ACKNOWLEDGEMENTS

The science of forestry is broad and complex. The art of the profession is improved and refined by experience. The Michigan Society of American Foresters wishes to recognize the following professionals who made contributions toward this publication. These professionals represent a broad range of expertise, employers, and many decades of experience in the field of forest management.

Bill Botti, Executive Director, Michigan Forest Association
Bill Cook, Michigan State University Extension
Donald Dickmann, Michigan State University
Mike Elenz, Elenz Logging, Incorporated
Jim Ferris, Forest Resources Division, Michigan DNR
Jerry Grossman, Grossman Forestry
Andy Henriksen, Natural Resources Conservation Service
Robert Heyd, Forest Resources Division, Michigan DNR
Doug Heym, Forest Resources Division, Michigan DNR
Ernie Houghton, Forest Resources Division, Michigan DNR
Maria Janowiak, Michigan Technological University
Donald Johnson, Forest Resources Division, Michigan DNR
Craig Kasmer, Hartwick Pines State Park, Michigan DNR
Russell Kidd, Michigan State University Extension
Larry Leefers, Michigan State University
Randy Keen, Biewer Lumber Co.
Linda Nagel, Michigan Technological University
Dave Neumann, Forest Resources Division, Michigan DNR
Dennis Nezich, Forest Resources Division, Michigan DNR
Jack Penegor, Penegor Consulting
Georgia Peterson, Forest Resources Division, Michigan DNR
Jack Pilon, Michigan DNR (retired)
Scott Pugh, USDA Forest Service, Forest Inventory & Analysis Unit
Martha Sjogren, USDA Forest Service, Hiawatha National Forest
Pete Squibb, Wildlife Solutions, Incorporated

We would also like to thank the authors of the 1998 Forest Management Guidelines, which served as the beginning of this version. A special thanks to Craig Kasmer for the fine wildlife artwork.

These guidelines are also on-line at http://michigansaf.org where more information about Michigan forestry can be found. The Michigan Society of American Foresters (MSAF) hopes that you will find these guidelines helpful in learning about forestry and, perhaps, how to better manage your own forest land.
# Forest Management Guidelines for Michigan

## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>The Guidelines</td>
<td>1</td>
</tr>
<tr>
<td>Characteristics of Michigan's Forests</td>
<td>2</td>
</tr>
<tr>
<td>Contributions of Michigan's Forests</td>
<td>5</td>
</tr>
<tr>
<td>Ecosystem Services</td>
<td>8</td>
</tr>
<tr>
<td>The Forest Plan</td>
<td>9</td>
</tr>
<tr>
<td>Michigan Forest Types and Their Ecology</td>
<td>11</td>
</tr>
<tr>
<td>Wetland Forest Types</td>
<td>12</td>
</tr>
<tr>
<td>Upland Forest Types</td>
<td>14</td>
</tr>
<tr>
<td>Open Canopy Forest Types</td>
<td>18</td>
</tr>
<tr>
<td>Forest Management</td>
<td>19</td>
</tr>
<tr>
<td>Silvicultural Systems</td>
<td>19</td>
</tr>
<tr>
<td>Even-Aged Systems</td>
<td>21</td>
</tr>
<tr>
<td>Uneven-Aged Systems</td>
<td>23</td>
</tr>
<tr>
<td>Intermediate Treatments</td>
<td>25</td>
</tr>
<tr>
<td>Regeneration and Reforestation</td>
<td>26</td>
</tr>
<tr>
<td>Harvesting Methods</td>
<td>27</td>
</tr>
<tr>
<td>Special Management Considerations</td>
<td>30</td>
</tr>
<tr>
<td>Forest Protection</td>
<td>30</td>
</tr>
<tr>
<td>Forest Health</td>
<td>31</td>
</tr>
<tr>
<td>Wildlife Habitat</td>
<td>32</td>
</tr>
<tr>
<td>Scenic and Recreation Values</td>
<td>38</td>
</tr>
<tr>
<td>Special Natural and Cultural Resources</td>
<td>39</td>
</tr>
<tr>
<td>Road Construction and Maintenance</td>
<td>40</td>
</tr>
<tr>
<td>Intergenerational Land Transfer</td>
<td>41</td>
</tr>
<tr>
<td>Taxation</td>
<td>43</td>
</tr>
<tr>
<td>Forest Certification</td>
<td>44</td>
</tr>
<tr>
<td>Biomass</td>
<td>45</td>
</tr>
<tr>
<td>Finding Assistance</td>
<td>47</td>
</tr>
</tbody>
</table>
INTRODUCTION

Michigan forests have always been important to the quality of life for Michigan citizens, but our demands on forests continue to grow and to change. To maintain our quality of life, the way we manage our forests will also need to change. The Michigan Society of American Foresters (MSAF) offers this publication of forest management guidelines to help readers better understand forest management in Michigan.

These forest management guidelines recognize the renewable nature of forests and the influence of forest management practices on the many uses of the forests including timber, water, recreation, wildlife, visual quality, and energy. Because of the diversity of forest conditions, values, and ownerships, no set of management guidelines can cover all situations. Forest owner and professional judgment must combine scientific knowledge and local conditions to determine management practices for a particular property. These guidelines can help.

The goal of these guidelines is to provide for conservation and stewardship of all forest lands in Michigan. The MSAF challenges landowners, forest managers, forest industries, and timber harvesting contractors to follow these guidelines. They provide a common-sense approach to better manage the forest lands of the state. At the end of this document are listed a number of organizations that can assist forest owners with their management needs.

THE GUIDELINES

Management Guidelines: Applicable to Public & Private Forest Land

These guidelines are written to apply to all forest land ownerships in Michigan. They define a set of considerations that, when taken as a whole constitute a framework of advice, encouragement, and obligation appropriate for the time and place for which they are written.

The guidelines represent neither a minimum set of requirements that applies in all situations, nor a guarantee that, if applied, all important considerations and obligations will be met. They are not intended as a complete forest management instruction manual for foresters, landowners, or the public.

Therefore, these guidelines must be supplemented with knowledge of local conditions, a familiarity with forest ecology and management,
recognition of the objectives and constraints of individual forest owners, and compliance with all applicable laws and regulations. To ensure that these factors are carefully weighed, the advice of trained, experienced, and thoughtful professional foresters and other resource managers is available and should be sought and considered.

Characteristics of Michigan’s Forests

Michigan's temperate forests teem with plant and animal life, provide outdoor recreation opportunities, protect and enhance air and water quality, and support thousands of jobs. They contribute billions of dollars to Michigan’s economy each year. Michigan forests touch our lives each day.

Forested ecosystems include living and non-living components combined into a much broader landscape diversity mix. The mix of biotic components helps define biodiversity. In the case of forests, the kinds of vegetation present determine the kinds of mammals, birds, amphibians, and other organisms which can survive. In 2007, Michigan's statewide forest inventory (USDA Forest Service’s Forest Inventory and Analysis program) identified over 100 different tree species.

The forest also contains other living components which are part of its overall health. These include lichens, mosses, dead and/or downed woody vegetation, fungi, and herbaceous plants. The relationship of these many components to one another creates different but important habitat. Examples are the edge between various forests or land uses and the presence of aquatic systems.

Forests dominate Michigan's landscape. In 2007, they covered 54% of the total land area, representing 19.7 million acres. Nearly all of these forest lands meet minimum tree growth productivity standards (20 cubic
feet per acre per year) to produce commercial timber crops, qualifying as timberland. Originally intended for industrial wood production, this classification provides a good measure of the forest's potential to produce a wide array of goods and services. Timberland area has increased 10%, to 19.2 million acres, since 1980.

Michigan's forests continue to mature and regenerate, altering forest structure continually. One measure of this process is reflected in the statewide forest inventory. Since 1980, Michigan's forest acreage of large diameter trees (roughly, trees greater than 10 inches) increased 59%; medium diameter (5 to 10 inch trees) acreage decreased 6%; and small diameter (trees smaller than 5 inches) decreased by 19% (Figure 1). Michigan's forests are growing in area and size. The trend towards maturity in Michigan's forests provides a variety of management opportunities, such as managing for old growth attributes, harvesting mature trees, improving structural diversity, or regenerating young forests.

Certain tree species in the forest grow near one another due to similar soil, moisture, climate, terrain, and past history. These tree species communities are called forest types and they can be categorized into forest type groups. Hardwood forest type groups (broadleaf deciduous tree species like oak, aspen, and maple) are the most common in Michigan forests. They account for approximately 75% of the forest land. Softwood forest type groups (comprised of tree species like pine, spruce, fir and cedar) account for the remainder. The two largest forest type groups in Michigan are maple-beech-birch (commonly referred to as northern hardwoods) at 6.7 million acres and aspen-birch at 3.4 million acres (Figure 2).

Private owners hold 63% of the state's timberland acres. They include 444,000 private forest land owners with an average ownership of 27 acres. Non-industrial private (farmers, individuals, hunt clubs, etc.) ownership is 49% of the total (Figure 3). Corporate and forest industry
ownership is 14% of the state total. These collective private holdings have a range of management objectives, including investment, recreation, and scenery. These owners generally have a strong land ethic and respond to opportunities to improve their property’s values. Public ownership accounts for the remaining 38% of the total timberland base. National forests in Michigan include the Ottawa, Hiawatha, and the Huron-Manistee, which represent 14% of the total. State-owned forest lands represent 21% of the total. A small fraction of public ownership is held by counties, municipalities, and various federal agencies. Principal ownership objectives of public lands include community stability through support for timber and recreational industries and the more naturalistic values associated with such things as environmental services and wild lands. Tribal governments, non-government conservation organizations, hunt clubs, and other private organizations account for the “other” timberland owners.

Though the total area of forest land in Michigan has changed little since the first Forest Inventory and Analysis survey was completed in 1935 (Figure 4), the volume of wood in the forest has risen (Figure 5). The 1955 survey estimated that Michigan had 10.7 billion cubic feet of growing stock (trees 5 inches in diameter and larger). By 2007, the inventory had increased to 28.3 billion cubic feet. Between 1980 and 2007, the inventory increased over 8.6 billion cubic feet, a 44% increase. Hardwoods make up over two-thirds of the growing-stock volume.

Michigan’s forests are currently growing twice as much wood (736 million cubic feet) as is being removed (363 million cubic feet) from the timberland base each year (Figure 6). Net growth represents growth minus mortality. Removals of wood include both harvests and diversions from timberland. Mortality due to old age, fire, wind, insects, and disease was 277 million cubic feet. In this same period, Michiganders consumed 740 million cubic feet of wood products (paper, lumber, furniture, etc.).
Michigan's surplus growing stock (annual net growth less removals) is among the largest in the nation, but there is potential to increase growth even more. Given favorable climate and soils and using forest management in a timely manner, growth can be increased by assuring fully stocked acres. Additional increases in wood growth can occur through the use of more active forest management techniques such as thinning and planting genetically improved trees.

