

COUNTY FOREST COMPREHENSIVE LAND USE PLAN
TABLE OF CONTENTS

CHAPTER 800
INTEGRATED RESOURCE MANAGEMENT

<u>Section</u>	<u>Subject</u>	<u>Page</u>
800	CHAPTER OBJECTIVES.....	4
805	INTEGRATED RESOURCE MANAGEMENT APPROACH.....	4
810	SUSTAINABLE FORESTRY.....	5
810.1	TOOLS IN MANAGING FOR SUSTAINABLE FORESTRY.....	5
810.1.1	Forest Inventory.....	5
810.1.2	Forest Habitat Classification System.....	6
810.1.3	Soil Surveys.....	6
810.1.4	National Hierarchical Framework of Ecological Units.....	6
810.1.5	Integrated Pest Management.....	7
810.1.6	Best Management Practices for Water Quality.....	7
810.1.7	Forest Fire Management.....	8
810.1.7.1	Fire Prevention, Detection, and Suppression.....	8
810.1.7.2	Fire Presuppression.....	8
810.1.7.3	Fuel Breaks.....	8
810.1.7.4	Prescribed Fire.....	9
810.1.8	Outside Expertise, Studies and Survey.....	9
810.1.8.1	Water Resources.....	9
810.1.8.2	Wildlife Resources.....	9
810.1.8.3	Soil Resources.....	9
810.1.8.4	Mineral Resources.....	10
810.1.8.5	Wetland Resources.....	10
810.1.8.6	Navigable Streams.....	10
810.1.8.7	Floodplains.....	10
810.1.8.8	Cultural Resources.....	10
810.1.8.9	Entomology/Pathology.....	10
810.1.8.10	Endangered Resources.....	10
810.1.9	Local Silvicultural Field Trials.....	11
810.1.10	Local Citizen Involvement.....	11
820	BIOLOGICAL COMMUNITY TYPES.....	11
820.1	FORESTED COMMUNITIES.....	11
820.2	NON-FORESTED COMMUNITIES.....	13
820.2.1	Upland Non-Forest.....	13
820.2.2	Wetlands.....	13
820.2.3	Open Water Habitats.....	14
830	PLANT COMMUNITIES MANAGEMENT.....	14
830.1	SILVICULTURE.....	14
830.1.1	Aspen.....	14
830.1.2	Northern Hardwoods.....	18
830.1.3	Red Oak.....	30
830.1.4	Scrub Oak.....	34

	830.1.5	Paper Birch.....	37
	830.1.6	Red Pine.....	43
	830.1.7	Jack Pine.....	46
	830.1.8	White Pine.....	49
	830.1.9	Other Conifers.....	52
830.2		LOCALLY UNCOMMON TREES.....	54
	830.2.1	American elm.....	55
	830.2.2	Eastern Hemlock.....	55
	830.2.3	White Cedar.....	55
	830.2.4	Black Cherry.....	55
	830.2.5	White Ash.....	55
830.3		EXOTIC PLANT SPECIES OF CONCERN.....	56
830.5		LEGALLY PROTECTED PLANT SPECIES.....	56
830.6		OTHER PLANT SPECIES and NATURAL COMMUNITES of CONCERN – NHI.....	56
	830.6.1	Special Concern Plants.....	56
	830.6.2	Natural Communities.....	56
840		WILDLIFE SPECIES MANAGEMENT.....	57
840.1		BACKGROUND.....	57
	840.1.1	Technical Planning.....	57
	840.1.2	Guidelines.....	57
	840.1.3	Inventory.....	57
	840.1.4	General Management Policies.....	58
840.2		WILDLIFE HABITAT DEVELOPMENT GRANT PROJECTS.....	59
840.3		HABITATS OF IMPORTANCE.....	59
	840.3.1	Aspen.....	60
	840.3.2	Jack pine.....	60
	840.3.3	Forest openings.....	60
	840.3.4	Lowland conifer.....	60
	840.3.5	Oak.....	60
	840.3.6	Pine Barrens.....	60
	840.3.7	Forest Game Species.....	61
	840.3.8	Non-Game Species.....	62
	840.3.8.1	Neotropical Migrant Birds.....	62
840.4		LEGALLY PROTECTED ANIMAL SPECIES.....	62
840.5		OTHER ANIMALS OF SPECIAL CONCERN.....	63
840.6		FISH AND WATERS MANAGEMENT.....	63
	840.6.1	Technical Planning.....	63
	840.6.2	Water Surveys.....	63
	840.6.3	Population Surveys.....	64
	840.6.4	Lake Management.....	64
	840.6.5	Stream Management.....	64
	840.6.6	Best Management Practices for Water Quality.....	64
	840.6.7	Water Access and Development.....	64
850		LANDSCAPE MANAGEMENT.....	64
850.1		BIOLOGICAL DIVERSITY.....	64
850.2		HABITAT FRAGMENTATION.....	65
850.3		OLD GROWTH.....	65

850.3.1	Old Growth/Benchmark Stands.....	65
850.3.2	Extended Rotation Forest.....	65
850.3.3	Presumed Climax Forest Cover.....	65
850.4	OTHER SPECIAL MANAGEMENT AREAS.....	66
860	INTEGRATED RESOURCE MANAGEMENT UNITS.....	66

CHAPTER 800 – INTEGRATED RESOURCE MANAGEMENT

800 CHAPTER OBJECTIVES

- (1) To introduce and communicate to the public, the County Board of Supervisors, and to the Wisconsin DNR, the integrated resource approach that forestry, wildlife and other natural resource staff will use on the Bayfield County Forest during this planning period.
- (2) To establish "Integrated Resource Management Units" (IRMU) that will identify and summarize the natural resources, social and physical management potential and opportunities for each unit.

805 INTEGRATED RESOURCE MANAGEMENT APPROACH

Integrated Resource Management is defined as: "the simultaneous consideration of ecological, physical, economic, and social aspects of lands, waters and resources in developing and implementing multiple-use, sustained yield management" (Helms, 1998)

This balance of ecological, economic, and social factors is the framework within which the Bayfield County Forest is managed. This broad definition describes the content of everything within this comprehensive land use plan. For the purpose of this chapter, the scope of Integrated Resource Management includes:

- Forests, habitats, and biological communities
- Wetlands and waters
- Wildlife and endangered resources
- Soils and minerals
- Cultural and historical resources
- Social and economic factors

Management of one resource affects the management or use of other resources in an area. Managing each use or resource by itself is less effective than managing all of them in an integrated way. This is a field level approach to integrated resource management. Management decisions are made while considering that each site is part of a larger ecosystem. Similarly, the development and implementation of this plan also considers other planning efforts in order to provide for broader scale management.

The working definition of Integrated Resource Management means, in large part, keeping natural communities of plants and animals and their environments healthy and productive so people can enjoy and benefit from them now and in the future.

The remainder of this chapter is written to help communicate how the Bayfield County Forest is managed with an integrated resource approach.

810 SUSTAINABLE FORESTRY

The definition of sustainable forestry in the Wisconsin Administrative Code and the Wisconsin Statutes is as follows:

"the practice of managing dynamic forest ecosystems to provide ecological, economic, social and cultural benefits for present and future generations" NR 44.03(12) Wis. Adm. Code and s.28.04(1)e, Wis. Stats.

For the purpose of this chapter, sustainable forestry will be interpreted as the management of the Forest to meet the needs of the present without knowingly compromising the ability of future generations to meet their own needs (economic, social, and ecological) by practicing a land stewardship ethic which integrates the growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air and water quality, and wildlife and fish habitat. This process is dynamic, and changes as we monitor and evaluate past management practices and implement research findings to optimize current and future benefits from the forest.

810.1 TOOLS USED IN MANAGING FOR SUSTAINABLE FORESTRY

Many tools are used by resource professionals to aid in the decision making process associated with the planning and implementation of forest management activities. Listed below are some common tools that, when used independently or in combination with one another, will provide the forest manager a better understanding of current stand conditions, the potential of a given site, ecological and silvicultural alternatives, the effectiveness of silvicultural treatments, and the impact of silvicultural treatments on water quality and wildlife habitat.

810.1.1 Forest Inventory

The present forest inventory format was established in the mid-1970's as a means of assessing the geographical, structural, and compositional attributes of the existing forest resources. In 2000, the inventory data and hand drawn timber type maps were digitized into a Geographic Information System (GIS) spatial database. In 2002 the County Forestry Department implemented a continuous forest inventory system based on: 1) the compartment reconnaissance (recon) procedures as described in the DNR Public Forest Lands Handbook 2460.5) 10 year re-inventory cycle and 3) entire compartments being examined at one time, instead of a stand-by-stand update.

County foresters will be responsible for the maintenance of the Bayfield County Forest GIS database. The DNR will maintain a copy of the County's recon data and, with data provided on a regular basis by the County, will be responsible for the maintenance of the State's copy of the Bayfield County Forest recon database. The DNR County Forest Liaison will assist in the interpretation of data used in the planning and scheduling of resource management activities.

810.1.2 Forest Habitat Classification System

The Forest Habitat Classification System (*A Guide to Forest Communities and Habitat Types of Northern Wisconsin Second Edition; Kotar, et al.*) is a natural classification system for forest communities and the sites on which they develop. It utilizes systematic interpretation of natural vegetation with emphasis on understory species.

The Forest Habitat Classification System is an ecological tool that promotes a common language for interpreting site capability based on potential natural vegetation. Its primary use is the assessment of biological potential of upland forest sites. Through the application of Forest Habitat Classification, land managers are better able to assess site potential of current stands, identify ecological and silvicultural alternatives, predict the effectiveness of possible silvicultural treatments, assess feasible management alternatives, and choose appropriate management objectives.

Data will be collected in order to classify the entire forest. This information will be collected along with, and made part of, the compartment reconnaissance system during regular field inspections. This data will also be compared to soil survey information in order to associate the relationships between forest habitat types and soil types.

810.1.3 Soil Surveys

Forestry staff's knowledge of forest ecology and their experience across the landscape will be used to associate forest habitat types and site indices with soil type information. These associations are beneficial in determining management prescriptions for specific sites. Detailed soil surveys, when available, will be made a part of the compartment reconnaissance system and continue to be correlated to the Forest Habitat Classification system.

Soil survey information can be obtained from the Natural Resource Conservation Service office.

810.1.4 National Hierarchical Framework of Ecological Units/Ecological Landscapes of Wisconsin

Integrated resource management recognizes that an individual forest site is part of a larger landscape, and management activities can have an impact beyond a specific site. The National Hierarchical Framework of Ecological Units (NHFEU) is a useful tool in understanding natural landscapes.

The Wisconsin DNR uses Ecological Landscapes of Wisconsin (WDNR Handbook 1805.1) which is an ecological land classification system based on the National Hierarchical Framework of Ecological Units (NHFEU). Ecological landscapes distinguish land areas different from one another in ecological characteristics. A combination of physical and biological factors including climate, geology, topography, soils, water, and vegetation are used. They provide

a useful tool and insight into ecosystem management. Land areas identified and mapped in this manner are known as ecological units.

Landtype Associations (LTA's) are considered landscape-scale ecological units, and are identified by surface geology, patterns of vegetation, soil parent materials, and water tables. Most LTA's are between 10,000 and 300,000 acres in size.

Each landtype association contains a general description of characters such as landform, historic vegetation, current vegetation, water resources, land area, socioeconomic data, agriculture, population, and ecological opportunities. Goals can be developed for an LTA based in part on its capability, productivity, unique character, and the scarcity or abundance of similar LTA's in the state, region or beyond. Objectives for vegetation management, wildlife habitat, ecological restoration, and recreation use can be tailored to the characteristics and potentials of the ecosystem.

810.1.5 Integrated Pest Management

Integrated Pest Management for the purpose of this Plan, is defined as follows:

“the maintenance of destructive agents, including insects, at tolerable levels, by the planned use of a variety of preventive, suppressive, or regulatory tactics and strategies that are ecologically and economically efficient and socially acceptable.”

The Committee has the authority to approve and direct the use of pesticides and other reasonable alternatives in an integrated pest management program on the Forest. Refer to Chapter 600 (610.3) for more detailed discussion and integrated pest management strategies.

810.1.6 Best Management Practices for Water Quality

Often the most practical and cost-effective method to assure that forestry operations do not adversely affect water quality on the County Forest is to utilize "best management practices" (BMP's) as described in *Wisconsin's Forestry Best Management Practices for Water Quality*. Publication number FR093.

Bayfield County will use BMP's on the Forest with the understanding that the application of BMP's may be modified for specific site conditions with guidance from a forester or other natural resource professional. Modifications will provide equal or greater water quality protection, or have no impact on water quality. Areas with highly erodable soil types, close proximity to streams or lakes, or steep slopes may require mitigating measures in excess of those outlined in the manual.

810.1.7 Forest Fire Management

810.1.7.1 Fire Prevention, Detection, and Suppression

The DNR is responsible for all matters relating to the prevention, detection and suppression of forest fires outside the limits of incorporated villages and cities. (s.26.11(1), Wis.Stats). This responsibility includes the Bayfield County Forest. Refer to Chapter 605.

810.1.7.2 Fire Presuppression

The County will initiate programs and actions to mitigate wildfire hazards. Wildfire Presuppression activities will be carried out in coordination with the DNR, local towns and fire departments, Forest Service, and others as appropriate. Fire mitigation measures on timber sales may include the lopping and scattering of slash, and slash free zones along property lines and access roads. Timber sale contracts will also have provisions to modify harvest operations depending on the fire danger and stipulate suppression responsibilities of the purchaser.

810.1.7.3 Fuel Breaks

Fuel breaks will also be used as a fire management tool in large areas of contiguous hazardous fuels and ignition potential. Fuel breaks will take many forms including:

- Lakes, streams, wetlands, and other natural features.
- Timber type changes, i.e. deciduous types adjacent to conifers.
- Keeping roads brushed back to the clearing limits or beyond.
- Maintaining a system of open land up to ¼ mile in width in the areas of highest potential ignition and risk.

The most intensive use of fuel breaks on the County Forest is the maintained fuel break system located in the Town of Barnes. This area, IRM Unit #5, has a high concentration of red and jack pine and potential ignition sources due to the summer home developments. A fire risk spatial analysis for Bayfield County was conducted in September of 2004. This analysis was undertaken by representatives of the Chequamegon-Nicolet National Forest, Bayfield County Forest, and the DNR. The fire risk spatial analysis consisted of GIS modeling with housing unit density and fuel model data. The Town of Barnes, with a large acreage of County Forest Land, and the Town of Drummond, with a large acreage of National Forest Land, was identified as having the highest risk. The outcome of the analysis was the establishment of the “Barnes-Drummond Community Wildfire Protection Plan Pilot Project” to address the risks identified in the assessment. Complementing the Wildfire Protection Plan, the County Forest fuel break system in the Town of Barnes will utilize enhanced clearing widths along Town and County Forest Roads and the maintenance of two wide, multi-purpose, fuel breaks. The first of which is a 2 ½ mile long break located along the Blue Lake Road and Moore Road where a variable width strip up to ¼ mile in width will be maintained to provide a fuel break to the northeast of a major, 865 unit, cabin/ home development. The second will be a

4 mile long break ¼ mile in width on the north side of Halfway Road between Webster and County Line Road. This will provide a fuel break about mid-way in a large contiguous block of jack pine. See map in Chapter 900. The multi-purpose nature of these fuel breaks are described in Chapter 840.3.6 Pine Barrens Management.

810.1.7.4 Prescribed Fire

Prescribed burning on the County Forest plays an important role in management. Many of the plant communities present today are the result of wild fires.

As opportunities arise to regenerate or maintain timber types or other plant communities, the Committee will examine the costs and benefits of each opportunity. Increased regulations, the county's cost of completing the burn, and the risk of breakouts and uncontrolled fires will have to be considered with the potential benefits attainable of vegetation management through prescribed burning.

All prescribed burning will be done in accordance with Wisconsin State Statutes 26.12, 26.14, and the DNR Prescribed Burn Handbook 4360.5 and in cooperation with the Department of Natural Resources per section 605.5 of this plan.

810.1.8 Outside Expertise, Studies and Survey

Additional data necessary to make management decisions on the County Forest will be sought from agencies or individuals, who in the Committee's opinion, are best equipped to provide that service. This data will be used as appropriate for management planning.

810.1.8.1 Water Resources

The DNR fisheries biologist and the water management specialist will provide surveys, studies, and technical advice as necessary to prepare and carry out planned activities affecting waters on the County Forest (also see Chapter 840.6).

810.1.8.2 Wildlife Resources

DNR wildlife biologists will implement population and habitat surveys, provide technical advice, and direct assistance needed for wildlife management planning and implementation on County Forest lands (also see Chapter 840). Wildlife projects are identified and implemented in collaboration with the County Forest administrator, DNR liaison forester, U.S. Forest Service, and the Forestry Committee.

810.1.8.3 Soil Resources

Soil maps and surveys prepared by the Natural Resource Conservation Service (NRCS) will be used in making management decisions on the County Forest.

810.1.8.4 Mineral Resources

Consultation with the County Highway Department and the DNR may provide valuable information for the management of gravel and other mineral resource management activities authorized by the Forestry Committee. (Also see Chapter 515.1).

810.1.8.5 Wetland Resources

Maps prepared by the DNR's Bureau of Fisheries Management and Habitat Protection, may be utilized for identifying wetlands. Assistance and technical advice may be requested from the DNR water management specialist when wetlands may be affected by management practices. The Army Corps of Engineers will also be consulted as appropriate. In addition, Wisconsin's Forestry Best Management Practices for protecting water quality will be used.

810.1.8.6 Navigable Streams

The DNR's water regulations specialist will be consulted when navigable stream crossings or navigable stream management projects are being planned. (Also see Chapter 840.6.5). Best Management Practices for protecting water quality will be used.

