



A Forest Manager's Guide to  
**Forestry for  
Michigan Birds**



# Introduction

Forestry for Michigan Birds (FMB) is a collaborative approach to help recover forest bird populations while maintaining forest ecosystem health and sustainable land use. This guide offers information on why bird conservation should be part of your goals as a land or forest manager, may facilitate discussions between forest planners and land owners, and demonstrates how modified forest management practices can be used to benefit Michigan's priority bird species.

For additional information, guidance on forest management, or questions about Forestry for Michigan Birds, please contact ABC at [michiganbirds@abcbirds.org](mailto:michiganbirds@abcbirds.org) or by phone at 540-253-5780.

## Forestry for Michigan Birds Contributors

### PLANNING\* AND STEERING COMMITTEE

Kayla Knoll, American Bird Conservancy\*  
Sherry MacKinnon, Michigan Department of Natural Resources\*  
Misa Cady, USDA Natural Resources Conservation Service\*  
Dave Fehringer, The Forestland Group\*  
Katie O'Brien, US Fish and Wildlife Service\*  
Michael Paling, American Bird Conservancy\*  
Jim Ferris, Caretaker Forestry\*  
Joyanne Mittig, American Bird Conservancy\*  
Emily Locke, American Bird Conservancy  
John Bowers, USDA Forest Service  
David Flaspohler, Michigan Technological University  
Shawn Graff, American Bird Conservancy

Stephen Handler, USDA Forest Service and Northern Institute of Applied Climate Science  
Andy Henriksen, USDA Natural Resources Conservation Service  
Gib King, US Fish and Wildlife Service  
Keith Kintigh, Michigan Department of Natural Resources  
Pamela Nankervis, USDA Forest Service  
Joshua Shields, Manistee and Mason-Lake County Conservation Districts  
Warren Suchovsky, Suchovsky Logging LLC  
Nicholas Sanchez, Land Conservancy of West Michigan  
James Gray, Natural Capital Forestry

### CO-AUTHORS

Julie Crick, Michigan State University Extension  
Linnea Rowse, American Bird Conservancy

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American Bird Conservancy is the lead organization for Forestry for Michigan Birds. American Bird Conservancy is dedicated to conserving wild birds and their habitats throughout the Americas. For more information, visit [www.abcbirds.org](http://www.abcbirds.org).

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Graphic design by Lana Bannow, Hey Charlie Creative. [www.heycharliecreative.com](http://www.heycharliecreative.com)

"Where in the Woods" graphic on page 20 created by Jada Fitch. [www.jadafitch.com](http://www.jadafitch.com)

Habitat illustrations for species profiles created by Dakota Wagner, Forest Stewards Guild.



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# Table of Contents

<b>WHAT IS FORESTRY FOR MICHIGAN BIRDS?</b>	4
Why is Forestry for Michigan Birds Important?	4
Major Threats to Bird Populations	5
How Can Forestry for Michigan Birds Help You Manage Woodlands?	6
Who Developed Forestry for Michigan Birds?	7
<b>MICHIGAN PRIORITY FOREST BIRDS</b>	8
Key to Species Profiles	10
American Woodcock ( <i>Scolopax minor</i> )	10
Broad-winged Hawk ( <i>Buteo platypterus</i> )	10
Brown Thrasher ( <i>Toxostoma rufum</i> )	11
Cerulean Warbler ( <i>Setophaga cerulea</i> )	11
Chestnut-sided Warbler ( <i>Setophaga pensylvanica</i> )	12
Eastern Whip-poor-will ( <i>Antrostomus vociferus</i> )	12
Golden-winged Warbler ( <i>Vermivora chrysoptera</i> )	13
Least Flycatcher ( <i>Empidonax minimus</i> )	13
Ovenbird ( <i>Seiurus aurocapilla</i> )	14
Red-headed Woodpecker ( <i>Melanerpes erythrocephalus</i> )	14
Wood Thrush ( <i>Hylocichla mustelina</i> )	15
Yellow-bellied Sapsucker ( <i>Sphyrapicus varius</i> )	15
Black-throated Blue Warbler ( <i>Setophaga caerulescens</i> )	16
Black-throated Green Warbler ( <i>Setophaga virens</i> )	16
Canada Warbler ( <i>Cardellina canadensis</i> )	17
Connecticut Warbler ( <i>Oporornis agilis</i> )	17
Northern Goshawk ( <i>Accipiter gentilis</i> )	18
Blackburnian Warbler ( <i>Setophaga fusca</i> )	18
Swainson's Thrush ( <i>Catharus ustulatus</i> )	19
Kirtland's Warbler ( <i>Setophaga kirtlandii</i> )	19
<b>FOREST HABITATS WITH BIRDS IN MIND</b>	20
<b>FOREST HABITAT ASSOCIATIONS</b>	22
Hardwood Habitat Association	24
Mixedwood Habitat Association	26
Softwood Habitat Association	28
Oak-pine Habitat Association	30
<b>FORESTRY WITH BIRDS IN MIND</b>	32
Landscape-level Considerations	32
Stand-level Considerations	33
<b>SILVICULTURAL SYSTEMS FOR MICHIGAN BIRDS</b>	36
<b>APPENDICES</b>	42
<b>REFERENCES</b>	46



# What is Forestry for Michigan Birds?

*Forestry for Michigan Birds* is an initiative designed to help you, the forest manager, integrate healthy and sustainable forest management and planning, while keeping in mind habitat needs for important forest bird species.

Throughout this guide, we provide suggestions for tweaking forest management practices so the resulting habitat will benefit priority bird species, as well as other wildlife species and overall ecosystem health. The accompanying guide, *A Forest Owner's Guide to Forestry for Michigan Birds*, has accessible information for landowners with whom you may work. Many landowners list wildlife or bird habitat as an important forest management goal. The *Forestry for Michigan Birds* guides provide information that can facilitate positive discussions with landowners, and may shift a landowner's perspective from a "do nothing" approach to proactive forest management with habitat elements in mind for forest bird species of concern.

*Forestry for Michigan Birds* is about managing forests with birds in mind -- enhancing, creating, and conserving habitat for birds

## 450

BIRD SPECIES DOCUMENTED IN MI

## 221

CONFIRMED BREEDING IN MI





© USDA NRCS Texas/Flickr

and other wildlife while also:

- Providing for landowner income
- Keeping forests healthy
- Offering forest management options
- Adapting to climate change
- Planning for future generations

### WHY IS FORESTRY FOR MICHIGAN BIRDS IMPORTANT?

Since 1970, **North America has lost three billion birds**, or roughly one in four birds, which represents an alarming decline of many of our most cherished species such as the Wood Thrush.<sup>1</sup> While populations of some groups of birds such as waterfowl have increased due to successful conservation efforts, other groups including forest and grassland birds have not. **Forest bird populations as a whole have declined by 1.2 billion birds since 1970.**<sup>2</sup> That means there are simply fewer individuals of most species remaining in our forests, which also means a tremendous decrease in the natural control of forest pests.

Birds face major threats throughout their annual cycle (during breeding, migration, and wintering locations) from climate change, habitat loss or fragmentation, and invasive species. A diversity of bird species is also beneficial for people: birds are important pollinators, seed dispersers, and scavengers, and are important in controlling insect or rodent pest populations. Related environmental issues such as clean water are also addressed by managing for healthy forest ecosystems. Birds additionally have a high cultural value; birding as a pastime continues to grow, with positive impacts for mental and physical well-being. Birding contributes to local economies: in the U.S., birders spend an estimated \$20 billion per year on travel and equipment, and generate even more economic activity in locales known for bird diversity or with bird festivals.

If we wish to continue to enjoy bird life, song, and beauty, we need to take action. Managing Michigan's 20 million acres of forestland is a critical component to addressing the causes of forest bird declines.



Courtesy of Cornell Lab of Ornithology



## MAJOR THREATS TO BIRD POPULATIONS

**Habitat loss and degradation** remain the biggest threats to forest bird populations. Certain birds are more sensitive to the effects of forest fragmentation, where they are increasingly impacted by predators or competitors near forest edges. Conversion of land for human uses, such as agriculture, development, resource extraction, roads, or utility line corridors contributes to forest habitat fragmentation. Migratory birds face habitat loss throughout their full life cycle: on their breeding grounds (i.e., here in Michigan), along migration routes, and on their wintering grounds. Enhancing forest habitat on the breeding grounds can help to mitigate losses of birds throughout the year, as successful reproduction is necessary for population recovery.

**Non-native, invasive plants** also negatively impact bird populations by providing lower quality food sources both in terms of nutritional quality for birds (i.e., from non-native berries), and by not supporting balanced insect populations. When considering the most important trees for birds and insects, certain families of trees, deemed “keystone genera,” support far more caterpillars than do most native or non-native plants, which are a critical food source especially during the spring and summer when birds are feeding their offspring.<sup>3,4</sup> The top five tree family groups supporting caterpillars across North America include oaks (*Quercus*), willows (*Salix*), cherries (*Prunus*), pines (*Pinus*), and poplar/cottonwood/aspens (*Populus*). These groups, especially the white oak group, are vitally important to breeding birds and forest wildlife, as 96% of terrestrial birds rely on insects to feed their young.<sup>5</sup> White oaks also provide desirable hard mast for many forest wildlife species, and are long-lived, and disease- and fire-resistant.

**Climate change** will impact forest birds in varying ways. A changing climate affects tree growing conditions and will shift tree species’ ranges over time, thus changing habitat suitability for birds. Some tree species will do well in our area or even see expanded habitat, while others are expected to decline across the landscape. The timing of bird migration has already shifted in many species, and timing mismatches with food sources (for example, insect emergence and fruit crops) on their breeding grounds can impact survival and breeding success. Many of our forest birds that breed in Michigan experience the stressors of climate change and forest fragmentation not only during the summer but also when they migrate to their wintering ranges. Climate change alters cycles of precipitation, fire, forest health concerns (invasive insects and plants; bacterial, fungal, or viral infections), and increases the frequency and severity of major weather events. These altered cycles impact bird nesting success, migration, and food sources. Climate change impacts to forest habitat associations will be discussed specifically later in this guide.

**Water quality** can be compromised by unsustainable forestry practices or by other land uses. Water quality impacts us all:

96% OF NORTH AMERICAN  
SONGBIRDS FEED  
THEIR YOUNG INSECTS



Yellow Warbler feeding chicks. © Ivan Kuzmin/Shutterstock

ecological services provided by healthy watersheds include mitigation of floods and extreme precipitation events, clean drinking water, and water availability for human food production. Many insects rely on clean water or wetlands for breeding and habitat for larval life stages. When those insects emerge from water as adults, they are a critical food source for insectivorous birds like the Canada Warbler. Forests managed with sustainable harvest practices that provide special consideration for riparian buffers not only protect water quality, but also protect bird food and habitat. Forest management for birds also results in improved water quality and coldwater fish habitat (e.g., for trout), and will help to mitigate the effects of climate change.