**Contributions of Michigan’s Forests**

Michigan’s forests contribute to the well-being of society by enhancing environmental quality, maintaining habitat for wildlife, providing recreational opportunities and settings, growing timber, and creating jobs to produce and manufacture wood and wood products.

Although difficult to measure, Michigan’s forests provide valuable environmental benefits by improving air and water quality and enhancing natural resource conservation. Forests filter pollutants from ambient air. A well-managed, growing forest in Michigan can sequester up to a ton or more of carbon per acre from the atmosphere each year until maturity. This is an important ecosystem service that, among other things, can
offset excess fossil fuel emissions of carbon dioxide. Forests protect watersheds from erosion and degradation, filter runoff and recharge ground water, and shade streams and lakes. They enhance the quality of Michigan’s 36,350 miles of rivers and streams, its 11,037 inland lakes and its drinking water.

Forests help conserve many natural resources. Threatened, endangered, or animals of special concern like the bald eagle, Kirtland’s warbler, moose, gray wolf, pine marten, and fisher, along with many rare plants, are found within Michigan forests, especially in wetlands. Some of our forests also serve as biological reserves to protect diverse habitats and genetic material.

Michigan forests provide habitat for wildlife, including the state’s estimated 1.7 million deer, and watershed protection for its inland fishery. In 2006, 1.7 million Michigan residents fished or hunted and 2.9 million residents participated in other wildlife-watching recreation. Anglers spent $1.7 billion in Michigan in 2006, participants in hunting spent $916 million, and other wildlife watchers spent $1.6 billion.

Michigan has 7.2 million acres of state and federal forest land that can be used for outdoor recreation. State forests hold 59% and national forests hold 41% of these lands. State and federal wilderness areas total over 322,000 acres. This land base provides opportunities for camping, hiking, skiing, stream and inland lake fishing, berry and mushroom picking, trail biking, and horseback riding. Forests are the setting for many tourist-related activities. Tourists spent $8.8 billion in 2000, much of it in forest-dependent counties.

Michigan produces a vast array of forest products, from paper to Christmas trees. Industrial production of sawlogs, pulpwood, veneer logs, and other timber products totaled 373 million cubic feet in 2007.
Additionally, domestic fuel wood production is increasing as costs of other forms of home heating are increasing. Over 1,600 firms were involved in forest products harvesting, transporting, brokering, or manufacturing in Michigan in 2004. Manufacturing accounted for about three-quarters of these firms whose sales totaled $10.5 billion (Figure 8). These sales, in turn, generated almost $9 billion in additional sales in Michigan’s economy. Lumber and wood products, wood furniture, and pulp and paper products contributed over $3.4 billion in value added to Michigan’s economy. Pulp and paper products manufacturing contributed about 42% of this total. In 2004 these industries, including logging, provided direct employment to over 46,000 people. These jobs generated 58,200 additional jobs outside the forest products industry.

In addition to the more traditional forest products and services, there is a renewed interest in wood-based energy and evolving roles for ecosystem services (carbon sequestration, nutrient cycling, etc.). These emerging markets herald a larger role for forests in Michigan’s economy.

*Figure 7: Volume of forest products in Michigan in 2007.*
Ecosystem Services

Ecosystem services are all of the benefits that the environment provides to society. Healthy forest ecosystems provide numerous services, including oxygen, watershed protection, timber production, energy, plant pollination, wildlife habitat, biodiversity, and scenic landscapes. Landowners that practice sustainable forest management not only create healthy and resilient forests for their own use and enjoyment, they are also performing an activity that benefits all other citizens. Traditionally ecosystem services have been seen as free services or “public goods” and have not had an economic value in society. However, new markets are emerging that may be able to generate incentives for people who provide these services. In the future, forest owners may able to participate in markets and generate revenue that will help balance the costs of producing these benefits and increase the societal value of forest lands.

One example of these emerging markets is carbon trading. As trees live and grow, they strip carbon from the carbon dioxide in the air leaving oxygen to be released into the atmosphere. The carbon becomes part of the wood (sequestered), and is also stored in the soil as wood decays. Planting trees and managing forests in a way that encourages healthy and vigorous tree growth can help to reduce the amount of carbon dioxide in the atmosphere, which will help to mitigate climate change. Carbon markets may allow forest owners to receive payments for forest management activities that sequester additional carbon from the atmosphere. With the possibility of new markets, forest owners may begin to see a return on investment for the ecosystem services that they have been providing for free. For example in 2008, investors received approximately $400,000 for sequestering carbon on their forest land.

Forest land provides many rewards to the forest owner as well as services to society. Michigan’s citizens and visitors benefit greatly from the 19 million forested acres in the state. Some of these benefits provide financial returns, such as those from forest products or hunting fees. Other ecosystem services are equally important but are not as easy to market and sell, such as beauty, solitude, and the joy of being a steward over a part of nature. With the possibility of new markets, forest owners may begin to see a return on investment for the ecosystem services that they have provided for free. For example in 2008, investors received approximately $400,000 for sequestering carbon on their forest land.
The Importance of a Forest Management Plan

Though forests can provide clean water, fuel wood, recreation, timber, wildlife and scenic value in numerous combinations, any action taken at one time may affect available choices for years to come. Forest planning can integrate and optimize management of all these forest attributes.

Forest planning is the process of comparing the forest owner’s ideas with the current condition of the woodlot and the inherent capabilities of the forest to provide goods and services on a sustainable basis. This comparison will consider any obligations or constraints pertaining to the forest owner and the property. This is the first step in active forest management, which may include timber harvesting, tree and shrub planting for timber production or wildlife habitat, or even the creation of forest openings to enhance diversity.

All forest owners have a plan, even if it is simply how they imagine their woodlot in the future. The advantage of a formal written plan is that it can more easily address complex considerations and resolve possible inconsistencies and conflicts between desired outcomes. A written plan is an excellent way to convey one’s vision of the property to the next generation. It also serves as a helpful reminder of our vision of the future. Management plans are useful when one participates in conservation programs, Tree Farm or other sustainable management systems, Michigan’s property tax relief programs, or carbon trading.

A written management plan is the blueprint of a woodlot. It begins with a statement of specific goals and objectives. Goals tend to be long-term and describe the desired future condition of the woodlot. Objectives are actions taken to achieve the goals. These are followed by a description of the woodlot and how it fits into the surrounding ecological landscape. The narrative may include physical features such as soil properties, wetlands, and topographic and hydrologic features. It details the presence of trees, shrubs, and herbaceous plants and wildlife, including rare and threatened species that are found or may be found there. A variety of data sources are available, including site-specific field work on a particular property. A useful map of the woodlot (Figure 9) shows the physical features of the property including the vegetative cover types (stands), roads, buildings, topographic features, and surface water. Additional maps may be added to show soils types and the locations of proposed treatments. Finally, sustainable forest management alternatives are presented that promotes the forest owner’s goals.
Forests are dynamic and management plans must be adaptable to changing forest and market conditions. For this reason, all forest plans need to be monitored, evaluated, and periodically updated to ensure forest conditions have not changed and that the plans are still relevant.

Forest owners should consider the advice and assistance of professional foresters and other resource professionals when developing a forest plan. The scope, detail, timetable, cost, and funding of the forest plan should be agreed upon prior to its preparation. Forest owners should also consider the amount of time and financial resources required to implement provisions laid out in the plan.

**Figure 9.** Sample forest management plan map.
Though forests once covered about 95% of Michigan, today about half the state is forested [see Dickmann and Leefers (2003), The Forests of Michigan, for a thorough discussion of the state’s forest history]. But this forest cover varies by region: 21% of the southern Lower Peninsula is occupied by patchy woods and wetland corridors, whereas 65% of the northern Lower Peninsula and 84% of the Upper Peninsula are covered by large forested tracts. Within each region the combined effects of glacial landforms, climate, soil, and recent history have produced a variety of forest habitats (Table 1). On these unique habitats grow different forest types.

A forest type is a broadly defined ecosystem—a varied and complex community of plants, animals, and other organisms living together in a common habitat. Forest types are defined principally by their characteristic tree species. This practice does not imply that the organisms associated with these trees are somehow less important ecologically. Trees are large and structurally dominant, and they may have monetary value or aesthetic appeal; thus we focus on them.

<table>
<thead>
<tr>
<th>Ecological Description</th>
<th>Xeric</th>
<th>Dry mesic</th>
<th>Mesic</th>
<th>Wet mesic</th>
<th>Hydric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average moisture during the growing season</td>
<td>Very dry</td>
<td>Somewhat dry</td>
<td>Moist</td>
<td>Very moist; water may stand in the spring</td>
<td>Wet</td>
</tr>
<tr>
<td>Drainage</td>
<td>Excessively drained</td>
<td>Very well-drained</td>
<td>Well-drained</td>
<td>Somewhat poorly drained</td>
<td>Poorly drained or undrained</td>
</tr>
<tr>
<td>Surface soil textures</td>
<td>Sand to loamy sand</td>
<td>Loamy sand to sandy loam</td>
<td>Sandy loam to loam</td>
<td>Loam to clay loam</td>
<td>Sand to clay loam; muck or peat</td>
</tr>
<tr>
<td>Natural fertility</td>
<td>Infertile</td>
<td>Moderately infertile to fertile</td>
<td>Very fertile</td>
<td>Fertile to moderately fertile</td>
<td>Moderately infertile to very infertile</td>
</tr>
</tbody>
</table>

Table 1. The continuum of forest habitats.

Michigan’s forests are very diverse, largely because of the extremely variable climate produced by the surrounding Great Lakes and the extensive south to north and east to west geography. Ten coniferous tree species and 52 hardwood or broadleaf deciduous tree species that reach commercial size are native to the state. Another 30 or so native
species are considered small trees or large shrubs. A number of these large and small trees reach the northern extent of their range in the southern part of the state. But because of their unique, gene-based adaptations, these native tree species do not all grow together in the same habitat or the same geographic area of the state. Rather, in a given geographic region certain trees congregate together in a particular habitat to form a distinctive forest type.

A forest owner may learn that there are a number of different forest classification systems. For these guidelines, the forest type descriptions are grouped under three broad classes: Wetland Forest Types, Upland Forest Types and Open Canopy Forests. Forest plantations are also described.

**Wetland Forest Types**

The glacial landforms of Michigan, combined with normally abundant rainfall, have produced an abundance of wet (hydric) habitats, and many of these habitats are forested. Wetlands are protected under Section 404 of the Federal Clean Water Act of 1972 and Part 303 of the Michigan Natural Resources and Environmental Protection Act of 1994 (P.A. 451). These acts regulate the discharge of pollutants into wetlands, the building of dams and levees, infrastructure development, and the draining of wetlands for farming, forestry, or other purposes. While nearly all forest management is guided by “best management practices” (BMPs), which are designed to protect water and soil resources, these BMPs particularly impact management of wetland forests.