810.1.8.7 Floodplains

Maps prepared by the Federal Emergency Management Agency (FEMA) will be used to identify floodplains. The County zoning staff may be consulted regarding management activities in the floodplain.

810.1.8.8 Cultural Resources

Management planning will take into consideration the presence of historical and archaeological sites. Assistance will be requested from the State Historical Preservation Office or the DNR's archeologist when necessary. Management activities will be modified to mitigate potential adverse effects to sites within the Forest. Sites discovered during the process of project planning or implementation will be added to the State's data base.

810.1.8.9 Entomology / Pathology

Wisconsin DNR forest pest staff will provide information and consultation as requested by the County. (Also see Chapter 610 for more information on forest pest control.)

810.1.8.10 Endangered Resources

DNR endangered resource staff will provide Natural Heritage Inventory (NHI) information and are available for consultation on endangered resources issues.

DNR guidelines for the management of Endangered Resources will be implemented where applicable.

810.1.9 Local Silvicultural Field Trials

Bayfield County has taken an active role in experimenting with different silvicultural prescriptions and regeneration techniques in order to better manage the County Forest. Some of these field trails have been completed, some are ongoing, and new ones may be started in the future.

To date, the field trails that have been completed or are ongoing on the County Forest include:

- 1) *Three different volume removal prescriptions (1/2,1/3,2/5) in a 120 acre first thinning red pine stand.*
- 2) *Bracke seeding jack pine.*
- 3) *Aerial seeding jack pine.*
- 4) *Seed tree harvests with scarification in white birch stands for natural regeneration.*
- 5) *Prescribed burning under oak shelterwood for natural regeneration.*

Results from the silvicultural field trials will be included in the Forestry Departments annual accomplishment reports (see Chapter 3000).

810.1.10 Local Citizen Involvement

The Bayfield County Forestry Committee is an open forum to listen, evaluate and incorporate, where appropriate, the public's input into management of the County Forest.

820 BIOLOGICAL COMMUNITY TYPES

A community is an assemblage of different plant and animal species, living together in a particular area, at a particular time in specific habitats. Communities are complex and dynamic systems named for their dominant plant species. Refer to Chapter 130.1.4 for more information

820.1 FORESTED COMMUNITIES

The forested cover types are made up of a variety of size classes (regeneration, sapling-pole, and saw timber) and structure (canopy, layers, ground vegetation, dead and downed material, and inclusions). Forested communities within the Bayfield County Forest cover approximately 93% of the Forest. Forest cover types associated with the County Forest are:

Aspen – 41%. Consisting of primarily aspen species often found in combination with paper birch and red maple.

Northern Hardwoods - 13%. Consisting of a mixture of upland hardwood species including sugar maple, yellow birch, basswood, ash and red maple.

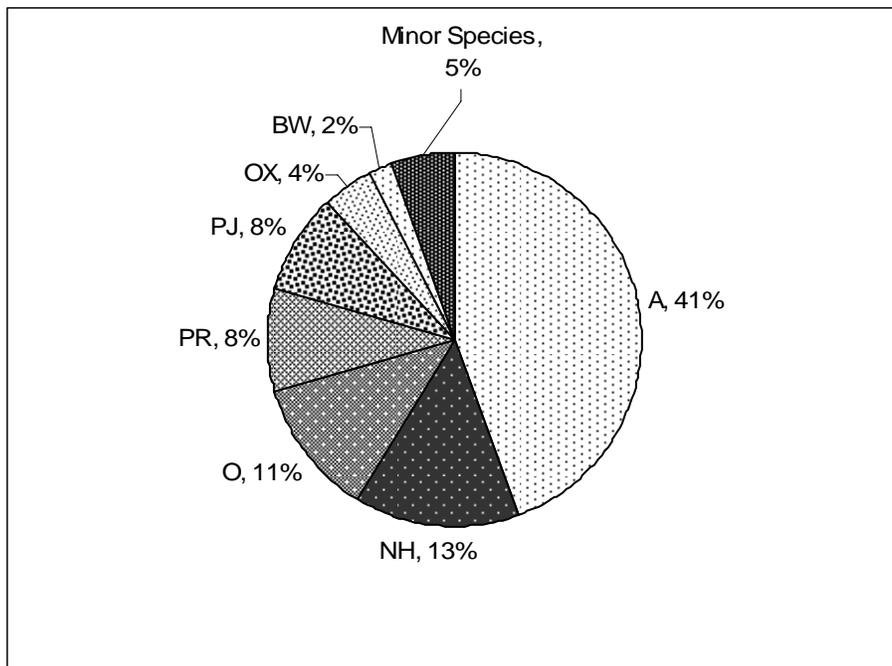
Red Oak - 11%. Dominated by red oak, white oak, black oak and associated with other hardwoods.

Red Pine - 8%. More than 50% red pine.

Jack Pine - 8%. More than 50% jack pine.

Scrub Oak - 4%. Consisting of a majority of poorer quality oak (often northern pin oak) capable of only fuelwood or cellulose fiber production.

Figure 830.1: Forested Communities Located within the Bayfield County Forest (Percent of Total)



Paper Birch - 2%. Consisting of a majority paper birch. Often found in combination with aspen and red maple.

Swamp Hardwoods - 1%. More than 50% swamp hardwood species including black ash, red maple, and elm.

White Pine - 1%. More than 50% white pine.

Fir-Spruce - 1%. Consisting of swamp border or upland types with mixed species, predominately balsam fir and spruce associated with white pine, cedar,

red maple, aspen, and birch.

Black Spruce - 0.5%. More than 50% swamp conifer species with black spruce predominating.

Swamp Conifer - 0.4%. Lowland type typified by balsam fir, cedar, and spruce in combination with red maple and other lowland hardwoods.

Tamarack - 0.4%. More than 50% swamp conifer species with tamarack predominating.

White Cedar - 0.2%. More than 50% swamp conifer species with white cedar predominating.

Hemlock Hardwoods - 0.1%. More than 50% hemlock associated with northern hardwood species.

Bottomland Hardwoods - 0.03%. Typically floodplain species including silver maple, river birch, elm, cottonwood, and green ash.

820.2 NON-FORESTED COMMUNITIES

Non-forested communities within the Bayfield County Forest cover approximately 7% of the forest. In broad categories, they are: upland (3%), wetland (3%) and water (0.5%).

Non-forested habitats are important components of management within the County Forest. Upland and wetland non-forest types provide important habitat for distinct groups of species.

820.2.1 Upland Non-Forest (3%)

Upland Non-Forest areas of the County Forest include:

Grass openings, prairies, herbaceous vegetation, shrub openings, pine barrens, rock outcrops and sand banks.

820.2.2 Wetlands (3%)

Wisconsin State Statutes define a wetland as “an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation, and which has soils indicative of wet conditions.”

Wetland communities are recognized to be a complex association of plants and animals, soils and water levels having special natural values. Wetlands provide many functional values including shoreline and flood protection, water quality protection, groundwater recharge, and animal and plant habitat. Therefore, it is the policy of Bayfield County to preserve, protect and manage the wetlands under its jurisdiction in a manner that recognizes the natural values of wetlands and their importance in the environment.

820.2.3 Open Water Habitats (0.5%)

Open water habitats are permanently flooded lands below the deep-water boundary of wetlands. Water is generally too deep to support emergent vegetation. Presence of these aquatic habitats within a forest landscape greatly increases the number of wildlife species that can potentially occur. They include rivers, lakes, and streams.

830 PLANT COMMUNITIES MANAGEMENT

Bayfield County recognizes the importance of maintaining the diversity of the Forest under an ecosystem approach. The process involved in making management decisions to encourage, or not to encourage, specific species or communities is complex. It includes an understanding of:

- Objectives of the County Forest.
- Integration of the National Hierarchical Framework of Ecological Units (NHFEU - landforms, soils, climate, vegetation classification at multiple scales).
- Application of habitat type classification to identify ecological potentials and silvicultural alternatives.
- Past, present, and future desired condition.
- Surrounding ownership patterns and their generalized objectives.
- Socio-economic needs.

830.1 SILVICULTURE OF COMMON FOREST TYPES

Forested communities are normally managed within the guidelines found in the Wisconsin Department of Natural Resources. Silviculture Handbook 2431.5. The Society of American Foresters defines silviculture as:

“the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.”

Typically, silvicultural guidelines are written to: 1) encourage stand health and vigor, 2) encourage a stand to contain the greatest quality and/or quantity of timber using either even-, or uneven-aged systems, and 3) lead to sustainable harvest levels over time. A summary of management on the Bayfield County Forest is described as follows:

830.1.1 Aspen

A. History

The aspen timber type makes up the largest single timber type in Bayfield County. Stands dominated by aspen comprise over 41 % or 68,635 acres of the county

forest. Most of these aspen acres are directly related to the fires that covered Bayfield County in the late 1800's and the early 1900's. Many stands were seed origin and appeared to be pure aspen while others were developed as root suckers or clones and grew in association with other species.

Road development and access to remote areas was of major importance to aspen management and timber sale establishment in the 1950's, 60's, and 70's. The last major block that was opened was accessed by what is currently known as the "Flag Road". This road was built by Bayfield County, using WIDNR Wildlife funds. The road was completed in 1972. The first aspen sales accessed by the Flag Road were established shortly after with many more to follow in the 1980's.

Many stands of aspen were mature in the mid to late 1950's. Companies like Jackson Box and Consolidated Paper were some of the major contractors at the time. Economics for the time favored removal of larger, superior trees. Even though timber sales were measured in the hundreds of acres, less than twenty percent of the annual allowable harvest was being cut per year. Those stands that were being cut were the most accessible and most desirable.

Wildlife funds were being used to do aspen improvement. These were known as "KG" cuts, aspen maintenance cuts, aspen betterment, or ORAP sales. The goal was to remove non-merchantable hardwood stems and/or aspen stems that were mature but otherwise non-merchantable due to location or lack of market. Large dozers with sharpened "KG" blades and raised push bars along with Giant, tree crushing machines were used to flatten over mature aspen stands in hopes of retaining the stands in aspen. Finally, contracted hand cutters were employed to sever all of the residual stems to complete the Timber Stand Improvement projects. By the early to mid 1980's, wildlife funding began to run out. Timber sales began to incorporate the removal of the nonmerchantable stems as part of the contract. This ran into strong opposition but by the late 1980's had become part of the logger's operating costs of a timber sale.

The cost of moving aspen to market and the availability of aspen closer to the markets kept the stumpage value of Bayfield County aspen low. Over mature aspen became the norm through the late seventies. The State of Wisconsin hired project foresters in the late 1970's and placed them throughout the northern counties. Their primary goal was to establish timber sales in the backlog aspen at an accelerated rate. Sales were established at a rate of 5,000 acres per year in Bayfield County. Wood was slow to sell through the early 1980's. Finally, as a result of past access development and the increased need for aspen, Bayfield County aspen began to sell. By 1987, a large portion of the backlog aspen was set up for harvest and sold.

1. Historical Acreage Trends

Since 1977 aspen acreage has, for the most part, steadily increased by 13.9%. Table 830.1 displays the total acreage trends for the aspen timber type between the periods of 1977 and 2005.

Table 830.1: Historical Acreage Trends for Aspen on the Bayfield County Forest (1977 to 2005)

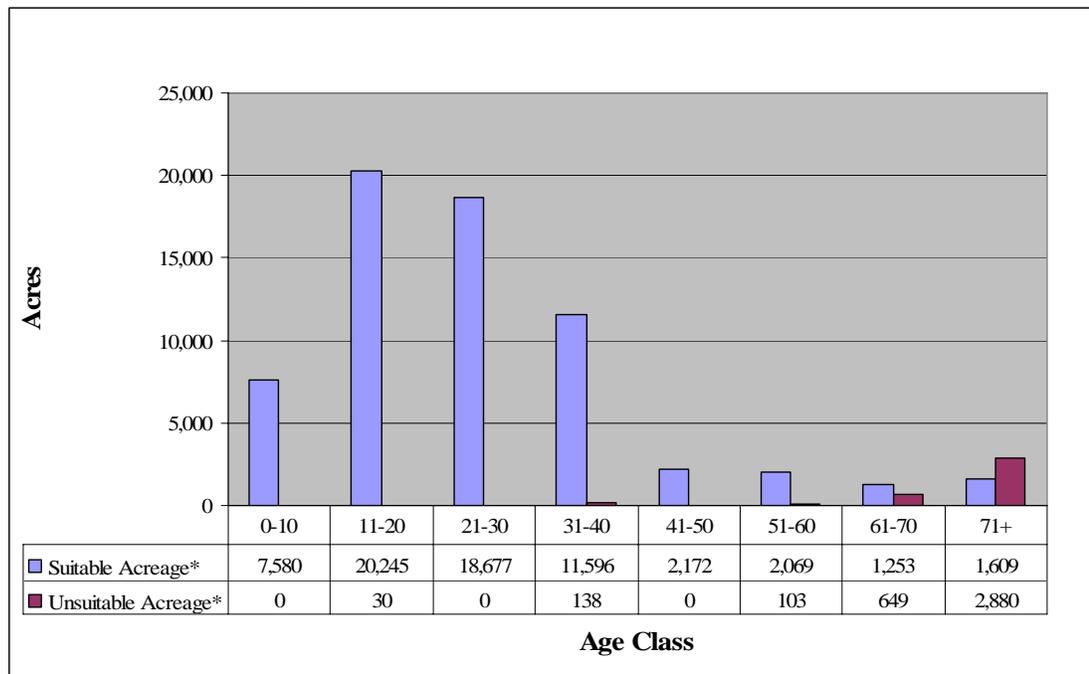
1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
60,241	62,166	60,146	61,965	68,635	8,394	13.9%

The major contributing factor for this increase is aspen’s aggressive regeneration and growth. Anytime there is an overstory removal in a stand with a major aspen component, aspen naturally sprouts and is able to out-compete other species for available growing space. This results in aspen occupying the majority of that site. Future trends for aspen show no significant increases in acreage.

B. Current Status (2005)

In the Lake States, aspen acreage is diminishing across the landscape. Thirty-eight percent, or approximately 65,200 acres of the Bayfield County Forest is typed as manageable aspen. An additional 3,800 acres of aspen is in Riparian Management zones and will not be managed for timber production. Through natural succession these Riparian Management zones will naturally convert to longer lived, late successional species.

Figure 830.2: Aspen Acreage by Age Class Distribution in 10-year Age Classes (2005 Data)



* Suitability refers to the appropriateness of resource management to an area of forest land. Unsuitable acreage is defined as forest land that is not being actively managed for timber production. Reasons for exclusion typically include ecological/environmental constraints or sensitivities, silvicultural constraints, or matters of policy. Areas are generally re-evaluated every 10 years to determine management status.

Ninety Percent of the total aspen acreage on the Bayfield County Forest is in the 0-40 year old age class. Mature and over-mature (60 years and older) aspen accounts for 4% of Bayfield County’s current aspen acreage. Figure 830.2 displays the total current aspen acreage (as of 2005) in ten year age classes.

C. Desired Future Condition

The goal is to evenly distribute the age classes over a longer time frame developing a regulated annual harvest level that is representative of the Bayfield County Forest’s manageable aspen acreage. Maintaining the current amount of acreage will also be a primary objective. Some acreage will naturally convert between aspen and other species but, as total acreage is concerned; it should stay relatively the same.

D. Management

1. Applicable Silvicultural Treatments

Currently, coppice regeneration (even-aged management), is the primary silvicultural treatment used for regenerating aspen. Past experience has shown that this treatment yields the most productive and vigorous aspen stands. Aspen is a highly researched species and there may, in the future, be alternative management prescriptions. Bayfield County will continue to investigate other silvicultural treatments that may be more appropriate to meet future objectives.

2. Determination of Annual Allowable Harvest Levels

Harvest levels for aspen are determined by dividing the total number of managed acres by the age aspen is considered to be biologically mature. For Bayfield County Forest it is 65,200 acres divided by 60 years (see Table 830.2 for aspen rotation ages). This equates to approximately 1100 acres per year. Due to the large percentage of young, non-merchantable aspen currently on the County Forest, this annual harvest level cannot be implemented. This age class will not be ready to be harvested for another 20 years.

Table 830.2: Rotation Ages for Aspen on the Bayfield County Forest

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
40	60	75

Current harvest levels were determined by taking all of the aspen acres that will be mature over the next 20 years and equally distributed them over a 20 year period which is 670 acres per year. In 2025 the annual harvest will increase from 670 acres a year to 1,200 per year. The increased harvest levels are designed to insure that the age classes do not become older than the 70-year-old age class and

no immature aspen is harvested. These acreage projections will continue to be refined based upon updated inventory data and harvest levels are also subject to change when it is necessary to respond to natural weather events and insect or disease outbreaks. See chapter 1000 for annual harvest levels of aspen.

830.1.2 Northern Hardwoods

A. History

The majority of mature northern hardwood stands in Bayfield County originated prior to the major fires of the early 1900's. Most stands developed through natural successional pathways and were not greatly affected by the fires. Areas were either burned very lightly or not at all. However, in the early 1900's, some areas that were intensively burned did regenerate to northern hardwoods. These stands appear to be even-aged and had little or no timber sale activity until the late 1980's and early 1990's. Past logging activity had a greater impact on the present health, quality, and overall appearance of these stands.

Old logging records indicate that many northern hardwood stands had 65+ year old aspen removed during the 1940's. One of the most common statements on these sales was to "remove overmature wood" as it related to aspen, sugar maple, yellow birch, and hemlock. During this time period, these stands were classified as good hardwood sites.

Northern Hardwoods harvested between 1940 and 1965 were usually done so using a diameter limit cut. The recommendation was to remove overmature (in many cases the largest trees), poor quality trees and release the 05-11 inch diameter class. Most records indicated that stands contained an abundance of poor quality wood and generally recommended heavy harvests of the overstory. It may be assumed that many of these sites had the best and largest sawlogs harvested during the late 1800's or early 1900's.