There are many additional threats to birds that are not covered in this guide. Read more about other impacts and resources to address these in the appendices.

Through this guide, we ask you, the forest manager, to help address current threats to forest birds, including habitat loss and habitat degradation due to the absence of or poor forest management and invasive plants. Cooperative partnership between government agencies, conservation organizations, timber industry, and private individuals is needed to maintain and improve habitat in order to recover bird populations across North America. As a forest manager or planner, you contribute to landscape scale impacts – benefiting forest health and bird habitat when forests are managed at a large scale and with key components to benefit bird species of concern.

## HOW CAN FORESTRY FOR MICHIGAN BIRDS HELP YOU MANAGE WOODLANDS?

Michigan forests, when functioning as healthy, intact, and resilient ecosystems, can play a critical role in reversing the population declines of forest birds. *Forestry for Michigan Birds* is dedicated to restoring and maintaining forest habitat through improved awareness and prescriptive management to create or enhance necessary structural elements for forest-dependent species.

Around the turn of the twentieth century, Michigan's forests experienced a period of widespread, unsustainable logging practices, followed by conversion of prior forestland for agricultural settlement, and suppression of natural disturbances such as fire or beaver flooding. The forests we have today are what grew back, or were planted by the Civilian Conservation Corps. Since then, standard management practices and/or a lack of management in some forest stands resulted in forests with a uniform, closed canopy of trees that are nearly all the same age and size. These forests lack the structural complexity and ecological resilience provided by forests with trees of various species, sizes, and ages. The absence of structural diversity negatively impacts the nesting, roosting, and foraging opportunities for birds and other wildlife.

Michigan's forest birds are among the most diverse in the U.S., and they utilize a variety of habitat features in the forest. Some birds need a dense layer of regenerating tree seedlings that



Canada Warbler. © Ray Hennessy/Shutterstock



Storm Damage © Land Between the Lakes/Flickr

## FOREST MANAGEMENT MIMICS NATURAL DISTURBANCE

Sustainable forest management should result in healthy forests with high structural and age class diversity by mimicking natural disturbances, such as wind or fire. For example, blowdown events from wind create irregular shaped openings that can be replicated with gap creation or group selection. Stand replacement disturbance caused by straight line winds or wildfire is similar to shelterwood and seed tree management. To further naturalize management activities, leave large tops and (portions of) the trunk on-site.



appear after a tree falls and creates a gap in the canopy (e.g., Black-throated Blue Warbler). Other birds require dense conifer saplings in which to hide their nests (e.g., Swainson's Thrush). Others still, like the Canada Warbler, nest on the ground or in the upturned root balls of fallen trees or rotten stumps.

Habitat enhancement by way of forest management activities that mimic natural disturbances offer a mosaic of tree ages and sizes across the landscape. Historically, natural disturbances like wind events and lightning-induced wildfires randomly occurred throughout the forested landscape, eliminating groups of large, mature trees and creating space for young trees to regenerate. Over time, these uneven-aged pockets of trees created more resilient, structurally diverse forests. The recommendations in this guide strive to mimic natural disturbances using forest management techniques that increase or create beneficial forest habitat elements for forest birds and wildlife.

As you consider the management of forests – especially if you consult with private landowners, it is important to consider that even with a hands-off approach (referred to as “do nothing”) the habitat elements are always changing. Limbs break, trees fall, and trees age and die, allowing new trees to regenerate. Given the current condition of our forested landscape, these small-scale changes may not be large enough to positively affect the health of the forest or the necessary habitat elements for breeding birds and other wildlife.

The purpose of this guide is to identify habitat requirements of Michigan's forest birds and other wildlife in a manner that easily translates into common terms and concepts for guiding long-term sustainable forest planning.



Cerulean Warbler. © Ray Hennessy/Shutterstock

## WHO DEVELOPED FORESTRY FOR MICHIGAN BIRDS?

*Forestry for Michigan Birds* (FMB) was conceptualized by groups of bird lovers, professional biologists, and foresters from various agencies and organizations across Michigan. FMB materials are adapted from Vermont Foresters for the Birds Program and Maine's Forestry for Maine Birds Program. FMB is led by the American Bird Conservancy in partnership with key federal, state, academic, non-profit, and forest industry partners including: USDA Forest Service, Natural Resources Conservation Service, U.S. Fish and Wildlife Service, Michigan Department of Natural Resources, The Forestland Group, Michigan Technological University, Michigan State University Extension, Michigan Audubon, Ruffed Grouse Society, Michigan Conservation Districts, private loggers, and consulting foresters. Funding for this project is provided by the U.S. Forest Service's Landscape Scale Restoration Grant Program.



Tree Swallow with nest material. © Hayley Crews/Shutterstock

# Michigan Priority Forest Birds

Priority bird species were selected for this guide based on a series of criteria, narrowed down from regional lists of conservation concern, including the Upper Mississippi/Great Lakes Joint Venture focal species list, Partners in Flight (PIF) Regional Priority species list, PIF Watch List species, PIF Common Birds in Steep Decline, PIF Regional Stewardship Species, PIF Regional Concern species, and the Michigan Wildlife Action Plan: Species of Greatest Conservation Need. These 20 species were also selected to represent four forest habitat associations found across Michigan: Hardwood, Mixedwood, Softwood, and Oak-pine.

It is important to consider the full life cycle of migratory birds for conservation efforts, not only how we approach habitat management in Michigan. For many migratory species, population declines may be linked to loss of habitat on their wintering grounds.

A **climate vulnerability score** for each species provides insight into how much a bird species' breeding or wintering range will be impacted with a **3°C rise in average global temperatures**.<sup>6</sup> By 2100, we are nearly guaranteed to see a 3°C (5.4°F) increase in average global temperatures, unless immediate and dramatic measures are taken to reduce global carbon and greenhouse gas emissions.<sup>6,7</sup>

- **Climate vulnerability** is a function of a bird species' exposure to climate change, sensitivity (projected current range loss), and its adaptive capacity (the ratio of projected range gain to loss).
- Highly vulnerable species are those that will lose a high percent of their current range and have limited opportunity for range gains in the future - which may be limited because of a species' dispersal ability or unsuitable habitat conditions for range expansion.
- For this document, climate vulnerability score is listed as high, medium, or low for the North American breeding range of each species, along with a descriptive prediction of range change within Michigan.
- Bird species with projected breeding range expansions or shifts are not necessarily "safe" from climate change. Habitat is important to consider; a new place in a bird's projected range might work in terms of temperature, but if the habitat there is not forested, it will not be suitable for a forest bird.

For more specific climate vulnerability information for selected birds, visit [audubon.org/climate/survivalbydegrees](https://www.audubon.org/climate/survivalbydegrees).<sup>6</sup>

For additional information on bird species' population trends, range and distribution, visit [AllAboutBirds.org](https://www.allaboutbirds.org) or [birdsoftheworld.org](https://www.birdsoftheworld.org).<sup>8,9</sup>

## KEY TO SPECIES PROFILES:

*Glossary of terms:* See appendices for more detailed definitions.<sup>10</sup>

**Diameter at Breast Height (DBH):** Diameter of the stem of a tree measured at 4.5 feet.

**Down Woody Material:** Logs and limbs on the forest floor.

**Feathered Edge:** Gradual transition between the forest and an open area.

**Forest Age Class:** Distinct group of trees from a single regeneration event.

**Forest Habitat Association:** Forest types with similar habitat features.

**Gaps:** Openings in the forest canopy that allow more light to reach the mid- and understory layers.

**Hardwoods:** Broadleaved deciduous trees.

**Leaf Litter:** Fallen leaf accumulation on the forest floor.

**Snags:** Standing dead trees.

**Softwoods:** Coniferous trees.

**Structure:** Arrangement of woody vegetation in the forest; may be classified as the following layers:

- **Overstory:** Uppermost layer of forest vegetation including twigs, branches, cavities, and trunks in the tallest trees.
- **Midstory:** Intermediate layer of forest vegetation including young trees and shrubs as well as mature shrubs.
- **Understory:** Lower layer of forest vegetation including small shrubs, grasses and herbaceous vegetation.

## ABBREVIATIONS:

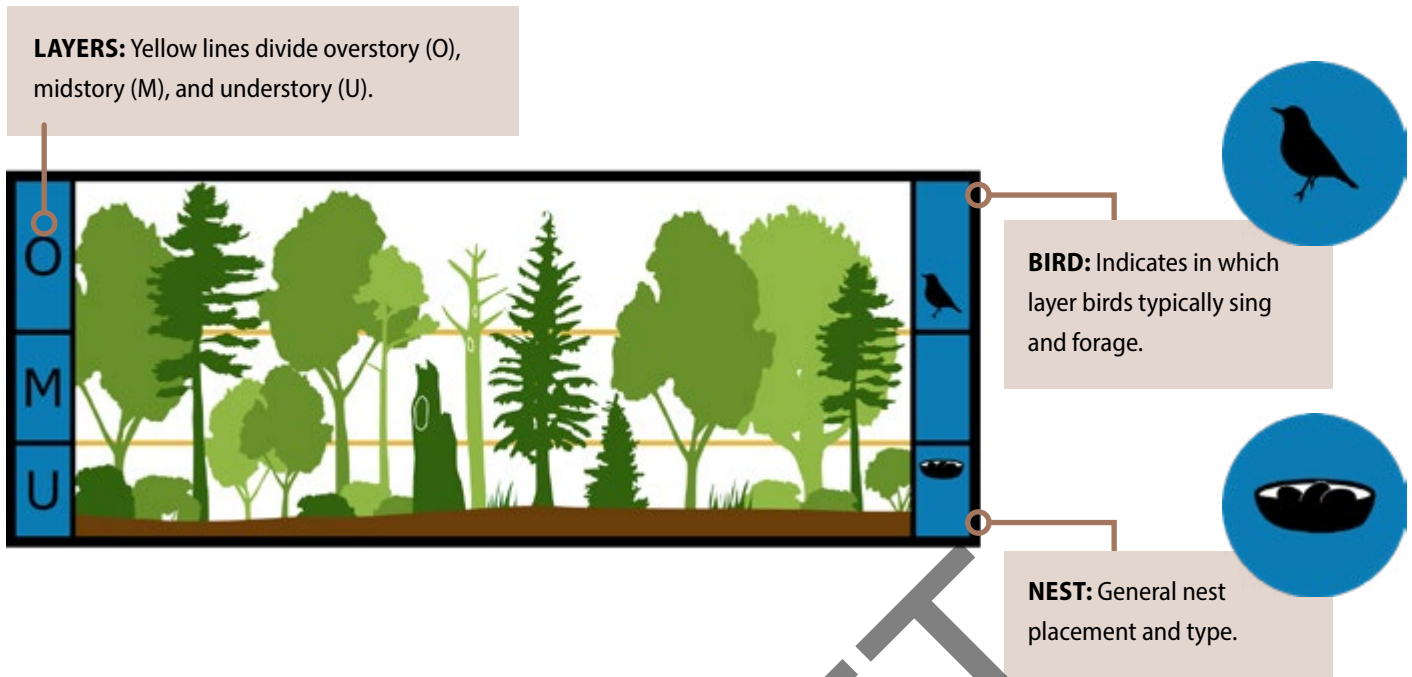
**U.P.:** Upper Peninsula

**L.P.:** Lower Peninsula





**KEY TO HABITAT FEATURES:**




**VEGETATION KEY:**





**TAB KEY**

**FOREST HABITAT ASSOCIATION**

- H:** Hardwood
- M:** Mixedwood
- OP:** Oak-pine
- S:** Softwood

**PREFERRED** 

**WILL USE** 

**RARELY USED** 

**HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:**

Each profile contains brief information about important habitat features that each bird species uses along with one or two management recommendations to encourage the creation or management of these habitat features. This information is highly condensed from other publications to give a brief overview. Many of these species have Best Management Practices and other guides that provide more in-depth details about habitat requirements and management recommendations. We provide links to several of these publications online.

