		
Indiana Bats	0.04	<ul style="list-style-type: none"> • 4.2 million acres of DNR forestlands conserved and managed as DNR lands, including 339,818 acres of summer habitat for Indiana bat.^b • 13,360 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 22,204 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Seasonal avoidance of summer roosts within 2.5 miles of all known roosts and capture locations for which no roost was found all but eliminating the potential for take. • Protective (year-round) buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.
Northern Long-Eared Bats	1.63	<ul style="list-style-type: none"> • 4.2 million acres of DNR forestlands conserved and managed as DNR lands, including 512 acres of winter habitat, 204,473 acres of fall/spring habitat and 4.2 million acres of summer habitat for northern long-eared bats.^b • 64,000 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures)for bats on DNR lands.^c • Additional estimated 111,1878 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 10 known hibernacula entrances on DNR lands.^e • Continued maintenance of 14 cave gates including 3 on DNR lands that contain approximately 253 northern long-eared bats. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.

Species	Estimated Take After Implementation of HCP Biological Objectives for Avoidance and Minimization (Bats/Year) ^a	Biological Objectives Targeted to Offset Remaining Take
Tricolored Bats	<0.01	<ul style="list-style-type: none"> • 4.2 million acres of DNR forestlands conserved and managed as DNR lands, including 172 acres of winter habitat, 51,966 acres of fall/spring habitat and 1,112,076 acres of summer habitat for tricolored bats.^b • 39,033 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 68,916 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 10 known hibernacula entrances on DNR lands.^e • Continued maintenance of 14 cave gates including 3 on DNR lands that contain approximately 1 tricolored bat. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.
Little Brown Bats	6.33	<ul style="list-style-type: none"> • 4.2 million acres of DNR forestlands conserved and managed as DNR lands, including 494 acres of winter habitat, 201,231 acres of fall/spring habitat and 4.2 million acres of summer habitat for little brown bats.^b • 64,000 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 111,187 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 10 known hibernacula entrances on DNR lands.^e • Continued maintenance of 14 cave gates including 3 on DNR lands that contain approximately 12,922 little brown bats. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.

Species	Estimated Take After Implementation of HCP Biological Objectives for Avoidance and Minimization (Bats/Year) ^a	Biological Objectives Targeted to Offset Remaining Take
Minnesota		
Northern Long-Eared Bats	0.79	<ul style="list-style-type: none"> • 3.8 million acres of DNR forestlands conserved and managed as DNR lands, including 184 acres of winter habitat, 57,490 acres of fall/spring habitat and 3.8 million acres of summer habitat for northern long-eared bats.^b • 49,500 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 88,785 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 11 known hibernacula entrances on DNR lands.^e • Continued maintenance of 11 cave gates including 9 on DNR lands that contain approximately 3 northern long-eared bats in those sites. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.
Tricolored Bats	0.01	<ul style="list-style-type: none"> • 3.8 million acres of DNR forestlands conserved and managed as DNR lands, including 268 acres of winter habitat, 36,227 acres of fall/spring habitat and 628,957 acres of summer habitat for tricolored bats.^b • 31,354 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 57,281 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 11 known hibernacula entrances on DNR lands.^e • Continued maintenance of 11 cave gates including 9 on DNR lands that contain approximately 24 tricolored bats. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.

Species	Estimated Take After Implementation of HCP Biological Objectives for Avoidance and Minimization (Bats/Year) ^a	Biological Objectives Targeted to Offset Remaining Take
Little Brown Bats	1.55	<ul style="list-style-type: none"> • 3.8 million acres of DNR forestlands conserved and managed as DNR lands, including 235 acres of winter habitat, 57,913 acres of fall/spring habitat and 3.8 million acres of summer habitat for little brown bats.^b • 49,500 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 88,785 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 11 known hibernacula entrances on DNR lands.^e • Continued maintenance of 11 cave gates including 9 on DNR lands that contain approximately 1,535 little brown bats. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.
Wisconsin		
Northern Long-Eared Bats	0.31	<ul style="list-style-type: none"> • 1.2 million acres of DNR forestlands conserved and managed as DNR lands, including 585 acres of winter habitat, 64,389 acres of fall/spring habitat and 1.2 million acres of summer habitat for northern long-eared bats.^b • 20,000 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 142,883 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 12 known hibernacula entrances on DNR lands.^e • Continued maintenance of 19 cave gates including 6 on DNR lands that contain approximately 5 northern long-eared bats. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.