Harvesting in the 1970's was generally concentrated in the better quality stands. Some of these stands had been thinned in the 1940's and 50's, while others were uncut since before records began. Many of these stands were established either by a diameter limit cut or the larger, mature trees were individually marked for removal.

Harvesting in the 1980's occurred in the better all aged northern hardwood stands. Individual tree marking using established silvicultural guidelines removed good quality saw timber along with pulpwood. The late eighties included sales of better quality stands with an increase in harvested pulpwood volumes.

In the 1990's, northern hardwood management occurred in stands with low sawlog and high pulpwood volumes. These stands were identified as having the greatest need for improvement. Sales sold until the mid to late 1990's when the hardwood pulp market became non existent.

As of 2005, market conditions allow the Bayfield County Forestry Department to pursue full silvicultural activities on all northern hardwood sites.

1. Historical Acreage Trends

Since 1977, northern hardwood acreage located within Bayfield County Forest boundaries has shown a steady increase. Table 830.3 displays the total acreage trends for the northern hardwood timber type between the periods of 1977 and 2005:

Table 830.3: Historical Acreage Trends for Northern Hardwoods on the Bayfield County Forest (1977 to 2005)

1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
19,435	19,525	22,954	22,948	22,290	2,855	14.7%

The overall increase may be explained by the natural progression from early successional, intolerant species to the later successional, tolerant species found in typical northern hardwood stands. The decrease in acreage from 1995 to 2005 may be best explained by a more thorough compartment examination performed by the Forestry Department since 2001.

B. Current Status (2005)

As of 2005, there is 21,793 acres of manageable northern hardwood forest type on the Bayfield County Forest. An additional 497 acres has been classified as unmanageable due to site sensitivities or proximity to streams and lakes. The northern hardwood type comprises approximately 13% of the total Bayfield County Forest acreage. Two distinct areas contain approximately 91% of the northern hardwood timber type located on the Bayfield County Forest. The areas are located in the Bayfield Peninsula to the north and in the Barnes area to the south. These areas contain roughly 11,200 acres (50%) and 9250 acres (41%), respectively. See the Appendix for the location of the northern hardwood timber type on the Bayfield County Forest.

C. Desired Future Condition

The long term management goal for the northern hardwood timber type on Bayfield County Forest Land is to perpetuate the current acreage and bring the acreage closer to a regulated condition. Some stands will likely convert to northern hardwoods due to the natural succession from shorter-lived, pioneer species to longer-lived, climax species. In addition, on better sites that are currently dominated by red oak, conversion to northern hardwoods may occur because of the inherent complexities involved in the regeneration of red oak. In contrast, northern hardwood stands that are displaying excessive amounts of poor quality trees may be converted to another species more suited for that particular

site.

D. Management

In general, the overall objective of northern hardwood management is to maximize the quality of an individual tree on any given site. Most northern hardwood stands on the Bayfield County Forest are second growth, pole sized, relatively even-aged (between 70 to 85 years of age), and contain a fairly high proportion of poor quality and/or diseased trees. Site potential, or the potential ability of a certain area to produce quality products of a given species, will play a major role in determining how a particular stand of northern hardwoods will be managed or if the site is better suited for an alternative species. Habitat type, soil characteristics, and site index are the preferred indicators of site potential. These indicators, as well as an assessment of current stand conditions will be used to determine which management options best meet long-term sustainable goals.

The northern hardwood type is essentially located in two distinctly different regions of the Bayfield County Forest. The northern hardwoods in the southern region are developing on mainly mesic sites with good to excellent relative growth potential. Soils for the area generally range from sandy loam to silt loam with ATM as the most common habitat type (refer to Chapter 900 for a general description of common habitat types found on the Bayfield County Forest). Within the Bayfield County Forest, this area has the best potential for high quality sawlog development in shade tolerant species. In the northern region, northern hardwood stands located in the Bayfield Peninsula have typically developed on dry-mesic or mesic to wet-mesic sites with poor to fair relative growth potential. Soils for the area are generally sand to loamy sand and are usually over clay. Terrain tends to be rolling, with aspect contributing to the development of individual stands (northern hardwoods tend to be better quality on north to northeastern facing slopes). The habitat types AVb and ASnMi tend to dominate the dry-mesic and wet-mesic sites, respectively, with ATM found on the good sites and AVVb on the poor. This area exhibits some potential for high quality sawlog development, however relatively slow growth rates may influence or, in some cases, restrict management options. (Refer to the DNR silviculture handbook HB 2431.5 for additional information on northern hardwood management).

1. Applicable Silvicultural Treatments

Northern hardwoods are ultimately managed with either even-aged or uneven-aged silvicultural systems. Most previously unmanaged, second growth stands will benefit from an initial improvement harvest. Other management goals may be to convert a stand from an even-aged condition to an uneven-aged. Numerous variables are considered before determining which silvicultural system will provide the best results for a given stand of northern hardwoods. These variables include, but are not limited to, site potential (habitat type, site index, soil characteristics), current stand conditions (structure, quality, species composition), past management practices, landscape/watershed protection, desired future

condition, and aesthetics. A description of various management systems is described below:

a. Improvement Harvest

Many northern hardwood stands on the Bayfield County Forest are previously unmanaged, second-growth, even-aged, and contain a large percentage of small diameter trees. In addition, there is frequently a large portion of poor quality and/or diseased trees, as well as many overmature, large diameter pioneer species (e.g. aspen, paper birch). The smaller diameter classes tend to be overstocked, while trees that are currently in the larger size classes are normally remnants of past management and are of poor quality. Improvement harvests focus on removing the trees that are the poorest quality, have reached biological maturity, and are in overabundant size classes. Target residual stocking or crown cover levels are designated, however little attention is directed toward the development of a balanced diameter distribution. Crop trees are identified and canopy gaps are naturally created from the removal of large diameter (and large crowned) overmature dominant trees.

The initial improvement harvest, in most cases, reduces the basal area to target levels before the need to consider other parameters. Residual basal areas in the range of 75 to 85 square feet per acre are typical targets. In stands that contain approximately 50% or more of the residual stocking in species like basswood and/or white ash (species with smaller crown areas), the target residual basal area should be 10 to 15 square feet higher. The stand is re-evaluated in approximately 10 years to determine whether even-aged or uneven-aged silvicultural practices will be used for future management.

b. Uneven-aged Management

Uneven-aged management generally refers to the removal of individual trees or small groups of trees with the goal of increasing the growth and quality of the remaining “best” stems while providing the appropriate space and seedbed conditions for the regeneration and recruitment of a new age class of desired tree species. Uneven-aged management emulates stand composition and structure using gap-phase processes (individual tree selection), maintains a continuous canopy cover with a permanent seed source, and is well suited to the perpetuation of shade tolerant species (i.e. sugar maple). Over the long term, stands managed with uneven-aged practices provide sustained yields of quality timber products at relatively constant intervals or cutting cycles. Stands are generally harvested every 10 to 30 years (cutting cycle) contingent upon site quality, growth rates, intensity of previous harvest, operational considerations, and long term goals. Two harvesting methods are generally applied when utilizing an uneven-aged management system: single tree selection and group selection (group selection is not commonly used on the Bayfield County Forest and will be excluded from further discussion). Additionally, variables such as the determination of crop trees, creation of canopy gaps, and targeted stand structure and stocking are incorporated into uneven-aged management systems. Stands are thought to be in

an uneven-aged condition when 3 or more distinct age classes can be recognized. Below is a description of the basic harvesting methods, as well as other variables used in uneven-aged management.

1). Single Tree Selection

Single tree selection is the most common uneven-aged harvesting practice used to manage northern hardwoods on the Bayfield County Forest. This method removes individual trees to a specified stocking or crown cover level while maintaining a fairly uniform and continuous canopy cover. Crop trees are identified and, in most cases, released and canopy gaps are intentionally created for the development and recruitment of a new age class. A desired residual stand structure guide is regularly developed to determine which size classes are over or under stocked. This guide will give the forest manager a targeted diameter distribution to strive towards when managing the stand over the long term. When deciding which trees to harvest, a designated order of removal is generally followed. Each harvest targets the removal of trees in the overstocked size classes, as well as the poorest quality trees throughout all size classes. The order of removal for overstocked size classes is as follows:

- (1). High Risk/Cull
- (2). Poor quality/Form
- (3). Release crop trees
- (4). Maximum tree size
- (5). Undesirable Species
- (6). Improve Spacing

In understocked size classes, only high risk and cull trees, as well as undesirable tree species and trees that have reached the designated maximum size are typically removed. The order of removal is meant to be a guide. Present stand conditions can be highly variable and may warrant slight deviations. Definitions and general parameters for some of the terms used to describe single tree selection are as follows:

- Crop Tree

Any dominant or co-dominant, low risk, desired tree species, exhibiting good form and vigor that is capable of producing a minimum of one 16 foot log, grade 2 or better. In general, uneven-aged management should be considered a viable management option if there are at least 45 crop trees per acre.

- Canopy Gaps

An opening in the forest canopy created by the removal of large crowned trees or groups of trees. Under uneven-aged management systems, canopy gaps are created at each entry to regenerate and recruit a new age class of

desired tree species. Typically, canopy gaps should range from 25 to 75 feet in diameter (averaging approximately 30 to 66 feet) and comprise between 5 to 15% of the total stand area at each entry. All trees 1 to 2 inches d.b.h. and larger are removed within each gap. Smaller gaps generally favor more shade tolerant species like sugar maple while larger gaps, when combined with site preparation and, in some situations, release, have the potential to regenerate less shade tolerant species like yellow birch and white ash.

- Target Stand Structure (Size Class Distribution)/Stocking

In uneven-aged management systems, target stand structure (or diameter distribution) refers to the desired level of trees per acre in various individual size (diameter) classes over a long-term period. Size class distributions are guidelines only. The purpose of developing this structure is to ensure that there will be a sufficient number of trees continuously growing into the next larger size class.

One of the most common variables used to calculate a targeted stand structure is expressed as the “Q” value. The Q value is the quotient between the number of trees in successively smaller diameter classes, resulting in a reverse J-shaped curve. Other variables such as desired largest tree diameter and targeted residual stocking level (target basal area after harvest) are incorporated into the development of the guide. Lower values of Q (1.2 to 1.4) will encourage the development of larger sawlog material over a greater proportion of the stand. Higher values of Q (1.5 to 1.7) will encourage a larger proportion of pole timber and small sawlogs (See Chapter 900 for an example of Q values).

Site potential, as well as past management practices, will play a major role in determining which stand structure levels will be the most appropriate for a given stand. In general, it may take multiple entries into a particular stand before target stand structure levels are realized (again, the guide is a target to strive towards). Most of the initial harvests focus on the removal of the poorest quality stems and thinning of the overstocked size classes.

Northern hardwoods growing on poor to fair sites, may be best managed with Q values in the range of 1.5 to 1.7 and largest tree diameters of 18 to 20 inches d.b.h. These sites are traditionally slow growing and may not be capable of continuously producing large high quality trees. Northern hardwoods developing on good to excellent sites should be managed with Q values of 1.3 to 1.5 and largest tree diameters of 20 to 24 inches d.b.h. These sites respond well to uneven-aged management practices, exhibit good to excellent growth and recruitment, and have the ability to develop large, high quality sawlog material on a continuous, long-term basis. In general, target residual basal area goals range from 65 to 90 square feet per acre (averaging 70 to 80 square feet), depending on many of the factors previously stated.

2). Summary of Guidelines for Uneven-aged Management

A variety of parameters should be considered when determining how and when to apply an uneven-aged management system. Once site potential and current stand conditions have been analyzed, designated stocking levels, targeted diameter distributions, and maximum carry over tree diameters need to be considered. The following are viable management options based on site potential for the Bayfield County Forest.

- Dry-mesic or wet-mesic sites with fair relative growth potential. Habitat types are typically AVb and ASnMi, respectively. Site Index generally in the range of 55 to 59.
 - (1). Identify at least 45 crop trees per acre. Consider even-aged management if at least 45 crop trees per acre cannot be located or if there is a poor response to uneven-aged silvicultural practices.
 - (2). Consider Q values in the range of 1.5 to 1.7 with a maximum tree diameter of 18 to 20 inches d.b.h. Generally, these sites do not have the capacity to grow numerous large, high quality timber products.
 - (3). Use single tree selection methods to reduce the basal area to approximately 65 to 90 square feet per acre (averaging 70 to 80 square feet), depending on site factors, current stand conditions, past management, and overall goals. In stands with a greater component of basswood and/or white ash (50% or more of residual basal area), basal area targets should be 10 to 15 square feet higher.
 - (4). Canopy gaps should comprise 5 to 15% of the total stand area and should not exceed 75 feet in diameter.
 - (5). Heavier thins (less than 70 square feet) may be necessary and will usually require 20 to 30 years of development before another harvest would be possible. In addition, because of the inherent slower growth rates on sites with fair growth potential, more intensive harvests tend to keep the canopy in an open condition for a longer period of time. Repeated heavy harvests may result in reduced quality due to the inability of trees to shed epicormic branches and to correct forking issues. Lighter thins may be re-evaluated in 10 to 20 years.
- Mesic sites with good to excellent growth potential. Habitat types are typically ATM or better. Site index generally 60 or better.
 - (1). Identify at least 45 crop trees per acre. Consider even-aged management if at least 45 crop trees per acre cannot be located or

if there is a poor response to uneven-aged silvicultural practices.

- (2). Consider Q values in the range of 1.3 to 1.5 with a maximum tree diameter of 20 to 24 inches.
- (3). Use single tree selection methods to reduce residual basal areas to approximately 65 to 90 square feet per acre (averaging 70 to 80 square feet). In stands with a greater component of basswood and/or white ash (50% or more of residual basal area), basal area targets should be 10 to 15 square feet higher.
- (4). Establish canopy gaps of approximately 30 to 60 feet in diameter and totaling 8 to 12% of the total stand area.
- (5). Stands may be re-evaluated in 10 to 15 years.

c. Even-aged Management

Even-aged silvicultural systems are designed to maintain and develop a single age class of trees. Stands are regenerated at a selected rotation age. The length of rotation may be defined by a variety of factors, including: mean age, maximum tree size, mean annual increment (MAI), and economic or biological maturity. Typical rotation ages for northern hardwood stands on the Bayfield County Forest range from 80 to 120 years. Table 830.4 displays the range of rotation ages used to manage northern hardwoods when using even-aged silvicultural systems. A variety of factors can influence the decision to manage a stand with even-aged techniques, these include, but are not limited to, current stand conditions (percentage of poor quality and/or diseased trees), site potential, past management practices, and species composition.

Table 830.4: Rotation Ages for Northern Hardwoods Managed with Even-Aged Silvicultural Techniques.

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
80	120	150

Even-aged management is normally prescribed on sites where the potential for northern hardwood development is poor to fair. Poor to fair sites generally have much slower growth rates, lower quality potential, and higher rates of mortality when compared to better sites. However, good to excellent northern hardwood sites do have the potential to be managed with even-aged practices. Stands developing on good to excellent sites that have been poorly managed in the past, have a high percentage of poor quality and/or diseased trees, have a high percentage of undesirable or intolerant species, or do not meet minimum requirements for uneven-aged practices may be considered for even-aged management. In addition, these stands have the potential to be converted to an

uneven-aged condition over time. Rotation ages on poor sites tend to be at the lower end of the range (80 to 100 years), while better sites tend to be in the upper end of the range (100 to 120 years). On good to excellent sites, the potential exists for extended rotation ages of up to 150 years.

Two forms of even-aged practices are commonly applied on the Bayfield County Forest: the shelterwood method and clearcutting. Intermediate harvests may also be used when mature stands are not yet ready to be regenerated, but are in need of management. Each method is described below.

1). Intermediate Harvest

Most mature northern hardwood stands (typically 60+ years of age or that average approximately 8 inches d.b.h.) on the Bayfield County Forest are in need of some form of management. If the long term goal is to manage a stand of northern hardwoods with even-aged methods, but the stand is not yet ready to be regenerated, an intermediate harvest may be prescribed. The ultimate goal of an intermediate harvest is to remove shorter-lived (aspen and paper birch), poor quality, and undesirable tree species, while encouraging the development of quality on the “best” stems (crop trees). Because the long-term goal is to create a single age class of desired tree species, canopy gaps are not intentionally created. Target stocking or crown cover levels may vary slightly but are generally in the range of 80 to 90% crown closure (70 to 85 square feet per acre), depending on the percentage of sawtimber and species composition.

Most stands are in a previously unmanaged, even-aged condition and overstocked in the smaller diameter classes. The order of removal, as described for single tree selection, should be followed when thinning these overstocked size classes. Stands are typically re-evaluated in 15 to 25 years.

2). Shelterwood

The shelterwood system is the most common form of even-aged management for northern hardwoods on the Bayfield County Forest. In addition to the regeneration of shade tolerant species like sugar maple, this method is preferred for the establishment and development of a greater component of lighter seeded and moderately tolerant species like yellow birch, red oak, white ash, basswood, and red maple. Two basic levels of shelterwood harvests are commonly applied to regenerate northern hardwoods: two-cut and three-cut (or multi-cut). In each method, crop trees are identified and harvests reduce the residual stocking or crown cover to designated levels. Trees are generally marked to leave rather than for removal. When an adequate amount of desired regeneration is present, the overstory is removed and a new even-aged stand is allowed to develop. The development of regeneration is highly dependant upon the potential of a given site, as well as the intensity of the harvest and should be closely monitored.

