### DOUGLAS COUNTY FOREST
### COMPREHENSIVE LAND-USE PLAN 2006-2020

#### CHAPTER 800
#### Integrated Resource Management

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CHAPTER 800
INTEGRATED RESOURCE MANAGEMENT

800 OBJECTIVES

(1) To introduce and communicate to the public, the Douglas County Board of Supervisors, and the WDNR the integrated resource approach that forestry, wildlife, recreation, and other natural resource staff will use on the Douglas 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

According to “The Dictionary of Forestry” (Society of American Foresters 1998), integrated resource management is the simultaneous consideration of ecological, physical, economic, and social aspects of lands, waters and resources in developing and implementing multiple-use, sustained yield management.

This balance of ecological, economic, and social factors provides a framework within which the Douglas County Forest is managed. Integrated resource management encompasses:

(1) Forests, habitats, and biological communities.
(2) Wetlands and waters.
(3) Wildlife and endangered resources.
(4) Soils and minerals.
(5) Cultural and historical resources.
(6) Social and economic factors.

Management of one resource affects the management and/or use of other resources in an area. As a result, it is more effective to manage a variety of resources in an integrated fashion. This field-level approach is based on the premise that each site or resource is part of a larger ecosystem. On the Douglas County Forest, this means ensuring that the natural communities of plants and animals remain healthy and productive for current and future generations.

810 SUSTAINABLE FORESTRY

Sustainable forestry is defined as follows: the practice of managing dynamic forest ecosystems to provide ecological, economic, social and cultural benefits for present and future generations (NR
For purposes of the Plan, sustainable forestry is forest-management that meets current ecological, economic, and social needs but also considers the needs of future generations. This requires adopting a land-stewardship ethic by which the growing, nurturing, and harvesting of trees for useful products is integrated with the protection of soil, air, and water quality and wildlife and fish habitat. This process is dynamic and may change as the DCFD evaluates past management practices and current research findings.

810.1 Tools Used in Managing for Sustainable Forestry

Many tools are used by Douglas County resource professionals in planning and implementing forest-management activities. Used singly or in combination these tools provide decision makers with a better understanding of current stand conditions, the potential of a given site, ecological and silvicultural alternatives, and the effectiveness of silvicultural treatments and their impact on water quality, wildlife habitat, and ecosystem processes.

810.1.1 Forestry Inventory

The current forest-inventory format was established in the mid-1970’s to assess the geographical, structural, and compositional attributes of the Douglas County Forest. In connection with the inventory, the DCFD acquired GIS computer technology in 1998. By 2000, prior inventory data and hand-drawn timber maps were digitized for inclusion in a spatial GIS database. In 2004, the DCFD developed a continuous forest-inventory system based on:

(1) Converting a forester position to an inventory forester position with the primary responsibilities tied directly to the forest inventory program.

(2) Capturing high-resolution, digital aerial orthophotography and re-delineating land-cover types down to the stand level.

(3) Using new technologies such as computers, personal digital assistants (PDA), and advanced software.

(4) Creating four temporary seasonal forest inventory positions with the primary responsibility of performing field related forest inventory work.

(5) Re-inventorying the entire Douglas County forest-land base on a 10-year cycle.

(6) Focusing initial inventory efforts on areas/stands with the greatest need.

(7) Implementing compartment reconnaissance (recon) procedures as described in the WDNR Public Forest Lands Handbook.

The DCFD staff will be responsible for maintaining the GIS based County Forest inventory database. The WDNR will retain a copy of the County’s inventory data and receive periodic
updates to the database. DCFD staff will be responsible for interpretation of the data to plan and schedule resource-management activities on the Forest.

810.1.2 Forest Habitat Classification System

The Forest Habitat Classification System (see “A Guide to Forest Communities and Habitat Types of Northern Wisconsin,” 2nd ed., University of Wisconsin, 2002) systematically interprets natural vegetation to classify forest communities.

This ecological tool a common language for interpreting site capability based on potential natural vegetation. Its primary function, is assessing the biological potential of upland forest sites. DCFD Land managers use the system to better assess the site potential of current stands, identify ecological and silvicultural alternatives, predict the effectiveness of possible silvicultural treatments, assess management alternatives, and set management objectives.

Data will be collected to classify the entire County Forest and be made part of the forest inventory system during regular field inspections. This data should be compared to soil-survey information to associate forest-habitat and soil types. Forest Habitat Classification types commonly found on the County Forest are described in Appendix X-I.

810.1.3 Soil Surveys

The DCFD staff's expertise will be invaluable in associating forest-habitat types and site indices with soil types. These associations are beneficial when determining management prescriptions for specific sites. Detailed soil surveys, are available for use with the forest inventory spatial database system and continue to be correlated to the Forest Habitat Classification system. Additional soil-survey information may be obtained from the USDA Natural Resource Conservation Service, Ashland Service Center, 2014 3rd Street West, Ashland, WI 54806 or http://soildatamart.nrcs.usda.gov

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 WDNR uses Ecological Landscapes of Wisconsin (Handbook 1805.1) an ecological land classification system based on the NHFEU. Ecological landscapes identifies land areas that differ from one another in ecological characteristics. A combination of physical and biological factors including climate, geology, topography, soils, water, and vegetation is used. A map of the Ecological landscapes occurring in the County Forest is included in Appendix U-II.

A Landtype Association (LTA) is considered a landscape-scale ecological unit and is identified by
surface geology, patterns of vegetation, soil parent materials, and water tables. Most LTA’s are 10,000 to 300,000 acres in size.

Each LTA includes a general description of land form, historical and 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. A map of the LTA’s occurring on the County Forest is included in Appendix V-II.

810.1.5 Integrated Pest Management

The FPRC is authorized to approve and direct the use of pesticides and other reasonable alternatives in an integrated pest management program on the County Forest (see Section 610.3).

810.1.6 Best Management Practices for Water Quality

Protection of water resources on the Douglas County Forest will be consistent with the WDNR field manual for loggers, landowners, and land managers entitled “Wisconsin’s Forestry Best Management Practices for Water Quality.” County Ordinance 7.6 includes general provisions, penalties, and violations related to BMP use on the Douglas County Forest. BMP’s are also standard contract requirements in all timber sales on the Forest to protect wetland, stream, lake, soil, and environmental resources. BMP protective measures are related to:

1. Locating roads, skid trails and landings.
2. Installing waterway bridges and crossings.
3. Protecting stream banks.
4. Disposing of waste oil and chemicals.
5. Controlling and cleaning up spills of hazardous substances.
7. Minimizing the use of wetlands.
8. Minimizing soil disturbance and erosion.

Douglas County will use BMP’s on the Forest with the understanding that they may be modified for specific site conditions with guidance from the Director of Forestry and Natural Resources, or WDNR Liaison Forester. Modifications will provide equal or greater water-quality protection or have no impact on water quality. Areas with highly erodible soil types, proximity to streams or lakes, or steep slopes may require mitigating measures in excess of those outlined in the field manual.
All DCFD forestry staff will receive appropriate BMP training. As part of Douglas County’s commitment to SFI forest certification standards, all logging contractors who purchase a County timber sale are required to maintain and provide a valid certificate(s) of successful completion for the current SFI training standards for the duration of the contract. A core component of the SFI training standards is a course that focuses on BMP’s. BMP’s also are incorporated into all other required training programs.

The BMP preventative practices system used on the Douglas County Forest will consists of the following:

1. Selection and Design. Appropriate BMP’s are selected for each project by professionally trained staff members. Selection and design are dictated by water-quality objectives, soils, topography, geology, vegetation, and climate. Environmental impacts and options for water-quality protection are evaluated and alternative mixes of practices are considered during the planning stages. A final collection of practices are selected that protect water quality and meet other resource needs. These final selected practices constitute the BMP’s.

2. Application. BMP’s are translated into contract clauses, special-use-permit requirements, project plan specifications, and so forth. This ensures that the contractor or person responsible for applying the BMP actually is required to apply it. Site-specific BMP prescriptions are taken from plan to ground during timber sale establishment activities by designating specific locations through marking and/or flagging. This is when final adjustments to fit the BMP prescriptions to the site are made before the resource activity is implemented.

3. Monitoring. During the course of project activities (timber harvest, road construction, recreational trail design, etc.), DCFD timber sale administrators, resource specialists, and others ensure that the BMP’s are implemented according to contract requirements. Formal and informal BMP monitoring is done before, during, and after the resource activity. Once BMP’s have been implemented, the effectiveness of BMP’s in meeting management objectives and protecting resources is evaluated.

4. Monitoring Evaluation. Technical evaluation and monitoring will determine how effectively BMP’s protect and/or improve water quality. Formal monitoring and evaluation will be conducted through audits performed by the WDNR’s, SFI forest certification program and other natural resource specialists/organizations. If the evaluation indicates that standards are not being met and/or beneficial uses are not being protected, corrective action will consider these questions:

- Is the BMP properly designed, technically sound, and effective? Is it really best or is there a better practice that is technically sound and feasible?

- Was the BMP applied entirely as designed? Was it implemented only partially? Were personnel, equipment, funds, or training lacking?

- Do the parameters and criteria used by audit personnel adequately reflect human-induced changes
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to water quality and beneficial uses?

(5) Feedback. Feedback related to the results of BMP evaluations will be both short and long term. Where corrective action is needed, the response will be immediate and may include modification of the BMP prescription and/or activity, additional staff training, redevelopment of contract specifications, or development of greater accountability standards. Cumulative effects over the long term also may require corrective actions.

Management activities on the County Forest adjacent to significantly important water resources in areas with fragile soils or severe slopes, will consider measures beyond customary BMP practices. DCFD staff may work with the WDNR Liaison Forester in cooperation with local WDNR water resources staff and other WDNR specialists in implementing site-specific measures where appropriate. Outstanding and exceptional resource waters located within Douglas County are listed in Appendix V-I.

810.1.7 Forest Fire Management

Fire has two sides on the Douglas County Forest. One side is beneficial when fire is under control and serves land-management goals. The other side is destructive when large fires rages out of control and destroy property and resources and threaten lives (see Appendix W-II for an historical map of destructive fires). Wildland fire management is directly tied to forest health. Current research has recognized fire as a critical process in many ecosystems in the northern Great Lakes Region.

810.1.7(a) Fire Prevention, Detection, and Suppression

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

810.1.7(b) Fire Suppression

Douglas County will initiate programs and actions to mitigate wildfire hazards. Wildfire suppression activities will be carried out in coordination with the WDNR, local towns, and fire departments, and others as appropriate. Fire mitigation measures on the Forest may include lopping and scattering of slash and establishing slash-free zones along property lines and roads. Timber sale contracts will have provisions to modify harvest operations depending on the fire danger, and stipulate the suppression responsibilities of the purchaser. During periods of high fire hazard, additional restrictions may be imposed upon contractors by the Director of Forestry and Natural Resources in accordance with WDNR Emergency Fire Regulations.

810.1.7(c) Fuel Breaks

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

(1) Lakes, streams, wetlands, and other natural features.
(2) Changes in timber type e.g., deciduous types adjacent to conifers.
(3) Keeping roads brushed back to clearing limits or beyond.
(4) Maintaining a system of open land up to ¼ mile wide 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 Towns of Gordon and Wascott. This area consists of a large sand outwash plain and has a high concentration of red and jack pine fuels and potential ignition sources due to both the seasonal and year-round residential development.

810.1.7(d) Prescribed Fire

Prescribed burning plays an important role on the Douglas County Forest as many plant communities are the result of wildfires.

As opportunities arise to regenerate or maintain desirable timber types or other desirable plant communities, the Director of Forestry and Natural Resources in consultation with the WDNR will examine the costs and benefits of each opportunity. Increased regulations, the cost incurred by the County to complete the burn, and the risk of breakouts and uncontrolled fires will be weighed against the potential benefits of vegetation management.

All prescribed burning will be done in accordance with Wisconsin State Statutes 26.12, 26.14, and the WDNR Prescribed Burn Handbook, and in cooperation with the WDNR per Section 605.5 of this Plan.

810.1.8 Outside Expertise, Studies, and Survey

Additional data needed to make management decisions on the Douglas County Forest will be sought from agencies or individuals, by the Director of Forestry and Natural Resources’ opinion. These data will be used in management planning.

