FOREST MANAGEMENT PLAN

Adopted October 5, 2011by the Marquette County Planning Commission

Marquette County, Michigan

Prepared by the Marquette County Forestry Commission with assistance by the County of Marquette Resource Management and Development Department Staff

MARQUETTE COUNTY, MICHIGAN
RESOLUTION OF ADOPTION
MARQUETTE COUNTY PLANNING COMMISSION

FOREST MANAGEMENT PLAN
A subplan of the
COMPREHENSIVE PLAN

WHEREAS, the Michigan Planning Enabling Act (MPEA) authorizes the Planning Commission to prepare a Comprehensive Plan for the use, development, and preservation of all lands in the County; and

WHEREAS, the Forestry Commission updated the Forest Management Plan, a subplan of the Comprehensive Plan and submitted the plan to the County Board for review and comment; and

WHEREAS, on August 16, 2011 the Marquette County Board received and reviewed the proposed subplan of the Comprehensive Plan prepared by the Forestry Commission, a sub-committee of the Planning Commission and authorized distribution of the proposed subplan of the Comprehensive Plan to the Notice Group entities identified in the MPEA; and

WHEREAS, notice was provided to the Notice Group entities as provided in the Michigan Planning Enabling Act; and

WHEREAS, the Planning Commission held a public hearing on October 5, 2011 to consider public comment on the proposed subplan of the Comprehensive Plan, and to further review and comment on the updated subplan of the Comprehensive Plan; and

WHEREAS, the Planning Commission finds that the updated subplan of the Comprehensive Plan is desirable and proper and furthers the use, preservation, and development goals and strategies of the County;

THEREFORE BE IT HEREBY RESOLVED AS FOLLOWS:

1. ***Adoption of the Forest Management Plan, a subplan of the Comprehensive Plan.*** The Planning Commission hereby approves and adopts the proposed Forest Management Plan, a subplan of the Comprehensive Plan, including all of the figures, maps, and tables contained therein.

2. ***Distribution to County Board and Notice Group.*** Pursuant to MCL 125.3843 the County Board has not asserted by resolution its right to approve or reject the proposed Forest Management Plan, a subplan of the Comprehensive Plan and therefore the approval granted herein is the final step for adoption of the plan as provided in MCL 125.3843 and therefore the plan is effective as of October 5, 2011. In addition, the Planning Commission approves distribution of the adopted amendments to the County Board and Notice Group.

3. ***Findings of Fact***. The Planning Commission has made the foregoing determination based on recommendation of the Forestry Commission, a sub-committee, independent review, input received from the County Board and public hearing, and finds that the updated Forest Management Plan, a subplan of the Comprehensive Plan will accurately reflect and implement the County's goals and strategies for the use, preservation, and development of county owned forest lands in Marquette County.

4. ***Effective Date.*** The Subplan shall be effective as of the date of adoption of this resolution.

The foregoing resolution offered by Planning Commissioner Goodman. Second offered by Planning Commissioner Bergdahl. The following voted: "Aye": Commissioners Bergdahl, Goodman, Holmes, Kaiser, Kristola, Struck and Touchinski. "Nay": __0__- Commissioners.

The Chair declared the resolution adopted: _____

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EXECUTIVE SUMMARY

The Marquette County Forestry Commission manages forest resources on County owned lands. Their primary guidance to accomplish this task is the Forest Management Plan. This document is the latest in a series of management plans dating back to the 1950's exemplifying commitment to scientific management of forest resources by the County.

The most significant forested property the county owns is the County Forest. The forest is comprised of approximately 9,300 acres in Sands and Forsyth Township near Sawyer. The County Forest is managed for multi-use. A variety of "prescriptions" have been developed that govern the manner in which individual tracts of land are used. These prescriptions range from intensive forestry efforts such as plantations where the focus is primarily growing trees much like a crop to areas that are preserved for fish and wildlife habitat. The primary "outputs" of multi-use become growing and harvesting of timber, wildlife, and recreation.

Most of the County Forest is an outwash plain created by the retreat of the last glacier that covered this area. The sandy soil left behind is a poor habitat for most tree species but well suited for jack pine. As a result, 72% of the tree cover in the forest is jack pine.

Jack pine grows best in even aged stands in full sunlight reaching maturity in about 50 years. Mother nature maintains this condition primarily by fire which eliminates the old stand and facilitates germination of seeds and establishment of a young vigorous stand. Man has interceded in this process. By clear-cutting and replanting we are able to approximate this cycle and utilize the timber resource. The jack pine component of the forest reached a "put and take" level of management where the area cut (typically 100+/- acres/year) is replanted the next year. However, mature stands are becoming limited. Areas to plant will be smaller, or an every other year planting could be considered.

A relatively new component of County forestry is growing of red pine where sites are suitable. Like jack pine, they are also being managed in plantations. Red pine are a much longer lived species and offer incremental thinning cuts before a final harvest takes place. These harvests can be spread over a 100 years or more, if desired. Benefits of growing red pine include aesthetics (fewer clear cuts), higher resistance to insects and disease, diversification of wildlife habitat, and an ability to generate more revenue over time on a given site versus jack pine.

An abundance of recreation opportunities exist on County Forest lands. Visitors participate in hiking, horseback riding, biking, cross country skiing, snowshoeing, snowmobiling, ORV riding, fishing, hunting, canoeing, kayaking, swimming, picnicking, berry picking, bird watching (including the endangered Kirtland's Warbler), camping and other activities.

The ability to generate revenue through sale of timber on the County Forest is extremely important. Sale proceeds are deposited in the Forest Recreation Fund and utilized for reforestation, wildlife enhancement projects, and recreation related activities. County sponsored recreation extends beyond the Forest boundary and includes facilities such as Perkins Park Campground, Big Bay Harbor of Refuge, Little Trout Lake and Sugarloaf Mountain Natural Area. These facilities are mentioned here because the Forest Recreation Fund supplements operational shortfalls at these sites as-well-as provides local matching funds for state and federal grants for capital improvement projects at these locations.

The greatest challenge in managing the County Forest results from most of the trees being of similar age. Ideally, with a 50 year "crop" like jack pine, you would want 1/50th of the trees to be in each year class. For example, if you had 5,000 acres of jack pine there should be 100 acres, 1 year old, 100 acres 2 years old, etc. This concept is called area regulation. This is a goal which will take decades to achieve in the County Forest.

From a budgetary standpoint, and because area regulation has not been obtained, there will come a time, roughly in year 2022, when there will be no mature trees to cut. In these years, some small thinning projects in red pine plantations will generate a little revenue, but for the most part, it will be necessary to "live off the bank" as expenditures will continue at County recreation facilities. It is necessary to prepare now for those times.

Successful management of the County Forest provides many benefits to residents and visitors of Marquette County. Many hours of enjoyment are derived from recreational pursuits on these lands and at other facilities these lands support. Additionally, the economy of the County benefits from the jobs created by the forest industry and spin off employment that results.

This plan will provide the guidance necessary for decision making regarding the County Forest for years to come.

1.0 PURPOSE, AUTHORITY, MISSION STATEMENT

1.1 PURPOSE

The purpose of this Plan is to provide a framework for decision making in order to help County Forest lands yield sustainable levels of commodities and amenities, in a multi-use environment while maintaining the quality of the resource into the future.

1.2 AUTHORITY

Authority for development of this Plan is granted pursuant to Section 7 of the Michigan Planning Enabling Act (P.A. 33 of 2008) and Part 527, Municipal Forests, of Public Act 451 of 1994, the Natural Resources and Environmental Protection Act.

1.3 MISSION STATEMENT

The Marquette County Forest consists of a variety of natural resources that provide for the social, economic, and ecological needs of present and future generations. The mission of Marquette County, through the actions of the Marquette County Forestry Commission, is to manage and protect these resources on a sustainable basis while maximizing public benefit from these lands.

2.0 FORWARD

This effort reflects over 55 years of scientific management of the County Forest. John J. Barnaks performed a forest inventory in 1954 which provided the basis for planning sustainable forest resources from this land. The 2011 Marquette County Forest Management Plan, though broader in scope and supporting a multiple use forest principle, carries on the tradition and responsibility for utilizing while preserving this public resource.

The primary focus of this plan will be the area commonly known as the County Forest. The County Forest is comprised of approximately 9,300 acres in Sands and Forsyth Townships 10 miles south of the City of Marquette in the proximity of Sawyer. This area is managed as a multi-use forest producing forest products and providing recreational opportunities for residents and visitors.

Other noteworthy County ownerships with forest resources are found at Sawyer (853 acres) adjacent to the County Forest, and the “Honor Camp” (420 acres) located in northern Sands Township near Harvey. As the Forestry Commission is charged with management of forest resources at both these locations some general discussion will occur as a separate part of this plan.

This document will provide valuable assistance for future decision making regarding County owned forest lands.

3.0 DESCRIPTION OF COUNTY FOREST

3.1 Physical Geography

The Marquette County Forest begins approximately 10 miles south of the City of Marquette and in close proximity to the community of Sawyer. It occupies portions of both Forsyth and Sands Townships and includes almost 9,300 acres.

3.1.1 Geology and Soils

Bedrock in the location of the County Forest is from the Paleozoic Era and is typically undifferentiated Cambrian formations. These Cambrian deposits are varieties of sandstones.

Surficial geology is the area of unconsolidated soil and rock materials that lie above the bedrock. It is believed that glaciers passed over this region as many as four times scouring away most of the loose surface material. As the glaciers retreated, the water released by the melting results in an outwash plain of stratified sand and gravel.

Forest lands consist primarily of an outwash plain of sandy soils resulting from early glacial activity. Significant areas of Grayling and Rubicon sand are present. These soils are known for their rapid permeability and low capacity for water retention. These droughty soils are well suited for jack pine. Other areas of the forest are influenced by a shallow depth to bedrock or rock outcroppings. These areas have soils with higher gravel content and forest cover tends to red or white pine. The East Branch of the Escanaba River runs through the western portion of the forest depositing and mixing soils providing opportunities for even greater forest diversity.

3.1.2 Topography

A large portion of the County Forest is in an area locally known as the Sands Plains. The term plain typically refers to a flat, treeless expanse. Though perhaps accurate when originally named, the area is now completely forested. The topographic component of the definition remains accurate though with a change of only about 40 feet over the distance of 5 or 6 miles. Some sections have only one contour line on a 10 foot increment scale. Altitude in the forest ranges from a maximum of 1,212 feet to a low of 1,072 feet. Most of the deviation from a “flat” landscape are the result of hydrologic forces such as the East Branch of the Escanaba River and several creeks and streams.

3.1.3 Climate

The climate of Marquette County is a temperate continental climate of a cool summer type. The mean annual temperature is 39.6 degrees Fahrenheit (Fº). The warmest month is July with a mean maximum of 77.0ºF. The record high temperature was 108ºF recorded in 1901. The record low was -49ºF in February of 1899.

Annual precipitation averages 36.32 inches. Much of this is received as snow with an average of 184.7 inches received per year. A record snowfall in the winter of 2001-2002 deposited 319.8 inches of snow, almost 27 feet. Distribution of precipitation throughout the county is effected by proximity to Lake Superior and elevation.

3.1.4 Biological Community

In the recent past, 50 years or so, much of the county forest would fall into the biological community know as Pine Barrens. This community is generally found in cooler climates in the Great Lakes region. Pine Barrens are found on outwash plains, sand lake plains, and sandy riverine terraces. Topography is typically flat or gently rolling with long expanses capable of carrying wildfires with few natural fire breaks. The soils of this community are sandy, acidic, droughty, and relatively infertile.

The natural process by which these barrens are perpetuated, principally fire, maintain open areas by limiting long term growth of woody species. Man impacts this process through fire suppression and reforestation efforts consistent with how our county forest is managed. From this management, primarily the tree planting activity, County land now more closely resembles a jack pine forest community.

3.1.5 Plants and Trees

The county forest is dominated by jack pine. There are numerous plants and trees that are associated with a jack pine ecosystem. As fire is a common natural occurrence in these areas there are typically few very large or old trees. There are also numerous open areas. Through man's intervention, there are fewer fires. However, open areas are created "artificially" through harvesting of timber.

Table 1 lists plants and trees that are typical of jack pine sites.

Though jack pine is the predominant cover type, the remainder of the county forest is made up of a variety of tree species. Depending on environmental conditions present, forest inventories have also identified the tree species that follow; aspen, balsam fir, red pine, spruce, tamarack, white birch, and white pine.

Table 1 Plants and Trees of the Jack Pine Ecosystem

Trees	Other Plants	
Aspen	Alleghany Plum	Hoary Puccoon
Black Cherry	Big Bluestem	Lichens
Jack Pine	Blueberry	Little Bluestem
Oak	Bracken Fern	Pale Agoseris
Red Pine	Fritillary	Rough Fescue
White Birch	Harebells	Stinkhorn Fungas
	Hill's Thistle	Sweet Fern

Source: RM/D and MDNR

3.1.6 Animals

A jack pine ecosystem dominates most of the county forest. The presence of the Escanaba River and some inland water bodies produce areas of other habitat as well. Animals also may take advantage of their mobility and utilize several habitats as availability of food, water, and shelter may vary on a seasonal basis.

The primary characteristics related to emergence of a particular habitat are soil type and availability of water. These "ingredients" determine the plant life that will emerge followed by the animals that depend on them.

Table 2 provides animals you may expect to encounter in the county forest. Species of particular note are the gray wolf and the Kirtland's Warbler. There are no confirmed sightings of gray wolf in the County Forest but there have been numerous sightings in the Escanaba River State Forest which consists of areas of Marquette, Delta, Menominee and the west half of Alger Counties. Federal and State recovery plans have had great success in re-establishing populations. In 2003, the U.S. Fish and

Wildlife Service changed the classification of the gray wolf from endangered to threatened. They are currently under consideration for delisting all together. The potential of a sighting in the future is possible.

Kirtland warblers were once only known to nest in Michigan. As populations have grown and dispersed, recent surveys have now found small populations in Wisconsin and Ontario. The vast majority however are still found in the northern Lower Peninsula. The Kirtland warbler is federally listed as an endangered species. The latest census results released recently by the Michigan Department of Natural Resources and Environment estimated a statewide population of 1,733 singing males. A total of 34 birds were found in the U.P., five of which were in Marquette County, primarily near Gwinn (County Forest) and south of Ishpeming.

Table 2 Animals of the County Forest

Beaver	Porcupine
Black Bear	Raven
Black-Backed Woodpecker	Red-headed Woodpecker
Bluebird	Red Squirrel
Bluejay	Red-tailed hawk
Brownheaded Cowbird	Ruffed Grouse
Canadian Jay	Skunk
Chick-a-dee	Snowshoe Hare
Coyote	Spruce Grouse
Crow	Upland sandpiper
Eastern Chipmunk	White-tailed deer
Garter Snake	Woodcock
Green Snake	
Kirtland's Warbler	
Pine Snake	

Source: RM/D

The warblers are ground nesters and select trees from 5 to 20 feet high with live branches reaching the ground. These young jack pine stands were once typically produced by fire. Currently, County reforestation efforts provide stands of young trees. Trees growing in burned areas are often more densely stocked with intermittent open patches which the birds prefer. In 2009, partnering with the U.S. Fish and Wildlife Service, the County developed a site of approximately 75 acres as wildlife habitat specifically designed for Kirtland warblers.

3.2 Land Ownership

Excluding right of ways, the Marquette County Forest consists of 9,297 acres located in Forsyth and Sands Townships. The county holds title to county forest lands under the three mechanisms as described in the following:

Table 3 Land Ownership

TYPE	ACRES	% OF FOREST
Fee Simple	3,516	38%
PA 223	296	3%
PA217	5,485	59%
Total	9,297	100%

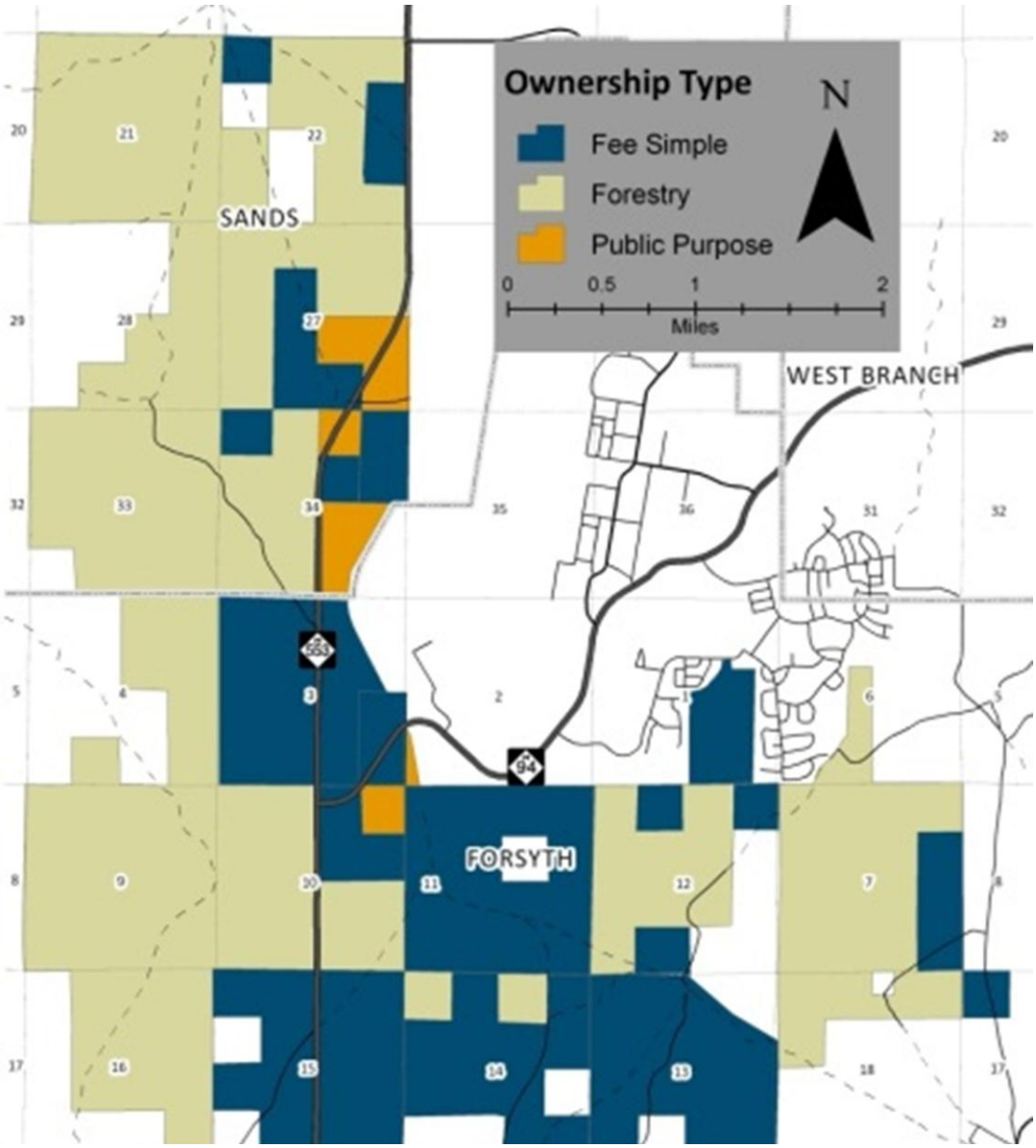
Source: RM/D

(1) Fee Simple - Approximately 3,516 acres (38%) of county forest land is held by the County Board in fee simple. Generally, this means the county has absolute possession. There may be exceptions where easements have been granted or other limitations such as reservation of mineral rights by other parties have occurred.

(2) Act 223 Lands - Public Act 223 of 1909 provided a mechanism whereby the State of Michigan could transfer "surplus" tax reverted land to local units of government. By this means the county now holds 296 acres within the county forest. This comprises 3% of forest holdings. A reverter clause is contained within the deeds that if the property is no longer utilized for public purpose it will be returned to the state.

(3) Act 217 Lands - Public Act 217 of 1931, the Municipal Forest Act, provided the source by which most county forest land was obtained. Approximately 5,485 acres or 59% of the forest came from this source. Act 217 has since been recodified under the Natural Resources and Environmental Protection Act, Act 451 of 1994, Part 527 Municipal Forests (MCLA 324.52701). This property also contains a reverter requiring if the property is no longer used for forestry purposes it returns to the state. This act not only provided land but also the statutory authority for a municipality, in this case the county, to appoint a forestry commission to manage forest properties. A stipulation of the act also requires that the Forestry Commission share income derived from the forest with the townships and school districts in which the forest lies.

Figure 1 Land Ownership



The Forestry Commission maintains an interest in acquiring additional forest lands. The primary mission related to land acquisition is to provide "infill", or acquire private holdings that are within the county forest boundary and also acquire lands immediately adjacent to the forest as they become available.

