PRIVATE LAND PARTNERSHIPS
WORKING TOGETHER FOR WILDLIFE

INTRODUCTION TO FOREST MANAGEMENT

In the early 1800s, forests covered most of Michigan's more than 36 million acres of land. Today, nearly all of the state's landscape has been disturbed by human activity. This disturbance has decreased our forests by 50 percent. A long period of heavy logging and fires, which began about 1840 and ended about 1930, substantially contributed to this loss. Currently, the largest threat to our remaining forests is fragmentation, which occurs when larger properties are divided into smaller parcels. Also, the lack of old growth forests, which provides structural diversity, is a threat to our landscape ecosystems. Current logging practices favor certain tree species over others causing forests to become "over simplified" and altering natural processes. Other threats to Michigan forests include over browsing by deer, hydrologic alterations, and the timber harvesting process of "high grading" which is a profit motivated technique that has no value for wildlife.

Importance as a Natural Resource

Michigan's more than 19.3 million acres of forest provide ecological, economic, recreational, and aesthetic benefits to the state's citizens. One of Michigan's important natural resources, these forests range in size from small, privately owned woodlots to larger areas owned by the public, industry, or timber companies. Trees help to hold the soil in place and prevent erosion. They remove carbon dioxide from the air and replace it with oxygen, furnish shade, and help cool rivers and streams. In addition, they furnish homes, food, and shelter for wildlife and provide wood for the production of lumber, paper, and various other products.

Forest Types

Michigan forests form a broad transition zone between the conifer forests (evergreens that bear needle leaves) of Canada and the deciduous forests (those broadleaf-bearing trees) of the eastern United States. For example, Michigan is in the southern range of the jack pine and white spruce and in the northern range of the Kentucky coffeetree, shagbark hickory, and tuliptree. As a result of this transition, there are many kinds of trees found throughout the state.

Forest types reflect changes in climate and soil texture. Within the Lower Peninsula, an imaginary line called the "tension zone" (that runs from Muskegon to Saginaw Bay) demonstrates such changes. South of the tension line the presettlement forests were primarily deciduous on all but the wettest sites. Black oak, white oak, red maple, and shagbark hickory grew on dry, well-drained uplands. Sugar maple, beech, basswood, and red oak flourished on moist, somewhat fine soils. Lowland areas, river bottoms, and lake plain soils supported forests of ash, silver, and red maple, swamp white oak, American elm, and cottonwood. White pine and hemlock grew along dunes.

North of the tension zone the soils tend to be coarser, the growing season is shorter, and the climate is cooler. As a result, beech and sugar maple, mixed with hemlock, white pine, and yellow birch grew on all but the driest uplands and wettest wetlands. Pines and mixed-pine communities were prevalent as they prospered on drier soils. In the Upper Peninsula, similar patterns developed with pines growing on sandy, acidic soils. Cooler summers promoted the growth of hemlock, yellow birch, balsam fir, and white spruce. Poorly drained sites contained black spruce and larch (tamarack), which tended to grow in bog communities.

Knowing what type of forest historically grew on your land will help you understand what is there today. It is important to know what kind of forest is on your property before you can make any management decisions. Although you can identify individual tree species with the help of field guides, it is more difficult to recognize forest types. One reason is because your property may contain more than one soil condition. Another reason is because individual trees don't always grow in only one type of soil. A professional forester or wildlife expert can help you identify the kind of forest you own.

This section contains chapters that explain eight different types of forest. These types are categorized by soil moisture content. The term "mesic" refers to soil that is moderately moist. Listed below are the classifications and their respective importance to wildlife. Keep in mind that just as a tree species may occur in more than one kind of forest, a species of wildlife may also use more than one kind of forest.

DRY CONIFERS are northern Michigan forests containing stands of jack pine and red pine as well as mixtures of these species with northern pin oak, white pine, and aspen. They grow on very dry, sandy plains and ridges that are acidic and low in nutrients. Today, about 800,000 acres occur mainly in the high plains region from Mio to Vanderbilt and in flat, sandy areas of the Upper Peninsula. Historically, dry conifer forests were found in a mosaic of pine "barrens" and-prairies. Only 100 acres of high quality pine barrens exist today. If presettlement maps show that historically there was a pine barren on your land, chances are it can be restored.


jack pine

Common mammals found in dry conifer forests are the badger, coyote, snowshoe hare, and black bear. Birds include the upland sandpiper, northern harrier, red crossbill, hermit thrush, bluebird, red-tailed hawk, American kestrel, and raven. The Kirtland's warbler is the best known of the rare species, which include the prairie warbler, black-backed woodpecker, sharp-tailed, and spruce grouse. The frosted elfin butterfly and secretive locust are two other rare creatures that inhabit dry conifer forests. A large number of rare plant species are also found here.

DRY MESIC CONIFERS are evergreens that grow on dry, sandy soils. The key tree species of this type is white pine. Because white pine was favored by loggers it no longer dominates dry mesic sites. Historically, white pine grew with red pine, white oak, beech, maple, and hemlock. These mixed stands include white pine-red pine forests in the high plains and rolling hills of the northern Lower Peninsula and white pine-white oak forests on the dry hills of west-central lower Michigan. White and red pine also mixed at times with combinations of red, black, and white oak. Mixed hardwoods of beech, red maple, and red oak grew with white pine and hemlock. Today, mature stands of white pine dominated forest are very uncommon.


white pine

The wild turkey, white-tailed deer, porcupine, red and gray squirrel, chipmunk, and black bear favor white pine dominated forests. Bird species include woodpeckers, crossbill, redpoll, scarlet tanager, red-breasted nuthatch, black-throated green warbler, black-capped chickadee, great-crested flycatcher, and pine warbler. The blue racer, a snake, lives there, and the rare Karner blue butterfly is sometimes attracted to the forest edge of open oak-pine forests.

MESIC CONIFERS are upland forests of evergreens that grow in moderately moist soils. There are two major types of mesic conifer forests. One type is dominated by eastern hemlock, while white spruce, balsam fir, and northern white cedar dominate the other type. These forests typically occur in northern Michigan along Great Lakes shorelines, along peatland edges, in narrow zones between wetlands and uplands, or in areas with seasonally wet soils. Historically, about 15 percent of Michigan's forests contained mesic conifers. Today, only a few small pockets of hemlock dominated forests still exist in Michigan, and very little hemlock can be found growing in northern hardwoods or other forest types.


northern white cedar

Mesic conifer forests provide winter cover, thick branches for nesting, and seed food sources for many wildlife species. Such species include the Canada warbler, ruffed grouse, brown creeper, junco, veery, pine siskin, red crossbill, redpoll, black-capped chickadee, white-tailed deer, bobcat, red squir-

rel, and spotted and blue-spotted salamanders. Also, many species of birds migrating along the Great Lakes rely on early spring insect production from shallow bays bordering mesic conifer forests.

LOWLAND CONIFERS comprise about 4.4 million acres of Michigan forest. These evergreen forests of black spruce, white cedar, and tamarack grow in muck- or peat-bottomed swamps and other poorly drained depressions mostly in the northern Lower and Upper Peninsulas. Sometimes these conifers mix with hemlock, white pine, and some hardwoods such as black ash. These forests often appear as a transition between wetland and upland habitats. Today, white cedar swamps have dramatically declined due to development, hydrologic alterations, roads, and over browsing by deer.


tamarack

Spruce-tamarack bogs attract white-tailed deer, spruce grouse, snowshoe hare, bobcat, black bear, white-throated sparrow, ovenbird, red-eyed vireo, Nashville warbler, and common yellow-throat. Additional species that favor white cedar swamps include the Swainson's thrush, Tennessee warbler, and yellow-bellied flycatcher.

DRY HARDWOODS are dominated by several species of oak and hickory and comprise six percent of Michigan forests. These forests were historically found mostly in the southern Lower Peninsula. Today, they are mostly found in the northern Lower Peninsula. These forests, which thrive best after fire, typically contain white, black, or red oak, along with pignut hickory. Other components may include white ash, red maple, black cherry, beech, and shagbark hickory. White and black oak with smaller amounts of black cherry, pignut hickory, and sassafras dominate mixed-oak forests.


oak

Dry hardwoods attract the great-crested flycatcher, Eastern wood pewee, rose-breasted grosbeak, scarlet tanager, ruffed grouse, wood duck, ovenbird, white-breasted nuthatch, red-bellied woodpecker, downy woodpecker, northern flicker, wild turkey, and black-capped chickadee. White-tailed deer, squirrels, chipmunks, deer mice, and voles are common mammals.

MESIC HARDWOODS are Michigan's most common forest type because they grow in cool, moist soils that fall between drylands and wetlands. About 19 percent of the state's forest community are mesic hardwoods consisting mainly of beech and sugar maple. In southern Michigan, these forests occasionally include a component of conifers along with basswood, red oak, white ash, American and red elm, shagbark hickory, black walnut, bitternut hickory, and tuliptree. North of the tension zone, hemlock, white pine, and yellow birch replace tuliptree, bitternut hickory, and other more southern species. In the western Upper Peninsula, beech is rare and white pine, yellow birch, basswood, and hemlock become major components.


beech

These forests are home to the ruffed grouse, woodcock, cottontail rabbit, snowshoe hare, elk, fox and Eastern gray squirrel, wild turkey, white-tailed deer, bobcat, fox, coyote, raccoon, black bear, American marten, fisher, gray wolf, barred owl, broad-winged hawk, wood frog, chorus frog, and vole. Uncommon animals include the northern goshawk, red-shouldered hawk, and black-throated blue and Blackburnian warbler.

LOWLAND HARDWOODS are hardwood swamps and floodplain forests that comprise about five percent of Michigan and provide some of the state's largest remaining natural forest habitats. Red maple, black and red ash, and swamp white oak dominate in mixed hardwood swamps, and may include pin and black oak, and black gum. Black ash swamps also occur on flat, sandy plains in southern Michigan. In northern Michigan, black ash sometimes mixes with northern white cedar or tamarack. Canopies are typically dense in hardwood swamps as well as in floodplain forests whose rich soils tend to flood in spring and sometimes fall. Southern Michigan floodplain forests support silver and red maple, red ash, and cottonwood with minor components of swamp white oak, black willow, and black walnut also occurring. Several southern trees reach their northern ranges in these forests.


swamp white oak

Songbirds that inhabit these forests include the warbling and red-eyed vireo, northern oriole, indigo bunting, gray catbird, and eastern wood pewee. Other

species include the wood duck, raccoon, woodcock, white-tailed deer, wild turkey, bats, salamanders, frogs, snakes, and many species of migrant waterfowl. Uncommon species include the red-shouldered hawk, Indiana bat, smallmouth salamander, spotted turtle, Blanchard's cricket frog, several species of mussels, and the cerulean, prothonotary, and yellow-throated warbler.

ASPEN-BIRCH forests comprise about 3 million acres, or roughly 10 percent, of the state's land base. Not truly a forest type, it is an early growth stage within a variety of forests. Historically, less than 270,000 acres of aspen-birch forests were present in Michigan. These sun-loving, fast-growing, relatively short-lived forests often grow with smaller components of balsam fir, pin cherry, red maple, white and red oak, and white and red pine. Aspen, often called poplar, regenerates best after it is clearcut by sending thousands of sprouts above the ground soon after the forest is harvested. Aspen and birch form open forests that allow many species of ground covers and fruiting shrubs to grow beneath the forest canopy, and these in turn attract a wide variety of wildlife.


aspen

At varying stages of growth, aspen-birch forests attract the chestnut-sided and mourning warbler, indigo bunting, least flycatcher, yellow-bellied sapsucker, ruby-throated hummingbird, red-eyed vireo, ovenbird, and pileated woodpecker. Other species include the black bear, white-tailed deer, woodcock, snowshoe hare, cottontail rabbit, ruffed grouse, woodland jumping mouse, porcupine, white-footed deer mouse, flying squirrel and, where evergreens are present, the American marten and fisher.

Management Options

Managing these forest types begins with defining what your goals are. Refer to the **Habitat Planning** section for more information. Perhaps more than any other type of natural resource you may own, forests require the skills of a professional to help you sort through the many options available. Your goals may or may not include a timber harvest. If you decide to harvest your forest, a forester or wildlife biologist can help you receive its full economic value. Also, they may be able to supervise timber removal in a way that minimizes impact to the environment, and to help you achieve your goals for improving or creating wildlife habitat.

Not cutting your forest is a management option that has both positive and negative consequences for wildlife. Harvest strategies of shelterwood cutting, clearcutting, and seed-tree management also have far-reaching implications. An example of when to cut occurs with a closed-canopy oak forest that you might want to manage for wild turkey habitat as well as generate income. An example of when not to cut involves a conifer swamp of white cedar or hemlock that you want to maintain for thermal cover for wintering wildlife.

In summary, Michigan's considerable forest resources are characterized into eight different communities keyed to soil moisture and conditions of climate. Over the years many of these forests have been dramatically altered, and may require some type of manipulation in order to provide optimal wildlife habitat for some species of wildlife. Although several million forested acres are owned by the public or by timber industries, about half of Michigan's forests are owned by more than 350,000 private property holders. On these private lands lies the future for improving or creating wildlife habitats. The type of management style a landowner chooses to conduct on their land will effect the kind of wildlife that are supported on the property.

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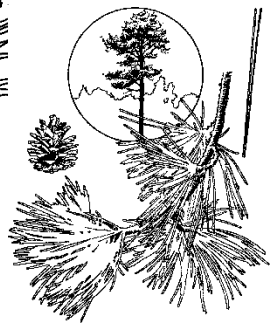
DRY CONIFERS
(JACK & RED PINE)

Dry pine forests include pure stands of jack pine and mixtures of jack, white, and red pine, northern pin oak, and aspen. These communities, which foresters collectively call dry conifers (evergreens) because pine is the key component, occur on dry, sandy soil that is acidic and nutrient-poor. Landscapes here are typically high and flat. These forests also occur on sandy ridges within large wetland complexes and on steep, cobblestone ridges next to large sandy plains.

Historically, this landscape was a shifting mosaic of forest and open grasslands, or "barrens," that was primarily maintained by wildfires of varying frequency and intensity. In the 1800's, there were approximately 1.3 million acres of dry conifer forest in Michigan, with about 80 percent of the total found in the northern Lower Peninsula. Today, about 800,000 acres remain. They occur mostly in the high plains region from Mio to Vanderbilt east of I-75 and in flat, sandy areas of the Upper Peninsula. Perhaps more than any other single influence, the timber-cutting operations that occurred between the eraly 1800's and early 1900's changed the way these forests look today.

jack pine



red pine

Before the loggers arrived, red and white pine were often mixed within dry conifer forests. Large-diameter trees that had survived wildfires helped to form a complex forest that varied from young seedlings and saplings to large canopy trees. Other typical trees, shrubs, and groundcovers included balsam fir, black cherry, paper birch, sweetfern, blueberry, huckleberry, sand cherry, and bearberry. Bracken fern, poverty grass, Pennsylvania sedge, and hairgrass were other common plants. Loggers removed much of the favored red and white pine, and the fires that followed helped jack pine to regenerate over many more acres than before.

These "slash" fires of a hundred years ago, so-called because they burned the logging debris, left charred stumps throughout the northern Michigan landscape. They also contributed to the rapid spread of bracken fern and many exotic species such as spotted knapweed. Were the timber cutters to return, they would not recognize the landscape that was originally a shifting mosaic of dry-pine forest and open grasslands or "barrens" containing some pines.

spotted knapweed -
an exotic species

Areas with frequent fires, such as portions of Lake, Crawford, Iosco, and Oscoda counties, were dominated by jack pine barrens. The barrens were not wastelands, as the name suggests, but rather a unique grass-dominated ecosystem with only a few jack pine trees per acre. Because this system was so open, it admitted sunlight to reach the forest floor allowing a diverse understory of shrubs, grasses, and wildflowers to flourish. Shrubs found here include those from the adjacent forest, along with prairie willow and hazelnut. Today, fire suppression and the establishment of pine plantations have reduced the number of high-quality jack pine barrens to only a few hundred acres. Inappropriate off-road-vehicle (ORV) use, a boom in second-home development in northern Michigan, and the invasion of invasive plants are other reasons why this unusual ecosystem is losing ground. Today, only 100 acres of high quality barrens remain.

hoary puccoon

birdfoot violet

Prairie species that may be found in a remnant pine barren.

Species Present

If you own a jack pine forest that is a fragmented patchwork of grassy openings and woods, look for prairie-associated shrubs, grasses, and wildflowers growing in the openings and along the forest edges. Plants to look for include rough blazing star, prairie cinquefoil, birdfoot violet, butterfly weed, harebell, and hoary puccoon. In addition, hill's thistle, rough fescue, Alleghany plum, and pale agosersis are rare plants that live in jack pine barrens. Grasses include big bluestem, little bluestem, poverty grass, hair grass, June grass, and needle grass. The presence of these species suggests that a seed bank exists beneath the maturing forest canopy. These rare communities are an important part of Michigan's heritage. Through prescribed burning and possibly planting, you might be able to restore what was originally a special kind of prairie. See the section on **Grassland Management** for more information.

Common animals found throughout the dry conifer mosaic include the red crossbill, hermit thrush, bluebird, red-tailed hawk, raven, American kestrel, coyote, snowshoe hare, and black bear. Also, badgers, upland sandpipers, and northern harriers are uncommon wildlife species that live in these areas. Unique to Michigan, the federally endangered Kirtland's warbler heads the list of rare species in this area. This songbird builds its nest on the ground under young jack pines between eight and 20 years old. Other rare birds found here include the prairie warbler, black-backed woodpecker, and sharp-tailed and spruce grouse. Prairie chickens, now extirpated from Michigan, were found in jack pine barrens that were at least several square miles in size. The frosted elfin butterfly is an uncommon species, and the secretive locust, which lives in shallow wetlands among the pine barrens, is also considered rare.

Management Considerations

Some type of disturbance, such as fire or timber harvest, is needed to maintain a jack pine forest. However, fire as a management technique has its perils. As a result, timber harvesting, often followed by artificial seeding or planting, is more commonly used in forest management. Professionals recommend either or both management techniques, especially for those property owners with 200 or more acres of dry conifer forest. The following are options to consider when managing dry conifers.

