



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 American Bird Conservancy at michiganbirds@abcbirds.org or by phone at 540-253-5780.

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Table of Contents

WHAT IS FORESTRY FOR MICHIGAN BIRDS?	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
MICHIGAN PRIORITY FOREST BIRDS	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
FOREST HABITATS WITH BIRDS IN MIND	20
FOREST HABITAT ASSOCIATIONS	22
Hardwood Habitat Association	24
Mixedwood Habitat Association	26
Softwood Habitat Association	28
Oak-pine Habitat Association	30
FORESTRY WITH BIRDS IN MIND	32
Landscape-level Considerations	32
Stand-level Considerations	33
SILVICULTURAL SYSTEMS FOR MICHIGAN BIRDS	36
APPENDICES	42
REFERENCES	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.¹ 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.**² 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.^{3,4} The top five tree family groups supporting caterpillars across North America include oaks (*Quercus*), willows (*Salix*), cherries (*Prunus*), pines (*Pinus*), and poplar/cottonwood/aspen (*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.⁵ 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.

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.



Cerulean Warbler. © Ray Hennessy/Shutterstock



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**.⁶ 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.^{6,7}

- **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.⁶

For additional information on bird species' population trends, range and distribution, visit AllAboutBirds.org or birdsoftheworld.org.^{8,9}

KEY TO SPECIES PROFILES:

Glossary of terms: See appendices for more detailed definitions.¹⁰

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.

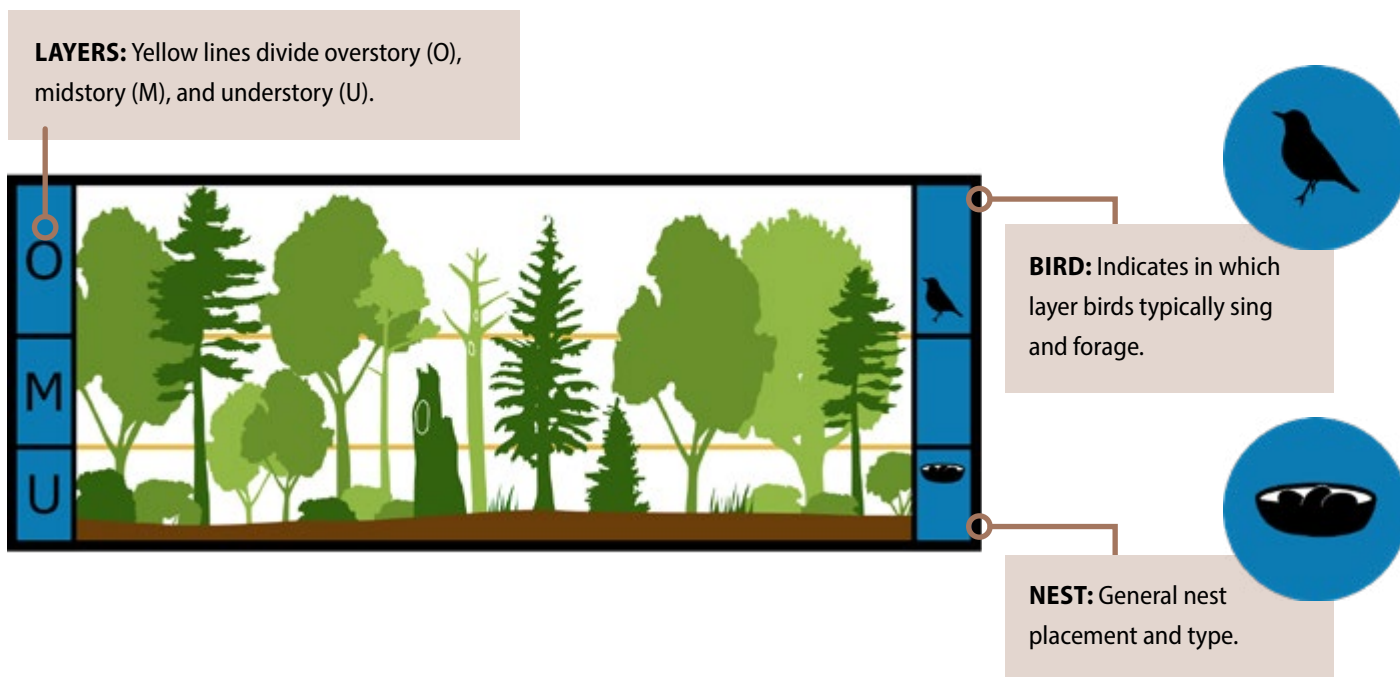
ABBREVIATIONS:

U.P.: Upper Peninsula

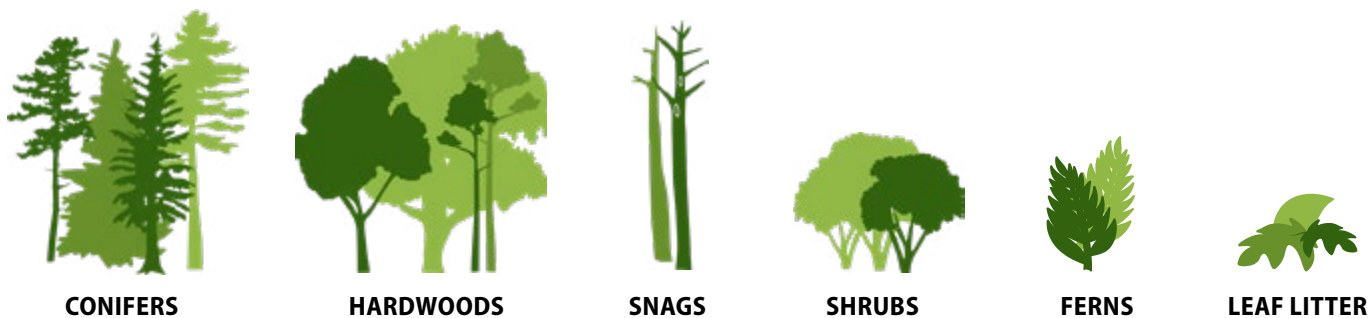
L.P.: Lower Peninsula



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*)

H

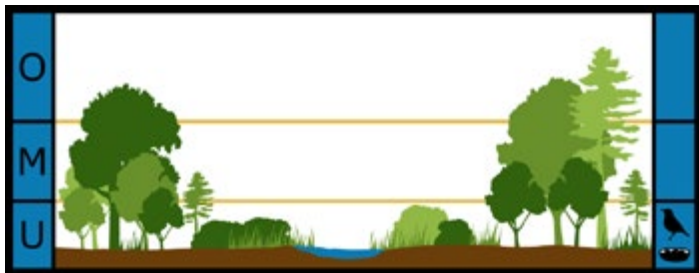
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OP

S



© 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.¹¹

Broad-winged Hawk (*Buteo platypterus*)

H

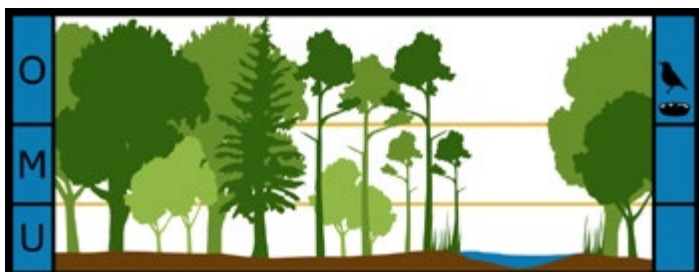
M

OP

S



© 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 Zupowski/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.

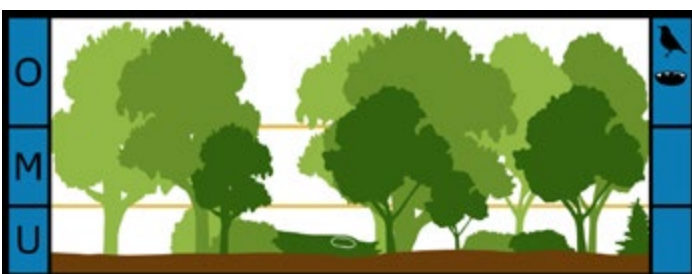
CLIMATE VULNERABILITY: High. Predicted to lose all of range in southern L.P. and maintain or gain some range in the U.P. and northern L.P.

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/.¹²

H

M

OP

S

H

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S

Chestnut-sided Warbler (*Setophaga pensylvanica*)

H

M

OP

S

© 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*)

H

M

OP

S

© 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.

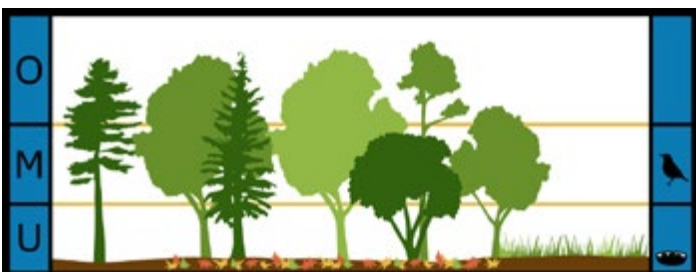
FOOD: Aerial insectivore; mainly moths and beetles. Feeding occurs primarily at dusk and dawn or when there is moonlight.

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*)

© Agami Photo Agency/Shutterstock



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.¹³

Least Flycatcher (*Empidonax minimus*)

© David O. Hill



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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© FotoRequest/Shutterstock



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 ≥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*)

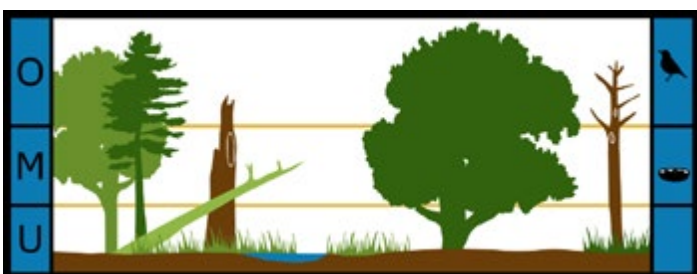
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FOREST AGE CLASS: Older Forest

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 (*Hylocichla 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.^{14,15}

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 under-story; 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 ≥5 residual trees per acre in harvest areas >2 acres.¹⁶

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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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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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.¹⁴