3.3 Road System

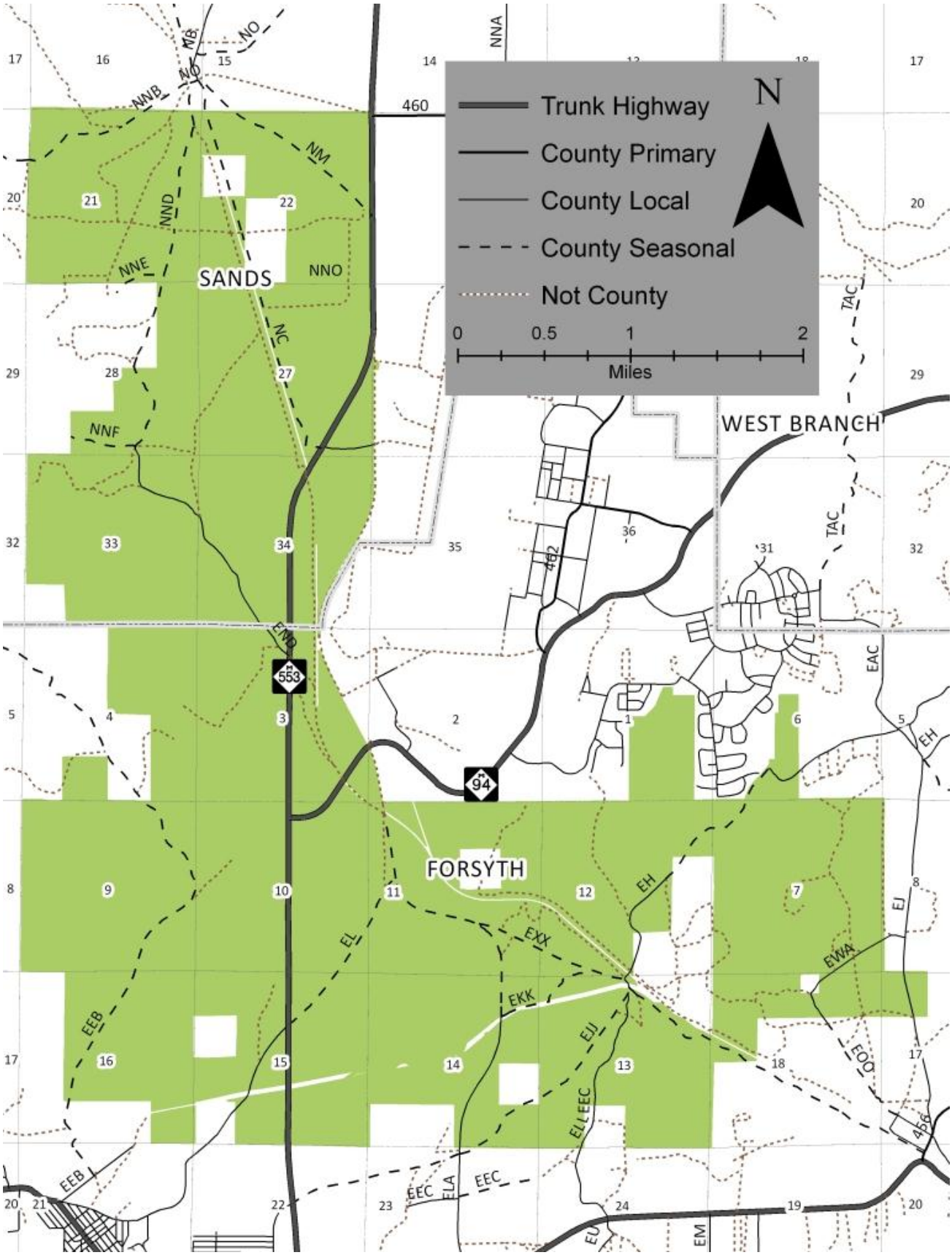
The county forest can be accessed from numerous roads and in essentially any direction. The most prominent road feature is M-553, a state trunk line that divides the forest into east and west components of approximately 4,160 and 5,140 acres respectively. This is a class "A" all season road. This feature makes timber sales in the county forest attractive to bidders because of the lack of spring weight restrictions which are placed on roads not constructed to class "A" standards. Weight restrictions (60% of axel weight) are placed on roads typically anywhere from mid-March to mid-May resulting in a period of no hauling or hauling of reduced loads. M-553 also provides all season access versus remote forestry locations in the county when we average 185 inches of snow each winter. State Highway M-94 also cuts through a small portion (2/3's of a mile) of the county forest but provides only limited access to county properties.

Branching off from M-553 in particular, is an extensive system of roads categorized as county local. This system contains both year round and seasonal (don't receive winter maintenance…..plowing) roads. The year round component is very small. There is about a ½ mile of Southgate Drive, ½ mile of Provost Lake Drive, and ¼ mile of Sporley Lake Road open all year. The balance of the system is of the seasonal variety. These roads provide access to timber sale areas as-well-as providing access to the public for recreational purposes such as hunting, fishing, hiking, canoeing, berry picking and other uses. The road network is also used extensively by off-road vehicles (ORV's) in the summer and some portions as a snowmobile trail in the winter.

Table 4 County Forest Road System

Road Name	Type	Length
Co Rd NNB	Seasonal	0.78
Co Rd NNE	Seasonal	0.23
Co Rd NNF	Seasonal	0.42
Co Rd	Seasonal	3.41
Co Rd NM	Seasonal	0.97
Co Rd NNO	Seasonal	0.51
Co Rd NC	Seasonal	1.62
Pohlman Dr	Seasonal	2.12
Southgate Dr	Year Round	0.55
Southgate Dr	Seasonal	1.08
Marshall Dr	Seasonal	2.30
Co Rd EKK	Seasonal	0.33
Co Rd EXX	Seasonal	0.88
Slough Lake Rd	Seasonal	1.21
Noren Lake Dr	Seasonal	0.03
Swanzy Lake	Seasonal	0.77
Millyard Rd	Seasonal	0.84
Martin Lake Rd	Seasonal	1.48
Co Rd EOO	Seasonal	0.15
Provost Lake	Year Round	0.45
Sporley Lake Dr	Year Round	0.26
M-94	Year Round	0.66
M-553	Year Round	6.06
Unnamed Roads	Seasonal	23.27
	TOTALS	
	Year Round	**7.98**
	Seasonal	**42.40**
	All	**50.38**

Figure 2 Road System



3.4 Recreation

Recreation is an integral component of a multi-use forest. In addition to the timber resources, the County Forest is rich in recreational opportunities. Forest based recreation has been expanding rapidly and public demand requires opportunities for a wide variety of recreational types. Some forms of recreation utilize roads and trails, others water features such as rivers, streams, and lakes, still others the flora, fauna and scenery.

3.4.1 Road Based Recreation

A national survey of outdoor recreation performed by the U.S. Census Bureau in 2001 found driving for pleasure to be the fastest growing form of outdoor recreation. The County Forest provides some opportunity for that with over 50 miles of roads that are present. Much of this road system is also used by ATV's (all terrain vehicles) and ORV's (off road vehicles) which would include a range of vehicles from 4-wheel drives and quad runners to motorcycles. There is some use of the roads for hiking, biking and possibly horseback riding. Since most of the roads are seasonal (no winter snow removal) they are also utilized for snowmobiling.

3.4.2 Trails

Trails can be classified as non-motorized or motorized. The County Forest has both, though none are specifically signed for one type of use versus another.

3.4.2.1 Motorized

In addition to the road system there are two specific trails that run essentially north/south through the County Forest and a spur trail that accesses Sawyer (see Figure 3, page 9). The Hiawathaland Snowmobile Club has an annual license issued by the County to maintain a snowmobile trail through the Forest and to Sawyer. Another portion of trail, though not formally designated, runs parallel to M-553 and weaves in and out of the right-of-way partly on County property and partly on Michigan Department of Transportation land. This trail is utilized by snowmobiles and ORV's depending on the season.

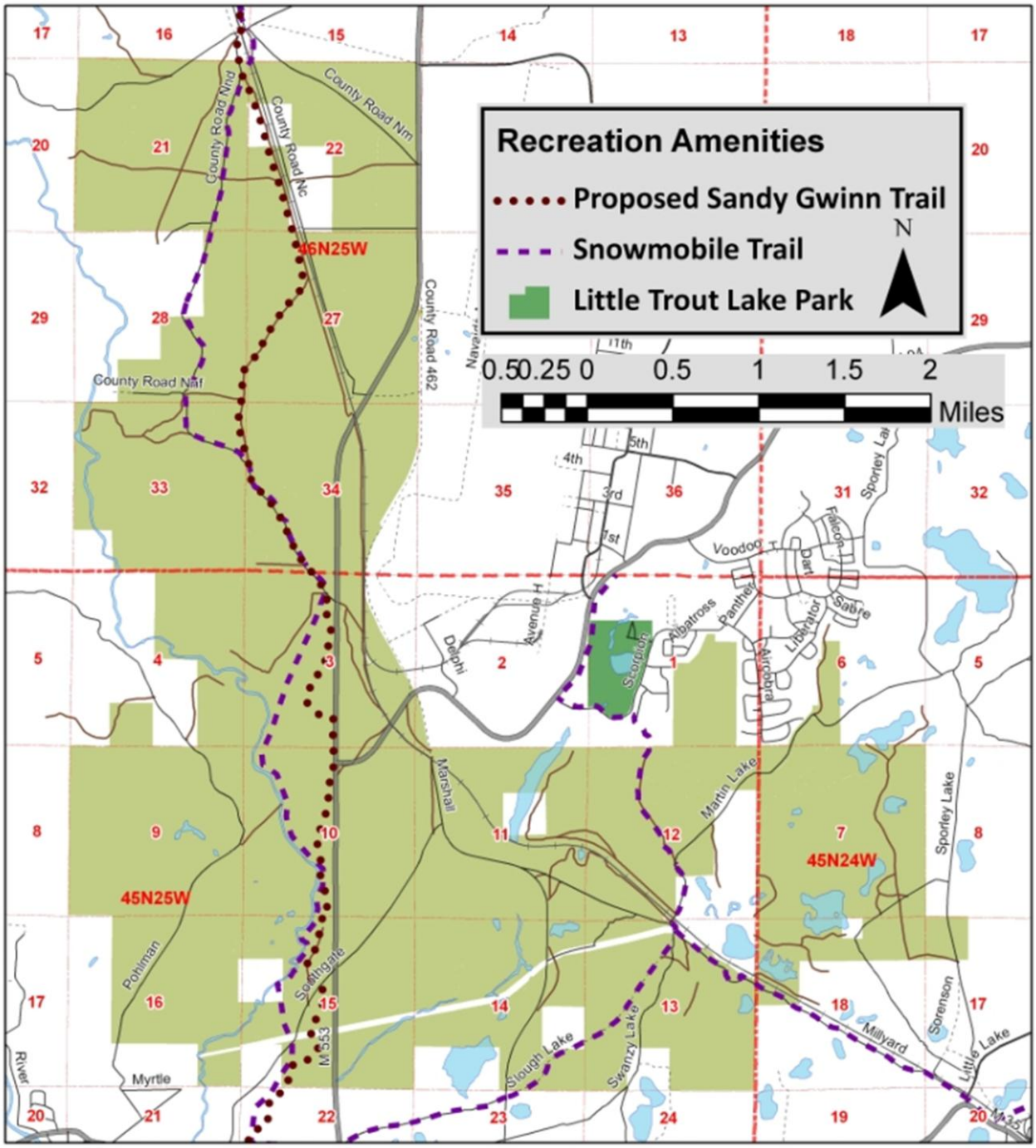
ORV's have extended their range to areas that once were only foot trails such as along the East Branch of the Escanaba River. These areas will need to be monitored for possible negative effects such as erosion, damage to plants and trees, and water quality. Areas negatively impacted may be closed to motorized use.

3.4.2.2 Non-Motorized

There are currently no designated non-motorized trails in the County Forest. A number of trails do exist and are primarily the result of years of travel primarily by fisherman along rivers and streams. There exists plenty of opportunity for trail development in the Forest. Currently there is an initiative in Forsyth Township for creation of the Sandy/Gwinn Trail that would begin at Nordeen Park in Gwinn, travel through the County Forest, bridge the East Branch of the Escanaba River, access Sawyer and continue on to the Crossroads area in Sands Township (Figure 3). This would be a hiking/biking trail in summer and a cross country ski/snowshoe trail in the winter.

It will be important to study forest management prescriptions and harvest schedules when deciding on trail locations.

Figure 3 Recreation Amenities



3.4.3 Rivers, Streams, Lakes

Water related activities can be pursued at numerous locations in the forest. All these locations offer opportunities to fish while others can provide swimming and canoeing. One of the enhancements suggested in this plan is development of a canoe/kayak put in site along the East Branch of the Escanaba River at a location yet to be determined. The area preferred would be in the most northerly portion of the Forest, perhaps in Section 20 of T46N – R25W of Sands Township. This location would

provide a 6 or 7 mile float to Nordeen Park in Gwinn. The potential of fish stocking in that stretch of the river has been discussed with Michigan Department of Natural Resources and Environment personnel.

3.4.4 Wildlife Related Activities

There is a wide variety of wildlife living in the County Forest. Some recreational uses of this resource are bird watching, wildlife viewing, photography, and hunting. From a bird watching standpoint the Kirtland Warbler is the premier sighting. These birds are federally listed as endangered and nest primarily in the northern Lower Peninsula and the U.P. Singing males have been located each spring for a number of years in the County Forest.

Hunting is the primary wildlife related recreational pursuit. There is big game, deer, and bear, and small game such as rabbits, squirrels, ruffed grouse, woodcock, and ducks. Coyote and bobcat are potentially available. The Forestry Commission annually budgets funds for wildlife enhancement projects. To this point there has been planting of wildlife corridors, establishment of fruit and mast producing trees and the Kirtland warbler habitat project mentioned in section 3.1.6. Various timber management prescriptions (see pages 35-40) also provide for habitat production and/or protection.

Aspen, a prime wildlife habitat, is being maintained for diversity in a largely jack pine forest. Future projects will include seeding landing areas and closed roads after logging operations with plants favored by wildlife for forage.

3.4.5 Berry Picking

Berry picking is a very popular activity in late June and early August. Service berry (juneberry, sugarplum, blackberries) and wild raspberries are present but the most popular of the berries is the blueberry. Blueberries commonly occur in areas where fire has occurred. Since fire is a common occurrence in a jack pine forest there are many areas in the County forest where berries flourish. In Marquette, a Blueberry Festival has been initiated which is an annual event.

It has been suggested that controlled burning or mechanical preparation by mowing with a brush hog would enhance berry production and may be a future management consideration.

3.4.6 Picnicking

There are many sites suitable for picnicking. None are developed. Though purely a matter of personal taste, the best locations are associated with the river corridor along the East Branch of the Escanaba. Since there are no developed sites or regular maintenance of the more popular locations, litter can be a concern in these areas.

3.4.7 Camping

The Marquette County Recreation Plan identified camping facilities as one of the most significant recreation deficiencies in the County. Most County resources in regard to camping are focused on our County owned/operated campground, Perkins Park, located in Big Bay. The County Forest, however, also provides a significant opportunity for additional camping. There is currently no initiative to develop formal camping facilities. The County does not have personnel available to support this program. Other public agencies that have "remote" rustic facilities have been forced to close them down due to operating costs. There are numerous sites where someone could "pitch a tent"

throughout the forest. A Camp Registration Card, similar to that used by the State on their lands is required to camp in the County Forest. There is no cost. Registration requires name, address and vehicle information. Camping is limited to a maximum of 15 days in one location. Registration cards are available by calling the Resource Management Department at 906-315-2673 or on the County website www.co.marquette.mi.us under Recreation and Development County Forest.

3.5 Forest Threats

A variety of natural and manmade threats face those tasked with scientific management of the County Forest. Natural threats predominate such as fire, insects, disease, invasive species, drought, and windstorms. Man might also be a source of fire, timber theft, and forest dumping.

3.5.1 Fire

For much of the County Forest, in particular the jack pine areas, fire is a part of the natural system. It is through fire that jack pine stands regenerate. Fire exposes mineral soils and the heat opens cones so seeds can be released. Man has interrupted this cycle by suppressing fires when they occur in order to protect people and property from their devastating effects. The end results of our management, harvesting, and planting are as close as we can come to imitating the natural cycle.

Fire has been and always will be a threat to the County Forest. Fires can be caused by natural occurrences such as lightning strikes but, by far, the biggest factor is man. There have been fires caused by trains passing over the still active rail line that traverses the forest, passing motorists on M-553 and downed power lines. Posing an even greater threat is the encroachment of residential structures on the perimeter of the forest and on private in-holdings. The wisdom of homesteading these areas is questionable. Extensive private development exacerbates the fire hazard to life, property, and resources. Introducing campers to the Forest increases potential for a camp fire to "get away" and a wildfire situation to develop.

The most significant fire in the County Forest occurred on May 6, 1986. This fire burned an estimated 1,338 acres. Almost all of this (1,315 acres) was productive forest land that was destroyed or seriously damaged. The event could have been even more significant if not for the ability to mobilize substantial numbers of personnel and equipment from nearby K.I. Sawyer Air Force Base. Subsequent to this fire the "Base" has closed and those resources are no longer available. The Michigan Department of Natural Resources and Environment, operating out of Gwinn, will continue in the lead role for fire suppression.

3.5.1.1 Fire Mitigation

Though fire prevention is key to protecting the forest, it is best to be prepared in case it occurs. Some level of preparedness can be obtained through management practices. Locations of roads, post harvest slash management, tree specie diversification and providing defensible areas are important to limiting spread of a fire once ignited.

The Forestry Commission has taken some action regarding all these techniques. Of particular note, is construction of a fire break on the south side of Sawyer's housing area in 1997. As fire traditionally travels from southwest to northeast in the County Forest, significant volumes of fuel were immediately adjacent (within feet) of the housing. In excess of 800 cords of wood was removed and stumps and

slash buried. It is important to maintain this fire break and to continue implementing mitigative measures.

3.5.2 Insects

There are several insects that can damage forest resources. Most prevalent of these in the County Forest is the jack pine budworm though white pine weevil, forest tent caterpillars, spruce budworm, and bark beetles can all cause damage.

3.5.2.1 Jack Pine Budworm

The jack pine budworm is considered to be the most significant insect pest effecting jack pine. Since about 72% of the Forest is jack pine the importance of preventing and mitigating outbreaks is extremely important.

Trees are damaged by the larval form of the insect. They cut the needles at their base and eat only the base portion. The rest of the needle remains caught in the silk left by the larvae and eventually dries turning to a reddish brown, the dominant color in an infested stand.

Outbreaks typically occur in 10 to 12 year cycles with an outbreak lasting 2-4 years. The most recent outbreaks were in 1991 and then 13 years later in 2004, only one year beyond the typical pattern. If this cycle holds true, we could expect a reoccurrence in the next 3-5 years (2014-2016). Stand age which reflects the vigor of the trees and their ability to withstand the defoliation is the most important factor to be considered when managing for budworm control. Over-mature trees are most susceptible to infestation. By eliminating "old age" stands, those over 50 years of age, the risk is greatly reduced. Harvesting recommendations under the 2004 Plan have removed the over age jack pine and the effectiveness of this technique will be monitored. A second strategy is to break-up large blocks of jack pine by planting other tree species. On suitable sites the County is currently planting red pine.

3.5.2.2 White Pine Weevil

The larvae of this weevil girdle the uppermost portions of both white pine and jack pine. The damage caused to the tree results in reduced growth rates and tops with multiple rather than a single stem. The last noted infestation in the County Forest was discovered in 1994 in Forest Management Unit 61. As a result of this "attack" nearly 40% of the trees in this stand developed multiple stems.

The most affected areas were those that were understocked. Maintaining fully stocked stands may be a preventive measure. The best solution is converting to red pine however, not all soils are suitable for this conversion.

3.5.2.3 Spruce Budworm

Spruce budworm target balsam fir and white spruce; though not a large component of the overall County Forest (4%) there is still a potential problem. The insect defoliates trees causing top kill and mortality. Again, the most susceptible stands are those which are over-mature. A 50 year harvest age should be maintained and stands should be fully stocked.

3.5.2.4 Forest Tent Caterpillar

These insects target primarily aspen. The aspen component of the County Forest is approximately 5%. Though not a substantial part it is an important part in that it provides some forest diversity and an important cover type for wildlife. The caterpillars are defoliators but their long-term impact is minimal and tree mortality is uncommon.

3.5.2.5 Bark Beetles

Bark beetles are not usually attracted to healthy stands. When a stand is damaged by budworms, windthrow, or other naturally occurring conditions the beetles will seek out stressed or freshly killed trees. Bark beetle infestation can be avoided by prompt salvage harvests after the damaging event.

3.5.3 Tree Diseases

There are a number of diseases that can also impact forest health.

- Scleroderris – fungus that kills lower branches of jack and red pine, can kill trees up to 6' tall.
- White Pine Blister Rust – fungus that attacks white pine and kills branches, can possibly girdle trees.
- Phellinus Igniarius – fungus that causes heart rot in aspen.

3.5.4. Invasive Species

Ecosystems all over Michigan are threatened by invasive plants. Every year more and more acres of land are invaded by non-native species. As these plants move into an area native vegetation often cannot compete and are eventually displaced. In turn, the animals that depend on the native plants for food and shelter can no longer be sustained and the ecosystem is entirely disrupted.