810.1.8(a) Water Resources

The WDNR’s Fisheries Biologist and Water Management Specialist will conduct surveys and studies and provide technical advice as necessary with respect to activities affecting waters on the County Forest (see Section 840.7).

810.1.8(b) Wildlife Resources

WDNR wildlife biologists will conduct population and habitat surveys, provide technical advice
and/or direct assistance with respect to wildlife management planning and implementation on County forest lands (see Section 840). Wildlife projects are identified and implemented in collaboration with the Director of Forestry and Natural Resources, WDNR Liaison Forester, and the FPRC.

810.1.8(c) Soil Resources

Soil maps and surveys prepared by the Natural Resource Conservation Service will be used in determining management prescriptions on the Douglas County Forest (see Section 810.1.3).

810.1.8(d) Mineral Resources

Consultation with the Douglas County Highway Department and the WDNR may provide valuable information for the management of gravel and other mineral-resource activities authorized by the FPRC (see Section 515).

810.1.8(e) Wetland Resources

Maps prepared by the WDNR’s Bureau of Fisheries Management and Habitat Protection may be used in identifying wetlands. Assistance and technical advice may be requested from the WDNR Water Management Specialist when wetlands might be affected by management practices. The U.S. Army Corps of Engineers also will be consulted as appropriate and BMP’s related to protecting water quality will be used.

810.1.8(f) Navigate Streams

The WDNR water regulations staff will be consulted when navigable stream crossings or management projects are being planned (see Section 840.7.6). BMP’s for protecting water quality will be used.

810.1.8(g) Floodplains

Maps prepared by the Federal Emergency Management Agency will be used to identify floodplains. The Douglas County Zoning Department may be consulted regarding management activities in the floodplain.

810.1.8(h) Cultural Resources

Management planning will take into consideration the presence of historic and archaeological sites. Assistance will be requested from the State Historical Society or the WDNR's Archeologist as necessary. Management activities may be modified to mitigate potential adverse effects to sites within the County Forest. Sites discovered during project planning or implementation will be added to the State’s database (see Section 540).
810.1.8(i) Entomology/Pathology

The WDNR forest pest staff will provide information and consultation as requested by the DCFD (see Section 610).

810.1.8(j) Endangered Resources

The WDNR endangered resource staff will provide Natural Heritage Inventory information and are available for consultation on endangered resources issues. WDNR guidelines for the management of endangered resources will be followed where applicable on the Douglas County Forest (see Section 535).

810.1.9 Local Silvicultural Field Trials

DCFD has taken an active role in experimenting with different silvicultural prescriptions and regeneration techniques to better manage the County Forest. Some of these field trials have been completed, others are on-going, and new ones will be initiated in the future.

The following field trials that have been completed or are ongoing on the County Forest:

1. Aerial seeding jack pine following whole-tree skidding, roller chopping, disk trenching, furrowing, blade scarification, and/or anchor chaining.
2. Pre-harvest blade scarification for natural regeneration in oak, jack pine, red pine, white pine, and balsam fir stands.
3. Pre-harvest salmon blade raking for natural regeneration in white birch, white pine, and jack pine.
4. Hand broadcast of white birch seed on a site that was clear-cut and scarified through whole-tree skidding.
5. Broadcast of jack pine seed on a site that was clear-cut and Bracke scalped to prepare the seedbed.
6. Seed-tree and shelterwood harvests with required pole-length skidding, whole-tree skidding, and/or chipping of tops in white birch, oak, and jack pine stands for natural regeneration.
7. Prescribed burning under jack pine and oak seed tree and/or shelterwood harvests for natural regeneration.
8. Strip clear-cutting of white birch and jack pine stands with pole-length or whole-tree skidding for scarification.
9. Strip clear-cutting black spruce/tamarack stands with surface disturbance of the organic soil layer for natural regeneration.
(10) Coinciding harvesting/site preparation treatments with seasonal seed dispersal periods for white birch, white pine, red pine, jack pine, and northern red oak.

(11) Comparing results of uneven-age and even-age prescriptions applied to marginal northern hardwood stands.

(12) Two different volume-removal prescriptions in red pine first thinnings (1/2 and 1/3 removals).

(13) Shearing adjacent stands of tag alder ground is frozen to increase the marginal area of occupancy for aspen regeneration.

(14) Diameter-limit harvesting in stands of black ash to reduce the overall levels of cambium and for regeneration. Reducing the level of available cambium is a protection measure against the anticipated threat from the emerald ash borer.

Results from these field trials will to be recorded, tracked, and monitored as part of the forest-improvement program, and new approaches may be used as appropriate to improve sustainable management on the Douglas County Forest. A compilation of silvicultural trials on State and County lands is available on the WDNR website.

810.1.10 Local Citizen Involvement

During its regular meeting, the FPRC evaluates and, as appropriate, incorporates input from the public into management decisions affecting the Douglas County Forest.

820 BIOLOGICAL COMMUNITIES

A biological community is an assemblage of different plant and animal species living together in a particular area and at a particular time in specific habitats. These complex and dynamic systems are identified by their dominant plant species (see Section 130.1.4).

820.1 Forested Communities

Forested cover types include a variety of size classes (regeneration, sapling-pole, and sawtimber) and structure (canopy, layers, ground vegetation, dead and downed material, and inclusions). Forested communities make up approximately 75 percent of the Douglas County Forest. The following cover types are associated with the County Forest:

- **Aspen (A)** – 41.0 percent. Aspen comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands.

- **Northern Hardwood (NH)** – 11.6 percent. Any combination of sugar maple, beech, basswood, white ash, and yellow birch comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands.
- **Swamp Hardwoods** (SH) – 11.2 percent. Any combination of black ash, green ash, red maple, silver maple, swamp white oak, and American elm comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. This type occurs on wetlands characterized by periodic inundation (fluctuating water table near or above the soil surface) and nearly permanent subsurface water flow.

- **Black Spruce** (SB) – 6.8 percent. Black spruce comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. This species is predominant in mixed swamp conifer stands.

- **White Birch** (BW) – 6.4 percent. White Birch comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands.

- **Red Pine** (PR) – 6.0 percent. Red pine comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. In mixed pine stands, red pine is predominant.

- **Jack Pine** (PJ) – 5.8 percent. Jack pine comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. In mixed pine stands, jack pine is predominant.

- **Fir-Spruce** (FS) – 2.6 percent. Balsam fir and spruce comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. In mixed swamp conifer stands, balsam fir and spruce are predominant.

- **Oak** (O) – 2.5 percent. Northern red oak, white oak, or black oak comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands.

- **Scrub Oak** (OX) – 1.9 percent. More than 50 percent stocked by various species of oak which, in this type, will produce only fuelwood and cellulose materials. (This type is also capable of producing pines when converted through planting or natural seeding.)

- **Swamp Conifer** (SC) – 1.2 percent. Swamp type with mixed species including predominantly balsam fir, cedar, and spruce, in association with red maple and a variety of other hardwoods.

- **White Cedar** (C) – 1.1 percent. Northern white-cedar comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. In mixed swamp conifer stands, white cedar is predominant.

- **Red Maple** (MR) – 1.0 percent. Red maple comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. If soil is poorly drained, then swamp hardwood type.
COMPREHENSIVE LAND-USE PLAN 2006-2020

- **Tamarack** (T) – 0.5 percent. Tamarack comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. In mixed swamp conifer stands, tamarack is predominant.

- **White Pine** (PW) – 0.3 percent. White pine comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands. In mixed pine stands, white pine is predominant.

- **Hemlock Hardwoods** (HH) – 0.1 percent. Hemlock comprises 50 percent or more of the basal area in sawtimber and poletimber stands, or 50 percent or more of the stems in sapling and seedling stands in associated with northern hardwoods.

**Figure 830.1**
Forest Cover Types within the Douglas County Forest (percent)

820.2 Non-forested Communities

Non-forested communities account for approximately 21 percent of the Douglas County Forest. In broad categories, they are upland (6.8 percent), wetland (90.0 percent) and open water (3.2 percent).

These communities provide important habitat for a variety of plant and animal species.

820.2.1 Upland Non-forest

The following non-forest upland cover types are found on the Douglas County Forest:
True Grasses (GG) – 34.4 percent. Ground cover predominately true grasses such as brome, quack, blue grass, timothy, big and little bluestem, Indian grass, etc.

Upland Brush (UB) – 32.9 percent. Upland sites less than 10-percent stocked with tree species but 50 percent or more of the area is stocked with taller growing, persistent shrubs. Includes but is not limited to shrubs such as hazel, gray dogwood, juneberry, sumac, choke cherry, black cherry, etc.

Rights-of-Way (ROW) – 11.5 percent. Improved roads, railroads, or rights-of-way for gas, power, pipelines or telephone lines.

Rock Outcrops and Sand Dunes (Z) – 8.7 percent. Rock outcrops including rocky beaches more than 1 acre in extent. Sand dunes including sand beaches more than 1 acre in extent.

Developed Use (I) – 5.9 percent. General developed uses.

Grass (G) – 3.5 percent. Upland grass, sweet fern, bracken fern, etc., including abandoned fields less than 10-percent stocked with tree species.

Herbaceous Vegetation (GH) – 2.2 percent. Ground cover predominately herbaceous vegetation species such as bracken fern, sweet clover, giant ragweed, stinging nettle, upland aster, goldenrod, prairie dock, etc.

Low Growing Shrubs (GLS) – 0.9 percent. Ground cover predominately low-growing woody plants such as blueberry, raspberry, etc.

Picnic Area (IP) – 0.1 percent. Maintained day-use areas containing picnic tables, toilets, etc.
820.2.2 Wetlands

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.

Wetlands are the transitional habitats between upland and aquatic systems where the water table usually is at or near the surface or where the land is covered by shallow water. The following wetland cover types are found on the Douglas County Forest:

- **Lowland Alder Brush (LBA)** – 52.8 percent. Lowland brush on lands less than 10-percent stocked with tree species that consists of more than 50 percent alder species.

- **Muskeg-Bog (KB)** – 19.4 percent. Bog such as sphagnum moss, cotton grass, leatherleaf, cranberry, labrador tea, etc.

- **Emergent Vegetation (KEV)** – 14.8 percent. Coarse emergent marsh vegetation such as cattails, river bulrush, tall sedges, etc.

- **Lowland Grass (KG)** – 7.1 percent. Ground cover consisting of more than 50 percent of true grasses such as canary grass, bluejoint, redtop, cordgrass, big bluestem, fire stemmed sedges, etc.
 CHAPTER 800: INTEGRATED RESOURCE MANAGEMENT

- **Lowland Brush (LB)** – 3.6 percent. Lowland brush on lands less than 10-percent stocked with tree species.

- **Marsh (K)** – 1.9 percent. Grass or high water-table areas.

- **Lowland Willow Brush (LBW)** – 0.4 percent. Lowland brush on lands less than 10-percent stocked with tree species that consists of more than 50 percent willow species.

**Figure 830.3**
Nonforested Wetland Cover Types within the Douglas County Forest (percent)

Wetland communities are recognized as a complex association of plants and animals, soils, and water levels with special natural values. These fragile systems are degraded rapidly by incompatible uses and unskilled management. Wetlands provide shoreline, flood, and, water-quality protection, groundwater recharge, and habitat for plants and animals. It is the policy of DCFD to preserve, protect, and manage wetlands under its jurisdiction in ways that recognize the natural values and their importance in forest ecosystems. The County will:

(1) Recognize wetland values in management plans, taking reasonable steps to minimize harmful effects. When wetlands are used in forest-management and/or recreational activities, all applicable BMP’s should be followed (see Section 810.1.6).

(2) Cooperate with the WDNR in inventorying wetlands and in preparing and disseminating information on wetlands.

(3) Maintain control of vital wetlands under its jurisdiction to prevent substantial site alteration and subsequent degradation.
(4) Minimize adverse changes in the quality or quantity of the waters that nourish wetlands.

(5) Cooperate with local, State and Federal agencies in conveying to the public the importance of wetlands and the need for land and water stewardship in guiding development decisions.

(6) Cooperate with the WDNR in planning and carrying out activities that enhance the quality and diversity of wetlands in the County and the region.