(a). Two-Cut Shelterwood

Shelterwood harvests using the two-cut method regenerate the stand with an initial regeneration harvest (first cut) and release the established regeneration with an overstory removal (second cut). The first harvest is designed to provide enough overstory shade to 1) reduce the competition from faster growing shade intolerant species (aspen and paper birch), 2) provide favorable conditions for mid-tolerant and lighter seeded species (yellow birch, white ash and red oak), 3) prevent the desiccation of newly established seedlings and allow for the development of root systems, and 4) develop quality on the residual “best” stems. A common procedure to regenerate stands of northern hardwoods with the two-cut shelterwood is as follows:

- (1). In the regeneration harvest (first cut), leave a uniform, well spaced crown cover in the range of 55 to 75% (45 to 65 square feet per acre) in dominant and co-dominant, vigorous, best formed, residual overstory trees (residual stocking may vary due to species composition, mean average stand diameter, and desired species regeneration goals). Site preparation may be necessary when attempting to regenerate species such as yellow birch and red oak.
- (2). Remove the overstory when desired established regeneration totals at least 2,000 to 5,000 stems per acre, 3 to 5 feet in height, that are above competing undesirable vegetation. This ensures that established seedlings and saplings have developed a solid, deep root system, are capable of responding to full sunlight (release), and are capable of maintaining dominance.
- (3). Overstory removal should occur during periods of snow cover . This will minimize damage to established and developing seedlings and saplings. In addition, the overstory removal is generally timed to coincide with the desired rotation age designated for the stand.

(b). Three-Cut or Multi-Cut Shelterwood

A three-cut shelterwood harvest is essentially one or more intermediate harvests followed by a two-cut shelterwood. This method may be required when there is good potential for quality improvement, inadequate advanced natural regeneration, a potential for grass or brush invasion (opening the canopy too much too soon may proliferate undesirable vegetation and inhibit desirable species establishment), or if aesthetics are an objective. In most cases, only one intermediate harvest is prescribed before the initiation of a two-cut shelterwood. However, the potential does exist for up to two treatments prior to a regeneration harvest. For an example, if the rotation age for a given stand of northern hardwoods is 120 years and the initial thin begins at age 70, at 20 year intervals, it may be possible to lightly thin a stand twice before initiating a two-cut shelterwood.

- (1). The first and, in some cases, second intermediate harvests follow the guidelines found in the intermediate thin section. Residual crown cover is left slightly higher (85 to 95%) to discourage the establishment of undesirable vegetation and to improve the quality of the existing stand. Canopy gaps are not intentionally created and crop trees are identified.
- (2). Prescribe the regeneration harvest when the stand is approaching the rotation age. Residual crown cover is left slightly lower (55 to 65%) to encourage the establishment of new seedlings and the development of advanced regeneration.
- (3). Remove overstory as described in the two-cut shelterwood system.

3). Clearcut/Conversion

A clearcut is generally the least desirable regeneration method when treating a stand of northern hardwoods. Clearcutting to develop a new even-aged stand is generally the least suited method to regenerate most species found in a typical northern hardwood forest. However, if the majority of the residual stand is of poor quality and/or form and contains a high percentage of disease or if a stand is generally poor quality and contains at least 20 percent of the residual stocking in aspen, clearcutting may be a viable option.

d. Conversion From an Even-aged Condition to Uneven-aged

As previously stated, some northern hardwood stands on the Bayfield County Forest are in a previously unmanaged (or lightly managed), even-aged condition. Most stands are overstocked in the smaller size classes and, as a result of the long-term closed canopy conditions, lack the development of advanced regeneration. Stands that are developing on sites that have fair to excellent growth potential may be converted to an uneven-aged condition with a combination of even-aged (intermediate thinnings) and uneven-aged (single tree selection) techniques. The initial entry combines even-aged thinning practices with the creation of canopy gaps. Improvement thinnings focus on the removal of the poorest quality trees and the quality development on the “best” stems, while canopy gaps will create the proper conditions for the establishment and recruitment of a new age class of desired tree species. Conversion is a long-term process. At least 3 to 4 harvests may be required to create a structurally diverse, fully stocked stand indicative of an uneven-aged forest.

2. Determination of Annual Allowable Harvest Levels

The northern hardwood timber type located on the Bayfield County Forest occurs over a wide geographical range and grows on a variety of site conditions. These factors, as well as others like past harvesting practices, current stand conditions, long term management goals, and aesthetics, play a role in determining how a

particular stand will be managed. Currently, northern hardwoods are managed with either uneven-aged or even-aged techniques. As of 2005, approximately 52% of the total manageable northern hardwood acreage (11,370 acres) is prescribed for uneven-aged management. The remaining 48% (10,423 acres) is prescribed for even-aged management. Determinations of the annual allowable harvest takes into account these two management systems, as well as management objectives and long-term management goals.

Under uneven-aged practices, the calculation of the annual allowable harvest divides the total acreage by the average length of time between harvests (year of entry or cutting cycle). The average year of entry for typical northern hardwood stands on the Bayfield County Forest is 20 years (this may vary from 10 to 30 years, depending on site conditions and/or the intensity of past management practices). In stands that will be managed using even-aged management practices, the annual allowable harvest is determined by dividing the total acreage by the desired age of rotation. The average rotation age for northern hardwoods on the Bayfield County Forest is 120 years (may range between 80 and 150 years, depending on site quality and long-term management goals). Other variables must also be considered when determining the total annual allowable harvest goals under even-aged management. When prescribing even-aged management, most stands will undergo between 2 and 4 total treatments. For a given stand, these treatments may include an intermediate thin, a shelterwood harvest, and final overstory removal. When determining the annual allowable harvest, it is important to include these treatments. Table 830.5 displays the estimated allowable harvest levels (acres) per silvicultural system per year.

Table 830.5: Northern Hardwood Estimated Allowable Harvest Acreage per Silvicultural System per Year.

Acres per System		Allowable Harvest per Year per System (Acres)			
Silvicultural System	Total Acres	Acres of Thinnings	Acres Regenerated	Acres of Overstory Removal	Harvest Totals
Uneven-Aged	11,370	----	569	----	569
Even-Aged	10,423	87	87	87	261
Totals	21,793	87	656	87	830

These numbers reflect the annual allowable harvest when the northern hardwood timber type, collectively, has reached a fully regulated condition (the point at which stocking, harvests, growth, and yield have been intentionally controlled to meet sustainable, long-term management objectives). The annual allowable harvest for northern hardwoods over the next 10 to 15 year period will be approximately 830 acres per year. In any given year, it may be necessary to increase or decrease the annual allowable harvest in an attempt to meet long-term management goals and achieve a regulated state. Factors such as a backlog (or shortage) of stands that are prescribed for management, an individual stands

response to treatment, natural disturbance (i.e. wind events, insect outbreaks), and improved accuracy of reconnaissance data have the potential to directly influence the allowable harvest of any given year. See chapter 1000 for annual harvest levels of northern hardwoods.

830.1.3 Red Oak

A. History

The oak type in Bayfield County is primarily a result of fires between 1890 and 1935. Periodic natural and human caused fires created the even-aged stands of today. Two distinct age classes generally characterize these stands. The older age class is approximately twenty to twenty-five years older and exhibits larger crown development characteristic of open grown trees. The younger, heavily stocked oak, are co-dominant at best and have poor canopy development for their age. Slow diameter growth in the oak is related to the high densities and under developed crowns. These stands “appear” healthier than they really are due to the straight boles and uniform sizes within the stands.

Early descriptions of oak management in Bayfield County described the oak as weed trees and usually indicated converting to other species. Timber sales cut in the 1960’s and 70’s usually left the oak because of its non-merchantability. These trees produced heavy epicormic branching, which led many to support the “weed tree” philosophy.

Red oak was also a large component of some hardwood stands. Yellow birch, aspen, maple, and hemlock were removed from these stands through thinning operations during the 1950’s, 60’s and 70’s. Oak was left primarily because of the same lack of merchantability. These same stands became some of the counties’ better oak sites in the mid 80’s and served as the turning point for oak management on the Bayfield County Forest.

Oak regeneration became one of the priorities for oak management in 1985. Fire was incorporated as a tool for regeneration. Better site identification and identifying all the major stresses that occur over the lifetime of an oak stand became a focal point of management. The goal for oak management was and still is to improve the health of the oak stands and reduce those stresses that we have control over. We can control densities, and age class distributions through intermediate thinning and regeneration cuts. We can maintain oak on the best-suited sites and we can, with sufficient markets, produce healthy new stands for the future.

During the summers of 2002-2004 the County was faced with a large amount of dead and dying red oak as a result of Two-Lined Chestnut Borer outbreak. The borer was the second of two stressors, the first being two consecutive years of Forest Tent Caterpillar defoliation. The Majority of the mortality was concentrated in the Cable area of the Bayfield County Forest. Several accelerated salvage sales were set up and the dead oak was removed. The mortality was so high in these stands that

large canopy gaps were created. The majority of these oak acres will be naturally converted to white pine and northern hardwood, which is currently in the understory. Regeneration of oak was not pursued due to the fact that these are stressful oak sites to begin with and more compatible for white pine.

Red oak can survive to a relatively old age. The oldest known oak in Bayfield County was cut illegally in 1987. It was 32 inches in diameter at the stump and was 215 years old. This tree was an exception; yet, the County's goal is to produce healthy trees that can resist insects and diseases for as long as needed to maintain a fully stocked oak forest.

1. Historical Acreage Trends

Acreage trends since 1977 show a slight increase in red oak acreage. Table 830.6 displays the total acreage trends for the red oak timber type between the periods of 1977 and 2005:

Table 830.6: Historical Acreage Trends for Red Oak on the Bayfield County Forest (1977 to 2005)

1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
16,045	15,711	15,808	16,291	17,702	1,657	10.3%

The majority of this is attributed to natural conversion from paper birch to red oak. The rest can be traced to corrections in the County's forest inventory data over time.

B. Current Status

The total northern red oak acreage in Bayfield County Forest is 17,702 acres. This accounts for about 11% of the total Bayfield County Forest. Of these acres, 15,939, or 91% of the acres are in the 71-100 year old age class. Figure 830.3 displays the total current red oak acreage (as of 2005) in ten year age classes.

C. Desired Future Condition

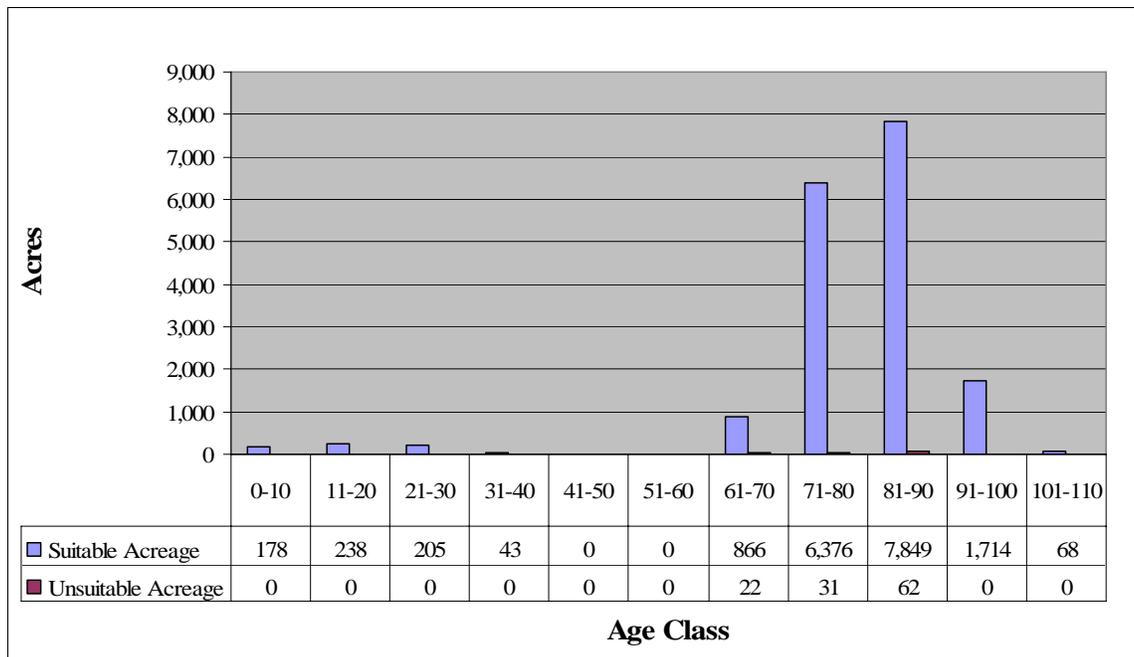
The primary goal of northern red oak management in Bayfield County is to maintain as much of the red oak acreage as possible and to evenly distribute the age classes over a 120 year period.

Looking into the future it is well known that this will be a daunting task. As many forest managers are discovering, red oak is going to be difficult to maintain on the landscape at its current levels. Insufficient research, number of personnel, available equipment, ideal burning conditions and natural succession to northern hardwoods are some of the concerns facing the future management of red oak in

Bayfield County. Since the successful regeneration of red oak on a large scale has proven to be very difficult, the County is proceeding cautiously.

In order to maintain as much of the current red oak acreage as possible, it will be necessary to insure that the silvicultural treatments and annual harvest levels encourage healthy, vigorous red oak stands that will be able to defend themselves against the multitude of elements that attack it. Elements, which have been observed to have a devastating affect on red oak include, but are not limited to, drought, Forest Tent Caterpillar, Two-Lined Chestnut Borer and, most recently predicted to affect Bayfield County, Gypsy Moth.

Figure 830.3: Red Oak Acreage by Age Class Distribution in 10-year Age Classes (2005 Data)



D. Management

1. Applicable Silvicultural Treatments

Northern red oak management consists of 4 different silvicultural treatments used throughout the lifespan of a red oak stand. These are intermediate thinnings, regeneration cuts, prescribed burns and overstory removals. Intermediate thinnings are used to maximize the quantity and quality of a stand's oak component. This process involves favoring dominants, seed origin oak, and quality stump-origin sprouts while discriminating against, or removing, oak of poor form and vigor and shade tolerant species such as maple. Intermediate thinnings can be repeated in the same stand of oak several times over its lifetime. They begin once the trees have reached 60 years old, or merchantable size, and adequate stocking, and repeated every 20 to 30 years as the trees continue to grow

until the stand has reached maturity.

Shelterwood cuts are used to regenerate mature oak stands. The residual oak will be used as a seed source for the future oak stand. Prescribed fire will be incorporated to prepare a seedbed for the oak and reduce seedling competition from more aggressive hardwood and aspen. Once an acceptable number of oak seedlings have been established, the remaining oak overstory will be removed to release the shade intolerant red oak seedlings. The County will continue to investigate new ways of regenerating red oak.

Over the past couple years it has become evident how fragile the county's oak resource can be when faced with a multitude of stresses. Both positive and negative responses to harvests have been observed from the oak. Negative responses were due to coincidental harvesting during a period of drought followed by 2 years of defoliation from the Forest Tent Caterpillar followed by an infestation of Two-Lined Chestnut Borer which also attacked and caused mortality in stands that were not thinned. Under normal conditions it has shown that thinning of red oak has a positive affect on improving the stands health and vigor. Maintaining an active thinning and regeneration schedule is a proactive step in the preparation to respond to future stresses.

2. Determination of Annual Allowable Harvest Levels

When determining the allowable cut for an even aged species such as red oak the age at which the species is considered to be ready to be regenerated needs to be determined. This is known as the rotation age. Red oak is considered to have reached rotation age at 120 years of age, which can vary, depending on site quality. Age classes older than 120 years of age would be kept on sites of higher quality and regenerated at a later time. Table 830.7 displays the range of rotation ages used to manage red oak on the Bayfield County Forest.

Table 830.7: Rotation Ages for Red Oak on the Bayfield County Forest

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
80	120	150

With three different silvicultural treatments being used in Oak management, three separate annual allowable harvest levels need to be determined. Under an ideal system, the total acreage is multiplied by the number of times the treatment will be done in a stand and then divided by the years between treatments. For intermediate thins the total manageable acreage, 17,587, is divided by the rotation age of 120 years and multiplied by 2 entries which equates to 293 acres per year. For the regeneration cuts, divide the total acres by the rotation age of 120 years which equates to 146 acres per year. The third treatment is the overstory removal. Since each Shelterwood is followed up by the overstory removal the acreages are

the same. This is done once the understory shows sufficient regeneration of red oak seedlings. The three treatments have a combined total of 585 acres per year. Rotation age and acres to be harvested are further refined by specific site capabilities and are subject to change when it is necessary to respond to natural weather events and insect or disease outbreaks. See chapter 1000 for annual harvest levels of red oak.

830.1.4 Scrub Oak

A. History

Scrub oak in Bayfield County is primarily off-site northern red oak and northern pin oak with some white oak in areas to the south. Northern red oak and northern pin oak hybridize readily and have been classified as one species. Scrub oak is also known locally as jack oak and sand oak.

The history of scrub oak follows that of our better oak stands where fire played an important role in their development. Unlike the better sites, scrub oak developed on droughty sands. Scrub oak stands varied from pure oak to mixtures of oak and aspen, oak and jack pine, and on some better scrub oak sites, oak, birch, and red maple.

These sites were low on the past priority list for harvesting. The stands with the lowest site index and lowest stocking were identified as non-productive and were scheduled for conversion to jack or red pine. Many of the stands were so heavily burned in the early 1900's that it did not take much site preparation to establish these areas in productive pine types. These were some of the earliest plantations in Bayfield County. Most were wild land planted and now have quite a natural appearance to them. Other sites, with more competition, were planted in furrows or treated with herbicide.

Economics also played an important role in the management of scrub oak sites. It was not economically possible to remove the nonmerchantable stems, do site prep, and plant all of the scrub oak stands. Eventually, money for red pine establishment was used on better sites or sites that had jack pine removed as part of a timber sale. Many non-productive scrub oak stands never were scheduled for harvest.

Sites with merchantable aspen were sold and followed up with aspen betterment projects. Sites with jack pine components were harvested and converted to red pine or, in some cases left as a scrub oak type. Most sites that showed possible merchantability were scheduled for an eighty year rotation. This allowed the sites to mature and hopefully find a market in the future.