Species	Estimated Take After Implementation of HCP Biological Objectives for Avoidance and Minimization (Bats/Year) ^a	Biological Objectives Targeted to Offset Remaining Take
Tricolored Bats	0.05	<ul style="list-style-type: none"> • 1.2 million acres of DNR forestlands conserved and managed as DNR lands, including 193 acres of winter habitat, 46,050 acres of fall/spring habitat and 51,966 acres of summer habitat for tricolored bats.^b • 9,080 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 66,027 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 12 known hibernacula entrances on DNR lands.^e • Continued maintenance of 19 cave gates including 6 on DNR lands that contain approximately 31 tricolored bats. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.
Little Brown Bats	4.78	<ul style="list-style-type: none"> • 1.2 million acres of DNR forestlands conserved and managed as DNR lands, including 572 acres of winter habitat, 69,831 acres of fall/spring habitat and 1.2 million acres of summer habitat for little brown bats.^b • 20,000 acres per year of habitat managed (e.g., through forest management with retention and implementation of all conservation measures) for bats on DNR lands.^c • Additional estimated 142,883 acres per year of habitat managed for bats on lands covered by the Land Enrollment Program.^d • Protection and enhancement of 12 known hibernacula entrances on DNR lands.^e • Continued maintenance of 19 cave gates including 6 on DNR lands that contain approximately 78 little brown bats. • Protective buffers of 150 feet (1.6 acres) around known maternity roosts. • WNS response plan and collaboration. • Outreach and education to private and municipal landowners.

^a Estimated Take After Implementation of HCP avoidance and minimization measures was calculated in Table 5-6.

^b Acres of seasonal habitat on DNR lands for each species can be provided in Chapter 3, Tables 3-8, 3-12, and 3-16.

^c Acres of low-quality and high-quality habitat under forest management are provided in Chapter 4, Tables 4-1 through 4-4, 4-10 through 4-12, and 4-17 through 4-19.

^d The Landowner Enrollment Program Conservation actions are described in Appendix F. Landowner enrollment programs encourage sustainable forest management with retention, which is anticipated to improve bat habitat over the long term by maintaining forested habitat, the preservation and creation of potential roost trees, and potential improvement to foraging habitat. Acres of low-quality and high-quality habitat in private, county, and municipal lands are provided in Chapter 4, Tables 4-1 through 4-4, 4-10 through 4-12, and 4-17 through 4-19.

^e Known hibernacula entrances on DNR lands quantified in Table 5-5.