## American Woodcock (*Scolopax minor*)

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© John Turner

**FOREST AGE CLASS:** Young to Intermediate Forest

**IDENTIFICATION:** Plump, short-legged shorebird with a very long, straight bill. Large head, short neck, and short tail give it a bulbous look on the ground and in flight. Well camouflaged in light brown, black, buff, and gray tones.

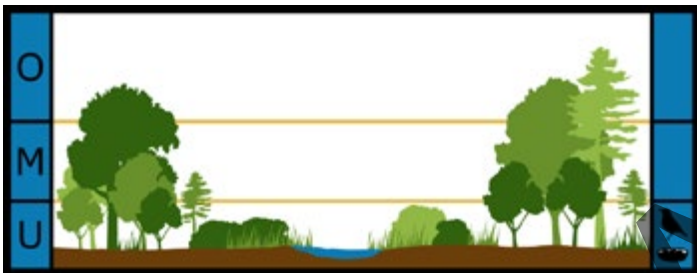
**CALL:** Displaying male gives a repeated, buzzy, nasal *peent* while on the ground between flights. In the air, a displaying male chirps melodically for up to 15 seconds as he zigzags downward from the apex of a display flight.

**NEST:** Ground nester, lays eggs in a scrape on the ground in dead leaves. Typically within 300 feet of a display area.

**FOOD:** Forages on the forest floor; probes moist soil for earthworms and invertebrates.

**TERRITORY SIZE:** Small area within communal singing ground is defended; multiple males will share a 0.5 acre opening. Found throughout Michigan.

**CLIMATE VULNERABILITY:** Moderate. Predicted to lose most of range in the L.P., and to maintain range in much of the U.P.



### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Mosaic of dense young forest, old fields or forest openings, shrublands, riparian corridors, and wetland-upland transition zones. Maintain early successional forest for feeding areas, with >0.5 to 1 acre openings for singing grounds (courtship displays) and dense shrub or sapling stands (≥5 acres) for nesting and cover. See Best Management Practices at: [timberdoodle.org/greatlakes/bmp](http://timberdoodle.org/greatlakes/bmp).<sup>11</sup>

## Broad-winged Hawk (*Buteo platypterus*)

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© Paul Witter/Shutterstock

**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** Small, compact raptor with a chunky body and large head. Adult has reddish-brown head, barred underparts, and broad black and white bands on the tail. The pale undersides of the wings have dark brown edges.

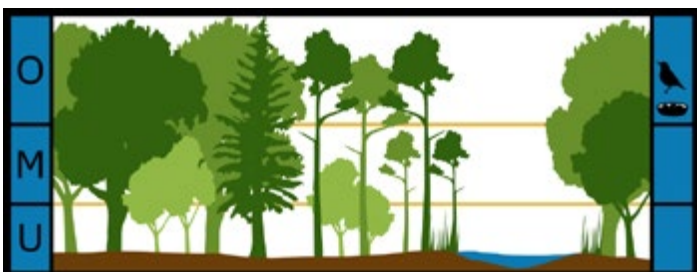
**CALL:** A plaintive, high-pitched whistle that lasts 2-4 seconds, with a short first note and a long second note: *kee-eee*.

**NEST:** Large stick nest; usually located in the lower third of a tree canopy, on a main limb. Often nests near forest openings or water bodies.

**FOOD:** Amphibians are an important component of the diet (especially frogs and toads); also consumes small mammals, juvenile birds, and insects.

**TERRITORY SIZE:** Nests at least 0.5 mile from other Broad-winged Hawk pairs. Found primarily in the U.P. and the northern L.P.

**CLIMATE VULNERABILITY:** Low. Predicted to lose all of Michigan range but has good potential to expand in much of its North American breeding range.



### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Diverse, unfragmented hardwood or mixedwood forest with small openings and wetlands. Manage for tree species diversity, create small openings where there are none, and avoid forest fragmentation. Retain large diameter trees (>12-15" DBH) for nest tree sites, especially aspen or birch; these should be interspersed among smaller diameter trees.

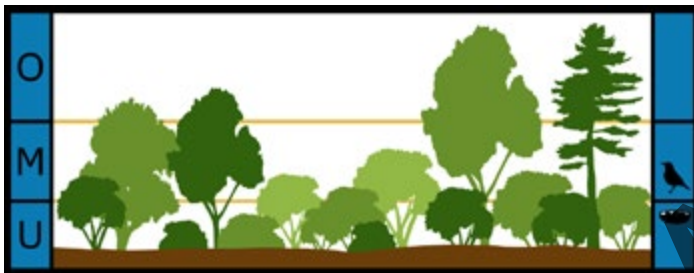


**Brown Thrasher** (*Toxostoma rufum*)



© Tim Zurawski/Shutterstock

**FOREST AGE CLASS:** Young to Intermediate Forest  
**IDENTIFICATION:** Fairly large and slender, with bright yellow eyes and a long tail often held cocked upward in the manner of wrens. Foxy brown plumage with heavy, dark streaking on whitish underparts.  
**SONG:** Mimic with extremely varied repertoire. Male sings a loud, long series of doubled phrases with no definite beginning or end, described as *plant a seed, plant a seed, bury it, bury it, cover it up, cover it up, let it grow, let it grow, pull it up, pull it up*. Call is a sharp *smack!*  
**NEST:** Cup nest, usually placed in a low shrub or small tree with numerous branches or thorns.  
**FOOD:** Invertebrates, seeds, and fruits. Often forages on the ground in vegetation and leaf litter.  
**TERRITORY SIZE:** 1-10 acres. Found throughout Michigan; especially widespread in the L.P.  
**CLIMATE VULNERABILITY:** High. Predicted to lose all of range in southern L.P. and maintain or gain some range in the U.P. and northern L.P.



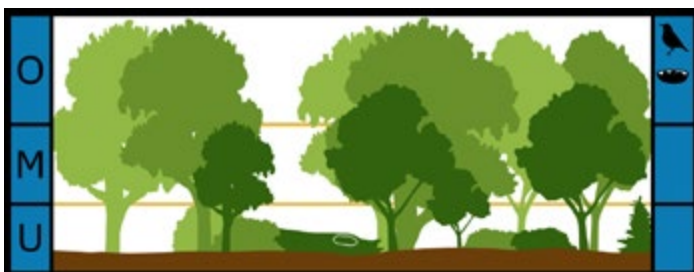
**HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:**  
 Dense young deciduous forest, shrub wetlands, and dense old field shrublands. Focus forest management efforts in existing thickets dominated by small trees and shrubs, and along forest edges, promoting early successional habitat. Use thinning practices to prevent a closed canopy and allow sunlight to reach the shrub understory layer.

**Cerulean Warbler** (*Setophaga cerulea*)



© Ray Hennessey/Shutterstock

**FOREST AGE CLASS:** Older Forest  
**IDENTIFICATION:** Male is sky-blue above with 2 white wing bars, a thin blue neck band, and blue streaks on sides of white belly.  
**SONG:** Song starts with 3 buzzy notes, followed by 4 fast warbles, and ends with a higher pitched buzzy trill.  
**NEST:** Small cup nest, high in a large-diameter hardwood, especially white oak. Usually nests near a canopy gap, in the midstory to upper canopy. Prefers trees >15-19" DBH.  
**FOOD:** Insectivorous; picks insects from twigs and leaves. Usually forages in midstory to upper canopy.  
**TERRITORY SIZE:** 2.5-5 acres; needs landscapes that are primarily forested. Found mostly in the southwest L.P.  
**CLIMATE VULNERABILITY:** High. Predicted to lose all of southern Michigan range with some potential gains in the western U.P.



**HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:**  
 Mature white oak/hickory forests with large-diameter trees, canopy gaps, and dense understory. Landscape should be primarily forested; will use small forest patches (<25 acres) if there is >75% forest cover within 6 miles. Create small gaps (22-35 foot diameter) if none present to promote understory regeneration and increase vertical structural diversity. A mature overstory is critical; if implementing a shelterwood cut, retain some residual canopy in all stages consisting of large diameter oaks, hickories, and snags. For additional information, see Cerulean Warbler Management Guidelines: [amjv.org/bird-conservation/](http://amjv.org/bird-conservation/).<sup>12</sup>

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## Chestnut-sided Warbler (*Setophaga pensylvanica*)

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© Michelle Nyss/Shutterstock

**FOREST AGE CLASS:** Young Forest

**IDENTIFICATION:** Breeding adults are crisp gray-and-white birds with a yellow crown, black face markings, and rich chestnut flanks. Relatively long tail is often held cocked upward.

**SONG:** Primary song is a short ditty ending with a decisive, accented ending. Often described as: *Pleased, pleased, pleased to meetcha! or I wish to meet Miss Beecher!*

**NEST:** Compact cup nest placed in a small shrub or within a dense group of small-diameter woody stems, within 6 feet of the ground.

**FOOD:** Insectivorous; particularly caterpillars. Picks or gleans insects from the undersides of leaves.

**TERRITORY SIZE:** 1-3 acres. Found throughout Michigan, especially in the U.P. and northern L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of Michigan range.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Young, dense forests (<30% canopy cover) or shrubby regeneration after clearcuts or other disturbances. Openings interspersed within a forested landscape provide additional diversity of food sources and habitat structure. Manage for dense sapling regeneration; retain scattered shrubs and both live and dead standing trees for singing perches. Clearcuts, thinning, and strip-cutting can be used to create young, shrubby forest patches.