**Southern Deciduous Swamps and Floodplain Forests**

Also known as the elm-ash-cottonwood type, these forests occur in the floodplains of rivers and streams, poorly drained former lakebeds, and wet depressions. Soils vary from sand to clay, but all are poorly drained with neutral to slightly acid pH. Signature tree species are silver maple, red maple, green ash, black ash, American elm, cottonwood, and black willow. Also common, but usually found in smaller numbers, are quaking aspen, peach leaf willow, crack willow, box elder, swamp white oak, bur oak, pin oak, slippery elm, sycamore, and yellow birch. The elms, however, have declined markedly due to Dutch elm disease and ashes now are being decimated by the emerald ash borer. A unique subtype is the relict tamarack-dominated wetlands that are scattered throughout southern Michigan. Though the elm-ash-cottonwood type occupies about 1.6 million acres in southern Michigan, the amount of timber harvested from it is relatively small due to its proximity to water.
**Northern Hardwood Conifer Swamps**
These poorly drained, seasonally inundated communities are found on northern floodplains, glacial lake plains, and morainal stream headwaters. Slightly acid to neutral soils are sandy to sandy loam in texture or muck over a mineral substrate. The signature hardwood is black ash, but green ash, yellow birch, American elm, red maple, and balsam poplar also occur. Scattered conifers—balsam fir, tamarack, northern white cedar, white pine, and hemlock—may be present. This common wetland type has little commercial timber value. It is found throughout the northern Lower Peninsula (about 500 thousand acres) and the Upper Peninsula (about 350 thousand acres).

**Northern Cedar Swamps**
These forests are found along streams and drainageways, adjacent to inland lakes, in abandoned embayments and interdunal swales along the Great Lakes, and in wet depressions. Surface soils are acid, organic muck or peat, but subsurface soil layers may be neutral or slightly alkaline in pH, especially where they overlie limestone or dolomitic bedrock. Forest structure and composition are strongly influenced by a constant flow of cold, mineral-rich groundwater through the soil. One singular conifer, often occurring in nearly pure stands, defines this type: northern white cedar. Tamarack also can be present, sometimes dominating the cedar. Associated trees include white pine, white spruce, black spruce, balsam fir (often in the understory), hemlock, red maple, black ash, paper birch, yellow birch, American elm, quaking aspen, and balsam poplar. Total state area of this type is about 1.35 million acres, with nearly half in the eastern Upper Peninsula. Cedar is an important source of posts, poles, and cabin logs, but its long-term future is uncertain because of excessive browsing by deer, especially in winter yarding areas.

**Northern Conifer Bogs and Muskegs**
This type occupies former lakes and ponds that have filled in with undecomposed plant residues over the course of thousands of years. Soils are deep, poorly drained or undrained, very acid, saturated peats devoid of groundwater influence—an infertile and stressful soil environment. The stress is obvious in muskegs, where trees are scattered and stunted. Conifers dominate this type, with black spruce often forming pure stands. Frequent associates include tamarack, balsam fir, and jack pine (on sandy hummocks or ridges), along with occasional white pines and northern white cedar. These distinctive northern wetlands are found mostly in the Upper Peninsula, although they do occur in the northern Lower Peninsula, occupying about 465,000 acres state-wide. They are of no commercial value.
Upland Forest Types

The extensive uplands of Michigan are of glacial origin. They include hilly ice-contact features—moraines, kames, eskers, drumlins, and crevasse fillings—as well as flat or gently undulating till plains, outwash plains, and well-drained former lakebeds. Near the shore of Lake Michigan and in some inland areas, wind-shaped sand dunes also occur. In the highlands of the western Upper Peninsula, ancient bedrock forms prominent, mountainous ridges. Upland habitats are extremely diverse, with local differences in climate and history adding their influence to habitat variation.

Southern Maple Beech Forests

Occupying southern mesic habitats, this type is the most species rich and productive in the state. Soils are deep, loamy, generally well-drained, and fertile. Because it is so productive, much of the pre-European settlement mesic forest of southern Michigan was cleared for farming. Within 10 to 20 miles of the Great Lakes, the humid climate also permits mesic forests to thrive on stabilized sand dunes. The signature trees are sugar maple and American beech. Sugar maple usually dominates in the richest mesic habitats, whereas beech is better adapted to sandy soils or those with somewhat poorer internal drainage. Seedlings and saplings of both species usually are abundant in the understory, except where deer browsing is heavy. A large number of trees can be associated with the maple and beech in the overstory: red oak, white oak, bur oak, chinquapin oak, white ash, tulip poplar, basswood, black cherry, red maple, bitternut hickory, black walnut, and sassafras. White pine and hemlock may be present near the Great Lakes. Maple-beech forests are the most common type in southern Michigan, covering about 1.3 million acres, mostly in scattered woodlots. They are an exceedingly important source of timber, but provide many other benefits as well.

Southern Oak-Mixed Hardwood Forests

This hardwood forest type (also known as oak-hickory) is emblematic of much of southern Michigan. Habitats are dry-mesic or xeric, and soils are typically moderately fertile to infertile, coarse-textured, acid sandy loams and sands. Prior to European settlement, much of the land now in this forest type probably was oak openings - open savanna communities maintained by frequent fires. Some of this land also was converted to agriculture by Euro-American settlers. This is an oak-dominated forest type, with black oak, white oak, and red oak the signature species. A number of associated trees may be present, sometimes outnumbering the oaks, especially if a stand has been selectively logged in the past: shagbark hickory, pignut hickory, sassafras, black cherry, red maple, bur oak, scarlet oak, northern pin oak, white ash, basswood, black walnut,
bigtooth aspen, red cedar, and white pine (near Lake Michigan). Drymesic oak forests are common in southern Michigan, covering about 700,000 acres. They are an important source of timber and provide prime habitat for wildlife.

**Northern Maple-Mixed Hardwood Forests**
This type (sometimes called maple-beech-birch) is the northern counterpart of the southern maple-beech forest. But because growing seasons are shorter, winter temperatures colder, and snowfall greater, southern hardwood species drop out, with their place taken by northern species. These forests are rich and productive; soils are mostly well-drained, acid loamy sands to loams. Although agriculture is not as pervasive in northern Michigan as it is in the south, some of this type was converted to farm land. One hallmark tree—sugar maple—usually dominates, sometimes forming nearly pure stands. American beech also is important, although its range does not include the western Upper Peninsula. In some areas (e.g., the eastern Upper Peninsula), this species has been devastated by the beech bark disease. Yellow birch, red oak, and basswood may be important associates on certain sites, but sugar maple usually is present in the overstory or understory. Minor canopy associates include red maple, white ash, black cherry, paper birch, bigtooth aspen, quaking aspen, eastern hemlock, white pine, white spruce, and northern white cedar (especially sand dunes and calcareous soils). Hemlock and white pine were much more common in this type in pre-European settlement times than today, but heavy cutting of these species during the late 19th and early 20th centuries, combined with repeated wildfires, reduced their frequency. At about 5.9 million acres, this is the most widely distributed forest type in Michigan, and it produces much high-quality timber.

**Northern Hemlock Forests**
Although hemlock can be a minor component of northern maple-mixed hardwood forests, some communities are dominated by hemlock. They typically occur on cool, moist coastal dunes of Lakes Michigan and Superior and on the north-facing slopes of ridges and ravines. Because the soils in these habitats are mostly dry-mesic acid sands or sandy loams, sugar maple is rare. Associates of hemlock can be American beech (except in the western Upper Peninsula), red maple, paper birch, yellow birch, red oak, white pine, white spruce, and balsam fir (the latter two usually in the understory). Not widely distributed, this type (about 228,000 acres) nonetheless can be found in its unique habitat across northern Michigan, especially in the western Upper Peninsula. Although the bark of hemlock was once harvested in huge quantities for use in the leather tanning industry, this type has very little commercial value today.
Northern Oak Forests
This extensive type is found on acid, moderately fertile or infertile, well-drained sands or loamy sands. It is largely an accident of human history. Prior to 19th and early 20th century logging, many northern areas now dominated by oaks were white and red pine forests, with oaks a minor component. The repeated wildfires that accompanied logging and settlement prevented the pines from re-establishing but favored the strong-sprouting, fire-adapted oaks. If undisturbed, many of these forests are now reverting back to pine. White oak, black oak, and northern pin oak in varying combination are the signature trees, with white pine, red oak, red pine, jack pine, black cherry, red maple, bigtooth aspen, quaking aspen, hemlock, and balsam fir occurring as associated species. The northern oak type occurs to a small extent in the Upper Peninsula, but most of it (about 1.2 million acres) occurs in the northern Lower Peninsula. This type provides critical acorn mast for wildlife and is harvested for timber, although many of the oaks are poor quality.

Northern Pine Forests
Northern xeric and dry-mesic habitats once supported the magnificent old-growth pine forests that made Michigan famous. This present-day type represents a second-growth reincarnation of these forests in areas where post-logging wildfires were not severe or repeated. The type gets its name from the three native Michigan pines: red (Norway) pine, white pine, and jack pine. Red pine and jack pine predominate on dry, sandy soils, whereas white pine will predominate on more mesic, sandy loam habitats. It is not unusual to see all three pines growing together, although red pine-jack pine or red pine-white pine mixtures are more common. Numerous hardwood and conifer trees can be associated with the pines: white oak, black oak, northern pin oak, red oak, red maple, black cherry, bigtooth aspen, quaking aspen, paper birch, hemlock, balsam fir, and white spruce. Historically, pine forests occurred in their greatest extent in the northern Lower Peninsula; at nearly 1.21 million acres, this remains true today. Extensive areas of this type are also found in the Upper Peninsula (about 644,000 acres). Pine forests are very important commercially, and young stands of jack pine are the only breeding habitat for the endangered Kirtland’s warbler. Wildfires have always been common in these highly flammable forests, and they remain a serious threat today.

Boreal Spruce-Fir Forests
True northern boreal forests occupy huge areas in Canada and Alaska, but they are also represented in a southern variant in northern Michigan. They typically occupy cool, mesic to wet-mesic habitats; soils vary from well-drained to somewhat poorly drained, acid to neutral, light sands to heavy clay loams. Two conifers usually dominate the overstory—white spruce and balsam fir. Northern white cedar is also common on sand
dunes and in areas of calcareous bedrock. Minor tree associates include paper birch, yellow birch, quaking aspen, red maple, white pine, and hemlock. This type is localized in the northern part of the Lower Peninsula but is more extensive in the Upper Peninsula, comprising about 540,000 acres in total. Some limited extraction of spruce-fir pulpwood and white cedar logs occurs, but overall the type is not commercially important.