In the mid 1980's, a market for fuelwood developed in northern Wisconsin. Mixed stands were put up for sale and harvested as chips. Companies began to discuss scattering semi-portable chippers throughout Bayfield and Douglas Counties. Scrub oak stands were revisited and some were established to meet this

fuel wood future. The chippers never were installed but the idea of buying low value products and chipping them as fuelwood remained.

The early to mid 1990's brought scattered areas of scrub oak mortality. Stands that looked healthy several years earlier were dying. These stands were harvested and converted to jack pine. The market for chips was viable enough to accept the quantities of oak we provided. The mid 1990's also brought a decision that all scrub oak need not be converted to red or jack pine. Better stands would remain on their rotation dates and would be harvested and retained as scrub oak into the future.

1. Historical Acreage Trends

Table 830.8 displays the total acreage trends for the scrub oak timber type between the periods of 1977 and 2005:

Table 830.8: Historical Acreage Trends for Scrub Oak on the Bayfield County Forest (1977 to 2005)

1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
9,449	10,049	9,253	9,004	6,602	-2,847	-30.1%

The table shows that scrub oak acres have declined through the years. There are a couple reasons for this decline. The main reason has been the conversion of scrub oak stands after they have been harvested to other species such as red pine, jack pine, or aspen. Another reason was due to incorrect inventory data. In the 1970's many stands were determined from the sole use of aerial photographs, without the incorporation of field checks. This method of stand delineation may result in areas that are incorrectly typed. Since the 1970's, many scrub oak stands have been re-inventoried and much of the incorrect data has, and continues to be, corrected.

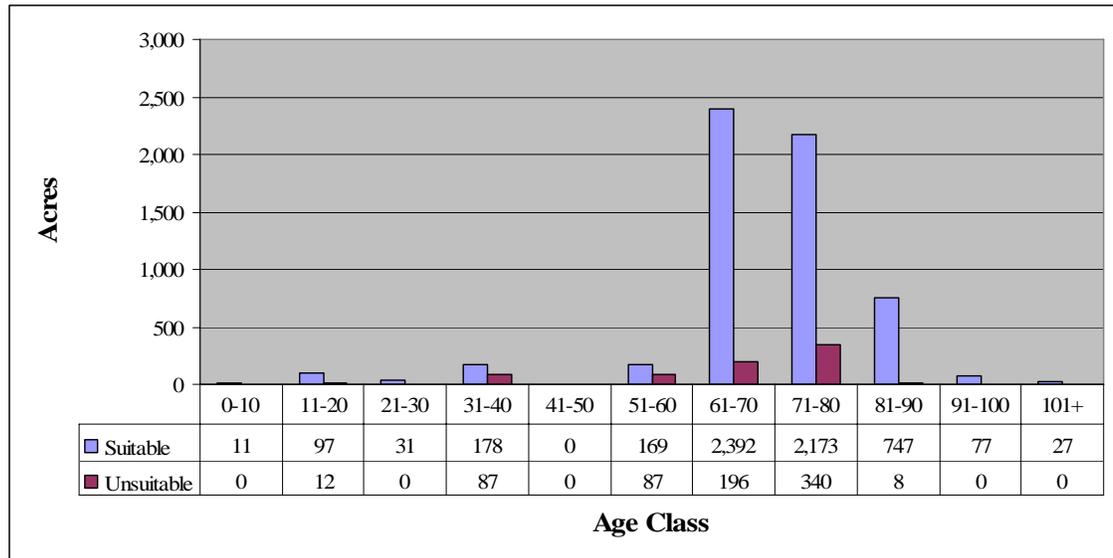
B. Current Status (2005)

Total scrub oak acres on County Forest: 6,633 acres.

Percent of scrub oak cover type on County Forest: 4%.

As shown in Figure 830.4, 90% of the scrub oak stands on the County Forest are 60 years old or older, which is the approximate rotation age for scrub oak. Between 2003 and 2005, the two-lined chestnut borer caused significant mortality in scrub oak stands in Bayfield County. Currently, and in the past the majority of scrub oak acres harvested have been converted to other species. Figure 830.4 displays the total current scrub oak acreage (as of 2005) in ten year age classes.

Figure 830.4: Scrub Oak Acreage by Age Class Distribution in 10-year Age Classes (2005 Data)



C. Desired Future Condition

There are two goals for scrub oak. The first goal is to regulate the species, which means having the age class distribution become more evenly distributed to ensure a continuous supply of timber. Currently (2005), the age class distribution is far from evenly distributed, but over the long term with calculated harvest levels the age class distribution should look better as more stands get regenerated into young stands of scrub oak.

The second goal is to try and maintain the current amount of scrub oak acres on the County Forest. Scrub oak acres on the County Forest have been steadily decreasing due to the conversion to more productive timber types such as red pine, jack pine, and aspen. The County would like to see this conversion of scrub oak to other species reduced. The main reasons for reducing the conversion of scrub oak include: the scrub oak timber type provides important habitat to many wildlife species, and the scrub oak type acres are dwindling on a landscape level and it is in the County's interest to maintain this type for the future.

D. Management

1. Applicable Silvicultural Treatments

Scrub Oak is managed under an even-age management system. The rotation age is 70 years. Scrub oak will regenerate naturally after clearcutting through stump sprouts and seed.

2. Determination of Annual Allowable Harvest Levels

The determination of harvest levels for scrub oak is based on the current inventory of scrub oak stands. This inventory includes the stand age, acres, and scheduled harvest date based on a 70 yr rotation age. Table 830.9 displays the range of rotation ages used to manage scrub oak on the Bayfield County Forest.

Table 830.9: Rotation Ages for Scrub Oak on the Bayfield County Forest

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
45	70	90

There is 6,602 acres of scrub oak on the County Forest of which, 5,902 acres are classified as suitable for management. With a rotation age of 70 years, the annual allowable harvest would be around 85 acres. Since much of the oak is greater than the 70 year rotation age, the allowable harvest has been increased in order to manage the older stands before they die. There are stands of scrub oak that may be left well past the rotation length. These stands would be left for mostly wildlife purposes: travel corridors, protective cover in areas surrounded with young pine stands, species diversity, etc. Leaving these stands would also aid in regulating the age class distribution. See chapter 1000 for annual harvest levels of scrub oak.

830.1.5 Paper Birch

A. History

Paper birch is a “pioneer” species that tends to regenerate areas that have been left in an open condition as a result of a fire event or intensive harvest. Paper birch developed on these landscapes as either pure stands or, more commonly, as a component with other less shade tolerant species like aspen and red oak. Pure stands of paper birch, characterized by containing at least 90 % of the total stand volume in paper birch, have generally disappeared. However, paper birch still is a major component in most aspen and oak types.

In Bayfield County, paper birch became established following the intensive harvests and fires that occurred between the late 1800’s and early 1900’s, with the last major fire in 1935. Unburned hardwood stands, on good quality soil, had large diameter birch as a component of their stands.

Management objectives varied by site quality, but all were influenced by longer rotation ages. In recent history, the paper birch in northern hardwood stands were the first to be harvested. From 1965 to the present, overmature, sawlog sized paper birch has been targeted for removal in most of these hardwood stands. Traditionally, marking has targeted the removal of paper birch.

Where paper birch was a component in a stand of oak, the birch was usually removed as part of red oak management. During periods where oak pulp markets were slow or non-existent, the removal of paper birch tended to “help sell” stands slated for red oak management. Most contractors liked cutting birch because of the higher production rate.

Eighty year old stands were cut in the mid 1980’s with varying harvesting techniques employed. The drought conditions of the late 1980’s took a toll on much of the birch that existed on wetter soils. Many paper birch stands were scheduled for earlier harvests and by the mid 1990’s, every birch stand had been visited to analyze health and vigor. Many stands were harvested due to noticeable birch decline. Stands that appeared healthy were scheduled for re-evaluation by 2000. Most were re-evaluated on a yearly basis and were harvested before then.

Several techniques have been employed in an attempt to re-establish paper birch. Seed tree, leave strips, undulating edges, and the encouragement of stump sprouting have been attempted. Areas burned for red oak management appeared to produce the most consistent regeneration of paper birch, especially when paper birch trees were left in the proposed burn areas. Aspen nearly always out-grows birch when cut together. No method employed has resulted in consistent, predictable paper birch regeneration.

1. Historic Acreage Trends

Since 1977, paper birch acreage within Bayfield County Forest boundaries has experienced a steady decline. Table 830.10 displays the total acreage trends for the paper birch timber type between the periods of 1977 and 2005:

Table 830.10: Historical Acreage Trends for Paper Birch on the Bayfield County Forest (1977 to 2005)

1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
7,000	6,541	6,258	5,557	2,613	-4,387	-62.7%

The overall decrease may be best explained by the natural progression from early successional, shorter lived, shade intolerant species to the later successional, longer lived, mid tolerant and tolerant species. The overall decrease in acreage from 1995 to 2005 is a result of the natural succession from shorter lived “pioneer” species (paper birch) to longer lived species (i.e. maple and red oak), as well as a more thorough compartment examination performed by the Forestry Department since 2001.

B. Current Status (2005)

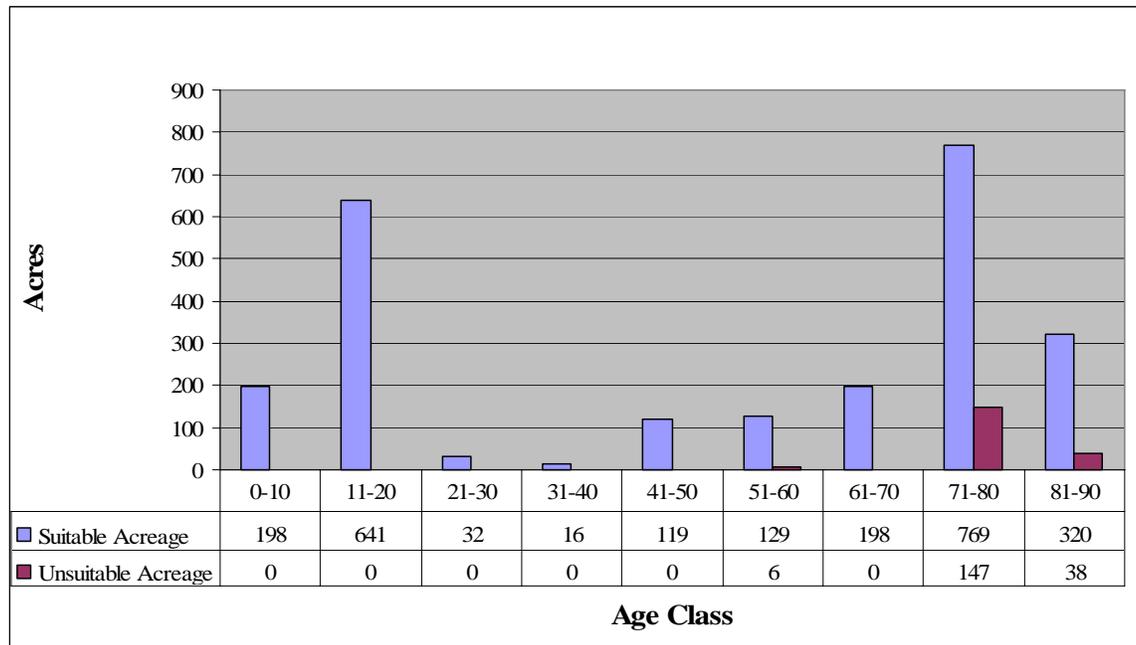
1. Current Acreage

As of 2005, there is 2,422 acres of manageable paper birch timber type. An additional 191 acres has been classified as unmanageable due to site sensitivities or proximity to streams and lakes. Paper birch comprises approximately 2% of the total Bayfield County Forest acreage. Approximately 1,942 acres (80%) of the paper birch timber type is located in the Bayfield Peninsula. See Chapter 900 for the location of the paper birch timber type on the Bayfield County Forest.

2. Age Class Distribution

Stands of paper birch on the Bayfield County Forest are primarily at maturity or are overmature. Roughly 56% of the total acreage is 61 years of age or older. Figure 830.5 displays the age class distribution for paper birch as of 2005:

Figure 830.5: Paper Birch Acreage by Age Class Distribution in 10-year Age Classes (2005 Data)



C. Desired Future Condition

The long term management goal for paper birch on the Bayfield County Forest is to bring the age class distribution closer to a regulated condition and aggressively maintain the current acreage. However, many acres of paper birch have naturally converted to more tolerant, longer-lived species and, because of the inherent complexities involved in the natural regeneration of paper birch, this trend is likely to continue.

D. Management

On the Bayfield County Forest, paper birch typically occurs as a component within stands of red oak, aspen, fir/spruce, and, occasionally, northern hardwoods. Paper birch is dominant in some stands, but rarely occurs as a pure component. Management of paper birch within the Bayfield County Forest will focus on regenerating stands where the site quality is fair to good and the potential for competition with aggressive species is low. This includes attempting to maintain stands currently dominated by paper birch, as well as, converting stands where paper birch is a minor component but has the potential to be the primary type.

Natural regeneration from seed is the preferred method of establishing a new stand, however, stump sprouting is common and is a good choice when the management objective is to maintain paper birch as a minor component. Some form of scarification is usually required to prepare a site for the natural regeneration of paper birch. Mechanical scarification is preferred, however, prescribed burning and whole-tree skidding may provide acceptable results. In general, an adequate seed bed for the germination, establishment, and recruitment of paper birch is accomplished by mixing mineral soil with organic and/or humus material on 50 to 75% of the area. An additional benefit of site scarification is the initial control of competing vegetation. Site preparation is normally performed during the fall (in conjunction with seed dispersal). This allows the seed to be mixed with or fall on top of bare mineral soil that is relatively free from competing vegetation. Many variables may affect the success of regenerating a stand of paper birch. These variables include, but are not limited to:

- **Silvics of paper birch:** paper birch seed is small in size and new germinants are very sensitive to moisture, temperature, nutrient, light, and seedbed conditions. Established seedlings are extremely sensitive to competition and are easily displaced (it is very important to control competing vegetation). Seed origin sprouts tend to be slower growing than those of vegetative origin. However, vegetative reproduction tends to be of poorer quality and matures at an earlier age.
- **Adequate site scarification:** in general, the greater the intensity of disturbance, the greater the potential for paper birch establishment. Achieving a mixture of mineral soil with organic material, as well as, providing bare mineral soil relatively free of competition is desired.
- **Timing of scarification:** paper birch seed is disseminated during the fall (September through November). Optimum seed-bearing occurs between 40 to 70 years of age. Incorporating the timing of seed fall with disturbance regimes is crucial in the establishment of paper birch.

- Control of competing vegetation: paper birch is sensitive to the competition for resources from other species at all stages of development. When attempting to regenerate paper birch, it is important to release suppressed regeneration as soon as possible. If aspen is a component of the residual stand, it may be necessary to designate them as leave trees (do not harvest) in an attempt to discourage root suckering. Aspen sprouts will out-compete paper birch seedlings.
- Browsing: Paper birch is a preferred food source for white-tailed deer and numerous other wildlife species. Repeated heavy browsing may be detrimental to the natural establishment of paper birch.

1. Applicable Silvicultural Treatments

Paper birch is managed with even-aged silvicultural practices. The seed tree method (sometimes referred to as a two-cut shelterwood) is the preferred method for establishing a new stand of paper birch. Clearcutting is an option, but should only be applied when the management objective is to maintain paper birch as a component (typically will be of stump sprout origin). On good to excellent sites where individual trees are exhibiting good quality and vigorous growth, and sawlog development is an objective, an intermediate thin may be a viable alternative. Listed below are general guidelines used by the Bayfield County Forestry Department to develop a new stand of paper birch.

a. Even-Aged Management

Even-aged silvicultural systems are designed to maintain and develop a single age class of trees. Stands are regenerated at a selected rotation age. The length of rotation may be defined by a variety of factors, including: mean age, maximum tree size, mean annual increment (MAI), and economic or biological maturity. Typical rotation ages for paper birch stands on the Bayfield County Forest range from 55 to 80 years. A variety of factors can influence the decision of when to manage a stand for the regeneration of paper birch. These include, but are not limited to, current stand conditions (percentage of poor quality and/or diseased trees), site potential, and species composition. Below are guidelines used to establish a new age class of paper birch:

- 1). In the initial harvest, leave approximately 20 to 40% residual crown cover, evenly distributed, in paper birch stems that are exhibiting the best form and vigor. Red oak and basswood are good species to leave when paper birch is unavailable. If aspen is a component, leave as many as possible (within the crown cover parameters) to discourage root suckering.

- 2). During the fall, scarify the site, either mechanically and/or with a prescribed burn, to expose and incorporate mineral soil with organic material and to reduce competition. Total area of disturbance should be approximately 50 to 75%. Generally, the greater the area and intensity of disturbance, the greater the potential for paper birch regeneration. Time scarification with seed dispersal (usually after leaf fall) to improve the potential for natural germination via seed. If aggressive site preparation methods are not available, timing the initial harvest during the fall and applying whole-tree harvesting techniques throughout, may provide acceptable results.
- 3). Monitor the establishment of desired paper birch seedlings. Consider the control of competing vegetation if a large percentage are overtopped by undesirable species. Remove the overstory during periods of snow cover to reduce the potential damage of established seedlings. Desired regeneration should be at least 1 to 2 feet tall upon release (stump sprouts may be taller).

2. Determination of Annual Allowable Harvest Levels

The paper birch timber type located on the Bayfield County Forest is managed under an even-aged silvicultural system. Table 830.11 displays the range of rotation ages used to manage paper birch on the Bayfield County Forest.