## Eastern Whip-poor-will (*Antrostomus vociferus*)

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© Frode Jacobsen/Shutterstock

**FOREST AGE CLASS:** Young to Intermediate Forest

**IDENTIFICATION:** Plumage is a complicated mottling of gray and brown, which camouflages nearly perfectly with leaf litter or tree bark. Blackish throat is bordered by a neat, white bib. Distinctly front-heavy look with a large, rounded head and stout chest that tapers to a long tail and wings.

**SONG:** The male's emphatic, chanted *whip-poor-will* is sometimes repeated for hours on end.

**NEST:** No actual nest is built: eggs laid directly on the ground in open woodlands, on soil with leaf litter. Nests are most often near a clearing or forest edge.

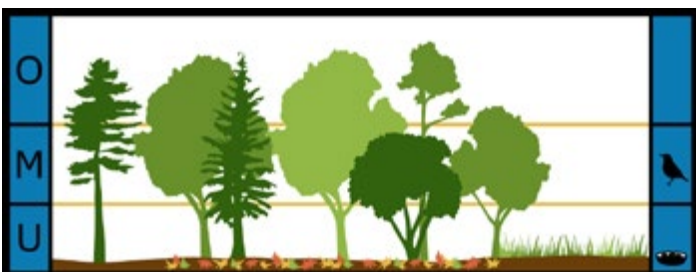
**FOOD:** Aerial insectivore; mainly moths and beetles. Feeding occurs primarily at dusk and dawn or when there is moonlight.

**TERRITORY SIZE:** 10-12 acres. Found throughout Michigan.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of range in the L.P. and eastern U.P., and will maintain range in interior western U.P.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Dry, semi-shaded woodlands with little to no understory or ground cover, preferably near open areas. Maintain open areas adjacent to deciduous and mixed forest types, creating a mosaic of habitat attributes for nesting and foraging. Use timber harvests to create openings >30 acres; skid roads and landings can provide additional habitat by increasing edge and variation. Use prescribed fire to maintain a semi-open forest understory and adjacent brushy areas that will produce more insects for foraging.



## Golden-winged Warbler (*Vermivora chrysoptera*)



**FOREST AGE CLASS:** Young Forest

**IDENTIFICATION:** Adult male is silvery gray with a strong black-and-white face pattern, yellow crown, and large yellow wing patches.

**SONG:** Buzzy, two-parted song: a long high-pitched note followed by 3-6 shorter, lower notes: *bee-bz-bz-bz*.

**NEST:** Cup nests are usually placed on the ground at the base of leafy herbaceous vegetation; well-concealed.

**FOOD:** Invertebrates; forages by gleaning and probing curled leaves to find insects and spiders.

**TERRITORY SIZE:** 5 acres minimum. Pairs tend to nest near other paired golden-wings.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of Michigan range.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Dense, young deciduous forest or shrubby patches adjacent to mature forest, within a forested landscape. Prefers >50% forest cover within 1.5 miles of nesting site and <30% conifer component. Create young forest patches with retained shrub clumps, 10-15 residual overstory "perch trees" per acre, and transitional zones (feathered edges) between open areas and older forest. Patches should be >5 acres if within 1,000 feet of other young forest patches, or >25 acres if no other young forest is nearby. See Best Management Practices at: [www.gwwa.org](http://www.gwwa.org).<sup>13</sup>



## Least Flycatcher (*Empidonax minimus*)



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** Very difficult to distinguish from other Empidonax flycatchers except by voice. Grayish olive head and back, a bold white eyering, dusky breast, very faint yellow wash to the belly, and 2 white wing bars.

**SONG:** Very short and distinctive, dry *chebec* that sounds more like a call. Song is repeated, sometimes as frequently as 60 *chebecs* per minute.

**NEST:** Nests typically placed 12-25 feet high in a small deciduous sapling or tree. May nest in loose colonies: multiple breeding pairs may hold very small territories in one general location.

**FOOD:** Insectivorous; also eats spiders and occasionally berries.

**TERRITORY SIZE:** Averages 0.2-0.5 acres; multiple breeding pairs may nest close together. Prefers to nest in maples or white oak. Found throughout Michigan.

**CLIMATE VULNERABILITY:** Moderate. Predicted to lose all of current Michigan range, but will maintain or gain range elsewhere in North America.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Diverse forest with a well-developed canopy and structural complexity in all layers. Sensitive to forest fragmentation and disturbances; harvests will be less impactful to grouped breeding territories if forest openings are clustered together rather than spread throughout a forest tract. Maintain contiguous, mid-successional forest blocks across the landscape, with diverse vertical structure.



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## Ovenbird (*Seiurus aurocapilla*)

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**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** A large, chunky warbler, with a round head, fairly thick bill, and jaunty tail. Olive-green above with dark streaked spots on throat and breast, bold black-and-orange crown stripes, and a white eyering.

**SONG:** A rapid, resounding *tea-cher, tea-Cher, Tea-CHER* growing louder over the first few repetitions.

**NEST:** Dome-shaped nest is built on the ground in thick leaf litter; resembles a small, rounded Dutch oven, with a side entrance. Typically located at least 60-70 feet away from a forest edge.

**FOOD:** Invertebrates, mostly foraged from leaf litter. Will also forage in trees and shrubs during spruce budworm outbreaks.

**TERRITORY SIZE:** 0.5-5 acres. Found throughout Michigan, especially the U.P. and northern L.P.

**CLIMATE VULNERABILITY:** Moderate. Predicted to lose all of Michigan range but has good potential to maintain or expand range elsewhere in its North American breeding range.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Large, contiguous blocks of mature forest with closed canopy, abundant leaf litter, and open understory. Maintain older forest with  $\geq 60$ -90% canopy cover, within large blocks of forest ( $>250$  acres). Avoid fragmentation and creation of edges. Forest management practices impact abundance and reproduction; include a plan to maximize interior forest as core habitat  $>350$  feet from any disturbance. Canopy gaps and adjacent early successional forest are used by fledglings.

## Red-headed Woodpecker (*Melanerpes erythrocephalus*)

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© Brian Woodman/Shutterstock



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** Adult has bright red head (hood), white underparts, and black back with large white patches on the wings and rump; the lower back appears all white when perched.

**SONG:** A variety of chirps, cackles, and other raucous calls. Most common call is a shrill, hoarse *tchur*, higher-pitched and less rolling than that of the more common Red-bellied Woodpecker.

**NEST:** Cavities are excavated in dead trees or limbs near the ground to  $>65$  feet high. Snags without bark are preferred, as the smooth surface protects against predators (e.g., snakes).

**FOOD:** Insects, fruits, and seeds. Uses "hawking" behavior to catch insects in flight. Nuts and seeds are cached in tree crevices for winter. Will also eat mice or raid bird nests.

**TERRITORY SIZE:**  $>5$  acres. Found mostly in the L.P., with highest concentration in the southwest L.P.

**CLIMATE VULNERABILITY:** High. Predicted to maintain range in southern L.P. and may expand range in northern L.P. and U.P. May lose most of current North American breeding range.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Open woodland, barrens, or savanna with scattered trees and snags, especially oak or beech; avoids unbroken interior forest. Uses dead tree limbs and cavities for nesting, roosting, and foraging. Retain/create large diameter snags (in groups if possible), especially along fields. Restore oak savanna and use prescribed fire as a management tool. In agricultural areas, keep trees along fencerows.



## Wood Thrush (*Hyllocichla mustelina*)



© Paul Reeves Photography/Shutterstock



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** A pot-bellied body, short tail, large head, and upright posture give it the profile of a scaled-down American Robin. Warm reddish-brown upperparts, bold black spots on white underparts, and a bold white eyering.

**SONG:** A flute-like *ee-oh-lay* is the middle phrase of a three-part song. There are several song variants with 2-10 loud, clear notes.

**NEST:** Open cup nest of leaves, grasses, and mud. Nest height varies; average is 7-8 feet off the ground in a sapling or shrub.

**FOOD:** Invertebrates and some fruits. Forages on or near the ground in leaf litter and low vegetation.

**TERRITORY SIZE:** 0.2-7 acres. Found throughout Michigan, primarily in the L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose most of range in the L.P. and maintain range in the U.P.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Moist, deciduous woods with structural diversity: moderately dense understory of saplings and shrubs, ideally within a large block (>200 acres) of unfragmented forest. Nests placed in fragmented tracts and near forest edges experience more predation and are often parasitized by Brown-headed Cowbird, reducing breeding success. Retain large, mature trees (>80% canopy cover) within a stand, providing a shaded forest floor with moist soil and decaying leaf litter. Plant native trees and fruit-bearing shrubs for site-level habitat enhancement, or create canopy gaps to promote understory vegetation growth.<sup>14,15</sup>

## Yellow-bellied Sapsucker (*Sphyrapicus varius*)



© Dennis W. Donohue/Shutterstock



**FOREST AGE CLASS:** Young Forest

**IDENTIFICATION:** Fairly small woodpecker with long wings and stiff tail. Black and white with boldly patterned face, red forehead, black bib, white wing patch, and 'dirty' white belly. Males have red throats.

**CALL:** Signature call is a scratchy, nasal mewing. Territorial squealing call, a repeated *quee-ah, quee-ah*, is often heard in breeding season. Unique drumming pattern begins with a rapid burst and ends with drawn out single taps.

**NEST:** Cavity nest with a small entrance, varies in height from 6-60 feet off the ground, usually in a live tree.

**FOOD:** Drills neat rows of sap wells along woody trunks and feeds on sap; also eats insects, fruits, and seeds.

**TERRITORY SIZE:** 2.5-8 acres. Found in the U.P. and all but the very southern L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of its current breeding range in Michigan.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Found in hardwood and mixedwood forests with structural complexity. Larger aspen, alder, and birch are important, and hardwoods with decaying heartwood (e.g., older aspen) are used for nest cavities. Maintain or create early successional habitat; young, fast-growing trees are favored for sapwells. Prefers a high percentage of shade-intolerant species, including aspen, birch, red maple, and elm, especially mixed with shade-tolerant species like sugar maple and American beech.

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## Black-throated Blue Warbler (*Setophaga caerulescens*)

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© Brian Lasenby/Shutterstock



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** Males are dark blue above and white below, with black on the throat, face, and sides. Females are grayish olive. Both have a characteristic small white wing patch, sometimes called a “pocket handkerchief.”

**SONG:** A slow-paced series of 3-7 buzzy notes, with the last note slurred upward: *I-am-so-la-zee, or please, please, please squeeeeeze.*

**NEST:** Small woven cup nest, placed within 6 feet of the ground in a shrub or sapling. Dense understory is critical; balsam fir is frequently used for nesting in the U.P. where heavy deer browse limits other understory plants.

**FOOD:** Insectivorous; caterpillars, moths, and butterflies comprise the bulk of their diet. Forages in the shrub layer and lower canopy, searching the undersides of leaves.