Invasive species often arrive as "hitchhikers" from other states or even foreign countries. They may be accidentally introduced by inadvertent transporting of seeds or parts of plants. In other cases, plants may be brought in for a different purpose, such as ornamental use, and "escape" into the wild.

Some examples of invasive plants currently of concern in Michigan are purple loosestrife, garlic mustard, Japanese knotweed, Japanese barberry, reed canary grass, white sweet clover, spotted knapweed, phragmites, Eurasian milfoil, and glossy buckthorn. The Upper Peninsula Resource Conservation and Development Council, with help from the U.P. Conservation Districts and others are collaborating on a grant funded effort to identify and take action regarding these plants. RRIP-IT-UP (Rapid Response Invasive Plant Intervention Team of the Upper Peninsula) is a team of volunteers that are trained to identify and properly remove unwanted plants. Efforts should be made to monitor the County Forest for invasive species on a regular basis and initiate control measures when invasives are identified.

3.5.5 Drought

Sufficient water is critical to trees. In soils with rapid permeability such as the County Forest, consistent rainfall is even more precious. Trees use water in the process of photosynthesis. Through this process, the tree combines sunlight, carbon dioxide and water to produce sugar which is its energy source. A lack of water in drought conditions inhibits the ability to produce energy. The energy that is stored is used the next year to produce new leaves, buds, and growth of the tree. Without the energy the tree will be weakened and susceptible to insect attack and disease.

3.5.6 Windstorms

Under conditions where stands are fully stocked and of sufficient size, windthrow is not a serious threat. Narrow strips of trees that offer significant edge exposure can be severely impacted. However, under severe conditions even the best stands can be impacted. Such conditions developed on July 21, 2002 cutting a west to east swath through Marquette County. In its path was the County Forest. Salvage operations were commenced and by the time cleanup was complete over 4,000 cords were harvested. The value of salvaged timber was about 25% of its normal market.

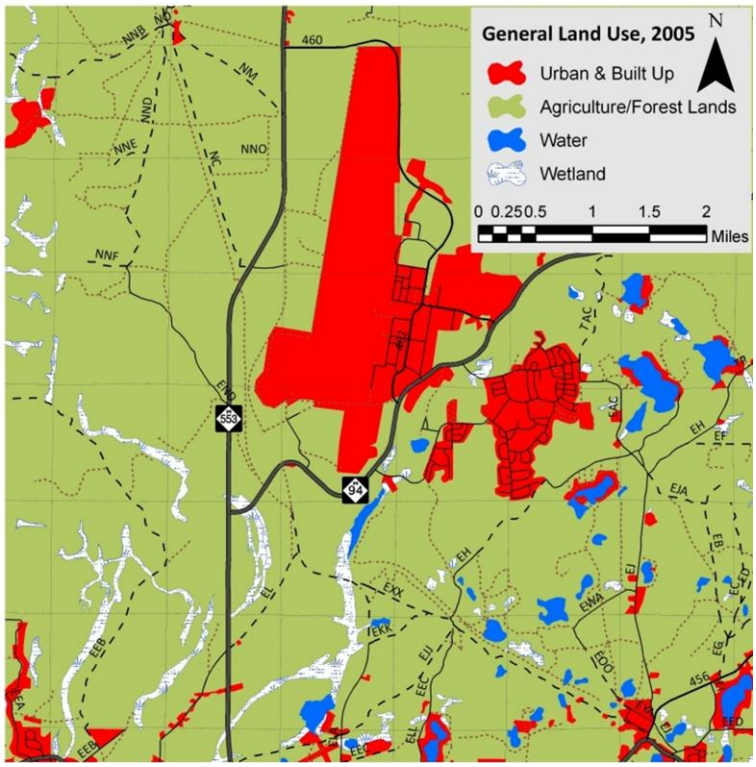
3.5.7 Timber Theft

Another potential threat to the Forest is timber theft. The best preventive measures regarding timber theft are through careful marking and monitoring of timber sales and accurate delineation of County ownership through accurate survey. Timber theft can occur intentionally or unintentionally through the timber sale process. It is extremely important that consultants contracted to mark sales do so clearly and accurately. Resource Management staff shall review the County parcel map for each sale area and appraise the consulting forester of potential ownership issues. Also, a pre-harvest conference between staff, the consultant, and the logger should occur to make sure any confusion over sale limits is eliminated. Survey of the perimeter of the County holdings and any other interfaces with other owners should be performed so no timber trespass occurs. All cases of alleged timber theft on the County Forest will be investigated.

3.5.8 Forest Dumping

Though not necessarily a critical threat to the survival of the County Forest, forest dumping certainly has an aesthetic impact affecting recreational use of the Forest. It has been five years since the last debris survey was done. At that time fifty-four sites were identified. An Eagle Scout service project done in the fall of 2007 targeted several of these sites. A follow up visit to the sites (which have been catalogued with a GPS) should be done and additional clean up facilitated.

Figure 4 General Land Use, 2005



3.6 Land Use

Land uses in the County Forest are agricultural (growing timber), transportation (roads, railroad), extractive (former pits/quarries), and recreational. Some of the factors that can affect land use are; the public interest, transportation, land

ownership, land value, natural determinants (physical characteristics of the land), and economics. What we see as the County Forest today may be significantly different in the future. Examples of such change would be sale of some land by the County for a larger industrial development because of the economic opportunity it could bring. With the nearby communities of Sawyer, Gwinn, Little Lake, New Swanzy, and Austin there may be demand for more public open space for recreation and timber production may become a lower priority output from the land.

Not only changes taking place on the County ownership but on surrounding land use can also affect the Forest. At this time, there has been pressure on Forsyth and Sands Townships to change zoning of parcels in areas that are currently for forestry purposes to residential use. This creates a "wildland/urban interface" which carries with it an inherent risk of wildfire.

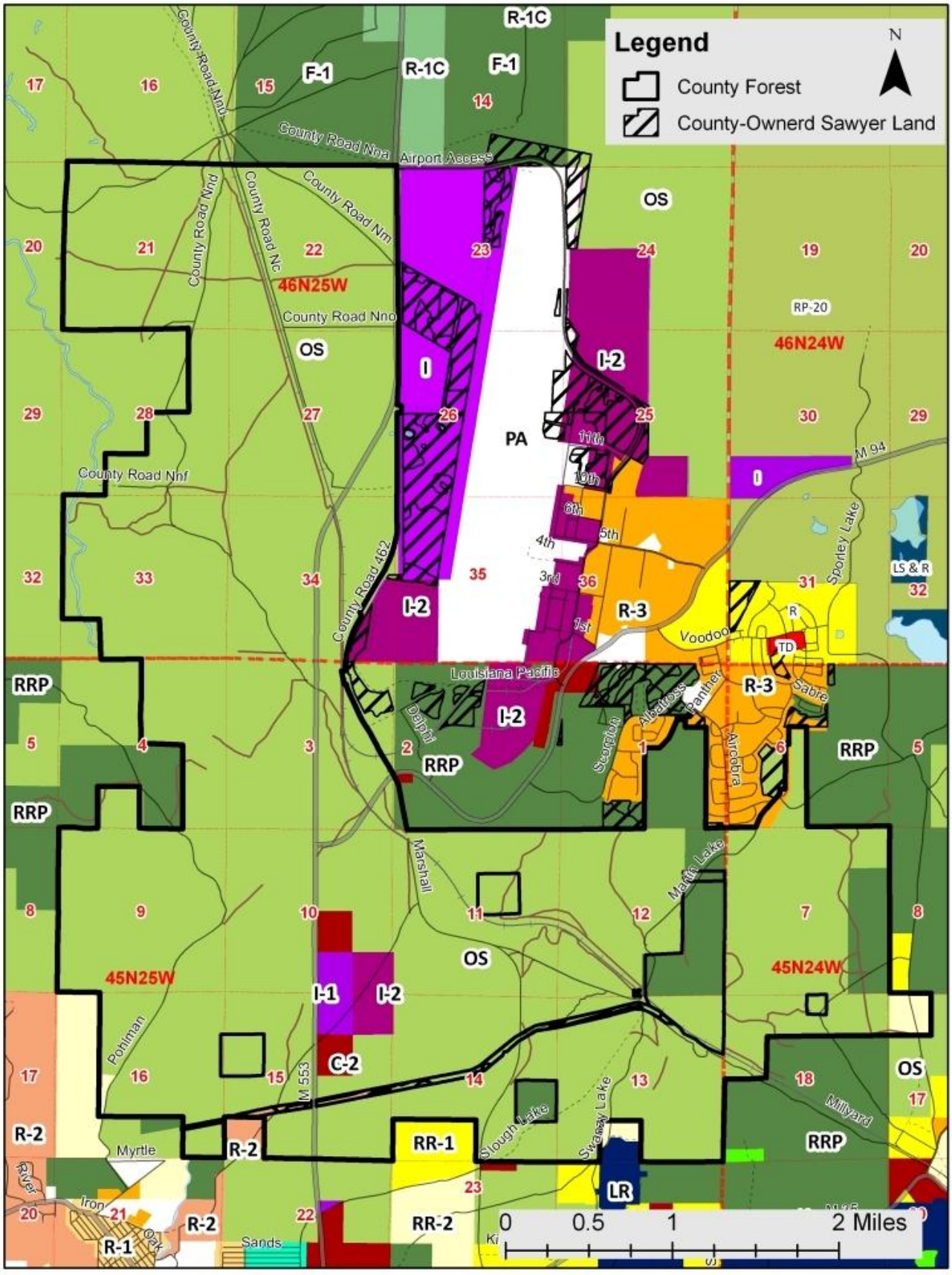
3.6.1 Zoning

Zoning is the mechanism by which municipalities can control the use of land. Uses are limited to specific districts which generally fall into residential, commercial, industrial, resource production, and open space categories. The County Forest is in both Forsyth and Sands Townships. Other county-owned land with timber management potential is in Sands, Forsyth, and West Branch Townships. The majority of the County Forest is a mixture of resource production and open space. Both districts allow timber harvesting and recreation. Some County Forest land falls under zoning districts that do not permit timber harvesting. Figure 5 shows zoning districts by township. The County-owned Sawyer land is depicted with a black hash mark on the map. Table 5 displays whether or not forestry is a permitted use per zoning district.

Table 5 Zoning Districts; County Forest and Sawyer Land

Twp	Zoning District	County Ownership		Use: Forestry	
		County Forest	Sawyer Land	Permitted	Not Permitted
Sands	Open Space (OS)	✔	✔	✔	
	Forestry and Agriculture (F-1)		✔	✔	
	Industrial (I)		✔		✔
Forsyth	Open Space (OS)	✔	✔	✔	
	Recreation Resource Production (RRP)	✔	✔	✔	
	Industrial (I-1)	✔			✔
	Industrial (I-2)	✔	✔		✔
	Commercial (C-2)	✔			✔
	Residential (RR-2)	✔			✔
	Multiple Family Residential (R-3)		✔		✔
	Public Area (PA)		✔		✔
West Branch	Residential		✔		✔
	Town Development		✔		✔

Figure 5 Zoning Map



4.0 HISTORICAL MANAGEMENT EFFORTS

Timber resources have long been sought from the region that is now the County Forest. Surveyor's field notes from 1852 read that "the white pine was of excellent quality and large quantities of logs were cut the winter before" this would be some 10 years preceding the civil war. Records also indicate subsequent cutting of jack pine in the mid 1920's and late 40's.

The land came under initial County control by way of transfer of tax reverted properties from the State of Michigan through PA 217 and PA 233 in 1948. Subsequent property acquisition has brought County Forest holdings to 9,297 acres.

A series of plans developed over time, have guided management of County-owned forested properties. The first such plan was the Timber Survey written by John J. Barnaks in 1955 based on inventory work he had done the previous year. This plan marked the first "scientific approach" to management and featured site index (a site quality indictor), maintaining proper stocking density, a 60 year rotation period for jack pine, recommended strip cutting, and reforestation with seedlings planted in furrows. The plan laid out a harvest schedule for the following 15 years.

The next management plan was a cooperative effort by Wilson and Spike produced in 1982, the Marquette County Forest Management Plan. A 1981 inventory by Spike provided the silvicultural basis for this work. The principal thrust of this plan was to attain a regulated jack pine forest that had an equal acreage growing in every age class from young to old (1 yr – 50). This regulation would provide a "sustained yield" or equivalent acreage available for harvest each year. The plan supported harvest by clear cutting in blocks (up to 142 acres) and tree planting to establish fully stocked stands. New to this plan was a departure from purely silvicultural management and inclusion of consideration for watershed protection, recreation, and wildlife issues.

Following this effort was the 1988 Forest Management Plan. This plan was essentially an update of the 1982 plan with additional goals and objectives identified and moved towards strategic planning for managing multiple use.

The 2004 Forest Management Plan combined the experience of previous management efforts with new inventory data and improved technology. The Marquette County Forest 1999 Inventory and Analysis, prepared by Grossman Forestry Company, includes new field work compiled in a computer data base which is linked to digital maps in the County's geographic information system. This new inventory information and improved technology has greatly enhanced County capabilities for management by allowing managers to visualize inventory data in an almost limitless variety of map formats.

5.0 FUTURE MANAGEMENT

5.1 Introduction

The goals and objectives of this plan are the result of assessing the desired outputs of the County Forest, such as timber products and recreation, and determining how they can best be attained and where they should be pursued. Critical in this process was gathering of silvicultural data through an inventory process so there was good information on what's out there. Next, an assessment of suitability of specific sites was made and the desired outputs were matched up with those sites that could best support them.

Other goals and objectives are extensions of programs initiated under previous management plans that have proved successful over time and will be continued. Still others are the result of "lessons learned" through long-term management of the Forest and from sources of external expertise.

5.2 Goals and Objectives

Land Ownership

Goal: To provide and maintain sufficient ownership to support the concept of a sustainable multi-use forest.

Objectives:

- Acquire private parcels within the Forest boundary and adjacent to the boundary as they become available from a willing seller on a case by case basis.
- To comply with the requirements of Public Acts 223 and 217 by which the County obtained the majority of its' holdings from the State.
- To develop adequate land control through additional survey.

Transportation

Goal: Develop a network of roads that will provide sufficient access to the varied uses of County Forest resources while maintaining environmental integrity.

Objectives:

- Access to areas will be provided and maintained to the extent such access is consistent with the management prescription for the area.
- Make an assessment of existing roads and determine which are certified and under the control of the Marquette County Road Commission versus forest roads.
- Due to their multi-use nature, keep roads open and available for use by motorized recreation vehicles to avoid development of random trails.
- New road construction for the purpose of harvesting timber will be the responsibility of the contractor with the approval of the Forestry Commission or its' agents.

Technology

Goal: To utilize technology to the greatest extent possible in managing the County Forest.

Objectives:

- Maintain the Geographic Information System (GIS) data base to reflect changes in conditions such as harvests, planting, road construction, trails, inventory updates, etc.
- Use Global Position Satellite (GPS) equipment compatible with the County GIS when performing field work.

Recreation

Goal: Provide a variety of recreational opportunities consistent with the concept of a multi-use forest.

Objectives:

- Use the County Recreation Plan as a guidance document to facilitate decision making regarding recreational emphasis in the County Forest.
- Allow for a variety of trail uses.
  - Minimize motorized/non-motorized trail conflict.
  - Trail design should accommodate multiuse.
  - Review annually the snowmobile trail license through the County Forest and spur accessing Sawyer.
- Develop a canoe/kayak "put in" site and parking area on the East Branch of the Escanaba River.
- Promote proliferation of wildlife for viewing, photography, and hunting through habitat improvement.
  - Maintain aspen component of forest, as prime habitat.
  - Identify areas best suited for wildlife enhancement projects.
  - Seed abandoned roads and landing areas after timber harvest.
  - Preserve/create habitat for endangered species such as Kirtland Warblers. Opportunities to work cooperatively with the US Fish and Wildlife Service, Michigan Department of Natural Resources or other entities in habitat creation should be considered.

Land Use

Goal: Utilize land in a manner which is most consistent with a sites suitability or capability of accommodating desired use.

Objectives:

- Monitor management prescriptions to assess environmental impact and ability to accommodate the highest public purpose.
- Participate with local units of government in land use planning.
  - Monitor zoning amendments in areas adjacent to the County Forest.
  - Consider requesting a zoning amendment regarding county owned properties on Sawyer to permit timber management.
- Assess former mineral extraction sites to determine whether county-owns mineral rights or if reclamation is an appropriate course of action.
- Provide buffers in watersheds to protect water quality.

Forest Threats

Goal: Take necessary steps to minimize threats to the County Forest and to quickly take mitigative measures including salvage harvest for those which do occur.

Objectives:

- Take necessary measures to prevent injury and loss of life or resources due to fire.
  - Periodically check and maintain the firebreak created on the south side of Sawyer housing.
  - Oppose rezoning of adjacent and private in-holdings to residential use.
  - Utilize proper slash management as a component of timber harvest including possible use as biomass.
- Reduce timber loss due to insect pests.
  - Maintain fully stocked stands of vigorously growing trees.
  - Monitor annually for insect infestations.
  - Avoid multi-storied stands and small stands which present greater "edge" area and "open grown" trees.
  - Adhere to proper age rotation of growing stock.
- Monitor for invasive plant species.
  - Include observation of invasive species with scheduled forest timber inventories.
  - Collaborate with the U.P. Conservation Districts, the Upper Peninsula Resource Conservation and Development Council, and others with expertise to take action regarding these plants.
  - Look for grant funding to support inventory and mapping of invasive species locations.
- Eliminate dumping of trash and debris on County land.
  - Report illegal dumping to proper authorities.
  - Complete an inventory of dump sites and develop a program for cleanup.
- Prevent timber trespass by County or private logging operations.
  - Complete a survey of lines where there is an interface between County and non-county ownerships.
  - Use extreme care in marking sale boundaries.

Silviculture

Goal: Utilize management prescriptions to optimize outputs from County land primarily to attain area management of jack pine resulting in sustained annual yields with a secondary focus on red pine production.

Objectives:

- Perform inventory updates on at least 15 year basis.
- Harvest trees when they reach maturity and do not carry over mature stock due to reduced growth rates and increased mortality and risk of loss.
- Plant seedlings of high quality and at proper stand density for optimal growth and to reduce vulnerability to forest pests.
- Encourage tree species diversification to provide varied wildlife habitat, buffer against large scale insect infestations, provide a variety of forest products, and provide diverse recreational opportunities.
- Explore the use of biosolids to enhance productivity in tree plantations.

Economics

Goal: Utilize forest outputs, both forest products and tourism/recreation to contribute employment and revenue to the local economy.

Objectives:

- Maintain a sustained yield of forest products to create employment through logging, trucking, mill operating, and value added wood products.
- Provide and promote a variety of recreational opportunities in the County Forest.
- Create a stable cash flow in the Forestry Recreation Fund to accommodate Forest Management Plan implementation as-well-as support of Sugarloaf Mountain Recreation Area, Perkins Park Campground, the Big Bay Harbor of Refuge, and Little Trout Lake.
- Pursue necessary steps for participation in marketing of "carbon credits" from carbon sequestration resulting from tree growth.
- Establish a forest "self-insurance fund" with a $500,000 balance and consider a mechanism to increase this amount to accommodate inflation.

6.0 SILVICULTURAL STRATEGY

6.1 Introduction

Since formal management of the County Forest began, the basic silvicultural strategy has remained essentially the same, advocating area management for jack pine. Under this system, the total forest acreage is divided by the rotation age of the tree species present. For example, a 5,000-acre forest of jack pine (rotation age 50 years and trees in age classes 1-50) could accommodate a harvest of 100 acres per year. Assuming replanting follows harvest, a sustained yield could be maintained indefinitely on the site. It is a principle silvicultural objective of this plan, through manipulation of harvesting and reforestation, to continue advancing the County Forest towards attainment of area management for the jack pine type.

A secondary focus of the plan will be in red pine management. As part of our 1999 forest inventory, site index data was gathered. From this information specific sites were identified that are well suited for growing red pine. As these sites are cleared per our harvest schedule, red pine plantations will be established. These stands will be managed primarily for a utility pole product. Pulpwood will result from early thinnings and saw logs from a final harvest.

The third component of the silvicultural strategy addresses "all other" tree species (white pine, aspen, spruce, fir, birch, etc). Some of these stands occupy sites which would be better utilized for jack pine or red pine and could potentially be converted. These cover types may also serve other roles such as providing wildlife habitat, watershed protection, species diversification, firebreaks, and recreation. These "other" types will be addressed on a site-by-site basis. There will be a greater focus on these species as mature jack pine becomes unavailable.

A fourth component of the strategy is the continued acquisition of land into the County Forest which can aid in attaining area management for jack pine, provide additional red pine sites, or add to species diversification.

A variety of "prescriptions," the method by which individual Forest Management Units will be managed, have been developed over several planning efforts. These prescriptions can be found on pages 35 through 40 of this section.

6.2 Forest Inventory

Knowledge of tree species, age, and volume is critical in developing a silvicultural strategy for management. Inventory data has been utilized in preparation of this and all previous plans. The table to the right compares forest composition as summarized from the various inventories.