Table 830.11: Rotation Ages for Paper Birch on the Bayfield County Forest

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
50	65	80

The standard age of rotation for paper birch on the Bayfield County Forest is 65 years. Paper Birch growing on sites with good to excellent relative growth potential may be extended to 80 years of age. Conversely, stands that are developing on poor sites and/or are exhibiting signs of decline may be harvested at 55 years of age. In a regulated condition (where there is an equal amount of acreage in ten-year age classes), the target annual allowable harvest would be calculated by dividing the total manageable acres of paper birch (2422) by the standard rotation age (65). The result would be approximately 40 acres per year. However, as of 2005, the age class distribution of paper birch is not in a regulated condition and, as a result, many variables must be considered when attempting to calculate the annual allowable harvest. Some of these variables are as follows:

- 1). The age class distribution (as of 2005) is roughly “U” shaped (meaning there are more acres in the oldest and youngest age classes and very little in the middle).

- 2). A majority of stands are either at maturity or are overmature. Many of these stands are at the stage of decline or are slowly being converted to other species.
- 3). To reach a regulated condition, it may be necessary to harvest stands earlier than the stated minimum rotation age or carry stands longer than the extended age. The complexities involved with the regeneration of paper birch make it essential to consistently monitor the effects of management (to determine if silvicultural practices were successful). Some stands will convert to other species, acreage totals will change, and new projections will need to be created. It may take several rotations to reach a fully regulated condition.

In an attempt to regenerate the current overstocked mature age-classes of paper birch and level the unbalanced age distribution, the annual allowable harvest must be accelerated. As of 2005, there is approximately 1,000 acres between the ages of 61 and 90. Over the next ten-year period, the goal is to regenerate this acreage while striving toward a regulated condition. If the total acreage of paper birch were to remain constant, paper birch would reach a fully regulated condition when each ten-year age class contained approximately 346 acres. To reach a regulated condition, the annual allowable harvest needs to be constantly adjusted to compensate for the current distribution of age-classes. Many variables may play a role in altering allowable harvest levels, these variables include, but are not limited to: an unbalanced age-class distribution, a rapid increase in mortality, natural disturbance, and improved reconnaissance data. Examples of annual allowable harvest goals may be found in chapter 1000.

830.1.6 Red Pine

A. History

Red pine was highly sought after in the early logging days of Bayfield County. Large diameter red pine were removed from the landscape in the late 1890's and the early 1900's. Many of the stands had seeded in and were reproducing red pine for the future. The 1928 Forest and Land cover map for Bayfield County indicated many areas in regeneration size classes of red pine. There were very few areas indicated as mature red pine though. Many fires burned in Bayfield County in the early 1900's through 1935. These fires destroyed the red pine regeneration. Without seed trees to seed in after the fires, red pine became nearly extinct within the county. Isolated pockets of unburned areas containing red pine became some of the counties present, natural 100+ year old stands.

It was recognized early that many of the areas in Bayfield County were well suited to red pine. More than 10,000 acres of red pine were planted by 1964. Planting took on a high priority. Many sites were considered non-productive. These sites were established in many ways over the years. Some sites were burned and planted in furrows. Other sites were burned and wildland planted. The

heaviest competition sites were treated with 2 4 5 D or 2 4 5 T and planted. Some of the richest and easiest sites to plant were old homestead sites. Each plantation took on the name of the previous owner; such as the Sam Bering plantation and the Van Stone’s plantation. It was easy to know exactly what plantation was being referred to. Most of the names have since been forgotten due to the changing manpower and the longevity of the pine species.

The earliest plantations from the forties were being thinned in the seventies. Plantations were being thinned as early as twenty-five years old. Then, as much of the market fell for other species in Bayfield County, so did the market for red pine thinning. “Juvenile” wood was identified as the culprit. Young plantations in the eighties produced too much juvenile wood that played havoc with the paper making process. First thinning red pine sales came to a halt. By the late eighties the “problem” with juvenile wood was resolved. Our management goals had also standardized thirty years as the best time to enter a stand for its first thinning.

Costs of planting continued to go up. Site prep, tree stock, and planting costs all increased. High school students, Boy Scouts, and local residents, worked as volunteers or at minimum wage, along with and under the supervision of the County employees for many years. This practice continued through the eighties. Contract planting was initiated in 1987. It became a way to reduce some of the costs while getting the job done more efficiently. It is still the preferred method of planting today.

1. Historical Acreage Trends

Table 830.12 displays the total acreage trends for red pine between the periods of 1977 and 2005:

Table 830.12: Historical Acreage Trends for Red Pine on the Bayfield County Forest (1977 to 2005)

1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
8,255	9,032	10,609	11,018	14,130	5,875	71.2%

As shown above, the number of acres in red pine stands has increased throughout the years. This increase is a result of converting other stands such as jack pine and scrub oak into red pine plantations.

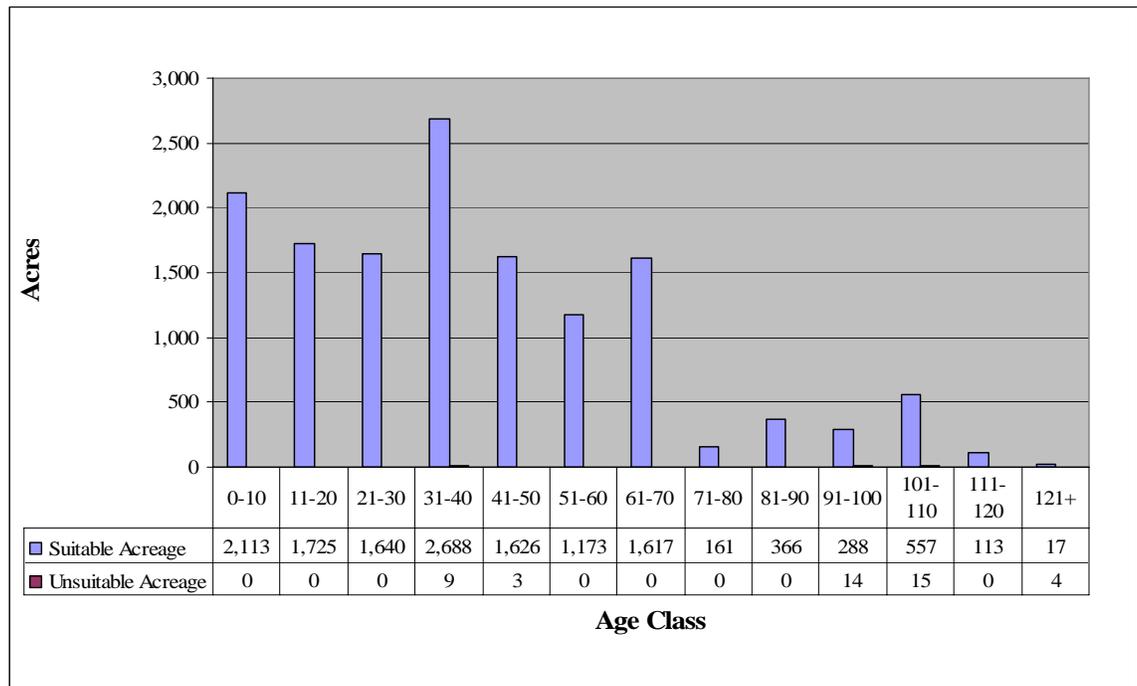
B. Current Status (2005)

Total red pine acres on County Forest: 14,130 acres. Percent of red pine cover type on County Forest: 8%.

As shown in Figure 830.6, the age class distribution for red pine is relatively

evenly distributed until age 70. There was an aggressive planting program in the 1930's starting with the CCC crews and have continued since. The stands older than 70 years are natural stands. Currently, there are many new red pine plantations being planted on sites that previously were jack pine and scrub oak. This translates into about a 50% conversion of harvested jack pine acres into new red pine acres. This conversion has resulted in a steady increase in the total acres of red pine. There are several reasons why this has occurred: the economics of red pine, effects of deer browse, and insect damage on jack pine.

Figure 830.6: Red Pine Acreage by Age Class Distribution in 10-year Age Classes (2005 Data)



C. Desired Future Condition

The County will reduce the conversion of jack pine and scrub oak stands to red pine plantations. Conversions to new red pine plantation acres will increase only slightly in the future. This increase will be attributed to the planting of a portion of the fuel break into red pine and converting poorly stocked or mostly upland brush sites into red pine.

D. Management

1. Applicable Silvicultural Treatments

The silvicultural system applied to red pine is even-aged management with periodic thinnings based on basal area control. Red pine stands are hand planted at an approximate spacing of 6ft x 8ft, which averages out to around 900 trees per

acre. These trees are planted after the site has been prepared by either a bracke or a disc-trencher. Survival checks are made every 2 years for the first 5 years. Herbicide may be used if necessary to set back competing vegetation. Red pine stands are first thinned around 30 years of age depending on the basal area. Based on the basal area, stands are either thinned with 50% volume removal (every other row removal) or 33% volume removal (every third row being removed). Subsequent thinnings will occur between 10-15 year intervals based on the basal area. Trees to be removed are individually marked.

The rotation age for red pine is 120 years (see Table 830.13 for red pine rotation ages). This number is flexible based on many factors including: growth rates, basal area, surrounding timber, etc. When a stand is ready to be regenerated, the stand is clearcut and replanted.

Table 830.13: Rotation Ages for Red Pine on the Bayfield County Forest

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
90	120	170

2. Determination of Annual Allowable Harvest Levels

The determination of harvest levels for red pine is based on current inventory data: expected thinning dates, and rotation age (120 yrs). There are two types of harvests for red pine: intermediate and regeneration. As explained above red pine stands are thinned (intermediate harvests) around age 30 and then every 10-15 years after that until the stand reaches rotation age where the stand is then clearcut (regeneration harvest) and started over. The rotation age for red pine is a flexible one. Some stands as they reach the rotation age may be left a bit longer because they are still growing strong or they may be left indefinitely because they are unique on the landscape and may be surrounded by young stands where there is little available cover for wildlife. The age class distribution for red pine is relatively evenly distributed throughout the age classes, which means the harvest level should remain relatively steady into the future. See chapter 1000 for annual harvest levels of red pine.

830.1.7 Jack Pine

A. History

Most present day mature jack pine stands in Bayfield County are directly related to the past fire history. Some jack pine plantations were planted during the CCC days and some "younger stands" developed on the fringes of older, mature stands. Jack pine occurred in pure, fully stocked conditions on poor to good sites and grew well in mixed stands of aspen and scrub oak.

Jack pine harvests in the 1960's and 70's were usually a result of wind damage or the naturally occurring jack pine budworm infestations. Many studies at that time showed superior economics and growth for red pine over jack pine. Jack pine was seen as an inferior species and was converted to red pine after harvest.

The early 1980's brought heavy wind damage to jack pine stands in the Barnes area. Record high prices for jack pine pulp peaked in 1982. The record high was followed by a total collapse of the jack pine market. Many uncut jack pine sales were extended for many years. The mid to late 1980's saw an increase of jack pine merchantability. Many jack pine sales were sold and cut but reforestation efforts fell behind. This resulted in former jack pine sites left open and non-productive.

Jack pine seeding trials were conducted in small areas in the late 1980's. By the early 1990's planting and red pine seedling costs had increased dramatically. Red pine stands on some of the lower site index stands were not performing as well as expected. Jack pine management was recommended on many areas. A decision was also made by the county to stop the conversion of most jack pine sites to red pine. The county decided to pursue reforestation at an accelerated rate in 1991. The scarification and jack pine seeding project was in full operation by 1993 and had most of the back log acres regenerated by 1997.

Between 1992 and 1995 the County experienced another jack pine budworm infestation preceded by ice damage in 1991. Experience from the 1980's outbreak showed that infested stands that were not harvested were able to survive and this provided future insight into how to respond to jack pine budworm infestations. The county followed a conservative jack pine harvest and used a wait-and-see philosophy. This resulted in harvesting only the stands with the worst response to the budworm damage infestation.

1. Historical Acreage Trends

Since 1977 jack pine acreage on the Bayfield County Forest has steadily declined by 35%. Table 830.14 displays the total acreage trends for jack pine between the periods of 1977 and 2005:

Table 830.14: Historical Acreage Trends for Jack Pine on the Bayfield County Forest (1977 to 2005)

1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
21,644	20,328	18,023	16,923	13,994	-7,650	-35.3%

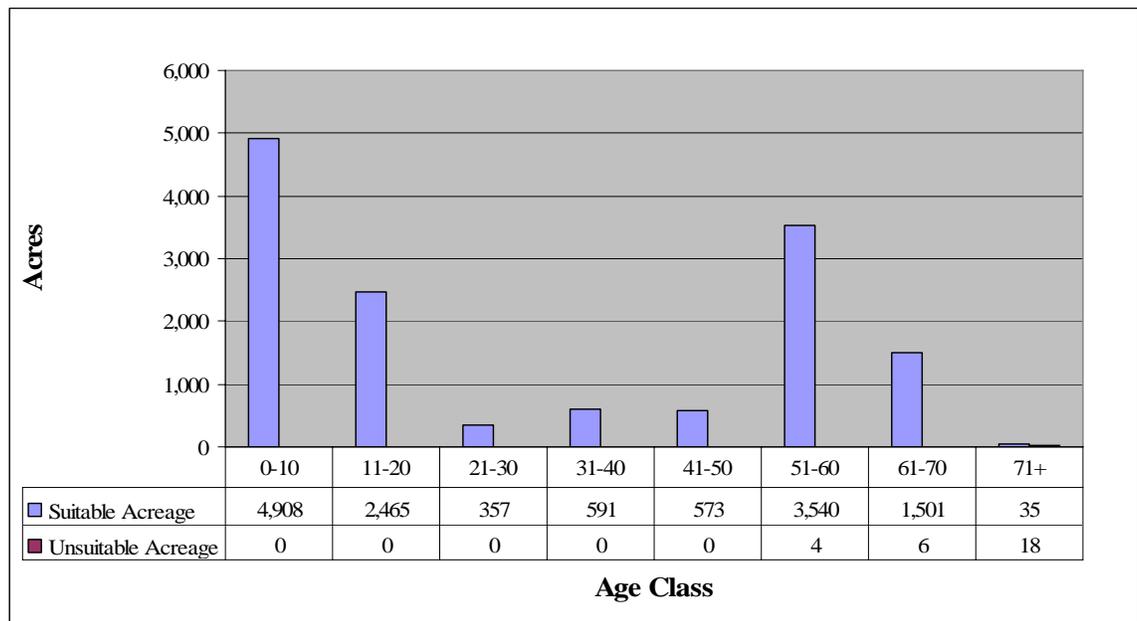
Some of the factors that have contributed to this decline have already been mentioned. Most recent events contributing to this decline include a historically high deer population browsing jack pine plantations to the point of severe

mortality. The development of the Bayfield County Forest Fuel Break converted a large portion of the jack pine stands to open grasslands and a portion of the jack pine stands have been allowed to naturally convert to aspen.

B. Current Status (2005)

Bayfield County Forest actively manages 13,966 acres of jack pine. This accounts for just over 8% of the County Forest. The largest portion of jack pine acreage is grouped into two age classes, 1-20 years old and 51-70 years old. Figure 830.7 displays the age class distribution for jack pine as of 2005. This uneven distribution of age classes makes it difficult to maintain a consistent annual harvest of mature jack pine.

Figure 830.7: Jack Pine Acreage by Age Class Distribution in 10-year Age Classes (2005 Data)



C. Desired Future Condition

The goal is to maintain as much of the existing jack pine acreage as possible and to evenly distribute the age classes over a 60 year period. The result of this will be a regulated annual harvest that is more representative of the Bayfield County Forest's total jack pine acreage.

D. Management

1. Applicable Silvicultural Treatments

Currently clearcutting followed by site prep and seeding are the primary silvicultural treatments used for regenerating jack pine. Bayfield County Forest

currently has a very aggressive jack pine regeneration program which includes both seeding and hand planting. Essential to jack pine regeneration is aggressive soil scarification for site preparation. Currently the County employs chaining, bracke scalps and trenching. Chaining sites are seeded with either a snowmobile or by airplane broadcast seeders. Bracke scalp sites have been broadcast seeded or seeded directly in each scalp with the use of a recently purchased Bracke Seeder, which automatically drops seed into each scalp. Hand planting with nursery stock is done in either trenches or bracke scalps. The hand planted sites have shown to be more susceptible to mortality from deer browsing. Bayfield County will continue to investigate other methods that may be more appropriate to meet future objectives.

2. Determination of Annual Allowable Harvest Levels

Harvest levels for jack pine, ideally, are determined by dividing the total number of managed acres by the age jack pine is considered biologically mature. For Bayfield County Forest it is 13,966 acres divided by 60 years (see Table 830.15 for jack pine rotation ages).

Table 830.15: Rotation Ages for Jack Pine on the Bayfield County Forest

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
40	60	75

This equates to approximately 233 acres per year. Because of the large amount of jack pine currently in the mature and over-mature age class the annual allowable harvest has been increased to 330 acres per year for the next 15 years. This will insure that large amounts of jack pine are not lost to mortality as a result of over-maturity. After 15 years the annual allowable harvest will be decreased to compensate for the decreased acreage in the age classes to follow. This annual harvest is subject to change upon updated inventory data and when it is necessary to respond to natural weather events and insect or disease outbreaks. See chapter 1000 for annual harvest levels of jack pine.

830.1.8 White Pine

A. History

Northern white pine is an important part of the history of this area. White pine was the premier species that was sought after by the early lumber companies. The early history is well documented.

White pine seedlings were well established prior to the removal of the pine overstory by the lumber companies in the late 1800's. Stems too small to harvest were released and grew rapidly. Scattered pockets survived the fires of the early

1900's and grew into our current natural white pine stands. White pine blister rust, introduced from Europe, moved into northern Wisconsin and began to infect many healthy stems. Manpower was plentiful during the CCC days, so an all out campaign was developed to rid the northern woods of gooseberry, the alternate host to white pine blister rust. Many man-hours were spent scouring and destroying acre upon acre of gooseberry plants on public land. This continued locally for many years after the CCC camps closed. It was found that wind could carry white pine blister rust spores for long distances and even the most diligent attempts at eradication were largely unsuccessful.