Prescribed Burning

If used safely, fire is the most effective management tool, particularly if a composite of forest, barrens, and grassy openings is your objective. Also, fire is the common means by which jack pine forests are rejuvinated. Jack pine is unusually adapted to fire because their pine cones are coated with a resin that melts at 112 degrees F., a temperature normally reached only through fire. Once the resin melts, the cones open and thousands of seeds are released. Fire also decreases competition, reduces leaf litter on the forest floor, prepares a good seed bed for regeneration, and releases nutrients into the soil. Besides the positive influence on jack pines, fire maintains the variety of prairie grasses and flowers that are also dependent on fire for their survival.

Consider conducting a controlled burn on any complex of forest, grasslands, and barrens that is

black bear

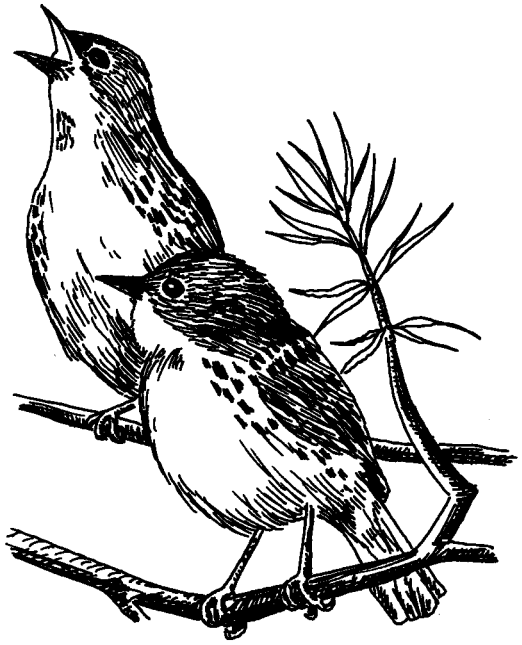
at least 20 acres in size. Such areas should be burned at 10 to 20 year intervals. You may also want to consider burning after your forest is clearcut and then follow with seeding or planting with trees. Because of economies of scale, bigger burns are more appropriate and cheaper.

Fire, as a tool, can be complex and dangerous. Rightly so, it is best left in the hands of a trained resource professional. Also, whenever prescribed fire is used as a management tool, you must work with your local fire officials to obtain permits and regulations. In many instances, the use of prescribed burning of jack pine forest is very limited on private lands, especially on smaller tracts. For more information, see the chapter on **Prescribed Burning** in the Grassland Management section.

Timber Harvesting

Timer harvesting produces many but not all of the same positive effects as fire. The **Timber Harvest** chapter, located in the Forest Management section, explains several options to consider. Clearcutting is the preferred way for managing jack pine stands from 20 to 200 acres in size. In this scenario, young pine is promoted soon after the mature trees are cut.

Professionals that manage for Kirtland's warblers use prescribed burning and jack pine planting or seeding to produce the dense, young thickets these birds demand for nesting. Jack pines from eight to 20 years old offer the abundance of low branches the birds require.



Kirtland's warbler

Jack pine and Kirtland warbler management plans commonly call for a complete harvest of jack pine every 40 to 60 years. Kirtland's warbler management blocks are usually several hundred acres in size.

To manage for other species of wildlife, it is best to cut in smaller blocks to produce a variety of age classes and densities. Such a system can be used to manage stands of jack pines as small as 80 acres by cutting 20 percent of the total (about 16 acres) every 10 years to give the entire stand as much diversity as possible. Make the cuts at least 100 yards wide and 300 yards long in a north-to-south direction whenever possible. Larger cuts are, of course, more economical when profitability is the goal. If you own 20 acres or less, cut all the jack pine at one time.

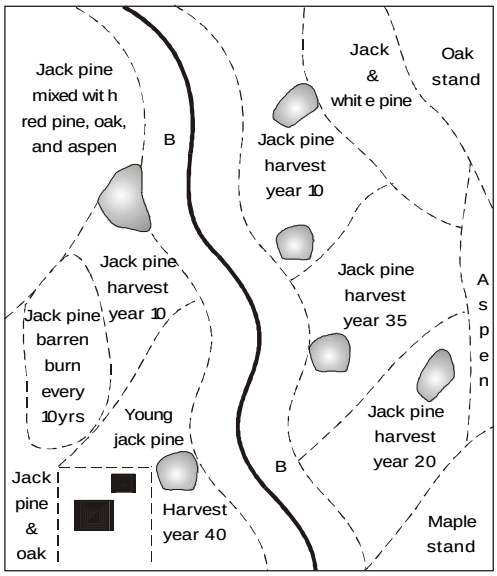
Clearcuts that follow the topography of the land are preferred, as are irregularly-shaped cuttings instead of straight-sided block cuts. Leaving 20- to 40-foot-wide strips of mature trees between the harvests will minimize short-term disturbances to the site. Avoid trying to manage frost pockets(low areas that experience late spring frosts) because these low-lying areas do not respond well to clearcutting. Also, within each cutting area consider leaving small clumps of 10 to 20 white pines, oaks, or shrubs such as serviceberry and hazelnut because these species provide food and cover for wildlife.

You can also increase cover for rabbits and other wildlife by making brush piles of at least 15 feet in diameter and five feet high from slash and other harvest debris. It is preferable in these areas to maintain only one brushpile for every five acres as too many rabbits will consume jack pine seedlings. Leave standing snags for cavity-nesting birds like woodpeckers and bluebirds, or put out nesting boxes. For more information, see the **Homes for Wildlife** chapter in the Backyard section.

Remember, pine barrens are very rare and are home to several rare plants and insects. If you own a jack pine forest that is currently a highly fragmented patchwork of grassy openings and forest where prairie-associated shrubs, grasses, and forbs are found, you may have a former pine barren. You should consider restoring it through prescribed burning and selective timber harvest.

In summary, dry conifer forests are a valuable part of Michigan's

40 acres



Existing features

Road

House

Stream

Habitat projects

B Buffer zone

Areas left uncut

All cuts are 20% of entire stand with intervals as stated on map. Cuts are made in N-S strips.

This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

natural landscape. Pine barrens are a unique and uncommon ecosystem within the dry conifer spectrum. If you have a dry conifer forest on your property, you may have the opportunity to manage for many wildlife species, including several rare ones.

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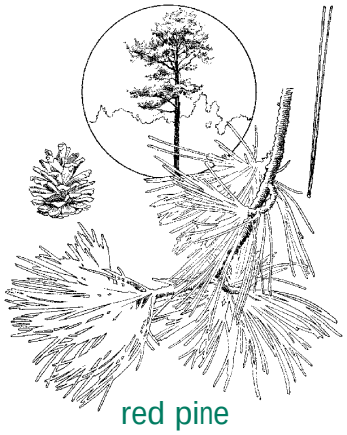
DRY MESIC CONIFERS
(WHITE PINE)

Dry mesic conifers are evergreen species that grow on dry, mostly sandy soils, although they can also tolerate a variety of conditions including drier mounded areas in wet depressions. White pine is the dominant species in this forest type. Michigan was once known as the king of white pine, and today this majestic evergreen is the official state tree. Before the logging era of 1840 to 1930, white pines dominated these forests and were found along Lake Michigan and throughout the northern Lower Peninsula and the Upper Peninsula. By far, the northern Lower Peninsula contained the largest tracts of white pine forest. From 1850 to 1900, Michigan delivered more board feet of this prized, long-lived tree to the lumber mills than did any other state. Two of the most productive regions in Michigan for white pine during that time period were the Muskegon River and Saginaw River watersheds.

white pine

Unfortunately, most of the white pine forests never recovered from this logging. Today, many former white pine sites have converted to a variety of forests including oak, aspen-birch, and red pine plantations. The white pine forests were also converted to farmland, especially along the Saginaw watershed. Although heavily logged, white pine is still found in mixed forests. These mixed communities include white pine-red pine forests in the high plains and rolling hills of the northern Lower Peninsula and white pine-white oak forests on the dry, rolling hills of west-central Lower Peninsula. White pine and red pine grow in combination with red, black, and white oak. White pine may also grow with eastern hemlock in mixed hardwoods of beech, red maple, and red oak.

White pine regenerates well following fire on a variety of sites. Fire is beneficial to the regeneration of white pine because it exposes the soil, releases nutrients from the leaf litter, and kills hardwoods such as sugar maple and beech that compete with white pine for space. However, white pine is also able to regenerate without the aid of fire because it is able to tolerate a variety of sun-shade conditions, except for extremely dense shade. For this reason it can be found growing in the understory of young stands of red and jack pine, and red, white, and black oak. If managed correctly, white pine can



red pine

again increase in numbers within these forests. Current locations of forests with white pine include the west central Lower Peninsula from the Allegan State Game Area in Allegan County to Evart in Osceola County to Hartwick Pines area near Grayling. White pine forests are also found in the Upper Peninsula. This tree is restricted in ornamental plantings due to its susceptibility to the white pine blister rust fungus and the white pine weevil.

Wildlife Value

White pine forests provide roost trees for wild turkeys, browse for deer in winter, dens for porcupines, and nesting cavities for woodpeckers, flickers, and flying squirrels. Crossbills, red squirrels, chipmunks, and gray squirrels eat the pine cone seeds in winter. Common plants that grow in the understory include bracken fern, blueberry, bush honeysuckle, wintergreen, and hazelnut. These food-producing shrubs attract

porcupine

ruffed grouse, rabbits, and many other species of wildlife. Black bears make dens under the roots of uprooted trees. The forest provides thermal protection in winter for many wildlife species. Also, the majority of eagle nests found in Michigan are in tall white pines near lakes and rivers. Other birds that frequent white pine habitats include scarlet tanagers, black-throated green warblers, black-capped chickadees, great-crested flycatchers, and pine warblers. The blue racer is a species of snake that likes the coolness of the white pine forest floor. The uncommon Karner blue butterfly is attracted to the edges of open dry white pine-white oak forests in limited areas in the Lower Peninsula.

Management Considerations

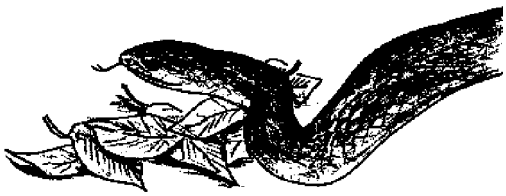
If you own a stand of white pine mixed with some hardwoods in a multiple-aged forest of seedlings, saplings, mature trees, and dead trees, then your forest is high-quality habitat and little further management may be needed at this time. However, in most cases you will probably need further management to successfully reestablish white pine in your forest. If your forest consists of a majority of red pine, jack pine, or oak with white pine growing in the understory, a timber harvest strategy could reestablish white pine as a dominant species and also produce income.

Preferred management for a variety of white pine forest systems are timber harvesting methods that can include group selection, shelterwood, strip clearcut, or seed tree techniques. The openings that result from these cuts allow the regeneration of a diverse stand of pines, hardwoods, and herbaceous cover. These harvest methods leave mature trees in or adjacent to the cut to provide a seed source and/or shelter for the regenerating seedlings. For more information refer to the **Timber Harvesting** chapter in this section.

Of these methods, the group selection method creates the least amount of disturbance to the existing forest. It involves cutting small patches in the stand up to 1/2 acre in size. Trees adjacent to these patches will provide both the seed source and shelter for the regerating trees. This cut should be no wider than 150 feet. If possible, plan the harvest across a diversity of forest types with a mixture of pines and hardwoods preferred. Although some hardwood regeneration is good because it adds to new-stand diversity, you may need to apply a selective herbicide to keep maples and other shade-loving hardwoods from completely taking over.

A shelterwood harvest involves a two-cut strategy where 40 to 60 percent of the trees are removed in the first cut, and the remaining trees are taken out 10 to 20 years later. This can be done in uniform, group, or strip formations. The trees left in the first cut provide shelter for the regenerating trees. They also provide shade that helps the young white pines to compete with more aggressive, sun-loving plants. Again, if regeneration is mostly hardwoods, then treatment with herbicides may be needed. Once the new pines are well established in the overall mix, then the remaining mature trees can be harvested. Most shelterwood cuts are from two to 20 acres in size. Be sure to make the first cut areas small enough to provide some shade for the regenerating white pines.

The clearcutting method involves removing all trees greater than one inch in diameter in one cut. This method can be used when there are many young white pines found in the understory as it allows them to grow without competition from larger trees. Plan cuts that are two to 10 acres in size, and provide for at least 100 feet of buffer forest between cuts. Smaller clearcuts scattered over an area produce the greatest amount of edge, while one large cut produces the least amount of edge. In areas with high deer numbers, cuts may have to be larger to overcome the impact of browsing on the regenerating trees. Clearcutting can also be done in strips. The exact size of the strips depends on the size of your property, the mix of forest species, and your overall goals.



blue racer

The seed tree harvest method is a type of clearcut that leaves specific mature trees or groups of trees within the cut itself to provide seeds for regeneration. These trees are chosen to dominate the stand. In this case, you would leave any white pine existing in the stand, young or mature, as well as some mature red pine and/or hardwoods to provide diversity. The remaining trees also decrease the environmental and visual impact of the clearcut.

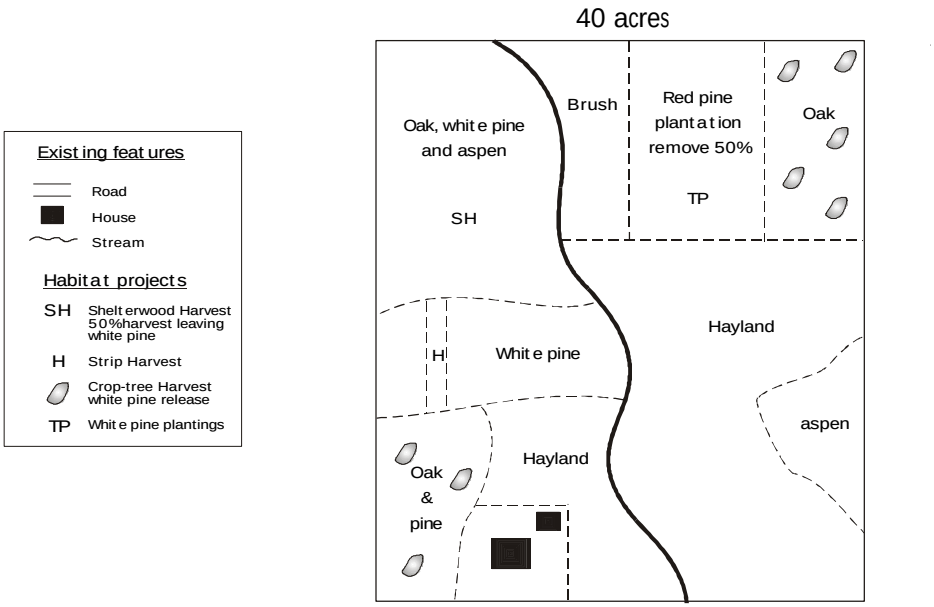
Thinning, followed by planting, is another management option to consider. This method is used when you do not want to change the dominant tree species in your forest, but want to establish some white pine. For example, if you own a large, red-pine plantation which you want to keep but also wish to establish some white pine, you can accomplish this by thinning the red pine by 30 percent or more and planting white pine seedlings in the created openings. This is a good option to consider in these plantations as straight-growing red pines begin to lose their lower branches and their food and cover value to wildlife at about 20 years of age. Underplanting the red pines with white pine or oak will increase the wildlife value of the stand.

In many black oak-white oak forests, white pine often grows in the understory. Thinning around the young pines in these forests will decrease competition for food, water, and light and encourage them to grow. You can also help to establish more white pine in these forests by planting. If you are planting white pine within a mixed-species forest, try to plant up to 20 percent white pine.

oak

Following these timber harvests with fire will also help in establishing white pine. Burning the openings created by the harvests will discourage the establishment of hardwoods such as sugar maple and beech that compete heavily with white pine. It will also encourage the establishment of oaks which will increase the wildlife value of the white pine forest. Further, burning the stand will increase the amount of groundcover diversity which is also beneficial to many species of wildlife. If prescribed burning is part of your overall management plan, be sure to contact local fire authorities for permits and advice. For more information refer to the **Prescribed Burning** chapter in the Grassland Management section.

In summary, if white pine is found in your forest, you have the potential to create valuable habitat for wildlife, especially if it is mixed with other tree species. Consult with a forester or wildlife biologist to consider the options that are best for your forest.



This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

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FOR ADDITIONAL ASSISTANCE: *CONTACT YOUR LOCAL CONSERVATION DISTRICT*

PRIVATE LAND PARTNERSHIPS
WORKING TOGETHER FOR WILDLIFE

MESIC CONIFERS
(HEMLOCK, WHITE SPRUCE, BALSAM FIR)

Mesic conifer forests are upland forests of evergreens (conifers) growing in moderately moist (mesic) soils. There are two major groups of trees that occur in this type of forest: 1) Eastern hemlock often mixed with yellow birch, red maple, or white pine, and 2) white spruce, balsam fir, and northern white cedar. Mesic conifer forests are typically found in northern parts of the state along shorelines of the Great Lakes, along peatland edges, in narrow ribbons between lowlands and uplands, along ravines and river corridors, or in areas with seasonally wet soils. It is estimated that about 15 percent of Michigan's overall land base historically supported mesic conifer forests.

At one time hemlock was the dominant tree species along transition zones from lowlands to uplands. Here, it often grew with northern hardwoods such as beech, sugar maple, and yellow birch, and occasionally with white pine and northern white cedar. Historically, hemlock-yellow birch forests existed along lake margins in the western Upper Peninsula. Forests of hemlock and white pine occurred on flat, sandy areas throughout the northern Lower Peninsula of the Saginaw Bay region. Hemlock can live to be 600 years old. Good places to see old stands of hemlock include the Porcupine and Huron mountains of the Upper Peninsula, high spots along old floodplains of the lower Manistee River in west-central Lower Michigan, and in the Black River gorge of the Port Huron State Game Area.