**TERRITORY SIZE:** 2-15 acres. Found in the U.P. and northern L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of current breeding range in Michigan.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Unfragmented, interior deciduous or mixedwood forest with a dense understory for nesting (in Michigan, this is primarily seedlings and saplings of overstory trees). Large forested tracts (>250 acres) are preferred, with 50-80% canopy cover and diverse tree sizes and ages. Use uneven-aged management approaches; promote structural diversity and a mosaic of canopy gaps across intact forest to facilitate dense shrub understory for feeding and nesting.



## Black-throated Green Warbler (*Setophaga virens*)

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© ttp1001/Shutterstock



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** Olive-green back, white underparts. Adult males have a bright yellow face and extensive black on the throat turning to black streaks on the flanks. Two bright white wing bars.

**SONG:** A high, cheery-sounding buzz, *zoo zee zo zo zee, or zee zee zee zo zee.* Also described as *trees trees I love trees.*

**NEST:** Cup nest built 3-10 feet above the ground in a conifer; hemlock preferred for nesting.

**FOOD:** Insectivorous; gleans insects from branches and needles, especially from hemlock but also from hardwoods such as sugar maple.

**TERRITORY SIZE:** Average is 1.6 acres, or as small as 0.6 acres in spruce habitat. Prefers hemlock-beech stands. Found mostly in the U.P. and northern L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of its current breeding range in Michigan.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Mature, mesic stands of mixed hardwoods and softwoods, containing white spruce, balsam fir, and eastern hemlock. Typically prefers forest stands with >80% canopy cover. Sensitive to forest fragmentation. Retain hemlock in harvest areas, and underplant eastern hemlock. Closely monitor eastern hemlock stands for hemlock woolly adelgid, especially in areas with high levels of human traffic.





## Canada Warbler (*Cardellina canadensis*)



© Ray Hennessy/Shutterstock



**FOREST AGE CLASS:** Intermediate Forest

**IDENTIFICATION:** Steely blue-gray above and bright yellow below with an obvious whitish eyering. Noticeable black necklace markings across the chest on adult males.

**SONG:** Song is clear and loud, starting with a chip and followed by a series of warbling notes that often ends on a higher pitch: *I'm-IN-here, but-you-CAN'T-SEE-ME.*

**NEST:** Nests on or near the ground, on mossy hummocks, stumps, down logs, or in upturned tree roots.

**FOOD:** Insects and spiders. Foraging is very active; frequently flushes insects from foliage and catches them on the wing. Also forages among leaf litter and by gleaning foliage.

**TERRITORY SIZE:** 1-3 acres. Territories often clustered; patches with >10 acres of habitat are most valuable. Found in the U.P. and northern L.P., and occasionally in southwest Michigan.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of current breeding range in Michigan.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Moderately closed canopy forest with dense mid- and understorey; moist riparian conditions with much down woody material. Prefers red maple, black spruce, and cedar-fir swamps, as well as mixed upland forests, interspersed with shrub wetland. Maintain 50-70% canopy cover, with small gaps. Use patch clearing (0.5-2 acres) to promote second growth and shrub layers, and introduce more down woody material. Retain  $\geq 5$  residual trees per acre in harvest areas >2 acres.<sup>16</sup>

## Connecticut Warbler (*Oporornis agilis*)



© Dan Behm



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** A plump warbler with a gray hood, bold white eyering, yellow belly, and olive back.

**SONG:** Song is a loud, ringing *chippy-chuppy, chippy-chuppy, chippy-chuppy*, being most emphatic in the middle.

**NEST:** Builds nest on or near the ground, in dense undergrowth. Very well hidden.

**FOOD:** Insectivorous, also eats spiders, other arthropods, and occasionally berries. Probes leaf litter and ground with its heavy bill.

**TERRITORY SIZE:** 0.5-1.5 acres. Uncommon to rare in the U.P.; Connecticut Warblers have the most restricted breeding range of all northern warblers except for Kirtland's Warbler.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of current breeding range in Michigan.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Conifer-dominated mixed forest with diverse layers, including wet tamarack or spruce bogs, dry jack pine barrens, and even dry aspen-dominated forest. While varied, these communities are often described as open and "park-like" but with dense ground cover. Avoid habitat fragmentation in both upland and lowland conifer-dominated forests. Maintain mature black spruce bogs; avoid harvesting black spruce except for unique experimental regeneration projects or salvage efforts. Where possible, use prescribed fire to manage and regenerate northern dry forests and deteriorating spruce. Increasing the total acreage of jack pine barrens will likely benefit Connecticut Warblers.

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## Northern Goshawk (*Accipiter gentilis*)

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© Lukasz Gajda/Shutterstock



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** A large accipiter with broad, rounded wings and long tail. Adult is dark slate gray above with pale gray barred underparts. Eye is orange to red, with a white "eyebrow" stripe.

**CALL:** Rapid-fire *ki-ki-ki-ki* alarm call, or drawn-out *kreey-a*.

**NEST:** Stick nest, placed in a large tree. Located in lower overstory, above open understory for ease of access and defense. Sensitive to disturbance and will defend nest site fiercely.

**FOOD:** Small to medium sized mammals (e.g., squirrel, snowshoe hare), birds, reptiles, and invertebrates.

**TERRITORY SIZE:** Extensive home range: 1,400-8,700 ac. Core breeding/foraging territory includes nest stands of 25-250 acres, with 1-5 alternate nest areas within core. Post-fledging range is >400 acres. Uncommon; found in the U.P. and northern L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of its current breeding range in Michigan.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Extensive, contiguous forest tracts, far from human development. Will use mature hardwoods or mixedwoods with high canopy closure (60-90%) for core nesting stands; extend riparian buffers. Implement a 30 ac. nest protection zone around active and alternate nests to avoid disturbance during breeding season (Mar.-Aug.). Protect inactive nest trees indefinitely when practical. Support prey species habitat with small forest openings, retained cavity trees, and downed logs.

## Blackburnian Warbler (*Setophaga fusca*)

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© Frode Jacobsen/Shutterstock



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** Breeding male is unmistakable with a vivid orange face and throat, and intricate black-and-white plumage.

**SONG:** Primary song is a rapid *zip zip zip zip zip zip zip titititi tseeeee*; the final note is much higher pitched.

**NEST:** Small cup nest, placed on a conifer limb away from the trunk, within dense foliage. Typically higher than 30 feet.

**FOOD:** Insectivorous; also eats spiders. Consumes many caterpillars when abundant, especially spruce budworm. Forages by hover-gleaning, and by probing clusters of needles and dead leaves.

**TERRITORY SIZE:** 1-2.5 acres, smaller territory in softwoods. Found in the U.P. and northern L.P.; uncommon in southwest L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of current breeding range in Michigan.

### HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:

Mature, conifer-dominated forests with diverse age classes, intact canopies (>80% canopy cover), and dense midstory. Very sensitive to forest fragmentation; prefers forest interiors with components of hemlock, white spruce, balsam fir, and white pine. Use a patchwork of even-aged management to create a shifting mosaic of spruce and fir in diverse age classes across the landscape. In mixed cover types (aspen-conifer, hardwood-conifer), maintain or increase the conifer component particularly where hemlock or white pine are present.

**Swainson's Thrush** (*Catharus ustulatus*)



© Agami Photo Agency/Shutterstock



**FOREST AGE CLASS:** Older Forest

**IDENTIFICATION:** Medium-brown with pale underparts, spotted breast, and large buff-colored eyerings that extend in front of the eye, creating “spectacles.”

**SONG:** Complex, distinctive, fluting song. An upward-spiraling melody, constantly ascending. Described as *whip-poor-will-a-will-e-zee-zee-zee*, ending in a high trill.

**NEST:** Nests in shaded understory, on average 3-10 feet above the ground in shrub thickets, conifer saplings, or young deciduous trees.

**FOOD:** Insectivorous and frugivorous; mostly forages on the ground but also catches insects with short hawking flights. Fruit is especially important during late summer and fall migration.

**TERRITORY SIZE:** 2.5-5 acres. Found in the U.P.; uncommon in the northern L.P.

**CLIMATE VULNERABILITY:** High. Predicted to lose all of its current breeding range in Michigan.

**HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:**

Coniferous forests with dense understory and native fruit-bearing plants. Conserve mature stands (>150 acres) of conifers dominated by fir, spruce, or eastern hemlock, with mostly-closed canopy. Alternatively, manage for dense mixed-deciduous stands that support a variety of understory layers. Retain and promote native, fruit-bearing trees and deciduous shrubs, or use moderate selective harvesting to promote understory growth. Consider the landscape context when planning for large areas of clearcutting.<sup>14</sup>

**Kirtland's Warbler** (*Setophaga kirtlandii*)



© Jacob Spendlow



**FOREST AGE CLASS:** Young Forest

**IDENTIFICATION:** Steel-gray with black streaks on the upperparts and lemon yellow underparts; has a black mask and white, broken eye-ring. A fairly large warbler; constantly pumps its tail.

**SONG:** Clear, distinct series of three emphatic couplets: *chip-chip-che-way-o*.

**NEST:** Cup nest on the ground; hidden by low vegetation.

**FOOD:** Insects and small fruits.

**TERRITORY SIZE:** Highly variable, affected by tree density and extent of habitat. Average is 15-20 acres; may be up to 150 acres. Territories grouped into “colonies;” isolated pairs rarely found. Geographically restricted, nesting primarily in the northern L.P., with scattered locations across the U.P., Wisconsin, and Ontario.

**CLIMATE VULNERABILITY:** Vulnerable to changes in habitat availability on breeding and wintering grounds. \*Species not assessed as part of Survival by Degrees report.