Table 6 Historic Forest Types (Acres) per Forest Management Plan

	1954	1981	1988	2003*	2010***	*2010 %)*
Jack Pine	6,449	6,302	6,422	6,846	6,694	*72%*
White/red pine	281	680	880	605	846	*9%*
Lowland conifer	354	530	354	230	236	*3%*
Hardwood	202	40	93	55	27	*0%*
Aspen/spruce/fir/birch	463	210	441	811	825	*9%*
Non-stocked	1,897	584	1,274	27	135	*1%*
Non-Forest (excluding road right of ways)	707	640		570	447	*5%*
Unknown**				342	87	*1%*
TOTAL	**10,353**	**8,986**	**9,464**	**9,486**	**9,297**	

Source: RM/D

**Inventory done in 1999, acreages modified to eliminate Sawyer holdings, subsequent sales and reforestation.*

***Unknown-properties in Co. Forest missed in 1999 inventory.*

****Derived from 2003 plus/minus timber sales and reforestation.*

A decrease of approximately 200 acres between 2003 and 2010 was the result of increased mapping accuracy. The reduction between 1954 and 1981 resulted from establishment of K.I. Sawyer Air Force Base in this location.

The table clearly portrays the importance of jack pine to any management decisions regarding the County Forest. Some 72% of the forest cover is in this type. Approximately 9% of the forest is in the aspen/spruce/fir/birch types, about 9% is red/white pine. The balance consists of cedar, oak, and swamp conifers.

Of significance in the table is the reduction of non-stocked acreage. Though the 1988 inventory did not separate non-stocked from non-forest, it could be assumed that non-forest ranged between 640 and 680 acres. Using this consideration, nearly 550 additional acres have been put into production between the last two inventories, nearly all of this in jack pine. This is a reflection of the reforestation efforts implemented from previous plans.

6.3 Jack Pine

Jack pine is essentially a Canadian tree species but also extends southward into the United States through northern New England, Michigan, Wisconsin, and Minnesota. In the Lake States, jack pine is one of the most important pioneer second growth species having filled the void created by harvest of once prevalent white pine stands. Their climatic preference averages 60° to 70°F in the summer and 0° to 25° F in the winter. This pine typically varies from 70-80 feet in height and 12 to 15 inches in diameter. The jack pine is very shade intolerant and grows best in pure even-aged stands exposed to full sunlight. Dry, sandy, acid soils too poor for other species is well suited for jack pine.

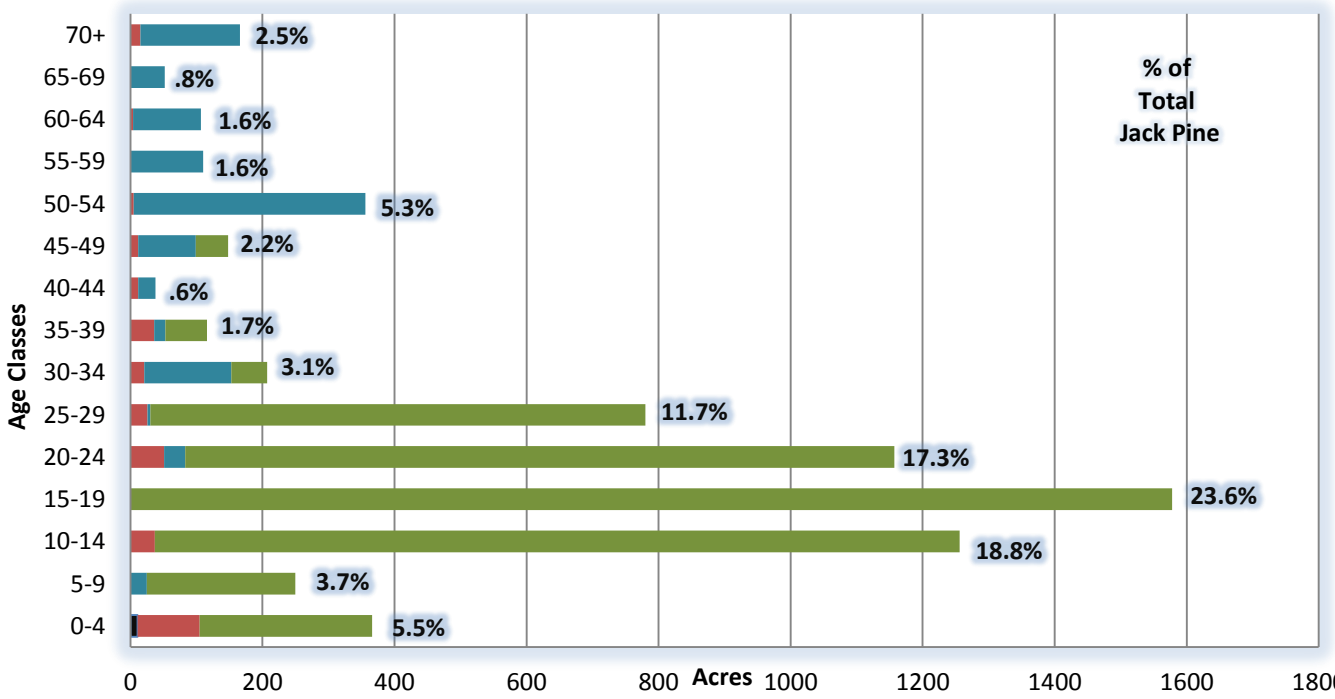
The soil and climatic preferences from the preceding describe conditions present in the County Forest and perhaps explains why jack pine dominates. It inhabits an area of 6,694 acres, approximately 72% of total forest cover.

Existing soils throughout much of the forest are sandy, acidic soils too poor for other species. On these sites, jack pine have thrived and provide valuable timber resources.

This plan advocates area regulation for jack pine. Under this system the total number of acres (6,694) is divided by the rotation age for jack pine (50 years) to determine how many acres could be harvested per year. In this case, 134 acres per year.

Though good in theory, and a sound management philosophy, a number of factors such as catastrophic loss (fire, insects, ice, drought, wind, etc.) social values (recreation, aesthetics), ecology (wildlife, watershed protection), economics (volatile markets, employment), and changes in administrative priorities (budget), can all impact the distribution of age classes. Further complicating area management in the Marquette County Forest, and perhaps the greatest challenge, is an uneven distribution of age classes (1 year old – 70+ years). The following figure, created from data gathered during the 1999 inventory and adjusted for sales and reforestation through 2010, shows the current age distribution, acreage, stocking density, and percent of jack pine in each class.

Figure 6: Age, Stocking Density, and Acreage of Jack Pine Type as of 2010



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70+
Nonstock	11														
Poor	94		37		51	26	21	36	12	12	5		4		15
Medium		25			32	4	132	17	26	87	351	110	103	52	151
Good	261	225	1,219	1,578	1,074	750	54	63		49					

From this distribution it can be noted that 12% of the jack pine is beyond 50 years old and should from both a silvicultural and economic standpoint be harvested. These are, essentially, the next 10 years of scheduled timber sales. It is also clear that we are nowhere near the 10% in each age class 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49 which would put us in a regulated forest mode. Of extreme significance is the fact that fully half the jack pine acreage is under 20 years old. This situation is the result of fire suppression, harvesting of mature stands and replanting following harvest. Much of the forest was mature or over mature at the same time making it difficult to spread out the age classes.

Jack pine stands that are greater than 55 years old are very risky to hold on to. Not only are individual tree characteristics becoming negative (growth rates and mortality), the potential for catastrophic events (fire, windthrow, and insects) become greater. It is recommended that the current harvest continue to focus on removal of over mature stock.

Reading from top to bottom in the preceding Figure 6 (oldest to youngest trees), if just the trees which are currently mature or over mature (ages 50-70+) are harvested in the next 10 years, there would be 791 acres available. This provides an average of 79 acres/year to cut.

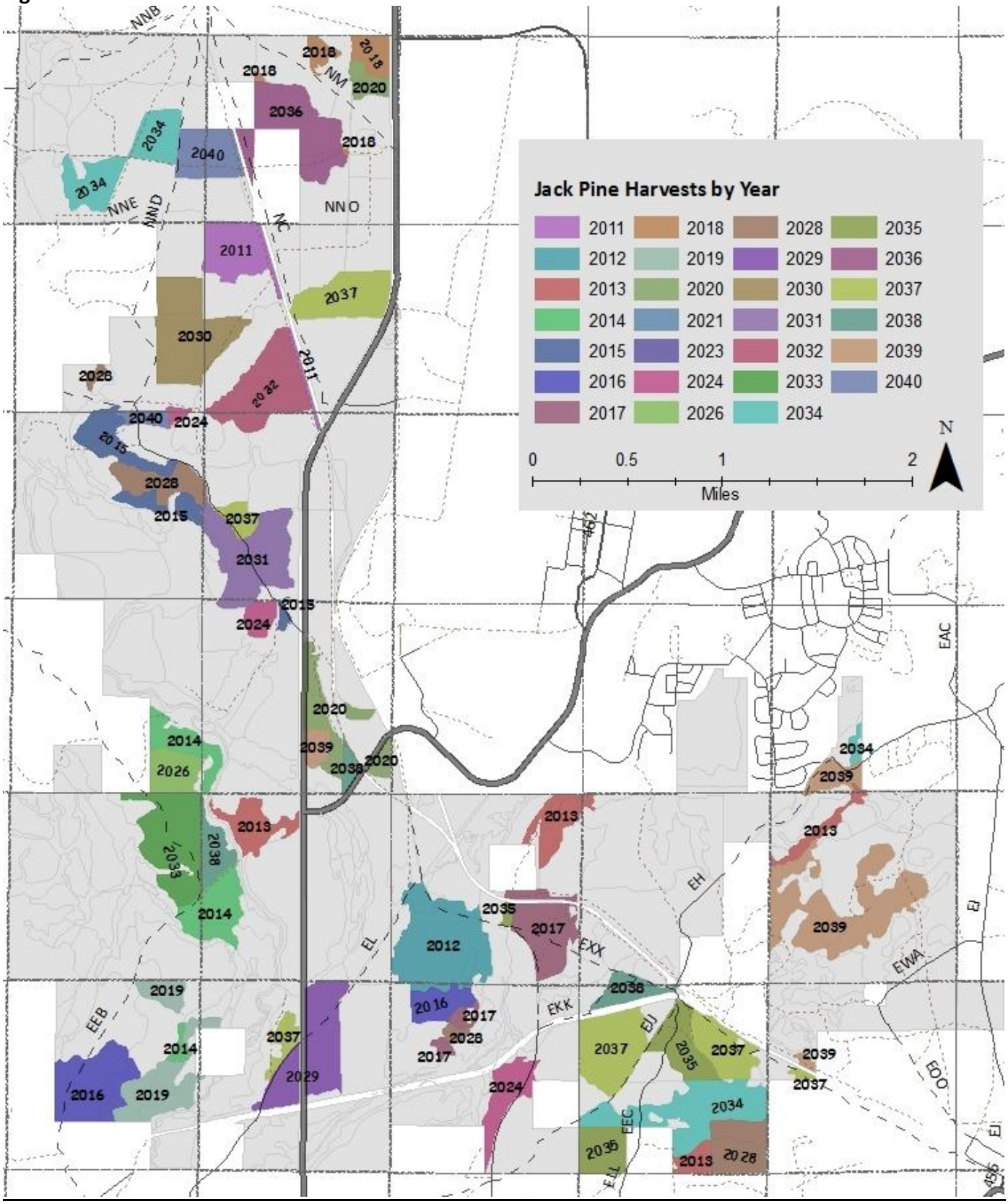
Looking further into the future, available stocks of mature trees begin a serious decline. The next 5 year period, 2021-2026, has only 148 acres (30 acres/year) followed by 38 acres in the period 2027-2031.

There are, of course, other considerations than just age that will go into scheduling of harvest such as distributing visual impact, multi-use forest concepts, fire and other catastrophic events, stand size and distribution, access to stands, etc.

A detailed study of individual year classes more clearly shows gaps within the age bands. A series of harvests from present until the year 2020 will be performed that will remove essentially all jack pine of 50 years age or older. The year 2021 begins a period of 7 years where there will be only 99 acres which reach maturity. Jack pine harvest will be augmented with harvest in “other” forest types and thinning in red pine plantations. Still, it is anticipated, there will be no harvest in 2022, 2025 and 2027. Figure 7 on the following page shows jack pine harvest areas by year.

Though progress has been made just by elimination of the “over 50” stock, an even distribution is still far off. Subsequent Forest Management Plans could vary the harvest period from 45-55 years (versus 50) relying on site index for areas where trees will mature faster.

Figure 7 Jack Pine Harvest Schedule



6.3.1 Silvicultural Recommendations for Jack Pine:

The Marquette County Forest 1999 Inventory Summary & Analysis, our most current inventory, prepared by Grossman Forestry Company for the County offers the following recommendations.

1) Monitor for jack pine budworm annually. Initiate salvage operations immediately in mature and over mature stands.

2) Harvest under stocked stands when they become commercially feasible to harvest and re-establish fully stocked stands.

3) Maintain and/or establish fire breaks in cooperation with Michigan DNR.

4) Harvest specifications should maximize the success of stand establishment.
   a) Harvest when the ground is not frozen with mechanical equipment. Maximum stump height of 6 inches.
   b) Use mechanical and/or chemical site preparation.
      i) While scarification immediately following a jack pine harvest can be successful it is very risky on the typical sites that the County has. The need to plant or interplant is high.
   c) Hand plant using the best available seedlings (containerized stock if available – red pine or jack pine – do not plant mixed stands). Machine planting is also acceptable. Plant 700 trees per acre on an 8' by 8' spacing. Re-planting and/or inter-planting is extremely expensive.
   d) Monitor survival at 3 years old and 5 years old and interplant/replant as needed.
   e) Manage to minimize jack pine budworm and fire danger:
      i) Harvest jack pine when stand age is equal to the site index minus five years. On the average this would be a 49 year rotation for the Marquette Forest.
      ii) Maintain basal area between 70 and 110 square feet per acre.
      iii) A <u>minimum</u> stand size of 40 acres will reduce the ratio of edge to stand area and is recommended. Avoid very large areas of mature and over mature jack pine.
      iv) Avoid leaving or planting narrow strips or islands of jack pine when regenerating a stand.
      v) Regenerate jack pine by clearcutting. Avoid creating uneven-aged or multi-storied jack pine stands. Scattered hardwoods or white pine can be left to enhance diversity.
   f) Consider conversion of stands to other species (red pine if site index is greater than 60).

6.4 Red Pine

The red pine is found in a relatively small geographic region (1,500 miles long and 500 mile wide) around the Great Lakes and the St. Lawrence River. Their climatic preference averages winter temperatures of 0°-25° F and 60°-70° F in the summer. The tree grows best on light acid sandy soils usually on gently rolling to flat plains.

The preceding description of site, soils, and climate certainly describes conditions present in the majority of the County forest. Though limited primarily by soils with much of the forest having soils that are marginal or poor for red pine (though well suited for jack pine) there are areas (approximately 713 acres) where red pine currently exist and additional sites (92 acres) which at present support other cover types that are suitable for managing red pine.

There are several prescriptions in this plan that involve red pine management but in general, they are saw timber, aesthetics, and plantation.

Saw timber management will take place in areas of naturally occurring red pine. These areas are typically two-storied stands with red and white pine over a jack pine, spruce/fir, aspen or birch under story. A variety of harvest techniques can be used to clear the under story when mature. Some thinning and timber stand improvement can also be done to the pine. The maximum age range for saw timber harvest is 80-100 years. The constraining factor is mill limitation to 18" diameter.

The aesthetic management for red pine is associated with areas of high public use, particularly the East Branch of the Escanaba River drainage system, Sawyer, and adjacent to highway M-553. Red pine will only be planted in areas where the site index is appropriate to support them.

The river regions are associated with wetlands and rock outcroppings that make harvesting difficult and is, at least in part, the reason some of these trees have remained. The trees provide soil stabilization from erosion, shade to keep waters cool, habitat for wildlife, and a scenic corridor for canoeists and other recreational users of the area.

A new management prescription was developed to address "urban forestry" or care of wooded areas (approx. 300 acres) associated with housing at Sawyer. These forestlands were annexed to the County Forest as a result of land transfer subsequent to the closure of K.I. Sawyer Air Force Base. These forest areas serve better as greenspace for recreation and wildlife habitat than areas to manage for timber products. Over mature jack pine is the current cover type and die-off is occurring. Red pine and other longer lived species should be introduced to these areas. Land acquisition by the private sector occurring in the housing area may eliminate this "responsibility" under the plan but remains as a sound management recommendation to the community.

Another aesthetic impact is the result of clearcutting along M-553. The flat land and long sight distances provide a stark landscape after harvest. On sites suitable for red pine, plantations will be established near the road. These stands can be managed for longer periods allowing for better coordination with harvest of adjacent stands which will reduce the open area created at any one time.

The third type of red pine management will be associated with plantations. These plantations will be established through disc trenching and planting of containerized stock at a density of 550 trees/acre. Plantations will be created on only those sites where the site index is 60 or greater.

The following table shows the red pine harvest schedule. One of the features of the table is thinning to a specific basal area and the year in which this should occur. Stoddard, Essentials of Forestry Practice

defines basal area as “the number of square feet per acre represented in trees measured at diameter – at breast height.”

Table 7 Red Pine Harvest Schedule

Year	Description	FMU(Stand)	Year	Description	FMU(Stand)
2019	12 ac. saw logs	38(1)	**2065**	14 ac. basal 120	62(3)
2023	43 ac. all trees over 15" dia.	66(4)		31 ac. basal 130	62(3)
	thin proper BA	65(3)	**2066**	17 ac. basal 130	69(1,2)
2026	91 ac. 1/3 thin - 1996	63(2), 64(3)		91 ac. clearcut	63(2), 64(3)
2031	105 ac. 1/3 thin	14(2), 13(4)		44 ac. basal 120	24(1,5)
2032	42 ac. 1/3 thin	45(11), 47(1,5)	**2068**	62 ac. basal 130	34(2), 69(3)
2034	85 ac. 1/3 thin	41(4)		6 ac. basal 120	59(3)
2035	31 ac. 1/3 thin	60(1)	**2070**	42 ac. basal 130	27(1), 24(2,3)
2036	17 ac. 1/3 thin	69(1,2)	**2071**	105 ac. clearcut	14(2), 13(4)
	91 ac. basal 110	63(2) 64(3)	**2072**	42 ac. clearcut	45(11), 47 (1,5)
2038	62 ac. 1/3 thin	34(2), 69(3)	**2074**	85 ac. clearcut	41(4)
2040	42 ac. 1/3 thin - 2010	27(1), 24(2,3)		28 ac. basal 130	48(1)
2041	105 ac. basal 110	14(2), 13(4)	**2075**	31 ac. clearcut	60(1)
2042	42 ac. basal 110	45(11), 47(1,5)		14 ac. basal 130	62(3)
2044	85 ac. basal 110	41(4)	**2076**	17 ac. clearcut	69(1,2)
	28 ac. 1/3 thin	48(1)		44 ac. basal 130	24(1,5)
2045	31 ac. basal 110	60(1)	**2078**	62 ac. clearcut	34(2), 69(3)
	14 ac. 1/3 thin	62(3)		6 ac. basal 130	59(3)
2046	91 ac. basal 120	63(2), 64(3)	**2080**	42 ac. clearcut	27(1), 24(2,3)
	17 ac. basal 110	69(1,2)	**2084**	28 ac. clearcut	48(1)
	44 ac. 1/3 thin	24(1,5)	**2085**	14 ac. clearcut	62(3)
2048	6 ac. 1/3 thin	59(3)	**2086**	44 ac. clearcut	24(1,5)
	62 ac. basal 110	34(2), 69(3)	**2088**	6 ac. clearcut	59(3)
2050	42 ac. basal 110	27(1), 24(2,3)	**2094**	27 ac. 1/3 thin	34(4)
2051	105 ac. basal 120	14(2), 13(4)	**2096**	91 ac. 1/3 thin	63(2), 64(5)
2052	42 ac. basal 120	45(11), 47(1,5)	**2098**	6 ac. 1/3 thin	59(3)
2054	28 ac. basal 110	48(1)	**2101**	105 1/3 thin	14(2), 13(4)
	85 ac. Basal 120	41(4)	**2102**	47 1/3 thin	45(11), 47(1,5)
2055	31 ac. basal 120	60(1)	**2104**	85 ac. 1/3 thin	41(4)
	14 ac. basal 110	62(3)		27 ac. basal 110	34(4)
2056	91 ac. basal 130	63(2), 64(3)	**2105**	31 ac. 1/3 thin	60(1)
	17 ac. basal 120	69(1,2)	**2106**	17 ac. 1/3 thin	69(1,2)
	44 ac. basal 110	24(1,5)	**2108**	62 ac. 1/3 thin	34(2) 69(3)
2058	62 ac. basal 120	34(2), 69(3)	**2114**	27 ac. basal 120	34(4)
	6 ac. basal 110	59(3)		28 ac. 1/3 thin	48(1)
2060	42 ac. basal 120	27(1), 24(2,3)	**2115**	31 basal 110	60(1)
2061	105 ac. basal 130	14(2), 13(4)		14 ac. 1/3 thin	62(3)
2062	42 ac. basal 130	45(11), 47(1,5)	**2116**	44 ac. 1/3 thin	24(1,5)
2064	27 ac. saw logs	34(4)			
	85 ac. basal 130	41(4)			
	28 ac. basal 120	48(1)			

The recommendation is to manage these stands for a minimum of 70 years. A number of harvests will take place over this period. At age 30 a thinning cut will remove every third row from the plantation producing 8-10 cords of pulpwood per acre. The next harvest will be a thinning at age 40 and each 10 years thereafter with the objective of growing trees suitable for utility pole use. A final clearcut could be performed at age 70 or delayed until 15 inches in diameter.