**Aspen-Paper Birch Forests**
With the exception of a few small areas of virgin forest—now mostly protected in parks—Michigan’s tree communities are second or third growth. The forests that grew back after 19th and early 20th century logging and wildfires or when marginal agriculture was abandoned consisted of vast areas of early successional hardwood pioneers that were exceptionally well-adapted to establish on highly disturbed sites. These pioneer forests occupy a wide variety of soils and habitats, from xeric to very wet-mesic. Quaking aspen, bigtooth aspen, and balsam poplar are benchmark species of this type. Their ability to produce large quantities of cottony, wind-blown seed and sprout copiously from shallow roots makes them well-adapted for the pioneer role. Paper birch is also an important pioneer species, especially in the Upper Peninsula. In the southern Lower Peninsula cottonwood is an aggressive invader of disturbed sites. These pioneer communities contain numerous hardwood and coniferous tree associates, often growing in the understory or subcanopy, and they eventually will succeed the overstory pioneers. About 3.2 million acres of early successional aspen-birch forests remain in the state today, a decline of over one-third from their peak acreage in the 1930s. About 96% of the current area lies in the northern Lower Peninsula and Upper Peninsula. These forests are an extremely important source of timber, and they provide excellent wildlife habitat.

**Plantations**
Trees have long been planted in Michigan for forestry purposes, usually on burned-over or cut-over tracts and abandoned fields or pastures. Most successful tree planting in the state has occurred on dry-mesic or mesic habitats. Some plantings have also occurred on very dry or very wet sites, but failure rates often have been high. Significant wild land planting began in the 1920s, reached peaks during the Civilian Conservation Corps era in the late 1930s and early 1940s, during the Soil Bank era in the 1950s, and, more recently, on Conservation Reserve Program lands. In recent years, between 25,000 and 30,000 acres per year have been planted in Michigan, much of it on public land. The bulk of the planting on private land is for Christmas trees. Most of Michigan’s existing wildland plantations consist of either red pine or jack pine, with the area planted with red pine nearly double that of jack pine. Other
trees occasionally found in forest plantations include white pine, Austrian pine, Scotch pine, white spruce, Norway spruce, and European larch. Only three hardwoods—black walnut, red oak, and hybrid poplar—have been planted to any extent, but their acreage is small compared to conifers. Plantations occur in every region of the state, with the largest area in the northern Lower Peninsula. Older plantations are being actively harvested for wood products, but planting continues, so this type will be an enduring feature of Michigan’s forested landscape.

Open Canopy Forest Types

Although not considered commercial forest types, small areas of open forests consisting of scattered or clumped trees—known as savannas or barrens—also occur in Michigan. They represent a transition between closed forests and prairies and are maintained by frequent disturbances, usually fire or grazing. Although they occupied more than 2 million acres in the state in the early 1800s, savannas are the rarest forest types in Michigan today. Because many savannas occupied fertile mesic habitats, they were long ago converted to agriculture. Many wet-mesic savanna habitats were drained or grew into closed forests. Urban development also claimed much of the area once occupied by open forests. Savanna communities in dry (xeric) habitats unsuitable for farming grew into closed forests when fire was excluded or when farmland was abandoned. Today state, federal, and private agencies are actively working to preserve or restore these unique communities, which can be classified as follows [see the field guide by Dickmann (2004), *Michigan Forest Communities*, for a complete description of these types]:

- **Southern lakeplain oak-hardwood openings** are very rare, occurring in lowland habitats near the shores of Lakes Erie and St. Clair and Saginaw Bay;
- **Southern oak barrens** are found in dry, sandy xeric habitats in the southern part of the state;
- **Northern pine and oak barrens** occur in dry, sandy xeric habitats in the northern part of the state;
- **Great Lakes barrens** are found in wide, sandy depressions between coastal sand dunes;
- **Alvar savannas** are rare communities growing on flat limestone or dolomitic bedrock close to the shores of the northern Great Lakes;
- **Pine stump plains** are found throughout northern Michigan and represent areas once densely forested that did not succeed back to trees following logging and wildfires.
Although savanna-barren communities are not a source of timber (except during restoration), they are important habitats for wildlife and savanna-prairie plants (some of them threatened or endangered) and represent unique ecological communities that should be maintained or restored.

**FOREST MANAGEMENT**

**Silvicultural Systems**

Silviculture is the art and science of tending and regenerating forest vegetation. A silvicultural system is a program of treatments that are prescribed to meet the forest owner’s objectives through the life of a forest. The premise underlying any silvicultural system is long-range sustainability, both of the forest itself and the production of goods and services from it. The silvicultural prescriptions that are part of any system may include harvesting or other treatments to promote tree growth and quality, alter species composition, reduce competition, create a certain stand structure or habitat, or regenerate a new stand, and they are specific to a particular stand of trees. Prescriptions may also recommend conversion of an existing stand to a different timber or vegetation type, or they may recommend that no treatments be made.

![Diagram](image)

**Figure 10. Developing a silvicultural prescription.**

The starting point for developing silvicultural prescriptions is the forest owner objectives, which can include timber sales, wildlife habitat, visual quality or recreational considerations, high biodiversity, protection of water, minimizing pest or disease damage, or production of forest commodities like fruits, nuts, greenery, or mushrooms. A professional forester can help refine these objectives by taking into account the
ecological characteristics of the stand and the site, any social or legal constraints that may exist (e.g., Best Management Practices for water quality protection or pesticide use regulations), and monetary factors, such as the need to generate income or budgetary limitations (Figure 10). Although prescriptions are developed on a stand-by-stand basis, a forest owner also must develop an understanding of how the stands in their ownership interact and how they relate to the surrounding landscape and other ownerships.

Once the objectives are set, the forester can work with the forest owner to implement them. If a timber harvest is planned, it is important to understand the roles of the forester and the logger. The forester is responsible for designing a forest plan, selecting the silvicultural system, planning for regeneration, determining the need for tending treatments, and arranging for the timber sale. The logger, on the other hand, is the person who does the harvesting of the trees in accord with the prescriptions developed by the forester and the forest owner.

Not all forests are managed. Not all timber harvests occur within the guidance a forest management plan. Timber harvest used to carry-out the objectives of a professionally guided plan promotes forest sustainability and increases the many values a forest owner might expect from their property. Decisions, or lack of them, have long-term impacts both ecologically and financially. Forest owners are encouraged to enlist the expertise of professional foresters when making decisions about their forests.

There are two basic silvicultural systems used in Michigan for management and regeneration of forest stands—even-aged and uneven-aged (also called all-aged). Under the even-aged system, stands consist of overstory trees of the same, or nearly the same, age. The uneven-aged system, by contrast, is applied in stands that contain trees of three or more different age classes. The choice depends on the ecology of the stand, its current structure, and the forest owner’s objectives. In some cases these systems require little silvicultural input and then nature, so to speak, does all the work. In other cases more intensive or specialized techniques may be necessary to regenerate commercially or ecologically valuable species such as yellow birch, hemlock, jack pine, white cedar, and oak or to create and sustain ecologically diverse communities. These techniques may include site preparation to reduce competition and prepare a mineral soil seedbed, prescribed fire, application of herbicides, and seeding or planting.
Even-Aged Systems

The even-aged system comprises three regeneration methods that represent a continuum of residual stand structures:

- Clearcutting
- Seed tree
- Shelterwood

Clearcutting (Figure 11) is the most common even-aged stand replacement method; it is most-often used to manage sun-loving, shade intolerant species, although under the right circumstances it will successfully regenerate almost any type of forest community. In this method, an entire commercially mature stand is removed in one harvest. Aspen, because of its inherent ability to sprout from the roots of harvested trees, is the classic example of a species that regenerates well by clearcutting. Often small patches or a few scattered trees are left on the site for reasons of visual quality, wildlife habitat, mast (animal food) production, or biodiversity. Many applications of this method are enhanced by site preparation and planting or seeding. In some cases, advanced regeneration of shade-tolerant species (e.g., sugar maple, balsam fir, and white pine) may have become established under the trees that are harvested, presenting some options in determining the composition of the new stand.

Figure 11. Clearcut (USFS)

Figure 12. Seed Tree
Seed tree (Figure 12) and shelterwood (Figure 13) are also called retention systems because some trees are left behind following a harvest of mature timber. In the seed tree method, nearly all of a commercially mature stand is removed in one cutting, except for a small number of trees that are left to provide seed for regenerating a new stand and, sometimes, for other purposes as well. Seed trees may be scattered, in small groups, or in narrow strips. Seed trees do not provide enough shade to have an effect on regeneration. Seed trees are often light-seeded, sun-loving species whose seed is dispersed by the wind. Species that are more vulnerable to windthrow or wind breakage are not used as seed trees.

Shelterwood is the most complicated of the even-aged systems and is an extension of the seed tree method. This method regenerates a new stand under the cover of a partial canopy called a shelterwood or overstory. The idea behind a shelterwood is that most tree species regenerate better in light-to-moderate shade, which provides a cooler, moister environment, and the canopy of the overstory protects young seedlings from frost. This system is particularly useful for heavy-seeded species (like oaks) or on harsh, droughty sites where regeneration following clearcutting can be problematic, but it can be successfully applied to almost any forest type. The shelterwood method involves two or more timber harvests: the first removes one-third to two-thirds of the mature trees, then when a young stand has regenerated and is well established the overstory is removed in another harvest. Sometimes part or all of the overstory is retained to create a more complex, two-aged stand structure and to grow larger trees. The new even-aged stand produced by this method can originate from seedlings, sprouts, or advance regeneration already established before the first harvest is done, depending on the species present and the ecology of the stand.
Uneven-Aged Systems

The uneven-aged system uses the selection method of harvesting (Figure 14), which favors tree species that thrive in moderate to moderately-heavy shade. It is the most complex system and should be implemented by a professional forester. There are two basic variations. Single tree selection removes scattered individual trees or small groups of two or three trees, creating small gaps in the overstory canopy that favor regeneration of shade tolerant tree species. Group selection, on the other hand, creates larger gaps by harvesting all trees in a one-quarter to one-half acre area, which can allow shade mid-tolerant species like yellow birch, basswood, or white pine to become established. Natural regeneration in the gaps may already be present as advance seedling regeneration or can occur from fresh seed fall. In northern hardwood management, however, advanced regeneration in the form of saplings and small poles should be cut because their poor growth potential and common deformities.

The successful application of this method depends on the condition and composition of the stand. It works best if a stand has at least three age or size (trunk diameter) classes or, better still, contains trees of all age classes, from seedlings to mature sawtimber. But the key to uneven-aged management is what is left behind in the residual stand after harvest. Trees to be cut should be individually selected from throughout all merchantable size classes so as to maintain or enhance the uneven-aged structure. It is also important not to cut too heavily in the largest diameter classes at any one time. If these principles are carefully followed, harvests can occur within the stand at regular time intervals of 10 to 15 years, called cutting cycles. The beauty of this method is that high-quality saw and veneer logs can be periodically harvested and generate income, yet the forest is retained. The selection system is the preferred
management method for high quality northern hardwoods, where sugar maple is the major species, but it also works well in spruce-fir stands.