**HABITAT FEATURES & MANAGEMENT RECOMMENDATIONS:**

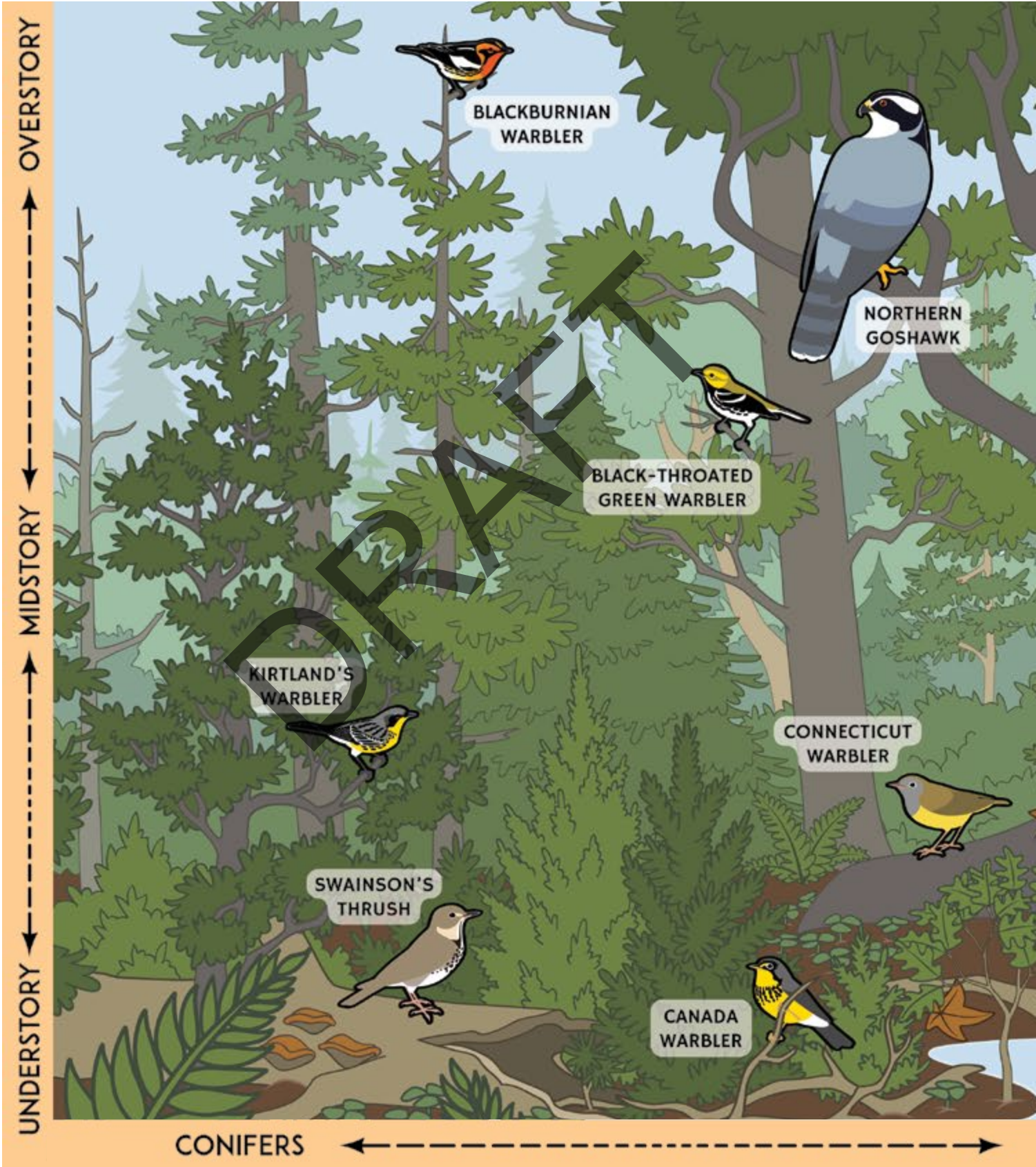
Young, expansive (minimum 200 acres; >300 acres preferred), high density (>1,000 stems per acre) jack pine communities on sandy outwash plains. Dense lower branches on jack pine trees 5-23 years old conceal nests along with grasses and forbs. Most management occurs on large tracts of public lands. The “opposing wave” method creates usable jack pine plantation breeding habitat. Private landowners adjacent to existing public management areas may be able to create habitat in coordination with public land management agencies.<sup>17</sup>

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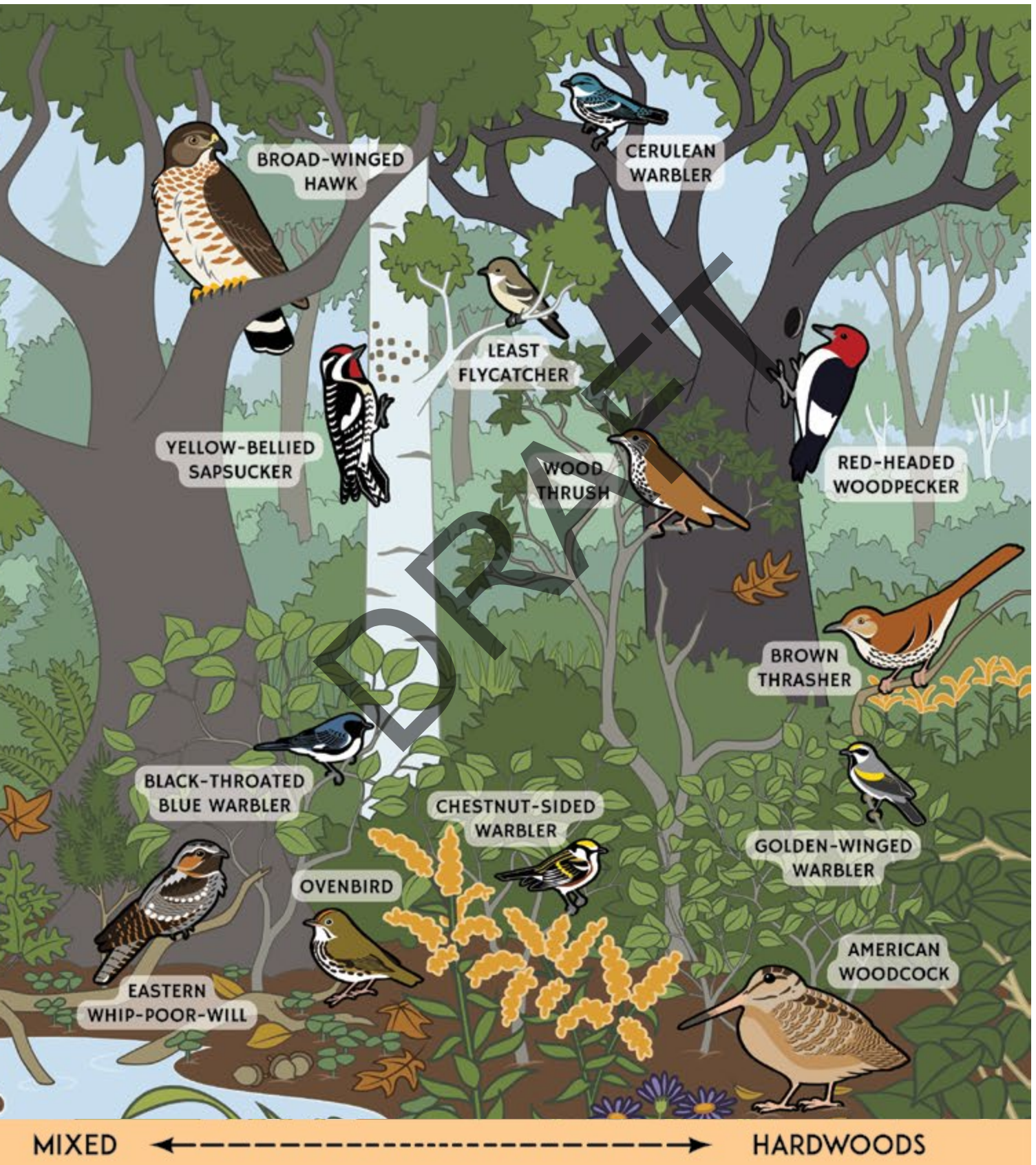
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# Forest Habitats with Birds in Mind

Each bird species uses slightly different habitat features, even if the same acre (or tree!) within a forest is shared. Resource partitioning, a division of limited resources within the same ecological niche, is a way for wildlife to co-exist. For example, Cerulean Warblers nest in the uppermost third of the forest, whereas Black-throated Blue Warblers nest within six feet of the ground in a well-developed shrub layer. Both warblers are insectivorous but easily co-exist, each foraging at different heights in the forest.



Other species have different requirements – some may need an older forest with little understory growth, such as the Northern Goshawk. Others, like the American Woodcock, need areas with dense, brushy understory as well as wide open areas for their breeding displays. Forest age class is also a factor. Kirtland's Warblers only use jack pine forest when it is young and trees are <30 feet tall. Let's take a look at forest habitat associations and where you can expect to find our priority bird species.



# Forest Habitat Associations

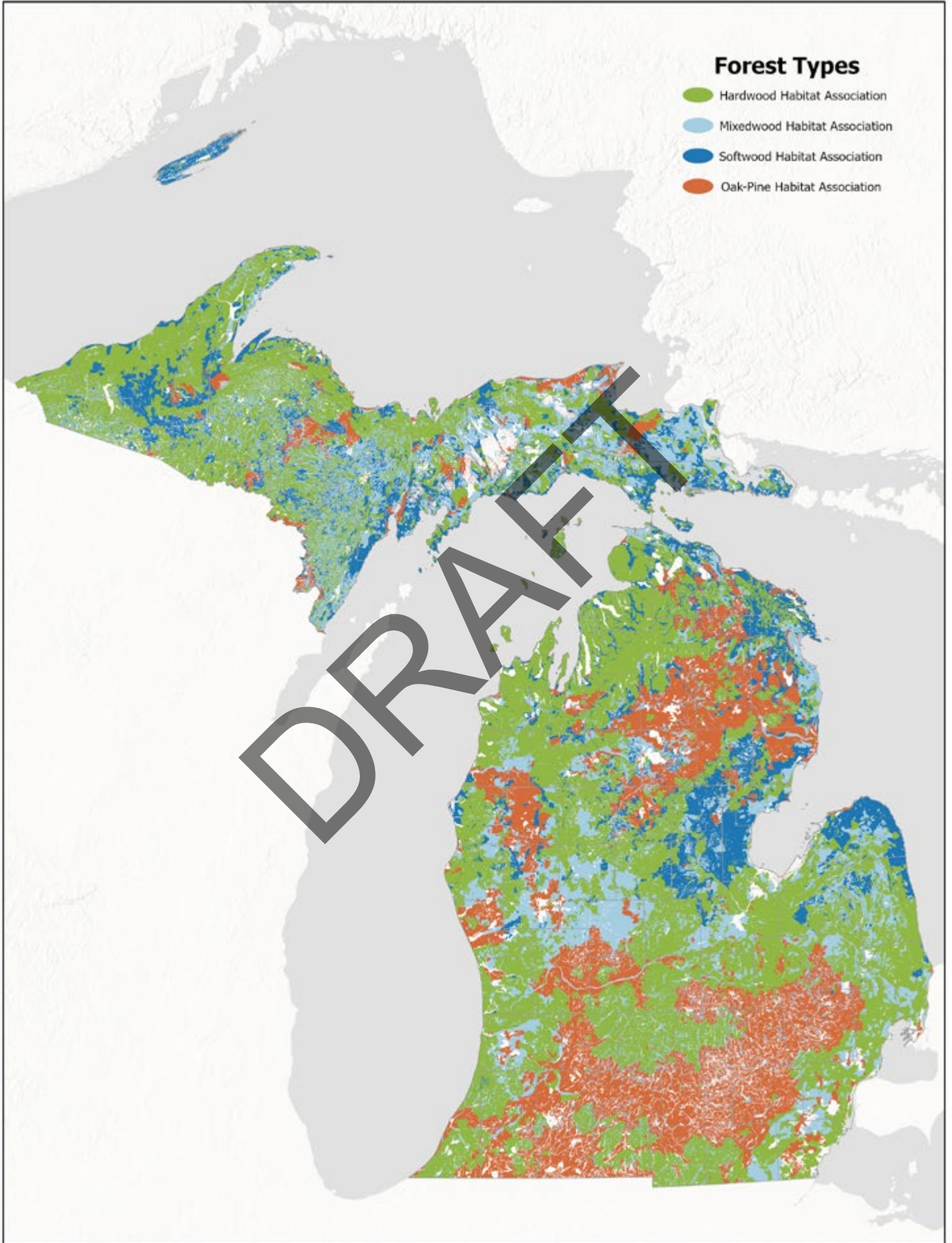
Michigan is home to a diverse selection of forest types, each with a unique composition of tree species, herbaceous plant cohorts, soil types, and associated landforms. While there are many different classification systems, the U.S. Forest Service classifies Michigan forests into more than 50 different types; only 23 of those types occupy more than 1% of the total forested area in the state.<sup>18</sup> This guide is focused on the most common forest types, which are grouped by tree species similarity, relation to one another on the landscape, and provision of similar habitat features for *Forestry for Michigan Birds* (FMB) priority species. These groups are referred to as *forest habitat associations* and are as follows:

FOREST HABITAT ASSOCIATIONS	GENERAL FOREST TYPES
<b>Hardwood Habitat Association</b>	Mixed hardwoods Aspen-paper birch Deciduous swamps and floodplains
<b>Mixedwood Habitat Association</b>	Hardwood/conifer uplands Hardwood/conifer swamps
<b>Softwood Habitat Association</b>	Northern cedar swamps/tamarack Spruce-fir Hemlock dominated
<b>Oak-pine Habitat Association</b>	Oak dominated hardwoods Softwood plantations Natural red and white pine Jack pine

The map on the following page shows the distribution of forest habitat associations from historic data. Forest ecosystems are constantly changing over time, with or without human influence. In some instances, historic data may be useful in guiding forest management decisions or when restoring native forest lands once occupied by plantations, agriculture, or other non-forested use. In other instances, it may not be realistic or feasible, or even desirable, to strive for the pre-settlement forest type. For finer-scale maps of pre-settlement forests (and other habitat types), visit the MI Vegetation circa 1800 Viewer at <https://mnfi.maps.arcgis.com/apps/StorytellingSwipe/index.html?appid=c285e9eab9774c77a36d8726474fa408>.



OCCURRENCE MAP<sup>19</sup>



## Hardwood Habitat Association

### COMMON FOREST TYPES

- Mixed hardwood
- Aspen-paper birch
- Deciduous swamps and floodplains

### IDENTIFICATION

Hardwood habitat association forest types are important to the Great Lakes region. In Michigan alone, northern hardwoods account for 29% of the total forestland in the state, and almost 16% of the total northern hardwood acres in the United States.<sup>18</sup> The most common tree species that make up hardwood forests include: sugar maple, American beech, American basswood, red maple, bigtooth and quaking aspen, yellow birch, and ash. Associated tree species with less than 25% stocking include: eastern white pine, eastern hemlock, northern white-cedar, and northern red oak.



© Josh Shields

### ECOLOGY

Hardwood forests are often closed canopy, mature systems where natural disturbances create small gaps that facilitate regeneration. In riparian systems, tip up mounds and periodic dry conditions are important for regeneration. Aspen-paper birch are early successional forests that thrive in more frequent and wide-scale disturbance regimes. Hardwood forests favor short growing seasons, cold winter temperatures, and heavy snow load.

### WILDLIFE

The diversity of tree species and habitats in hardwood habitat association forests supports the largest variety of FMB's priority bird species. Mature stands of mixed hardwoods, including American beech, oaks, hickories, and walnuts, produce hard mast and nuts, which are staple food sources for wildlife. Vernal pools, or ephemeral wetlands, are common and serve as breeding habitat for frogs, salamanders, and a host of macro-invertebrates. Vernal pools also provide ideal stopover sites for migrating birds. Mature hardwood forests are relatively stable and wildlife habitat is maximized when mature forest is interspersed with younger forests at various stages of succession.

### CLIMATE VULNERABILITY/ADAPTATION<sup>20</sup>

As the climate continues to change, hardwood habitat association forests and accompanying bird habitat may be moderately vulnerable to increased threat from pests, diseases, and drought. The adaptive capacity of hardwood habitat association forests is fairly high due to diverse tree species and fertile, well drained soils. Overall temperatures are expected to rise, particularly in the winter, resulting in fewer days with frozen ground. The growing season will become longer, with increased chances of summer droughts.

#### Tree species winners and losers

Across the entire state of Michigan, habitat suitability is projected to decline for sugar maple, yellow birch, and to a lesser degree, eastern hemlock. In southern occurrences of the aspen-paper birch forest type, similar declines are projected for eastern white pine, balsam fir, paper birch, and quaking aspen. Conversely, hardwood species found in southern Michigan, including white oak, sycamore, tupelo, hickories, and yellow poplar, are projected to gain new suitable habitat in the Northern Lower Peninsula. Red maple is a common associate throughout the state and is projected to fare better under future climate conditions relative to the other species in this forest system, suggesting that it may have a competitive advantage in the future. Although individual species may increase or decrease as the climate changes, there is evidence that the hardwood habitat association forest types may be better able to maintain productivity relative to other forest types.

#### General trend of forest type

Hardwood habitat association forest types are projected to be negatively affected by altered precipitation patterns: more frequent and severe droughts in the summer, and more frequent and intense heavy rainfall events. Pressure from invasive pests and diseases is expected to intensify; stress caused by exotic earthworms will become greater for the northern hardwoods forest type. Management activities that remove large down woody debris or reduce diversity will negatively affect the northern hardwoods type. Deer herbivory will continue to impede regeneration across all forest types.





## HARDWOOD HABITAT ASSOCIATION TABLE<sup>21</sup>

FMB PRIORITY SPECIES	KEY HABITAT FEATURES
<b>Black-Throated Blue Warbler</b>	Dense shrub understory
<b>Chestnut-Sided Warbler</b>	Regenerating gaps and young forest
<b>Golden-Winged Warbler</b>	Young forest openings with large residual trees
<b>Wood Thrush</b>	Mature trees, dense leaf litter
<b>Ovenbird</b>	Leaf litter, mature forest, little understory cover
<b>Yellow-Bellied Sapsucker</b>	Young, regenerating openings, especially aspen or birch; snags
<b>Broad-Winged Hawk</b>	Small gaps within mature forest
<b>Northern Goshawk</b>	Mature trees, no fragmentation
ADDITIONAL WILDLIFE SPECIES	KEY HABITAT FEATURES
<b>Black Bear</b>	Large forested areas, hard mast, downed woody debris
<b>Northern Flying Squirrel</b>	Cavity trees, hard mast
<b>Pileated Woodpecker</b>	Snags, cavity trees, large trees in decline
<b>Blue Spotted Salamander</b>	Downed woody material, leaf litter
<b>Barred Owl</b>	Densely forested riparian areas













oak hardwood forests, the absence of surface fire and management could favor mesic hardwoods over oaks, leading to a type shift. Drier conditions also increase the potential for wildfire, pest, and disease activity. Increased mortality to seedlings in plantations may occur due to more intense spring rain events combined with long, dry summers.

### OAK-PINE HABITAT ASSOCIATION TABLE<sup>21</sup>

FMB PRIORITY SPECIES	KEY HABITAT FEATURES
<b>Kirtland's Warbler</b>	Young, dense, expansive jack pine stands
<b>Red-headed Woodpecker</b>	Open areas with scattered trees, clustered snags, forest edge
<b>Blackburnian Warbler</b>	Tall conifers (for perches above the canopy)
<b>Ovenbird</b>	Leaf litter, mature forest, little understory cover
<b>Wood Thrush</b>	Mature, tall trees and dense leaf litter
<b>Northern Goshawk</b>	Mature trees, open understory in nest stands
ADDITIONAL WILDLIFE SPECIES	KEY HABITAT FEATURES
<b>Sandhill Crane</b>	Riparian forest openings
<b>Gray fox</b>	Mosaic of forests and openings
<b>Smooth green snake</b>	Moist mixed pine forest edges
<b>Kirtland's Warbler</b>	Dense, young jack pine
<b>American beaver</b>	Forested riparian areas and wetlands
<b>Northern long-eared bat</b>	Forests with low structural diversity

### FOREST MANAGEMENT RESTORES KIRTLAND'S WARBLER HABITAT AND POPULATION

Scientists began to monitor the population decline of the Kirtland's Warbler in the 1940's, around a decade after fire suppression efforts increased in Michigan and the United States. The absence of fire disturbance meant the majority of young (6- to 15-year-old) jack pine stands were becoming unsuitable as breeding habitat. By 1973, the Kirtland's Warbler was placed on the Federal Endangered Species list due to plummeting populations. In response, Federal and State agencies began to mimic fire disturbance by planting and short rotation harvesting of extensive swaths of dense jack pine forests. In 2019, the Kirtland's Warbler was removed from the Federally Endangered Species List and continues to be listed as endangered in the State of Michigan.<sup>8,17</sup>





































## CLIMATE CHANGE RESOURCES

### Climate Change Atlas for both Birds and Trees

Examine distributions of current and modeled future habitat quality for many individual tree species within the eastern United States. Explore regional species summary tables to see how tree species habitat quality may change. [fs.fed.us/nrs/atlas](https://fs.fed.us/nrs/atlas)

### National Audubon Society's Climate Change

Audubon scientists used more than 140 million observations, recorded by birders and scientists, to describe where 604 North American bird species live today—an area known as their “range.” The latest climate models were then used to project how each species’ range will shift as climate change and other human impacts advance across the continent. More than two thirds of North American bird species are at risk from climate change. [audubon.org/climate/survivalbydegrees](https://audubon.org/climate/survivalbydegrees)

### Northern Institute of Applied Climate Science

The USDA Northern Forests Climate Hub and the Northern Institute of Applied Climate Science (NIACS) provides information and practical advice for land managers to help forests adapt to changing climate conditions. [forestadaptation.org/adapt](https://forestadaptation.org/adapt)

#### Forest Climate and Action Scorecards for Private Landowners

The *Keep Your Woods Healthy for Tomorrow* publication was developed by NIACS to help private landowners consider climate change in the context of their woods. The publication contains four separate “Scorecards” to help landowners think about forests in terms of forest diversity, structure, regeneration, and other factors. Each Scorecard also includes a list of Climate-informed Actions that might help landowners address the greatest risks.