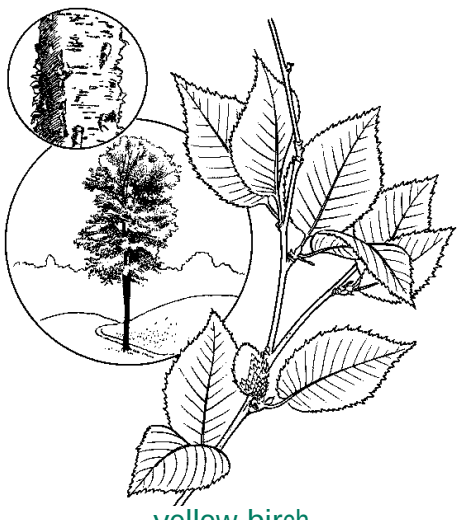

eastern hemlock

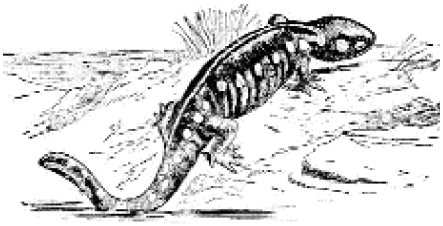
Today, hemlock is an uncommon component in most Michigan forests for several reasons. During northern Michigan's logging era from about 1840 to 1930, the tannin in hemlock bark was highly prized for tanning leather. Thus, hemlock became a targeted species. Since it is a shade-tolerant, slow-growing tree that needs rotting nurse logs or moist, acidic soils with very little leaf litter in order to grow, it is hard to regenerate. Also, hemlock is a favorite winter food of deer and elk, which cause damage by heavily browsing on seedlings and young trees.

The other kind of mesic conifer forest is often referred to as boreal forest. Those sites are dominated by white spruce, balsam fir, and northern white cedar and are typically too cold, humid, wet, or nutrient-poor for other trees to survive. These areas include sandy soils, rocky shorelines, and thin soils over bedrock. Here windthrow from storms occurs frequently because root growth is usually shallow. Paper birch and aspen often grow in these naturally created openings. Ground cover in the boreal forest includes sedges, mosses, lichens, twin flower, star flower, wild sarsaparilla, bunchberry, and mayflower.

Wildlife Value

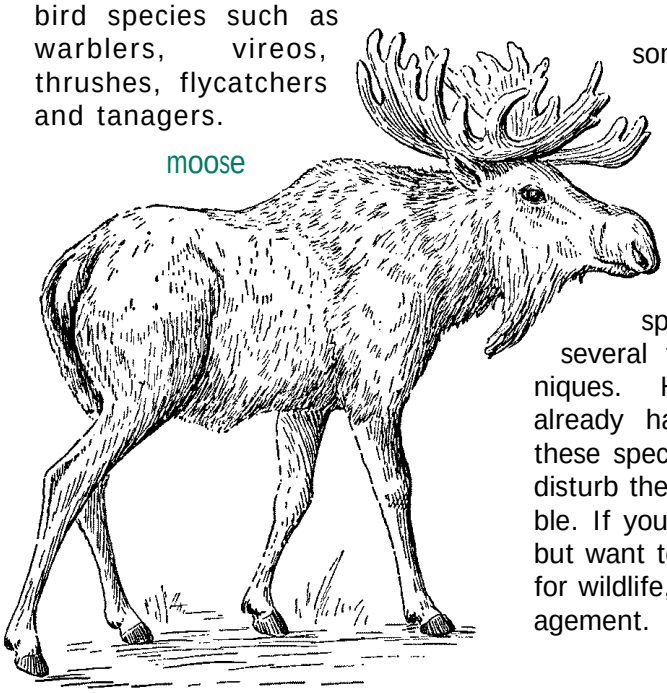
Mesic conifer forests provide good habitat for a variety of wildlife species. Bald eagles and ospreys perch and sometimes nest in the tall evergreens. This is especially seen along the northern Great Lakes. Uncommon plants that grow in these forests include the ram's head orchid and dwarf lake iris. The dwarf lake iris is found only along


yellow birch



spotted salamander

northern shorelines of Lake Michigan and Lake Huron, and is the official state wildflower. Mesic conifers offer thermal protection for deer, ravens, sharp-shinned hawks, and other wildlife species during cold weather. Moose, fishers, and American martens also live in these forests, as well as Blackburnian warblers, winter wrens, Canada warblers, ruffed grouse, brown creepers, white-tailed deer, bobcats, and spotted and blue-spotted salamanders. The veery and junco in particular like to nest in thick hemlock groves. The seeds from hemlock cones provide food for red crossbills, pine siskins, black-capped chickadees, and red squirrels. Shrubs and ground cover attract insects that provide food for migrating bird species such as warblers, vireos, thrushes, flycatchers and tanagers.



moose

Management Considerations

There are two management options to consider: protection or timber harvesting.

Protection

In forests with a large amount of hemlock and yellow birch, or white spruce, balsam fir, and northern white cedar, little or no timber harvest may be necessary to increase habitat value to wildlife. Therefore, healthy mesic conifer forests and their adjacent uplands should be disturbed as little as possible. In fact, because wet or seasonally wet soils are typical of this forest type, logging operations if done poorly can have a negative impact because they often disturb the soil and impound water. Mature hemlock are especially susceptible to disturbance. Therefore, avoid creating roads, trails, or openings as much as possible. If you must make roads, maintain a gradual edge, and reseed and block access when they are no longer needed.

However, without some type of disturbance, establishment of a younger hemlock stand may occur once every 50 to 200 years because of the slow rate of regeneration. Landowners can help speed up this process with several timber harvesting techniques. However, if your forest already has a large amount of these species present it is best to disturb the forest as little as possible. If you wish to remove timber but want to retain maximum value for wildlife, use uneven-aged management. This practice, which is best performed near the forest edge, will mimic natural disturbances as it limits your cuts to single trees or small clumps of five to ten trees. If you have pure stands of hemlock, it is best to leave uncut groves that are several acres in size. You can also use this practice for managing mesic conifer forests of mostly white spruce and balsam fir. However, be sure to spare any northern white cedar as it is very hard to regenerate, especially in areas that support moderate to high deer numbers.

Timber Harvesting

In mixed hardwood forests with hemlock present in the understory, timber harvesting of the overstory hardwood trees may help hemlock to grow and become a dominant species. Hemlock regenerates in moist soils beneath the shade of more sun-loving trees. Seedlings often establish themselves on large fallen rotting logs or on moist exposed soils. However, if these shady conditions remain, the hemlock can remain stunted for 25 to 200 years. When some type of disturbance, such as windthrow or fire, opens the canopy and lets sunlight in hemlock begins to grow very rapidly. The following are timber harvesting methods to be used in forests where hemlock is found in the understories of other species, and needs help becoming more quickly established. Please refer to the **Timber Harvesting** chapter in this section for more detailed information on these techniques.

Uneven-aged management causes the least amount of disturbance and comes closest to providing the greatest diversity of tree ages and heights, which are of the greatest benefit to wildlife. Single

tree or small group selections of five to ten trees promotes a diverse stand. Locate hemlock seedlings in the understory and remove competing trees around them. Creating these small openings will allow hemlock to receive enough sunlight to grow. Follow-up with group selection treatments every three to five years to thin out competing hardwoods.

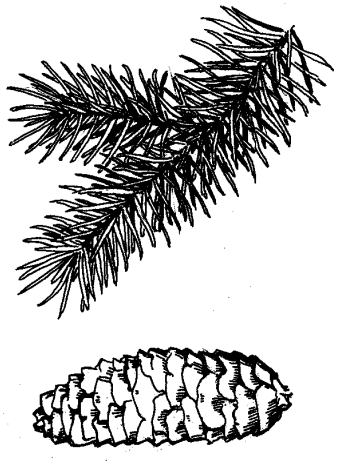
Even-aged management using shelterwood cuts is the preferred method when conducting a large scale harvest. This method removes 40 to 60 percent of the mature trees but leaves the healthiest and largest trees to provide shelter for the growing seedlings. Because the tree species in a mesic conifer forest prefer shade or partial sun, cut small areas of 60 feet to a side and leave these tree species as well as others to ensure a diverse regeneration. This first cut will allow sunlight to reach the forest floor and prompt tree seedlings to sprout and grow beneath the protection of the shelterwood trees. When seedling and sapling development has reached four to six feet in height, and shelter is no longer necessary, the remaining mature trees can be cut. This technique can be done in uniform, group, or strip formations.

bald eagle

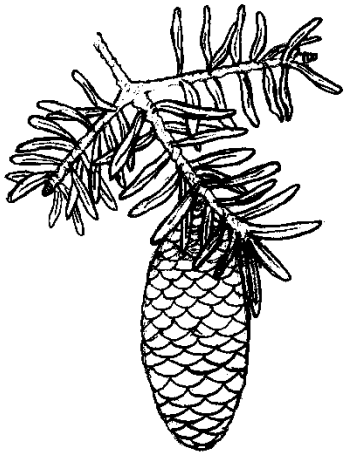
Even-aged management using clearcutting followed by planting can also be used when managing areas with few hemlock, spruce, fir, or cedar. However, it may be difficult to regenerate a diverse stand of tree species with this method. Small patch cuts of five to 10 acres in size and narrow strips are preferred. Strips should be no wider than 150 feet in areas with mild winds and no wider than 50 feet in areas with strong winds that are prone to windthrow. Desired species can then be planted in the cut areas. Adjacent uncut areas should be at least 100 feet wide. These cut areas will progress from open ground to saplings and finally to mature trees over a period of 50 to 80 years. The different stages of growth and diversity of tree species will provide varying habitats that will attract different species of wildlife over a long period of time.

If you choose to harvest your mesic conifer forest, all cutting activities should be conducted after the ground is frozen to minimize disturbance to the soil. In clearcuts, consider leaving clumps of 20 plus trees to provide nesting habitat and thermal cover for wildlife. Wherever needed, add culverts to maintain normal water flow.

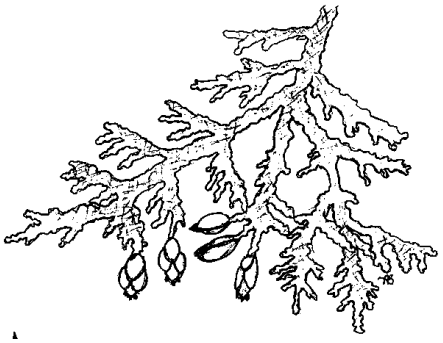
A clear forest is not beneficial to wildlife. Leaving large branches on the forest floor is beneficial to many species of wildlife. Creating brushpiles provides essential cover, especially for rabbits and snowshoe hares. However, be aware that attracting these species to the area can lead to over-browsing of regenerating seedlings. Leaving dead standing trees (snags) and fallen logs, provides valuable habitat for invertebrates, amphibians, woodpeckers and cavity-nesting birds. Also, leaving logs on the forest floor aids with the regeneration of hemlock and yellow birch.



white spruce

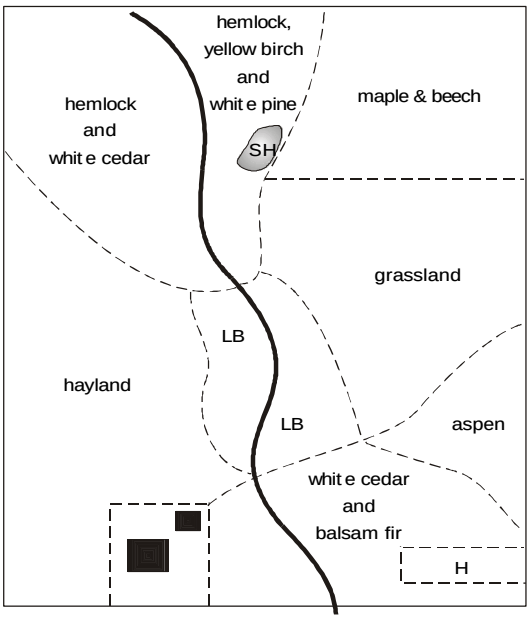


balsam fir



northern white cedar

40 acres



Existing features

- Road
- House & yard
- Stream
- LB — Lowland brush

Habitat projects

- SH — Selection Harvest single trees or small groups (0.5-1acre)
- H — Strip Harvest cut all trees in an east to west strip

This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

Exotic Mesic Conifers

Norway, Austrian, and blue spruce are not native to Michigan. However, some landowners add them to their property where they provide aesthetic value as landscape screens and have some benefit for wildlife--mostly in the form of travel lanes and corridors as well as winter cover.

Blue spruce and Scotch pine (Scots pine) have economic value when they are grown in Christmas tree plantations. Rabbits, mice, and other small mammals may find shelter and nesting sites under the spreading limbs of trees under 20 years old, if they are periodically thinned. Mourning doves often nest in the crotched branches of blue spruce. However, these exotic species lose their limited wildlife value the older they grow, and Scotch pine in particular is susceptible to insects and diseases.

In summary, wherever mesic conifer forests grow in Michigan, they have high value for wildlife. If you have healthy mesic conifer forest you should protect it if possible. If your forest has the potential to contain more of these species there are timber harvesting techniques that can help them become established. Knowing how different wildlife species are impacted by your decisions should help guide you in the management choices you make.

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PRIVATE LAND PARTNERSHIPS
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LOWLAND CONIFERS (TAMARACK, BLACK SPRUCE & WHITE CEDAR)

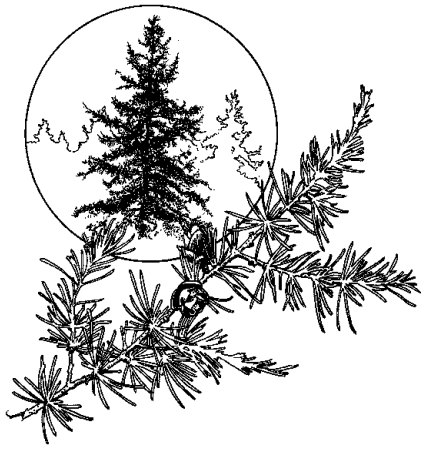
Lowland conifers are forests of evergreens that grow in association with swamps, in areas adjacent to streams, or other poorly drained depressions where peat or muck accumulates. These forests are found in the transition between aquatic environments and uplands. There are two groups of tree species associated with these areas: 1) tamarack (larch), black spruce, and northern white cedar are the most common and 2) white pine, balsam fir, eastern hemlock, and some hardwoods such as black ash. These forests of lowland conifers are primarily found in the northern Lower Peninsula and Upper Peninsula although they also grow in southern Michigan. Foresters estimate there are about 4.4 million acres throughout the state.

In general, black spruce is the dominant tree in the lowlands of the western Upper Peninsula. Northern white cedar is the dominant species in lowlands of the northern lower and eastern Upper Peninsula, and tamarack tends to dominate in southern Michigan lowlands. However, conifer swamps vary throughout the state, and what grows on your property depends upon soils, climate, drainage, and past disturbances.

For example, in areas where there is significant water flow through calcium-rich bedrock or soil, northern white cedar is the most common species. Cedar will be the first of these species to colonize in very alkaline, high flowing groundwater conditions. In swamps, cedar is often accompanied by black ash, balsam poplar, speckled alder, aspen, and red maple. In lowland stream borders, cedar is found with balsam fir, black spruce, eastern hemlock, white spruce, and other hardwoods. Many swamps of white cedar have an underlying layer of peat that is shallower than that found in bogs. Cedar swamps are common throughout Presque Isle county, the eastern Upper Peninsula within the Seney National Wildlife Refuge, and within Lake Skegemog Natural Area near Traverse City in the northern Lower Peninsula. Cedar swamps are also found in southern Michigan lowlands within the Highland Recreation Area and Horseshoe Lake State Game Area, which have significant cooler temperatures than surrounding uplands. Although white cedar is the dominant tree, there are also some balsam fir, eastern hemlock, white spruce, red maple, and paper birch.

Black spruce is dominant in acidic areas with cold, stagnant water. This includes very slow moving swamps and the edges of sphagnum bogs. In these areas, tamarack, balsam fir, red maple,

northern white cedar



tamarack

black spruce

and yellow birch are also found. Tamarack grows in most wet lowlands that receive full sunlight and have acidic soils. Spruce-tamarack bogs, which are basically peatlands, are common in the Upper Peninsula and in northern Lower Michigan. They occur as scattered trees over an open area containing a surface layer of deep peat, sphagnum moss, and sedges. The trees, seldom taller than 60 feet, give way to red maple around the edges, and these in turn progress to white pine and white cedar on adjacent areas. Sphagnum moss often blankets the ground of these conifer peatlands and is interspersed with a variety of ferns, orchids, and acid-loving shrubs such as Labrador tea, bog rosemary, and leatherleaf. Cranberries frequently grow in black spruce swamps and are typical inhabitants of open sphagnum bogs.

Many white cedar forests of the Upper Peninsula are 200 years old or older, are in healthy condition, and in no danger of being lost except for their timber value. However, these areas were historically not harvested for timber as much as other species on drier sites. Therefore, healthy lowland conifer forests can still be found throughout Michigan.

snowshoe hare

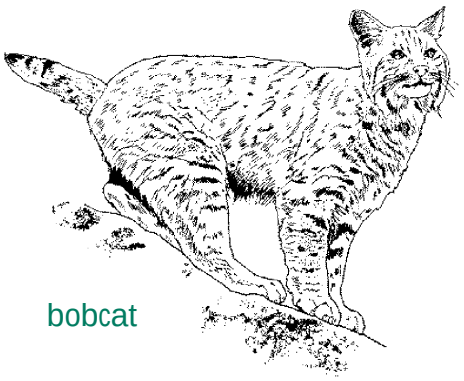
Wildlife Value

Those conifer swamps especially rich with white cedar provide habitat for many types of amphibians, songbirds, reptiles and mammals seeking water, insects and dense cover. Wood frogs breed in pools within these forests. White-tailed deer, elk, snowshoe hares, Swainson's thrush, American redstart, black-throated green warblers, and black and white warblers are also species that use cedar swamps. Uncommon birds include the palm warbler, boreal chickadee, and yellow-bellied flycatcher. Uncommon mammals include the moose, spruce grouse, and wood turtle. Examples of rare plants are the Michigan monkey-flower, round-leaved orchid, ram's head orchid, Calypso orchid, and marsh grass-of-parnassus.

Common wildlife species that inhabit spruce-tamarack bogs include white-tailed deer, spruce grouse, snowshoe hares, bobcats, black bears, mink frog, bog turtles, white-throated sparrows, ovenbirds, red-eyed vireos, Nashville warblers, and common yellowthroats.