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.¹⁷

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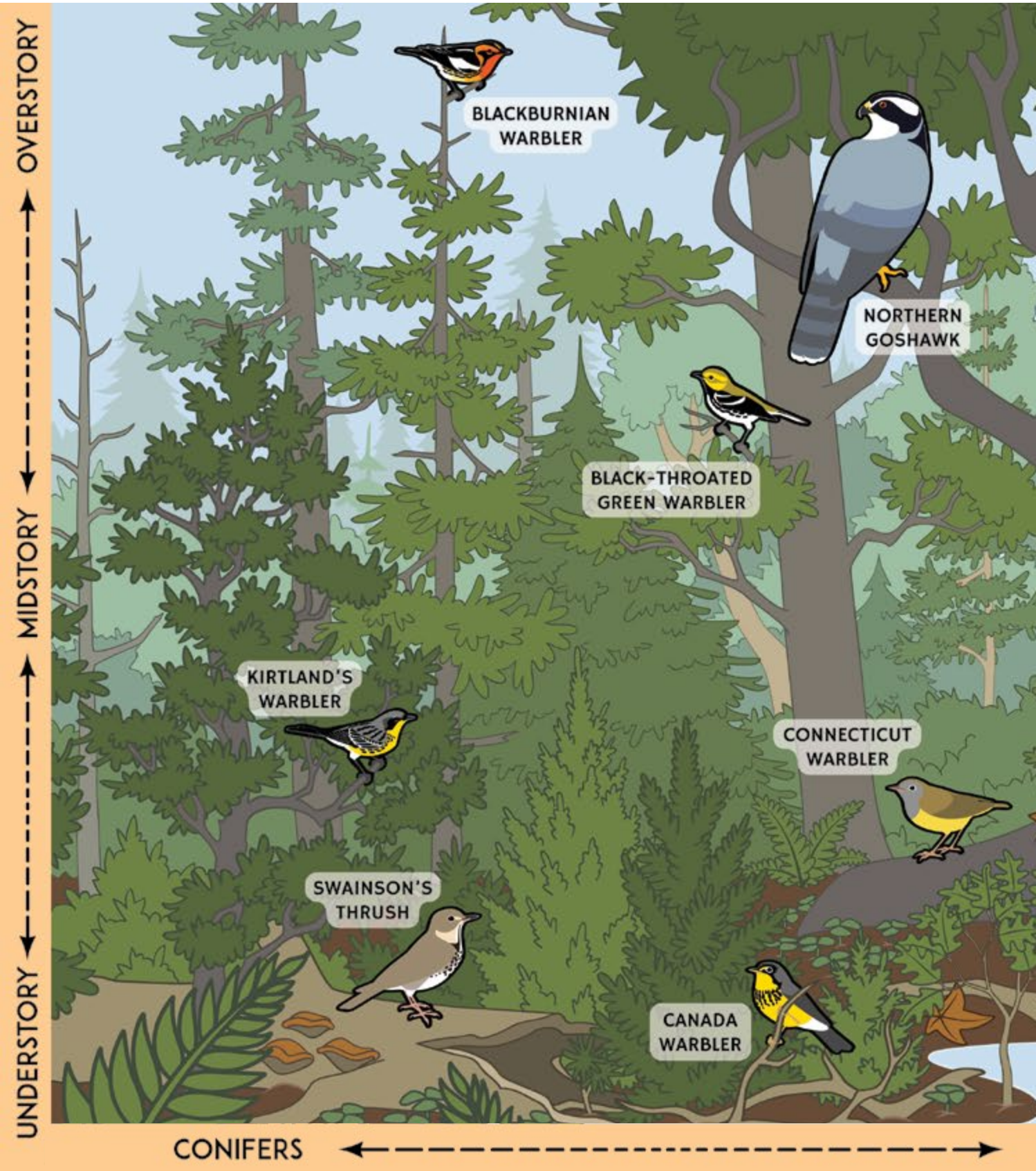
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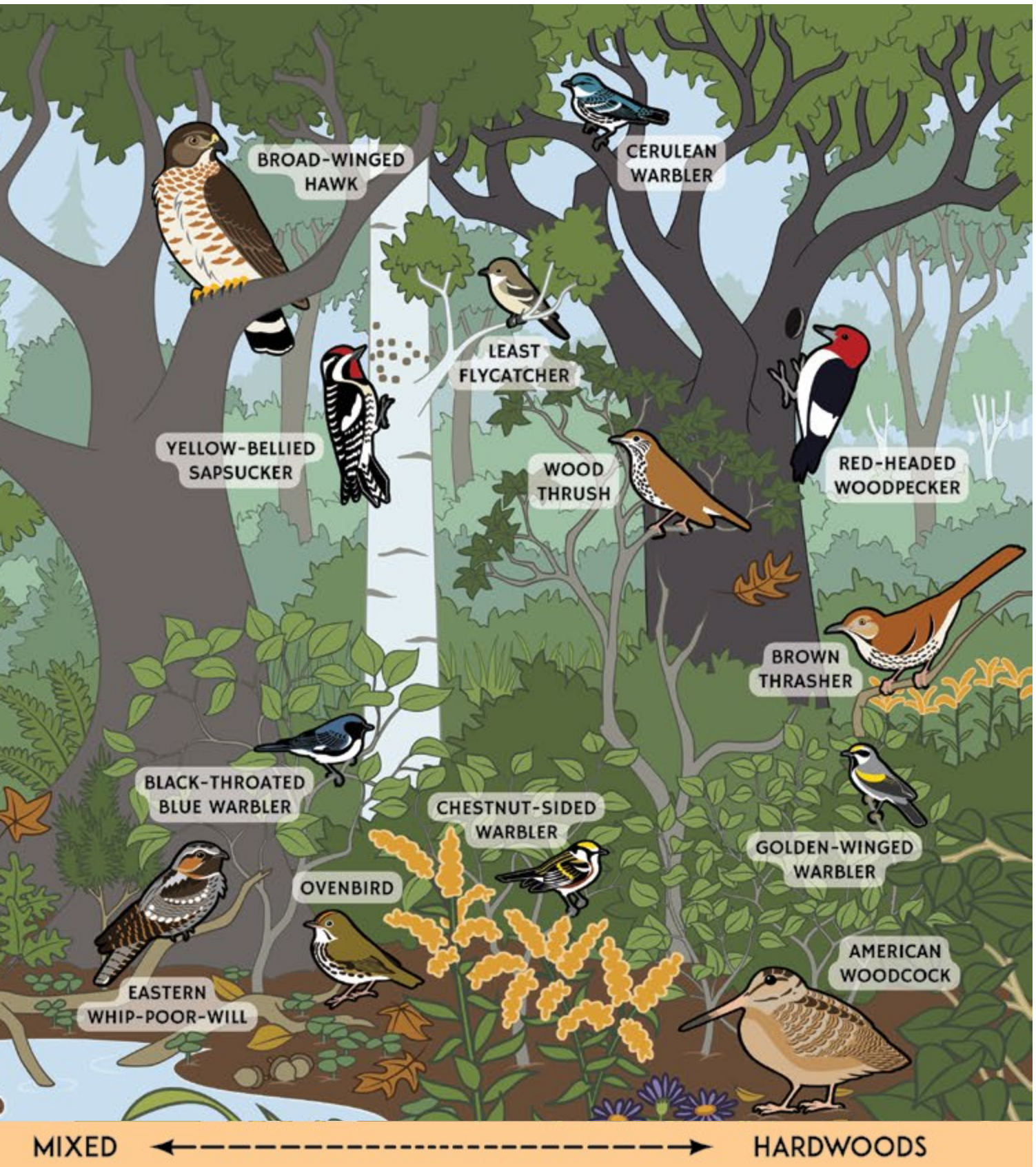
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Forest Habitats with Birds in Mind

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.



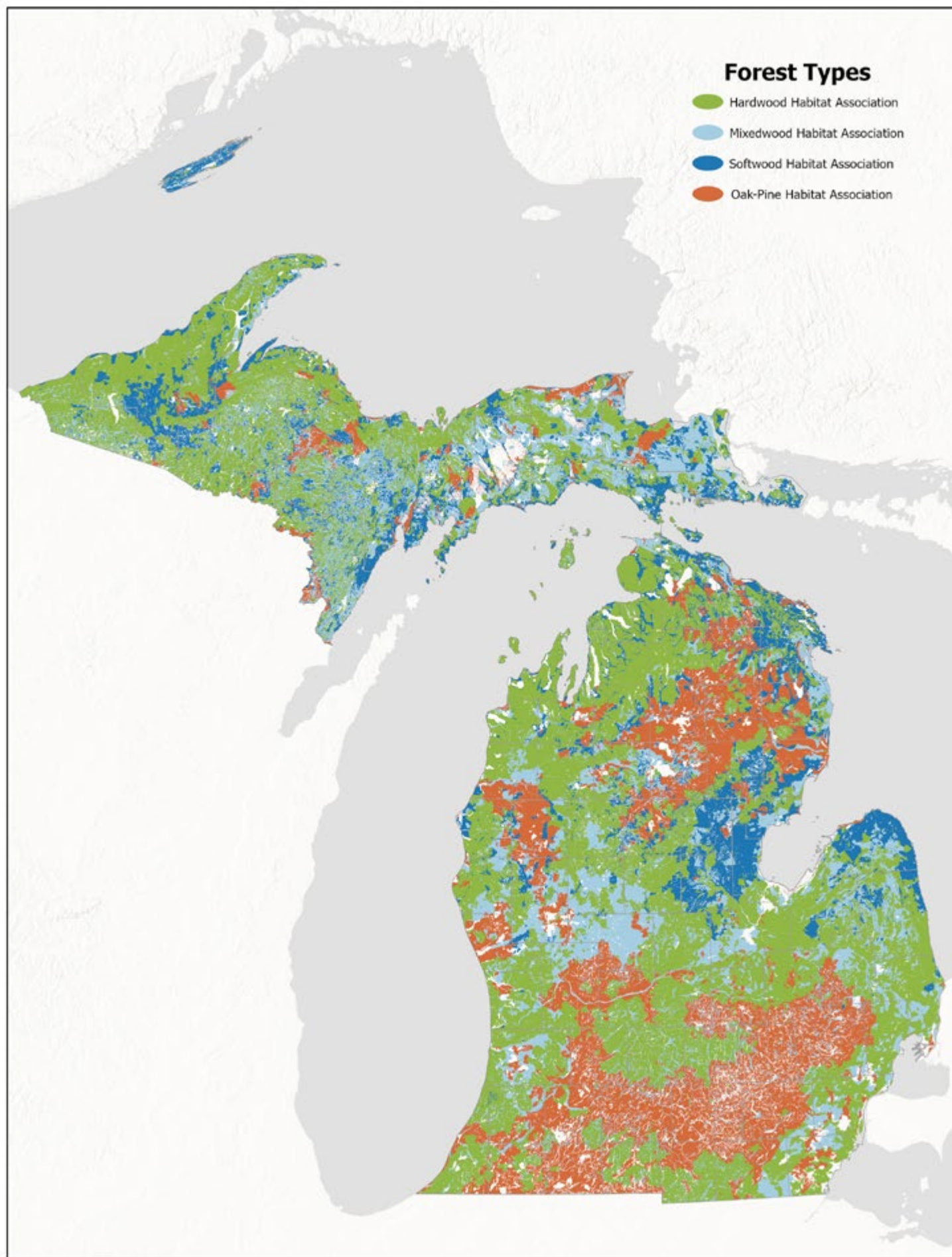
Forest Habitat Associations

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.¹⁸ 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
Hardwood Habitat Association	Mixed hardwoods Aspen-paper birch Decidious swamps and floodplains
Mixedwood Habitat Association	Hardwood/conifer uplands Hardwood/conifer swamps
Softwood Habitat Association	Northern cedar swamps/tamarack Spruce-fir Hemlock dominated
Oak-pine Habitat Association	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>.