Table 8 Jack Pine to Red Pine Conversion

Year	Acres	FMU(Stand)
2004	85	41(4)
2005	31	60(1)
2006	17	69(1,2)
2008	62	34(2), 69(3)
2010	42	24(2,3), 27(1)
2014	28	48(1)
2015	14	62(3)
2016	44	24(1,5)
2018	6	59(3)

6.4.1 Silvicultural Recommendations for Red Pine:

The following silvicultural recommendations are provided by Grossman Forestry Company.

When jack pine site index is greater than 60, consider converting the site to red pine.

Harvest specifications should maximize the success of stand establishment:

1. Harvest when the ground is not frozen with mechanical equipment. Maximum stump height of 6 inches.
2. Use mechanical and/or chemical site preparation.
3. Hand plant using the best available seedlings (containerized stock if available) Plant 550 trees per acre on a 8' by 10' spacing.
4. Monitor survival and competition at 3 years old and 5 years old. Use chemical release and/or interplant as needed.
5. Harvest every third row when trees have 2-3 eight foot pulpwood sticks in them (25 - 30 years old). Thin by individual tree selection every 7-10 years after that (thin from basal area 180 to 120). When trees average approximately 15 inches in diameter clear-cut and re-plant (80 to 100 year rotation).

6.5 White Pine

White pine once covered a large portion of the Great Lakes region and was a substantial contributor to the early economy of the area. Much of the white pine was harvested and has all but disappeared from the landscape other than small stands or isolated trees. What is now the County Forest also had significant volumes of white pine, almost all of which was cut prior to the 1900's. The white pine that remain today range from 70 to 90 years of age. The majority (112 acres) is 90+ year old but still, relatively young for trees that can live over 400 years. If any "old growth" does remain, it would be found in isolated areas where terrain and poor access has saved it.

Roughly 1.5% of the County Forest, or 133 acres, is in the white pine cover type. Most of these stands have severe access limitations and at least for the present, are not recommended for harvest. Only 11 acres (FMU 38 Stand 4) are identified in the implementation schedule.

Though the white pine resource is valuable, it is still a relatively small component of the Forest as a whole. Some preservation may be considered to provide forest diversity and maintain an ecosystem type which has been nearly eliminated.

6.6 "Other" Species

The "other" cover type category includes a variety of tree species and comprises 12% of the total County Forest acreage. Primary species in this category include aspen/birch/spruce/fir (9%) and lowland conifers (3%).

These diverse species inhabit different types of sites from upland to wetland and pose management opportunities that become fairly site specific. Prescriptions for management vary from aggressive clearcut to preservation for wildlife habitat, watershed protection, and aesthetics.

The "other" species, since they inhabit about 1,100 acres of the forest do have great timber management potential. The Marquette County Forest 1999 Inventory and Analysis, prepared by Grossman Forestry Company, recommends a harvest of 70 acres per year of these types for each of the next 10 years and 30 acres/year for the following 15 years. These recommendations are from a purely silvicultural perspective and don't necessarily accommodate multi use forest objectives. Some areas of "other" species will be actively managed, particularly in light of declining volumes of jack pine available for harvest. Clearcutting will be the typical harvest technique when the stand has reached 50 years of age.

Harvest specifications should maximize the success of stand establishment. To maximize aspen generation on a poor site, leaf off harvest should be considered. To increase softwood percentage, harvest when the ground is not frozen. Reforestation will rely solely on natural regeneration in these areas.

6.7 Woody Biomass

This section describes woody biomass and explores the practicalities of its utilization as part of the County's timber management program.

6.7.1 Definition

Woody biomass may be defined as "the trees and woody plants, including stem, limbs, tops and other woody parts, tree needles, leaves or cones grown in a forest or woodland environment.[1]" Expanding the definition even further, it is a renewable resource that can be derived from a number of sources including; harvested wood and residual "slash", mill residues (material that is produced during the processing of wood products), material from lands planted specifically to provide fuel for energy production, products made from wood that no longer serve their primary purpose (old railroad ties, pallets) construction materials and demolition debris.

[1] Modified from Federal Regulation 48 C.F.R. 1437.7203

6.7.2 Utilization

The initial portion of the definition takes in essentially the whole tree. As such, utilization covers basically any products made from wood including lumber, veneer, plywood, paper, wood fuel, and many others.

Trees harvested from the County Forest are primarily destined for lumber or paper. The consideration in this section, however, is more in regard to those portions of the tree, tops and limbs, along with deadwood which currently aren't being utilized.

6.7.2.1 Woody Biomass for Green Energy

Probably the most practical use for tops, limbs, and dead wood available on County harvest sites is chipping to produce fuel stock or provide raw material for further processing into fuel by manufacturers.

This is the most common use of this type of biomass on a national basis. According to the US Forest Service, in 2006 biomass was the second most utilized renewable fuel for electricity production in the United States. Hydro was first. Biomass can be used as a substitute for coal, gas, or oil.

6.7.3 Biomass Harvesting Guidance

There has been much consideration regarding potential damage that may be caused by removing biomass from harvest sites. In response, the State of Michigan formed a work group in 2008 to study the issue and make recommendations. The general recommendation is that 1/6 to 1/3 of tree residues (slash) should be left on site. The study goes on to further say "lower biomass retention may be appropriate for jack pine stands on nutrient poor sites due to its lower demand for nutrients." No harvest would remove 100% of the material because of difficulty in collection. Most of the "fine" material, leaves, small twigs which contain most of the nutrients would remain.

From this discussion it can be concluded that harvest residues can be collected on County sites and that there are essentially no limitations on quantity.

6.7.4 Energy Crops

Consideration has been given to conversion of forested County sites to use for growing energy crops. Options from switchgrass to hybrid poplar were explored. In conversation with Jerry Grossman of Grossman Forestry Company and a member of the biomass work group mentioned in 6.7.3, he concluded that County sites were not fertile enough to support energy crops.

The topic was also discussed with Raymond O. Miller, Ph.D, the director of the Forest Biomass Innovation Center, operated by Michigan State University. He stated "The sites you have are quite sandy and dry and probably not suitable for growing poplar and willow hybrids – the cost of establishment and management cannot be justified on poor productivity sites."

6.7.5 Summary

Utilization of woody biomass can provide additional revenue from County sites and should be encouraged. Not only will availability of another "product" make sales more attractive to bidders, a

cleaner site after harvest will also facilitate reforestation efforts. There is not a need to limit the amount of material because of the existing low nutrient levels.

Growing of energy crops is not encouraged due to poor site quality. However, it may be possible in the future to increase the density of jack pine per acre and harvest at an earlier age. Studies in this regard are ongoing and should be monitored.

6.8 Carbon Sequestration

6.8.1 Definition

Wikipedia defines carbon sequestration as "the process of removing carbon from the atmosphere and depositing it in a reservoir". As applies to the County Forest, trees remove carbon dioxide from the atmosphere during the "process" of photosynthesis. The "reservoir" is the trees stem, branches, leaves, and roots.

6.8.2 Carbon Trading

Carbon sequestration has gained notoriety as it relates to carbon trading. Carbon emissions make up what is known as a carbon footprint. Carbon emitters have a baseline profile of what these amounts are. Regulators determine if emissions are in excess of set standards. If an emitter is below the standard then the difference between their emissions and the set "limit" gives them a carbon credit. These credits can then be sold to others that are over the regulatory limit to bring them into compliance.

Carbon sequestration by trees which remove carbon dioxide from the air have become another recognized source of carbon credits available to emitters. The Chicago Climate Exchange, for example, is a member based market of large companies, municipalities, and institutions that purchase these credits.

The potential for selling carbon credits would possibly create a viable option for a new revenue stream from the County Forest.

6.8.3 Carbon Credit Process

The first step towards carbon credit trading is to have a qualified forester complete a forest inventory and create a carbon baseline. This could be accomplished in a few different ways. Include the required data necessary in the next County Forest inventory or, allow an outside party to perform the inventory and the carbon credit marketing for a percentage of revenues realized. A hybrid between the two is also possible.

After the inventory, an approved growth and yield model is utilized to determine the baseline carbon stock and determine the rate of carbon sequestration in the forest. A third party will confirm the value of the sequestration and then the credits will be eligible for sale.

6.8.4 Program Challenges

Programs for addressing carbon sequestration continue to develop. There are challenges for the County Forest to be able to participate though. One of these challenges is a requirement to participate in a stewardship certification program such as the Sustainable Forestry Initiative, Michigan Forest Stewardship Program, or be a Certified Tree Farm Group member. This requirement may change or the County will need to explore possible participation. A more significant hurdle is that, to this point, only private lands have participated. According to Matt Smith of Finite Carbon, there is currently a methodology being considered to allow non-federal public lands. In his estimation approvals could come as soon as the end of 2011.

6.8.5 Summary/Direction

Staff should continue to monitor program developments and explore the potential for County Forest lands to participate in marketing of carbon credits. At a minimum, the appropriate baseline data should be collected during the next forest inventory so we are properly positioned should the opportunity develop in the future.

If forest certification remains a requirement it will be necessary to consider participation. This, again, may be a consideration in a future inventory.

6.9 Management Units and Prescriptions

To achieve the County goals for use of County forest properties will require implementation of thoughtful management techniques based upon the capability of each unit of land in the County forest system to produce public benefits or outputs. To do this, the County forest was divided into management units or blocks of land comprised of common characteristics or potential.

Delineation Factors used to define management units include:

- Soil Characteristics
- Forest Resource Potential
- Recreation Resource Potential
- Current and Competing Land Use
- Special or Unique Wildlife Plant or Mineral Characteristics
- Access

Management units are shown in Figure 8 on the following page. In order to achieve each management unit's potential, a series of management strategies or prescriptions were developed. The prescriptions are described on the pages following Figure 8.

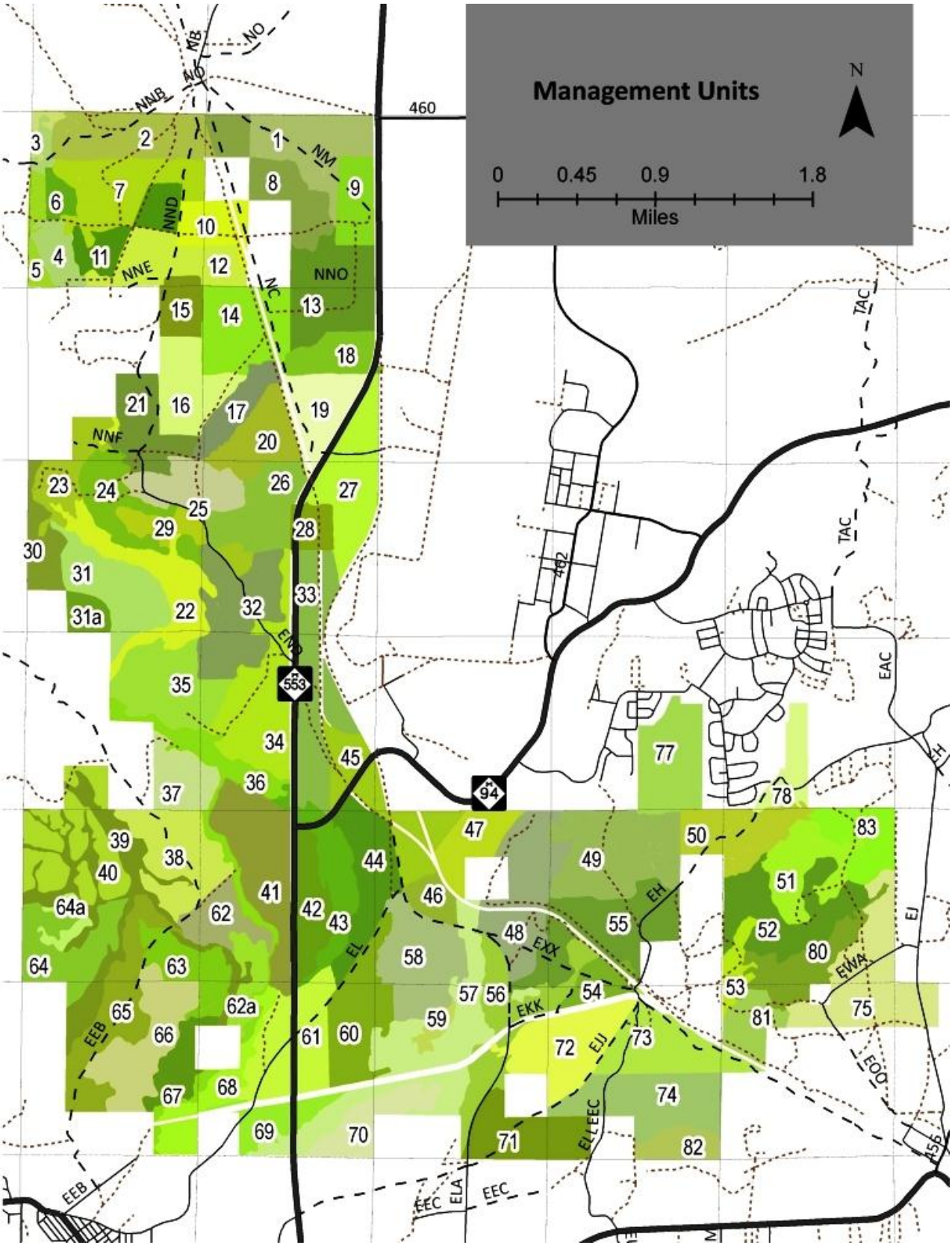


Figure 8 Forest Management Units

1.1 JACK PINE MANAGEMENT FOR FIBER PRODUCTIONS

INTENT

- Emphasize the production of high quality jack pine fiber.
- Produce low to moderate outputs of game/non-game wildlife.
- Provide for low intensity dispersed recreational opportunity.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

Surface geology is basically outwash plain, in some cases pitted, or associated with shallow depth to bedrock on rock outcroppings. Soils are mostly Rubicon sand with low fertility.

Lands under this prescription consist of even-aged plantations of jack pine ranging in age from 1-50 years. Size of these plantations generally varies from 40-160 acres. For the most part, these areas are roaded and may contain small tracts of non-productive forest land such as kettles, inactive quarries and ponds. Harvest operations consist of clearcuts either piece cut or mechanized whole tree, with pulp being decked along roadsides. Slash is scattered over the clearcuts or may be chipped and utilized as biomass.

Recreation activities are dispersed including hunting, berry picking and driving for pleasure. Snowmobile and ATV use occurs on the existing road network and on licensed trails.

1.2 JACK PINE MANAGEMENT FOR FIBER/WATER BASED RECREATION

INTENT

- Emphasize jack pine fiber production while recognizing the needs of water based recreation.
- Provide for medium to high levels of water-based recreation.
- Low to moderate amounts of game/non-game wildlife outputs.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

Lands under this prescription occur primarily on glacial outwash plains made up of Rubicon sands. Generally these areas are pitted with small kettles, ponds and lakes. Soils are deep and low in fertility.

These lands consist of even-aged irregular shaped jack pine plantations ranging in age from 1-50 years. Plantations vary in size from 10 to 100 acres.

Harvest operations are clearcut using piece cut or mechanized whole tree methods. Pulpwood decking occurs along roadsides. Slash is scattered across clearcuts or may be chipped and utilized as biomass. It is common to restrict harvesting near water features to preserve water quality and aesthetics associated with recreation areas.

This unit is roaded and it receives significant amount of recreational use because of the prevalence of small lakes or other water features (i.e., fishing, boating, canoeing, swimming and camping).

1.3 DISPERSED RECREATION/WILDLIFE AND PINE SAW TIMBER PRODUCTION

INTENT

- Emphasize production of quality pine saw timber while managing other compatible tree species components for fiber.
- Encourage low to moderate amounts of dispersed recreational activities.
- Medium to high game/non-game wildlife outputs.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

Lands are level to undulating glacial outwash or rock hills and ranges. Such areas are dissected with numerous drainages. Soils are generally sand to loamy sand with higher productivity than the Rubicon sands in units 1.1 and 1.2.

Forests under this prescription are two-storied with large red and white pine over jack pine, spruce, fir, aspen, white birch and red maple. Ultimately this land will contain a diversity of forest types with a mix of naturally and artificially regenerated stands of saw timber. Saw timber is harvested at a minimum age of 70 years. Consideration of timber size accepted at mills would determine maximum age for harvest and may be carried to greater age for diversity, buffering, etc. Partial cutting, clearcutting and timber stand improvement cutting are practices employed in managing these stands.

A significant part of this unit is roadless. Recreational activities are dispersed including such activities as hunting and hiking. Habitat improvement consists of planting forage crops and maintenance of forest specie and age class diversity.

1.4 RED PINE MANAGEMENT FOR UTILITY POLE TIMBER

INTENT

- Emphasize the production of high quality utility poles, fiber from thinnings, and saw timber.
- Produce low to moderate outputs of game/non-game wildlife
- Provide for low intensity dispersed recreational opportunity.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

These units can be identified as outwash plains with light acid sandy soils.

Forests under this prescription will result from conversion of jack pine cover type to red pine plantation in those areas where the site index (greater than 60) dictates a high potential for success. Sites from 10 to 100 acres have been identified. These areas will have established access as conversion follows harvest. Harvest operations will remove every third row from plantation at age 30. Thin by individual tree selection every 10 years following. When trees average 15 inches in diameter clear-cut and re-plant (70 to 80 year rotation).

Recreational activities are dispersed including hunting and driving for pleasure. Snowmobile and ATV use occurs on the existing road network and on licensed trails.

2.1 UPLAND EVEN-AGED MIXED FOREST FOR FIBER PRODUCTION/WILDLIFE

INTENT

- Emphasize medium to high levels game and non-game wildlife outputs.
- Production of wood fiber from mixed stands of upland conifers, aspen, birch and red maple.
- Low to medium amounts of dispersed recreational activities.

DESCRIPTION OF LAND AS MANAGED UNDER THIS UNIT

This unit occurs on level to hilly outwash and moraines. Soils have good drainage and low to medium fertility.

Forests under this prescription are even-aged with mixtures of different age stands in adjacent areas. Ten to forty-acre clearcuts are the preferred harvest strategy. Rotation age is generally 40-50 years except for scattered small stands of red and white saw log pine. Stands are naturally and artificially regenerated. These areas are generally roaded although some access improvement will be scheduled with individual harvests.

Wildlife outputs are to be increased via habitat improvement including seeding roads/landings with forage crops, wildlife openings, and stand age/specie diversity. Recreational activities are dispersed with hunting predominating.

3.1 UNEVEN AGED MANAGEMENT OF NORTHERN HARDWOODS FOR SAW LOG AND FIBER PRODUCTION

INTENT

- Emphasize management of northern hardwoods for quality saw log and fiber production.
- Low to medium outputs of game/non-game wildlife.
- Low amounts of dispersed recreational activities.

DESCRIPTION OF LAND AS MANAGED UNDER THIS UNIT

This unit occurs on hilly glacial moraine. Soils are medium in fertility. Small pockets of unproductive lowland occur in this unit.

These forests include primarily stands of sugar maple and yellow birch. The forest includes trees of a variety of age and size. Trees are selectively harvested on a timber stand improvement basis. Stands are naturally regenerated. These areas are generally roaded.

Wildlife outputs are encouraged through periodic thinning, preservation of den trees, and planting roads and landings. Plantings also reduce potential for erosion.

Low intensity recreational use occurs including hunting and fishing.

4.1 EVEN-AGED MANAGEMENT OF ASPEN FOR FIBER PRODUCTION/WILDLIFE

INTENT

- Emphasis is on management of aspen for fiber production and medium to high game/non-game wildlife outputs.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

Sites under this prescription are level to hilly uplands with sand to loamy sands with good drainage. Small areas of lowland dissect this unit.

This unit consists of predominantly aspen forest type with some mixtures of red, white and jack pine, spruce, balsam fir, white birch and red maple. These stands are even-aged with harvesting occurring at 40-50 years in clearcuts. Ranging in size from 10-40 acres. Regeneration is natural. These areas are roaded.

Medium to high wildlife outputs are encouraged by creating different age class stands in adjacent areas, and by seeding roads and landings. Den trees are retained for non-game species utilization.

5.1 LOWLAND CONIFER MANAGEMENT FOR FIBER PRODUCTION

INTENT

- Emphasize the production of soft wood fiber.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

This unit occurs in swamps with mineral and organic poorly drained soils.

Lands under this prescription include forests of black spruce, balsam fir and tamarack. Jack pine is also a major component of some of these stands. Group selection and small (up to 10 acres) patch cuts are the preferred harvesting method. Rotation age is 50 years plus. Internal road access to these stands is limited to winter.