Selection of individual trees in a stand for retention or harvest is based on the species, quality, biodiversity concerns, wildlife habitat or mast production, and diameter class distribution. Selection system harvesting should concentrate on age classes or tree diameter ranges that are too dense for optimum growth and on trees that will not be in good condition at the end of the cutting cycle in 10-15 years. Trees marked for harvest should, by their removal, allow better quality, more vigorous trees to grow and use their growing space. The goal is to leave a distribution or mix of tree sizes that maintains the stand in an uneven-aged condition. Usually adequate regeneration occurs under this system, but spot

<table>
<thead>
<tr>
<th>EXAMPLES OF INAPPROPRIATE HARDWOOD MANAGEMENT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High-grading—harvesting all the mature, high-quality trees and leaving the unmerchantable, poor-quality, and undesirable trees to grow, with no regard for long-term sustainability.</td>
</tr>
<tr>
<td>• Diameter limit cutting—cutting all merchantable trees down to a specified stem diameter (usually 12 or 14 inches). This practice destroys the uneven-aged structure of a forest stand and leaves behind a battered forest of young, often poor-quality trees.</td>
</tr>
</tbody>
</table>

In addition to the immediate detrimental ecological and visual effects of the above practices, the regeneration potential of the residual stand is severely degraded by removing the largest trees of the most valuable species. These are the trees that would have produced large quantities of superior seed.

scarification (exposing mineral soil) or planting can be used to increase species diversity or increase the regeneration of commercially valuable species.
The uneven-aged system works best in stands that already have many or at least three age or diameter classes. In many cases, stands of tree species that can be managed by the uneven-aged system were converted to an even-aged structure through past cutting, fires, grazing, or other disturbances. Such stands can be managed using one of the even-aged systems. However, development of a diverse, uneven-aged structure can be fostered through careful thinning favoring potential crop and wildlife trees to increase diameter growth rates and development of advance regeneration, although this will still take many decades.

**Intermediate Treatments**

Several cultivating treatments (operations carried out during the life of a stand but before final timber harvest) may be prescribed in even-aged silvicultural systems to accomplish certain objectives. In young stands, thinning of dense regeneration and release of desired species from unwanted plant competition are applied to give the best trees more growing space and reduce the time needed to grow crop trees to a desired size. However, these treatments are a cost to the forest owner and are not always performed, despite their silvicultural benefit and the greater value they give to the final crop.

On the other hand, commercial thinning (the removal and sale of merchantable trees) is beneficial in all respects, usually associated with uneven-aged silvicultural systems. In Michigan commercial thinning should be performed whenever stands of intermediate-age are too dense and enough marketable trees can be cut to make the operation profitable. Thinning to proper densities by removing poorer quality tree stems and non-commercial timber species frees the best trees from competition and allows them to grow faster in diameter. Thinning can be performed in any forest type that grows in Michigan, although it is seldom done in aspen or jack pine stands.

Pruning is the removal of living and dead limbs from the main stem of potential high-value crop trees. A tree properly pruned by cutting branches flush with the stem will produce knot-free wood once the wound heals over. Pruning also produces a more visually pleasing forest, for some people, and improves safety and access. Pruning is a good investment when knot-free logs bring a premium price; e.g., with white pine, red oak, black cherry, or black walnut.

Prescribed fire is a useful silvicultural tool that simulates a natural ecological process. When fire is used as a tending operation in established, intermediate-aged or mature stands, it can reduce accumulation of fuels to lessen the chance of a destructive wildfire, improve wildlife habitat, discourage unwanted shrub or tree species,
increase plant and animal biodiversity, reduce certain insects and diseases, and stimulate regeneration of favored trees. In Michigan, this type of prescribed fire is used in management of red pine stands or in oak and pine-oak savannas. Prescribed fire can also be used following a harvest of mature timber - principally clearcutting - to consume heavy accumulations of slash (residue following a timber sale) and prepare the site for natural seeding or planting.

Regeneration and Reforestation

Regenerating the forest after harvest is a necessary part of sustainable forest management. Regeneration is accomplished either by natural or artificial means.

Natural regeneration methods
Properly harvested, many tree species regenerate themselves either by root suckering (e.g. aspen), stump sprouting (e.g. red maple, paper birch, oak), or seeding (e.g. northern hardwoods, oak). Several conifers (e.g. spruce, balsam fir, white pine, cedar, hemlock, and tamarack) also regenerate naturally from seed. The vast majority of trees in Michigan are regenerated naturally. Cedar and hemlock are slow-growing and are preferred browse species for deer, and as a result, natural regeneration of these species is usually only successful where deer populations are low. Where deer populations are high, natural regeneration of other species, particularly in oak and northern hardwood stands, may also be threatened. To assess local deer impacts on regeneration, it is a good idea to observe regeneration and browse conditions in nearby stands harvested within the last five to ten years. Deer browsing can substantially alter the tree composition and other aspects of the future forest.

Artificial regeneration methods
Red pine and jack pine are commonly regenerated by planting seedlings. Proper site preparation and planting methods must be followed to minimize seedling mortality. To prepare a site for planting, competing vegetation must be controlled and slash, e.g. logging residue, reduced to improve conditions for seedling survival and to make the planting job easier. Common methods of site preparation include herbicides (which kills vegetation but doesn’t reduce the slash), furrowing, and patch scarification (exposing mineral soil). Patch scarification removes the sod layer from approximately a 2 foot square area which is critical before planting. Even light sod will create problems for young seedlings competing for moisture and nutrients, especially on drier sites. The proper method of planting includes making sure the seedling is inserted
into the planting hole with the root collar at the soil surface and with its roots straight down, not twisted to the side or folded (J-rooted). After the seedling is properly placed, the hole must be completely closed with firm pressure from the foot or heel. All air space in the root area must be closed or the roots will dry out. During the few years after planting, competing vegetation may need to be controlled in order to minimize seedling mortality.

Selection of species, type of planting stock, and spacing is dependent upon the owner’s objective(s) and site conditions. The forest owner is always wise to select species and methods which are suited to the local soil and climate. When mixing species on a planting site, be certain that they have similar growing requirements and are compatible with each other. Contact a forester for more detailed recommendations and guidance.

Red pine can be regenerated from seed using a shelterwood system and scarification but the risk of failure is higher. Seed production is quite variable from year to year and mature red pine standing over young seedlings may harbor a damaging fungus (*Diplodia*) that can harm or kill young seedlings. Jack pine may be successfully regenerated from seed in the cones left after harvest. To accomplish this, slash must be uniformly distributed across the site. Scarification from logging activity is seldom adequate, so additional scarification using anchor chains or roller chopping is necessary to prepare a mineral soil seedbed. Regeneration attempts that do not include a scarification treatment rarely succeed in jack pine stands.

**Harvesting Methods**

Timber harvesting, or logging, is the process of cutting and removing trees from the woods. The three major types of harvesting methods used in Michigan are shortwood, tree length, and whole-tree methods. Improper logging or the improper logger can seriously damage a stand, which will have long-lasting effects and undo years of careful management. Appropriate skidding (moving of a tree from the stump to a roadside landing) and harvesting equipment for the job, operated by an experienced and conscientious crew, will minimize the amount of damage done to the soil and remaining trees.

The **shortwood harvesting method** involves the conversion of trees into desired length products at the stump, either by chain saws or by using a mechanized processor which fells,
delimbs, and bucks the tree into sawlogs, pulpwood sticks, or other products. The individual pieces are then transported to the landing with a forwarder. In some cases the tops of the trees are transported to the landing by the forwarder and then processed. The shortwood method is used mainly with partial stand removal, such as thinning a stand and single-tree selection silviculture. It may also be used in clearcutting operations in some parts of the state. Under the uneven-aged silvicultural system where a high quality residual stand is essential, the shortwood method may be preferred.

The **tree-length harvesting method** involves felling, deliming, and topping trees in the woods and the transporting the tree lengths to the landing. The tree lengths are bucked into logs and/or sticks at the landing. In some instances, the tree lengths are hauled to a mill site for processing.

The **whole-tree harvesting method** involves transporting the entire felled tree to the landing for processing. It’s usually used in clearcutting operations and can be used to scarify (expose mineral soil) sites to encourage regeneration of some species. Applications in Michigan include whole-tree chipping operations, as well as systems built around processors which delimb the whole tree and cut them into desired length products at the landing. One advantage of the whole-tree method is that it can utilize the entire biomass of a tree, as is true for whole-tree chipping operations. Whole-tree harvesting presents the greatest potential for damage to the residual stand. The main advantage of the whole-tree harvesting operation is that it generally leaves the harvest site cleaner than any other harvesting method; therefore it is visually more pleasing. In operations where the limbs are not used, whole-tree harvesting concentrates slash at landings or in piles throughout the harvest area.

Setting up a harvest usually consists of establishing the outside perimeter of the area to be harvested. Ribbons are hung or trees are spot-painted to identify the boundary of the harvest area. Often the perimeter of the harvest will closely follow property lines. After the harvest area is set up, trees to be removed are identified. There are several ways trees are designated for harvest, depending on the type of timber. During selection cuts, the trees to be removed are often identified by spot-painting on the stem and on the stump. After the marked trees are harvested, stumps can be checked for paint to insure that the correct trees were removed. In plantations undergoing the first harvest, individual rows of trees are often marked for removal. In subsequent harvests, trees within rows are marked as in a selection harvest. Other times certain species of trees are designated to be removed.
Regardless of the method used to identify the trees to be harvested, it is important that the logger knows which trees to cut and the forest owner (or their forester) can check on the logger after the trees have been removed.

REGARDLESS OF THE HARVESTING SYSTEM EMPLOYED, SEVERAL IMPORTANT POINTS ARE NOTEWORTHY FOR SUCCESSFUL APPLICATION ON THE LANDSCAPE:

- Tailor the harvesting method and the silvicultural system to the landowner's objectives.
- Design the harvesting method with the visual quality of the area in mind (e.g. slash, landing location, etc.).
- Consider seasonal issues, e.g. drought, spring sap flow, road restrictions, etc.
- The harvesting operation should be conducted by well-trained, skilled operators who are reputable and conscientious. Do not be afraid to ask for references.
- The tree-length and whole-tree harvesting methods require larger landings than the shortwood method. In addition, the whole-tree chipping operation will generally require better access roads.
- Use bids to obtain the highest prices, or employ the services of a professional forester to set-up and administer a timber sale.