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.¹⁸ 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/ADAPTATION²⁰

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 TABLE²¹

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



© Eric Greenwood/Flickr

Mixedwood Habitat Association

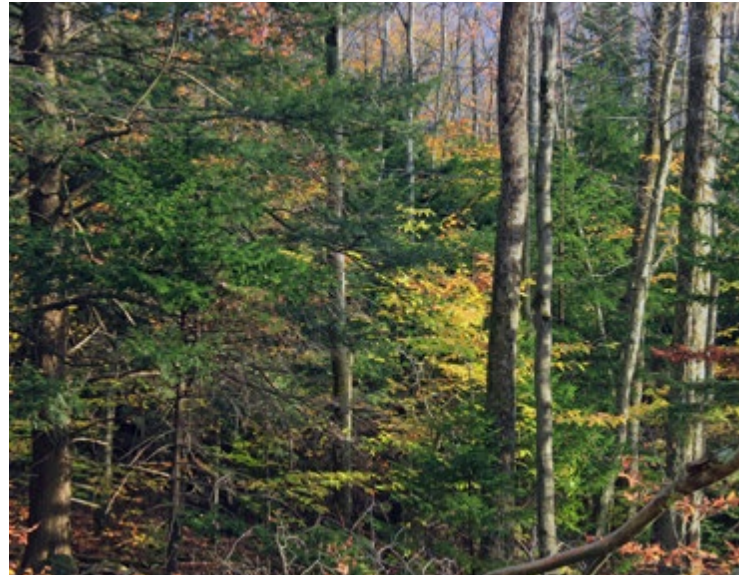
COMMON FOREST TYPES

- Hardwood/Conifer uplands
- Hardwood/Conifer swamps

IDENTIFICATION

Mixedwood habitat association forest types are transitional forests where neither hardwood nor softwood species exceed 75% of stocking, with species composition largely dependent on water availability.

Lowland mixedwood forests occur on poorly drained soils that are seasonally flooded or in areas of groundwater discharge. Common hardwoods include black ash, green ash, quaking aspen, white birch, American elm, red maple and balsam poplar as well as willow and alder species. Conifers include black spruce, balsam fir, northern white-cedar, and tamarack.



© Nicholas A. Tonelli/Flickr

In upland areas, mixedwood forests grow on well-drained, sandy loam, and include white birch, quaking aspen, balsam fir, and white spruce. Additional diversity is gained from a wide variety of associate species including eastern white pine, eastern hemlock, yellow birch, and American basswood. While the upland species are often restricted to drier microsites in the lowland mixed stands, lowland associates rely on moist sites in upland stands. These microsites are often created by subtle elevation changes.

ECOLOGY

The habitat structure of mixedwood habitat association forest types is driven by windthrow and fire disturbances, and changes to surface and groundwater. Windthrow, often aided by ice and snow accumulation, creates small gaps. Regeneration is dependent on gap size and is influenced by the surrounding seed source. Shading and leaf litter in hardwood-dominated stands may negatively affect recruitment of conifer seedlings. Species like yellow birch, eastern white pine, northern white-cedar, and eastern hemlock often germinate on hummocks and on decaying logs and stumps. Mycorrhizal connections may be necessary for seedling establishment in muck or wet soils. Insect outbreaks, plant parasites, invasive plants, and ungulate herbivory can alter community composition and structure.

WILDLIFE

The mosaic of habitat offered by the mixedwood habitat association forests is well used by wildlife. Bird species like the Northern Goshawk utilize mature forests with open understories in close proximity to water features. Dense vegetation and near-surface groundwater flow create the desired wintering grounds for white tailed deer, elk, and moose. Beaver regularly use lowland mixedwood habitat association forests; flooding from constructed ponds and herbivory can result in conversion to wetlands.

CLIMATE VULNERABILITY/ADAPTATION²⁰

The vulnerability of lowland mixedwood habitat association forests is high, as they typically grow in specific hydrologic conditions driven by the water table. Irregular precipitation patterns may result in droughty summer conditions negatively affecting shallow-rooted species, such as balsam fir and paper birch. Stands that are fed primarily with groundwater or are in low-lying areas are better able to withstand droughts and water fluctuations; increased winter and spring precipitation may buffer summer droughts in low-lying areas. Adaptability of lowland mixedwood forests is moderate as the diversity of species present and the variety of microsites on which trees grow reduces the risk of species decline in future conditions. Riparian forests tend to feature species with more southerly ranges which may increase their ability to adapt.

The vulnerability of upland mixedwood habitat association forests is moderate to high due to predicted reduction in soil moisture and enhanced evapotranspiration late in the season as the climate warms. Drought stress and mortality may increase, with the greatest risk on dry and poor quality sites. Forest pests like the forest tent caterpillar and spongy moth (formerly gypsy moth) may become more damaging, making stressed trees more susceptible to diseases like hypoxylon canker. Adaptability of upland mixedwood association is moderate as the dominant species are near their southern range limits and are projected to decline in suitable habitat.



Tree species winners and losers

Due to the emerald ash borer, black ash is predicted to be severely reduced across Michigan. This change can cause a chain reaction, creating unstable hydrologic conditions that can harm other species, like birch, which are intolerant of heavily saturated soils. Northern white-cedar, balsam fir, and black spruce are also expected to have declining suitable habitat. Red maple is predicted to do better in both lowland and upland sites due to excessive seed production and the ability to colonize and tolerate diverse site conditions. All species of the hardwood/conifer upland forests will be negatively affected by drought conditions, which increase susceptibility to insects, disease, and fire.

General trend of forest type

Irregular seasonal precipitation and groundwater flow could result in forest type transition, as drier soils will support a larger variety of tree and shrub species. Areas that remain inundated with water may transition to wetlands. These unstable conditions will cause trees stress, making them more susceptible to insects and disease. Collectively, large mortality events will create gaps; in the best case scenario, trees from the surrounding forest will seed in before invasive species gain a foothold. Continued wildlife browse on seedlings will dictate species composition and habitat structure.

MIXEDWOOD HABITAT ASSOCIATION TABLE²¹

FMB PRIORITY SPECIES	KEY HABITAT FEATURES
American Woodcock	Small shrubby clearings with dense undergrowth near water sources
Black-throated Green Warbler	High (>80% canopy cover) with preference to stands including hemlock
Black-throated Blue Warbler	Dense shrub understory
Canada Warbler	Wet areas with small gaps and high amounts of woody debris
Yellow-bellied Sapsucker	Young, regenerating openings, especially aspen or birch; snags
ADDITIONAL WILDLIFE SPECIES	KEY HABITAT FEATURES
American beaver	Forested riparian areas and wetlands
Snowshoe hare	Moist areas with dense undergrowth
Ruffed Grouse	Dense aspen regeneration, large woody debris
Wild Turkey	Forested areas with grassy openings
White-tailed deer	Winter browse and conifer cover



Softwood Habitat Association

COMMON FOREST TYPES

- Northern cedar swamps/Tamarack
- Spruce-fir
- Hemlock-dominated

IDENTIFICATION

Softwood habitat association forest types make up around 10% of the forested area in Michigan and occur in small pockets in the Northern Lower Peninsula with more extensive stands across the Upper Peninsula.¹⁸ The dominant species in this forest habitat association include northern white-cedar, eastern hemlock, white spruce, and balsam fir. Associate species include eastern white pine, black spruce, red maple, black ash, paper birch, yellow birch, quaking aspen, and red oak. Hardwood associates make up less than 25% of species present.



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ECOLOGY

Softwood habitat association forest types are found in cool, moist environments on soils that range from muck to dry-mesic sands. Soils are generally acidic but can be alkaline in areas where underlying bedrock is limestone or dolomite. Softwood habitat association forest types are found along streams or drainages (cedar swamps), adjacent to the Great Lakes in dunes, or inland in glacial lake plains (spruce-fir) or on north-facing slopes of ridges or ravines (hemlock). Proximity to the Great Lakes makes these forests more susceptible to windthrow, creating regeneration gaps. Softwood habitat association forest types thrive in climates dominated by temperate summer conditions with high humidity, fog, mist, and heavy snow accumulation in the winter.

WILDLIFE

Softwood habitat association forest types provide critical feeding, roosting, and perching habitat for migrating birds. The native shrubs found in these forests often produce fleshy fruits, an important source of nutrients for birds like the Swainson's Thrush. The conifer cover and temperatures moderated by groundwater provide white-tailed deer, elk, and moose winter yarding areas. In the spruce-fir forest type, moose preference for balsam fir affects the tree's height and abundance, ultimately affecting species composition, community structure, and successional patterns. These forest types support a variety of wildlife species listed as threatened or of special concern like the gray wolf and the eastern massasauga rattlesnake.

CLIMATE VULNERABILITY/ADAPTATION²⁰

Michigan's softwood habitat association forest types occur near the southern end of their range and are vulnerable to inconsistent hydrologic and soil moisture conditions driven by the changing climate. Lowland areas may remain cooler and be protected from drought if winter and spring moisture is retained through the summer months. Future precipitation and groundwater levels are difficult to predict, given the growing trend in disruptive climate events. Adaptability is low as increased pressure from neighboring forest types, native pests and pathogens, and invasive species could alter successional patterns and habitat suitability. Acid or alkaline soil conditions in the northern white cedar or tamarack swamps may decrease their susceptibility to forest types changes and invasive species. Damage from spruce budworm, a native pest, may reduce the spruce-fir forest type's resilience to predicted future conditions.

Tree species winners and losers

Many of the conifer species in softwood habitat association forest types (including northern white cedar, balsam fir, and black spruce) are expected to undergo significant declines in suitable habitat and biomass due to changing hydrologic conditions. Associated hardwood species, such as paper birch and quaking aspen, are also expected to decline. Eastern hemlock is predicted to experience a small decline in suitable habitat except in the western Upper Peninsula where suitable habitat may increase. Tamarack is expected to increase across the upper peninsula and experience little to no change in the northern lower peninsula.

General trend of forest type

Softwood habitat association forest types could experience significant community changes due to a variety of climate-related factors. Drought and changes to the water table are predicted to increase stress, making trees more susceptible to pressure from native and invasive



pests. Mortality from pests and drought conditions could increase the frequency of stand replacing fires or type change pressure from neighboring forest types, as seeds from surrounding trees find the drier soils suitable for recruitment. Herbivory by white-tailed deer, elk, and moose may alter forest structure and succession patterns.