5.2 LOWLAND CONIFER MANAGEMENT FOR WILDLIFE HABITAT

INTENT

- Emphasize game/non-game wildlife outputs.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

This unit consists of mixed size stands of black spruce, tamarack, and balsam fir on organic soil with low productivity in swamps and along small drainages. As such, these areas have low fiber producing potential yet retain importance as strategic wildlife habitat. Harvesting is discouraged in view of regeneration limitations. This unit is generally roadless.

Limited recreation potential exists with the exception of hunting.

5.3 MIXED LOWLAND HARDWOOD AND CONIFER MANAGEMENT FOR WILDLIFE AND FIBER PRODUCTION

INTENT

- Emphasize wildlife outputs.
- Manage lowland hardwoods/softwoods for fiber production.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

These lands consist of lowland hardwoods and softwoods on poorly drained soils. Wildlife outputs are enhanced by planting forage crops and by harvesting trees using group selection and very small patch cuts (two acre minimum). Hunting is the predominant recreational activity pursued in this unit. This unit is not roaded.

6.1 WETLANDS MANAGEMENT FOR GAME/NON-GAME WILDLIFE AND DISPERSED RECREATION

INTENT

- Emphasize wetland management techniques which provide for game/non-game wildlife outputs especially fish, waterfowl and other water based species.
- Watershed protection

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

The majority of land in this unit is non-forested wetlands supporting tag-elder and other lowland brush along stream courses. Soils are organic or mineral and are very poorly drained. Small pockets of conifer may be managed in accordance with prescription 5.2. These areas are not roaded. Recreational activities include fishing, waterfowl hunting and canoeing.

6.2 SMALL LAKE BASED FISH AND WILDLIFE HABITAT MANAGEMENT

INTENT

- Emphasis is placed upon fish and wildlife outputs.
- Watershed protection.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

This unit consists of swamplands surrounding small lakes. These lands have limited capability for producing forest products. As such, no forest harvests are anticipated in this unit. In general, these lands are best suited for wildlife and recreation. Fish and waterfowl resources are to be enhanced.

7.1 RIVER-BASED OR LIMITED ACCESS RECREATION FOREST MANAGEMENT FOR WILDLIFE

INTENT

- Emphasis is placed upon river based recreation such as fishing, canoeing, hiking and hunting.
- Even-aged forest management recognizing wildlife and aesthetic needs and watershed protection.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

Lands in this unit are primarily associated with the East Branch of the Escanaba River drainage system. Timber stands are mixed red and white pine, spruce/fir, aspen, birch and jack pine. The area is limited in its potential to produce forest products because of the predominance of rock and wetlands. Harvesting is limited to wildlife habitat improvement. Emphasis is placed on providing for canoeing, camping, hunting, fishing and hiking.

8.1 AESTHETIC FOREST MANAGEMENT

INTENT

- Emphasis on scenic potential for public enjoyment
- Medium to high recreational use with trail development

DESCRIPTION OF LAND MANAGED UNDER THIS PRESCRIPTION

Lands under this prescription are typically associated with urban settings and provide greenspace buffers dispersed through developed areas. Buffers may also be created along highway corridors.

Timber management is primarily maintenance of forested areas in and around Sawyer.

The predominant tree species in the housing area is overmature jack pine. Conversion to longer lived and more diverse species is desirable. Techniques to reduce fire hazard will be promoted.

Some stands are associated with developed playgrounds. Interconnecting trails through and between facilities will enhance recreational opportunities.

9.1 EXTRACTIVE

INTENT

- Priority is placed upon providing for future extractive resource needs (i.e., sand, gravel, minerals).
- The production of forest products.

DESCRIPTION OF LAND AS MANAGED UNDER THIS PRESCRIPTION

Lands included in this unit may be managed consistent with prescriptions 1-8 above with the exception that extractive resource needs take precedence. Future investment in regeneration of forest resource under this prescription must be carefully examined on a case-by-case basis. In addition, attempts should be made to secure timber before extraction operations commence, or expand.

Figure 9 Management Prescriptions

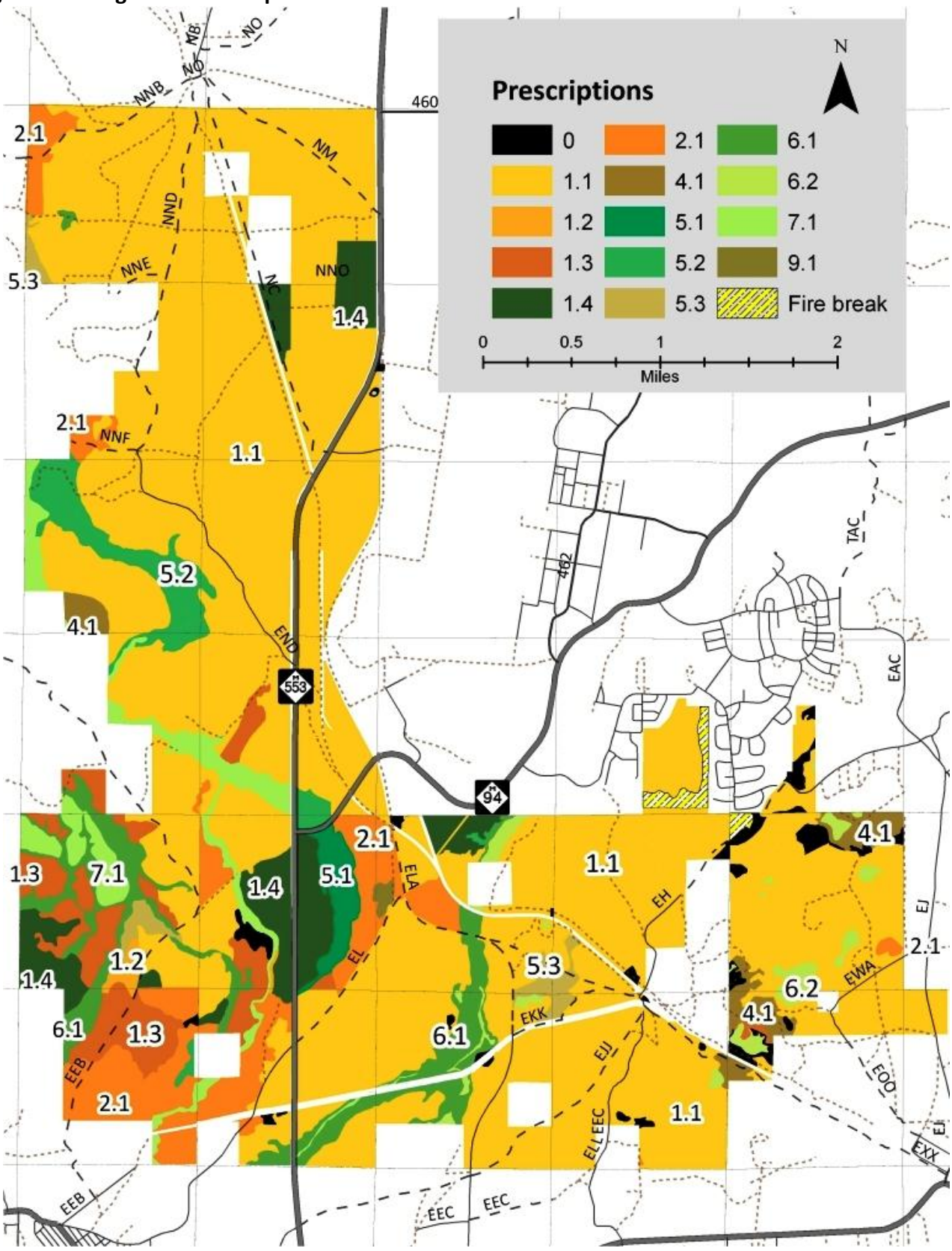


Table 9 Summary - Prescriptions by Amount of County Forest Land Area

Prescription	Description by Emphasis of Management Outputs	Acres	% of Total
0	Unknown (pending inventory)	110	1%
1.1	Jack Pine Management For Fiber Production	6,451	69%
1.2	Jack Pine Management For Fiber/Water Based Recreation	25	0%
1.3	Dispersed Recreation/Wildlife and Pine Saw Timber Production	363	4%
1.4	Red Pine Management for Utility Pole Timber	417	4%
2.1	Upland Even-Aged Mixed Forest For Fiber Production/Wildlife	593	6%
3.1	Uneven Aged Management of Northern Hardwood For Saw log and Fiber Production	0	0%
4.1	Even-Aged Management of Aspen For Fiber Production/Wildlife	136	1%
5.1	Lowland Conifer Management For Fiber Production	87	1%
5.2	Lowland Conifer Management For Wildlife Habitat	221	2%
5.3	Mixed Lowland Hardwoods and Conifer Management for Wildlife and Fiber Production	87	1%
6.1	Wetlands Management for Game/ Non-Game Wildlife and Dispersed Recreation	386	4%
6.2	Small Lake Based Fish & Wildlife Habitat Management	107	1%
7.1	River Based or Limited Access Recreation Forest Management for Wildlife	265	3%
8.1	Aesthetic Forest Management	0	0%
9.1	Extractive	0	0%
FIREBREAK	Firebreak Area	49	1%
	TOTAL	9,287	100%

6.10 Timber Sales

Harvesting of timber is a critical component in the management of the county forest. Not only is the practice silviculturally sound (recognizes the life cycle of trees) but it also provides ecological benefits (varied wildlife habitat) and economic benefit (employment in the forestry and wood products industry) as well as financial support for ongoing county forest activities and county sponsored recreation sites. Over the course of the last 15 years, County sales have generated over $2 million.

Sales themselves are part of a long term plan to maximize desired outputs from the county forest. The various prescriptions from the previous section determine whether the outputs will be timber, wildlife, aesthetics, recreation, etc… or some combination of outputs. On the short term, at least in forestry terms, there are timber sales scheduled annually for the next 10 years.

6.10.1 Timber Sale Process

Each sale follows a similar process with the components listed on the next page. Tasks are either performed by staff or the county's consulting forester.

Contract specifications are designed to meet the goals of the prescription assigned to a timber stand or group of stands. Site characteristics identified in the on-site inspection carried out by the forestry consultant may result in "fine-tuning" of a prescription. Catastrophic events such as fire, wind storms, or insects may require abandonment of existing prescriptions to facilitate salvage of timber resources.

6.11 Reforestation

Over its management history, a variety of techniques have been used for reforestation of harvested areas in the county forest. Early harvesting relied on natural restocking with cones on slash opening to release their seeds randomly over the site. Collecting cones, extracting of seeds, and broadcasting the seeds over harvested areas was tried. Hand scalping (to expose mineral soil) and planting seedlings and, later, a mechanized version of this also was used. All of these techniques were successful to varying degrees. The most successful approach and the one that should produce the most uniform results and greatest volume is the technique used today, hand planting of containerized stock in mechanically prepared (disked) trenches.

Figure 10 on the following page shows the history of planting in the forest since transitioning from utilizing seeds to using seedlings. A significant decline can be noted from the figure regarding the number of seedlings planted from 2002 onward. This can be attributed to successful implementation of the two previous Forest Management Plans. One of the objectives of these plans was to eliminate non-stocked or understocked sites. Figure 6, previously displayed on pg 23 regarding stocking densities shows only about 5% of the Forest now falls in either of these categories. Salvage sales due to a fire and a wind storm also attributed to larger areas requiring reforestation.

As a result of full stocking the County Forest has reached a point where essentially we are replanting only sale areas. Since sales have been typically 115 acres or so reforestation has stabilized at the current level.

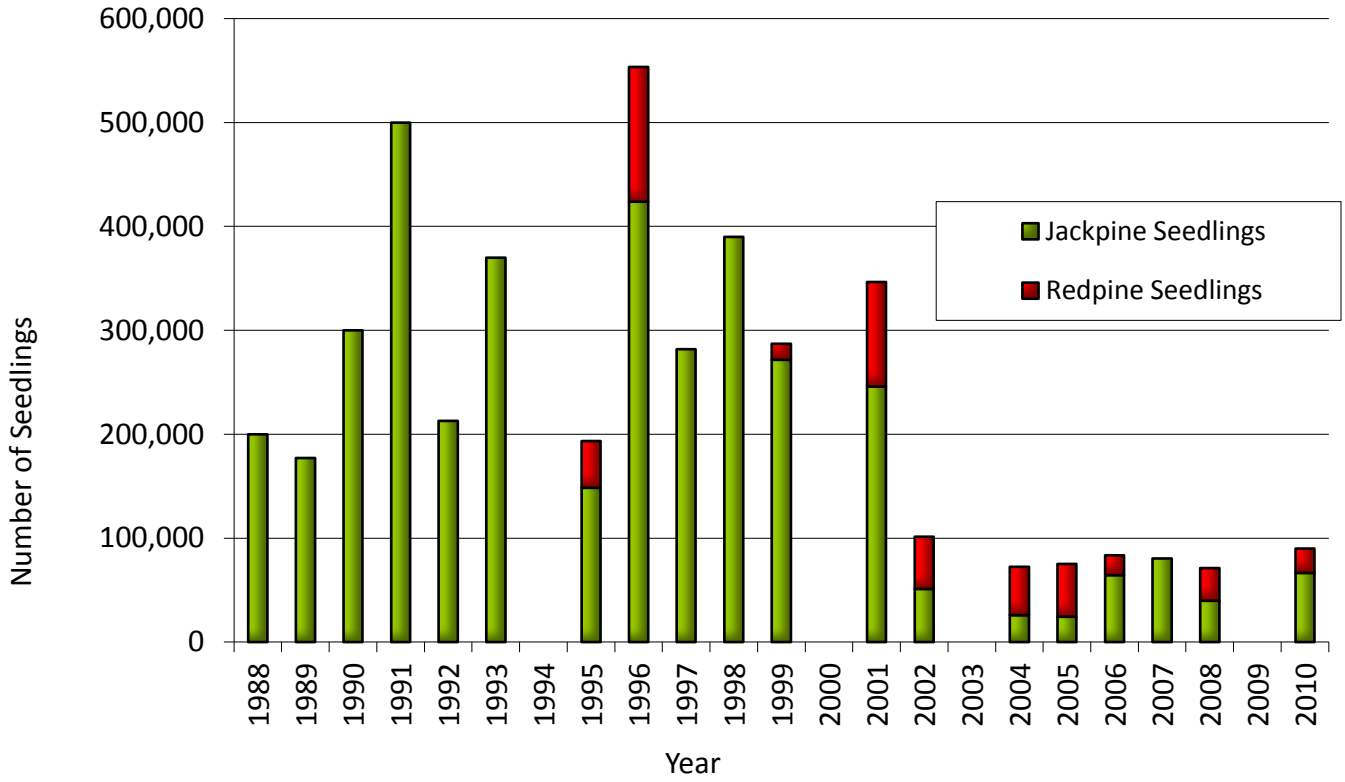
Table 10 Timber Sale Process

Step	Staff	Consultant	Forestry Commission
1) Identify sale area per plan	✔		
2) Approve Sale	✔		✔
3) Review Parcel Layer for Ownership	✔		
4) Provide map and prescription to consultant	✔		
5) Perform full volume cruise and marking, delineation of boundaries		✔	
6) Prepare bid and contract documents	✔		
7) Submit documents for administrative review	✔		
8) Publish sale announcement in newspaper and mailings	✔		
9) Bid Award			✔
10) Contract processing	✔		✔
11) Accounting procedures	✔		
12) Preharvest conference	✔	✔	
13) Harvest monitoring		✔	
14) Sale close-out			
Contract compliance		✔	
Accounting	✔		
Approve Bond Return			✔

Table 11 Seedlings Planted, 1988-2010

	Jack Pine	Red Pine	Acres
TOTAL	3,874,900	511,900	5,265
AVG/YR	203,942	51,190	277

Figure 10 Planting History, 1988-2010



Current specifications for reforestation are as follows.

6.11.1 Trenching Specifications

1. Row scarification shall provide trenches alternating a spacing of 8’ and 10’ between furrow centers.

2. Continuous furrows will be made to displace slash, brush, and organic matter, exposing but not excavating the mineral soil.

3. Furrow direction and orientation will be specifically determined for each site by the County’s Forester.
(generally parallel to heavily traveled roads).

4. All trenching and associated activities will stay within the boundaries of the treatment areas.

6.11.2 Seedling Specifications

1. Age - All seedlings must be the equivalent of two years old.
2. Genetics - All seedling stock must be grown from seed originating in climatic zones #1 and #2 as shown on the U.S. Forest Service Regional Zone Map. The nursery providing seedlings shall certify that seeds used meets this requirement.
3. Size - Seedlings must average 8” in height.

4. Type - Only containerized stock will be acceptable. Seedlings will be delivered in 14" x 24" styro-blocks or equivalent with 1" plug holes. No bare root stock will be accepted. Stock will be free of freezer burn, insect damage, or other stress characteristics which might reduce their potential for survival once planted.

6.11.3 Planting Specifications

1. Trees shall be planted vertically resulting in the root plug being one inch below the surface of mineral soil.
2. Trees shall be firmed in the planting hole with mineral soil packed in and around the roots, so they cannot be pulled out of the ground by light tugs about equal to the breaking strength of six jack pine needles. No dry or loose soil, ash, organic matter, rock, or air pockets will be permitted in the planting hole.
3. Tree seedlings must be planted in such manner that twisted, balled, or "J" roots will not occur. After planting, their stems shall stand erect.
4. Red Pine – If 8' spacing was selected in trenching specifications, then trees will be planted 10 feet apart within trenched furrows. If 10' spacing of furrows was selected, trees will be planted 8' apart. Density of 550 trees/acre.
   Jack Pine – If 8' spacing was selected in trenching specifications, then trees will be planted 8 feet apart within trenched furrows. If 10' spacing of furrows was selected trees will be planted 6' apart. Density of 700 trees/acres.

Reforestation has reached what is essentially a "put and take" condition. Those areas contracted as sales the previous year are planted the subsequent fall.

As timber sales are scheduled to "level off" at roughly 100 acres/year over the next several years, it may be prudent to switch to an every other year planting. Mobilization of equipment can be a costly component of the process and these costs could be reduced by combining acreages of two or more sale years. Something else to factor into this decision is that a jack pine plantation will produce .5 to .75 cords/year of growth per acre. Over 100 acres this is a range of 50 to 75 cords and using a value of $55/cord results in a lost earning opportunity of $2,750 - $4,125 for missing a growing season.

7.0 ECONOMICS

7.1 Background

The forest products industry has played and continues to play a major role in the economy of our region. Virgin stands of white pine attracted the first loggers. Next, the regions hardwoods brought a second industry "boom." Today, much of the timber that is harvested is "second growth" which has replaced the original stands.

A substantial portion of today's forests are managed either by corporate, government or individual property owners in a manner which assures there will always be timber resources available to meet market demands.

7.2 Employment and Impact Data

Michigan's timberlands rank as the fifth highest in the United States based on acreage. The forest products industry, and related forest-based tourism and recreation, contributes over 200,000 jobs and $12 billion annually to the State's economy. Marquette County forest resources and businesses contribute to this total. Census data indicates there are 17 logging companies and 2 sawmills operating in the County. Add to that the wood manufacturing businesses (furniture, trusses, flooring), transportation (trucking, railroad), and retail businesses that sell products made with wood and the local significance of the industry becomes more apparent.

According to the Bureau of Economic Analysis, logging has a fairly high multiplier effect—each job creates 0.8292 additional jobs in Marquette County. For comparison, iron mining creates 1.3048 additional jobs, but construction creates 0.5778 additional jobs. Of course, pulpwood logs end up creating jobs in other counties that have paper mills.

An average American uses 749 pounds of paper per year. This is the equivalent of a tree 100 feet tall and 16 inches in diameter for every man, woman, and child. Is " your tree" growing in the Marquette County Forest?

7.3 Forest Recreation Fund

The ability to implement the Management Plan is tied directly to the amount of funding available for this purpose. It is plan implementation that is the driving force behind the budget request submitted annually by the County Forestry Commission to the Marquette County Board of Commission.

The source of funding to implement the Plan is the Forest Recreation Fund. This fund was created in 1995 and combined responsibility for management of the County Forest and county-owned recreation facilities (Perkins Park Campground, Big Bay Harbor of Refuge, Sugarloaf Mountain Natural Area and Little Trout Lake) under the Forestry Commission.

The primary source of revenue for this fund is receipts from timber sales which are offered to the public on a sealed bid basis by the Commission each year. Table 12 summarizes sales receipts over the period 1994-2010.

Other sources of revenue to the Fund are state and federal grants. Grants have been obtained for reforestation and wildlife enhancement projects. As the fund title indicates recreation grants are also pursued and provide for capital improvement projects at the previously mentioned facilities. Still other revenues to the fund result from "user fees" for camping, boat launching, fuel sales, etc. generated at these facilities.