820.2.3 Open Water

Open-water communities are permanently flooded lands below the deep-water boundary of wetlands. Water generally is too deep to support emerging vegetation. Within a forest landscape these aquatic ecosystems greatly increases the number of wildlife species that inhabit areas near rivers, lakes, and streams. Three open-water types are found on the Douglas County Forest:

- Minor Lakes (LM) – 65.9 percent. Water under 40 acres in area; excluding rivers less than 1/8 mile in width.
- Water (L) – 26.5 percent. Lakes, ponds, and flowages in excess of 40 acres in area, or rivers in excess of ½ mile in width.
- Minor Streams (LMS) – 7.6 percent. Streams less than 1/8 mile in width.

Figure 830.4
Nonforested Open Water Types within the Douglas County Forest (percent)
CHAPTER 800: INTEGRATED RESOURCE MANAGEMENT

830 PLANT COMMUNITY MANAGEMENT

DCFD recognizes the importance of maintaining the diversity of the Forest using an ecosystem approach. This process involves in making management decisions to encourage, or not to encourage, specific species or communities and requires a knowledge of the:

(1) Objectives set for the Douglas County Forest.
(2) National Hierarchical Framework of Ecological Units.
(3) Habitat Type Classification System.
(4) Desired condition of the Forest.
(5) Patterns of surrounding ownerships and the objectives of landowners.
(6) Socio-economic needs of society.

830.1 Silviculture of Common Forest Types

Forested communities normally are managed within the guidelines of the WDNR Silviculture Handbook. 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.*

Silvicultural guidelines are typically 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-age or uneven-age systems.
(3) Lead to sustainable harvest levels over time, and achieve a given future timber stand and condition.

830.1.1 ASPEN

Aspen is the largest timber type on the Douglas County Forest and includes both the quaking and bigtooth species. Stands dominated by aspen account for more than 30 percent of the Forest. Most of this acreage is directly related to the fires that covered the County in the late 1800’s and early 1900’s. Many stands were of seed origin and appeared to be pure aspen while others were developed as root suckers or clones and grew in association with other species.

Local sawmills probably were the earliest markets for timber harvested from the Douglas County Forest. Small sales of sawable timber dominated early timber sales. The Proffit Lumber Co. of Dairyleand, Wentworth Lumber Co. of Wentworth, and Campbell Lumber Co. of Superior are several of the larger local mills that would have sawn lumber from County timber in the 1940’s. Also, Jackson Box Co. of Black River Falls operated two sawmill sites on the County Forest; the
first was located off County Highway M west of U.S. Highway 53; the second was off Lucas Road west of Solon Springs. This company aggressively harvested aspen and sawed lumber into the 1950’s and is responsible for most of today’s aspen acreage.

There also were early markets for aspen pulpwood but these were limited because of the distance to “down-state pulp mills.” Aspen pulp (usually peeled) was shipped by rail to mills in central Wisconsin through three brokers: Branham in Eagle River, W.F. Spafford in Spooner, and C.E. Campbell of Duluth, Minnesota. These brokers bought both raw stumpage and cut products from the County Forest.

In the mid-1940’s, local truckers hauled pine sawtimber harvested from the County Forest to Duluth to build the Superwood plant. Superwood began buying aspen to produce “wafferboard” in 1948-49, paying $2.60 per 1,000 pounds with a maximum diameter of 11 inches. This mill is the first sizeable local market for aspen products and many other commercial timber species.

From the 1950’s to the 1970’s, road development in remote areas increased aspen production and timber sales as vast blocks were opened up by access roads that provided the means for removal of harvested products.

In 1962-63, another market for aspen opened in Superior when Superior Fiber Products began buying aspen up to 18 inches in diameter to produce high-quality composite board for the auto industry. This forced Superwood to raise its maximum diameter to 18 inches allowing for better utilization of all trees encountered on a sale tract on scale.

Up to the 1960’s, aspen harvesting on the County Forest entailed cutting merchantable trees (not always mature trees) and protecting of all other species growing beneath the aspen canopy. This residual component minimized the regeneration of aspen because of the shade it produced. As a result, only pure aspen stands regenerated successfully. During the 1960’s, the Wisconsin Conservation Department’s, Bureau of Forestry and the USDA Forest Service developed management guides for Wisconsin forests. These guides (which ultimately became the State’s Silviculture Handbook) identified cutting prescriptions to perpetuate aspen as the primary type for future rotations as well as prescriptions to achieve other desirable future stands and conditions.

By the 1970’s, wildlife habitat research had linked aspen with abundant populations of northern Wisconsin’s primary game species: white-tailed deer and ruffed grouse. This research resulted in a manual that called for maintaining the aspen type at prescribed percentages of total forest cover to achieve desired deer densities. The Manual Code 2112, 1970 was adopted for use on State and County forests. For Douglas County this meant maintaining a minimum of 25 percent of its total forest acreage in aspen.

At this time, wildlife funds were being used to improve the aspen timber types. These improvements were known as aspen maintenance cuts, aspen betterment, or ORAP sales. The goal was to remove non-merchantable hardwood and/or aspen stems that were mature but otherwise non-merchantable due to poor 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 overmature aspen stands in hopes of retaining stands in the aspen type. Finally, contracted hand cutters were employed to sever all of the residual stems to complete timber stand improvement projects and promote natural regeneration of aspen. By the mid-1980’s, wildlife funding for the removal of residual trees could not keep up with the amount of acreage needing treatment, so timber sales began to incorporate the removal of the non-merchantable stems. This additional removal encountered strong opposition from logging contractors but became part of the logger’s operating costs by the late1980’s.

With the completion of the Douglas County Forest inventory and subsequent computerization of the records in 1976-77, the full extent of mature and overmature aspen in need of harvest became evident. It was this backlog of harvestable acreage (and that of surrounding county forests) that likely influenced the locating of a Louisiana-Pacific orientated strand board (OSB) mill at Hayward. Louisiana-Pacific began buying stumpage in 1978 while the mill was being built, and began purchasing aspen pulpwood and producing OSB products in 1979.

The aspen stands that originated in the 1920’s and 1930’s, matured during the 1970’s without available markets for the entire resource. Limited local markets and the cost of moving aspen to distant markets (where there were already abundant supplies of aspen) kept its stumpage value low on the County Forest. Over-mature aspen was the norm from the late 1970’s until the late 1980’s. The State hired project foresters whose primary goal was to accelerate timber sales to reduce the backlog of aspen in the northern counties. In Douglas County, aspen sales were established at a rate approaching 5,000 acres per year Aspen was slow to sell through the early 1980’s but by the late 1980’s, began to sell due to increased demand in combination with new access roads and the accelerated timber sale program.

830.1.1(a)  Historical Acreage Trends

Aspen acreage on the County Forest declined from the mid-1950’s to the early 1980’s and then began to increase. Overall there has been a 14 percent decrease (13,580 acres) in aspen acreage from 1954 to 2006 (Fig. 830.5) however, despite this overall decline, aspen acreage has rebounded since the mid 1980’s.
The major reason for the increase in aspen over the last two decades is conversion of other types using aspen’s aggressive regeneration and growth potential. When overstory removal occurs in a stand with an adequate aspen component, aspen sprouts naturally 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 slight increases in acreage.

830.1.1(b) Current Status (2006)

In the northern Great Lakes Region, aspen acreage has been declining steadily since the 1960’s. The primary reasons for the decline are: (1) lack of harvest as stands reach maturity (natural succession), (2) selective harvest, and (3) suppression of historical fire regimes. The end result is natural conversion to more shade-tolerant timber types.

Thirty-one percent (83,363) acres of the Douglas County Forest is typed as manageable aspen. An additional 419 acres of aspen is in riparian management zones and will not be managed for timber production. Through natural succession these zones will naturally convert to longer lived, late successional species (see Appendix A-III for the location of the aspen timber type on the Douglas County Forest).

Secondary timber types are in association with 59 percent of the aspen stands on the Forest (Fig. 830.6). Distinct secondary types include; paper birch (13,263 acres), fir-spruce (11,552), northern hardwoods (11,455), and non-commercial (6,663). These species provide a limited option for
alternative silvicultural prescriptions, primarily conversions, but converting the aspen type can be difficult and usually is discouraged on the Douglas County Forest.

**Figure 830.6**
Secondary Types Associated with Aspen on the Douglas County Forest (percent)

On the Douglas County Forest 76 percent of the total aspen acreage is in the 0-40 year age classes. Mature and over-mature (60 years and older) aspen accounts for 13 percent of the current aspen acreage on the Forest. Figure 830.7 shows the total aspen acreage (as of 2006) by 10-year age classes. Breaking down the age classes into 5-year intervals reveals a shortage of aspen in the 50-54 class where only (815 acres) exist. While suitable for management, this interval has been reserved to maintain this age component across the landscape. The harvest within this interval has been redistributed until younger stands mature. All stands at least 75 years old have been designated as high-priority stands for management.
Figure 830.7
Aspen Acreage on the Douglas County Forest as of 2006 by Age Class

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<th>Age-Class</th>
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<th>Unsuitable Acreage*</th>
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<td>8</td>
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<tr>
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<td>852</td>
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</table>

*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, or silvicultural constraints. These areas generally are re-evaluated every 10-years to determine their management status.

830.1.1(c) Desired Future Condition

On the County Forest, the primary goal for aspen is to evenly distribute the acreage throughout all age classes and to develop an annual sustainable harvest level (down to 5-year intervals). Some stands may be entered for management at an early age while others may be reserved for prolonged rotation to ensure even distribution by age class. Other goals are to maintain the current amount of acreage and to expand the aspen type, particularly in areas that contain poorer quality stands of other species.

830.1.1(d) Management

Aspen is a short-lived, prolific, shade-intolerant species that needs full sunlight to regenerate. It regenerates well after severe disturbances, by root suckering and stump-collar sprouting after disturbance or seeding after fire. The latter opens the forest canopy, allowing sufficient light to penetrate.

The aspen type provides habitat for a variety of wildlife species and is an important species for commercial fiber production. A substantial component of the DCFD’s annual revenue is generated
by the sale of aspen. Producing aspen timber stands and maintaining wildlife habitat are compatible objectives on the Douglas County Forest. Management typically creates highly desirable habitat for favored game species such as deer and grouse.

Aspen is vulnerable to attack by a variety of forest insects diseases. Although, insect pests such as the forest tent caterpillar and large aspen tortrix can damage aspen stands control of these pests seldom is economically justified on the County Forest. Hypoxylon canker and heart rot are destructive diseases that can cause considerable economic loss to aspen stands each year. These diseases are prevalent on the County Forest, particularly in deteriorating, overmature stands. Their spread can be minimized by cutting stands before they become overmature and establishing well-stocked conditions.

(1) Applicable Silvicultural Treatments

Currently, even-age management is the primary silvicultural system used to regenerate aspen. Douglas County is committed to managing, maintaining, and in some instances expanding its aspen acreage by coppice regeneration treatments. Aesthetic concerns can be minimized by retaining residual coniferous and/or deciduous tree species within the stands limiting the size of harvest units, creating multiple harvest units, using the topography of the land to conceal portions of the harvest, and/or creating irregularly shaped unit boundaries.

Inclusions of other species or non-commercial types typically are reserved while managing the aspen type to help promote wildlife habitat. This includes leaving multiple reserve corridors and fingers of standing timber with irregularly shaped edges throughout the harvest area to provide cover for wildlife that need to travel between them. These corridors provide beneficial forest aesthetics, experience significant post-harvest wildlife use, and have become a primary consideration in sale design as is leaving scattered snags and snag recruits after a coppice harvest. These trees provide additional vertical habitat and add aesthetic value.