SOFTWOOD HABITAT ASSOCIATION TABLE²¹

FMB PRIORITY SPECIES	KEY HABITAT FEATURES
Blackburnian Warbler	Mature, interior forest, tall conifers
Swainson's Thrush	Dense, shrubby under- and midstory, native fruit-bearing shrubs
ADDITIONAL WILDLIFE SPECIES	KEY HABITAT FEATURES
American marten	Mature and cavity trees, large woody debris
Northern flying squirrel	Cavity trees, hard mast
Snowshoe hare	Moist areas with dense undergrowth
Moose	Forested wetlands and riparian areas
White-tailed deer	Winter browse and conifer cover
Boreal chorus frog	Forest openings in riparian areas
Eastern massasauga rattlesnake	Wetlands and riparian areas

SPRUCE BUDWORM: NATIVE FOREST PEST DOUBLES AS BIRD FOOD

The spruce budworm is a native defoliating caterpillar whose outbreak populations create large areas of disturbance in northern spruce and fir forests, facilitating forest succession and in some cases, a change in forest type. The budworm population is cyclic; outbreak populations are an important food source to many of FMB priority species. The Blackburnian Warbler alters foraging behavior to hover over and probe clusters of needles in search of caterpillars. Ovenbirds will forage in trees and shrubs rather than in the ground leaf litter. Other FMB species that have a higher density with increasing budworm populations include Least Flycatcher, Swainson's Thrush, Black-throated Blue Warbler, Black-throated Green Warbler, and Canada Warbler.²²



Oak-pine Habitat Association

COMMON FOREST TYPES

- Oak dominated hardwood
- Softwood plantations
- Natural red and white pine
- Jack pine

IDENTIFICATION

The composition of oak-pine habitat association forest types range from pure oak-dominated hardwoods to mixed hardwood and softwood stands. In Southern Michigan, oak generally dominates the mixed hardwood forest with black oak, white oak, and northern red oak being most common. Associate species are hickories, sassafras, black cherry, American basswood, eastern black walnut, eastern red cedar, and eastern white pine. Selective logging of these forests could result in associate species becoming dominant. In northern Michigan, northern pin oak is more common and conifer species like white, red and jack pine may dominate on some sites. Plantations on state land include red and jack pine; on private land, plantations generally contain red and jack pine as well as abandoned Christmas tree plantations characterized by overstocked and declining Colorado blue spruce, Scotch pine, and fir. Oak-pine habitat association forest types occur throughout the state and account for nearly 19% of the forested acres in Michigan.¹⁸



© Julie Crick

ECOLOGY

Much of the current oak-pine habitat associations are a result of a forest type change due to European activity, including the suppression of wildfires. Oak-dominated hardwood stands in southern Michigan were once oak savanna communities that were converted to agricultural systems by Euro-American settlers. In the Northern Lower Peninsula, northern pin oak forests and northern pine forests occupy similar habitats that once supported the grand white and red pines harvested during the logging era. In northern Michigan, northern pin oak forests are now found where frequent, intense fires burned the landscape in the early 1900's, and northern pine forests occur where fires were less frequent or severe. Regeneration is facilitated by fire, windthrow events, and insect outbreaks. Low-intensity fire helped maintain oak-pine forest communities; prescribed fire, where appropriate, currently contributes to healthy oak-pine forests.

WILDLIFE

Throughout the state, oak-pine habitat association forests provide a variety of wildlife habitat elements. The hard mast produced by oaks and hickories are favored by game species like white-tailed deer, Wild Turkey, Ruffed Grouse, and squirrels. Oaks are host to hundreds of insects that provide food for birds and other wildlife. Cavities are used by a variety of wildlife species for nesting and shelter. Older trees with rough bark and intricate branching provide ideal perching, roosting, and nesting opportunities for the Red-headed Woodpecker and Broad-winged Hawk. Young jack pine stands provide critical habitat for the once endangered Kirtland's Warbler, brought back from the brink of collapse by joint forest management efforts from state and federal government agencies.

CLIMATE VULNERABILITY/ADAPTATION²⁰

Oak-dominated forests grow on sandy to dry-mesic soils and are moderately vulnerable to predicted drier summer conditions; adaptability is moderate due to low species diversity. Pine-dominated stands are highly vulnerable to the effects of climate change and are at risk of type change towards more drought-tolerant species. Increased competition from associate species could lead to forest type shifts; drought tolerant species may find new habitat as expected drought conditions alter mesic habitats.

Tree species winners and losers

Many of the hardwood associate species in oak-pine forests, including white oak, hickories, sassafras, red maple, and black walnut, are expected to increase in suitable habitat. The ranges of species limited by cold winter temperatures (e.g., sassafras and hickories) will expand under future climate scenarios. Across the entire state, jack pine is projected to experience a small decrease in suitable habitat but may expand into habitats that were once mesic. Eastern white and red pine may experience declines where soil moisture decreases.

General trend of forest type

Forest type changes may occur in pine dominated forests as less frequent late season frost events could allow oak species to move into jack pine forest habitat. Drier soils may facilitate the movement of jack pine and northern pin oak into eastern white and red pine forests. In mixed



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 TABLE²¹

FMB PRIORITY SPECIES	KEY HABITAT FEATURES
Kirtland's Warbler	Young, dense, expansive jack pine stands
Red-headed Woodpecker	Open areas with scattered trees, clustered snags, forest edge
Blackburnian Warbler	Tall conifers (for perches above the canopy)
Ovenbird	Leaf litter, mature forest, little understory cover
Wood Thrush	Mature, tall trees and dense leaf litter
Northern Goshawk	Mature trees, open understory in nest stands
ADDITIONAL WILDLIFE SPECIES	KEY HABITAT FEATURES
Sandhill Crane	Riparian forest openings
Gray fox	Mosaic of forests and openings
Smooth green snake	Moist mixed pine forest edges
Kirtland's Warbler	Dense, young jack pine
American beaver	Forested riparian areas and wetlands
Northern long-eared bat	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.^{8,17}



Forestry with Birds in Mind

LANDSCAPE-LEVEL CONSIDERATIONS

Birds and other wildlife traverse the landscape for food, water, protected habitat, and mates. Long, narrow bands of forests provide corridors for travel between larger forest blocks, whereas large forested areas provide for nesting and long-term occupancy. Established territories, or home ranges of birds and other wildlife depend on quality habitat and often cross land ownership boundaries.

How forest types and habitat structure are arranged across the landscape, both within an ownership and across property boundaries is critically important for birds. Managing forests with birds in mind should include a look at the landscape context surrounding any given area.

Create a foundation for stand management decisions based on the habitat provided across the adjacent 2,500 acres, or four sections in the landscape. Use aerial photographs and ground surveillance to assess the habitat using following considerations: size and shape of the forest, distribution of age classes, and role of the stand in relation to the landscape (e.g., Is it an isolated stand or a wildlife corridor?). If possible, learn when and how the surrounding forest stands will be managed and adjust stand level plans to preserve unique and important habitat considerations.

Size and shape

The size and shape of a forest influences how much of the habitat is considered edge (<250 feet from the forest edge) and interior (>250 feet from the forest edge). Picture a forest as a perfect square: a small forest has a higher edge to interior ratio, where a larger forest has a higher interior to edge ratio. Interior habitat is more desirable for forest birds and offers protection and necessary habitat elements for healthy bird populations. For example, Ovenbirds prefer interior forest habitat for a variety of reasons including the dense leaf litter which provides nest building material and habitat for invertebrates, their preferred food source. Edge habitat leaves forest birds and their young more exposed to weather, disturbance, predation, and nest parasitism.

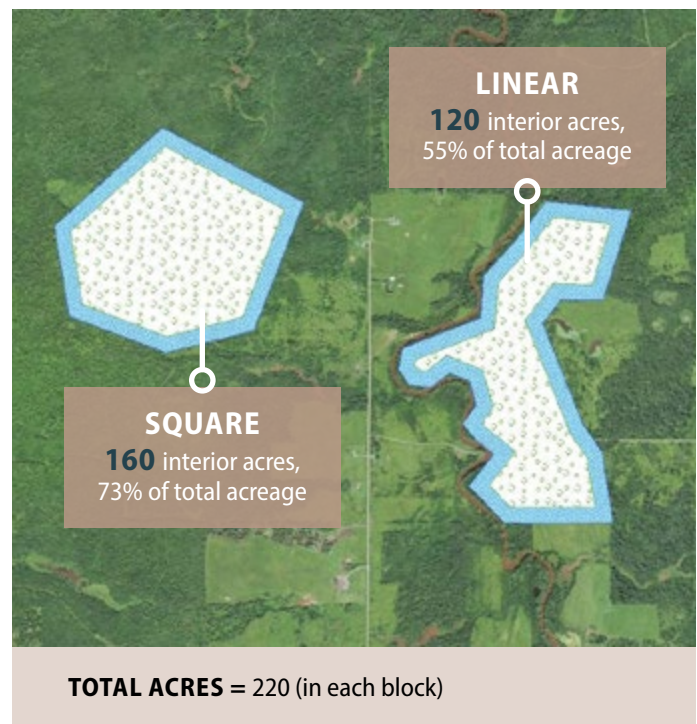
Edge effects can be softened with the recruitment or addition of young trees and shrubs outside the forested edge, creating a vegetative structure that gradually thins out, rather than one that abruptly stops. This is called feathering. Removing trees and shrubs from the existing forest to create a feathered edge negatively affects interior forest habitat.

Distribution of age classes

Various age classes across a forested landscape create important habitat elements that provide forest birds with diverse areas for feeding, nesting, and roosting. Age class diversity is created as groups of trees regenerate after natural disturbances or management activities (i.e. planned disturbances) that occur throughout time across the landscape. Groups of trees in early stages of regeneration usually offer dense growth of small trees and shrubs, while older, actively managed forests have multiple layers of cover and more established elements, like down woody debris and leaf litter. Work to diversify age classes across the landscape when developing forest management plans.

Role of stand in relation to landscape

In addition to size and shape of the forest, the arrangement of land uses across the landscape often determines the role the forest stand plays in providing habitat. In agriculturally dominated areas, a stand may act as a corridor to facilitate wildlife movement from one forest to another. Or, it may be the only stand in the landscape; or contain a wetland. In a forest dominated landscape, the forest type may be unique in relation to surrounding forests. A thorough understanding of the forest stand's role in the landscape is crucial to creating a management plan that will diversify, enhance, or preserve habitat across the landscape.

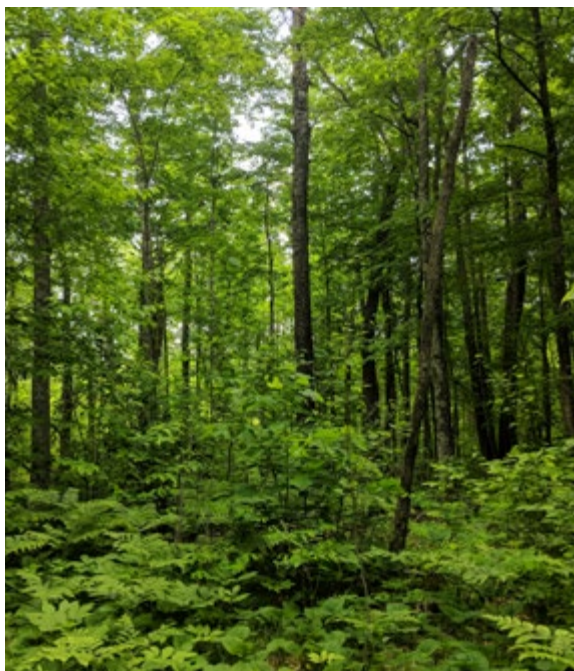


STAND-LEVEL CONSIDERATIONS

Wildlife habitat elements can be created over time through natural disturbance or planned management activity. Prior to implementing management activities, use the “Bird Habitat Assessment,” found in the appendix, to qualitatively assess the wildlife habitat elements within the stand. Continue to perform assessments through time, comparing the data to provide a summary of how species and structure have changed and to guide next steps in the long-term plan for management.