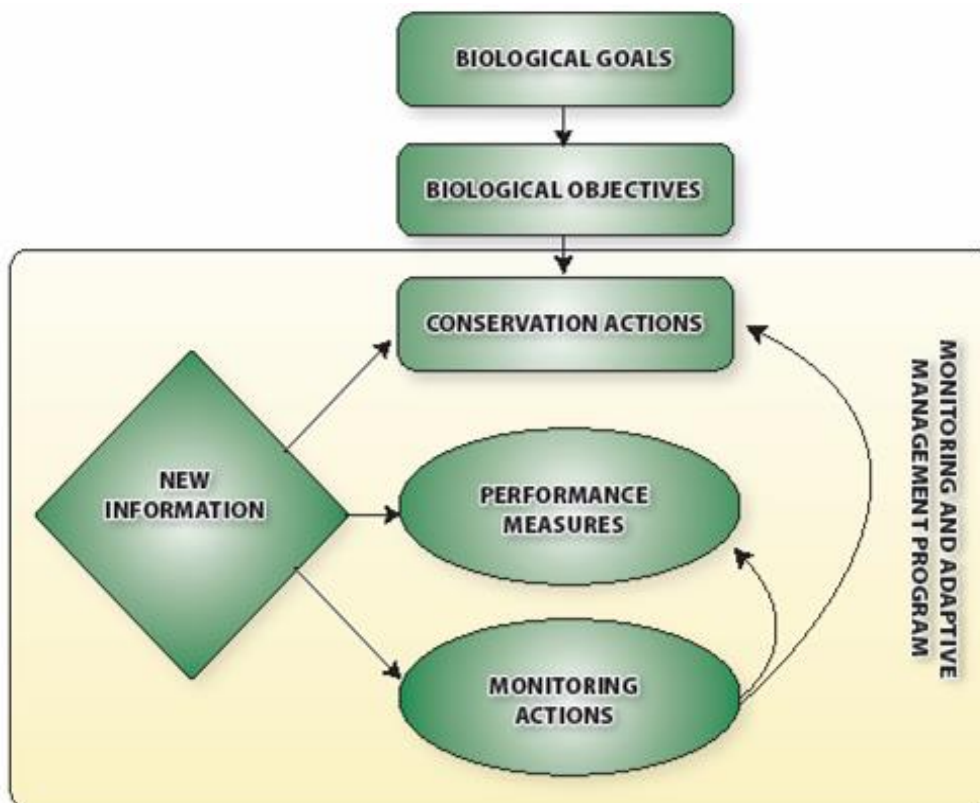
5.4 Adaptive Management

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 within 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 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 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 (81 *Federal Register* [FR] 93702). Figure 5-2 shows the overall model of adaptive management.

Figure 5-2. Adaptive Management Concept Model



The Lake States HCP incorporates the concepts of passive and active adaptive management advocated and defined by USFWS for implementing HCPs (65 FR 35250–35257). Through passive adaptive management, 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 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 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 shows a decline in bat abundance that is not well understood. In these cases, the DNRs will work with USFWS to resolve these uncertainties.

5.4.1 White-Nose Syndrome

As indicated in Chapter 3, 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.

The DNRs will take the following actions to respond to WNS declines.

- 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, active maternity colonies, and known roosting areas.
- Although no known large-scale means of treating bats infected with WNS is known, the 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.
- Should any of the covered species begin to recover from WNS, the DNRs will ensure that existing conservation measures are prioritized to support that recovery.
- Should covered bats become isolated in only a few locations in the Lake States, the DNRs will work with USFWS to determine if it may be necessary to shift existing protective measures to target these populations.

5.4.2 Climate Change Leading to Shifts in Distribution

The primary effect of climate change on the conservation strategy is 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 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. 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 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 twenty-first century. Such a shift in habitat could allow Indiana bats to begin using hibernacula 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 for 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 were previously rare (Kurta 2008). Once again, a warming climate and with 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.

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. The DNRs will respond to changes in distribution, from climate change or other factors, by adding protections to new hibernacula and roosts, as outlined in Sections 5.4.3 and 5.4.4.

5.4.3 Addition and Subtraction of Hibernacula

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 is discovered on DNR lands, the DNR will incorporate these sites as managed resources under this HCP and will apply any relevant conservation objectives or measures.

If a new hibernaculum (a location where one or more live bats are found hibernating) is discovered on enrolled non-DNR 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 HCP. County, municipal, 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 DNRs to identify property owners of enrolled lands (e.g., the certificate of inclusion reflecting participation in the Landowner Participation Program will follow the deed when properties are sold) and to ensure

that property owners have time to receive the notification and to understand and implement the changes.

The WNS threat makes it all but certain that bats will also cease to be found within some hibernacula 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 and/or a survey for bats in the area (refer to U.S. Fish and Wildlife Service 2018). If no covered bats are detected for five consecutive years, the site will be considered unoccupied for the purposes of this HCP. Historic sites 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.