The time of year when aspen management occurs influences the amount of root suckering. Studies have shown that regeneration of and subsequent growth rates for aspen can be adversely affected by soil compaction for up to 20 years postharvest. Much of Douglas County’s aspen management is restricted to frozen-ground conditions to maximize production of vigorous suckers, which appear the following spring. Harvesting during the winter coincides with the dormancy period and allows for the greatest retention of stored nutrients in root systems and maximum protection from soil compaction. Harvesting on frozen ground typically results in prolific suckering and allows for maximum growth in the new stand. Sprouts often grow 5 feet or more the following spring or summer, and usually outgrow other woody species or herbaceous growth on the site. Managing aspen in the fall after leaf drop when the trees become dormant also can produce vigorous regeneration the following year. Harvesting in spring/summer typically results in fewer suckers than a winter harvest and increases the risk of soil compaction, which difficult to monitor and prevent. In some cases, a spring or summer harvest is desirable and can produce enough suckers to regenerate the stand. On the County Forest, transportation access, targeted species management, habitat type, soil characteristics, and site index will be used on a case-by-case basis to determine the
seasonal harvests that best promote the long-term sustainability of aspen.

Douglas County will continue to investigate other silvicultural treatments for aspen as they become available.

(2) Determining Annual Allowable Harvest Levels

Harvest levels for aspen are determined by dividing the total number of managed acres by the average rotational age at which aspen is considered biologically mature. On the County Forest, 85,912 acres divided by 60 years equates to approximately 1,430 acres per year. Due to the large percentage of young, non-merchantable aspen currently on the Forest, this annual harvest level is not feasible. On average, this age class will not be ready for harvesting for another 20 years.

Annual harvest targets are further broken down by 5-year intervals for removals or reserves. This type of management should allow the County to attain the desired future condition for aspen by evenly distributing the age classes.

Table 830.1
Rotation Ages for Aspen on the Douglas County Forest

<table>
<thead>
<tr>
<th>Early Rotation age</th>
<th>Standard Rotation age</th>
<th>Extended Rotation age</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 years</td>
<td>55 years</td>
<td>75 years</td>
</tr>
</tbody>
</table>

Current harvest levels acres are determined by developing a plan by which all mature aspen acres are equally distributed over 20 years by 5-year age classes with 70 years as the maximum. Factors such as site potentials, wildlife habitat management, aesthetic and structural distribution, reserve areas, and other special objectives influence current harvest levels. As the large acreages of young, non-merchantable aspen currently on the Forest approach maturity, annual harvest levels for this species should increase over time and provide an opportunity to balance the age classes.

Projected harvest levels will continue to be refined on the basis of updated inventory data. Harvest levels also are subject to change in response to natural weather events or outbreaks of insect or diseases. See Chapter 1000 for estimated annual harvest levels for aspen over the next 15 years.

830.1.2 NORTHERN HARDWOODS

Northern hardwoods are diverse in species composition and stand characteristics. The single characteristic common to all upland northern hardwood types is a successional trend toward and predominance, of sugar maple.

Principle species other than sugar maple includes white ash, yellow birch, basswood, red maple,
American elm, and hemlock. Common secondary associates or minor components are aspen, paper birch, northern red oak, ironwood, and black cherry. Northern hardwood stands also support conifers such as white pine, balsam fir, white spruce, hemlock and northern white-cedar.

Most of the mature northern hardwood stands in Douglas County originated before the major fires of the early 1900’s. Most stands developed through natural successional pathways and were burned very lightly or not at all. Logging has had a greater impact on the current health, quality, and overall appearance of these stands. To a far lesser degree, some areas that were burned intensively in the early 1900’s regenerated to northern hardwood. These mostly even-age stands had little or no timber sale activity until the late 1980’s and early 1990’s.

Old logging records and field examinations indicate that many of the current northern hardwood stands on the County Forest were entered during the 1940’s. In many of these entries, only aspen and higher quality hardwoods were removed due to market conditions. This was the generally accepted management method for these stands, which were classified as good hardwood sites.

Until the mid-1960’s northern hardwoods were harvested by a diameter-limit cutting, which removed large trees and released stems in the 5 to 11-inch diameter class. Most records indicated that sales produced a varying mix of sawlogs and tie cuts. Stands contained an abundance of poor quality wood and generally received heavy harvests of the sawlog overstory to improve the quality and growth of poletimber. This abundance of poor-quality wood can be assumed to be a direct result of having only the best and largest quality sawlog trees harvested in previous entries. This resulted in poor-quality and genetically inferior trees dominating many of these stands.

Harvesting in the 1970’s and 1980’s again concentrated in the better quality sawlog stands, but now these stands were marked for selective thinning under the new management guides that recently had been adopted on Federal and State lands as well as the County Forest. Research on the Argon Experimental Forest in eastern Wisconsin identified parameters for stands needing thinning and levels of residual stems that were to remain after harvest. Because of the still limited hardwood pulp market, only high sawlog volume sales could be sold. Some of these stands had been entered as early as the 1940’s while others had been left uncut since the early 1900’s. Much like the management in the 1950’s and 60’s, marking for these thinnings removed the largest and most mature trees, but efforts were made to ensure that not only the largest and best quality trees but also poorer quality stems were harvested. However, market conditions at the time made this difficult and many poor quality trees were cut and left.

830.1.2(a) Historical Acreage Trends

Since 1954, northern hardwood acreage within the Douglas County Forest has shown a steady increase. Overall, there has been a 33-percent increase (5,895 acres) in northern hardwood acreage from 1954 to 2006 (Fig. 830.8).
The overall increase in acreage is due to the natural progression from early successional, intolerant species to later successional, tolerant species found in northern hardwood stands. The leveling out and even slight decrease in acreage over the last several years is attributed to the conversion to other species which has become a management priority on certain sites.

During the 1970’s, northern hardwood was designated as a “catchall” timber type. Mixed stands of northern hardwood and species such as red maple that are identified as different types in today’s inventory were grouped. As a new inventory assesses the County Forest today, many of these grouped stands may be retyped, resulting in changes, in northern hardwood acreage.

830.1.2(b) Current Status (2006)

As of 2006, there were 23,563 acres of manageable northern hardwood stands on the Douglas County Forest. An additional 160 acres have been classified as unmanageable due to site sensitivities or proximity to streams and lakes. The northern hardwood type accounts for about 8.7 percent of the total forested acreage. Many of these stands are not pure sugar maple but a mixture of northern red oak, yellow birch, basswood, aspen, ironwood, white birch, red maple, balsam fir, and black ash (see Appendix B-III for the location of the northern hardwood timber type on the County Forest).

Secondary timber types are in association with 32 percent of the northern hardwood stands on the Forest (Fig. 830.9), making alternative silvicultural prescriptions a viable management option.
Distinct secondary timber types include aspen (2,262 acres), red maple (1,842), paper birch (1,779), and oak (982). Some of these types were once the primary type in these stands and through natural succession, northern hardwoods have become better established.

Figure 830.9
Secondary Types Associated with Northern Hardwood on the Douglas County Forest (percent)

830.1.2(c) Desired Future Condition

The long-term management goal for the northern hardwood timber type on the Douglas County Forest is to perpetuate healthy and high-quality stands and bring the current acreage closer to a regulated condition. Some stands likely will continue to convert to northern hardwoods from other types due to the natural succession from shorter lived, pioneer species to longer lived, climax species. On better sites that are currently dominated by northern red oak and/or paper birch, conversion to northern hardwoods may occur because of the inherent complexities in the regeneration of oak and birch. By contrast, northern hardwood stands that cannot produce a minimum amount of quality sawlogs may be converted to species better suited to a particular site.

830.1.2(d) Management

The overall objective of northern hardwood management is to maximize the quality of individual trees on a given site. Most northern hardwood stands on the Douglas County Forest contain a fairly high proportion of poor quality and/or diseased trees and are relatively even-age (65 to 75 years old). Multiple age class stands are nearly nonexistent. The broad range in tree diameters in most stands is a result of an individual tree growing in relationship to the canopy rather than age. The
development of seedlings and saplings is stagnant. Typically, seedlings and saplings are much older than they appear. In most cases, advanced regeneration occurs only where mature trees have died of natural causes and created openings in the forest floor. These natural canopy gaps are sporadic throughout the landscape.

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 whether a particular stand of northern hardwoods will be managed or whether the site is better suited to alternative species. Habitat type, soil characteristics, and site index will be used along with an assessment of current stand conditions to determine the optimum management options.

The northern hardwood type is distributed throughout the Douglas County Forest over a range of sites. Most of the acreage is on AVCL, ACL, or AAs habitat types (see Appendix X-I). The AVCL and ACL types are located on the dryer, flatter portions of the landscape, while AAs is associated with more mesic sites or on side slopes.

The best northern hardwood sites that have good to excellent relative growth potential are within an isolated block in the southeastern portion of the County Forest. This block encompasses about 2,525 acres or about 11 percent of the total northern hardwood type. Soils in this area generally range from sandy loam to silt loam with ATM the most common habitat type. This area holds the best potential for the development of high-quality sawlogs of shade-tolerant northern hardwood species.

The other 89 percent of northern hardwood stands are scattered throughout the Forest. Most of these stands have developed on dry-mesic to mesic sites with poor to fair growth potential. Soils in these areas generally are sand loam to loamy sand. The habitat types AVCL, ACL, and AAs tend to dominate the dry-mesic and mesic sites, with AAs on the better sites. The AVCL and ACL areas relatively poor growth potential and typically do not support high-quality northern hardwood stands. The AAs areas hold some potential for developing high-quality sawlogs but relatively slow growth rates may influence or, otherwise restrict management options as on AVCL and ACL sites. The WDNR Silviculture Handbook contains additional information on managing northern hardwoods.

(1) Applicable Silvicultural Treatments

Northern hardwoods are managed using even-age or uneven-age silvicultural systems. Most of the previously unmanaged, second-growth stands will benefit from an initial improvement harvest. Management goal may be to convert a stand from an even-age to an uneven-age condition. Numerous variables are considered before determining which silvicultural system will provide the best results for a given northern hardwood stand. They 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, wildlife habitat improvement, and aesthetics.
(A) Improvement Harvest

An improvement harvest is an intermediate silvicultural method by which less desirable trees of any species in a stand of pole-size or larger stems are targeted for removal primarily to improve composition and quality. Trees are removed to encourage the growth of more desirable trees within or below the main canopy.

Many northern hardwood stands on the Douglas County Forest are previously unmanaged, second-growth, and even-age, and contain a large percentage of small-diameter suppressed trees. Some stands contain a large portion of poor-quality and/or diseased trees as well as many overmature, large-diameter pioneer species e.g., aspen and paper birch. The smaller diameter classes tend to be overstocked while most of the trees that currently are in the larger classes are remnants of past disturbances and of poor quality. Improvement harvests focus on removing trees of the poorest quality that have reached biological maturity and are in overabundant size classes. The intent of many improvement harvests on the County Forest in removing undesirable material is to set the stage for producing a higher quality stand.

The most common type of improvement harvest within northern hardwoods stands on the County Forest is a thinning treatment that reduces stand density to improve growth, increase stand health, or remove dead trees. Thinning usually entails removing trees to temporarily reduce stocking and concentrate growth on the more desirable stems. On the County Forest, thinning operations usually target residual stocking associated with designated crown-cover levels; little attention is directed toward developing of a balanced diameter distribution. Crop trees are identified and canopy gaps of varying sizes are created naturally following the removal of dominant and codominant trees.

Initial thinning entries in most northern hardwood stands typically reduce the basal area to target levels before the need to consider other parameters. Residual crown cover levels of 80 to 90 percent are typical targets that usually coincide with basal areas ranging from 70 to 85 square feet ft² per acre. In stands in which half or more of the residual stocking is in species like basswood and/or white ash (species with smaller crown areas), the target residual basal area should be 10 to 20 ft² higher. Following a thinning treatment, the stand is monitored for 15 to 25 years and then reevaluated to determine whether even-age or uneven-age silvicultural practices will be used.

(B) Uneven-Age Management

Uneven-age management systems usually are used to harvest, regenerate, and tend northern hardwood stands that will regenerate and grow under their own shade. Stands managed under uneven-age systems usually comprise three or more age classes. Many northern hardwood species are adapted to regenerating under partial canopies following minor disturbances such as individual tree mortality, or a moderate disturbance such as a wind storm that partially damages the stand. Uneven-age systems are designed to mimic such disturbances.