Table 12 Timber Sales 1994-2010

Year	Sale Receipts
2010	$65,001
2009	$72,632
2008	$76,000
2007	$88,063
2006	$104,223
2005	$84,240
2004	$228,192
2003	$74,985
2002	$65,858
2001	$83,732
2000	$351,401
1999	$131,966
1998	$132,318
1997	$131,904
1996	$381,186
1995	$197,472
1994	$83,398

Source: RM/D

Expenditures from the fund related to the forestry program are principally for reforestation, inventory, forest monitoring and evaluation, survey, and preparing timber sales. Recreation related expenditures are matching funds for grants, capital improvement projects, and balancing user fees versus operational expenses at

Perkins Park and the Harbor and in support of Sugarloaf Mountain Natural Area and Little Trout Lake which generate no revenue to the fund.

7.4 Valuation of County Forest

In 1999 an inventory of timber resources was performed on the County Forest. Grossman Forestry Company, Newberry, Michigan, was contracted to analyze data gathered through this effort. As the value of the resources relates to the volume present, the following table displays the volume of what would be considered the growing stock or "marketable" timber. (Note that size class is a measure of size and density, i.e., 1=poorly stocked saplings, 2=moderately stocked saplings, 3=well stocked saplings, 4=poorly stocked poles, 5=moderately stocked poles, 6=well stocked poles, 7=poorly stocked saw logs, 8=moderately stocked saw logs, 9=well stocked saw logs…saplings are less than 5" diameter, poles 5"-10" and saw logs 10" or greater.)

Table 13 Acres and pulpwood volume by size class

Size	Acres	Cds
4	460	2,479
5	805	9,983
6	3,530	84,223
7	50	900
8	102	1,149
9	382	6,934
	5,329	105,668

Source: Grossman Forestry 1999

Table 14 Acres and saw timber volume by size class

Size	Acres	Mbf
4	460	30
5	805	133
6	3,530	1,478
7	50	130
8	102	485
9	382	1,616
	5,329	3,872

Source: Grossman Forestry 1999

The 1999 inventory volume on the forest in size class 4-9 was approximately 105,700 cords and 3.9 mbf (million board feet).

With these 1999 volumes, and utilizing an average value of $35.00/cord and $175.00/mbf (thousand board feet), an approximate value of $4.4 million was derived. Additionally, the sapling growing stock (size 3 valued at $200/acre and size 2 valued at $150/acre) which is not reflected in the tables provides another $1 million in value.

These estimates provide a "snap shot" of conditions as they existed over 10 years ago. Subsequent to this calculation, additional harvest of mature timber has taken place and been replaced with sapling growing stock. The average cord value has also increased as can be seen on the graph on the following page.

7.5 Financial Analysis

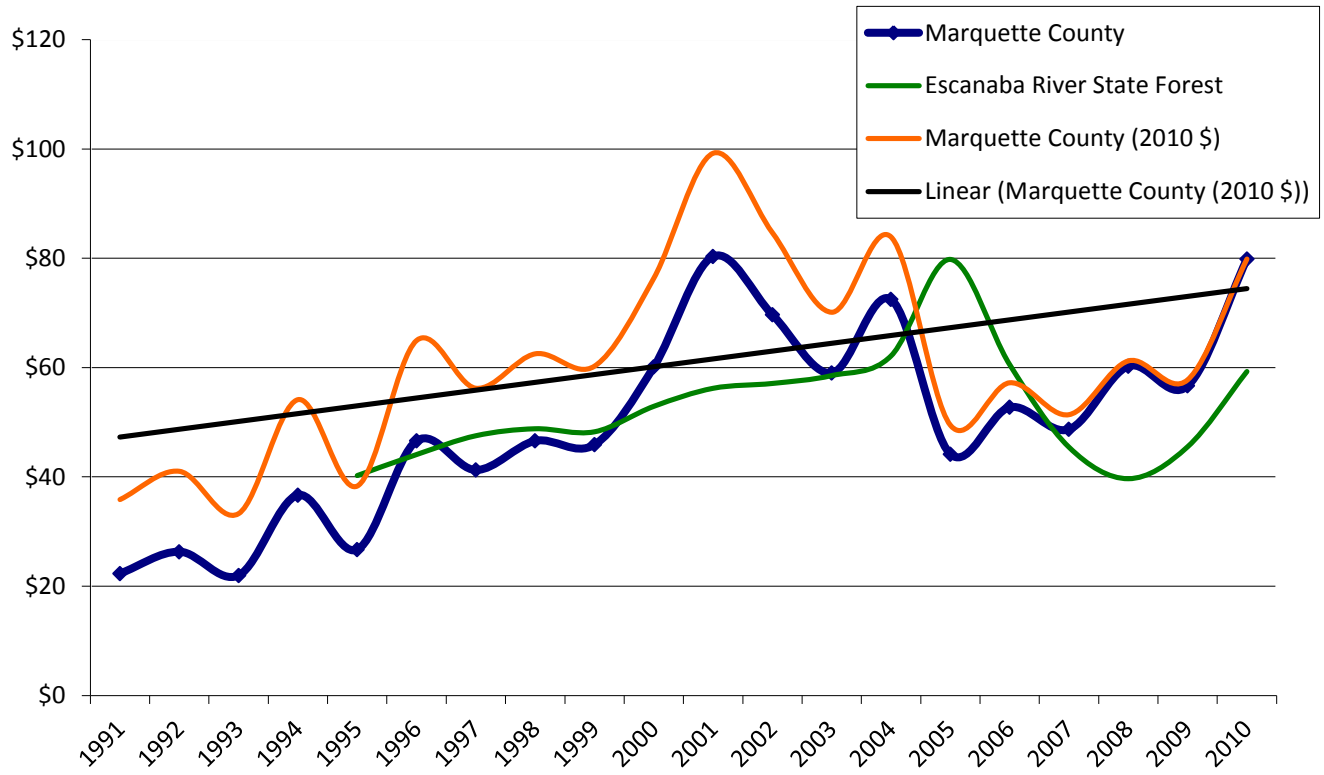
The silvicultural strategy section of this Plan promotes area management for jack pine. Currently, approximately 72% of the County Forest is in a jack pine cover type. Due to soil types and other site characteristics jack pine production will remain the primary focus.

A secondary focus will be red pine production. On those sites suitable for red pine they will, after about age 35, out-produce jack pine in volume and continue to do so from that point forward.[2] As future harvests occur, appropriate sites will be converted from jack pine to red pine production.

[2] USDA Forest Service, North Central Forest Experiment Station, Grand Rapids, Minnesota

Jack pine – Historical prices are often used to estimate future prices. Following is a graph of per cord prices paid to the County (blue line) over the period 1991-2010. These figures represent actual amounts received and are not adjusted for inflation. Red line shows an inflation adjustment. The green line shows per cord prices for Michigan DNR lands.

Figure 11 Historical Stumpage Prices



There are many reasons why the jack pine market has shown volatility. These include the general economic growth and decline, the severe reduction in softwood production from the Western United States, and the development of dimensioned lumber markets for jack pine (notably Louisiana Pacific – Gwinn).

Red Pine – Only relatively high productivity sites will be converted to red pine production. On a forest-wide basis this would amount to approximately 500 acres. This is in addition to the 472 acres of red pine currently in the County Forest. Table 15 reflects current product prices for red pine.

In comparing jack pine and red pine stands it is necessary to assess volumes produced over time. The harvest cycle for jack pine will be 50 years in County plantations (trees will live longer but growth rate slows). For the jack pine stand there is one clear-cut harvest at the end of 50 years. Our experience on the most recent county sales is a volume of approximately

Table 15 Current Red Pine Product Prices

Product	Unit	$/Unit
Pulpwood	Cord	60.00
Sawtimber	Mbf	175.00
30 ft. pole	Pole	12.03
35 ft. pole	Pole	15.47
40 ft. pole	Pole	18.91
45 ft. pole	Pole	24.06
50 ft. pole	Pole	37.81

Source: Grossman Forestry Company

15 cords per acre. This figure will vary in the future when plantations are cut due to better socking levels versus natural stands we are presently harvesting. Reducing the volume somewhat will be the 50 year age because we are cutting 70 year old over-mature trees. Plantation volumes at 28 cords per acre can be anticipated.

The red pine plantation will be thinned once at 30 years and then subsequently thinned at 40, 50 and 60 years then finally clear-cut at 70. The first thinning should produce 8-10 cords/acre. The red pine stand will produce from 1.8 to 1.9 cords per acre/year yielding an additional 18-19 cords at each 10-year increment. Therefore, at age 50, the red pine stand should have produced between 44 and 48 cords per acre versus the 28 in jack pine for the same period. Additionally, a red pine thinning will happen again at 60 and clear-cut of the remaining stand at 70 if desired.

This extended harvest period takes greater advantage of the maximum ages of the trees on the site. A further advantage of a non-silvicultural nature is that harvest can take place in a more "aesthetic" manner than one clear-cut. An area where aesthetics is of particular concern, for example, would be along highway M-553 where terrain is flat and sight distance is great. A red pine plantation would have some "buffering" effect in these areas.

The rotation age on red pine could be extended to 120 or 140 years for saw log production if desired. This allows an opportunity to adjust harvest cycles to fill in "gaps" in the 50-year jack pine harvest schedule in an effort to maintain a sustained yield on a forest wide basis.

7.6 Forestry Fund Revenues and Expenditures

In this section, various tables and graphs are utilized to forecast revenues and expenditures of the Forest Recreation Fund over time as stands become mature, are harvested, and replanted. "Ongoing expenses" are also assessed such as operational debts incurred at Perkins Park, Big Bay Harbor, Sugarloaf Mountain and Little Trout Lake. Also, special appropriations are made from the Fund, some on an annual basis and others on occasion by County Board directive.

Table 16 Forest Recreation Fund

YEAR	TOTAL ASSETS	CASH	TIMBER SALE REVENUE	EXPENSES	DIFFERENCE
2000	$601,874	$601,874	$351,401		
2001	$650,903	$650,903	$93,035	$158,506***	-$65,471
2002	$563,974	$563,974		$148,759**	
2003	$491,846	$491,846	$74,985	$59,070	$15,915
2004*	$10,888,142	$463,371	$228,192	$42,896	$185,296
2005	$11,040,911	$583,473	$84,240	$58,417	$25,823
2006	$11,195,371	$584,387	$104,223	$102,547	$1,676
2007	$11,255,181	$616,075	$88,062	$63,442	$24,620
2008	$11,297,727	$674,704	$76,000	$61,305	$14,695
2009	$11,313,363	$707,615	$72,632	$49,580	$23,052
2010	$11,130,686	$541,617	$65,001	$67,081	-$2,080

**Prior to 2004, land and buildings were not part of total assets*
***60,486 soil conservation district 61,000 economic development*
****60,486 soil conservation district*

Separate budgets are prepared for Forestry Services which includes timber sale revenues and expenses such as consulting and reforestation and budgets are prepared individually for the recreation facilities; Perkins Park (includes Sugarloaf), Big Bay Harbor, and Little Trout Lake.

Table 16, on the previous page, shows the overall impact of timber sales and expenses in the last 10 years (2001-2010). The Forestry Services component has been able to show a positive balance nearly every year.

Table 17 represents revenue and expenses (includes capital and grant matches) at Perkins Park (and Sugarloaf) for a period of over 30 years. As can be seen in the difference column the Park operates "in the red" every year. The amount varies from year to year and can be attributed to things as simple as bad weather and gas prices which lower camping revenues to more significant differences when capital projects and matches for grants are required. Over the period depicted the deficit averages $17,258 per year.

The Big Bay Harbor of Refuge has a considerably smaller budget than Perkins Park. Mooring fees and fuel sales more closely offset operating expenses. Prior to 2000, revenues at the Harbor often exceeded expenses. For nine of the last ten years however the harbor operated at a loss. The average deficit is about $2,100. Table 18 on the next page shows Harbor operating history.

Table 17 Perkins Park Operating Revenues and Expenses

YEAR	OPERATING	CAPITAL OUTLAY	TOTAL	REVENUE	DIFFERENCE	REVENUES AS A % OF EXPENSES
1979	$36,261			$15,200	-$21,061	42%
1980	$35,980			$17,831	-$18,149	50%
1981	$35,500			$15,500	-$20,000	44%
1982	$42,400			$18,300	-$24,100	43%
1983	$34,142			$20,200	-$13,942	59%
1984	$37,745			$18,483	-$19,262	49%
1985	$35,464	$21,708	$57,172	$16,780	-$40,392	29%
1986	$33,014	$1,993	$35,007	$21,927	-$13,080	63%
1987	$31,758	$3,907	$35,665	$23,500	-$12,165	66%
1988	$33,774	$1,808	$35,582	$22,747	-$12,835	64%
1989	$30,726		$30,726	$23,960	-$6,766	78%
1990	$33,128	$3,714	$36,842	$28,445	-$8,397	77%
1991	$35,632	$3,323	$38,955	$30,607	-$8,348	79%
1992	$39,918		$39,918	$34,400	-$5,518	86%
1993	$50,966	$2,337	$53,303	$33,151	-$20,152	62%
1994	$38,755	$3,373	$42,128	$31,392	-$10,736	75%
1995	$44,694		$44,694	$35,076	-$9,618	78%
1996	$44,691		$44,691	$36,078	-$8,613	81%
1997	$59,148	$3,225	$62,373	$34,615	-$27,758	55%
1998	$56,040	$1,840	$57,880	$45,126	-$12,754	78%
1999	$52,256	$26,582	$78,839	$41,666	-$37,173	53%
2000	$50,747		$50,747	$35,031	-$15,716	69%
2001	$56,047	$2,600	$58,647	$40,486	-$18,161	69%
2002	$62,648	$4,425	$67,073	$51,213	-$15,860	76%
2003	$71,299	$6,923	$78,222	$50,752	-$27,470	65%
2004	$84,599	$1,368	$85,967	$50,406	-$35,561	59%
2005	$78,560		$78,560	$66,723	-$11,837	85%
2006	$67,397	$1,463	$68,860	$68,412	-$448	99%
2007	$68,953	$4,786	$73,739	$68,245	-$5,494	93%
2008	$76,540	$3,463	$80,003	$67,428	-$12,575	84%
2009	$86,968	$2,600	$89,568	$63,606	-$25,962	71%
2010	$103,821	$1,404	$105,225	$73,829	-$31,396	70%

Responsibility for Little Trout Lake was transferred from Sawyer Operations to the Forestry Commission in 2010. The annual budget is $5,000. The year of transfer was funded by Sawyer. This year marks the beginning of fiscal responsibility falling onto the Forest Recreation Fund. This facility was taken on knowing "up front" that there were/are no revenues associated with its operation.

7.7 Forest Recreation Fund Future

As can be seen in the previous discussion, there are expenses related to recreation facilities that are anticipated to continue into the future. Funding to "offset" these shortfalls will come from two primary sources: 1) the difference between timber sales revenue and forestry related expenses and 2) from the cash balance of the Forestry Fund ($541,617 at the end of 2010).

With a lack of mature trees to harvest, timber sales will be smaller in size in coming years. With less income and steady or increasing costs, the Fund's Cash Account will carry a steadily increasing annual burden. To estimate this impact on the Fund over time, it is necessary to project timber sale revenues based on the implementation schedule (Section 9 of this Plan, page 55) for harvests against annual expenses for forestry services and recreation. In estimating sale revenues a number of variables were considered. First, the forestry database was queried to determine an average volume per acre (in cords). This review resulted in an average of 15 cords/acre. Next, the Michigan Department of Natural Resources Average Stumpage Report (1/1/2011 to 3/31/2011) was utilized to obtain a value per cord by species from sales in this area. The final component is the acreage proposed for harvest.

For example, the 2012 sale would be estimated as follows: 15 cords/acre x $51.86 (jack pine value per cord) x 137 (acres) = $106,572.

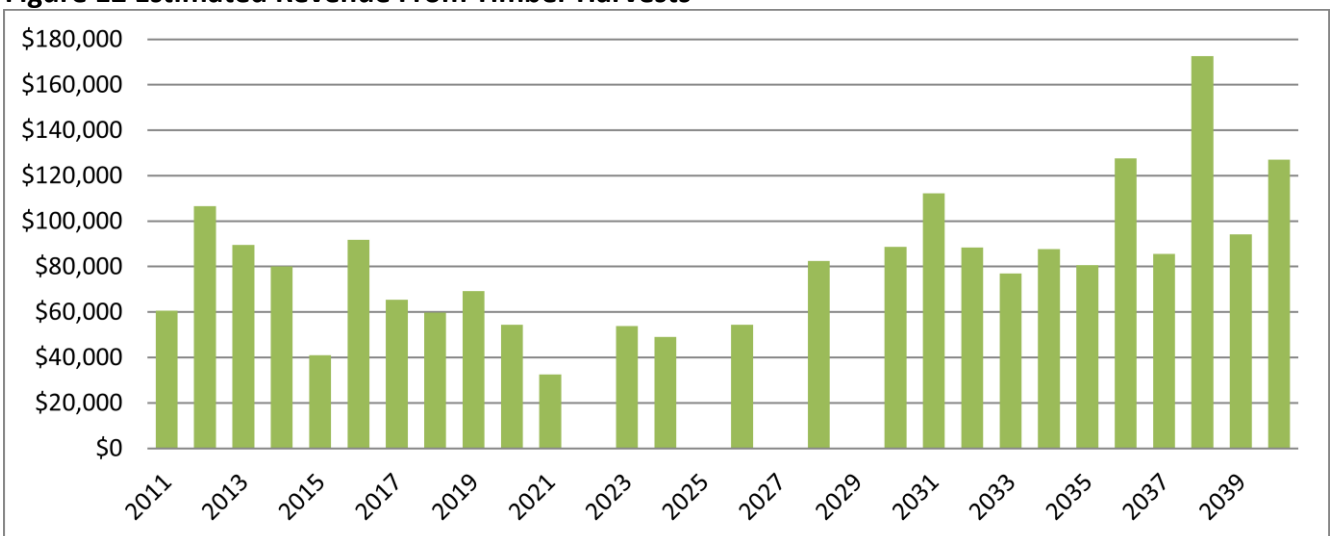
Table 18 Harbor of Refuge Operating Revenues and Expenses

YEAR	EXPENSES	REVENUES	REVENUES AS A % OF EXPENSES
1983	$2,825	$3,815	135%
1984	$3,065	$2,889	94%
1985	$3,009	$2,741	91%
1986	$2,940	$2,985	102%
1987	$4,103	$4,164	101%
1988	$5,134	$4,227	82%
1989	$6,595	$5,657	86%
1990	$6,961	$6,298	90%
1991	$3,742	$6,361	170%
1992	$5,284	$6,540	124%
1993	$5,847	$3,828	65%
1994	$4,190	$2,457	59%
1995	$3,998	$1,921	48%
1996	$5,922	$3,494	59%
1997	$8,645	$7,979	92%
1998	$10,023	$10,173	101%
1999	$8,668	$9,855	114%
2000	$12,167	$11,386	94%
2001	$10,875	$7,271	67%
2002	$11,193	$7,973	71%
2003	$10,526	$8,282	79%
2004	$8,383	$8,656	103%
2005	$14,658	$13,935	95%
2006	$13,513	$11,924	88%
2007	$6,311	$2,169	34%
2008	$8,968	$6,197	69%
2009	$9,205	$8,823	96%
2010	$11,923	$9,403	79%

There are also future sales that begin thinnings in red pine plantations. The first of these doesn't take place until 2023. Values from thinning are calculated as in jack pine however, volume per acre is lower and value per cord is lower. The 2023 sale would be estimated as follows: 9 cords/acre x $32.27/cord x 70 acres = $20,330. Figure 12 (next page) shows the estimated timber sales revenue using this method.