Table: Overview of key habitat structures for FMB priority forest bird species¹⁰

Vertical structure diversity/canopy cover	Vertical structure diversity, or differing levels of canopy cover in the over-, mid-, and understory, provides habitat to many forest breeding birds.
Horizontal structure diversity	Diversity in horizontal structure, or the arrangement of species and woody structure on a plane parallel to the ground, provides habitat to many forest breeding birds.
Gaps	Create gaps, or openings, to regenerate desired tree species and to diversity habitat for forest breeding birds.
Native biodiversity/invasive species	Manage to create a diversity of native forest plants to ensure that birds have available food sources, including insects and mast. Eliminate invasive plants that may interfere with tree and shrub regeneration.
Large diameter trees	Provides structural elements for nesting, roosting, perching, and feeding habitat for many forest breeding birds.
Softwood inclusions	Retain or create clusters of softwood, or conifer trees, for habitat and to increase forest resilience to climate change and other stressors.
Snags or cavity trees	Provides structural elements for nesting, roosting, perching, and feeding habitat for many forest breeding birds.
Downed woody material	Provides structural elements for ground nesting birds as well as habitat for invertebrate food sources.
Leaf litter and duff	An adequate layer of duff is essential to ground nesting birds and invertebrate populations. In oak dominated hardwood forests, it may hinder natural oak regeneration.
Riparian and wetland forests	Water features and the surrounding vegetation provide beneficial habitat elements for forest bird breeding and migration.



Vertical structure diversity/canopy cover

Vertical structure diversity is the density and arrangement of vegetation, including twigs, branches, tree trunks, and cavities that occur from the forest floor to the tops of the trees. Vertical structure is often measured as the percent of canopy cover in each vertical layer of the forest: overstory, midstory, and understory. To enhance or maintain vertical structure diversity use forest management techniques that result in an uneven aged forest stand.

Horizontal structure diversity

Horizontal structure diversity is the density and arrangement of vegetation, including tree trunks and branches that occur in a flat plane across the forest stand. The horizontal structure of tree trunks may be measured as basal area, which favors capturing larger trunks, or stems per acre, which captures large and small trunks without distinction. Canopy cover is also a measurement that can be used to assess the percentage of stand acres covered by the overstory, midstory, or understory. To enhance or maintain horizontal structure, use forest management techniques, including small gaps, that result in an uneven aged forest stand.

Gaps

Gaps of various sizes are areas in the forest where sunlight can easily penetrate the canopy to stimulate the growth and regeneration of trees and the seed and fruit production of woody shrubs and herbaceous plants. Gaps provide areas for birds to fly freely to feed on insects on the wing. Increased seed and fruit production means increased foraging opportunity. The resulting regeneration increases structural diversity over time. When appropriate, plan for gap creation in forest management plans.



Canopy gap. © Michael Paling

Native biodiversity / Invasive species

Invasive plants negatively affect bird habitat, and interfere with or outcompete tree regeneration. Invasive species use strategies like prolific seeding, vegetative propagation, and stolons, or above ground roots, to quickly colonize disturbed areas. Eradicate invasive species in and around the forest prior to conducting forest management activities. Ensure equipment entering the site has been cleared of mud and debris, which can transport invasive species.



Northern Cardinal nest in multi-flora rose. © Linnea Rowse

Large diameter trees

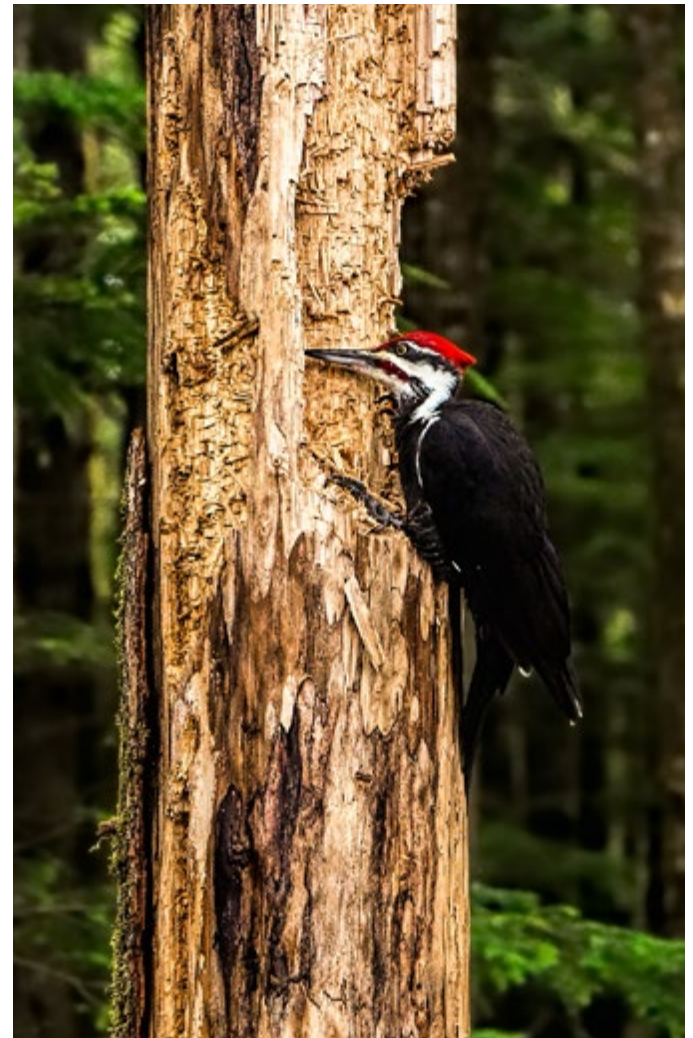
Large diameter trees contribute to stand structural diversity and provide nest sites, perches, and places to forage for a number of forest birds. Conduct management activities to preserve large diameter hardwood and softwood trees throughout the forest. If none are present, use management activities like crop tree release on small diameter trees with growth potential to create large diameter wildlife trees in the future.

Softwood inclusions

Softwood trees, or conifers, provide year-round shelter for birds and other wildlife. The needles, twigs, and cones are utilized by a variety of wildlife for nest building material and food; the duff supports invertebrate populations. Use management activities to retain or recruit softwood inclusions (clusters), or create softwood inclusions by planting conifers.

Snags or cavity trees

Snags provide structural elements for nesting, roosting, and perching in addition to harboring insects which are a food source for birds. Retain or create snags by girdling during management activities. In general, retaining six declining trees per acre is ideal, with at least one snag >18 inches in diameter and another <12 inches in diameter.



Pileated woodpecker. © Sheila Sund/Flickr



Down woody material

Down woody material, or debris, provides important habitat structure for birds and other wildlife for the material it provides for nesting and for the development of invertebrate food sources. Down woody debris is classified as either large (>6 inches in diameter and over four feet long) or small (<6 inches in diameter and <4 feet long). Retain existing down woody debris. If necessary, create a mix of both large and small woody debris during management activities.



Down woody material. © Kayla Knoll

Leaf litter and duff

Leaf litter is created as the leaves and needles from trees and expired herbaceous vegetation build up on the forest floor. Duff is created as leaf litter breaks down and becomes part of the soil. Deciduous leaf litter and duff are important for bird habitat and invertebrate food sources and can be beneficial to some tree species seed germination. Ideal depth is >1.5 inches. Conversely, too much leaf litter in the oak-hickory forest type can inhibit the growth of understory flora and oak acorns, which prefer to germinate in areas of bare mineral soil.



Leaf litter. © Michael Pailing

Riparian and wetland forests

Water features and the surrounding vegetation provide beneficial habitat elements favored by certain bird species; forested wetlands, or vernal pools, are essential breeding grounds for amphibians and a host of aquatic invertebrates. While structural diversity of vegetation near water can be beneficial to birds, special care should be taken when managing these sensitive areas. If management is necessary, ensure leaf litter and duff remain intact and avoid the creation of deep ruts, which interfere with amphibian migration. When planning for management around water features, refer to the Michigan DNR's "Michigan Forestry Best Management Practices for Soil and Water Quality."



Jordan River. © Josh Shields

GOLDEN-WINGED WARBLER RIPARIAN HABITAT MANAGEMENT

Golden-winged Warblers depend on young forest habitat, and will use regenerating brushy wetlands such as recently sheared tag alder stands with reserve trees. When managing these stands, minimize impacts to wetlands by operating in the winter on frozen ground to avoid creating ruts. In the absence of overstory reserve trees, it is important to leave "islands" of alder to provide structural diversity for nesting habitat. Regenerating alder also builds soil fertility as it fixes nitrogen, and allows for a flush of forbs, grasses, and sedges which are important for nesting cover and support insects as a food source.



© American Bird Conservancy

Silvicultural Systems for Michigan Birds

Forestry for Michigan Birds is designed to help landowners incorporate small tweaks to traditional forest management activities that meet their goals to promote habitat structure, forest health, climate change adaptation, and species and structural diversity. Choosing which silvicultural treatment is appropriate will largely depend on the site characteristics, the quality of the stand, and landowner objectives.

Below are descriptions of the management techniques that enhance habitat features for FMB's priority species, followed by additional considerations for each forest habitat association. Where appropriate, incorporate these techniques into forest management plans or recommendations. Include the landowner in decision making to increase their understanding and promotion of FMB techniques.

INTERMEDIATE TREATMENTS

Intermediate treatments are stand improvements which often do not have a commercial outlet. Intermediate treatments are intended to improve the stand structure, composition, health, and quality. Using silvicultural practices such as thinning, cleaning, or weeding will remove poor-quality stock and release trees with ecological or economic value. Retain a variable density by creating gaps to provide a mosaic of bird-friendly habitat features. These treatments can help stands become more resilient to climate change impacts by improving forest health, diversifying species present, and increasing structural diversity to provide a variety of conditions for tree growth and regeneration. Regional timber markets are highly variable; some intermediate treatments may produce income if local markets allow.

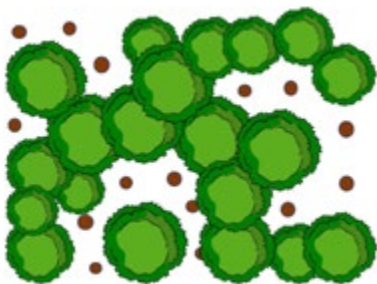
Non-timber intermediate treatments include controlling invasive species and planting native trees and shrubs to improve species and structural diversity. Invasive species can reduce the success of silvicultural prescriptions by changing the natural patterns of forest succession. Planting native trees and shrubs will improve species diversity and provide additional habitat elements, such as nesting sites or food. Consider plant competition and browse pressure when planting.