Establishing new white pine stands still appeared to be worth the investment in spite of the possible infection from blister rust. Bayfield County planted white pine in mixture with red pine in the early 1940's and did some experimental planting of white pine during the same era. The experimental plots have long since disappeared and the mixed stands of red and white pine are now dominated by red pine.

Tip weevil damage, blister rust, and lack of a market for white pine pulp all contributed to planting other more profitable species. Mature stands were marked mainly to remove blister rust infected trees or in extreme cases, removal of entire white pine stands that had a high potential for infection. Some natural trees appeared immune to blister rust. The State nursery has been growing and selling white pine seedlings that show a tendency toward a resistance to the blister rust infection. Bayfield County started to re-introduce white pine in the late 1990's to areas in Bayfield County that once supported large stands of white pine. The goal is to provide a seed source for natural regeneration well into the future.

1. Historical Acreage Trends

Table 830.16 displays the total acreage trends for white pine between the periods of 1977 and 2005:

Table 830.16: Historical Acreage Trends for White Pine on the Bayfield County Forest (1977 to 2005)

1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
2,158	2,192	2,098	2,307	2,376	218	10.1%

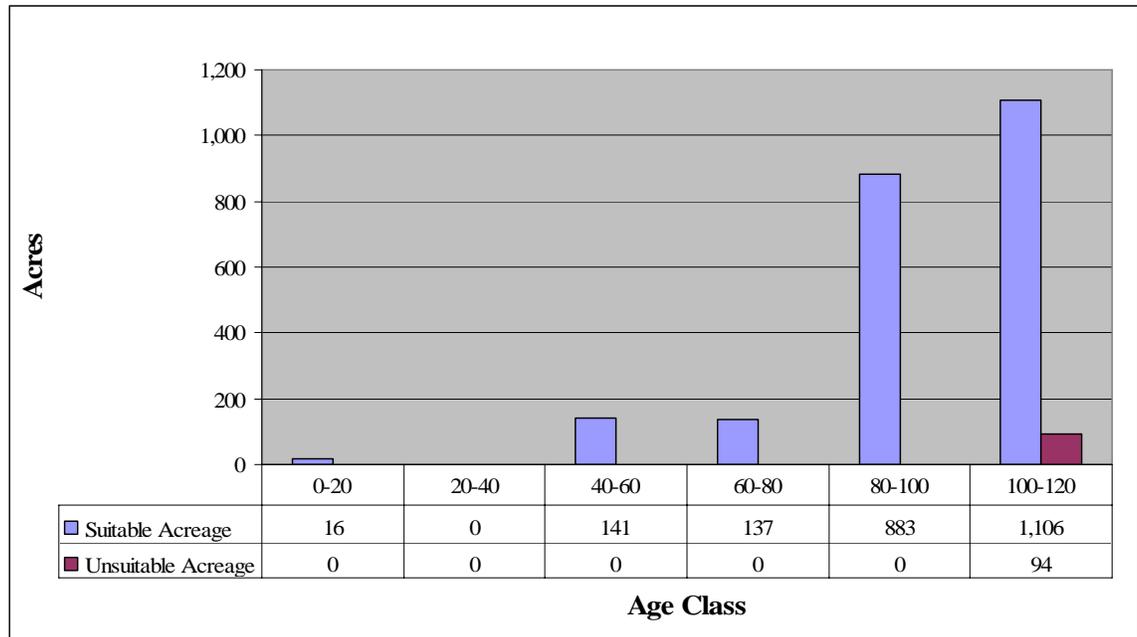
The chart above shows how the number of white pine acres have changed since the mid-1970's. This small fluctuation in acres could be attributed to a few different things. First, the stand could have naturally converted to another species. For example; white pine might have been well represented at one point, and when the stand was re-inventoried the red pine volume was larger than white pine. Secondly, the stand might have been mis-typed one year and corrected the next time the stand was inventoried.

B. Current Status (2005)

Total white pine acres on County Forest: 2,376 acres.
 Percent of white pine cover type on County Forest: 1%.

As shown in Figure 830.8, a small percentage of the white pine stands on the County Forest are less than 80 years of age.

Figure 830.8: White Pine Acreage by Age Class Distribution in 10-year Age Classes (2005 Data)



This shows that most of our white pine stands are natural stands that seeded in after or were unmerchantable during the big logging era in the early 1900's.

C. Desired Future Condition

Currently, the white pine timber type on the County Forest is small and is made up of mostly natural stands. The County plans on working towards increasing the acreage in the future through planting white pine plantations and encouraging more natural regeneration in stands where white pine is already a component. There will be challenges in increasing the white pine acres on the County Forest. Deer browse will be the primary challenge in establishing successful stands of white pine. Potential white pine plantations will be selected based on local deer numbers and the effect the deer are having on existing white pine in that area. Measures to deter deer browsing may be implemented in the future to increase the white pine's chance of survival.

D. Management

1. Applicable Silvicultural Treatments

Even-aged management will be applied on white pine plantations with periodic thinnings based on basal area control. White pine plantations are managed similar to red pine plantations. Future white pine plantation sites are site prepped with a bracke or disc-trencher and then hand planted. Survival checks are made every couple years up to 5 years to monitor success. Herbicide may be applied if needed to set back competing vegetation. Stands are thinned around 30 years of age depending on basal area. Subsequent thinnings occur every 10-15 years. Rotation length is 130 years (see Table 830.17 for white pine rotation ages).

Table 830.17: Rotation Ages for White Pine on the Bayfield County Forest

Early Rotation Age	Standard Rotation Age	Extended Rotation Age
90	120	170

White pine can be naturally regenerated using the seed tree and/or shelterwood regeneration methods. Pruning is recommended in pole sized stands for future quality sawtimber products as white pine does not self-prune well.

2. Determination of Annual Allowable Harvest Levels

Currently, there is no harvest level set for white pine. The white pine acreage on the County Forest is small and most of the stands are made up of old poorly stocked stands. Most of these stands are being left untouched to provide a seed source for possible natural regeneration. The County occasionally manages white pine stands when they are near other stands ready to be managed.

830.1.9 Fir-spruce, tamarack, cedar, swamp hardwoods, swamp conifer, black spruce, hemlock

A. History

The Bayfield County has several wetland related species. These species as a whole make up a very small percent of the area on the County Forest. This grouping includes the following species: fir-spruce, tamarack, cedar, red maple, black ash, black spruce. Most of these species fall into either a swamp hardwood or swamp conifer type.

There is very little logging history on these species. They are generally located in sensitive harvest areas, are difficult to access and are of lower quality than much of the surrounding upland. Both swamp hardwood and swamp conifer areas were harvested as part of adjacent stands when the quality and access proved to be profitable.

Swamp hardwood stands were inventoried in the late 1980's and again in the mid 1990's. The sites were evaluated for harvest. Most sites showed low stocking levels. Several areas were established that were closer to northern hardwood. Unfortunately, the hardwood market disappeared. Regeneration in many of the swamp hardwood sites were nonexistent. Harvesting and subsequent management of the residual stands appeared difficult at best. It was agreed between the State and County to re-evaluate future management goals on the worst swamp hardwood sites.

Hemlock was associated with many of the northern hardwood types within the County. Most of the merchantable hemlock not harvested in the early 1900's was harvested in the "hey day" of hardwood logging in Bayfield County during the mid to late 1960's. Much of this hemlock was listed as fire scarred. Currently, there are scattered pockets of hemlock throughout the County. The value as wildlife cover has out weighed the value as a wood product in recent years.

Balsam fir makes up the largest area of this miscellaneous group. Fir has been harvested as a secondary species on many timber sales. Balsam fir was not severed as part of the aspen maintenance wildlife funded cuts during the 1970's and 1980's. They were left as wildlife benefits and appear as many of the small, scattered fir stands. The most recent logging activity directly related to the fir-spruce type occurred with the development of a new plant in Duluth that used spruce and fir in the mid to late 1980's. Many fir stands were established, sold, and cut, while the new plant was getting started. Unfortunately, the size, quality, and cost associated with the harvesting and cull led to very few contractors interested in cutting fir pulp.

Harvesting of other miscellaneous species has been incidental with little direct management goals or objectives. The early years in Bayfield County had a history of few deer. White cedar, spruce, hemlock, and fir occurred in many of the traditional deer yards. Harvesting of these species in these areas was almost forbidden by the County. Deer populations were such that few deer were seen in the woods prior to 1990.

1. Historical Acreage Trends

Table 830.18 displays the total acreage trends for various timber types between the periods of 1977 and 2005. Many of the species acres have fluctuated since the 1970's. Most of this fluctuation was a result of poor inventory data that was collected in the past and is currently being re-inventoried and corrected.

Table 830.18: Historical Acreage Trends for Various Minor Timber Types

on the Bayfield County Forest (1977 to 2005)

Species	1977 Acreage	1983 Acreage	1992 Acreage	1995 Acreage	2005 Acreage	Acreage Change 1977-2005	Percent Change 1977-2005
Fir-Spruce	2,218	2,149	2,016	1,907	1,933	-285	-12.8%
Swamp Conifer	393	393	543	509	687	294	74.7%
Black Spruce	738	724	695	701	798	60	8.1%
Tamarack	396	395	468	445	645	249	62.9%
White Cedar	299	292	342	298	406	107	35.6%
Hemlock- Hdwd	112	112	137	137	237	125	111.9%
Swamp Hdwd	1,650	1,579	1,807	2,039	2,436	786	47.7%

B. Current Status (2005)

Total acres of the above forest cover types on County Forest: 7,142 acres
 Percent of total forest cover types on County Forest: 3.6%

Collectively, these species make up a minor component of the County Forest. Currently, there are no harvest goals for these species.

C. Desired Future Condition

The County will try to maintain the current acreage of these respective timber species.

D. Management

1. Applicable Silvicultural Treatments

Occasionally the County will implement a silvicultural prescription on these timber species. For example, there are a few white spruce plantations on the County Forest that require periodic thinnings. Also, if there is a stand of manageable swamp hardwoods within or near a northern hardwood stand that is being marked, the swamp hardwood stand may be included. The same goes for tamarack and black spruce. They could be added to a nearby sale or if the volume is large enough it may be set up as its own sale. The County Forest at this time does not harvest white cedar. White cedar is a hard species to regenerate and is not very common on the County Forest. Silvicultural prescriptions implemented on these timber species will follow the DNR Silvicultural handbook, HB2431.5, where appropriate.

830.2 LOCALLY UNCOMMON FOREST TYPES

The presence or lack of a particular plant species is dependent on the land's capabilities, climate, and natural (e.g. fire, browsing) and/or man-caused (e.g. logging, farming) disturbances.

The following are considered uncommon on the Forest and perhaps to some

extent across the regional landscape:

American elm, Eastern hemlock, white cedar, black cherry, white ash

830.2.1 American Elm

American elm is rare on the County Forest primarily due to the mortality caused by the Dutch elm disease. Where found elm will normally be left uncut in hopes that it may continue on the landscape and provide seed for the future.

830.2.2 Eastern Hemlock

Eastern hemlock is found on the County Forest usually in stands of northern hardwood. Generally, within these hardwood stands hemlock is a small component. There are a few small pure stands of hemlock on the County Forest. Hemlock is not harvested on the County Forest. There is no market for the wood and since hemlock is not well represented on the County Forest the species is left uncut. Natural regeneration of hemlock on the County Forest is not very successful due to the high deer numbers and the strict requirements hemlock seeds require for germination. Currently, hemlock in the eastern U.S. is under attack by the hemlock woolly adelgid, which is causing high rates of mortality. It is only a matter of time before this insect is found in Wisconsin.

830.2.3 White Cedar

White cedar is found on the County Forest in small isolated pockets. There are approximately 400 acres of white cedar on the County Forest. Because cedar is uncommon on the Forest it is not harvested. Cedar plays an important role for wildlife especially white-tailed deer as cover and an important food source in the winter. Regeneration of cedar is rare to see because of the palatability and nutritional value it has for deer.

830.2.4 Black Cherry

Black cherry is found occasionally in our northern hardwood stands. The quality is poor because Bayfield County is on the edge of its range. This species will be left for its uniqueness.

830.2.5 White Ash

White ash is found occasionally in our northern hardwood stands. It is a minor component when it is present. The presence of white ash in hardwood stands provide added diversity to the stand and the County makes an effort to maintain and even increase it's presence when it is found in hardwood stands being marked for thinning. White ash is generally left and surrounding trees are marked for removal to increase the sunlight penetrating to the forest floor to accommodate the higher light requirements for successful regeneration. White ash seed is eaten by many wildlife species.

830.3 EXOTIC PLANT SPECIES OF CONCERN

Exotic or non-indigenous invasive plant species can cause significant ecological and economic damage to the Forest. Some invasive species, such as common and glossy buckthorn, eliminate not only wildflowers but also limit the regeneration of tree species. Keeping them from dominating the understory is critical to the long-term health and economic viability of the forest. Currently, the Bayfield County Forest has few significant infestations of invasive plants. With training, vigilance, and control efforts, new infestations can be managed or eliminated. There are many highly invasive plants that are threatening to invade much of the northern forests in Wisconsin.

830.4 LEGALLY PROTECTED PLANT SPECIES

There are some plants in Wisconsin that are afforded protection under the Federal Endangered Species Law, the State Endangered and Threatened Species Law (s. 29.604 Wis. Stats. and NR 27 Wis. Adm. Code), or both. Under Wisconsin State Law, no one may possess or sell any wild plant that is listed without a valid endangered or threatened (ET) species permit. On public lands or lands one does not own, lease or have permission of the landowner, one may not cut, root up, sever, injure, destroy, remove, transport, or carry away a listed plant without an ET species permit. There is an exemption on public lands for forestry, agriculture and utility activity under the state law.

In the Natural Heritage Inventory (NHI) program the DNR tracks information on these species in the State.

830.5 OTHER PLANT SPECIES AND NATURAL COMMUNITIES OF CONCERN – NHI

The NHI program at the DNR also tracks information on rare species and natural communities, in addition to legally protected species.

830.5.1 Special Concern Plants

Special Concern Plants Species are those species in which some problem of abundance or distribution is suspected, but not yet proven. The main purpose of this category is to focus attention on certain species before they become threatened or endangered. The DNR maintains the list of special concern plants.

830.5.2 Natural Communities

Similarly, specific records of some natural communities of concern are also tracked by the DNR.

840 WILDLIFE SPECIES MANAGEMENT

840.1 BACKGROUND

For the purpose of this plan, wildlife will include all native birds, mammals, fish, amphibians, reptiles, and insects with a strong focus on the natural communities in which they live. Wildlife biologists will emphasize habitat management that interrelates and benefits wildlife, and complements sound forestry practices. Concerns about the biological diversity of the County Forest and how it fits into the regional, continental and global perspective, may cause wildlife management to place increased emphasis on segments of the forest community. Practices such as; old growth, snag and den tree management, access management, forest openings maintenance, pine barrens management, jack pine, aspen and oak management, can be priorities in the dynamics of forest management. A primary goal of wildlife management on the Bayfield County Forest is to provide a diversity of healthy ecosystems necessary to sustain native populations for their biological, recreational, cultural and economic values.

840.1.1 Technical Planning

Planning will be a cooperative effort of the administrator, DNR liaison forester and wildlife biologist in formulating management plans and utilizing wildlife management techniques for the overall protection and enhancement of the forest community, of which wildlife is a key component.

840.1.2 Guidelines

DNR manual codes on; Feasibility Studies and WEPA Analyses for Establishing or Modifying Property Project Boundaries (2105.2), Guidelines for Defining Forest-Wildlife Habitat Management (2112), Forest Opening Maintenance and Construction (2112.1), and the Public Forest Lands Handbook (2460.5), are important references and guidelines in wildlife planning efforts.

840.1.3 Inventory

Habitat needs will be determined by analysis of forest reconnaissance information. Population estimates will be conducted periodically by DNR wildlife, endangered resources personnel, and other trained cooperators. Typical surveys include:

- Deer; registration, sex-age kill computations, summer doe/fawn surveys, and winter deer yard surveys.
- Bear; registration, aging, and bait survey.
- Ruffed grouse; spring drumming count and summer brood observations.
- Woodcock; spring singing ground survey.
- Furbearers and Snowshoe hare; winter track index.
- Eagle and Osprey; aerial activity and productivity survey.

- Ducks and Geese; spring aerial wetland and pairs counts.
- Timber wolf; pack and population monitoring.
- Herpes; annual frog and toad count.

Additional information used in analyzing habitat needs may be obtained from surveys conducted by other agencies, private individuals, and non-profit wildlife organizations. Examples include:

- Christmas bird count
- Spring road counts
- Natural Area Inventories
- Federal waterfowl surveys

840.1.4 General Management Policies

Commercial timber sales will continue to be the most important tool for affecting wildlife habitat. The value of habitat for wildlife depends on the size, shape, location, timing, and cutting requirements of timber sales occurring on the county forest.

Forest management practices may require modifications to benefit wildlife and biodiversity in certain situations. The following will be considered in forest management planning:

1. Even-aged regeneration harvests will vary in size and shape.
2. Management activities will promote a diversity of stand ages, sizes and species.
3. Mast-bearing trees and shrubs, den trees, and an adequate number and variety of snags will be retained when feasible.
4. The maintenance of cull trees (future snag or den trees) not interfering with specific high value trees.
5. Timber types, habitat conditions and impacts on affected wildlife.
6. Access (roads and trails) management.
7. The maintenance of early successional forests such as aspen, jack pine, and scrub oak will be a priority activity due to their importance for a wide variety of songbirds and small mammals, deer, grouse, woodcock, and snowshoe hare. Aspen should be considered the most important early successional forest type that has and will continue to experience losses in acreage due to natural succession to mid-tolerant forests and public misconceptions about the impacts of clearcuts in Wisconsin.
8. Management activities will also emphasize maintenance of representative areas

of mid to late successional forest stages for wildlife and habitats that require these forest stages.