Uneven-age management generally refers to the removal of individual trees or small groups of trees to increase the growth and quality of the remaining “best” stems while providing sufficient space
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and appropriate seedbed conditions for regenerating and recruiting a new age class of desired tree species. Thinning, regeneration, and harvesting usually occur simultaneously. The harvested trees are essentially replaced by growth on the residual trees left in the stand. These silvicultural systems maintain an uneven-age stand condition while manipulating the multi-age and multi-size structure of the overstory to facilitate continual recruitment and development of quality growing stock. Uneven-age management maintains a continuous canopy cover with a permanent seed source, and is well suited to the perpetuation of shade-tolerant species (like sugar maple). Over the long term, stands managed with uneven-age practices provide sustained yields of quality timber products at relatively constant intervals or cutting cycles. Stands generally are entered for harvest every 15 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 used under uneven-age management: single-tree selection and group selection. Additionally, variables such as the determination of crop trees, creation of canopy gaps, and targeted stand structure and stocking levels are incorporated into uneven-age systems. The decision to cut or leave is based on factors such as size, quality, condition, species, age class, wildlife habitat, and/or aesthetics.

(1) Single-Tree Selection

Single-tree selection is the most common uneven-age harvesting practice used to manage northern hardwoods on the County Forest. By this method, individual trees are removed periodically to a specified crown cover with associated basal area and a fairly uniform and continuous canopy cover is maintained. Crop trees are identified and in most cases released, and canopy gaps are created for the development and recruitment of a new age class.

The overall goal of single-tree selection in northern hardwood stands is to achieve an optimum distribution of size and age classes such that each contains a sufficient number of quality trees to replace those harvested in the next larger size class.

In achieving the desired residual stand structure, a guide is developed periodically to determine which size classes are overstocked or understocked. The guide provides a targeted diameter distribution to strive toward when managing the stand over the long term. When deciding which individual trees to harvest, the following designated order of removal generally is followed.

(1) High risk/cull.
(2) Poor quality/form.
(3) Crop-tree release.
(4) Maximum tree size.
(5) Undesirable species.
(6) Improve spacing.
The individual trees are selected for removal in overstocked size classes, as are the poorest quality trees in all size classes. In understocked size classes, high-risk and cull trees, undesirable tree species, and trees that have reached the designated maximum size are removed. The order of removal is only a guide. Current stand conditions can be highly variable and may warrant slight deviations in single-tree selection.

(a) Crop tree

A crop tree is any dominant or strong co-dominant stem upon which to concentrate growth through thinning. These are the trees that form the final crop prior to regeneration of the stand. Selection of crop trees is based on the following criteria:

- Low risk.
- Good crown vigor.
- Capable of producing one 16 foot sawlog with the potential for Grade 2 or better.
- Desirable species.
- Good form (no stump forks or high V-shaped stem forks).

Uneven-age management should be considered where there are at least 45 crop trees per acre.

(b) Canopy Gap

A canopy gap is an opening in the forest canopy created by removing trees or groups of trees to allow sunlight to reach the forest floor and thus create favorable conditions for regeneration of a new age class. Under uneven-age systems, canopy gaps are created at each entry.

Canopy gaps should range from 25 to 75 feet (drip edge to drip edge) in diameter (averaging approximately 30 to 60 feet) and make up 5 to 15 percent of the total stand area at each entry. All trees 1 inch in 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, e.g., yellow birch and white ash.

(c) Target Stand Structure/Stocking (Size-Class Distribution)

In uneven-age 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 period. Size-class distributions can be altered slightly given certain stand conditions. The purpose of a target stand structure is to ensure that there will be a sufficient number of trees continuously growing into the next larger size class to maintain the desired structure over time.

One of the most common variables used to calculate a targeted stand structure is expressed as the Q-value. The Q-value is the average quotient between the number of trees in consecutive diameter
classes, resulting in a reverse J-shape curve (Fig. 830.10). Other variables such as desired maximum tree diameter and targeted residual stocking level (target basal area after harvest) are incorporated into the guide on achieving the desired residual stand structure. (see Appendix Y-I for Q-values and common targeted diameter distributions on the Douglas County Forest).

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

On poor to fair sites where pulpwood-size material is the expected major product, higher Q-values (1.5 to 1.7) and maximum tree diameter of 18 to 20 inches are used to encourage a larger proportion of poletimber and small sawlogs. These sites are traditionally slow growing and may not be unable to continuously produce large, high-quality trees. Typical target goals for residual basal area range from 65 to 90 ft² per acre (average 70 to 80 ft²), depending on many of the factors previously cited. In general, there will be more small trees than larger ones and a cutting cycle of 20 to 30 years is likely.

On good to excellent sites, a lower Q-value (1.3 to 1.5) and maximum tree diameter of 20 to 24 inches is used to encourage the development of larger sawlog material over a greater proportion of the stand. These sites respond well to uneven-age management, exhibit good to excellent growth and recruitment, and can develop large, high-quality sawlog material on a continuous, long-term basis. Typical target goals for residual basal area range from 70 to 95 ft² per acre (average: 75 to 85 ft²), depending on numerous factors. In general, there will be more large trees and fewer small ones and a shorter cutting cycle of (15 to 25 years).
On many stands, a relatively high initial Q-value of 1.5 to 1.7, may be necessary depending on the relative proportions of size classes. The goal would be a lower Q-value of 1.3 or 1.4 in successive harvests as stand quality increases over time. A guide for estimating Q-values for existing northern hardwood stands based on basal area in pole and sawtimber size classes is shown in Table 830.2.

<table>
<thead>
<tr>
<th>Percent of Basal Area in each Size-Class</th>
<th>Pole-Sized (5 inch – 9 inch d.b.h.)</th>
<th>Sawtimber-Sized (10+ inch d.b.h.)</th>
<th>Q-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>55%</td>
<td>45%</td>
<td></td>
<td>1.7</td>
</tr>
<tr>
<td>50%</td>
<td>50%</td>
<td></td>
<td>1.6</td>
</tr>
<tr>
<td>40%</td>
<td>60%</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>30%</td>
<td>70%</td>
<td></td>
<td>1.3</td>
</tr>
</tbody>
</table>

An example guide for achieving a desired residual stand structure in Appendix Z-I contains field data collected from a typical stand of northern hardwood on the Douglas County Forest.
The desired number of trees by size class is a goal, a future distribution to strive toward. Considerable flexibility is needed in marking both previously unmanaged and managed stands based on inherent conditions. In many cases, the first entry in the stand, regardless of the stand structure desired, will include removing a high proportion of the largest stems along with the poorest quality trees and undesirable species. In future entries, the guidelines for desirable trees can be applied more rigidly. However, even in the first entry, most stems should be marked in size classes with surplus trees. It also is important to inventory and monitor the seedlings and sapling stems as these eventually will replace the current stand. The lack of seedlings and saplings is common throughout many northern hardwood stands on the Forest today.

(2) Group Selection

Single tree selection is the preferred uneven-age practice for promoting sugar maple on the County Forest. Group selection is used to promote a higher preponderance of mid-tolerant species such as yellow birch, the ashes, and oaks, basswood, red maple, and white, and red pine. This method tends to increase species diversity in northern hardwood stands compared to single-tree selection.

With group selection, trees are removed in small groups periodically to create conditions that favor the regeneration and establishment of new age classes. The openings created range in size from a 0.02 acre (30 foot diameter circle) to 0.5 acre (166 foot diameter circle). In northern hardwood stands with a mid-tolerant species component, openings generally are 0.10 to 0.20 acre and make up 10 to 20 percent of the total stand area. Smaller openings and lower overall percentages favor the regeneration of highly tolerant species such as sugar maple, while larger openings and greater overall percentages favor mid-tolerant species such as yellow birch.

Stands dominated by large-crowned, more tolerant species do not require the large openings for sunlight and individual trees are harvested as they mature under single-tree selection. However, some of the mid to less tolerant species associates e.g., basswood, yellow birch, and red maple, benefit from group selection which promotes the recruitment and growth of new seedlings. On some sites, gaps of ¼ to ½ acre also may be appropriate in the management of uneven-age stands of mid-tolerant species such as northern red oak and red and white pine.

Openings often require site preparation and the release of preferred species from competition. Gaps usually are cleared of all non-crop and nondesirable stems down to 1 inch in diameter. Groups selected for harvest to create the openings have the poorest form, vigor, and quality or are at the rotation age for the stand. Structural diversity is promoted by scattering openings across the stand. During harvest entries and the creation of openings, thinning and crop-tree release are used throughout the remainder of the stand to improve quality and maintain space requirements for harvesting equipment.

Although a well-proven method, group selection can be difficult to apply. It often is more expensive than single-tree selection because site preparation is necessary to prepare the seedbed and/or control undesirable competing vegetation, and regeneration release usually is required. As a result, single-tree selection will remain the most common uneven-age practice for northern
hardwood on the Douglas County Forest. Group selection may be used infrequently where management objectives, regeneration opportunities, site capability, and species composition warrant.

(3) Summary of Uneven-Age Management of Northern Hardwood

In general, stands managed under uneven-age systems regenerate as a result of the manipulation of light levels during the harvest process. In some cases, non-commercial removal of additional cull trees or poorly formed saplings may be required to enhance regeneration in areas that are not opened by the normal selection process.

A variety of factors are considered when determining how and when to use uneven-age management. Once site potential and current stand conditions have been analyzed, designated stocking levels, targeted diameter distributions, and maximum carryover tree diameters must be considered. The following are uneven-age management options based on site potential for northern hardwoods for the Douglas County Forest.

(a) Dry-mesic sites with poor to fair relative growth potential. Habitat types typically are AVCL and ACL. Site index generally in the range of 55 to 59.

(1) Identify at least 45 crop trees per acre. Even-age management will be considered if at least 45 crop trees per acre cannot be located or if there is a poor response to past uneven-age practices on the same site or similar sites.

(2) Establish Q-values in the range of 1.5 to 1.7 with a maximum tree diameter of 18 to 20 inches. Generally, these sites do not have the capacity to grow numerous large, high-quality northern hardwoods.

(3) Use single-tree selection to develop a target stand structure and compare with the actual stand structure to identify size classes to for removal. Reduce crown closure to 90 percent using recommended stocking levels (excluding gap areas). In most stands, this usually will correspond to a basal area of 60 to 90 ft$^2$ per acre (with an average target of 70 to 80 ft$^2$), 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 percent or more of residual basal area), basal area targets should be 10 to 15 ft$^2$ higher.

(4) Establish three to five canopy gaps per acre that range in size from 30 to 75 feet from drip edge to drip edge. These gaps can range from 5 to 15 percent of the total stand area but 10 to 12 percent should be targeted as an average. Locate gaps where groups of poorly formed, diseased, or defective trees occur and/or where advanced regeneration is already established to release it.

When sugar maple is the dominant overstory and understory species, smaller canopy gaps are sufficient. Where more mid-tolerant species are desired in the gaps, openings should be larger and
placed near these species components. Additional pre- or post-harvest site preparation may be necessary in the openings when attempting to establish more mid-tolerant species.

(5) Heavier treatments (less than 70 ft² of residual basal area per acre) may be necessary to reduce excessive poor-quality stems and/or better target desired long-term goals for residual stand structure. These types of heavy treatments usually require an extended cutting cycle of 20 to 30 years.

In addition, because of the inherent slower growth rates on sites with poor to fair growth potential, more intensive harvests tend to keep the canopy in an open condition for a longer period. Repeated heavy treatments may result in reduced quality due to the inability of trees to shed epicormic branches and correct forking. Lighter treatments may be re-evaluated in 10 to 20 years.

(b) Mesic sites with good to excellent growth potential. Habitat types typically are AAs and ATM. Site index generally is 60 or better.

(1) Identify at least 45 crop trees per acre. Even-age management will be considered if at least 45 crop trees per acre cannot be located or if there is a poor response to past uneven-age practices on the same or similar sites.

(2) Establish Q-values in the range of 1.3 to 1.5 with a maximum tree diameter of 20 to 24 inches. Generally, these sites have good to excellent relative growth potential and the capacity to grow high-quality northern hardwoods.

(3) Use single-tree selection to develop a target stand structure and compare with the actual stand structure to identify size classes for removal. Reduce crown closure to 90 percent using recommended stocking levels (excluding gap areas). In most stands this usually will correspond to a basal area of 65 to 90 ft² per acre (with an average target of 75 to 85 ft²) 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 percent or more of residual basal area), basal area targets should be 10 to 15 ft² higher.