Special consideration needs to be given when harvesting on certain sites, such as steep slopes, highly erodible soils, where windthrow hazards are high, or near water courses. Best management practices (BMPs) help address road layout in various situations in order to protect soil and water resources.
SPECIAL MANAGEMENT CONSIDERATIONS

Forest Protection

Overall, Michigan's forests are healthy and productive. However, forests experience periods of stress and decline. Stress is caused by factors such as fire, drought, storms, late spring frosts, diseases, insects, and the advanced age of some especially shade intolerant forest types. These forests are most commonly even-aged with trees reaching maturity about the same time. Shade intolerant trees like aspen, northern pin oak, balsam fir, and jack pine do not live as long as shade tolerant trees and are more easily stressed once they reach maturity. Such trees most often mature around 50-70 years of age. Site conditions such as soil texture and moisture availability affect tree vigor and the tree’s response to biotic limiting factors (e.g. periodic defoliation). Declines, mortality, and/or fire hazard are an integral part of the ecology of Michigan's shade intolerant, forest types. Declines caused by periodic stresses, especially periods of drought, play a significant role in shaping Michigan's forests. Recognizing, understanding, and working with these, and other limiting natural processes and events, is an integral part of forest resource management.

Wildfire is a major concern in a forested landscape. Spring and fall are usually the periods of highest hazard due to the cured leaves, grass, and other vegetation that have accumulated from the previous growing season. Summer droughts can also be a time when serious wildfires may threaten the forest resource and interspersed homes. Increased numbers of people living in wildlands, along with diverse and increasing recreational use in the forest, have increased the risk of wildfire. Things to consider that could reduce the hazard of wildfire are limiting access to the area, establishing fuel breaks, reducing fuel (such as logging slash), and making users aware of fire danger.

The use of prescribed burning as a silvicultural treatment is a valuable tool in the management and regeneration of several tree species, particularly jack and red pine. Wildlife habitat, endangered species, and rare ecosystems may also be enhanced by the use of prescribed burning. There are definite hazards to prescribed burning. Prevention of escape requires special planning and preparation by experienced personnel.

More homes and housing developments in forested areas have added a new dimension to fire protection and the use of fire as a management
Homeowners can reduce the risk of wildfire through the use of Firewise landscaping techniques. Information on the Firewise program is available on the Internet or from Michigan State University (MSU) Extension. Communities may want to consider developing Community Wildfire Protection Plans to reduce local risks. This is a collaborative process to reduce the risk of fire on neighboring public and private land. Contact the adjacent state or Federal land managing agency, which in Michigan could be the Bureau of Indian Affairs, USDA Fish and Wildlife Service, National Park Service, USDA Forest Service, or the Michigan DNR for additional information.

**Forest Health**

Tree health and forest health are different things. A healthy tree is vigorous and disease free but not all trees in a forest should be healthy to have a healthy forest. A healthy forest supports many different life forms, some of which require components of dead, dying, and decaying trees.

Definitions of forest health closely reflect the values and beliefs of the observer. To one person, a vigorously growing forest producing a renewable timber resource is ideal. To another, the presence of specific habitats for wildlife species is paramount. Yet, another person would say that "letting nature take its course" is the ultimate in forest health.

A forest resource manager must balance resource demands based on a wide array of forest values. This requires an understanding and appreciation of all values, ability to compromise, a comprehensive inventory of the forest resource, and knowledge of limiting factors. A limiting factor is defined as a biotic or abiotic agent that has a negative influence on forest health and vigor of trees. Among the many limiting factors that affect the diversity, productivity, and vitality of Michigan’s forests are native and non-native insects and diseases, invasive plant species, and deer browsing; as well as abiotic stressors such as prolonged drought and poor soils. There are complex interactions within and between both biotic and abiotic limiting factors.

The most common biotic limiting factors are native insects and diseases which are components of natural ecological processes that periodically kill weakened trees. However, due to an expanding global economy, there is an ever-present threat of introducing new invasive plants,
diseases, insects, and other animals. Non-native species have not evolved with and are not integral parts of native ecosystems. Consequently, many have no native biological controls to keep their populations in-check within the ecosystems that they invade. Non-native pests can cause new, and sometimes devastating, effects that disrupt natural ecological functions and processes and have major ecological consequences on the composition and health of native forest communities. Well known examples of invasive species include Dutch elm disease and chestnut blight which greatly reduced the number of American elm and American chestnut trees, respectively. More recently introduced invasive species include the emerald ash borer, beech bark disease, oak wilt, and the hemlock woolly adelgid.

Once an exotic agent like the emerald ash borer or oak wilt begins killing trees, they can be moved to new, sometimes very distant areas in firewood, nursery stock, or other wood products produced from infested trees. The responsible use and movement of firewood is currently the focus of public education and outreach. State and federal regulations are one way to reduce the introduction and spread of exotic pests in our forests.

Forest health information is available from forest resource managers and forest health specialists with the Michigan Department of Natural Resources and MSU Extension.

**Wildlife Habitat**

Wildlife is an integral part of forest ecosystems. Species composition, population dynamics, and corresponding habitat requirements are folded into a complicated web of scientific, economic, and social factors. The diversity of vegetation provided by various silvicultural practices provides habitat required by numerous wildlife species. Therefore, sound forest management practices are a key to managing wildlife. The implementation of various management strategies, such as even-aged and uneven-aged silvicultural techniques, or simply no active management, provides a variety of stand ages, tree sizes, and plant compositions. Within a stand, habitat quality is determined by size, shape, distribution, and species composition. Size, timing, shape, and juxtaposition of timber harvesting can be critical for maintaining selected wildlife species or a diversity of species.

Maintaining a diversity of tree species within and among stands provides an important role in maintaining the biodiversity associated with forest ecosystems. Michigan has nearly 600 species of birds, fish, mammals, amphibians, and reptiles that live or visit the state. Most of these depend
upon forests for at least one aspect of their life cycle. Additionally, there are thousands of invertebrate species and other life forms.

Forest owners should seek to balance their species goals and expectations for population levels with the ability of the property to provide quality habitats. It is also important to take into account the surrounding land types and uses to assure there is no conflict with neighboring property goals and expectations and, perhaps, to identify opportunities for collaboration and cooperation.

To increase the beneficial effects of forest management for wildlife, it is important for forest owners to consider and provide the specific food, cover and reproductive conditions for the wildlife they are interested in featuring on their property. These requirements should be addressed when developing a forest management plan. It is important to note though, that management for one species will produce unfavorable conditions for other species. The following sections describe habitat elements to consider when managing your forest for wildlife.

SOME RULES OF THUMB TO REMEMBER WHEN PLANTING TREES, TREATING TREES, OR SELECTING TREES TO LEAVE ON YOUR PROPERTY:

- Limiting factors which affect the growth and survival of selected tree species include soil, weather extremes, insects, diseases, and animal browsing.
- Soil requirements: consider soil texture, soil moisture, and fertility. Obtain a soil analysis.
- Site requirements: consider shade tolerance, wind tolerance, salt tolerance if along a salted road (most conifers are very susceptible to salt injury).
- How successful has this tree species been in neighboring areas on similar sites?
- Before deciding to treat an insect or disease problem, evaluate whether treatment is really needed for the health of the forest and if treatment alternatives are cost effective. Biological pesticides can be used if they are available, economic, and effective.
- Healthy and vigorous trees can usually withstand some periods of short-term stress. Before deciding to remove trees due to forest health concerns, consult a forest resource professional.
Forest Edge

Edge is the margin between different habitats. Whenever two habitats come together, the edge will be more favorable to more wildlife species than either type alone. Edge is directly related to diversity. The more edge that is available, the more diverse the habitats, even within a single-type timber stand. The distribution of habitat components within the landscape is usually more important for wildlife than the amount of any one habitat component. Edge makes food, cover, and water available in a much smaller area, thus reducing an animal’s need for long movements to meet its daily survival needs. Natural resource managers create more edge in forests by developing a diversity of age classes in a forest type, converting a forest type by planting a new tree species, or cutting back forest borders around fields, food plots, roads, and trails.

Other wildlife species, however, are less likely to utilize edge habitats, such as ovenbirds, pine martens, saw-whet owls, and red-backed salamanders. These species do better in larger tracts of a forest type, often composed of similar forest types. Therefore, forest owner species preference and land capability should be evaluated prior to prescribing any silvicultural practice.

Planting, Seeding, and Fertilizing

In many forest areas, one critical habitat often lacking is open area. These areas provide sites for nesting and rearing of young for many forest birds and mammals. Existing open areas can be enhanced by planting, seeding, and/or fertilizing. Landings from logging, and other open or disturbed areas, may be seeded with perennial grasses. Shrub species may also be planted that provide additional food and/or cover. When considering planting or seeding to enhance habitat, forest owners are encouraged to use native plant species that are well-adapted to the site conditions and climate.

Application of fertilizer to enhance plant growth should always be used with caution. The application of additional nutrients may make plants more attractive to herbivores (e.g. deer, rabbits, squirrels). The added browsing by these species may make it difficult to establish plantings. The application of fertilizer may also adversely affect the soil for plant species (and associated wildlife) that are adapted to nutrient-poor sites. Consider consulting a professional wildlife biologist before planting, seeding, or fertilization projects are undertaken.
Snags and Dead and Downed Woody Material
When developing a forest management plan consider leaving some snags and downed woody material. Snags are the dead, standing trees that typically make up approximately 5% to 10% of a forest. Snags provide habitat for species including woodpeckers, squirrels, and raccoons. Decaying logs, stumps, and tree tops also provide benefits when left on the forest floor, although they may also be visually displeasing to some people. Besides providing habitat for many mammals, birds, reptiles and amphibians, the decaying plant material returns nutrients to the soil and provides regeneration sites for certain trees and plants. Treetops and other logging slash can also provide seedling protection from browsing animals.

Mast Producing Trees
Seeds produced by mature trees provide a food source for wildlife. These seeds are referred to as “mast”. Trees which consistently produce mast are valuable forest components for many wildlife species. Maintaining a variety of hard mast (e.g. acorns) and soft mast (e.g. berries) trees will assure year round food sources for many small mammals and birds that have small home ranges. In timber stands containing hard mast producing trees, consideration should be made to ensure a multi-aged distribution of trees to provide mast well into the future. When determining which mast trees should be retained in a forest stand, consider leaving and/or releasing trees with large crowns for mast production. Doing so is usually a trade-off between high quality timber production and large crowned trees which provide high quality wildlife food.

Soft mast is an important food source for many species of wildlife but is available for a relatively short duration. Most species produce at varying times, so collectively they are available throughout most of the growing season. Soft mast production is also affected by the amount of canopy in the stand. Improved soft mast production can be increased by opening up the canopy and providing openings where these plants can grow.

Conifer Cover
Both upland and lowland conifer stands are valuable components for many species. The micro-climate on the forest floor beneath these stands often provides habitat for many plant and wildlife species. Rare plant species can often be found in these environments. Mature stands of northern white cedar and eastern hemlock provide winter cover for white-tailed deer and are important year-round nesting and escape
habitat for other wildlife species, such as songbirds. Small inclusions of conifers in hardwood stands can also increase the use of these stands by wildlife species.