5.4.4 Addition and Subtraction of Known Roosts

The discovery of new summer roosts, including maternity colonies, is also likely to continue across the Lake States. Similar to the procedures described for hibernacula above, if a new roost is discovered on DNR lands, the DNR will incorporate these sites as managed resources under this HCP and will apply any relevant conservation objectives or measures.

If a new roost is discovered on enrolled non-DNR lands, the DNRs will follow the same procedures described above for hibernacula to enroll and implement changes on non-DNR lands.

Once identified, a maternity roost is presumed to be occupied unless surveys reveal the roost tree is unoccupied. The survey approach is an acoustic survey whereby one detector is placed for 7 weather-appropriate nights without detecting a covered bat. Once deemed historic (no longer occupied) sites will be recorded and resurveyed every 5 years to confirm that they remain inactive.

5.4.5 Eligibility for Landowner Enrollment Program

As described in Appendix F, Section F.2.1, *Landowner Enrollment Program*, 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 is based on the assumption that if the amount of take estimated within a given ownership size equates to less than one bat, take is not reasonably certain to occur on those parcels. The threshold ownership sizes on which take of covered bats is reasonably certain to occur are provided in Table 5-1, and the methodology used to calculate these thresholds is provided in Appendix F, Section F.3, *Methodology to Determine Program Eligibility*. 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 DNRs will ensure that this analysis is recalculated every five years throughout the permit term and that the values in Table 5-1 are adjusted, as needed, to reflect changes in bat populations.

5.5 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 5-8 summarizes the monitoring actions (both compliance and effectiveness) for each objective.

5.5.1 Types of Monitoring

5.5.1.1 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 5-8).

5.5.1.2 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.

5.5.2 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 Habitat Conservation Planning and Incidental Take Permit Processing 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).

- 1) Are the DNRs complying with the terms of the HCP (e.g., gates are maintained, avoidance 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 via hibernacula counts 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.

5.5.2.1 Staff Training

DNR staff 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 have the knowledge they need to implement the Lake States HCP and to communicate important information about covered bat conservation to the public, the 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 1 and year 2, then every 5 years, and will be provided to all staff responsible for making and implementing management decisions on 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 DNR lands.

5.5.2.2 Status and Trends Monitoring

Baseline data for covered bats on covered lands is documented in this HCP (Chapter 3). Any changes to the 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 provide a reference point for future status and trends monitoring. The DNRs in all three states will leverage existing monitoring programs in order 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, non-detections in hibernacula over multiple years, or adverse effects of monitoring actions on the covered bats and other factors

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 the months of 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 data set 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 provide data that 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.

5.5.2.3 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.
- Additional requirements if signs of WNS are observed during the course of a cave/mine visit.

5.5.2.4 Monitoring the Biological Goals and Objectives

Requirements for status and trends monitoring are described above in Section 5.5.2.2, *Status and Trends Monitoring*. All other monitoring is tied directly to the biological goals and objectives, as described in Table 5-8.