Intermediate treatments may be utilized to create single-tree or group-sized gaps. It is important that some downed trees remain on site to mimic canopy gaps created by wind events, disease, low-intensity fires, or insect infestations. These gaps promote species and structural diversity by increasing light availability and creating woody debris, nurse logs, tip-up mounds, and hollows that increase microsite heterogeneity.

Prescribed fire is a management tool that mimics the disturbance created by low-intensity fires that were historically common across Michigan due to lightning events and intentional ignition by Native Americans for vegetation management. Prescribed fire continues to be used to manage forest stand vegetation, and can both positively and negatively impact bird habitat. For example, flycatching or canopy nesting species, such as Least Flycatcher, respond positively to the open understory after prescribed burns. Ground nesting and foraging birds, such as Ovenbird, respond negatively due to the lack of leaf litter. To minimize negative impacts, plan for burns to occur outside the nesting season and break up areas to burn so that only a portion of the habitat across the landscape is burned in any given year. If adjacent forest types are the same or similar and under different ownership, segmenting burns in the stand may not be necessary unless prescribed fire is also used in the neighboring stand. The Michigan Prescribed Fire Council (MPFC) should be consulted as a resource; more information about the MPFC is available in the appendix.



Loud Creek Prescribed Burn. © Huron-Manistee USFS



CROP TREE RELEASE

Crop Tree Release is a technique used to create more space for crowns of desired trees resulting in increased diameter growth. Used in mixed hardwood stands, desired trees have ecological or economic value and may be chosen based on their ability to produce mast, timber, or wildlife habitat. In some cases, desired trees may be grouped for release. Once the desired tree or trees are identified, the directly adjacent crown competitors are marked for removal. Crop tree release can be an intermediate treatment and part of the strategy for the next several management steps, including group selection and/or shelterwood activities.



GROUP SELECTION STRATEGIES

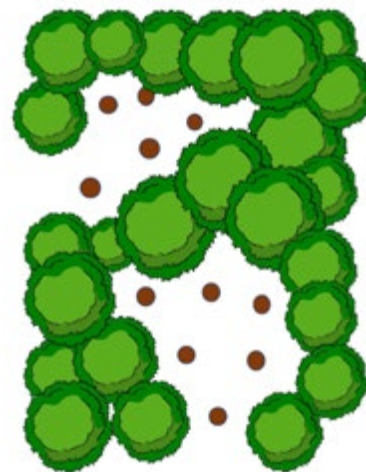
Group-selection harvesting is a technique where several trees in a group are removed together to create a canopy opening smaller than a typical clearcut opening but larger than a canopy opening resulting from single-tree selection harvesting. Utilize group selection to create gaps that produce irregular mosaics of forest structure and composition. Uneven-aged stands result in the greatest diversity of tree ages and sizes and the least amount of disturbance. Size and location of group selection cuts are important to consider in a landscape context when diversifying bird habitat structure and meeting landowner goals. Incorporate desirable live and standing dead legacy trees into group selection gaps to mimic natural disturbances.

Group Selection Sizes

- Vary gap sizes and shapes to mimic natural disturbances.
- Small gaps are ≤ 0.5 acre.
- Large gaps are 0.5-2 acres in size.
- In total, harvest no more than 10% of the stand acres with group selection.

Group Selection Placement

- Near mature seed and mast producing trees (e.g., oak, yellow birch, black cherry).
- Adjacent to overstory tree species that are mid-tolerant or intolerant of shade to encourage regeneration.
- Near conifer species to encourage conifer inclusions and thermal cover (especially eastern hemlock).
- Where desired advanced regeneration is already present.
- Create large gaps sparingly or group them together to minimize edge effect impacts on wildlife that depend on interior forest habitats.
- Feather gap edges by retaining pole- and seedling-sized trees and shrubs within the gap to create a transition into the forest interior.

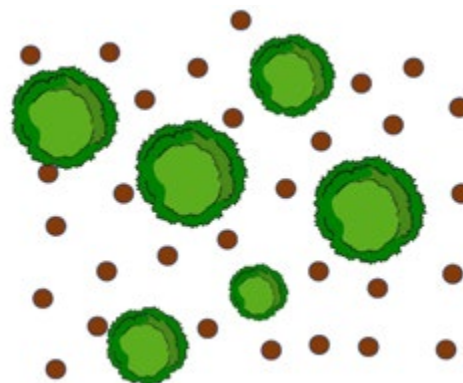


Group Selection Return Interval

- Generally, a 15- to 20-year cycle; refer to basal area growth rate to determine the appropriate cutting year.
- Use single tree selection and/or crop tree release between canopy gaps in combination with group selection to control quality and recruit advanced regeneration.

SEED TREE MANAGEMENT STRATEGIES

Seed tree strategies often include one-cut with retention of approximately 10-20 ft² of basal area per acre with widely dispersed canopy trees to provide a seed source. Canopy trees may be removed when regeneration is adequate (two-cut), or they may be left onsite for species and structural diversity. This strategy is most appropriate when used in small units (10-20 acres) or as one step of a long-term management plan.



SHELTERWOOD MANAGEMENT STRATEGIES

Shelterwood systems retain greater basal area than seed tree strategies for the purposes of moderating the microclimate for regeneration in addition to providing a seed source. Shelterwood strategies can be varied in the number of trees retained and/or the return interval for overstory removal. Both types of variations result in increased structural and age class diversity.

Shelterwood with reserves refers to lowering the basal area to release a new cohort, while retaining the overstory over time to contribute to structural diversity, increase diameter growth for specialty products, or enhance the scenery. Use a first cut shelterwood harvest to reduce the residual basal area to an average of 50 ft² per acre to enhance conditions for seed production and regeneration protection. Schedule the second cut when regeneration reaches an adequate level of stocking to release the established vegetation from overstory competition or retain the overstory indefinitely. If performing a second cut, leave a portion (5-15%) of the overstory trees (especially large diameter trees) for more than 25% of the rotation time frame (or indefinitely), irregularly dispersed for habitat structure.

Irregular Shelterwood Management Strategies²³

The basic premise of two- or three-stage shelterwood strategies is that a new cohort of mid-tolerant to tolerant tree species is initiated with each activity and provides a longer regeneration period than a traditional shelterwood. Irregular shelterwood options should be tailored for site conditions and desired species regeneration.

- **Expanding Gap (Group) Shelterwood**

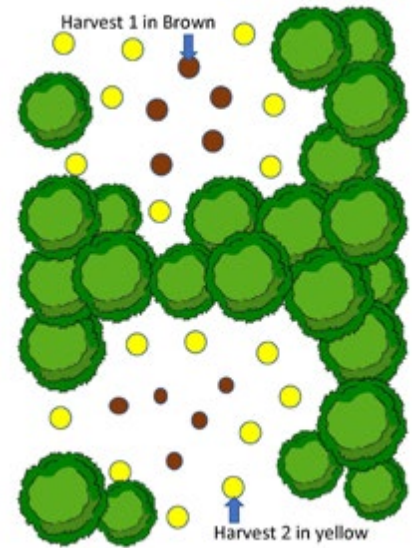
Establish group cuttings in select areas with advance regeneration. The harvest rotation is every 15-20 years; each harvest gradually enlarges the previous gaps until the whole stand has been regenerated. This type of shelterwood prevents advanced regeneration from being destroyed in subsequent harvests and provides forest gap habitat.

- **Extended Shelterwood**

Conduct a regeneration harvest as normal for traditional shelterwood, but with subsequent harvests occurring later (20-30 years) or not at all. This provides canopy nesting sites for birds such as the Cerulean Warbler, while releasing regeneration and providing habitat for understory and shrub nesting bird species, such as Chestnut-sided Warbler.

- **Continuous Cover Shelterwood**

This shelterwood type is intended to regenerate shade-intolerant and mid-tolerant species while maintaining the forest in multiple-age cohorts and creating high productivity. As appropriate, combine thinning, group selection, and traditional shelterwood to create habitat elements to benefit birds that prefer mixtures of gaps, dense understory layers, and large canopy trees.



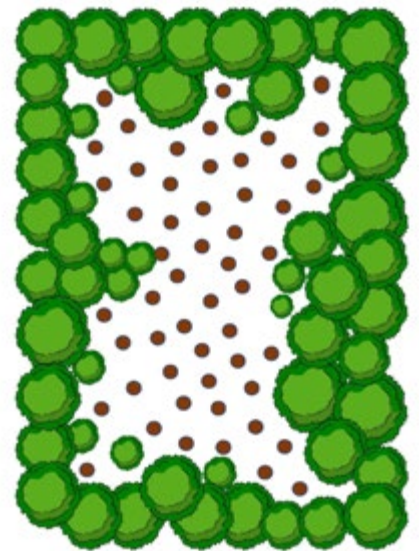
CLEARCUT MANAGEMENT STRATEGIES

Clearcut strategies are used when the desired species for regeneration thrive in full sun. Clearcuts are often used to regenerate aspen and other shade intolerant species on upland sites. Small tweaks to the clearcut management strategy will maintain habitat on the site in the short term and enhance the habitat in the regenerating stand over time.

- Retain or create 2-3 snags or cavity trees per acre.
- Create tip-up mounds and down woody debris by pulling down and/or retaining 2-3 declining trees per acre.
- Retain groups of conifers and desirable and/or rare tree species including: oak, eastern white pine, eastern hemlock, northern white cedar, and other trees beneficial to wildlife.
- When feasible, break up large clearcuts into 10 to 20 acre blocks to create structural diversity across the landscape.
- Avoid clearcuts in lowland areas where the harvesting would alter the hydrology such that the resultant habitat becomes dominated by undesirable vegetation rather than regenerating forest cover.

Strip- or patch-clearcutting is a treatment for species with short-distance seed dispersal, like cedar.

- Width of strips should take windthrow and other effects into consideration.
- Generally, strips should be no wider than 150 feet in areas with mild winds; limit to 50 feet in areas prone to windthrow, especially near the Great Lakes shorelines.
- Uncut areas are typically at least 100 feet wide.



INVASIVE SPECIES MANAGEMENT

Invasive species can quickly colonize areas opened up by management activities. Climate change will exacerbate the issue as increased tree stress from pests, disease, and drought cause pockets of mortality and create opportunities for invasive species colonization. Be proactive and reduce the opportunity for invasive species to establish or spread by removing them from in and around the forested area prior to management activities. Work with loggers to clear equipment of mud and brush debris that can import invasive species to the site. These simple measures increase the chances of successful desired regeneration and long-term habitat management.





BROWSE IMPACT MANAGEMENT

Regeneration could be negatively impacted by browse from white-tailed deer, moose, elk, eastern cottontails, snowshoe hares, and other wildlife that are capable of browsing regeneration. In areas with high browse pressure, consider the following measures.