(4) Establish three to five canopy gaps per acre that range in size from 30 to 60 feet from drip edge to drip edge. These gaps can range from 5 to 15 percent of the total stand area but 10 to 12 percent should be targeted as an average. Locate gaps where groups of poorly formed, diseased, or defective trees occur and/or where advanced regeneration is already established to release it.

When sugar maple is the dominant overstory and understory species, smaller canopy gaps are sufficient. On sites with excellent growth potential, sugar maple will be targeted as the primary management species.

(5) Stands may be re-evaluated in 10 to 20 years. Heavier treatments (less than 70 ft² of residual basal area per acre) may be necessary in initial entries to reduce excessive poor quality stems and/or
develop a target residual stand structure. These types of heavy treatments usually require an extended cutting cycle of 20 to 30 years.

(C) Even-Age Management

Even-age 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 factors, such as mean age, maximum tree size, mean annual increment, and economic or biological maturity. With even-age systems, typical rotation ages for northern hardwood stands on the Douglas County Forest range from 70 to 120 years to balance quality development, growth potential, and economic risk. Table 830.3 shows the range of rotation ages used to manage northern hardwoods using even-age silvicultural systems. Some of the factors that can influence the decision to manage a stand with even-age techniques are current stand conditions (percentage of poor-quality and/or diseased trees), site potential, past management practices, and species composition.

<table>
<thead>
<tr>
<th>Early Rotation Age</th>
<th>Standard Rotation Age</th>
<th>Extended Rotation Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 years</td>
<td>100 years</td>
<td>150 years</td>
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</table>

Even-age management usually is prescribed on sites where the potential development of northern hardwood is poor to fair. Most of these dry-mesic sites on the Douglas County Forest exhibit the AVCL or ACL habitat type with site indexes less than 60. These 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 (AAs and ATM habitat types) have potential to be managed with even-age 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-age practices (crop trees per acre) may be considered for even-age management. These stands also have the potential to be converted to an uneven-age condition over time. Rotation ages on poor sites tend to be at the lower end of the range (70 to 100 years), while better sites tend to be in the upper end (100 to 120 years). On good to excellent sites, the potential exists for extended rotation ages up to 150 years.

Two forms of even-age practices for northern hardwood management on the Douglas County Forest are shelterwood harvests and clearcutting. Intermediate harvests are used when mature stands are not yet ready to be regenerated but are in need of management.
(1) Intermediate Harvest

Most mature northern hardwood stands (typically 60+ years of age or that average approximately 8 inches d.b.h.) on the Forest are in need of some form of management. If the long-term goal is to manage a stand of northern hardwoods with even-age methods but the stand is not yet ready to be regenerated, an intermediate harvest may be prescribed. The goal of an intermediate harvest is to remove shorter lived (aspen, paper birch, and red maple), poor-quality, and undesirable tree species, while encouraging the development of quality on the more desirable stems (crop trees). Because the long-term goal is to create a single age class of desired trees, canopy gaps are not created intentionally during an intermediate harvest to facilitate regeneration. Target stocking or crown-cover levels may vary slightly but generally range from 80 to 90 percent crown closure (70 to 85 ft$^2$ of basal area per acre) depending on the percentage of larger diameter trees and species composition. Smaller pole-size stands (5-9 inch d.b.h.) typically are reduced to 80 percent crown closure and larger sawlog-size stands (10+ inches d.b.h.) are reduced to 90 percent crown closure. Trees generally are marked for removal or to cut rather than to leave. Cutting should focus on:

- Removing poor-quality competitors to release dominant and co-dominant crop trees.
- Removing high-risk and cull trees.
- Thinning from below by removing subcanopy stems until minimum stocking is reached.

Most northern hardwood stands on the Douglas County Forest currently are in an unregulated, even-age 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 re-evaluated in 15 to 25 years.

(2) Shelterwood

The shelterwood system is the most common form of even-age management for northern hardwood on the Douglas County Forest. In addition to the regeneration of shade-tolerant species like sugar maple, this method is preferred for establishing and developing of a larger component of lighter seeded and moderately tolerant species like yellow birch, northern red oak, white ash, basswood, and red maple.

Two basic levels of shelterwood harvests are two cut and three cut (or multi-cut). In each method, crop trees are identified and harvests reduce the crown cover and associated residual stocking to designated levels. Trees generally are marked to leave rather than for removal. When an adequate amount of desired regeneration is present, the overstory is removed and a new even-age stand is allowed to develop. The development of regeneration is highly dependant the potential of a given site as well as the intensity of the harvest, and should be closely monitored. Stands often require site preparation to promote more mid-tolerant species.
(a) Two-Cut Shelterwood

Shelterwood harvests using the two-cut method regenerate the stand with an initial regeneration harvest (first cut) and release of established regeneration with an overstory removal (second cut). The first harvest is designed to provide sufficient 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 northern red oak).

(3) Prevent the desiccation of newly established seedlings and allow for the development of root systems.

(4) Develop quality on the desired residual stems.

The following procedure is used to regenerate northern hardwood stands with a two-cut shelterwood:

(1) In the regeneration harvest (first cut), leave a uniform, well-spaced crown (55 to 75 percent crown closure) with 45 to 65 ft² per acre in dominant and co-dominant, vigorous, best-formed, residual overstory trees. Residual stocking may vary due to species composition, quadratic mean average stand diameter, and goals for desired species regeneration. Site preparation may be necessary when attempting to regenerate species such as yellow birch and northern red oak.

(2) Remove the overstory when desired established regeneration totals 2,000 to 5,000 stems per acre, stems are 2 to 4 feet tall, and stems are above undesirable competing vegetation. This ensures that established seedlings and saplings have developed a solid, deep root system, and can respond to full sunlight (release) and maintain dominance.

(3) Overstory removal should occur when the ground is frozen and/or is adequately snow covered. This will minimize damage to established and developing seedlings and saplings. The overstory is removed when the canopy is at or near rotation age or in degraded stands with adequate advanced regeneration.

(b) Three-Cut or Multi-Cut Shelterwood

A three-cut shelterwood harvest is one or more intermediate harvests followed by a two-cut shelterwood. This method may be required where there is potential for quality improvement, inadequate advanced natural regeneration, undesirable species, or potential grass/brush invasion (opening the canopy too much too soon may proliferate undesirable vegetation and inhibit desirable species establishment). This method also is used to enhance aesthetic values. In most cases, only one intermediate harvest is prescribed before the initiation of a two-cut shelterwood. However, there can be two treatments prior to a regeneration harvest. For example, if the rotation age for a given stand of northern hardwoods is 110 years and the initial thinning begins at age 70, at 20-year intervals, it may be possible to lightly thin a stand twice before initiating a two-cut shelterwood.
The following procedure is used to regenerate northern hardwood stands with a three-cut or multi-cut shelterwood:

(1) The first and in some cases second intermediate harvests follow guidelines used for intermediate harvests. Residual crown cover can be left slightly higher (85 to 95 percent) to discourage the establishment of undesirable vegetation, discourage stem defects and encourage stem correction, and to improve the quality of the existing stand. Canopy gaps are not created intentionally and crop trees are identified for future regeneration harvests.

(2) Prescribe the regeneration harvest when the stand is approaching the rotation age. Residual crown cover is left slightly lower (55 to 65 percent) to encourage the establishment of new seedlings and the development of advanced regeneration. Site preparation may be necessary when attempting to regenerate more mid-tolerant species.

(3) Remove the overstory as described in the two-cut shelterwood system.

(3) Clearcut Conversion

In general, clearcutting is not an authorized initial harvest option when managing for northern hardwood on the Douglas County Forest. A clearcut is the least desirable regeneration method to develop a new even-age stand of northern hardwood and generally the least suited method for regenerating most species found in a typical northern hardwood stand. However, if most of the residual stand is of exceedingly poor quality and/or form and contains a high percentage of diseased trees, or if a stand is of poor quality and contains an adequate amount of aspen in the residual stocking to successfully regenerate the aspen type, clearcutting may be a viable option for conversion. Any northern hardwood clearcutting prescription other than that for species conversion will require prior review and approval by the Director of Forestry and Natural Resources and the WDNR Liaison Forester.

(D) Conversion From Even-Age to Uneven-Age Condition

As stated previously, many northern hardwood stands on the Douglas County Forest are in a previously unmanaged (or lightly managed), even-age condition. Most stands are overstocked in the smaller size classes and, as a result of long-term, closed-canopy conditions, lack the development of advanced regeneration. Stands that are developing on sites with fair to excellent growth potential may be converted to an uneven-age condition with a combination of even-age (intermediate thinnings) and uneven-age (single-tree selection) techniques. The initial entry combines even-age thinning (intermediate harvests) with the creation of canopy gaps (single-tree selection).

Intermediate harvest methods such as improvement thinnings focus on the removal of the poorest quality trees and quality development on the desired stems, while canopy gaps created through application of single tree selection will create the proper conditions for the establishment and
recruitment of a new age class of desired tree species. Conversion is a long-term, multiple entry process. At least three to four treatments may be required to create a structurally diverse, fully stocked stand indicative of an uneven-age forest.

(2) Determining of Annual Allowable Harvest Levels

The northern hardwood timber type on the Douglas County Forest occurs over a wide geographical range and grows on a variety of site conditions. These and other factors such as past harvesting practices, current stand conditions, long-term management goals, and aesthetics play a role in determining how a particular stand will be managed.

As of 2006, it was estimated that one-third of the total manageable northern hardwood acreage on the Douglas County Forest would be well suited for uneven-age management. This estimate will continue to be refined based on updated inventory data and new research findings. Determining the annual allowable harvest takes into account both even-age and uneven-age management, as well as long term management goals.

Under uneven-age practices, determining annual allowable harvest levels revolves around the average period between entries for typical stands. The average period between entries for typical northern hardwood stands on the Douglas County Forest is 20 to 25 years (the actual range can be 15 to 30 years depending on site conditions and/or the intensity of past management practices).

Under even-age practices, determining annual allowable harvest levels revolves around the average rotation age for typical stands. The average rotation age for northern hardwood on the Douglas County Forest is 80 to 100 years (the actual range can be 70 and 120 years depending on site quality and long-term management goals). Under rare circumstances on excellent sites, the potential exists for extended rotation ages up to 150 years. Other variables must be considered when determining the total annual allowable harvest goals under even-age management. When this method is prescribed, most stands will undergo between two and four total treatments. For a given stand, treatment may include an intermediate thinning, a shelterwood harvest, and final overstory removal. It is important to include these treatments when determining the annual allowable harvest. See Chapter 1000 for estimated annual harvest levels (acres) per silvicultural system per year projected over the next 15 years.

Annual allowable harvest levels are determined when the northern hardwood timber type has reached a fully regulated condition (the point at which stocking, harvests, growth, and yield have been controlled intentionally to meet long-term management objectives). The annual allowable harvest for northern hardwood on the Forest may increase or decrease in a given year to attain long-term management goals and achieve a regulated condition. Factors such as how individual stands respond to treatment, natural disturbance, e.g., wind events, and/or insect outbreaks, and improved accuracy of inventory data can directly influence the allowable harvest.
830.1.3 PAPER BIRCH

Paper birch is a member of the white-barked birches that most commonly includes European White birch, Asian White Birch, and Paper Birch. It is native to North America and is commonly referred to as White Birch in many management publications. For all practical purposes of this plan, any reference to white birch in regional publications (including those published by the WDNR) can be presumed to be paper birch on the Douglas County Forest. Paper birch is a “pioneer” species that tends to regenerate in areas that have been left in an open condition following disturbances such as fire or an intensive harvest. Throughout the Douglas County Forest, mature stands of paper birch have developed as pure stands or more commonly as a component with other less shade-tolerant species like aspen and northern red oak. Today there are few pure paper birch stands but this species remains a major component in most aspen and oak stands on the Forest.

Much of the County’s paper birch became established following intensive harvests and fires that occurred during the late 1800’s and early 1900’s. The last major fire occurred in 1935. As a result, in the early days of the County Forest, few stands of mature paper birch required regeneration. In unburned northern hardwood stands on good-quality soil, large-diameter birch was a common component. It was this birch, that was encountered while harvesting other species that is mentioned in early timber sale records. Local sawmills have always used small quantities of paper birch but sales specific to this species and management to perpetuate paper birch on a site for future rotations is a relatively recent occurrence.