**Aspen**
Plants associated with the aspen forest provide a variety of food and cover needed by many wildlife species. Because it is a pioneer forest species, aspen can build nutrients into soil, making the site more beneficial to other plants. Maintenance of this important forest type is important since the area of aspen stands, and the plants associated with them, have decreased across the Michigan landscape. The maintenance of various age classes of aspen and other deciduous species, especially near conifer cover, is important as a wildlife food source. For many bird species, these dense, regenerating stands provide food during the winter as well as dense nesting, hiding, and brood cover during the spring and summer.

**Vernal Ponds, Small Ponds, Natural Seeps, and Springs**
Within many forest stands, there are natural springs or seeps. These conditions provide special micro-habitats for some plants. These areas can also provide habitat components for a variety of wildlife including salamanders, frogs, and several forest birds. Protection of these areas should be considered in your forest management plan. Vernal ponds are those that typically occur only in the spring.

**Roads and Trails**
When completing a timber harvest, consider closing roads to vehicles until the next timber harvest is scheduled. Reducing vehicle access can reduce disturbance to forest dwelling wildlife and lessen the risk of introducing invasive species.

**Diverse Forest Conditions**
Maintaining a wide range of age classes and stand sizes across all of Michigan's forest habitat types is important for maintaining biodiversity. Some wildlife species, such as ruffed grouse, require relatively young trees (as well as older ones) while other species (woodpeckers and other cavity nesting birds and black bears) require older trees to meet some of their habitat needs. In providing these habitat conditions, natural resource managers should attempt to use timber harvest regimes that emulate natural disturbance patterns.

Because of the diversity of forest habitat types throughout Michigan, there are many rare, endangered, and threatened species of plants, insects, reptiles, amphibians, birds, and mammals. Forest owners should be aware that these species exist, and striving to help maintain Michigan's diverse habitat conditions will help conserve these species.
Deer in the Forest
As foresters in Michigan strive to maintain forests to provide healthy forests and a variety of wildlife habitat, forest owners should be aware of the impacts of too many deer in the landscape. Studies of high deer populations have repeatedly shown adverse affects on forest environments, reduced species diversity, elimination of tree regeneration, contribution to excessive car-deer collisions, and the loss of billions of dollars from damage to home landscapes and agriculture.

While many forest owners desire to manage for deer, other species and forest health should also be considered. Although anecdotes and traditions abound, a forest owner is best served by objectively examining the body of forest management science, especially as it relates to wildlife habitat.

The field experience of many private and agency foresters indicates that excessive deer browse has adversely affected forests in many parts of Michigan. Deer population and habitat condition data, and research from Michigan and elsewhere, indicate that these large deer populations threaten habitat sustainability. In some areas, deer overabundance, through reduced forest reproduction, could affect the forest certification status of both public and private forestlands (see the forest certification section). Many issues of habitat management, deer management, and natural resource management are highly contentious. Michigan is not alone in this situation. The stakes for current and future generations are potentially high. Making forest management decisions to best assure future forest diversity will require the finest resources which biological, social, and economic sciences can offer.

Objectives of Adjacent Landowners
Forest owners should investigate wildlife habitat conditions and landowner objectives for adjacent lands. Many wildlife species are dependent on habitat conditions across large land areas. Coordinating forest management practices among multiple forest owners will enhance the types of wildlife habitat that can be provided across the state. There are many local and statewide organizations interested in restoring/maintaining habitat for certain wildlife species. A forest owner may consult these groups for opportunities to participate in land management partnerships to affect a larger area than their own property.
Scenic and Recreation Values

Maintaining or improving the scenic quality of the forest is often an important objective for private forest owners, particularly near roads. A variety of scenic management objectives may be accommodated by modifying activities prescribed in special areas within the overall ownership. Special recreation management objectives may also be incorporated with scenic management efforts in forest management plans.

Although private forest management programs are rarely intended to provide for the full range of recreational uses that are present in a public forest, private forest owners often wish to incorporate hunting and hiking opportunities and, occasionally, camping or picnicking. Forest owners who wish to make special efforts to promote scenic or recreational objectives should consider the following suggestions in consultation with a professional forester.

- The design and layout of access roads should be considered in conjunction with recreational and scenic objectives. Access roads may be designed to provide for permanent recreational driving access, for future use as foot trails or ORV trails, or they may be designed to be abandoned and re-vegetated after the cutting activity is completed.
- The modification of the normal harvest prescription may include eliminating clearcuts near roads or modifying the edges of clearcuts to blend with the landscape. Thinning may be modified to emphasize big tree character or clearcuts may be introduced where they would not normally be used in order to create scenic vistas.
- Avoid or modify cutting activity where unique natural features such as rocky bluffs, sand dunes, or groups of unusual trees are located.
Special Natural and Cultural Resources

Forests are more than just places where trees grow; they are places with many characteristics. Sometimes they are places where people live now. Sometimes they are places where people lived 100 or 1,000 or 10,000 years ago. Some forests are places with unusual geology or soils and they are places where rare plant communities or rare animals may live. Forest owners whose property contains special natural and cultural resources may have a legal responsibility to protect and preserve them.

Archaeological sites contain physical remains of almost 15,000 years of human occupation in the state. Written records cover only about two percent of our history. The rest must be gleaned from oral history and physical traces left by Michigan's earlier inhabitants. Cultural resources provide us with a link to understanding our own past, whether they are historic sites of old logging camps and homesteads, or prehistoric sites which remind us that, for centuries, people have been choosing the same places to live, work, and play. These sites contain important, irreplaceable information and sometimes artifacts of prior human activity and cultures.

Michigan’s forests are also home to a wide variety of plants and animals, some of which are rare or threatened by human activities. For example, if a forest is home to the endangered smallmouth salamander, the threatened bald eagle, or one of the rare moonworts; a forest owner may want to take these habitat needs under consideration when developing a management plan. Rare plants and animals are often restricted to certain microhabitats: the salamander, a vernal pool; the eagle, a large white pine near a lake; the moonwort, a sandy dune area. The significance of a particular kind of community in providing a species niche should not be overlooked when developing management plans. This often involves looking beyond a single property or stand of trees to a wider landscape level. It involves considering the actions of many forest owners, providing wildlife corridors, migratory stopovers, various sizes of forest patches, and the impact of invasive species on native communities. Forest owners and managers should be aware of cumulative impacts on rare species and communities. Individually, the loss may seem small, but over time and throughout its range, small losses of a species or community can add up to a significant impact.

Soil disturbing activities, such as the use of heavy equipment to cut trees and brush, build roads, and pull out stumps should be avoided in suspected sensitive areas until consultation is made with individuals trained in recognizing the special characteristics associated with special
natural or archaeological sites. Forest owners and managers who may have special natural resources are encouraged to contact the Michigan Natural Features Inventory (MNFI) to discuss their resources and management options. The mission of the MNFI is to deliver the highest quality information that contributes to the conservation of biodiversity, especially rare and declining plants and animals, and the diversity of ecosystems native to Michigan. Forest owners with potential archeological resources may also wish to contact the Office of the State Archaeologist (OSA). The OSA records, investigates, interprets, and protects Michigan’s archaeological sites.

Legal responsibility for special natural resources can be found in both the Federal Endangered Species Act and the Michigan Natural Resources and Environmental Protection Act (Public Act 451).

**Road Construction and Maintenance**

Properly planned, constructed, and maintained roads are an asset to forest properties for many uses. Access is necessary for harvest, regeneration, protection, other management activities, and recreational uses of forest land. On occasion, excluding access is also appropriate when objectives such as protecting sensitive areas or maintaining semi-primitive and wilderness areas are important concerns. However, improperly constructed roads have the potential for negative impact on biological and physical components of forest ecosystems.

Access roads should be carefully laid out before construction. Tools such as aerial photographs, soil surveys, and topographic maps should be consulted to help in locating roads away from sensitive areas. Objectives of forest land ownership, frequency of access, types of vehicles to be used, and the relative ease of road building under existing conditions of soil, terrain, and finances should all be considered when planning a permanent road system. Professional assistance is often required since improper location, design, and construction of roads is the greatest source of soil erosion on forest lands. Permits may be needed for long distance haul roads or for roads that are constructed within 500 feet of a lake or stream (Public Act 451, Part 91).

Roads should be adequately designed to accommodate the type of use they will receive. Main access routes and haul roads should be ditched and sloped to provide for adequate drainage. They should be graveled under most conditions. Use of geotextile cloth and other erosion control products are also very useful in constructing durable, serviceable roads. Secondary and temporary roads can be narrower and seeded to native herbaceous cover after use
in order to prevent erosion and to provide food for wildlife. Roads over wet soils should be limited to the shortest length possible, re-routed to upland areas, or developed for use only when frozen.

Stream crossings require bridges or culverts of a size sufficient to handle stream flow especially during the spring thaw and normal floods. Temporary and permanent stream crossing permits are required under Public Act 451, Part 301. Contact the Michigan DEQ for permitting information as part of the planning process whenever a stream must be crossed. Roadside slopes and ditches leading to stream crossings must be carefully located and designed in order to prevent stream sedimentation. Specifications for the bridge or culvert, ditches, and roadsides are required in the stream crossing permit application package.

Water quality Best Management Practices (BMPs) should be applied to all road construction projects. The Michigan DEQ “Sustainable Soil and Water Quality Practices on Forest Land” manual should be used as a guide for road design and construction. This is available on the Internet.

Road maintenance is important in order to minimize erosion and the expense of reconstruction. A well-designed and well-maintained road system will serve optimal forest use at minimal cost with minimal environmental damage. Other points to consider are to do as much road work in advance to allow roadbeds time to settle and avoid use of roads when soils are wet.

**Intergenerational Land Transfer**

For thousands of Michigan citizens, forest land ownership is considered a valuable asset beyond its timber supply. These lands are used extensively for hunting, fishing, birding, and other recreational pursuits. According to a survey of Michigan’s family forest owners conducted by researchers at Michigan State University, about 70% of landowners considered passing their land on to their children or other heirs to be very or somewhat important to them. The latest National Woodland Owner Survey also found that over 60% of forest owners are older than 55 years of age. This suggests that a large portion of family forest lands will transfer ownership in the next two decades. Although most offspring expect to inherit the family’s forest land, less than half are interested in actively managing those forests. They may also not be prepared for the unforeseen expenses of this family land, or the potential financial emergencies that may lead them to sell it off for immediate cash needs.
To avert the parcelization and fragmentation that these land “disposals” create—not to mention the loss of a family heritage—aging forest owners must be able to articulate their desires to family members, and plan for the inevitable legal and financial events that come with ownership transfers. Talking about what should happen upon a parent’s death is a very difficult conversation to have. Taking small steps toward family forest succession planning can help ease the process.