Management Considerations

Forests of lowland conifers are susceptible to windthrow, fire, insect damage, and water level fluctuations. Small-scale disturbances from insects and fire open up the canopy, allowing sunlight to reach the forest floor and develop a diverse understory of shrubs and other plants. Larger scale disturbances such as logging, road building, or intense beaver activity can have vast negative effects on lowland conifers. Often after these disturbances aspen and birch, or in wetter sites cattail and sedges, move in and dominate the area.



bobcat

Most lowland conifer stands in Michigan are in good condition, and there is no need to regenerate them over the next 20 to 40 years. Further, researchers and other professionals have experienced limited success in duplicating the natural conditions that created these forests. Therefore, unless there is an economic need to harvest your lowland timber, you are best advised to leave these forests alone.

Protection

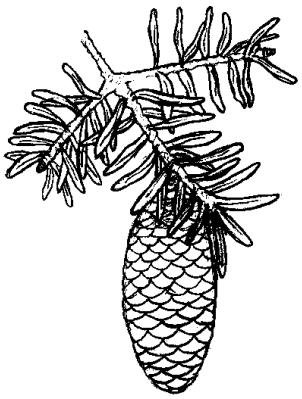
Lowland conifers provide thermal protection for several species of birds and mammals. The dense evergreen branches furnish escape cover from predators and offer secure nesting sites. Maintaining the hydrology (water level) of these forests is important because severe flooding or years of drought can have a major impact on the health of the stand. Draining adjacent uplands can lead to a higher water table which will flood lowland conifers. Flooding can eventually convert the forest to a stand of cattails or a thicket of alders and willows. Conversely, if the soil dries out over a long period of time, an invasion of upland trees and shrubs will likely occur.

For these reasons, plan for minimum disturbance to both lowland conifers and nearby uplands. Maintain a buffer strip of at least 100 feet wide around the site. Do not plan a major tree harvest or build roads or trails within the lowland stand or the buffer strip because little or no timber harvest is needed to increase the value of the stand to wildlife. If timber is removed, it should be done by removing single trees, preferably along the stand's edge. Small cuts that harvest one to four trees at a time is the closest method to imitating natural disturbance. To minimize impacts to the soil surface and water table, any cutting should be done after the ground is frozen.

A clear forest is not helpful to wildlife. Building brushpiles and leaving large branches on the forest floor are beneficial to wildlife. Leave dead standing trees (snags) and fallen logs because they provide valuable habitat for invertebrates, amphibians, woodpeckers, and other cavity-nesting birds. Avoid making roads, adding buildings, or opening up clearings.

Timber Harvesting

The low success rate of regenerating lowland conifers should preclude a major timber harvest.



balsam fir

Therefore, the financial return-should be highly justified if you decide to harvest the forest. White cedar, tamarack, and black spruce reproduce best in full sunlight. Although some professionals encourage the harvest of cedar as part of an overall deer management plan, only in limited cases will cedar regenerate. Typically, only white spruce and balsam fir will grow because deer will browse on their preferred food-- young cedar sprouts.

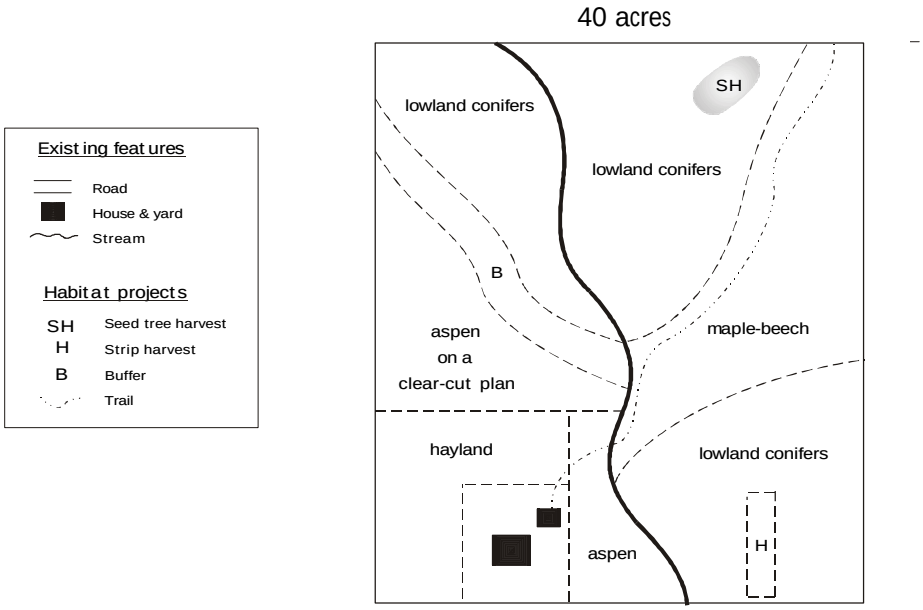
If you want to harvest your stand of lowland conifers, consult with a professional forester who will consider the potential for regeneration. Sites with productive organic soils, slow-flowing groundwater, high soil pH, and low deer populations have the best chance at cedar regeneration. An example of this is seen in the northern Upper Peninsula and the north-central Lower Peninsula where areas receive at least 100 inches of snowfall each year. They have a good potential for regrowth because seedlings are somewhat protected from browsing deer in winter. Because young cedar grows slowly--about six inches per year--it may take 20 years for trees to grow tall enough to escape being damaged by deer browsing.

If it is determined by a professional that the area has a high chance of successful regeneration, lowland stands can be harvested using seed tree, shelterwood, or clear-cut methods, all of which are described in detail in the chapter on **Timber Harvest** in this section. Cutting is often done as clear-cuts in strips and blocks. They should be 150 to 250 feet wide and at least two acres in size. Cuts from two to 10 acres on the correct site will often result in regeneration.

eastern hemlock

Management of a large cedar swamp that may be several square miles in size will likely require the cooperation of several landowners. The overall goal should be to identify harvest blocks of 40 to 60 acres in size and then cut the block over a 10-year period by removing two to 10 acres of cedar each year. Stands dominated by black spruce and tamarack may need clearcutting as large as 40 acres in order to ensure regeneration. If you or your fellow landowners are not able to follow this plan or can not get professional help, you should delay or cancel your cutting plans.

Of critical importance with any harvest of lowland conifers is to avoid disturbing the peat layer and avoid creating logging roads that will alter the flow of water. Locate main skid trails and any roads on the upland edge of the cut to minimize soil disturbance and soil compaction. Log only when the ground is frozen, and leave clumps of scattered trees as seed sources for regeneration. After the harvest, close any roads or trails against further use and reseed them if neces-



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sary. Leftover branches and other slash should be evenly distributed over the harvest area or stacked in brushpiles along the edge of the cut. For instructions on making brushpiles, see the chapter on **Rabbits** in the Species Management section. However, be aware that attracting too many rabbits may be detrimental to the regeneration of lowland conifers due to over browsing. Also, do not harvest white cedar where deer browsing is moderate to severe.

Burning the site may also help in the regeneration process. If you choose to burn, however, be sure to develop fire lanes around the area and consult with local officials for permits and assistance. For more information refer to the chapter on **Prescribed Burning** in the Grassland Management section.

As you can see, lowland conifers are among the hardest of all forest types to regenerate. For this reason, and because of their great value to wildlife, lowland conifers are generally best left alone and protected. If you have a swamp of black spruce, white cedar, or tamarack on your property, it is probably already very beneficial wildlife habitat. You will be able to enjoy a variety of wildlife on your property with a very small amount of work.

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PRIVATE LAND PARTNERSHIPS
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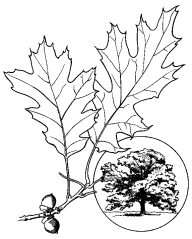
DRY HARDWOODS
(OAK-HICKORY)

Dry hardwood forests are those dominated by several species of oak and hickory. Before settlement, mixed oak/oak-hickory forests covered approximately six percent of Michigan's landscape and about 16 percent of the southern Lower Peninsula where they were primarily found. Even though more than nine million people now live in Michigan, the amount of dry hardwood forest has remained surprisingly stable. Today, it is estimated that five percent of the state still supports this type of habitat.

Although there is presently almost an equal amount of dry hardwood forests in the state as there was in the 1800's, the distribution of these forests has changed. The northern Lower Peninsula has greatly increased from only a small scattering of dry hardwood forests to approximately nine percent of the landscape, while southern Michigan has lost two-thirds of the dry hardwood forests. This increase of dry hardwoods in northern Michigan is a result of the logging and slash fires that took place 70 to 150 years ago. Loggers removed the favored red and white pine, and because dry hardwoods regenerate with fire, the fires that followed helped dry hardwoods to become dominant in some of these areas. The loss of dry hardwood forests in southern Michigan is due to the increase in human developments and the suppression of fire, which caused dry hardwood forests to convert to beech-maple forests.


red oak


black oak


white oak


pignut hickory

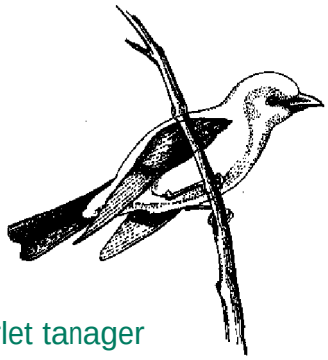

shagbark hickory

Most dry hardwood forests are dominated by white, black, and northern red oak, and pignut hickory with minor components of white ash, red maple, white and red elm, black cherry, beech, and shagbark hickory. Mixed-oak forests are dominated by black and white oak with smaller amounts of black cherry, pignut hickory, and sassafras. The understory of dry hardwood forests often contains witch hazel, hazelnut, arrow-leaved viburnum, blueberry, and black huckleberry. Common ground-layer plants include May apple, clustered-leaved tick-trefoil, naked tick-trefoil, white snakeroot, black snakeroot, whorled loosestrife, fragrant bedstraw, wild strawberry, and sweet cicely.

Wildlife Value

Wildlife prefer white oak acorns, which are produced in abundance every two to six years. However, since they are susceptible to frost damage they are often unpredictable as a food source. Red oak acorns, which are produced in abundance every two to three years, are less prone to frost damage. Hickory trees produce an annual crop of nuts, which are eaten by a variety of small mammals but seldom eaten by birds as the nut is too big, and hard to crack.

Bird species that live in oak forests include the great-crested flycatcher, Eastern wood pewee, rose-breasted grosbeak, scarlet tanager, ruffed grouse, wood duck, blue jay, ovenbird, white-breasted nuthatch, red-bellied woodpecker, downy woodpecker, northern flicker, wild turkey, and black-capped chickadee. White-tailed deer, squirrels, chipmunks, deer mice, and voles are common mammals. Deer, squirrels, wild turkeys, and wood ducks in particular prefer a dry hardwood forest because it produces hard mast (nuts). A properly managed oak-hickory forest contains a mixed stand of white, northern red, and black oaks and hickories.



scarlet tanager

The Importance of Disturbance

Over many centuries, fire played a major role in the perpetuation of the oak-hickory community. Whether started by lightning or native Americans, fires killed competing vegetation and released nutrients in the soil, which promoted the growth of fire-adapted species such as oaks. Historically, oak forests probably burned more frequently than most other forest types. Today, many of these forests have converted to closed-canopy oak forests and beech-maple forests because of fire suppression.

Only about one-third of southern Michigan's original oak forests remain, and many of these are contained in small, fragmented woodlots of 20 to 40 acres. These forests declined because the partially open forest canopy that was created historically by fire closed in and now produces too much shade for oak seedlings to grow. Competition with shade tolerant species is also a factor in this decline. Most downstate oak-hickory forests support seedlings of red maple and beech, both of which are more shade-tolerant than are oak and hickory. Eventually, these shade-tolerant species will dominate the forest. Another factor facing regenerating dry hardwoods is the large numbers of browsing deer in southern Michigan, as they often kill oak and hickory seedlings before they can establish themselves.

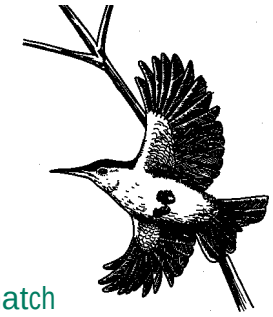
Without some kind of disturbance, such as fire, wind throw, or timber harvest, your dry hardwood forest will convert to maple-beech or some other forest type. In stands with mature oaks and saplings of maple and beech, this conversion may occur over a 20- to 40-year period. For dry hardwood forests that are young and contain many pole-size and sapling oaks, this conversion may take 100 to 200 years. When conversion occurs, both the habitats and the kinds of wildlife that live there slowly change. The result is not necessarily bad, just different. These converted forests have value for wildlife too, as the soft mast of red and sugar maple in spring and the beechnuts in fall provide food. However, if your goal is to maintain your oak-hickory forest, then this conversion needs to be prevented.

Associated Rare Communities

There are several rare communites historically associated with dry hardwood forests that may have the potential to be restored on your property. All of these rare communities are home to several uncommon plants and insects and should be restored whenever possible.

Many of Michigan's current white oak-black oak forests may have historically been dry sand prairies in the southern Lower Peninsula or oak-pine barrens in the northern Lower Peninsula. The presence of prairie-associated vegetation in forest openings or along forest edges may indicate that there is a remnant seed bank under the maturing forest canopy. If you live in west-central Michigan and own a black oak-white oak forest that contains prairie associated shrubs, grasses, and flowers, consider encouraging regeneration of these species through prescribed burning and selective timber harvest. Refer to the chapter on **Prairie Restoration** in the Grassland Management section to learn more.

Another rare community associated with these oaks is the white pine forest. Since white pine is a transitional species it is found mixed with red pine in the northern Lower Peninsula and mixed with oaks in the southern Lower Peninsula. Historically, white pine dominated these mixed forests. Today, white pine is found only as a small component in these forests, and is rarely a dominant species. However, white pine is presently making a comeback and can be found along the tension zone in western Michigan. Oak/white pine forests are present in Newaygo, Mason, Lake, and Manistee counties. If you own a forest of dry hardwoods mixed with some white pine, you may want to restore white pine as a dominant species instead of managing for dry hardwoods entirely. Refer to the chapter on **Dry Mesic Conifers** for more information on managing for white pine.



nuthatch

Another associated community occured on certain flat, sandy lake plains in southeastern Mich-igan. This community most often grew on beach ridges and is a variation of the mixed-oak forest. Black oak, bur oak, white oak, and scarlet oak were the dominant species. These most often occurred in southeast Lower Michigan. However, very few examples of this forest type exist today.

Management Considerations

Landowners have three management options to consider: protection, prescribed burning, and timber harvesting. Protection is most often used in areas that are highly fragmented, or in plans that wish to maintain mature forests. Prescribed burning and timber harvesting are both tools that are used to maintain dry hardwood forests and to restore former communities. The management option you choose will depend on your goals and the condition and location of your land.

Protection

If you own a high-quality stand of oaks supporting a mixed-age stand of seedlings, saplings, mature trees, and snags, then your forest may be in great shape. You may opt for no action as your management decision. Another example of areas that need protection are forests that have been severely fragmented through road building, property divisions, house construction and other human disturbances. These sites should not be made smaller by creating openings. Certain birds that require deep-forest interior habitats are easily threatened by fragmentation that pushes them closer and closer to the habitat edges. As a general rule, creating large openings is discouraged in oak-hickory forests smaller than 100 acres in size. Selective cutting that allows sunlight to penetrate the forest floor for regeneration of oaks will not highly impact the health of a forest of this size.

The best way to increase wildlife numbers and diversity across the southern Michigan forest landscape is to increase the size of individual woodlots and reduce their fragmentation. Planting the kinds of trees and shrubs described earlier to connect one or more woodlots and to encourage wide habitat corridors between habitats is one method to consider. However, be aware of surrounding landscapes and do not fragment other, more dominant habitats in the area.

Prescribed Burning

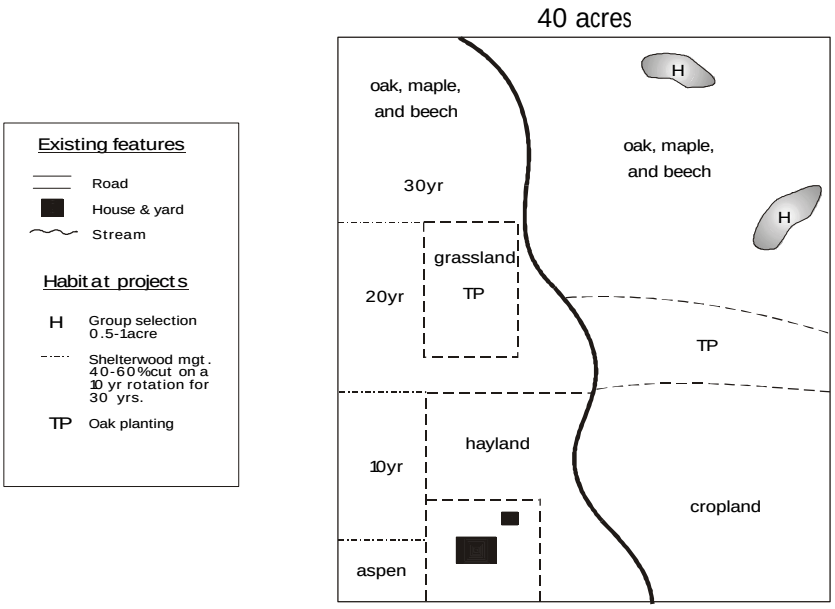
The natural process of maintaining oak-hickory stands is fire. A prescribed burn will decrease competition from shade-tolerant species such as red and sugar maple, and beech. Fire also reduces leaf litter, prepares a good seed bed for oak and hickory seeds, releases nutrients into the soil, and maintains or increases the variety of ground plants. Burning should be done on a 10 to 20 year rotation. The whole stand should not be burned at one time. It is especially useful in restoring prairie and barren landscapes as it regenerates prairie vegetation. Fire is a complex tool that should be managed by a trained resource professional. The use of fire may be limited on small southern Michigan forests. Get assistance from your local forester or wildlife biologist and work with local fire officials to obtain any required permits and to understand regulations. Refer to the chapter on **Prescribed Burning** in the Grassland Management section.

Timber Harvesting

If you have a forest of mature oak trees with an understory of young maple and beech and you wish to maintain the forest as oaks, then a timber harvesting strategy may be needed. Removing a few big-crowned oaks in a closed-canopy forest will allow sunlight to reach the forest floor encouraging oak regeneration. Therefore, to ensure regeneration of the stand, you must use harvest strategies such as group selection cutting, shelterwood cutting, strip cutting, or seed tree cutting.