9. Detailed management plans and technical advice will be developed for endangered and threatened species by the DNR. Recommendations will be made to the liaison forester and the Administrator.

840.2 WILDLIFE HABITAT DEVELOPMENT GRANT PROJECTS

The Wisconsin DNR offers financial support to Bayfield County for the planning, development, or maintenance of projects that will improve wildlife habitat on the Forest. County Conservation aids and Wildlife Habitat Development grants are available annually for qualified projects. The following projects have been identified and may be considered for funding under these grant programs. No attempt has been made to list these projects by priority.

1. Maintenance, renovation, and development of forest openings.
2. Forest access management: maintenance of existing trails; renovation; gating and closing of trails; new trail development.
3. Post sale aspen management.
4. Jack pine type maintenance: seeding, planting, and site preparation activities.
5. Oak management: burning, planting, firebreak, and scarification.
6. Paper birch management: site preparation activities.
7. White pine management: planting, seeding, and site preparation activities.
8. Barrens management including jack pine seeding, planting, and habitat management.
9. Land acquisition for critical wildlife management.
10. Education: specifically wildlife focused, interpretative signs and brochures.
11. Equipment purchase: wildlife related equipment.
12. Beaver bafflers.

840.3 HABITATS OF IMPORTANCE

Important habitat types are those cover types known to be of importance to certain native wildlife and whose absence would make that wildlife significantly less

abundant. These shortages may be on a local or broader scale. The following habitat types are considered important:

840.3.1 Aspen

The aspen type is recognized as providing habitat values to a wide variety of wildlife species. This type will continue to be regenerated, with consideration given to reserving scattered den and mast-producing trees in the process.

840.3.2 Jack Pine

Jack pine and its associated plant understory provide a vital mix of breeding and winter habitat for many wildlife species. This type will become increasingly important on the Forest as conversion to other tree species occurs on private lands. Jack pine habitat maintenance will be a high priority.

840.3.3 Forest Openings

Forest openings are essential to well-balanced wildlife habitat. These openings come from a variety of sources such as logging roads, timber sale landings, and recreational trails and developed wildlife openings. The DNR maintains, by hand treatment, 300 openings totaling 278 acres on the Forest. The County maintains, by tractor mowing, an additional 182 openings totaling 185 acres. These openings are maintained on a five year rotation of treatments. Intensive maintenance of permanent opening will be dependant on future budget allocations and priorities. Wildlife openings are a dynamic component of the Forest. Over time, the location of some of these openings may change. The addition and removal of forest openings will be an ongoing process in the Bayfield County Forest.

840.3.4 Lowland Conifer

Cedar, hemlock, and balsam fir types are important for winter cover for many wildlife species. These forest types will be maintained where practical.

840.3.5 Oak

The oak type is important to wildlife because of its cavity-forming potential and mast production. Future management will focus on protecting and regenerating this type.

840.3.6 Pine Barrens

Pine Barrens are classified as a true savanna type. The term savanna is used for any plant community where trees are a component, but where their density is so low that grass and other sun-loving herbaceous vegetation dominate. Pine Barrens are unique among savannas in that the shrub component is much more extensive than in other savanna types. Three major factors: fire, soils, and topography dominate the development and maintenance of Pine Barrens. Humans

have had a large influence on the fire factor. Intensive fire control has virtually eliminated the large, frequent fires which once naturally occurred in the Pine Barrens. In the absence of fire, natural plant succession coupled with an intensive tree planting program has turned almost all of Wisconsin's Pine Barrens into forests.

Pine Barrens management on the Bayfield County Forest will occur in portions of Integrated Resource Management Unit #5. This is an extensive, 35,000 acre, pine sand area located north of the Town of Barnes. Two areas will be maintained in early successional stages of grass/shrub mixture. These two areas will be maintained in that early successional state through the use of prescribed fire. These areas will provide a core area for the many species of plants and animals that are associated with Pine Barrens. These permanent openings will also serve as fuel breaks as described in Chapter 810.1.7.3 Fuel Breaks. In addition to the maintained grass/shrub core area, a Pine Barrens management component consisting of connected and satellite surrogate or floating barrens will be established. The floating barrens will be significantly larger in size than the average timber sale on County Forest land, perhaps up to a section in size. The floating barrens will be maintained through commercial timber harvests on a scheduled basis to complement the core areas. The harvest units will be regenerated, but will continue to provide barrens type habitat until the regeneration reaches approximately ten feet in height. The core area will cover over 900 acres, with an additional 9,000+ acres of predominantly jack pine that will be managed to provide floating barrens habitat. The floating barrens area and the remaining 26,000 acres of IRM Unit #5 will provide a diverse matrix of sand habitat cover types including; scattered grass and shrub openings, scrub oak, aspen, birch, oak, jack pine, and red pine.

Barrens management in Bayfield County is not limited solely to the County Forest. The Chequamegon-Nicolet National Forest has extensive barrens management areas a short distance to the northeast of IRM Unit #5. The Moquah Barrens Management Area (MA 8C) is a large, 13,460 acre, contiguous block of Savanna type that is maintained primarily through the use of prescribed fire. An additional 13,000 acres of the National Forest is managed as surrogate barrens. These surrogate barrens are large temporary openings (up to 1,000 acres in size) that provide conditions similar to pine barrens. These surrogate barrens are maintained through harvest of areas on a regularly scheduled rotation of sites.

840.3.7 Forest Game Species Habitats

The management of forest game (white-tailed deer, ruffed grouse, black bear, turkey, snowshoe hare, and numerous furbearers) is centered on maintaining early successional species such as aspen, jack pine, white birch, and scrub oak; with aspen and oak being the primary species of importance.

Manual Code 2112 is a Wisconsin DNR document that establishes guidelines for measuring forest game habitat. It has been used like a barometer to measure changes in forest wildlife habitat. While the scope of Manual Code 2112 can be

narrow (deer habitat units compared with landscapes and ecoregions) by today's management standards, the impacts are broad.

Foresters, in concert with wildlife biologists, will continue to monitor forest game species and adjust land management prescriptions where appropriate.

840.3.8 Forest Non-Game Species Habitats

840.3.8.1 Neotropical Migrant Birds

Neotropical migrant birds (NTMB) are songbirds that breed in North America and winter in Central and South America. There are over 120 species of NTMBs that spend a portion of each year in Wisconsin. Different NTMBs utilize a wide variety of habitats including forests, shrubs, and grasslands. Warblers, tanagers, vireos, thrushes, swallows, and hummingbirds are just some examples of NTMBs. In addition, these species play an important role in forest health by consuming large amounts of insects, including forest pest species such as gypsy moths and forest tent caterpillars.

Since there are so many neotropical migrants that utilize a wide variety of habitats and successional stages, it is difficult to make generalizations as to the impacts of forest management on the health of certain bird populations. Species such as chestnut-sided warblers and mourning warblers benefit from early successional tree species produced by even-aged management techniques such as clearcutting. In contrast, species that rely on more mature forests or interior forests may be negatively impacted by intensive forest management. To assure a rich diversity of NTMBs in Wisconsin's forests, emphasis will be placed on forest management activities that promote a wide diversity of habitat for NTMBs.

As habitat is lost and fragmented by development on private lands, Wisconsin's County Forests continue to provide increasingly important habitat to numerous NTMB species that occur in a wide variety of forest types and age classes.

Efforts will be made with the DNR to inventory existing populations, identify needs, and maintain valuable habitat types.

840.4 LEGALLY PROTECTED ANIMAL SPECIES

The Federal Endangered Species Act of 1973 and the Lacey Act together provide for the protection of wild animals threatened with extinction. The State Endangered and Threatened Species Law also requires that the State assume responsibility for conserving wild animals by restricting and regulating the taking, possession, transportation, processing, or sale of endangered or threatened wild animals within its jurisdiction. Further, the Federal Migratory Bird Act and the Eagle Protection Act provide additional protection for certain species of birds. Because animals usually travel freely from one property to another, they belong to everyone. Therefore, if a species is legally protected, it is protected anywhere it occurs in Bayfield County. Bayfield County has one known federally listed

endangered wildlife species, the Timber Wolf. Timber wolves have been delisted from the State Endangered and Threatened Species List since the last ten year plan, and are proposed for delisting from the Federal List as well. There are currently 18 known wolf packs found in Bayfield County with at least 57 wolves known to reside here in 2005.

Three known State listed endangered wildlife species also are found in the County; the American Marten, Trumpeter Swan, and the Common Tern. In addition, there are also five State listed threatened wildlife species found in Bayfield County; the Cerulean warbler, Red-shouldered Hawk, Yellow Rail, Osprey, and the Wood Turtle. Only one federally listed threatened wildlife species is found in the County, the Bald Eagle, which has been delisted from the State Endangered and Threatened Species List. The DNR also maintains a list of endangered and threatened invertebrates and plants found in Bayfield County

840.5 OTHER ANIMALS OF SPECIAL CONCERN – NHI

Just as with plants, the DNR tracks information on rare animal species when some problem of abundance or disturbance is suspected but not yet proven. The main purpose of this category is to focus attention on certain species before they become threatened or endangered. The DNR maintains an updated list of Special Concern animal species known to occur in Bayfield County (on or near the County Forest). The list of legally protected species and species of special concern can be found in Chapter 900.8.3. This list is continually updated and the most current list may be viewed on the DNR's website.

840.6 FISH AND WATERS MANAGEMENT

Public waters shall be managed to provide for optimum natural fish production, an opportunity for quality recreation, and a healthy balanced aquatic ecosystem. Emphasis will also be placed on land-use practices that benefit the aquatic community. Management of County Forest lands will attempt to preserve and/or improve fish habitat and water quality.

840.6.1 Technical Planning

Management of all waters within the County Forest is the responsibility of the DNR. Technical assistance will be provided by the local fisheries biologist. Studies and management will be conducted in the manner described in DNR Fish Management Handbook 3605.9.

840.6.2 Water Surveys

Comprehensive lake and stream surveys on the County forest will be conducted by the DNR fisheries biologist as required. The publication, "Surface Water Resources of Bayfield County", contains additional information relative to these waters.

840.6.3 Population Surveys

Surveys of fish populations in waters within the County Forest will be conducted by the DNR as required and will generally run concurrently with water surveys. Fish management programs will be guided by these surveys.

840.6.4 Lake Management

Management of lakes within the County Forest will be consistent with the capability of the resource and any unique aspects associated with that resource.

840.6.5 Stream Management

Trout streams on the County Forest will be managed to protect and enhance their quality. Streams containing warm water or cool water species will be managed to perpetuate their inherent qualities. Corresponding land and water use practices will be consistent with this policy.

840.6.6 Best Management Practices for Water Quality

Protection of water resources in the county will be consistent with the “Wisconsin Forestry Best Management Practices (B.M.P.s) for Water Quality”. Examples of these protective measures are:

1. Uncut riparian zones
2. Erosion control measures
3. Stream bank protection

840.6.7 Water Access and Development

Water access and development on County Forest lakes will be acted on by the Forestry Committee on a case by case basis.

850 LANDSCAPE MANAGEMENT

850.1 BIOLOGICAL DIVERSITY

For the purposes of this plan, biological diversity will be interpreted to reference the variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur. It also refers to ecological structures, functions, and processes that occur in ecosystems to sustain the system as viable entities. The forest landscape, within Bayfield County and at a Regional scale, consists of a mosaic of plants and animals of various sizes and ages are in constant flux due to succession from both natural and planned events.

Management of all species is important ecologically and economically. Economic health results from controlled, balanced harvest over a span of several years. Ecological health in our region, and all of North America, results from deliberate sound management of these communities. Such practices as regeneration cuts,

variable sale size, distribution and timing of harvests and methods of cutting will assure biological richness which can mimic natural events such as wildfire and wind storms. Special management guidelines will be considered emphasizing biodiversity.

Opportunities to manage Bayfield County Forest lands toward these ends will be continued provided they are deemed to be in the public's best interest by the Committee and within the framework of the County Forest Law (s.28.11 Wis. Stats.).

850.2 HABITAT FRAGMENTATION

The adoption of management plans and strategies developed cooperatively with neighboring forest owners and managers will help to consider fragmentation on a landscape level. A continued program of encouraging land acquisition within the forest blocking will decrease negative impact of forest fragmentation by land uses other than forestry.

850.3 OLD GROWTH

Managing old growth attributes on the Bayfield County Forest will be addressed in the various Integrated Resource Management Unit descriptions. For the purposes of this Plan, old growth has been subdivided into three components:

850.3.1 Old Growth / Benchmark Stands

These are old growth reserves or benchmark stands designated by the county. These stands may represent any of the natural cover types present on the Forest.

850.3.2 Extended Rotation Stands

Extended rotation stands represents mature forest stands managed for both forest products and for the development of some of the ecological and social benefits associated with older forests. These sites are dominated by biologically mature trees that are older than their traditional rotation age and younger than their average life expectancy. In general, management prescriptions on these sites are delayed beyond the normal rotation that is used on the balance of the forest. These extended rotation stands may be aspen, northern hardwood, pine, or any other species that creates stand conditions with large diameter trees, native plant conditions, and coarse woody debris and down timber.

850.3.3 Presumed Climax Forest Cover

With the development and acceptance of habitat classification as a management tool, land managers are gaining a much better understanding of the natural successional patterns on differing habitat groups and soil types. Presumed climax forest cover stands will be associated with a specific habitat type. It is important to understand that there are often multiple possibilities for a climax

overstory on many habitat types. It is also important to understand that the climax overstory on certain sites may not be as socially and economically beneficial as an early or mid successional species.

850.4 OTHER SPECIAL MANAGEMENT AREAS

See Chapter 530 for Special Management Area descriptions.

860 INTEGRATED RESOURCE MANAGEMENT UNITS

Previous chapters have outlined the planning objectives, decision guides and management considerations for administering the Bayfield County Forest. The "Integrated Resource Management Units" will summarize management considerations and land uses for each geographic unit. Resource managers may use these units as a tool, which will assist them in communicating resource management needs and accomplishments in the future.

Land use and management activities that occur within each unit are dynamic and may evolve with time as more is learned about each unit. An adaptive management approach will apply to the units and will allow flexibility to adjust or modify management practices when the Committee and the forestry staff recognize the need for change.

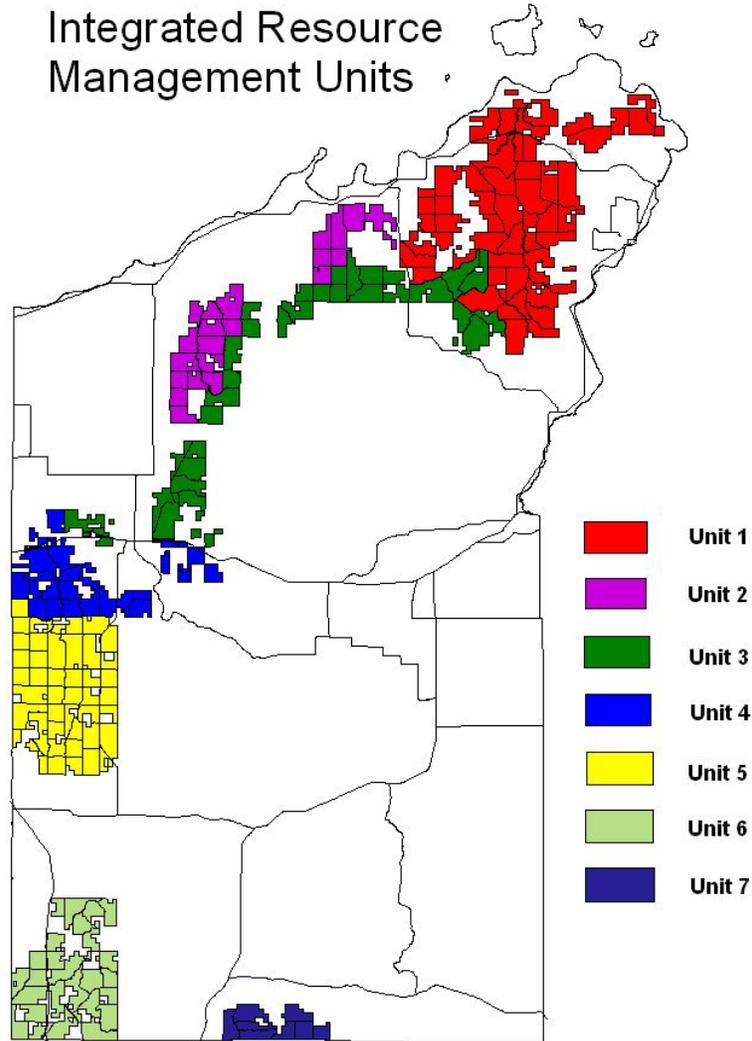
Each "Integrated Resource Management Unit" description includes a map of the area, the unit name and number, and includes the following summary information:

- (1) Compartment #'s and County Forest acreage in the unit.
- (2) Forest cover types, existing and desired.
- (3) Landforms, geology and soils.
- (4) Land Type Association (LTA).
- (5) Surface water resources inventory.
- (6) Recreation uses.
- (7) Historical and cultural sites.
- (8) Special Management Areas.
- (9) Protection needs.
- (10) Access management, roads, and trails.
- (11) Management issues, concerns, and opportunities

The Bayfield County Forest has been sub-divided into seven Integrated Resource

Management Units. Soil types were used as the criteria for the delineation of these geographic units. The most recent soil survey completed by the Natural Resource Conservation Service (NRCS) in 2004 was used in this process. The locations of the seven units are shown on the following map:

BAYFIELD COUNTY FOREST



As resource inventories are completed and resource outputs assigned to the various Integrated Resource Management Units, the individual Unit summaries will be posted in Chapter 4000 of this Comprehensive Land Use Plan. All seven unit summaries will be completed by the third year of the Plan.