Table 5-8. Biological Goals, Objectives, and Associated Monitoring Actions^a

Biological Goal	Biological Objective	Monitoring Action
Biological Goal 1: Maintain a healthy forest on 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.	DNRs will document in their annual reports the number of acres currently managed as forestland, including documentation of forestland with a hibernaculum entrance or known roost either sold or acquired during the year. The annual reports will contain a description of sustainable forestry as implemented by the DNRs. Results of periodic reviews (every 5 years) of FIA data will also be reported.
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.	A subset (1–3%) of harvested units is assessed as part of internal programs (Minnesota) or forest certification programs (Michigan, Minnesota, Wisconsin). These monitoring and audit reports will be provided to USFWS annually to demonstrate compliance with this objective.
	Objective 2.2: Minimize impacts on roosting bats by implementing a 150-foot buffer around all known roost trees.	DNRs will generate a list of all sites with roost trees on DNR lands and will map those sites by year 1. Annual reports will document that these were not affected by covered activities. Note that annual reports will not include these maps.
Biological Goal 3: Promote stewardship on private, county, and municipal lands.	Objective 3.1: Increase bat conservation by providing a land enrollment program in private, county, and municipal lands throughout the permit term.	DNRs will develop and administer a Landowner Participation Program for private, county, and municipal lands in each state. The amount of land (in acres) and the number of enrollees will be reported annually. Compliance with conservation strategy requirements will be achieved through annual self-reporting from enrollees on adherence to relevant conservation measures. If enrollees participate in forest certification programs, audits under this process will satisfy the monitoring requirement.
	Objective 3.2: Develop and implement a communication plan for educating the public on covered bats and their conservation.	DNRs will develop and begin implementation of a communication plan by year 2 of Plan implementation. The communication plans will be provided to USFWS. Implementation of specific actions associated with the plan will be documented annually.
Biological Goal 4: Protect and enhance hibernacula and associated wintering bats.	Objective 4.1: Remove obstructions at known hibernacula entrances on DNR lands by year 5 and continue throughout the permit term.	DNRs will check all known hibernacula entrances for obstructions at least once in first 5 years. Additional checks will occur at each hibernaculum at least every 10 years.
	Objective 4.2: Protect known hibernacula on DNR lands by implementing a 0.25-mile protective buffer and maintain or enhance habitat in those areas throughout the permit term.	Annual reporting will confirm that no harvests have occurred within the specified protective buffer. Harvest specifically geared at enhancement will be documented as part of an enhancement plan. Audits before and after enhancement will ensure that removal criteria

Biological Goal	Biological Objective	Monitoring Action
	<p>Objective 4.3: Maintain gates on all known entrances to occupied hibernacula on DNR lands (unless determined to be not needed or detrimental) throughout the permit term.</p> <hr/> <p>Objective 4.4: Promote awareness and understanding of WNS through distribution of state-specific WNS response plans and collaboration with researchers throughout the permit term</p>	<p>have been met. Trespass will be monitored when hibernacula are visited as part of species monitoring.</p> <hr/> <p>Within the first 5 years of the permit, the DNRs will complete an assessment of all known hibernacula on DNR lands. This assessment will provide the following data:</p> <ul style="list-style-type: none"> • Information about current condition of hibernacula on 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 DNR lands. • A list of sites where additional data is needed to determine if a gate is appropriate. <p>New and existing gates will be visited at least every 5 years, and photo-documentation of gate condition will be provided in the annual report.</p> <hr/> <p>DNRs will provide state-specific recovery plans to USFWS by year 3 (if one has already been developed it can be provided in year 1). The states will also document the publicly available website where the plan was made available. The DNRs will describe collaboration with USFWS or other entities on research as part of the annual report. The establishment of a regional clearinghouse will be documented. Research findings will be included as part of annual reports.</p>
<p>Biological Goal 5: Avoid and minimize effects from covered activities on covered species.</p>	<p>Objective 5.1: Incorporate criteria within prescribed burn plans that minimize impacts on roosting and hibernating bats by year 5 and continue throughout the permit term.</p> <hr/> <p>Objective 5.2: Minimize impacts on covered bats from tree removal associated with construction of new, permanent roads and trails throughout the permit term.</p>	<p>Impact minimization criteria will be incorporated into burn plans and will be submitted to USFWS by year 5. Annual plans will document training of prescribed fire staff on new criteria.</p> <hr/> <p>DNRs will report annually on any road construction within a 2.5-mile buffer of a hibernaculum entrance or 150-foot buffer of a known roost that occurs and the season and location of activity.</p>

Notes:

^a There are 25 known hibernacula on DNR lands, but some hibernacula have multiple entrances. Current records document 30 hibernacula entrances on DNR lands.

DNR = Department of Natural Resources; HCP = habitat conservation plan; USFWS = U.S. Fish and Wildlife Service

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