These timber harvesting techniques, all of which are explained in the **Timber Harvest** chapter in this section, help to promote a diverse forest of mixed ages. Each strategy involves a minimum amount of stand disturbance and can be a low-impact alternative to clearcutting the entire stand.

These timber harvesting techniques focus on the harvest of small to large groups of trees that remove a total of 40 to 70 percent of the stand. Space timber harvests 10 to 20 years apart to minimize disturbance and yet promote diversity. Any harvest should spare a good mix of valued species such as birch, basswood, and ironwood. It should also retain a few large trees that may function as cavity trees, whether these solitary trees are dead (snags) or living (den trees). Do not remove flowering



This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

dogwood, witch hazel, arrow wood, serviceberry or other berry-producing shrubs. Remove competing shade-tolerant trees such as sugar and red maple.

Group-selection harvests are usually small cuts of only 1/8 to 1/2 acre in size that mimic natural disturbances from lightning strikes and windthrow. If your stand is larger than 20 acres, you may consider taking out a total of two to five acres at a time (about four to ten groups). The groups should be no wider than 150 feet. The goal is to create a varied stand of mostly oaks and hickories with components of other hardwoods and a few pines.

Shelterwood harvest involves a two-cut plan in stands of two to 20 acres. A total of 40 to 60 percent of the trees are taken during the initial removal, and the remaining mature trees that surround the site are harvested five to 10 years later after they have prompted rapid regrowth. The first cut leaves adjacent trees to provide shelter for regenerating young seedlings. If regeneration is mainly maple, cherry, and sassafras, then treatment with an herbicide may be necessary to ensure the return of oak. However, allowing some maple and pine to grow will help to create a diverse stand.

A seed tree harvest is a clear-cut that spares specific mature trees or groups of mature trees within the cut to provide a seed source for regeneration. Leave five to 10 large nut producing trees, white pine, and black cherry per acre. When the regenerating seedlings are 20 to 30 feet tall the mature trees can then be cut if desired. Follow-up herbicide treatment may also be needed to control maple, cherry, and sassafras.

The shelterwood or seed tree techniques can be cut in circles, squares, or strips. The cuts should not be wider than 150 feet so adjacent trees can provide seed for new growth and protect young trees from wind and sun.

In summary, dry hardwood forests of mixed oak/oak-hickory provide valuable habitat for many species of wildlife. Although slow growing and sometimes difficult to regenerate, they can be managed. Alternatives range from protection to mimicking natural disturbances through prescribed fire and several timber harvest methods. There are also several rare communities associated with these forests that may have the potential to be restored on your property. Be aware of these restoration possibilities before making any management decisions.

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MESIC HARDWOODS
(SUGAR MAPLE & BEECH)

Mesic hardwood forests are areas where hardwoods grow in cool, moist soils that fall between wetlands and drylands. From the sugar maple-beech forests in southern Michigan to the sugar maple-basswood forests of the western Upper Peninsula, mesic hardwood forests are the state's most common forest type. Before European settlement, these forests were the most dominant forest types in Michigan and covered nearly half the state. Today, these forests cover about 19 percent of Michigan's landscape with more than half of the total occurring in the Upper Peninsula.

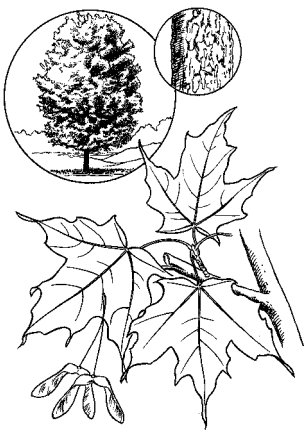
Southern Michigan mesic hardwoods are dominated by beech and sugar maple but also contain basswood, northern red oak, white ash, American and red elm, shagbark hickory, black walnut, bitternut hickory, and tuliptree. Along an maginary line that runs from Bay City to Muskegon, or what is known as the "tension zone," these forests blend into northern hardwood stands. Tuliptree, bitternut hickory, and other more southern species give way to eastern hemlock, white pine, and yellow birch. In the western Upper Peninsula, beech is replaced by white pine, yellow birch, basswood, and hemlock.

Mesic hardwood forests are typically dominated by plant species tolerant of dense shade. For this reason, few shrubs are found in the understory, although Canada yew was an important historical component in northern tracts. Shade tolerant shrubs that sometimes grow under the canopy include maple-leafed viburnum, leatherwood, spicebush, and prickly gooseberry. In spring before leaves emerge to shade the forest floor, an array of wildflowers often carpets the ground. Common species include trout lily, spring beauty, toothwort, Dutchman's breeches, and squirrel corn along with large-flowered trillium, wild ginger, hepatica, bloodroot, and wild geranium. Because of the high levels of shade, morel mushrooms, and ferns also appear in abundance in these forests. Uncommon ferns include green spleenwort, American hart's-tongue fern, expanded fern, and male fern. Rare plants associated with the southern Michigan beech-maple forests are prairie trillium, green trillium, toadshade, nodding pogonia, cranefly orchid, goldenseal, and purple twayblade. Ginseng, which is listed as a state-threatened species, grows in both beech-maple and northern hardwood-conifer forests.


trout lily

A unique microhabitat associat-


beech


sugar maple


basswood

ed with mesic hardwoods is the seasonal wetland. These shallow pools of water occur in the spring within small depressions on the forest floor. Many of these wetlands include a large amount of standing dead or dying trees (snags) that provide homes for many wildlife species. For more information, see the chapter on **Seasonal Wetlands** in the Wetlands Management section.

Mesic forests host a diverse mixture of trees, shrubs, flowers, and other plants. This diversity is maintained by periodic disturbances. For example, lightning strikes kill individual trees and sometimes create fires. Insects and diseases also are responsible for killing trees, and even take out large groups of trees. Windthrow, caused by tornadoes and other severe storms, topple single trees or knock down groups of trees. Historically, these natural forces created a complex forest canopy of many-aged trees with shade-intolerant early successional species, such as aspen and birch, often filling in where large disturbances had taken place.

Depending on location within the state, soil type, moisture gradient, and age of the stand, mesic forests have different compositions. Aspen and birch eventually mature and give way to maple-beech, white pine, or hemlock depending on the site. Today, however, many of these northern Michigan stands, lack the white pine and hemlock that historically were common components. Reasons include fire suppression, intensive timber harvesting over short rotation periods, and intensive deer browsing on young hemlock. After these hardwood sites were cleared, areas that

morels

were allowed to grow back as forests often regenerated into even-aged forests of aspen and birch. This conversion to aspen-birch stands is also seen in southern Michigan where severe disturbance has effected these forests.

Wildlife Value

Diverse mesic hardwood stands offer varied habitats that are used by a wide variety of songbirds, invertebrates, amphibians, and mammals. Deep leaf litter in these stands affords different levels of decomposition. Combined with fallen branches and logs in varying stages of decay, the forest floor is critical habitat for insects, blue-spotted salamanders, white-footed mice, shrews, and chipmunks. Furthermore, certain types of wildlife use the different layers of the forest such as various levels of the overstory, understory, as well as the forest floor.

The red-shouldered hawk, a state-threatened species, prefers to nest in the lower crotches of mature trees in northern hardwood and southern floodplain forests. Other uncommon or declining birds found in mesic hardwood forests include the northern goshawk, black-throated blue warbler, and--especially where hemlock is present--the blackburnian warbler.

The American marten, fisher, elk, and gray wolf live here along with the barred owl, pileated woodpecker, broad-winged hawk, bald eagle, wood frog, chorus frog, and deer mouse. Other species include ruffed grouse, woodcock, cottontail rabbit, snowshoe hare, fox and eastern gray squirrel, wild turkey, white-tailed deer, bobcat, fox, coyote, raccoon, and black bear.

Seasonal wetlands in these forests attract many migrating and nesting birds due to large amounts of insects present at these times. The wetlands within these forests also provide critical habitat for several kinds of frogs--the chorus, wood, and gray tree species.

Management Considerations

Management options for mesic hardwood forests include both protection and timber harvesting. If you own a mature mesic hardwood stand that is diverse in structure and species composition, it may be best to disturb the stand as little as possible. Structural diversity refers to age, tree diameter, crown size, and shape of trees within the stand. Included are microhabitats, such as cavities and crotches, within individual trees. Compositional

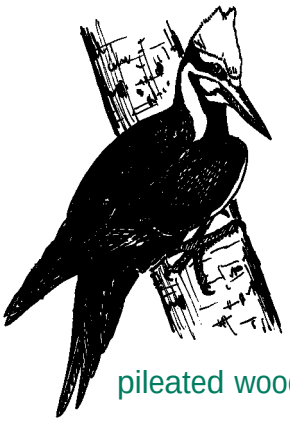
red-shouldered hawk

diversity promotes a mixture of several tree species. In a forest like this, little timber harvest is needed to increase the value to wildlife.

However, like all other forest types, mesic forests change with time, and some type of management may be needed to keep them viable for some species of wildlife. Also, the market value of the forest is sometimes an important consideration to landowners. When conducting timber harvesting, you must take into account the full range of benefits that these forests provide. Such benefits include habitat for wildlife, soil protected from erosion, good water quality in streams and ponds, and a healthy environment for soil organisms. Any cutting program you choose should also take into account local factors--problems with gypsy moth infestation or overbrowsing by deer--and the importance or unique nature of the forest relative to surrounding landscapes.

Protection

If your forest has a diversity of trees along with a variety of understory shrubs and plants, it is probably in good shape to be managed as a mature stand. Many migratory songbirds that nest in these forests are declining due to stand-size reduction, which occurs when property is developed or subdivided. Species that need a large amount of interior forest are jeopardized when large, intact, mature stands of 100 acres or larger are fragmented. Such interior species include the American redstart, ovenbird, wood thrush, and red-eyed vireo. Because there are not many large tracts of mature forest, these forests should not be fragmented if possible. Therefore, do not disturb intact stands by adding roads and clearings, erecting buildings, or allowing livestock to graze. Also, stands that connect waterways or other woodlands offer the greatest benefit to wildlife and should be maintained or restored whenever possible. Please see the chapter on **Edges and Fragments** in the Habitat Planning section for more information.



pileated woodpecker

Timber Harvesting

There are two timber harvesting methods: uneven-aged management and even-aged management. Both methods are discussed in detail in the **Timber Harvesting** chapter in this section.

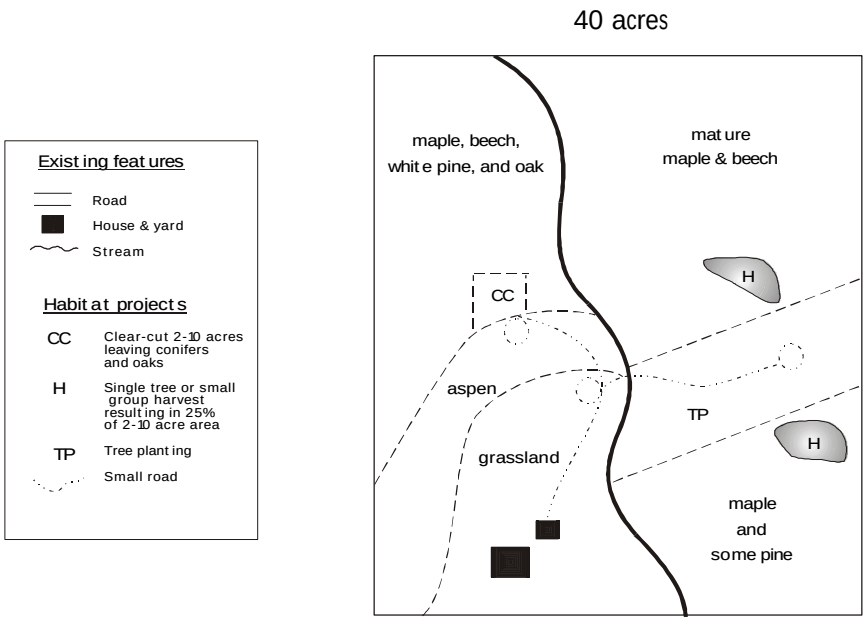
Uneven-aged management promotes a forest of mixed-aged trees of many species and is the best timber harvesting method for wildlife in these forests. It creates the least amount of disturbance and helps to maintain the integrity of the ecosystem. The forest should contain multiple levels from the canopy trees to shrubs to downed logs. This method can include either single tree or group selection cutting techniques. Single tree selection calls for removing single trees, especially along the edge. Group selection calls for small cutting areas that remove two to four trees. These techniques are supposed to mimic natural disturbances.

Single trees or small groups of trees are harvested with no more than 25 percent of the trees in the stand removed at any one time. Space cuttings 10 to 20 years apart and retain a broad mix of species. Spare some basswood, beech, and other large, mature trees that may serve as dens, snags, or wolf trees (mature, large sprawling trees that are still alive). Limit your group cuttings to one-half to one-acre parcels. Because of the overall dominance of sugar maple, remove this species in favor of less-dominant ones such as basswood, oak, yellow birch, white pine, spruce, and hemlock.

Michigan property owners who decide to cut their mesic hardwoods tend to prefer an even-aged management technique such as clear-cutting. However, in the past this strategy has focused on short harvest rotations of 30 to 50 years to promote aspen, which grows in the early successional stage of this ecosystem. By managing in longer rotations, the hardwoods-conifer mix of the original mesic forest can return to provide the habitat diversity that attracts many types of wildlife.

Even-aged management of mesic hardwood forests involves two- to 10-acre cuts using the seed tree or shelterwood techniques. Trees are left within the cutting area to provide shelter or a seed source, which will promote regeneration of that species within the stand. To minimize the amount of edge, plan the cut as a circle or square rather than a rectangle or other shape. This practice will reduce the impact of parasitism by brown-headed cowbirds on nesting interior woodland bird species.

MESIC HARDWOOD FORESTS



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Seed tree and shelterwood harvests can help maintain the diversity of mesic hardwood forests. In cuttings larger than eight acres, leaving small stands of trees 1/2 to one acre in size within the cut will provide diversity. Even when focusing on conifers, sparing important species such as oak will add diversity. Remove mostly dominant broadleaf bearing trees, such as maple, and leave a variety of other species for regeneration of a diverse forest. If your sugar maple forest is in southern Michigan, leave species such as northern red oak, white ash, black cherry, and tuliptrees. For property in northern Michigan, leave hemlock, white pine, yellow birch, and black cherry. Saving only 10 to 15 percent of these mature trees will add diversity values. About 60 years later, a total of 40 to 70 percent of the forest can again be cut, once more leaving a diversity of species as shelter and future seed sources.

A clear forest is not beneficial to wildlife. Building brush piles and leaving large branches on the forest floor are helpful to wildlife. Also, save any standing dead trees (snags) and fallen logs because they too provide valuable habitat for invertebrates, amphibians, woodpeckers, and other cavity-nesting birds. During the harvest, protect all waterways and seasonal wetlands from logging equipment and vehicles. Leave a vegetative buffer at least 100 feet wide around any ponds, streams, rivers, and lakes, and protect any corridors that connect waterways to the forest interior. In northern Michigan, if no conifers are present in the forest, consider planting a few after the harvest, but realize that cedar and hemlock are hard to establish, especially in areas where deer are plentiful, as they take a relatively long time to grow.

In summary, mesic hardwood forests are Michigan's most widespread forest type. Those stands that offer the most diversity attract the largest number of wildlife species. It is beneficial to protect the integrity of these forests. Landowners have several timber harvesting options to consider that may help to maintain the diversity of these forests. If you decide to harvest your forest, you should consult with a forester or wildlife biologist. They will help you sort through the many options to make the best decision.

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LOWLAND HARDWOODS

(RED &SILVER MAPLE, RED ASH & COTTONWOOD)

Lowland hardwoods are found in areas that hold water at least some part of the year. There are two kinds of lowland hardwood forests: hardwood swamps and floodplain forests. Hardwood swamps are forests that grow in depressions containing standing water at least part of the year. Floodplain forests are found next to rivers along flat, seasonally flooded areas. Lowland hardwoods form a dynamic ecosystem containing many trees and shrubs not commonly found in other forest types. They are one of the state's largest remaining natural habitats because they are not easily farmed or logged.

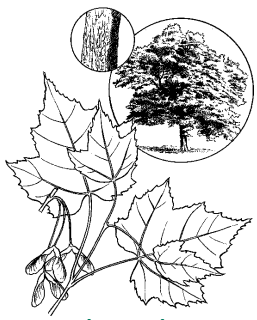
Lowland hardwoods occur mostly in southern Lower Michigan. However, some hardwood swamps can be found in northern Michigan depressions, and there are some occurrences of floodplain forests in the Upper Peninsula. Today about five percent of the entire state is comprised of this forest type.

Mixed hardwood swamps contain red maple, black and red ash, swamp white oak, and American elm. American elm used to be more dominant than it is today, but the elm blight has shortened its life cycle and reduced its dominance. A variation of the mixed hardwood swamp occurs in depressions on southern Michigan sandy plains where the soil is very acidic. Pin oak, black oak, and black gum dominate this rare kind of wetland. Black ash swamps can also occur on flat, sandy plains in southern Michigan, but also mix with northern white cedar or tamarack in scattered regions of northern Michigan. Swamps have dense canopies and are often flooded in spring and fall causing the ground layer to be relatively sparse. However, if there is a drought, or severe windthrow occurs, the groundcover can also be dense. The trees in these swamps are often subject to windthrow during severe storms as they have shallow roots. This disturbance, along with lightning strikes, creates a complex forest of many age classes and tree species.

The southern floodplain forest is one of Michigan's most diverse natural communities as well as one of its most threatened. Damming, dredging, and channelization are all human induced threats to these forests. Seasonally flooded in spring and fall by the wide rivers and streams they flank, these forests grow in loam or silt-loam soils that are rich in minerals. Silver maple, red ash, red maple and cottonwood dominate these forests. Red oak, swamp white oak, black willow, and black walnut also occur as smaller components. Trees that reach their northern limit in these forests are Ohio buckeye, pawpaw, red bud, blue ash, Kentucky coffee tree, honeylocust, sycamore, hackberry, and red mulberry. Shrubs and small trees include spicebush, hawthorn, alternate-leafed dogwood, American hornbeam, American bladdernut, steeplebush, prickly ash, and ninebark. Common ground-layer plants are skunk cabbage, jewelweed, wild geranium, cinnamon fern, sensitive fern, buttercup, jack-in-the-pulpit, and meadow rue. Rare plants include winged stemmed monkey flower, prairie trillium, snow trillium, black cottonwood, and twinleaf.