A first step in this process should be to construct a property overview that includes the latest forest management plan. This overview should contain the legal and financial descriptions of the property, and a history of any timber sales or other management activity that has taken place on the land. An appraisal of the property’s fair market value should also be included. If this hasn’t been done for some time, it may be surprising to discover how a property can increase in value. An heir can potentially inherit his/her parents’ land and end up facing steep inheritance taxes based on the market value of the land. Knowing the land’s value and financial history before such a transfer can help parent owners and their offspring plan accordingly.

Another important step includes discussing the personal values each family member has for their forest land. Oregon State University Extension describes an “Heirloom Scale” that helps owners articulate their personal value of the forest property. The scale ranges from 1 to 10, where a 1 represents a relatively low heritage value toward the property, and a 10 represents the other extreme—the owner feels the property should be protected and remains in forested conditions at all costs. This simple tool can help spouses and other family members begin the conversation about their shared and individual interests in the family forest.

Current owners of the family forest should also discuss and document their long- and short-term goals for the property. What do they want to see happen in the next 10, 20, and 30 years? What challenges could stand in the way? What are immediate goals?

Children of forest owners may not seem particularly interested in acquiring the property. This may be due to several factors, such as a reluctance to talk about their parents’ mortality, or guilt about wanting the property for themselves. The conversation can begin by sharing their passion for the land and using the Heirloom Scale and goal outline as a starting point. Perhaps there is one child who seems to express a special interest—he or she can then be “groomed” for leadership on the property by passing on the parents’ knowledge and experience to him/her. If none of an owner’s children seem interested, perhaps there are grandchildren with whom that passion can be shared.
Forest owners can also create a legal structure for ownership, and invite their children to participate. There are currently three main types of ownership structures that can be applied to forest ownerships: a family partnership, a closely held ‘S’ corporation, and a limited liability company (LLC). For more details on these options, consult an attorney who knows how to plan for woodlands as part of an estate.

Although using one of these legal structures can help transfer ownership to children after parents have died, it does not address the potential increase in tax burdens many face when inheriting property. If this is a concern, establishing some form of land trust or easement as part of the legal structure may be of value. These easements can alter the assessed value of the land, thus making the tax burden lower in many cases. Many forest owners are leery of these easements in part because there is the misperception that they would no longer be able to actively manage their forest land. But an easement can be specified in any way the forest owner wishes, allowing for continued management. The legitimate concern is that these easements are made in perpetuity, which will ultimately limit what a forest owner’s heirs can do with the property in the future.

As with forest management and planning, any of these legal activities related to ownership and structure should not be pursued without professional advice. In addition to an attorney, a forest owner should also have an accountant that is familiar with forest income and tax liabilities, as well as a forestry consultant who can work with the rest of the legal “team” members. All of this planning requires money, but will be well worth the investment if a family’s forest lands are to be maintained as a valuable part of its heritage.

**Taxation**

Forest owners pay property tax on their land. While specific taxation information changes regularly and consulting a qualified tax preparer is strongly recommended, there are some basic ideas that can help sort out some of the issues. In Michigan, there are two forest management programs that reduce private property taxes in exchange for timber management. Both require an approved forest management plan and have additional eligibility requirements. Both have penalties for withdrawal. Each should be considered carefully before entering the program. The Commercial Forest program offers the largest tax reduction but the property must be open to the public for hunting and fishing – foot access only. The Qualified Forest Property program allows owners to exclude the public but does not have as large a tax reduction.
Taxation on timber sale income is sometimes not considered when scheduling a timber sale. The federal Internal Revenue Service (IRS) has special rules that allow some potentially substantial reductions in gross income. A portion of the original purchase price (timber basis) of just the timber can be deducted (timber depletion). Also, many timber sales are eligible for treatment under capital gains rules, which is more favorable than ordinary income. Lastly, many out-of-pocket expenses can be deducted from the timber sale. Again, consulting a qualified tax preparer is strongly recommended.

A number of government cost-share programs are available to forest owners. Enrolling in one or more these programs may have impacts on income taxes. Costs associated with tree planting also have special IRS consideration. Working with your tax preparer can help you sort through available options.

**Forest Certification**

Forest certification developed as a way to verify sustainable forest management. It is an outgrowth of the desire of many publics in our nation, and throughout the world, to have forest owners and forest managers demonstrate responsible, healthy, and sustainable management of our forests. In the future, certification may be important to maintaining timber markets, local economies, and a forest owner’s ability to manage their forest.

Forest Certification involves:

- Review of on-the-ground forest practices against a set of standards that address environmental, social, and economic issues.
- Provision of an independent, third party review attesting how effectively current management maintains forest health and productivity, and that there is conformance with certification standards.
- Periodic re-verification and re-certification after initial certification.

Voluntary forest certification systems are in place for forest owners and consumers who want assurances that land is being managed sustainably to credible standards. In the US there are two primary certification systems:

1. Programme for the Endorsement of Forest Certification schemes (PEFC) is an umbrella organization for the assessment of and mutual recognition of national forest certification schemes. This organization works at the global scale. Under this umbrella, in
the USA, are the Sustainable Forestry Initiative (SFI) and the American Forest Foundation-American Tree Farm System (ATFS).

a. SFI Inc. is an independent, non-profit organization responsible for maintaining, overseeing and improving a sustainable forestry certification program that is internationally recognized and is the largest single forest standard in the world. In order to be certified under SFI, a forest owner must be in conformance with SFI Objectives, Performance Measures, and Indicators. The SFI program collaborates with ATFS to provide forest certification on family forest lands.

b. ATFS has a forest certification standard that applies to small landowners in the United States. The ATFS works to sustain forests, watershed and healthy wildlife habitats through the power of private stewardship by offering affordable forest certification for family forest landowners. Landowners have three options to ATFS certification: Group Certification through State Tree Farm Committee programs, Group Certification through Independently Managed Group (IMG) Organizations, and Individual Third Party Certification.

2. Forest Stewardship Council (FSC) is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world’s forests. FSC is a certification system that provides internationally recognized standard-setting, trademark assurance and accreditation services to companies, organizations, and communities interested in responsible forestry. FSC has a number of systems in place for smallholders seeking to demonstrate their long-term and careful management practices. Smallholders is an FSC term used to describe those who own, manage or use forests which are considered “small” in relation to others in their region.

Additional information about these systems is available from their respective websites. Forest owners interested in pursuing certification should contact a professional forester in their area.

**Wood Energy and Forest Biomass**

Trees and forests have supported human development for thousands of years and certainly are a crucial part of our modern economy. Trees have historically provided heating and cooking fuel but recently have
been used as a substitute for fossil fuels to generate a wide range of energy and chemical products.

Michigan forests certainly have the capacity to sustainably meet increased demands for harvests, especially in forest types and species not previously commercial. Better managed forests will produce more wood fiber and potentially supply greater amounts of feedstocks into the growing bioeconomy. Also, plantations designed to serve the current and emerging markets may provide yet more fiber.

Woody biomass, a form of cellulosic fiber, can be used to produce heat, electricity, transportation fuels, and a wide range of valuable chemical products. Some improved combustion technologies are currently available, while others remain at least a few years away from commercial production. Wood chips and pellets can provide cost-effective fuel for heating buildings such as schools and homes. Combined heat and power (CHP) plants, sometimes called ‘co-gen’, can be built around towns and cities with existing infrastructure; or where investment in water pipeline construction is feasible in a “district energy” plan. Municipal solid waste can be used to generate both heat and electricity in urban areas.

Emerging technologies include combinations of biochemical or thermo chemical separation of wood components and reforming them into more desirable products. Biochemical processes use water and fungi or bacteria. Thermo-chemical processes heat wood in oxygen-deprived ovens. Target products focus on liquid fuels, such as bio-oils, ethanol, and a range of chemicals.

Environmental and ecological considerations of more intense harvest practices may limit production on certain sites or at certain times of the year. However, the greatest constraints from growing the wood portion of Michigan’s bioeconomy are more likely to come from economic and social factors. Government, industry, and research institutions working together with a common purpose will likely produce the best outcomes.
Finding Assistance

The Michigan Society of American Foresters (MSAF) represents approximately 450 professional land and resource managers within the State of Michigan. The Society's objectives are to advance the science, technology, education, and practice of forestry in Michigan and in the nation and to use the knowledge and skills of the profession to benefit the public. Our stated mission is responsible stewardship of Michigan forests while meeting critical needs of society.

Forests resources provide many benefits, including the potential for high monetary investment and returns. The management of forest lands deals with a wide range of issues. Decisions have long-term effect; an error in judgment or practice can affect stand conditions, composition, and associated resources for decades. Cost-share and property tax programs are typically administered by the Michigan DNR or the USDA Natural Resource Conservation Service. Assistance comes in a variety of forms from different sources. Therefore, the MSAF urges forest owners to avail themselves of the many sources of expert assistance, advice, and resources available in order to manage their forested lands in a professional and socially acceptable manner.

- Consulting Foresters - http://forestry.msu.edu/extension/extdocs/consulfor/consult.htm
- Consulting Foresters – http://acf-foresters.org
- Consulting Wildlife Biologists
- Industrial Foresters from companies with a private lands program
- Michigan Department of Natural Resources - http://www.michigan.gov/DNR
- Michigan Natural Features Inventory - http://web4.msue.msu.edu/mnfi
- Michigan State University County Extension Offices - http://www.msue.msu.edu/portal
- Michigan State University Department of Forestry - http://www.for.msu.edu
- Michigan Technological University – http://www.forest.mtu.edu
- Michigan Tree Farm Program - http://michigantreefarm.org
The Society of American Foresters (SAF) is the national scientific and educational organization representing the forestry profession in the United States. Founded in 1900 by Gifford Pinchot, it is the largest professional society for foresters in the world.

The mission of the Society of American Foresters is to advance the science, education, technology, and practice of forestry; to enhance the competency of its members; to establish professional excellence; and, to use the knowledge, skills, and conservation ethic of the profession to ensure the continued health and use of forest ecosystems and the present and future availability of forest resources to benefit society.

SAF is a nonprofit organization meeting the requirements of 501 (c) (3). SAF members include natural resource professionals in public and private settings, researchers, CEOs, administrators, educators, and students.

The Michigan SAF consists of over 400 foresters from many walks of life; state, federal, industry, consultants, university, and others. While many perspectives may lie within every natural resource issue, the depth and diversity of the Michigan SAF provides strength and expertise found nowhere else.

Realizing that the health and use of forests are vitally important to society and that we, as foresters, have a technical and advisory role to play as spokesperson for these resources, we offer the following.

- Promote and enhance the professional development of our members.
- Create public awareness of professional forestry.
- Participate in constructive, open dialogue with other resource professionals, conservations groups, state and local government, and the general public the professional forestry organization.