In the 1970’s distant markets began to purchase paper birch for pulp and sawbolts but little was used other than that encountered while harvesting other species. Most of the birch that was harvested was on aspen clearcuts, where it was removed to allow aspen to receive full sunlight. The majority of the birch was of pulpwood size since it originated in mixed stands with aspen in the 1920’s and 1930’s. Mature aspen stands with too large a component of birch were bypassed in hopes that there would be a better chance to fully utilize the birch should markets develop in the future. This policy led to some of the overmature aspen stands on the County Forest today.

As aspen cutting increased with improving markets, so did the volume of paper birch that was encountered, though it remained a minor component on individual sales. Not all contractors could sell birch and some contractors could not sell all of the birch encountered while harvesting aspen. This led the DCFD to make utilization of birch optional on selected aspen clearcuts in the late 1980’s. If a contractor could not market the paper birch volume his or her bid would not include a value for the species. The cutting specifications on these sales still required that the birch be felled to accomplish the clearcut prescription for aspen. This was a short-lived practice as the birch market improved, primarily as a result of the use of birch by Flambeau Paper Co. of Park Falls.

Today, there is a diversified market for birch harvested from the Douglas County Forest. It continues to be marketed for sawtimber products such as veneer, and the market for birch pulpwood has grown substantially in the last decade. Birch is also harvested for specialty items such as toothpicks, popsicle sticks, and golf tees which has added to the overall marketability for this species.
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Forest aesthetics are enhanced by the attractive green foliage and distinctive white bark of paper birch. This species also is important to numerous species of wildlife that consume its seeds, buds, and bark.

Several techniques have been used to reestablish paper birch stands throughout the County Forest: shelterwood and seed-tree harvests, strip clearcutting, undulating harvest edges, and encouraging stump sprouting. Also, site preparation before, during, and after harvesting has been prescribed along with seasonal harvest restrictions coinciding with seed dispersal. Consistent paper birch regeneration has been observed in areas burned to manage northern red oak. Aspen nearly always outgrows birch when these species are harvested together, even when the birch stocking is greater than that of the aspen. To date, the most effective method used to achieve consistent, semi-predictable paper birch regeneration on the County Forest is a shelterwood or seed-tree harvest with intense site preparation in the form of soil scarification.

830.1.3(a) Historical Acreage Trends

Paper birch acreage on the Forest has declined steadily since the 1970’s. Overall, there was a 40-percent decrease (8,718 acres) in paper birch acreage from 1977 to 2006 (Fig 830.10).

Figure 830.11

The overall decrease in acreage is attributed to the forest’s natural progression from shorter lived, shade-intolerant, early successional species (paper birch) to later successional, longer lived, mid-
tolerant and tolerant species, e.g., sugar maple. The absence of natural fire regimes due to human activity has contributed to this progression. Another significant factor in the decline of paper birch is the conversion of birch stands to aspen after harvesting. Aggressive aspen regeneration quickly occupies sites and outcompetes birch. Paper birch also is susceptible to numerous damaging agents, especially the birch leaf-minor and the bronze birch borer. Finally, drought and windstorms have been a contributing factor in the decline of birch. Future trends for paper birch indicate a continued decrease in acreage, though the rate of decline may be reduced.

830.1.3(b) Current Status (2006)

As of 2006, there were 13,010 acres of manageable paper birch on the Douglas County Forest. An additional 119 acres have been classified as unmanageable due to site sensitivities or proximity to streams and lakes. Paper birch accounts for about 4.8 percent of the total forested acreage. Because of its continuing decline, paper birch is a priority “managed for” species on the Forest (see Appendix C-III for the location of the paper birch timber type on the Douglas County Forest).

Secondary timber types are in association with 85 percent of the paper birch stands on the Forest, (Fig. 830.12), making silvicultural prescriptions for other species a viable management option when managing for the birch type is impractical and/or unfeasible. Distinct secondary timber types include northern hardwoods (4,083 acres), aspen (3,675), oak (1,531) and fir-spruce (1,157). Without management, many of these secondary types will progress toward primary types and the birch component will decrease through natural succession.

Figure 830.12
Secondary Types Associated with Paper Birch on the Douglas County Forest (percent)
Stands of paper birch on the Douglas County Forest are primarily at maturity or are overmature. Approximately 80 percent of the total acreage is at least 60 years old. Figure 830.13 shows the total paper birch acreage (as of 2006) by 10-year age classes. The relative spike in the 0-9 class can be attributed to increased birch recruitment due to a greater focus on managing specifically for paper birch in recent years. All stands at least 80 years old have been designated as high-priority stands for management if the birch type is to be managed for, especially on those sites that are well suited for birch.

830.1.3(c) Desired Future Condition

The long-term management goal for paper birch on the Douglas County Forest is to bring the age class distribution closer to a regulated, evenly distributed condition and aggressively maintain the current acreage in a healthy and vigorous state. Another goal, though opportunities generally are limited, is to expand the paper birch type on the Forest, particularly on sites that are well-suited for birch management. Most of these limited conversion opportunities occur in stands of northern hardwood with a birch component. Once a stand of paper birch has converted naturally toward more tolerant, longer-lived species, it is difficult to manage for birch because of the inherent complexities involved in the natural regeneration of this type.
830.1.3(d) Management

On the County Forest, paper birch usually is as a component within stands of northern red oak, aspen, fir/spruce, and northern hardwoods. Management of this species will focus on regenerating stands where the site quality is fair to good and the potential for competition with aggressive species (aspen) is low. This includes attempting to maintain stands currently dominated by paper birch, as well as converting stands in which this species is a secondary component but has potential to be the primary type. It is important to retain paper birch as a minor associate of other timber types as much as possible.

Natural, single-stem regeneration from seed is the preferred method of establishing a new stand when managing for the paper birch type on the Douglas County Forest. Stump sprouting is common and is a good choice when the goal of secondary management is to maintain paper birch as a minor component. Site preparation in the form of scarification or exposure of mineral soil is critical for natural seed regeneration of paper birch. Mechanical scarification including whole-tree skidding is preferred, though, prescribed burning may produce acceptable results. In general, an adequate seedbed 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 percent of the area. An additional benefit of site scarification is the initial control of competing vegetation. The best results for site preparation and subsequent regeneration have occurred when the scarification was performed during the late summer and 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. The following are some of the variables that may affect the of regeneration of paper birch stands:

(1) Silvics of paper birch. Paper birch seed is small and new germinants are sensitive to moisture, temperature, nutrient, light, and seedbed conditions. Established seedlings are highly sensitive to competition and are easily displaced (it is important to control competing vegetation). Sprouts of seed origin 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.

(2) Adequate site scarification. In general, the greater the intensity of disturbance, the greater the potential for paper birch establishment. It is desirable to achieve a mixture of mineral soil with organic material, and to provide non-compacted bare mineral soil that is relatively free of vegetative competition.

(3) Timing of scarification. Paper birch seed is disseminated during the late summer through winter with 90 percent falling from September through November. Optimum seed bearing occurs at 40 to 70 years of age. Incorporating the timing of seedfall with disturbance regimes is crucial in establishing paper birch.

(4) Control of competing vegetation. Paper birch is sensitive to the competition for resources from other vegetative species at all stages of development. When attempting to regenerate this species, it
is important to release suppressed regeneration as soon as possible. In stands where birch is mixed with aspen, it is difficult to regenerate this species as the primary cover type. It may be necessary to designate aspen as leave trees (do not harvest) to discourage aggressive root suckering. Aspen sprouts will outcompete paper birch seedlings.

(5) Browsing. Paper birch is a preferred food source for white-tailed deer and numerous other wildlife, including hare and small mammals. Repeated impacts by animals e.g., heavy browsing by deer, may adversely affect the natural establishment of paper birch. On the County Forest, multiple research and demonstration sites have been established on harvested birch stands where enclosures were located to prevent browsing of birch regeneration. These sites will continued to be monitored over time to learn more about deer/vegetation interactions on the Forest.

(1) Applicable Silvicultural Treatments

Paper birch is managed with even-age silvicultural practices on the Douglas County Forest. In general, clearcutting is not an authorized initial harvest option when managing for paper birch on the Forest. Over the past decade, strip clearcutting was used in several stands but regeneration has been relatively unsuccessful. The two-cut shelterwood and seed-tree method (sometimes referred to as light two-cut shelterwood) with adequate soil scarification are preferred for establishing new paper birch stands. Clearcutting should be applied only for species conversions and when the management objective is to maintain paper birch as a component (typically of stump sprout origin).

Any clearcutting prescription other than that for species conversion or component maintenance will require prior review and approval by the Director of Forestry and Natural Resources and the WDNR Liaison Forester. On good to excellent sites where individual trees exhibit good quality and vigorous growth and sawlog development is an objective, an intermediate entry in the form of thinning may be a viable alternative.

The following are general guidelines used by the DCFD to manage paper birch on the Douglas County Forest.

(A) Even-Age Management

Even-age silvicultural systems are designed to maintain and develop a single ageclass of trees. Stands are regenerated at a selected rotation age. The length of rotation may be defined by factors such as, mean age, maximum tree size, mean annual increment, and economic or biological maturity. Typical rotation ages for paper birch stands on the Douglas County Forest range from 55 to 80 years. Some of the factors that influence the decision of when to manage a stand for regeneration of paper birch are current stand conditions (percentage of poor-quality and/or diseased trees), site potential, and species composition. The following methods are used to establish a new age class of paper birch.
(1) Seed Tree

In this method, only 3 to 10 trees per acre are left as a seed source for regeneration within the harvest area. This method differs from a shelterwood in that the residual stocking is too sparse to modify the understory environment for seedling protection. Seedlings may be more at risk to environmental factors where the residual canopy is not sufficient to protect, modify, or shelter the site.

(2) Two-Cut Shelterwood

This method remains the preferred method when managing the paper birch type on the Douglas County Forest. Compared with the seed-tree method, a shelterwood provides greater control in manipulating the overstory and understory to create conditions that favor the establishment and survival of paper birch seedlings. The two-cut shelterwood regenerates the stand with an initial regeneration harvest (first cut) and then releases established regeneration with an overstory removal (second cut). The overstory serves to modify understory conditions to create a favorable environment for regeneration and provide a seed source. A secondary function of the overstory is to allow additional development of quality residual stems during seedling establishment. A successful shelterwood harvest to regenerate paper birch requires the removal of most if not all intermediate or suppressed saplings and poles because the smaller understory trees suppress the development of vigorous birch seedlings. A three-cut shelterwood with an intermediate thinning before the regeneration harvest may be an option on good to excellent sites where individual trees exhibit good quality and vigorous growth, and where sawlog development is an objective.

The following is the preferred procedure for regenerating stands of paper birch by the seed-tree or shelterwood method on the Douglas County Forest:

(1) In the initial harvest, leave 20 to 40 percent residual crown cover (two-cut shelterwood) or 3 to 10 trees per acre (seed tree), distributed evenly, in paper birch stems with the best form and vigor. Northern red oak and basswood are good species to leave in lieu of paper birch. If aspen is a component, leave as many as possible (within crown-cover parameters) to discourage root suckering.

(2) During the late summer into the fall, scarify the site, mechanically and/or with a prescribed burn before the harvest or during the harvest (by whole-tree skidding) to expose and incorporate mineral soil with organic material and to reduce competing vegetation. The total disturbance area should be 50 to 75 percent. Generally, the greater the area and intensity of disturbance, the greater the potential for paper birch regeneration. To improve the potential for natural seed germination, time the scarification and, if possible, the initial harvest with seed dispersal (usually shortly before and after leaf drop). In the fall, apply aggressive site-preparation techniques during harvest (whole-tree skidding) or directly after the initial harvest (anchor chaining, root raking) if seedbed preparation is necessary.
(3) Monitor the establishment of desired paper birch seedlings and consider controlling competing vegetation if a large percentage of birch seedlings is overtopped by undesirable species. Because paper birch is shallow rooted and susceptible to even slight increases in soil temperature, the overstory should be removed promptly once regeneration is established to capture merchantability before decline is significant. Remove the overstory when the ground is frozen and adequately snow covered to reduce potential damage to established seedlings. Desired regeneration should be adequately stocked (1,200 stems per acre over 1 foot tall at 4 years) and stems of seed origin that are at least 2 feet tall upon release (stump sprouts may be taller).