- Increase the harvest area and the resulting regeneration area to overwhelm ungulate browse; lack of cover in large harvest areas is a deterrent. Use only when necessary as this results in reduced shelter and food for birds.
- Leave large top-wood and large woody debris in piles or rows to protect seedlings.
 - Large tops keep branches off the ground and allow space for regenerating seedlings.
 - Consider slash walls rather than scattering woody debris to obtain one to two years of seedling establishment. To be effective, slash walls may need to be quite large (10-20 feet wide and 10 feet tall) and be sufficiently dense to deter ungulate browse.
 - Large woody debris also provides partial shade and protection to tree seedlings, reduces runoff, increases nutrient cycling, and provides habitat for birds, invertebrates, reptiles, and amphibians.
- When regenerating preferred browse species (oak, aspen, cedar) plan for extra time or use protective measures listed below.
 - Use fenced enclosures, tree tubes, bud caps, or other measures to protect seedlings.
 - Fencing for enclosures should be a minimum height of eight feet; ideal for small areas of regeneration.
 - Individual tree tubes should be a minimum height of five feet.

CLIMATE CHANGE MANAGEMENT²⁰

When developing forest management plans, be sure to account for risk factors that could affect regeneration and forest health as the climate continues to change. For more specific information related to each forest type, refer to the climate vulnerability and adaptation information presented in the Forest Habitat Associations section of this guide. For additional information about climate change resources in Michigan, consult with the Northern Institute of Applied Climate Science (NIACS) at niacs.org.

- Assess the site for drought risk factors such as dry soils, south-facing slopes, or high stocking.
 - Summer drought will become increasingly common as precipitation occurs less frequently but in concentrated, heavy events and snow melts earlier in the winter and spring. Mitigate drought stress by decreasing the level of stocking to reduce competition, and favor drought-resistant tree species on dry soils and on south-facing slopes.
- Assess and mitigate threats from non-native, invasive pests and diseases.
 - Trees experiencing stress related to climate change will become more vulnerable.
 - Decrease the pressure from non-native, invasive forest pests and diseases by treating known infestations or infections.
 - Diversify tree species for increased forest resiliency.

Silvicultural System Tweaks for each Forest Habitat Associations

Below are slight modifications, or tweaks, to the silvicultural systems described above and are designed to maximize bird habitat creation in each forest habitat association. As the forester or land manager, tailor the following tweaks to the site characteristics, surrounding landscape and landowner goals before recommending or including these in a forest management plan.

HARDWOOD HABITAT ASSOCIATION MANAGEMENT CONSIDERATIONS

- Use single tree selection in conjunction with other management strategies, like group selection or shelterwood, to increase the structural and tree species diversity of the stand. This improves forest health and resilience over time and results in a variety of wildlife habitat elements including:
 - Increased structural diversity for nesting and breeding sites.
 - Increased tree species diversity for shelter and food.
 - Increased sunlight to stimulate tree regeneration, woody shrub, and herbaceous plant growth.
- Maintain or promote diversity of tree species by:
 - Selecting over-represented species for removal.
 - Using site characteristics and soil types to determine appropriate species to encourage or plant on the site.
 - Locating canopy gaps close to underrepresented species to favor their regeneration.
- Retain or recruit unique, old, large trees with large horizontal branches to provide peeling bark, crevices, and cavities for nesting opportunities.
- Leave or create additional snags with each entry.
- Discourage browse when regenerating preferred species.
- Shelterwood harvests in hardwood associate forest types are best conducted on sites with high amounts of unacceptable growing stock that needs to be rehabilitated. High amounts of unacceptable growing stock may be a factor of past management but it may also be a function of site quality. If it is due to low site quality, shelterwood harvests regenerating even-aged stands are recommended.

MIXEDWOOD HABITAT ASSOCIATION MANAGEMENT CONSIDERATIONS

- Soils that support hardwood/conifer swamps are generally too wet for harvest except during the winter months; groundwater flow may not allow the ground to freeze hard enough to support heavy machinery even during winter. Harvesting is not recommended unless it is possible to protect the hydrology of the site.
- Mixedwood uplands are typically found on soils that are not favorable for high-quality hardwoods. Often these are well-drained and acidic soil types; other soil factors such as shallow bedrock, organic hardpans, and/or seasonally perched water tables may foster this cover type. Seasonal operational restrictions may be necessary, but much less so than in mixedwood lowlands.
- Although topwood and large woody debris may be used to improve equipment floatation, exposing soils for seed germination is also important to maintain species diversity; have loggers pile the debris when they leave the site for the last time.
- Ensure scarified areas will not fill in with water, as with track and tire ruts.
- Maintain mature dead and dying canopy trees to ensure a continuing source of woody debris for seedling germination and survival as well as microtopographic variability that leads to high species richness and diversity.
 - Yellow birch, eastern white pine, eastern hemlock, and northern white-cedar use large-diameter down logs as germination substrate due to their increased survival over wet, mucky soils or heavy ground litter.
 - Tipping over some trees prior to severing from the stump will expose the mineral soil under the roots and provide aforementioned germination sites.
- In hardwood/conifer swamps, planting native conifers may be necessary in areas where high amounts of deciduous leaf litter hinder conifer seedling establishment.
- Retain mature, seed-bearing conifers to ensure regeneration of conifers in both wetland and upland habitats to avoid conversion to hardwoods. Additional retained trees may be required around remaining seed trees to prevent wind throw, especially where rooting is shallow in wet or restricted soils.



SOFTWOOD HABITAT ASSOCIATION MANAGEMENT CONSIDERATIONS

- Be sure to retain mature, seed-bearing conifers to ensure a seed source for regeneration.
- In lowland black spruce, assess the advanced regeneration prior to harvest. If advanced regeneration is low, small islands of seed trees should be left to assure wind firmness.
- Monitor local pest activity (e.g., spruce budworm and eastern larch beetle). Schedule harvests as pre-salvage cuts when appropriate.
- When managing lowland softwoods, retain sufficient basal area to avoid inundation and conversion to tag alder. Sufficient basal area varies based on the hydrology of the site.
- Management activities should avoid disturbance to the site's hydrology and sensitive areas, which may require winter logging or prevent management completely.
- In stands dominated by eastern hemlock, use single tree selection to promote hemlock regeneration.
- In mixed eastern hemlock/hardwood stands, use a long-term three-cut shelterwood system.
 - Eastern hemlock regeneration will require protection from browse (see "Browse Impact Management" section for suggestions).

OAK-PINE HABITAT ASSOCIATION: MANAGEMENT CONSIDERATIONS

- Prior to management, pay attention to dominant or super-dominant oaks with large, healthy crowns for acorn production and thin competing vegetation in a crop tree release to stimulate acorn production. Retain these oaks until the regeneration cut, or leave indefinitely.
- Consider pre-settlement vegetation maps and restoring savannas or barrens using hybrid forest management strategies (clear cut, seed tree, shelterwood) as the first step.
- Promote or release trees with super canopy potential, like eastern white pine.
- Sustain or promote rare native red pine ecosystems and associated historical structure.
- Where necessary, lightly thin the forest stand by retaining 80-90 ft² of basal area to maintain a closed canopy for canopy-nesting species, such as Cerulean Warbler.
- Preserve established regeneration to create a mosaic of age classes into the future.
- With shelterwood silviculture, be sure there is a proper seedbed for adequate oak and pine regeneration. If the understory has too much competition or the duff layer is too thick, new seedlings may have difficulty becoming established.
 - Summer harvesting with tracked equipment will promote scarification.
 - Conduct a prescribed burn before harvest to remove leaf litter.
 - Intentional scarification post-harvest, such as salmon blading, can also be beneficial for exposing mineral soil and creating a favorable seedbed.
- In stands where maintaining oak is the goal:
 - Ensure mesic tree species such as red maple do not encroach upon or outcompete oak-pine species and change the forest type. Avoid large cuts adjacent to mesic stands to avoid unwanted recruitment.
 - Leave treetops and large woody debris on-site after harvest to discourage browsing by wildlife, promote regeneration, and provide nesting materials and foraging sites for birds like the Brown Thrasher. Encourage loggers to pile tops for the same purpose.
 - Shelterwood systems with initial residual basal area of 40-60 ft² can provide habitat for bird species that are generalists and mid successional birds. The final overstory removal cut releases advanced regeneration, creating the preferred habitat of early successional bird species.
 - Use shelterwood with reserves to establish early successional, shrubby habitat while retaining partial overstory for perch and nesting sites. This habitat is ideal for Eastern Whip-poor-will or the Chestnut-sided Warbler.
 - If conducting an overstory removal harvest, ensure that the advanced regeneration is at least five feet high.
- If re-planting a red pine plantation back to red pine, add oak to the mix and plant native fruiting shrubs around the perimeter.

Appendices

PRIORITY SPECIES AND HABITAT FEATURES SUMMARY TABLE

Priority Species	Forest Habitat Association				Age Class			Management Recommendations	Habitat Features								Climate Vulnerability ⁶ (3°C Global Increase)				Michigan Population Trend ²⁴	
	Hardwood	Mixedwood	Oak-Pine	Softwood	Young	Intermediate	Older		Canopy Gaps	Area Sensitive	Forest Interior	Moist Soil or Riparian	Large-diameter Trees	Snags or Cavity Trees	Canopy Cover	Down Woody Material	Leaf Litter	Vulnerability Ranking - North American Breeding	Breeding Range Lost (%)	Breeding Range Maintained	Breeding Range Gained (%)	Breeding Bird Survey Population Trend (1966-2019) (Percent change per year)
American Woodcock								Manage for young, early successional forest, with small 1/2 acre openings for singing displays and dense shrub or sapling stands (≥5 acres) for nesting and cover.				X			Low-Medium			Moderate	54	46	31	-1.7
Broad-winged Hawk								Promote tree species diversity in unfragmented forest; create small gaps if none present; protect forested wetlands. Retain large-diameter trees (>12-15" DBH).	X		X	X	X		Medium-High			Low	48	52	92	0.3
Brown Thrasher								Maintain or create young sapling or shrub thickets along mature forest edges. Thin canopies to allow light to reach understory.							Low			High	87	13	36	-2.2
Cerulean Warbler								Maintain mature overstory with large diameter trees (>15-19" DBH), create vertical structural diversity, and open canopy gaps (400-1000 ft²) if none present.	X				X		Medium-High			High	98	2	84	-0.8
Chestnut-sided Warbler								Create or maintain young, densely regenerating openings with <30% canopy cover. Retain scattered overstory trees for singing perches.							Low			High	100	0	19	0.3
Eastern Whip-poor-will								Maintain or create openings (>30 acres) next to deciduous or mixedwood forest with semi-open understory. Skid roads/landings can provide habitat variation.							Low-Medium		X	High	81	19	44	-0.6
Golden-winged Warbler								Within mature forest, create young forest patches (>5 acres) with retained shrub clumps, 10-15 residual overstory trees per acre, and feathered edges.							Low			High	100	0	61	-4.1
Least Flycatcher								Maintain a diverse forest (age class and structure) with well-developed canopy and open understory. Avoid fragmentation.		X	X				High			Moderate	69	31	42	-1.8
Ovenbird								Maintain large blocks of mature forest (>60-90% canopy cover, >250 acres). Avoid fragmentation. Deep leaf litter and little ground vegetation important.		X	X				High		X	Moderate	71	30	47	0.4
Red-headed Woodpecker								Uses open woodlands or savanna. Avoids unbroken, interior forest. Create or retain clusters of snag trees especially along adjacent fields.						X	Low			High	94	6	33	-3.1