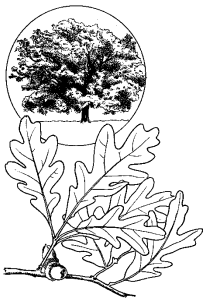
Wildlife Values

Floodplains, swamps, and seasonal pools offer water, food, and cover for many kinds of birds and mammals. The warbling vireo, northern oriole, red-eyed vireo, indigo


red maple


silver maple


cottonwood

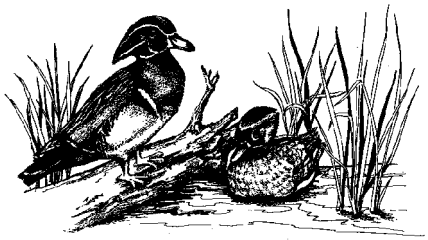

swamp white oak


black ash

bunting, gray catbird, and eastern wood pewee are birds that live in these forests. Other species include the wood duck, cottontail rabbit, raccoon, woodcock, white-tailed deer, wild turkey, and many species of migratory waterfowl. Rare animals include the red-shouldered hawk, Indiana bat, several amphibians (smallmouth salamander, spotted turtle, and Blanchard's cricket frog), and at least three warblers (cerulean, prothonotary and yellow-throated). Streams and rivers, which flow through these forests, are home to numerous rare mussels such as the clubshell, catspaw, northern riffleshell, and round hickory nut.

Floodplains, swamps, and seasonal pools provide many benefits to wildlife. These areas are rich in plants and invertebrates because of their shallow depths and warm temperatures. They provide beneficial food and breeding grounds for many species of wildlife including migratory birds, frogs, toads, and salamanders. Refer to the **Swamps** and **Seasonally Flooded Wetlands** chapters in the Wetland Management section for more information.

Floodplains are also an important aspect in many of these forests. They exist along rivers, lakes, and streams and provide many benefits not only to wildlife, but also to humans. Floodplains provide corridors for wildlife to move from one habitat to another, which is especially important in urban and residential areas where few natural places occur. Without floodplains, the river system would be altered in structure and composition, and the hydrology of the area would be changed. Floodplains benefit humans directly as they provide areas for water overflow, which helps prevent upland flooding. When floodplain forests are developed by humans, there are frequent and often severe flooding occurrences that affect cities and residential areas. Floodplain forests also help to maintain cool waterways in the summer.



wood duck

Management Limitations

Many larger forested lowlands have been broken up into fragments. Reasons include excessive logging, farming and grazing. Fragmentation tends to lessen wildlife values of the forest. Other problems include the invasion of aggressive non-native plants such as glossy buckthorn, purple loosestrife, reed canary grass, and garlic mustard; and Dutch elm disease. These problems have reduced tree species and diversity. As trees die or are removed, the forest canopy changes in structure and composition and loses some of its value for wildlife.

There are several things to consider when weighing your management options. What little information that has been published on how best to manage lowland hardwoods suggests that these stands present special problems when harvesting timber. Because they occur on poorly drained sites, access with equipment is difficult. The quality of wood varies but typically is less valuable than other forest types.

Where stands exist on poorly drained muck soils or in places with high water tables, the regrowth following a timber harvest may not be predictable. Sometimes the makeup of the new stand is not at all like the parent forest, especially if the water table has been greatly affected by the harvest. As stated before, this can reduce the value to wildlife. Fully-crowned lowland hardwoods will release up to a quarter-inch of soil moisture into the air each day. Therefore, if these trees are taken out, there may be more water present on the ground than before. A high water table and seasonal flooding can add to this and completely change the vegetation composition. Instead of trees, sedges and cattails may grow if the area is too wet. However, if the area is too dry shrubby brush may grow. Either way, you have destroyed the lowland hardwood forest. It may be helpful to know the stand's elevation above the local groundwater table before choosing a management option. Agency technicians in your county Conservation District office can help you determine the elevation of the present water table.

Management Condsiderations

Given these limitations, it may be best to manage for protection of your lowland hardwoods instead of harvesting timber. However, there are still several management options to consider if harvesting timber will best achieve your goals.

Protection

In a mature floodplain forest little or no timber harvest is needed to increase wildlife values. The decline of certain migratory songbirds in lowland hardwoods is primarily due to fragmentation of large, intact tracts of mature forest. For more information, see the chapter on **Woodland Birds** in the Species Management section. Many lowland hardwood fragments should simply be protected and allowed to mature. Planting native trees and shrubs to reconnect fragments is also a consideration. Be sure to choose species suited to site

conditions. Connecting other woodlands can greatly benefit wildlife, especially when the forest size exceeds 100 acres. If possible, manage for a mature forest on parcels larger than 100 acres. Be advised, however, that the creation of a full canopy from the crowns of mature trees will produce little ground cover for other species that require this kind of habitat.

Allow seasonal water fluctuation to occur naturally. Leave most cavity trees regardless of age. Eliminate or limit trails and roads to lessen the impact on wildlife species that move back and forth from the water's edge to upland areas. This consideration is especially important during the spring and early summer when birds, amphibians, and reptiles are breeding and laying eggs, and when young of the year disperse.

Large logs play a key role in a stream's health because they help retard bank erosion, provide shelter for fish, sunning sites for turtles, create sandbars and other depositions, encourage channel scouring, and retain nutrients. Therefore, if possible leave trees that fall into the river. Allow the river system to naturally meander, which helps slow the water flow. This reduction in velocity permits the growth of vegetation and stream microorganisms which start the food chain. Major threats to southern Michigan floodplains include water diversion for dams and wells, channelization, and dredging. Another key concern is non-point source pollution from runoff from farms and urban area storm water, construction, and leaky septic systems. For more information refer to the chapter on **Streams and Rivers** in the Wetlands Management section.

Exotic nuisance plant species can also lower the value of lowland hardwoods as they lessen species diversity. Learn to identify purple loosestrife, garlic mustard, reed canary grass, or glossy buckthorn. Cut them back in late winter or early spring, and apply a glycophosphate herbicide, such as Rodeo in wet areas, to the stumps within ten minutes of cutting. Follow all label directions.

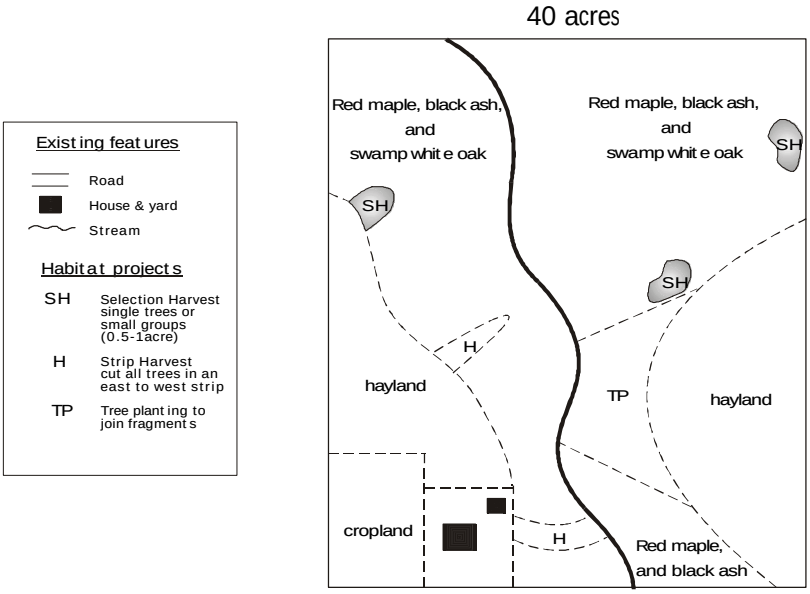
Timber Harvesting

Occasionally, lowland hardwood stands lack the young growth of saplings, shrubs, and ground covers that benefit deer, grouse, woodcock and many other animals. If creating more young growth is part of your management plan, opening the canopy through timber harvest will permit sunlight to reach the forest floor and stimulate the growth of many kinds of plants. There are several timber harvesting methods that can acheive this and still maintain the integrity of the forest. Again, you should check the hydrology of the area before conducting any harvesting to determine the chances of regeneration of the stand. If the regeneration rate is expected to be low, you may want to reevaluate your goals and chose another management option.

One timber harvesting method used in lowland hardwood stands is selection cutting. This method best mimics natural disturbances and is the least detrimental to forest structure and composition. This method focuses on the harvest of single trees or small groups of trees. It is often used to obtain firewood or veneer-grade lumber. In these cases limit the harvest to single trees along the stand's edge or one to four trees within the forest itself. Plan to remove no more than 25 percent of the trees in any one cutting. For group selection cuts concentrate on one-half acre to one-acre openings. To minimize large disruptions to the stand, space harvests by 10 to 20 years. Because of the overall dominance of red maple, plan to remove this species in favor of less-dominant types such as ash and American elm. Retain a good mix of species including swamp white oak, basswood, ironwood, and hackberry. Retain some den trees, snags, and wolf trees (mature, large sprawling trees that are still alive). Plan the harvest for late summer when soils are dry and firm or winter when the ground is frozen.

The selective harvest method promotes a forest of mixed-aged trees of many kinds. Structural (age, diameter, crown size, and shape of tree) and compositional (species of trees) diversity is therefore assured. Also maintained are micro-habitats within individual trees--cavities that attract flying squirrels and northern flickers, and low crotches in large trees that red-shouldered hawks find suitable for nesting. This strategy is a low-impact timber removal alternative that maintains the integrity of the ecosystem. Many landowners prefer it because of its overall value to wildlife although it is not as beneficial for some game species as other harvest techniques.

Another method of timber harvesting conducted in lowland hardwoods is seed tree cutting. In lowland hardwoods seed tree cutting is done in strips, and is a type of clearcutting where all, or most, of the timber is removed. Trees left standing next to the strips will furnish seeds needed for regeneration. Landowners who do not want the stand to convert to marsh grass or shrubs, but who wish to remove more timber than the selective harvest method, often choose seed tree strip cutting. The goal is to cut one-third of the stand, in strips 120 feet wide. If possible, cut the strips in a general east-to-west orientation to reduce the chance for windthrow



This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

from prevailing west winds. Retain some swamp white oak and pin oak within the strips, because these trees provide important mast (nuts) for wildlife food. Ground cover will most likely increase in the remaining stand because of better light penetration.

After ten years, another 1/3 of the stand can be harvested. The remaining 1/3 can be cut ten years after that. On each cut, save enough oak and den trees to comprise 10 to 15 percent of the remaining stand. The mixture of saplings, pole-sized, and mature trees you will create with the strip harvest method should provide abundant cover for deer, rabbit, raccoon, grouse, wild turkey, cardinals, and many other species. Wood ducks, squirrels, and other cavity nesters will also find den sites. Adding to habitat diversity will be ground covers and fruiting shrubs. To increase diversity even more you can plant some shrubs, such as nannyberry and highbush cranberry, along with a few lowland conifers (evergreens).

Most lowland hardwood forests are odd-shaped because of varying soil types, topography, and old land-use patterns. When cutting strips, follow the land's contours as much as possible, keeping in mind that long stretches of straight-edged cutting blocks are less beneficial to wildlife and may create a wind-tunnel effect during storms.

Cut no closer to waterways than 100 feet. This precaution will avoid problems with erosion and sedimentation. The 100-foot-wide buffer you leave will also shade the stream, and help regulate water levels and temperature. Also, it is best to cut in winter when the ground is frozen to minimize soil distrubance.

A clear forest--one with all downed timber, logs and branches removed--is not beneficial to wildlife. Leave most snags (dead or dying standing trees), logs and fallen branches because they provide valuable habitat for invertebrates, amphibians, woodpeckers, and other cavity-nesting birds. Building brush-piles will create habitat for many small creatures, including rabbits.

In summary, if you have lowland hardwoods on your property you have an opportunity to attract a wide variety of wildlife. Large, unbroken tracts with a variety of trees of different ages provide the diverse habitats that many kinds of wildlife use. Protection may be the best management strategy when harvesting and regrowth may be difficult due to uncertain water tables. Lowland hardwoods that were artificially drained can sometimes be restored to original habitats if present trees are cut and any drains plugged.

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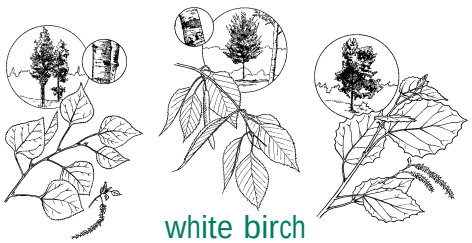
FOR ADDITIONAL ASSISTANCE: *CONTACT YOUR LOCAL CONSERVATION DISTRICT*

PRIVATE LAND PARTNERSHIPS
WORKING TOGETHER FOR WILDLIFE

ASPEN & BIRCH

Aspen and birch forests are not truly considered a forest type as they are early growth stages within many different forest types. However, these forests are included here as there are large amounts of them throughout Michigan today. Though forests of aspen and birch were scattered throughout Michigan before the logging period, they covered less than one percent of the state's land base. Today, they comprise about 10 percent of the landscape and occupy some 3 million acres. The majority of these forests are located in northern Michigan.

Aspen-birch forests in northern Michigan and the Upper Peninsula are dominated by white birch, trembling (quaking) aspen, and big-toothed aspen, all of which are shade-intolerant, fast growing and short-lived. In southern Michigan, white birch is not common in these forests. Other trees associated with the aspen-birch community include balsam fir, pin cherry, red maple, and white and red pine. The open forests that aspen and birch create allow sunlight to reach the forest floor where wintergreen, bracken fern, serviceberry, beaked hazel, and many other ground cover and fruiting shrubs are able to grow. For this reason, aspen-birch forests support a wide variety of wildlife.



quaking aspen

white birch

big-toothed aspen

Aspen Regeneration

Aspen and birch are not shade tolerant species and typically grow in sunlit areas unoccupied by other shade-tolerant trees. Therefore, historically aspen grew as minor components in openings of most other forest types. These openings were created by natural disturbances in the forest such as fire, storm windthrow, insects, and disease. Aspen and birch established in these disturbed areas as they received a lot of sunlight. As the aspen and birch grew, they provided shade for regenerating shade tolerant saplings that would eventually replace the aspen and birch and dominate the mature forest.

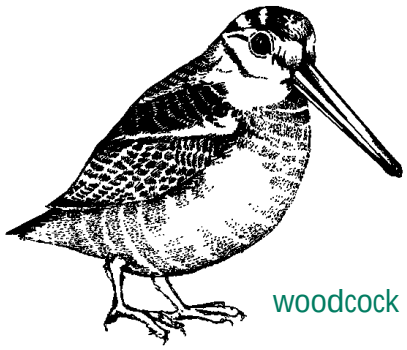
However, upland stands of red and white pine on dry soils, and lowland stands of northern white cedar and white spruce-balsam fir presented a different scenario as aspen had a larger impact on these forests. When natural disturbances produced openings in these forest types, aspen quickly colonized to form solid stands. It was difficult for the original species to regenerate in the presence of these dense aspen stands and many of these forests were reduced because of this competition.

The dramatic increase of this pioneering, sun-loving tree in Michigan occurred as a result of intense cutting and frequent fires that burned during and after the logging period. Since aspen regenerates best when it is cut, logging helped it become established in many more areas than before. Because of fire suppression efforts, fire no longer plays a large role in the regeneration of aspen. Instead, today clearcutting has become the main means of aspen regeneration. Once aspen is cut, its root systems respond with a rapid production of 5,000 to 70,000 root suckers per acre.

If aspen is not cut, it will eventually convert to shade tolerant species of the forest type it is growing in. Left undisturbed on good sites aspen will be replaced by more shade-tolerant species such as oak, maple, beech, balsam fir, or spruce, depending on the forest type. On poor quality sites, aspen may be replaced by grasses and shrubs. This process may take 50 to 70 years. If your goal is to regenerate aspen on your land, you must cut it. On the other hand, if your goal is to convert the forest to its historical condition, you need to let it mature.

The Aspen Controversy

Throughout much of the 20th century, due to its intensive management for pulpwood production and deer and grouse habitat improvement, aspen has increased



woodcock

and is now dominant in many forest types across the state. Through the 1950s, professional foresters managed many public land upland sites for aspen and birch that once hosted white and red pine forests. Almost fifty percent of dry mesic conifer forests were converted to aspen and birch forests. Lowland conifer and hardwood forests were also severely impacted by the increase in aspen-birch forests.

Many people believe there are too many deer in Michigan and that intensive management of aspen is one of the reasons, especially in the northern Lower and western Upper Peninsulas. When possible, these individuals would rather let the aspen mature and manage for the mature forest type to attract other kinds of wildlife. Others would rather manage for aspen, grouse, and deer. Those who understand their options, and what changes will occur with each decision, are likely to make the best choices for wildlife. For this reason, if your property contains aspen forests, you should also consider reading the other chapters in this section.

Wildlife Value

Aspen-birch forests support a wide range of plant diversity over the stand's life span of 50 to 70 years. Different growth stages in aspen forests result in different ground covers, fruiting shrubs, and competing tree species that advance or retreat. It is this plant diversity that attracts so many different species of wildlife.

Young stands of aspen saplings are under three inches in diameter, 10 to 20 feet in height, and less than 10 years old. They attract the chestnut-sided warbler, mourning warbler, indigo bunting, and golden-winged warbler which is a species that is quickly disappearing in Michigan. Other species that use this stage of the aspen forest as habitat include woodcock, deer, cottontail rabbit, snowshoe hare, and ruffed grouse.

When the stand grows to pole size, it will be 10 to 40 years old, 20 to 70 feet high, and contain trunk diameters of four to nine inches. Species that use this stage of the aspen forest as habitat are the least flycatcher, yellow-bellied sapsucker, ruby-throated hummingbird, red-eyed vireo, ovenbird, pileated woodpecker, woodland jumping mouse, porcupine, deer, and ruffed grouse.

When diameters exceed nine inches, foresters classify the stand as a sawlog forest. Tree heights may exceed 70 feet, and the stand will be at least 40 years old. Species attracted to this stage of aspen forests include the black bear, porcupine, flying squirrel, white-footed deer mouse, pileated woodpecker, veery and--where conifers are mixed in--the American and pine marten, and fisher.