<https://forestadaptation.org/learn/resource-finder/michigan-private-landowner-climate-scorecard-actions>

#### Michigan Climate Change Bulletins

NIACS and Michigan State University Extension worked together to produce “Forest Management in a Changing Climate,” a 5-part bulletin series for foresters and natural resource managers in Michigan.

[forestadaptation.org/learn/resource-finder/michigan-climate-change-bulletins](https://forestadaptation.org/learn/resource-finder/michigan-climate-change-bulletins)

## BEST MANAGEMENT PRACTICES AND MANAGEMENT GUIDES FOR SELECTED FMB PRIORITY FOREST BIRD SPECIES:

- American Woodcock: [timberdoodle.org/sites/default/files/American\\_Woodcock\\_Upper\\_Great\\_Lakes\\_BMP.pdf](https://timberdoodle.org/sites/default/files/American_Woodcock_Upper_Great_Lakes_BMP.pdf)
- Canada Warbler: [highbranchconservation.com/wp-content/uploads/2017/02/Guidelines-for-Managing-Canada-Warbler-Habitat-in-the-Northeast-and-Mid-Atlantic-Regions-2017.pdf](https://highbranchconservation.com/wp-content/uploads/2017/02/Guidelines-for-Managing-Canada-Warbler-Habitat-in-the-Northeast-and-Mid-Atlantic-Regions-2017.pdf)
- Cerulean Warbler: [amjv.org/wp-content/uploads/2018/06/cerulean\\_guide\\_1-pg\\_layout.pdf](https://amjv.org/wp-content/uploads/2018/06/cerulean_guide_1-pg_layout.pdf)
- Golden-winged Warbler: [gwwa.org/wp-content/uploads/2020/06/GWWA-GLRegionalGuide\\_190711.pdf](https://gwwa.org/wp-content/uploads/2020/06/GWWA-GLRegionalGuide_190711.pdf)
- Swainson's Thrush: [com-bbimages.s3.amazonaws.com/bbimages/clo/pdf/thrushguide.pdf](https://com-bbimages.s3.amazonaws.com/bbimages/clo/pdf/thrushguide.pdf)
- Wood Thrush: [com-bbimages.s3.amazonaws.com/bbimages/clo/pdf/thrushguide.pdf](https://com-bbimages.s3.amazonaws.com/bbimages/clo/pdf/thrushguide.pdf) and [highbranchconservation.com/wp-content/uploads/2017/02/Guidelines-for-Managing-Wood-Thrush-and-Scarlet-Tanager-Habitat-in-the-Northeast-and-Mid-Atlantic-Regions-2017.pdf](https://highbranchconservation.com/wp-content/uploads/2017/02/Guidelines-for-Managing-Wood-Thrush-and-Scarlet-Tanager-Habitat-in-the-Northeast-and-Mid-Atlantic-Regions-2017.pdf)

## ADDITIONAL THREATS TO BIRDS:

There are many additional human-caused threats to birds, driving overall declines in bird populations across North America.

### The primary human-caused threats to birds include:

- Cats outdoors (both feral and owned cats)
- Glass collisions
- Communications tower collisions
- Wind turbines (collisions and habitat fragmentation)
- Vehicle collisions

**Other threats that are harder to quantify, yet have direct impacts to birds include:**

- Pesticides
  - Direct toxicity to birds ingesting coated seeds
  - Indirectly impacts birds by reducing critical bird food supplies (insects)
- Rodenticides
  - Impact predatory birds who capture and eat a poisoned rodent
- Heavy metal contaminants
  - Lead shot or fishing sinkers are toxic to birds consuming fragments of lead in their prey (e.g., Bald Eagles and Common Loons consuming fish, or Turkey Vultures consuming carcasses)
  - Mercury bioaccumulates through the food chain and harms breeding success of birds such as Tree Swallows, which may ingest mercury by eating insects that emerged as adults from wetlands, lakes, ponds, or rivers
- Impacts of burning fossil fuels and other environmental pollution (e.g., water pollution)
  - The number of birds harmed directly and indirectly by these sources of pollution are not yet well understood

**Resources to better understand these additional threats, and how you can help protect birds:**

- Bird-friendly Communities - Ideas to help transform your community into a healthier place for birds and people: [michiganaudubon.org/bfc](http://michiganaudubon.org/bfc)
- Seven Simple Actions to Help Birds: [birds.cornell.edu/home/seven-simple-actions-to-help-birds](http://birds.cornell.edu/home/seven-simple-actions-to-help-birds)
- Impacts of outdoor cats to birds: [abcbirds.org/program/cats-indoors/cats-and-birds](http://abcbirds.org/program/cats-indoors/cats-and-birds)
- Safe Passage
  - Safe Passage Great Lakes: [michiganaudubon.org/bfc/safe-passage-great-lakes](http://michiganaudubon.org/bfc/safe-passage-great-lakes)
  - Preventing window collisions
    - American Bird Conservancy's guide to window collision causes and solutions: [abcbirds.org/glass-collisions](http://abcbirds.org/glass-collisions)
    - National Audubon Society's Lights Out program: [audubon.org/lights-out-program](http://audubon.org/lights-out-program)
  - Preventing bird-window collisions in Michigan: [michiganaudubon.org/bfc/bird-window-collisions](http://michiganaudubon.org/bfc/bird-window-collisions)
  - Michigan Dark Skies: [sites.lsa.umich.edu/darkskies](http://sites.lsa.umich.edu/darkskies)
- Contaminants
  - Lead in Michigan wildlife: [michigan.gov/dnr/0,4570,7-350-79136\\_79608\\_85016-26676--,00.html](http://michigan.gov/dnr/0,4570,7-350-79136_79608_85016-26676--,00.html)
  - Mercury impacts to loons in Michigan: [blog.nwf.org/2011/12/mercury-impacts-to-loons-michigan-lakes-draws-thousands-of-conservationists-anglers](http://blog.nwf.org/2011/12/mercury-impacts-to-loons-michigan-lakes-draws-thousands-of-conservationists-anglers)

**COST SHARE PROGRAMS AVAILABLE TO LANDOWNERS****Forest Stewardship Program (FSP)**

The DNR administers the Forest Stewardship Program (FSP), using United States Forest Service funding to pay certified plan writers a portion of the total cost for writing a management plan for landowners.

[michigan.gov/dnr/0,4570,7-350-79136\\_79237\\_80945\\_81361---,00.html](http://michigan.gov/dnr/0,4570,7-350-79136_79237_80945_81361---,00.html)

**Natural Resources Conservation Service (NRCS) Cost Share**

In addition to technical assistance, NRCS' 52 field offices in Michigan offer several financial assistance programs to landowners to help with the cost of conservation plan development as well as with implementation of planned activities. Programs including the Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP) can provide funding for Forest Management Plans, forest stand improvement, invasive species control practices, tree and shrub planting, wildfire mitigation practices, and much more.

Find your local NRCS Service Center here: [nrcs.usda.gov/wps/portal/nrcs/mi/contact/local](http://nrcs.usda.gov/wps/portal/nrcs/mi/contact/local)





## TAX INCENTIVE PROGRAMS FOR FOREST LANDOWNERS

### Qualified Forest Program (QFP)

Administered through the Michigan Department of Agriculture and Rural Development (MDARD), the Qualified Forest Program requires active management for commercial timber harvest, wildlife habitat enhancement, and improvement of other non-forest resources in exchange for reduced property taxes. The program is voluntary, however participating landowners that withdraw must repay up to seven years' value of the foregone taxes. For example, if your property was enrolled in the program for four years and you decided to withdraw it, you would repay four years of the saved taxes. If your property was enrolled in the program for 20 years and you decided to withdraw it, you would repay the maximum of seven years of the saved taxes.

While enrolled, the property is not open to public access. [michigan.gov/qfp](https://michigan.gov/qfp)

### Commercial Forest (CF)

The Commercial Forest Program is administered through the Michigan DNR and provides a property tax incentive to private landowners to retain and manage forestland for long-term timber production. The program is voluntary, however participating landowners that withdraw must repay up to seven years' value of the foregone taxes in addition to a withdrawal administrative fee. For example, if your property was enrolled in the program for four years and you decided to withdraw it, you would repay four years of the saved taxes. If your property was enrolled in the program for 20 years and you decided to withdraw it, you would repay the maximum of seven years of the saved taxes.

While enrolled, the forested property is open to public foot access.

[michigan.gov/documents/dnr/IC4171\\_CommercialForestSummary\\_185969\\_7.pdf](https://michigan.gov/documents/dnr/IC4171_CommercialForestSummary_185969_7.pdf)

## NATURAL RESOURCE INFORMATION

### Web Soil Survey: Know Your Soils

Web Soil Survey can be used to learn more about the soils and associated tree, shrub, and vegetative species for your forested property. It also provides the opportunity to view satellite images of your property in relation to the surrounding landscape:

[websoilsurvey.sc.egov.usda.gov/App/HomePage.htm](https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm)

### Audubon Native Plants Database

Find the best native plants to support birds in your local area. When you enter your zip code this tool provides information on bird-friendly native plants suited to your geographic area, as well as local resources and information. [audubon.org/native-plants](https://audubon.org/native-plants)

### Conservation Districts

Conservation Districts are local units of government that utilize state, federal and private sector resources to solve today's conservation challenges. In Michigan, the 75 Conservation Districts are the local providers of natural resource management and frequently have the answers to your natural resource questions. [macd.org/find-your-district](https://macd.org/find-your-district)

### Cooperative Invasive Species Management Associations

All Michigan counties are covered by a Cooperative Invasive Species Management Areas (CISMA). 'CISMAs' are groups of non-profits, government agencies, businesses and volunteers that have come together to tackle the issue of invasive species in their regions. CISMAs can offer a range of services for preventing, identifying, reporting and managing invasive species. Some CISMAs provide management assistance to private landowners. Contact your local CISMA if you have questions about invasive species or if you are interested in becoming involved in efforts to prevent and control invasive species in your community. [michigan.gov/invasives](https://michigan.gov/invasives)

### Michigan Soil and Water Quality Best Management Practices

The Michigan Department of Natural Resources and Department of Environment, Great Lakes and Energy (Formerly Department of Environmental Quality) created this BMP manual to provide specific guidance on how to protect water quality, critical habitat, and aquatic resources, while conducting timber harvesting or other forest management activities. [michigan.gov/-/media/Project/Websites/dnr/Documents/FRD/Mgt/IC4011\\_SustainablePracticesForestLand.pdf](https://michigan.gov/-/media/Project/Websites/dnr/Documents/FRD/Mgt/IC4011_SustainablePracticesForestLand.pdf)

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#### **Forestry for Maine Birds: A Guidebook for Foresters Managing Woodlots "With Birds in Mind"**

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