Key: Dark orange: Preferred Forest Habitat Association or Age Class; Light orange: Used Forest Habitat Association or Age Class;

Light gray: Rarely or infrequently used Forest Habitat Association or Age Class; Canopy Cover categories: Low <30%, Medium 30-70%, High >70%



Priority Species	Forest Habitat Association				Age Class			Management Recommendations	Habitat Features								Climate Vulnerability ⁶ (3°C Global Increase)				Michigan Population Trend ²⁴
	Hardwood	Mixedwood	Oak-Pine	Softwood	Young	Intermediate	Older		Canopy Gaps	Area Sensitive	Forest Interior	Moist Soil or Riparian	Large-diameter Trees	Snags or Cavity Trees	Canopy Cover	Down Woody Material	Leaf Litter	Vulnerability Ranking - North American Breeding	Breeding Range Lost (%)	Breeding Range Maintained	Breeding Range Gained (%)
Wood Thrush								Preserve large, contiguous forest blocks. Maintain >80% canopy cover in uneven-aged forest with mature trees and diverse mid- and understory structure.	X	X	X				High		High	57	43	20	-1.2
Yellow-bellied Sapsucker								Create early successional habitat with fast-growing trees (e.g., aspen, birch) for sapwells and retain older hardwoods or snags for nest cavities.	X				X	X	Low-Medium		High	88	12	57	4.6
Black-throated Blue Warbler								Maintain unfragmented, interior mature forest with dense shrub/tree seedling understory. Tracts >250 acres preferred, with 50-80% canopy cover.	X	X	X				High		High	98	2	39	1.2
Black-throated Green Warbler								Maintain uneven-aged stands of mixed hardwoods and softwoods, with hemlock or softwood inclusions for nesting; canopy cover >80%.		X	X				High		High	88	13	19	1.5
Canada Warbler								Manage for semi-closed canopy forest (50-70% canopy cover) with diverse age classes, small canopy gaps, dense mid- and understory, and down woody material.	X	X		X			Medium	X	High	95	5	63	-2
Connecticut Warbler								Avoid forest fragmentation. Improve vertical structural diversity in conifer-dominated forests; maintain "park like" feel, with dense ground cover.		X					High		High	100	0	14	-0.5
Northern Goshawk								Maintain contiguous forest with diverse age classes, snags, and down woody material. Keep 30 acre protection zone around active nests (Mar. - Aug.). Small openings support prey species.	X	X	X	X	X		High	X	High	60	41	16	-0.1
Blackburnian Warbler								Maintain boreal or mixed forests with diverse age classes, intact canopies (>80% canopy cover), and dense midstory.	X	X		X			High		High	99	1	33	0.1
Swainson's Thrush								Conserve mature, dense stands of conifers (fir, spruce, hemlock) or mixedwoods, with native fruit-bearing understory plants.	X	X					High		High	73	28	28	-2.1
Kirtland's Warbler								Manage for young, expansive (>200 acres), high density (>1,000 stems per acre) jack pine plantations on sandy outwash plains.	X						Low		N/A	N/A	N/A	N/A	N/A

FIELD BIRD HABITAT INVENTORY DATASHEET

Property: _____

Date: _____

Stand ID: _____

Stand Size: _____

Plot ID: _____

Forest Association: Hardwood Softwood (Circle One)
Mixedwood Oak Pine

Technician: _____

Forest Type: _____

Location: _____

Basal Area: _____

Vertical Structural Diversity

Estimated Canopy Height:		<10'	10'-20'	20'-40'	40'-60'	>60'
Overstory (30'+)	% Cover:	<10% - 10%	20% - 30%	40% - 50%	60% - 70%	80% - 90%
	Distribution:	uniform	patchy			
	Gaps:	1/4 - 1 Acre	1 acre	2 acres	Absent	
	Average Diameter:					
	Dominant Species:					
Midstory (5' - 30')	%Cover:	<10% - 10%	20% - 30%	40% - 50%	60% - 70%	80% - 90%
	Distribution:	uniform	patchy			
	Average Diameter:					
	Dominant Species:					
	Understory (0' - 5')	%Cover:	<10% - 10%	20% - 30%	40% - 50%	60% - 70%
Distribution:		uniform	patchy			
Dominant Species:						
Results						
<div> <div>Low</div> <div>Medium</div> <div>High</div> </div>						

*In general, creating and/or maintaining vertical structural diversity within a mature forest stand is highly beneficial to many forest breeding birds.

Species Diversity

Trees

Shrubs

Herbaceous

Results

Low Medium High

*Managing for a diversity of native forest plants will ensure that birds have available food sources, including insects and mast.



Invasive Plants		present	absent		
% Cover:	<10% - 10%	20% - 30%	40% - 50%	60% - 70%	80% - 90%
Species:					
Location:					
Large Diameter Trees		present	absent		
Size:	Hardwood (24"+ DBH)	Softwood (20"+ DBH)			
Quantity:					
<p>*Large diameter trees offer nest sites, perches, and places to forage for a number of forest birds. If none are present, select some smaller diameter trees to leave and become large diameter wildlife trees in the future.</p>					
Softwood Inclusions		present	absent		
<p>*Retain and/or promote at least some softwoods where they occur, especially within a predominant hardwood stand. Even a cluster of trees less than an acre in size has high habitat value to forest birds.</p>					
Notes:					
Dead Standing Trees and Cavity Trees		present	absent		
<u>DBH</u>	Estimated Trees Per Acre				
<10 inch diameter					
10" - 18"					
>18 inch diameter					
<p>*Dead standing trees or "snags" provide locations for nesting, roosting, and foraging for insects. Cavity trees of all sizes provide nesting and roosting sites for birds. Maintain/create six per acre over 10" and at least one over 18".</p>					
Down Woody Material		present	absent		
Small material: any diameter, length less than 8'	Qty.	Scattered/Aggregated			
Medium material: 5-10" diameter, at least 8' long					
Large Material: 10"+ diameter, at least 8' long					
<p>*Down woody material both fine and coarse include logs, stumps, large and small branches. DWM enhances habitat for forest birds by providing cover, perching sites, nest sites, and foraging opportunities. Aim to have one large piece per acre.</p>					
Leaf Litter and Duff		present	absent		
Adequate:	>1.5" thick				
Inadequate:	1.5" thick				
Not Applicable:	Softwood stands				
<p>*Leaves, needles, and other decomposing vegetative materials have a high foraging value for forest birds. Estimate the average for your stand or plot</p>					
Birds Observed or Heard		Wildlife Sign, Tracks, Scat, or other Observations			



GLOSSARY¹⁰

- **Biodiversity:** The variety of life forms and relative complexity of species and ecosystems.
- **Bioaccumulation:** A process of accumulation of chemicals in an organism that takes place if the rate of intake exceeds the rate of excretion.
- **Down Woody Material:** Logs and limbs on the forest floor.
- **Duff:** The partially decomposed organic material of the forest floor beneath the litter of freshly fallen needles, leaves, and twigs.
- **Feathered edge:** A gradual transition between two habitat types that is accomplished by planting shrubs and grasses of varying heights.
- **Forest age class:** A distinct grouping of trees originating from a single natural event or regeneration activity.
- **Forest habitat association:** Broad grouping of forest types that provide similar habitat features.
- **Forest management:** The practical application of biological, physical, quantitative, managerial, economic, social and policy principles to the regeneration, management, utilization and conservation of forests to meet specified goals and objectives.
- **Gaps:** Openings in the forest canopy that allow light to reach the mid- and understory layers.
- **Habitat fragmentation:** The process by which a landscape is broken into small islands of forest within a mosaic of other forms of land use or ownership, negatively affecting the movement and dispersal of animals.
- **Hardwoods:** Broadleaved deciduous trees that lose leaves in autumn.
- **Invasive species:** A non-native species that causes ecological or economic harm.
- **Leaf Litter:** The surface layer of the forest floor that is not in an advanced stage of decomposition, usually consisting of freshly fallen leaves, needles, twigs, stems, bark and fruits.
- **Pesticides:** A chemical preparation used to control individual or populations of injurious organisms.
- **Snags:** Standing dead trees.
- **Softwoods:** Coniferous trees with needles.
- **Forest Stand:** A contiguous group of trees sufficiently uniform in age-class distribution, composition and structure, and growing on a site of sufficiently uniform quality to be a distinguishable and manageable unit.
- **Forest 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.

Resources

BIRD IDENTIFICATION RESOURCES

All About Birds Online Guide by the Cornell Lab

An online guide to birds and birdwatching. Includes information on: Bird ID Skills; Feeding Birds; FAQ's and Common Problems; Bird Friendly Homes and more. allaboutbirds.org

Merlin Smartphone App by Cornell Lab

Answer three simple questions about a bird you are trying to identify and Merlin will come up with a list of possible matches. Merlin offers quick identification help for all levels of bird watchers to learn about the birds across the Americas, Europe, Asia, Africa and Oceania. This app is free to download. merlin.allaboutbirds.org

Sibley Birds V2 Smartphone App

The app based on the Sibley Guide to Birds includes all of the content in the printed guide as well as over 2,800 audio recordings, additional text, complete seasonal status data for every species in every state and province, hundreds of searchable criteria, and much more. There is a cost associated with this app. sibleyguides.com/product/sibley-birds-v2-app

Audubon Online Guide to North American Birds

Features a catalog of North American bird species information, songs, climate vulnerability and more. audubon.org/bird-guide

Bird Watcher's Digest

What bird is that? Consult our bird identification guide to ID mystery birds in the backyard and beyond. We have photos, song recordings, in-depth entries, and more to help bird watchers correctly identify the birds they spot.

birdwatchersdigest.com/bwdsite/learn/identification.php



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

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

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

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

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
- Canada Warbler: 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
- Golden-winged Warbler: gwwa.org/wp-content/uploads/2020/06/GWWA-GLRegionalGuide_190711.pdf
- Swainson's Thrush: com-bbimages.s3.amazonaws.com/bbimages/clo/pdf/thrushguide.pdf
- Wood Thrush: 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

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
- Seven Simple Actions to Help Birds: birds.cornell.edu/home/seven-simple-actions-to-help-birds
- Impacts of outdoor cats to birds: abcbirds.org/program/cats-indoors/cats-and-birds
- Safe Passage
 - Safe Passage Great Lakes: 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
 - National Audubon Society's Lights Out program: audubon.org/lights-out-program
 - Preventing bird-window collisions in Michigan: michiganaudubon.org/bfc/bird-window-collisions
 - Michigan Dark Skies: sites.lsa.umich.edu/darkskies
- Contaminants
 - Lead in Michigan wildlife: 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

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

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



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

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

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

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

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

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

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

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