Management Considerations

There are two ways to manage your aspen-birch forest stand--let it grow to maturity, or subscribe to a series of planned even-aged timber harvests. If you decide to cut your forest, you must decide between a short rotation period that will produce ruffed grouse and deer habitat, or a long rotation period to grow sawlogs that will produce habitat for bears and porcupines. You may want to allow natural succession to convert your stand to anther forest type beneficial for other wildlife species.

Mature Stand Management

Mature stands of aspen-birch will contain many trees that are dead or dying (mature aspen is vulnerable to hydroxylon cancer disease). These trees host an accumulation of insects, which in turn provide food for many kinds of wildlife, especially black bears. As the forest matures and more trees die, other species will eventually replace the aspen and birch and dominate the stand. On good to high quality sites, shaded areas provided by the maturing aspen have likely helped to increase pines, oak, maple, beech and other shade-tolerant species. On a poor site consisting of dry, sandy soils-the aspen will often be replaced by grasses, forbs, shrubs, and a few scattered oaks or pines. In areas which were historically northern hardwoods, beech-maple forests, white pine-red pine forests, or savanna openings, it may be possible to promote a conversion to the original condition. If this goal is part of your management plan, then do not cut the forest at all.

ruffed grouse

black bear

Letting the forest mature will result in a very diverse array of species composition. With each change of vegetation, the habitat for wildlife will also change. For example, if the aspen is replaced by an oak forest, it will attract the fox squirrel, wild turkey, white-breasted nuthatch, black-capped chickadee, and downy woodpecker. If you continue to let the forest mature, and the oak is replaced by a maple-beech forest it will attract the broad-winged hawk, red-shouldered hawk, black-throated blue warbler, and northern goshawk. If instead, the oak is replaced by a stand of upland pines it will draw pine warblers, black-throated green warblers, crossbills, redpolls, and red squirrels.

If you do not want your aspen to be replaced but wish to maintain a mature aspen stand on your property, instead of a young stand, you will need to do small amounts of clearcutting. Without some type of large disturbance, such as clear-cutting, some successional change will happen. If you cut the stand when at least half the aspen is in healthy condition, then the site will regenerate to aspen-birch. On many sites, this would need to be conducted before the stand is 80 years old. To help maintain the stand as a "mature" aspen-birch forest, make small clear-cuts of one to two acres each scattered within the forest. The regeneration that occurs will provide diversity and give healthy, young aspen a chance to replace older, dying aspen. Also, shelterwood or seed-tree cuttings that promote a mix of conifers, oaks, beech, or maple will add diversity to the stand. For more information on these timber harvesting methods, see the chapters on Timber Harvesting.

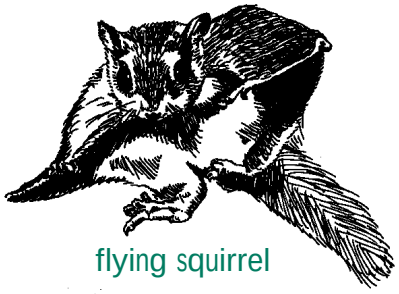
Even-Aged Timber Management

If your goal includes maintaining many ages of aspen on your land, you will need to conduct a timber harvesting rotation. Most professional managers prefer even-aged management for the regeneration of aspen. Besides quick regeneration, this management technique also can lead to increased revenue to the landowner. The goal is to create a mixture of young (sapling), medium-aged (pole) and mature (sawlog) aspen by clear-cutting blocks of one to 10 acres in size at intervals that will establish a 40 to 60 year rotation. This means that the whole stand will have been cut after 40 to 60 years. Cuts should be adjacent to each other to attain the maximum wildlife benefits. This method can be used to manage aspen stands as small as eight acres. For example, cutting two acres of an eight acre stand every 10 years will result in a 40 year rotation.

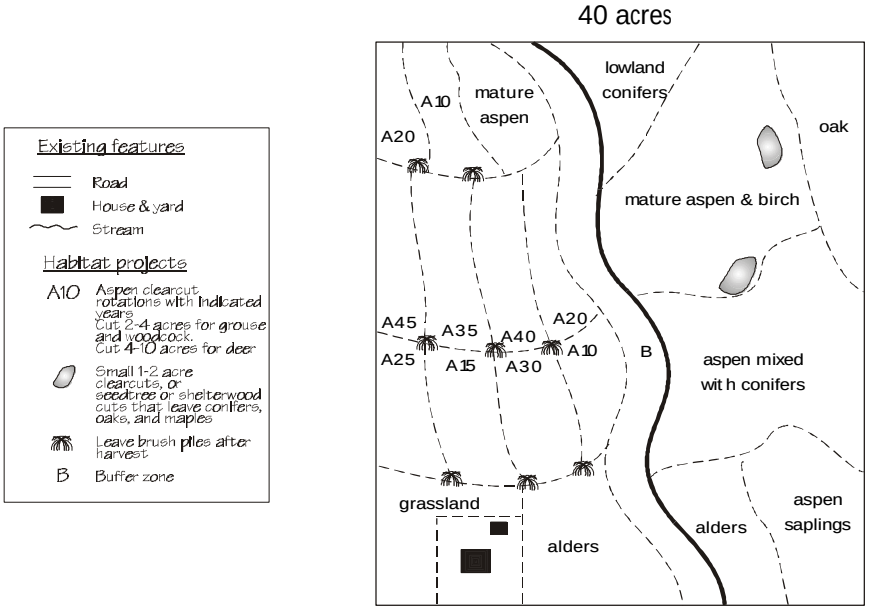
To ensure regeneration, you must cut in winter when the trees will have stored energy in their root systems. The following spring this energy will be released in the form of numerous new sprouts. Each harvest should be at least one-acre in size to minimize shading from trees left standing, which will defeat your purpose. Remove all trees larger than one inch in diameter. A long, linear cut provides more edge than a square, checkerboard harvest, but the best prescription is to follow the topography of the land when possible. Make the cut at least 50 yards wide and 100 yards long in a north/south direction if possible to let sunlight penetrate along the north side.

If managing smaller stands up to 10 acres in size, cut a quarter of the stand every five to 10 years by taking out two to three acres at each harvest. Begin with the southeast quarter, followed by the southwest quarter, then the northeast parcel and finally the remaining northwest piece. The goal is to cut the entire stand over a period of 40 years and then start the cycle again. This same plan can be used to manage smaller stands of only 20 to 30 mature aspens if you shorten the rotation. Simply cut one-fourth of the stand every three years, starting with those in the southeast quarter. Clearcuts that are two to four acres in size benefit ruffed grouse and woodcock. Smaller cuts make more economic sense if they are connected by trails or are relatively close to each other.

If managing larger tracts from 20 to 40 acres in size, make larger cuts more often. On aspen stands larger than 40 acres, manage the forest as several 20- to 40-acre



flying squirrel



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parcels with cuttings following the above prescription. Larger cuts of up to 10 acres each are most helpful to white-tailed deer. Larger cuts may be necessary to ensure regeneration in areas where deer and elk are numerous, as this will help prevent the browsing and subsequent loss of all or most of the saplings. In areas with moderate to high deer or elk numbers, cuts may have to be 40 acres in size or larger. Larger cuts are also more economical for commercial harvest.

To increase stand diversity, leave several non-aspen trees per acre. Small clumps of two to 10 individual trees and shrubs such as white pine, hemlock, cedars, spruce, oaks, hickory, serviceberry, and hazelnut will all help to provide the habitat mix that favors a variety of wildlife. Leaving 20 to 40 foot strips of mature standing trees between cuts will help to minimize the short-term disturbances after the cut and lessen the denuding appearance of the clear-cut.

Avoid clearcutting trees near streams or seasonal wetlands--the best assurance is a vegetation buffer of at least 100 feet around these sensitive areas. Leave standing snags (dead trees) and occasional wolf trees (large, short-trunked, widely branching trees), which will provide food and homes for wildlife. Remember that a clear forest is not beneficial to wildlife. Many insects, amphibians, reptiles, birds, and small mammals depend upon leaf litter, decaying logs, and fallen branches for food and shelter.

Build brush piles from the harvest slash by incorporating live-lopped trees when possible. These small trees are only partially cut and then bent over the pile, which should be at least 15 feet in diameter and five feet high. Reptiles, amphibians, rabbits, and other small mammals will use them for shelter. Limit brushpiles to one to two piles per acre to reduce over-browsing of saplings by rabbits.

In summary, aspen-birch forests are an early successional stage in many forest types. These forests offer great opportunities for landowners that wish to manage their property for wildlife. The relatively fast-growing trees love sunlight and are fairly easy to regenerate when cut. Aspen-birch forests permit a variety of understory shrubs and ground covers to grow. It is this diversity that attracts many kinds of animals. However, you may choose to let your aspen-birch forest mature and be replaced by other species. This too will attract a variety of wildlife to your property.

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PRIVATE LAND PARTNERSHIPS
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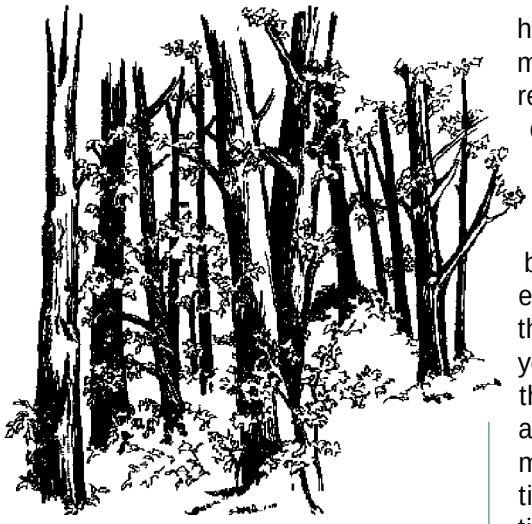
TIMBER HARVESTING



Forests of varying composition and successional stage dominate much of Michigan's natural ecosystem. About 38 percent of the state, or nearly 14 million acres, is forest. The plant species (trees, shrubs, and wildflowers) that make up our forests yield food in the form of fruits, berries, and nuts for many species of wildlife. Some examples are browse for rabbits and deer, nectar and pollen production for bees and butterflies, and green matter for caterpillars and other insect larvae. Forests also offer critical cover for wildlife to nest, rest, hide from predators and seek shelter from heat, cold and moisture. Furthermore, forests also recycle nutrients, regulate water flow, and modify our climate locally.

Landowners can manage for a wildlife species or a group of wildlife by managing for the forest type that exists, or can potentially exist, on their land. Managing woodlands on your property, whether small or up to thousands of acres, will provide valuable wildlife habitat. Forest management can involve a combination of timber harvesting and site-preparation practices followed by planting trees or allowing them to regenerate naturally. The type of management that you chose will depend on the forest type present on your land, the forest condition, and your goals. The key is to have both a short-range and long-range management plan that addresses your wildlife management goals. Other chapters in this section describe how to manage for beech-maple, oak-hickory, and aspen-birch as well as lowland hardwoods and upland and lowland conifers. However, this chapter explains how to harvest timber with the primary goal of maintaining or increasing wildlife. It also addresses secondary goals of producing timber for products like firewood or lumber for personal use or commercial sale.

Trees and Shade Tolerance

Trees grow differently in varying soil, moisture, and sunlight conditions. Certain tree species are "shade intolerant," requiring full sunlight to regenerate and grow. Other kinds of trees are "shade tolerant," growing best in the shade of other trees. In making forest management decisions, it is helpful to understand the importance of sun and shade in the forest. To do this, we need to look at a forest's "overstory" and "understory". Overstory is the crown or canopy of branches and leaves that shut out sunlight. These trees receive the most sunlight. Understory is the assortment of plants that grow underneath the canopy as ground covers, forbs, shrubs, and young trees. These plants most often receive little sunlight.

If a forest is left unmanaged, eventually succession will occur and shade tolerant trees will prosper and

Appropriate Shade Tolerance

Very Tolerant	Tolerant	Intermediate	Intolerant	Very Intolerant
Balsam Fir	American Basswood	American Elm	Black Ash	Eastern Cottonwood
E. Hemlock	Black Spruce	Bitternut Hickory	Black Cherry	Jack Pine
Ironwood	N. White Cedar	E. White Pine	Black Walnut	Aspen
Sugar Maple	White Spruce	Green & White Ash	Butternut	Tamarack
	American Beech	Red & White Oaks	Paper Birch	Pin Cherry
	Serviceberry	Red Maple	Red Pine	Willow
		Shagbark Hickory	Silver Maple	
		Pignut Hickory	Black Oak	

replace the intolerant species. Timber harvesting can set back succession of a more mature forest as it removes trees from the forest. However, it can also move forward succession of a new forest by allowing the understory shade intolerant trees to grow as they receive more sunlight. Therefore, when making management decisions, it is important to know which trees are shade tolerant, and which are shade intolerant. The accompanying panel lists species according to their tolerance or intolerance for shade.

Timber Harvesting Techniques

The main purpose of timber harvesting is to create conditions that will allow the forest to renew or reproduce itself. When trees are removed, the canopy is opened and new trees are allowed to regenerate. Also, removing trees creates more space for mast producing trees to grow. Since most seed is produced on exposed portions of tree crowns, fully exposed tree crowns offer potential for the greatest mast production.

There are basically two types of forest regeneration management practices to consider for your property: even-aged management and uneven-aged management. Even-aged management creates stands that consist of trees of the same age, and includes the "clearcutting technique", "seed tree technique", and various types of "shelterwood techniques". Forests with even-aged management will contain mostly shade intolerant trees, where all trees grow at approximately the same height. Uneven-aged management creates stands that consist of at least three different age and size classes, and includes various types of "selection techniques". Forests with uneven-aged management will contain mostly shade tolerant trees, where young trees grow in the shade of older trees. These management practices differ by the age distribution of trees left standing and the amount of sunlight that reaches the forest floor after a harvest. Another practice called "high-grading" is a profit-motivated method, which has little or no value to wildlife. High-grading takes only the most economically valuable trees--regardless of size or quality--and leaves the rest. The undesirable trees left standing are genetically inferior, and it is their progeny that will regenerate the forest. You may want to consult with a professional forester and wildlife biologist before deciding which one of the forest management practices is best suited for your wildlife management goals.

Even-aged Management

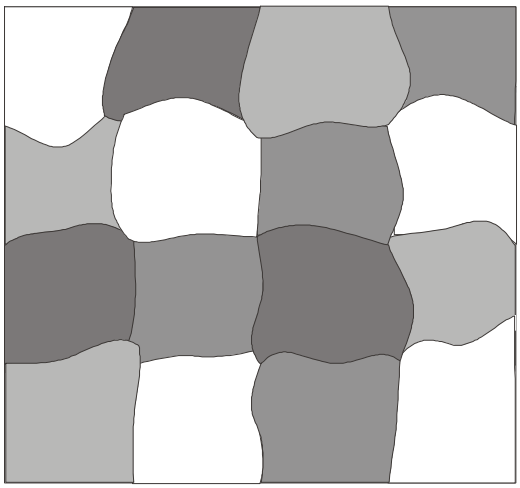
Clearcutting Technique

Clearcutting is the most common method of regeneration among the even-aged management practices. This technique involves one cut, which may remove the entire stand. Clearcutting is for landowners whose goals require a large amount of new growth seedlings, and young shade intolerant trees. These cuts will provide the highest level of forage, shade intolerant tree mast, and woody stem density, and will attract ruffed grouse, snowshoe hares, rabbits, deer, and edge-loving songbirds.

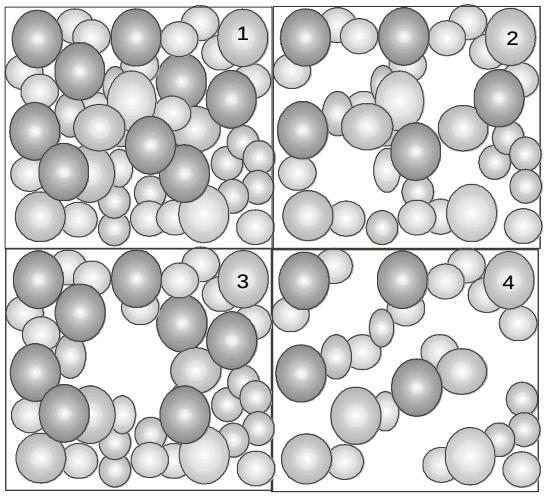
Clearcutting results in the best conditions for regenerating aspen as it responds to cutting with explosive root sprouting that can number 5,000 to 70,000 stems per acre. Aspen forests are early successional stages of many forest types and need clearcutting to regenerate. If they are not cut, they will be replaced by shade tolerant species.

This technique benefits edge-loving wildlife the most when the cuttings are from two to 10 acres in size and a different portion is cut every 10 to 20 years. Cuts of 20 acres or more will result in large proportions of shade intolerant trees such as aspen, pin cherry, black cherry, and red oak. Cutting in patches or narrow strips will produce more intermediately tolerant and tolerant trees. Best regeneration occurs when cuts are made in a north/south orientation to receive full amounts of sunlight.

Landowners that subscribe to this technique should consider leaving a buffer zone of trees of at least



Clearcut management description for a 40 acre tract of land.
Each section represents approximately 2.5 acres



Types of shelterwood management after first year cut
1: Unmanaged stand. 2: Uniform method.
3: Group method. 4: Strip method.

100 feet around wet areas, and saving valuable snags and mast producing trees at the rate of one to five individuals per acre. Leaving small clumps of aspens and/or oaks, white pine, and hemlock in clearcuts larger than 5 acres is also encouraged to maintain diversity of vegetation and wildlife. It is suggested, in any forest management plan, to leave 1/4 to 1/3 of an acre uncut per 10 to 15 acres of timber harvested area to maintain diversity.

Seedtree Technique

The seedtree technique involves removing nearly the entire stand in one cut, while leaving a number of trees, usually shade intolerant species, to provide seed for regeneration. These seedtrees can be left either alone, in small groups, or narrow strips. These trees do not provide enough cover to have any significant sheltering effect on the regeneration. The seed trees are then harvested after regeneration is established. This technique is most often used for conifers.