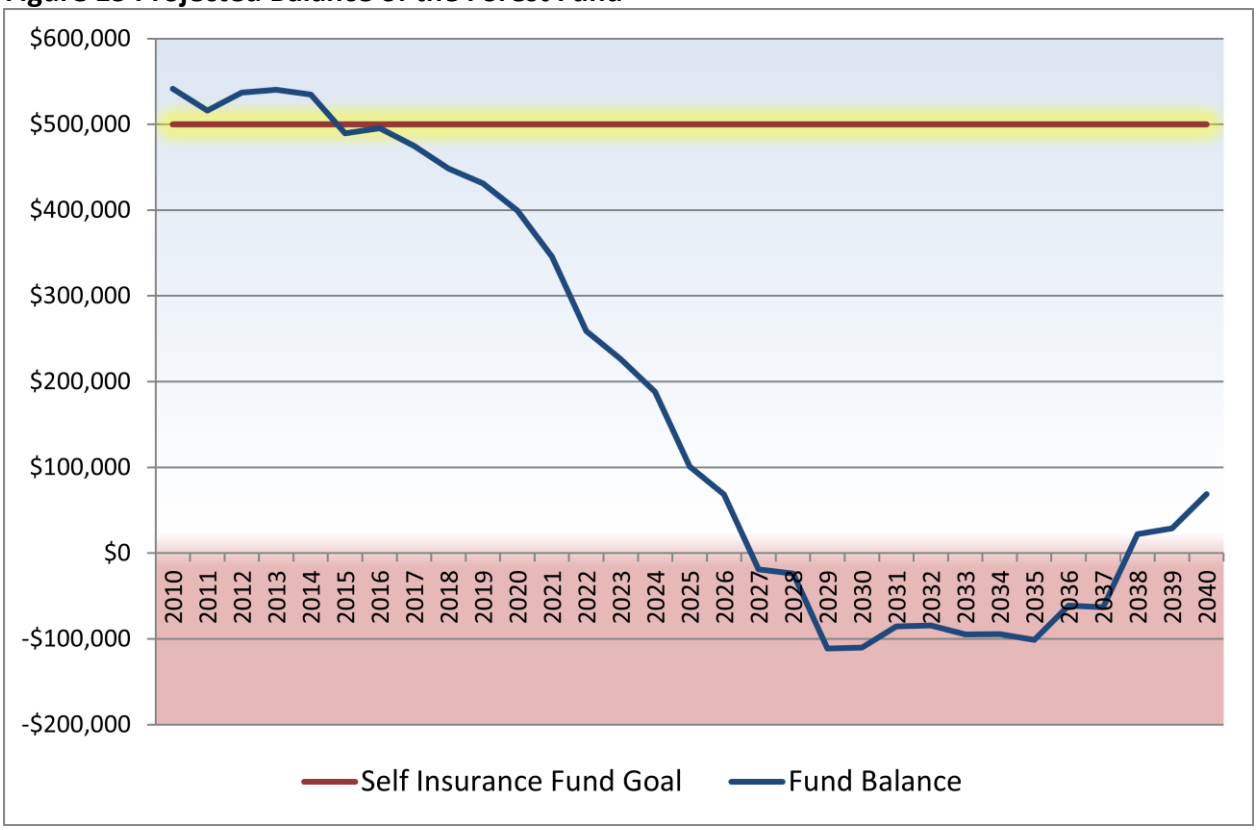
Annual expenses of the Forestry Fund were more difficult to estimate and an annual cost of $87,392 was derived. This was calculated by combining costs for the forestry operation itself ($63,042 average over the last eight years Table 16), and the annual average deficit at Perkins Park ($17,258 Table 17), Harbor ($2,092 Table 18), and Little Trout Lake ($5,000). All calculations are in 2011 dollars without adjustment for inflation. This is true of both revenues and expenditures.

Figure 12 Estimated Revenue From Timber Harvests



The combined effect of declining sales revenue and persisting deficits at the Park, Harbor, and Little Trout Lake will erode the Fund balance over time as the program will be "living off the bank". Figure 13 graphs the impacts of revenue versus expense over time. The decline in fund balance is significant and the fund is entirely depleted by 2027 under the set of assumptions utilized in this analysis.

Figure 13 Projected Balance of the Forest Fund



7.8 Self Insurance Fund

Grossman Forestry Company, the consultant that coordinated our most recent inventory, also provided some data used in this financial analysis. One item of particular note is the recommendation for a Self Insurance Fund. Not insurance in a traditional sense (policy), but a financial reserve for unforeseen occurrences.

Catastrophic events such as fire, ice storms, drought, and insect infestations pose serious risks to the County Forest. In the case of a jack pine forest, the potential for a significant catastrophic event approaches 100% according to Grossman. To provide a reserve for reforestation following such an event, Grossman recommends a Self Insurance Fund within the Forest Recreation Fund in the amount of $500,000 (this amount is in 1999 dollars). These funds would be used to reestablish stands lost to a disaster. A factor to accommodate inflation and the increasing value of the forest should be considered.

Declining size of sales (and corresponding revenue) with increasing expenses threaten the ability to maintain this “insurance fund”. The previous figure shows the “threshold” being crossed in the next 3-4 years.

7.9 Finance Summary

As can be seen from the assessment in 7.7 and Figure 13, there are challenging times ahead. The assumptions used in the preceding section may or may not come to fruition. The trend in the fund balance however, is downward. This does not even consider potential catastrophic events that would interrupt the revenue stream and create greater expense without a self insurance fund. Calculations also do not include matching funds for grants or “out of the ordinary” expenses. There are only two ways to address this trend: either an increase in revenue or a decrease in expenditures.

Revenue options are limited in that “we are growing trees as fast as we can.” There are currently timber resources on two County properties outside the County Forest; the Honor Camp and Perkins Park, that are mature and should be harvested in the next few years. A bit more “nebulous” but a possible long term revenue stream could come from marketing carbon credits as described in Section 6.8. This would be entirely “new” revenue. Potential for user fee increases at County sites such as the Park and Harbor will need to be kept up to market levels. During the harvest schedule development process approximately 300 acres lacked data to determine when or if there might be harvestable resources present. These areas should be inventoried in the next two years and integrated into the implementation schedule when (or if) applicable. Another potential solution is subsidizing the Forest Recreation Fund from other County funds.

The other option for mitigating the rate of Fund decline is to reduce expenditures. If the current annual cost to the Forestry Fund can be reduced from its current average level of $87,392 to $81,275, a reduction of 7%, a negative Fund balance could be averted. A “mix of fixes” where revenues increase and expenditures decrease will likely be the long term solution to solvency of the Fund.

An understanding of the scope of the problem and enough “lead time” to take corrective action provides managers an opportunity to maintain a positive Fund balance into the future.

8.0 GEOGRAPHIC INFORMATION SYSTEM

8.1 Introduction

A Geographic Information System, or GIS, is a type of "smart map". It is a type of mapping software that allows you to maintain and manipulate several different levels, or layers of data within one or across several regions. GIS and database technology have grown rapidly over the last several years. The number of different applications for these technologies has been growing as well. Many different organizations and professions now benefit from the vast capabilities of these tools, and forest management most certainly falls into this category.

The combination of GIS and databases allows one to "predict the future" of the forest area that is being managed. When the GIS, and its database, are kept up to date, it becomes easy to see which stands should be harvested, where those stands are located, and when they should be harvested. The GIS and the database have different features that are very valuable to this process. It is the combination of these features, however, that are of the greatest benefit to the user. This capability allows the County to plan their harvests and reforestations 50 years or more in advance.

8.2 GIS Forestry Applications

The function of the database is to be a place where all of the desired data and information are stored and organized. The amount and quality of the data that is stored in the database will directly determine how much can be done with or gleaned from the database. How the database is designed is another important aspect of its usability. If the database is designed well and contains good, useful data, then there is no end to what can be done with it. Year planted and harvest year fields have been added to Marquette County's database to make future harvest decisions easier. Fields defining harvest, reforestation, and plantation assessment schedules have also been added to the database. There is also a field for remarks and is utilized as a place to catalog updates to the forest GIS layer and to track field observations. Using these fields, along with the size, density, cover type, acres, and prescription will allow the County to see which stands or forest management units (FMUs) need to be harvested each year.

Layering the forest data with aerial photography, local zoning districts, road networks, property ownership, and utility information allows staff to foresee potential difficulties and/or opportunities in an upcoming sale. Coupling the powerful tool of GIS with forester knowledge and a GPS unit in the field eases inventory and assessment discussion a process that use to entail multiple trips "into the field".

8.3 GIS Data Maintenance

Annual or "on the fly" updating of the database is necessary to accurately reflect timber harvest, reforestation, and catastrophic events that will impact subsequent timber production. Reinventory of the County forest on 15 year increments will facilitate a complete update of the database.

8.4 GIS Equipment/Software

Computer, Arc GIS, Photo Quality Plotter, GPS Unit, Digital Camera

9.0 IMPLEMENTATION SCHEDULE

	HARVEST			REFORESTATION			PLANTATION ASSESSMENTS			
							3 YEAR		*5 YEAR*	
YEAR	**TYPE**	**ACRES**	**FMU (STAND)**	**TYPE**	**ACRES**	**FMU (STAND)**	**ACRES**	**FMU (STAND)**	**ACRES**	**FMU (STAND)**
2010	JP	97	28(2) *MCRC*	JP	95	33(4)	112	44(1)	127	42(1)
			33(1,8)			48(9)				60(1)
			44(3)			78(1)				
			45(1,4)	RP	43	24(2)				
			68(5)			27(1) *HAND PLANT*				
2011	BALSAM FIR, WHITE BIRCH	17	5(1)	NAT. REGEN.	6	28(2) *MCRC*	116	34(2)	117	69(1,2)
	JP	69	14(1)	JP	68	33(1,8)		41(1)		77(2,3)
			19(2)			44(3)		69(3)		
	PREP 8(4) FOR 2012 PLANTING					45(1,4)				
				NAT. REGEN.	23	68(5)				
2012	JP	137	46(2)	NAT. REGEN.	17	5(1)	*WARBLER HABITAT*		112	44(1)
			58(1,2,3)	JP	69	14(1)				
						19(2)				
				JP	37	8(4)				
2013	JP	99	41(2)	NAT. REGEN.	8	46(2)	138	33(4)	116	34(2)
			48(1,11,12)	JP	129	58(1,2,3)		48(9)		41(1)
			50(3)					78(1)		69(3)
	JP	16	82(1,3)					24(2)		
	DEVELOP ACCESS 82(1) NOREEN LK							27(1) *HAND PLANT*		
2014	JP	38	37(1)	JP	71	41(2)	97	28(2) *MCRC*	*WARBLER HABITAT*	
						48(11,12)		33(1,8)		
	JP	57	62(1,3)			50(3)		44(3)		
	JP	8	67(2)	JP	16	82(1)		45(1,4)		
				NAT. REGEN.	0.6	82(3)				
				RP	28	48(1)		68(5)		
2015			24(1,4,5,6)	JP	38	37(1)	123	5(1)	138	33(4)
	JP	49	34(3)	JP	43	62(1)		14(1)		48(9)
	SPRUCE	5	22(1)	NAT. REGEN.	8	67(2)		19(2)		78(1)
				RP	14	62(3)		8(4)		24(2)
	check buffer FMU 77 for possible harvest; Inventory									27(1) *HAND PLANT*

2016	JP	31	58(4)	RP (JP to RP)	43	24(1,5,6)	137	46(2)	97	28(2) *MCRC*
	JP	40	65(4)	JP	9	24(4)		58(1,2,3)		33(1,8)
	JP	47	66(5,6)	JP	5	34(3)				44(3)
				NAT. REGEN.	5	22(1)				45(1,4)
	Plan Update									68(5)
2017	JP	84	48(2,3,8,10)	JP	31	58(4)	115	41(2)	123	5(1)
			59(1,3)	NAT. REGEN.	40	65(4)		48(1,11,12)		8(4)
				NAT. REGEN.	47	66(5,6)		50(3)		14(1)
								82(1,3)		19(2)
2018	JP	52	1(1,2,6,7)	JP	70	48(2,3,8,10)	103	37(1)	137	46(2)
			43(6)		8	59(1)				58(1,2,3)
	SPRUCE	19	5(3)	RP (JP to RP)	6	59(3)		62(1,3)		
	SPRUCE, ASPEN	20	43(2,3,5)					67(2)		
2019	RP	12	38(1)	JP	44	1(1,2,6,7)	54	24(1,4,5,6)	115	41(2)
	JP	88	66(2,7)			43(5,6)		34(3)		48(1,11,12)
			67(1,4,5)	NAT. REGEN.	34	5(3)		22(1)		50(3)
						43(2,3)				82(1,3)
2020	JP	70	1(3)	RP	12	38(1)	118	58(4)	103	37(1)
			9(1)	JP	88	66(2,7)		65(4)		62(1,3)
			33(5)			67(1,4,5)		66(5,6)		67(2)
			45(18)							
2021	FIR	12	68(1)	JP	70	33(5)	84	48(2,3,8,10)	54	24(1,4,5,6)
	ASPEN	49	68(2)			45(18)		59(1,3)		34(3)
			69(4,7)			1(3)				22(1)
			66(3)			9(1)				
	WHITE PINE	11	38(4)							
2022				RP	11	38(4)	96	1(1,2,6,7)	118	58(4)
								5(3)		65(4)
								43(2,3,5,6)		66(5,6)
2023	RP/ JP*	43	66(4)				100	38(1)	84	48(2,3,8,10)
	RP (thin)	70	65(3)					66(2,7)		59(1)
	**thin RP, remove JP*							67(1,4,5)		59(3)
2024	JP	41	56(4)				70	33(5)	96	1(1,2,6,7)
	JP	5	25(1)					45(18)		5(3)
	JP	17	32(4)					1(3)		43(2,3,5,6)
								9(1)		

2025				JP	41	56(4)	73	68(1,2)	100	38(1)	
				JP	5	25(1)		69(4,7)		66(2,7)	
				JP	17	32(4)		66(3)		67(1,4,5)	
								38(4)			
2026	RP (thin)	83	64(3)						70	33(5)	
	RP (thin)	8	63(2)							45(18)	
	JP	36	37(2)							1(3)	
										9(1)	
2027									73	68(1,2)	
										69(4,7)	
										66(3)	
										38(4)	
2028	JP	5	23(1)				63	56(4)			
	JP	42	29(1)					25(1)			
	JP	6	59(2)					32(4)			
	JP	21	74(5)								
	JP	32	82(2)								
2029	JP	71	61(2)	JP	106	23(1)					
	JP	29	61(6)			29(1)					
						59(2)					
						74(5)					
						82(2)					
				RP	36	37(2)					
2030	JP	30	16(1)	JP	100	61(2, 6)			63	56(4)	
	JP	58	16(2)							25(1)	
	JP	26	16(3)							32(4)	
2031	RP (thin)	33	14(2)	JP	114	16(1,2,3)					
	RP (thin)	72	13(4)								
	JP	100	32(1)								
		5	32(2)								
2032	RP (thin)	18	45(11)	JP	105	32(1,2)	142	23(1)			
	RP (thin)	24	47(1)					29(1)			
	RP (thin)	5	47(5)					59(2)			
	JP	96	20(1)					74(5)			
								82(2)			
								37(2)			
2033	JP	99	38(2)	JP	96	20(1)	100	61(2,6)			
2034	RP (thin)	85	41(4)	JP	99	38(2)	114	16(1,2,3)	142	23(1)	
	JP	39	11(1)							29(1)	
	JP	42	11(2)							59(2)	
										74(5)	
										82(2)	
										37(2)	

2035	RP (thin)	31	60(1)	JP	81	11(1,2)	105	32(1,2)	100	61(2,6)
	JP	4	48(4)							
	JP	39	71(2)							
	JP	49	73(2)							
2036	RP (thin)	10	69(1)	JP	92	48(4)	96	20(1)	114	16(1,2,3)
	RP (thin)	7	69(2)			71(2)				
	RP (2ND THIN)	83	64(3)			73(2)				
	RP (2ND THIN)	8	63(2)							
	JP	13	8(2)							
	JP	69	8(1)							
	JP	6	8(3)							
	JP	10	10(2)							
2037	JP	110	74(4)	JP	98	8(1,2,3)	99	38(2)	105	32(1,2)
						10(2)				
2038	JP	67	18(1)	JP	110	74(4)	81	11(1,2)	96	20(1)
	JP	80	72(2)							
	JP	38	73(3)							
	JP	10	73(4)							
	JP	3	73(6)							
	RP (thin)	32	34(2)							
	RP (thin)	30	69(3)							
2039	JP	11	45(3)	JP	67	18(1)	4	48(4)	99	38(2)
	JP	27	54(3)	JP	80	72(2)	39	71(2)		
	JP	17	61(5)	JP	38	73(3)	49	73(2)		
	JP	17	23(4)	JP	10	73(4)				
	JP	15	33(6)	JP	3	73(6)				
	JP	24	78(3)							
	JP	4	81(5)							
	JP	6	78(2)							
2040	RP (thin)	5	27(1)	JP	121	45(3)	98	8(1,2,3)	81	11(1,2)
	RP (thin)	28	24(2)			54(3)		10(2)		
	JP	143	52(3)			61(5)				
	JP	8	52(2)			23(4)				
						33(6)				
						78(3)				
						81(5)				
						78(2)				

10.0 ACHIEVEMENTS OF MARQUETTE COUNTY FORESTRY COMMISSION

Management of the County Forest has been carried on, in some form, for nearly 60 years. The entity currently charged with this responsibility is the Marquette County Forestry Commission. The Forestry Commission was created by resolution of the Marquette County Board of Commissioners on November 1, 1994. It is a sub-committee of the Marquette County Planning Commission and consists of three members. Concurrent with this appointment, the Forest Recreation Fund was created within the County budget. Revenues generated from timber sales as-well-as money derived from fees at Perkins Park Campground and the Big Bay Harbor of Refuge are combined to finance forest management operations and support County-owned recreation facilities.

10.1 County Forest

The most visible activity in the County Forest is timber sales. In the last 15 years (1996-2010) sales have generated just over 2 million in revenue. Subsequent to harvest, all areas cut have also been replanted. Planting has been predominantly jack pine with 3,264,469 seedlings planted since 1990. On higher quality sites 483,120 red pines were planted in that same period.

In 1999, an inventory was performed on approximately 15,000 acres of the County Forest and newly acquired Sawyer properties. This inventory, updated to reflect harvests and reforestation since, provides the necessary silvicultural information to carry on current management activities as-well-as future planning.

A wildlife project commenced in 2000. A 30 acre “open space” was created in conjunction with a timber sale. Working with a local boy scout troop, some 200 fruit and nut bearing trees were planted to provide a future food source for wildlife. A second project was implemented in 2009. Working in conjunction with the US Fish and Wildlife Service, Michigan DNR, Gwinn School and Boy Scouts of America, a 75 acre site was prepared for regeneration into Kirtland warbler habitat.

The County Forest grows in very close proximity to the housing units at Sawyer posing a serious risk should wildfire occur. To prevent a potential disaster, the Commission, in cooperation with the Air Force, created a fire break. Over 800 cords of wood was removed and stumps and slash buried.

The Forestry Commission has utilized a high level of technology in its forest management. Data collected in the last inventory was loaded in the County’s geographic information system (GIS). The GIS is essentially a smart map. All the inventory data is tied to a map of the forest stands and a wide variety of maps combining many different attributes can be generated. Complex queries of the data base can be processed and mapped. Field work is being performed utilizing global positioning satellite (GPS) technology. When field work is completed in this manner, the information can be brought back to the office and mapped using the GIS previously described. Digital orthophotos, which are computer stored, were taken for the County in 2002. Since then a number of public sources for updated photos have become available. Photos provide an overhead view of the forest and are a useful tool in identifying specific features before commencing field work.

10.2 Perkins Park Campground

In 2010, the campground accommodated 10,379 campers. Sale of day use passes for access to the boat launch swimming beach, and picnic area was at 704 with another 53 season passes sold. The park is

currently undergoing renovations through a number of phased improvements. Phase I included boat launch updates, a fishing pier, fish cleaning station and parking lot reconfiguration. Phase II constructed a new shower/restroom facility and rehabilitated the old bathhouse to include an open air pavilion. Phase III converted some existing sites into pull through sites and provides utilities to these locations. The picnic area was relocated from in the camping area to provide additional sites, and is now in a location where it is associated with other day uses such as the beach and the boat launch. A trail with viewing platforms was also developed. An office at the campground entrance is almost complete and will be in service for the 2011 camping season. Future phases will add group campsites and other facilities. These projects have been made possible by grants from the Natural Resources Trust Fund ($132,000), Clean Michigan Initiative ($246,674), and Land and Water Conservation Fund ($97,500). Local match for these grants come from the Forest Recreation Fund ($231,169).

The Forest Recreation Fund also covers annual shortfalls in operating revenue for the Park at about $17,000.

10.3 Big Bay Harbor of Refuge

The Big Bay Harbor is part of a chain of harbors surrounding the Great Lakes that offer safe mooring, fuel, water, pump out and restrooms for boaters. The facility serves transient boaters, seasonal uses, and has a boat launch for day use. Last year, 2010, there were seven boats moored for the whole season. There were six boats in the undeveloped seasonal slips and there were 28 season launch passes. The Harbor operates at about a $2,100 annual deficit supplemented by the Forest Recreation Fund.

10.4 Sugarloaf Mountain Natural Area

Sugarloaf Mountain is arguably the most frequently visited county-owned recreation site. A 3,200 foot trail leads to the summit where there are three platforms that offer views of Lake Superior, Little Presque Isle, and the City of Marquette.

Maintenance and capital improvements are financed by the Forest Recreation Fund. The last significant project there took place in the summer of 1999 and was funded by equal shares from the Coastal Zone Grant and Forest Recreation fund. The $90,000 project replaced several old stair sections plus made improvements to the gravel and natural pathways.

10.5 Little Trout Lake

The 111 acre park was developed by the United States Air Force for its personnel and their families while stationed at K.I. Sawyer Air Force Base during the Cold War era in the 1950's. The park's facilities include a pavilion with grills, picnic table, a concession building, volleyball court, basketball court, horseshoe court, playground equipment and a restroom facility.

Park ownership transferred to Forsyth Township after the Base closed in 1994. Recently the Township relinquished ownership of the park and it reverted to Marquette County. In 2010, Marquette County amended their recreation plan to include Little Trout Lake as a County owned recreation facility. In 2011, Marquette County applied for a Michigan Natural Resources Trust Fund for the second time to build a new ADA accessible restroom facility, a bike path to the elementary school, and new accessible playground equipment. The first grant application was not successful and the most recent one is still pending. If selected by the Department of Natural Resources, the total grant would be $314,745 with a match of 25% or $78,687 coming from the Forest Recreation Fund.