Shelterwood Management

The shelterwood technique is the most complicated of the even-aged management practices. It is used to provide protection and shade for the regeneration area. This technique results in two to three even-aged classes of trees, and is used to regenerate trees that thrive in partial shade. It involves a series of two or more cuts over 15 to 30 years, in which the first cut removes 50 to 70 percent of the canopy. The rest of the stand, called the shelterwood, is left to provide a partial canopy that protects the regenerating stand. In the first cut, thickets of saplings or poles that are extensive enough to form a stand are left. After 5 to 10 years, when the new growth is well established, a second cut can either remove all or half of the shelterwood stand. If only half of the stand is removed on the second cut, then a third cut is used 10 to 20 years later to remove the last half. The final cut may leave trees that are long survivors such as sugar maple, oaks, white pine and hemlock.

There are three ways to implement the shelterwood technique. The "uniform" method harvests trees that are evenly scattered throughout the stand. The "group" method removes groups of trees at each cut. The "strip" method uses an alternating or progressing pattern that moves through a portion of the stand at each cut.

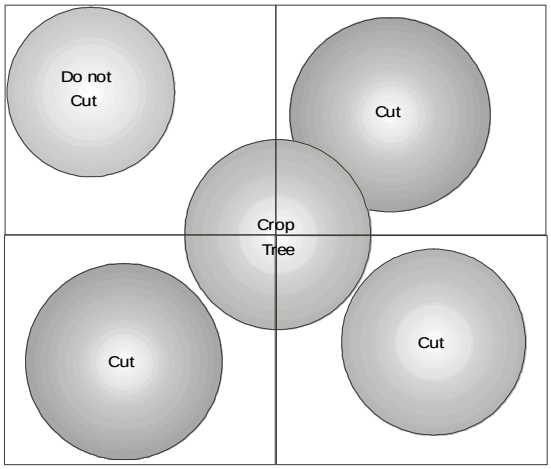
The shelterwood technique is used to regenerate moderately shade tolerant speces. It is especially successful in regenerating oak. Oak rebounds in forests that allow some sunlight to enter, while maintaining some shade and shelter for seedlings to become established. By creating space for large oak trees, acorn production increases and oak regeneration from seed is successful.

Uneven-aged Management
Selection Technique

The selection technique is preferred for landowners who wish to maintain a small amount of edge, and manage a relatively mature, diverse forest with little amounts of disturbance. It is also a good technique to use when a long-term supply of quality sawlogs is an objective. This technique promotes regeneration of shade tolerant trees, such as sugar maple, basswood, beech, and ash. If trees selected for harvest are in groups more than 1/2 acre in size, then oaks, hickories, red maple, and other intermediately shade tolerant species will grow. The selection technique employs light cuts that remove 10 to 30 percent of the trees of all sizes at each cut. Trees are selected based on species, quality, biodiversity, and size. Selection sites should be areas that are too dense for optimum growth. The goal is to provide proper spacing to encourage rapid growth and reproduction. Thin lightly every 10 years or so to prevent severe disturbance and to encourage continuous rapid growth. The result will be a variety of species in many different size and age classes. In other words, the forest will be structurally and compositionally diverse.

The crop-tree method is an example of selection management. The landowner decides what their primary wildlife improvement goal is and then inventories the property to see which trees meet the goal. In other words, trees are selected based on species, size, or age. For example, if you want to increase acorn production for deer and squirrels, you would need to cut trees that are competing with oaks. Cutting com-

TIMBER HARVESTING



Selection management: Trees should be cut that touch or are about to touch the crop tree. Picture is viewed from the ground looking up through the canopy.

peting trees will "release" the best oaks for growth. To determine which competing trees must be cut to release a crop tree, simply look up into the crop-tree crown and picture it divided into four separate sides. Evaluate each side for interference from neighboring crowns. Any crown that touches or is about to touch the crop tree will compete with it for growth and should be cut.

There are two types of selection techniques: single tree selection and group selection. Single tree selections choose individual trees for cutting, and are used in stands dominated by shade tolerant trees such as beech and sugar maple. This method is good for wildlife that do not require openings or shade intolerant mast producing trees as it maintains a relatively continuous forest canopy. Single tree selection is also often used to obtain firewood. Group tree selections choose groups of trees for cutting, and are used to provide wildlife with shade intolerant mast producing trees and shrubs as it permits more sunlight. Another way of providing these trees and shrubs is to plant them along the forest edge, or along logging roads or trails.

Other Considerations

Edge occurs when two different cover types, such as forest and open field, meet. Many species require an abundance of edge, such as rabbits, deer, and ruffed grouse. Be aware, however, that there are also animals that shun the edge and seek the safety of deep woods. Examples include the broad-winged hawk, pileated woodpecker, acadian flycatcher, yellow-throated vireo, American redstart, and cerulean, and hooded warblers. Before choosing a timber harvesting technique, you must be familiar with the species that inhabit your forest. If your forest is largely unfragmented, and there are species present that depend on this type of habitat, it would be wise to choose the technique that produces the least amount of edge.

The management practice you choose is dependent upon your wildlife management goals. However, there are some things you can do, regardless of which management practice you choose, that will benefit wildlife and increase the diversity of the forest. It is best to leave snags and trees containing cavities, along with grapevines, serviceberries, and other wildlife food sources. Large trees with poor form and no commercial value can be girdled rather than harvested, creating snags. To girdle a tree, which will eventually kill it, cut two rings two inches deep completely around the tree. Dead trees do not compete for light, moisture or nutrients. Besides cavity-type homes, they yield insect grubs for chickadees, nuthatches, and many kinds of woodpeckers. Leave harvested treetops and brush for slash that will provide cover. Timber harvests that result in trees left on the ground create opportunities for building brushpiles, and creating shelter for wildlife. Also, leave any logs on the forest floor for decomposition. Logs provide homes for wildlife and help replenish the soil. These few details will increase wildlife quality at little to no cost to the landowner.

In summary, careful planning will help you manage your woodland to create diverse habitats. Each management practice will regenerate a specific group of trees, and should be selected based on the present landscape conditions and your goals. Whichever you select, a wise choice will make the landscape more beneficial for wildlife, and may produce income too.

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Private Land Partnerships: This partnership was formed between both private and public organizations in order to address private lands wildlife issues. Individuals share resources, information, and expertise. This landowner's guide has been a combined effort between these groups working towards one goal: Natural Resources Education. We hope this manual provides you with the knowledge and the motivation to make positive changes for our environment.

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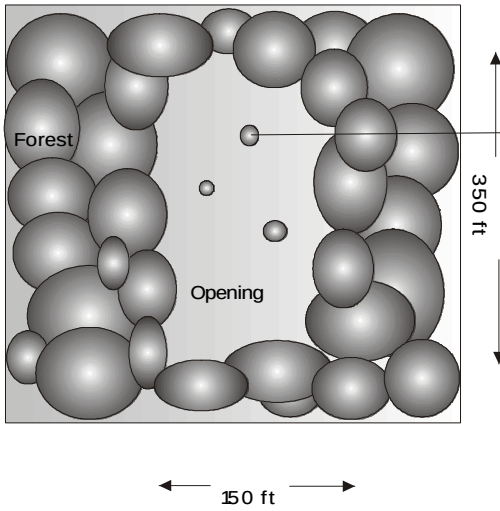
PRIVATE LAND PARTNERSHIPS
WORKING TOGETHER FOR WILDLIFE

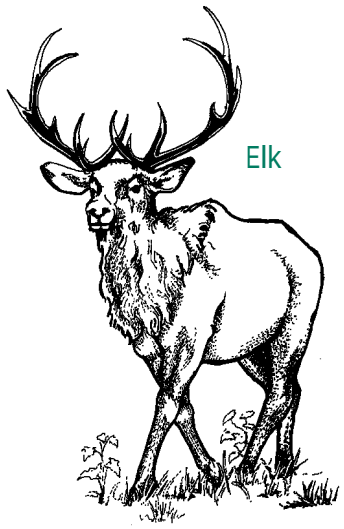
FOREST OPENINGS

Prior to Michigan's settlement millions of acres of pine and hardwood forest covered the landscape. Approximately 150 years ago these expansive tracts of forest contained patches of scattered grass or shrubland openings. These openings were created by natural disturbances such as fire, ice storms, wind, disease, insect outbreaks, drought, and flooding. These disturbances provided more sunlight and moisture to the forest floor, reduced competing vegetation, and generated a suitable seed bed for colonizing grasses, shrubs, and trees. Over time, shrubs and small trees would dominate the site and often in 10 -15 years trees would once again cover the area. These temporary openings provided browse, food, and cover to a variety of wildlife such as ruffed grouse, white-tailed deer, elk, and rabbits. Examples of larger open areas that fit into Michigan's highly forested landscape are native prairies, oak and pine savannas, and wetlands. These areas experienced more frequent disturbances, and thus had fewer trees.



Michigan's forests have greatly changed since the early 1800's. The majority of the vast forests in southern Michigan have been lost to development. However, northern Michigan still remains largely forested. Even so, many of the remaining forests in Michigan are severely fragmented. Fragmentation occurs when roads, trails, homes, agricultural fields, pipeline and powerline corridors, and other forms of development break up a natural area. Fragmentation produces a large amount of edge. Edge is the transition zone between two vegetation types. As a result of fragmentation, many species that have a high sensitiviy to edge have been negatively impacted. These species seek the interior of large forested areas hundreds of acres in size. When edge sensitive woodland birds are forced to nest within 300 yards of large openings or grassland edges, they become vulnerable to predation and nest parasitism by cowbirds. Species of wildlife such as the least flycatcher, redstart, ovenbird, veery, and red-shouldered hawk can all be negatively impacted by the development of forest openings.

A forest with a full canopy does not generally have a lot of understory vegetation. This is because the overstory prevents sunlight from reaching the forest floor. When openings are created, sunlight is able to facilitate the growth of a variety of vegetation. A one acre opening, with full sunlight, will produce significant food for species such as deer, elk, hares, vireos, warblers, and thrushes. Selecting where to place an opening is important because location, size, and slope will determine how the opening gets sunlight. In addition to this, it important to know when creating openings will be beneficial or detrimental to the ecosystem.


Elk

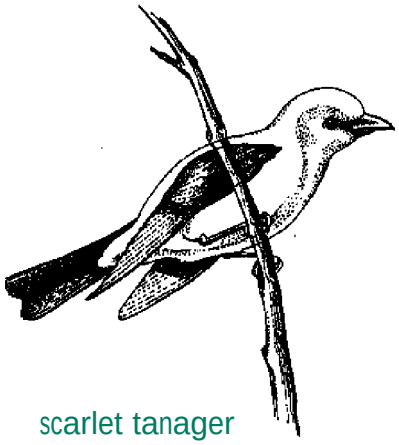
When to Create Openings

Landowners must consider many factors before deciding when creating openings is needed, and how large they should be. The lack of mature, old growth forest, and rarity of many types of forest

should be taken into consideration before any opening is planned. Maintaining and restoring these types of forest may be the best alternative. Whenever trees are harvested, whether the stand is 80 acres or over 200 acres, the kind and number of wildlife will change. Species that require large, undisturbed blocks of forest, may not be able to survive in the area if the disturbance is too large.

Because of the large amount of fragmentation, especially in southern Michigan, you must examine surrounding landscapes before creating openings. In general, forest openings should not be developed in extensively fragmented landscapes. It may be better in these areas to connect existing fragments rather than fragment the forest further by creating openings. If you are not managing for edge dependent species, openings are unnecessary in forest tracts less than 100 acres in size since openings and fields commonly already exist around them.

However, there are instances where creating openings may be beneficial to wildlife or habitat diversity. For example, areas that were historically prairies and savanna's are ideal locations for creating forest openings. Forest openings would mimic these unique grassland communities and would restore them to the area. Edges and openings of forests provide a large variety of vegetation and, consequently, support a variety of wildlife. The management of forest openings has been traditionally conducted for game and edge dependent species such as deer, turkeys, ruffed grouse, elk, rabbits, snowshoe hares, and songbirds such as towhees, indigo buntings, cardinals, and chipping sparrows.



scarlet tanager

Some openings may already exist on your property. You should determine the amount of existing openings in your forest before creating new openings. If your forest already contains the necessary amount of openings, you can enhance them instead of creating more. This will avoid fragmenting your forest, while fulfilling your goals for edge dependent species. Blowdowns from storms and fires from lightning strikes are examples of naturally created openings. Logging trails and log landings (where logs are piled and loaded) are examples of human created openings. These openings can simply be maintained or enhanced to fulfill wildlife needs.

Management Considerations

LOCATION: The best places for creating forest openings are where there are already only a few existing trees. Considerations include frost pockets (areas prone to late spring frosts), sites with shallow soil, and those that are excessively well-drained. If your property is large, you can often find good sites for openings on soil maps, aerial photographs, or topographic maps. A field examination will confirm whether or not the location is suitable.

To minimize the impact of the opening to area sensitive species you should place openings near other existing openings such as roads and trails or areas prone to windthrow. Enhancement of an existing opening will have less of a negative impact than creating a new opening. Also, openings should be placed near the edge of the forest, versus the middle, to minimize any negative impacts caused by increased fragmentation.

SLOPE: Slope is an important consideration when deciding on an opening location as it determines how much sunlight the opening will receive, and thus the potential for diverse vegetation growth. A south facing slope is the most desirable location because it will provide more ground area exposed to sunlight. However, it will tend to be drier because of summer heat. In early spring many species will use openings with a south-facing slope because green browse will appear there first as the snow melts. Areas

with moderate or low slope should be chosen if the area is to be planted. Areas with steep slopes are harder to plant and may cause erosion problems if not quickly revegetated.

SIZE: Openings are usually created to allow for maximum plant growth and diversity. A 1/2 to 2 acre opening will allow both shade tolerant and intolerant species. Sun-loving species such as grasses, legumes, crabapples, hawthorn, sumac, and gray and silky dogwood will grow in the middle and north side of the clearing as these areas receive the most sunlight. Shade tolerant species such as beaked hazel, serviceberry, flowering dogwood, and highbush cranberry will grow in the shade from adjacent trees on the south end of the clearing. Openings smaller than 1/2 acre will only support shade tolerant species as they are too small to receive much sun. Openings larger than two acres support more shade intolerant species as they have only a small shaded area.

When managing for edge dependent species, about five to 10 percent of your forest should be in openings. If you own more than 100 acres of woods, five to eight acres of openings are ideal. One option is to maintain five to eight one acre openings, while another option is to maintain three or four two acre openings.

Openings should be at least twice as long as they are wide because small animals seldom venture more than 50 feet from escape cover. An opening that is 100 feet wide by 200 feet long will be about 1/2 acre in size. Extending the length to 300 feet will produce an opening of 3/4 acre. An opening of 100 feet by 400 feet is about one acre. Long, rectangular shaped openings will maximize the amount of edge. Square and circular openings will minimize the edge effect. Openings should be about 100 feet wide to provide nearby escape cover and create an even amount of shaded and sunlit areas. The amount of shaded area that will result from a stand can be determined by the height of the trees. A tree will produce shade equal to half of its height. For example, trees that are 70 feet tall will produce 35 feet of shade into the opening.

When the width of the opening is narrow, there will be more time that the opening will be shaded. For example, a half-acre opening that is only 100 feet wide will be in the shade for more than half of the daylight hours. Increasing the width will allow a greater share of the opening to receive full sunlight. But don't always limit yourself to straight-sided rectangular openings. Be creative: Nature seldom creates straight lines, and neither should you.

MAINTENANCE: Once openings have been established, you have several options to maintaining them. You can either leave it alone and let succession reestablish it with trees, manage it as brushland, or manage it as a grassland. Your decision will depend on your management goals.

raspberry

If you allow the site to regrow with trees, the opening's effect on some wildlife species will last less than 15 years. Deer, rabbits, grouse, cardinals, towhees, and certain other songbirds will use the rapidly closing open area, but if you wish to retain high populations of these species, you will need to create another opening every five to eight years. If your goal is to introduce native species of desirable trees (hickory, red oak) and shrubs (serviceberry, beaked hazel) to your forest, this prescription is ideal.

If you wish to establish the opening as a brushland or grassland, you will have to prevent succession from going past these stages. You may have to kill the stumps of the cut trees to prevent their regrowth. This usually requires a specialty herbicide. To find out what herbicide is best for your opening, contact the Michigan State University Extension office in your county. Be sure to read, and follow all container directions. Once stumps are dead, sun loving grasses, broadleaf annuals and perennials will quickly fill the site, along with raspberries, blueberries, and shrubs. Allow the site to progress in natural succession as far as you want. When succession has reached the stage you desire, set it back by disking or mowing every three to five years, depending on soil moisture (moist soils

diagram of a brushpile

increase the rate of succession). Mark any trees and shrubs you have planted to avoid damage while disking or mowing.

Removing the stumps with a bulldozer, stump rake, or stump grinder will allow you to plant the opening with grasses or forbs. Mixes of native grasses and forbs such as Canada wild-rye, little bluestem, Indiangrass, and bush clover are preferred. Other alternatives, that are not native to Michigan, include timothy grass, orchard grass, and many clovers. Before planting, determine soil pH through the extension service, and apply fertilizer and lime, at the rates recommended. Adding wildflowers, and fruit bearing trees and shrubs, not only increases the aesthetic value of an opening but will attract a greater variety of wildlife, including bees, moths, and butterflies. Refer to the **Grassland Management** section for more information.

GENERAL: When cutting trees to create openings save some snags (dead trees) and wolf trees (large, wide spreading, short-trunked trees) near edges as many species of wildlife use the cavities often found in them for shelter. Leave clumps of conifers in and around openings because they provide escape cover and shelter for wildlife. In openings greater than two acres in size you can also leave a clump of trees or shrubs in the middle. Leaving some of the slash on the ground provides habitat for amphibians and reptiles. The addition of brush piles along the forest edge gives rabbits, snakes, turtles, grouse, and chipmunks additional high-quality escape cover next to food producing edges. Landowners can enhance fruit production along the edges, as well as reduce a harsh edge by planting sun-loving fruit bearing shrubs along the north side of the opening and shade-tolerant species within the shaded zone of trees along the south side.

In summary, the decision to create openings in your forest depends on your management goals and your surrounding landscape. Forest openings can increase habitat diversity for many species of wildlife. However, they can also have negative impacts on other wildlife species. By carefully developing your goals you can determine if the practice will be beneficial on your property and produce your desired results, or if it will be detrimental to the ecosystem.

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