(2) Determining Annual Allowable Harvest Levels

Table 830.4 shows the range of rotation ages used to manage paper birch on the Douglas County Forest.

<table>
<thead>
<tr>
<th>Early Rotation Age</th>
<th>Standard Rotation Age</th>
<th>Extended Rotation Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 years</td>
<td>65 years</td>
<td>80 years</td>
</tr>
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</table>

The standard average age of rotation for paper birch on the Douglas County Forest is 65 years. Paper birch growing on sites with good to excellent relative growth potential can be extended to 80 years. Conversely, stands developing on poor sites and/or exhibiting signs of decline be regenerated at 50 years.

Because of the current unbalanced age class distribution, i.e., paper birch is not in a regulated condition, many variables must be considered when determining harvest levels. To regenerate the current overstocked mature age classes of paper birch and begin to level the unbalanced age class distribution, annual allowable harvest levels have been accelerated in recent years. This has reduced the amount of primary-type paper birch stands converting naturally to more tolerant species and improved regeneration success by treating stands at maturity (before seed production decreases) rather than when severely overmature.

To reach a fully regulated condition by which each age class contains approximately the same acreage, the annual allowable harvest must be adjusted constantly to compensate for the current age class distribution. Over the next 15 years, the goal for paper birch management on the Douglas County Forest is to maintain and enhance the current acreage, expand the birch type where appropriate, and strive toward a regulated condition. Because of the current unbalanced age class distribution and average lifespan of paper birch on the forest, achieving a fully regulated condition may require multiple rotations. Among the variables that may play a role in altering paper birch’s harvest levels, are an unbalanced age class distribution, a rapid increase in mortality from insects,
disease, drought, etc., natural disturbance, and improved inventory data. See Chapter 1000 for estimated annual harvest levels (acres) of paper birch over the next 15 years.

830.1.4 NORTHERN RED OAK

Throughout the Douglas County Forest, northern red oak has developed as pure stands or more commonly as a secondary component with other primary timber species. Pure stands of northern red oak, are less prevalent on the Forest but oak remains a major component in aspen, paper birch, and northern hardwood types.

Much of the northern red oak type resulted from large fires between 1910 and the early 1930’s. Northern red oak’s thick bark that insulates the tree from heat allows the stem to resprout after fires that kill fire-sensitive competing hardwoods. Repeated natural and human-caused fires from the late 1800’s to the early 1930’s allowed northern red oak to regenerate and create the even-age stands that are on the Forest today.

In the early days of the Douglas County Forest, northern red oak was harvested for sawing lumber and tie cuts. It did not occur in pure stands but was associated with other timber types, usually northern hardwood, that were unaffected by the fires in the early 1900’s.

Early management descriptions on the County Forest considered oak species as weed trees and usually advocated converting to other species. Until this decade, northern red oak has been unmarketable as pulpwood. Oak pulpwood, harvested as an associated species in the management of other types, was sold as firewood locally. Early on, it would have been one of the species that was sheared following an aspen harvest to maintain the aspen timber type.

Northern red oak provides excellent food and cover for many species of wildlife on the Forest. Acorns are the preferred food preference of the blue jay, wild turkey, squirrel, small rodents, white-tail deer, raccoon, and black bear. Deer also browse the buds and twigs during the winter months. Live or dead standing trees with cavities provide nesting sites for squirrel, raccoon, and numerous bird and other species. Many wildlife species on the Forest are associated with stands of northern red oak. It is this high value to wildlife that resulted in a “no cut” policy for this species on the Douglas County Forest in the late 1970’s. At first, this policy included all oak but most oak trees left in an otherwise clearcut declined and died quickly. Thus it became policy to exclude patches predominated by oak from sale areas while at the same time, cutting scattered oak to regenerating it by stump sprouting.

By the 1980’s, associated oak that originated in the 1920’s and 1930’s with the aspen being harvested was of a size appropriate for sawbolt products. The popularity of oak for flooring, furniture, and other interior woodwork created strong markets for this lesser size and quality of oak sawlog, which could be sawed and re-glued into usable lengths and thicknesses for millwork. This reduced the load on the firewood market and allowed better utilization of the harvested oak.
As the source of oak cut volume on the County Forest has changed from associated trees to the harvest of nearly pure northern red oak types needing regeneration, today’s markets are strong enough to use all of the Forest’s oak resource. Oak products removed today are used for furniture, veneer, flooring, pallets, boxes, and firewood. When treated, the wood also is used for fenceposts, railroad ties, and mine timbers.

Northern red oak is susceptible to many damaging agents, particularly the forest tent caterpillar, two-lined chestnut borer, gypsy moth, and oak wilt disease.

The forest tent caterpillar is a native insect that can defoliate entire stands of northern red oak. Outbreaks usually cycle over a 10 to 12-year period, remaining high for 2 to 4 years before dropping to lower levels due to harsh weather, predation, disease, and/or starvation. Mortality of host trees generally occurs when populations interact with other disturbances and/or stresses, e.g., as drought and insect outbreaks.

The two-lined chestnut borer was responsible for the most recent large-scale dieoff of northern red oak in the County Forest during the summers of 2002-04. The borer feeds beneath the bark and girdles the stem, eventually killing the tree. Trees that are weakened by overcrowding, drought, mechanical damage, and/or other stresses are targeted. To minimize borer damage, stands should be regulated aggressively to maintain vigor and residual damage, cause by harvesting operations should be avoided. As of 2006, no known populations of gypsy moths have been observed in Douglas County. However, gypsy moth is common in the eastern and central regions of the State and is predicted to expand its range westward over the next 15 years.

Like the gypsy moth, oak wilt has not been observed in Douglas County as of 2006. However, is has been recorded in neighboring Burnett County and nearby Polk and Barron Counties and is expected to enter Douglas County within the next 15 years. Oak wilt is an aggressive disease that infects and kills northern red oak by plugging water-conducting vessels in the stem. Rapid leaf discoloration and wilting beginning at the top of the crown are common symptoms. The fungal pathogen moves from tree to tree underground through the root system or overland by insect carriers. To minimize infections, stands should not be harvested from mid-April through mid-July. Infected stands should be harvested promptly along with adjacent healthy stands before the spring following an outbreak to minimize progression of the disease.

Several techniques have been used on the Douglas County Forest to produce healthy stands of northern red oak that can resist insects and diseases for as long as needed to maintain a vigorous and fully stocked conditions. Successful regeneration became one of the priorities for oak management in the late 1980’s. Shelterwood harvests, undulating harvest edges, and encouraging stump sprouting have been attempted. Additional site preparation-techniques before, during, and after harvesting have been prescribed along with seasonal harvest restrictions coinciding with acorn dispersal. Fire has been incorporated as a management tool for regeneration. Better site identification and identifying all the major stresses that can have detrimental effects on a stand of oak over its lifetime is a focal point of management.
The goal for oak management on the Douglas County Forest is to continue improving the health of oak stands and reduce stresses through proper management. Stand densities, age class distributions, competing vegetation, and seedbed preparation can be controlled by intermediate thinning, regeneration harvests, and site-preparation techniques. Oak management over the next 15 years will focus on maintaining the current oak acreage and expanding the oak type on sites that are best suited for developing healthy stands.

### 830.1.4(a) Historical Acreage Trends

Northern red oak acreage on the County Forest has increased steadily since 1977. Overall, there has been a 50-percent increase (1,736 acres) in the northern red oak acreage from 1977 to 2006 (Fig. 830.14).

![Figure 830.14](image)

**Figure 830.14**

*Northern Red Oak Acreage Trends on the Douglas County Forest 1977 to 2006*

The majority of this increase is attributed to natural conversion from paper birch to northern red oak. Northern red oak is a longer lived and more tolerant than paper birch. When both of these species occupy a stand without management, the primary birch component generally will deteriorate initially and the secondary type of northern red oak will naturally convert to the primary type. Another reason for this increasing trend can be traced to errors in the County’s forest inventory data over time. Where data later was connected following field reconnaissance.

Trends for the northern red oak type not only in Douglas County but throughout the northern Great Lakes Region, indicate a gradual decrease in acreage over time. This prediction is based on a
combination of factors, the most notable of which is the absence of natural fire regimes due to human activity that has lead to poor natural regeneration. The inherent complexities in regenerating northern red oak on a consistent basis without the use of fire presents a significant challenge to forest managers. Without fire, the Forest should continue to progress naturally from more early- and mid-tolerant species (northern red oak) to later successional, longer lived, tolerants like sugar maple. Another significant factor in the predicted decline of northern red oak is an increase in both the type and severity of damaging agents such as the two-lined chestnut borer, gypsy moth, and oak wilt disease. Finally, climate changes and the resulting increase in severe weather events, particularly drought and windstorms, are also expected to be contributing factors in the predicted decline of northern red oak.

Over the past several years it has become evident how fragile the County’s oak resource can be when faced with a multitude of stresses. Destructive hail, harsh summer droughts, repeated defoliation by the forest tent caterpillar, and devastating infestations of the two-lined chestnut borer have contributed to the exceedingly high oak mortality rates throughout Douglas County in recent years.

830.1.4(b) Current Status (2006)

As of 2006, there were 5,197 acres of manageable northern red oak on the Douglas County Forest. Northern red oak accounts for about 1.9 percent of the total forested acreage. Because of its average age and condition on the forest, northern red oak is a priority “managed for” species on the County Forest (see Appendix D-III for the location of the northern red oak timber type on the Douglas County Forest).

Secondary timber types are in association with 84 percent of the northern red oak stands on the Forest, (Fig. 830.15 making silvicultural prescriptions for other species a viable management option when managing for the oak type is impractical and/or unfeasible. Distinct secondary timber types include northern hardwoods (2,331 acres), paper birch (1,528), and aspen (278). Without management, the northern hardwood secondary type will continue progressing toward a primary type and the oak component will decrease through natural succession.
Stands of northern red oak on the Douglas County Forest are primarily at maturity. About 90 percent of the total acreage is at least 70 years old. Figure 830.16 shows the total northern red oak acreage as of 2006 by 10-year age classes. The relative spike in the 0-9 class can be attributed to increased oak recruitment resulting from greater focus on managing specifically for northern red oak regeneration in recent years.
830.1.4(c) Desired Future Condition

The primary long-term goal for oak management on the Douglas County Forest is to aggressively maintain as much of the northern red oak acreage as possible and to evenly distribute age classes over a 90-year period. To maintain as much of the current northern red oak acreage as possible, it will be necessary to ensure that silvicultural treatments and annual harvest levels encourage healthy, vigorous stands that withstand attacks by damaging agents. Another goal, though opportunities generally are limited, is to expand the northern red oak type on the Forest, particularly on sites that are well-suited to oak management. Once a stand of northern red oak has converted naturally toward more tolerant, longer lived species, it is difficult to manage for oak because of the inherent complexities in the natural regeneration of these species.

Primary concerns in managing northern red oak on the County Forest, and in forests throughout the northern Great Lakes Region are discovering the absence of natural fire regimes due to human suppression activities, the many complications associated with planning and carrying out prescribed burns, the increase in both type and severity of damaging agents, and the natural succession to northern hardwood. Because the natural regeneration of northern red oak on a large scale has proven difficult, the DCFD has proceeded cautiously in prescribing harvest and site-preparation techniques in recent years.
830.1.4(d) Management

On the County Forest, northern red oak typically is a component within stands of paper birch, aspen, and northern hardwood. Northern red oak is dominant in some stands but pure stands are prevalent due to the absence of catastrophic fires. Northern red oak management on the Douglas County Forest will focus on regenerating healthy, vigorous stands where the site quality is fair to good and the potential for competition with aggressive species (aspen) is low. This includes attempting to maintain stands currently dominated by northern red oak and to convert northern hardwood stands where northern red oak is a secondary component but has potential to be the primary type. It is important to retain northern red oak as a minor associate of other timber types as much as possible.

Natural single-stem regeneration from seed (acorns) is the preferred method of establishing a new stand when managing for the northern red oak type on the Douglas County Forest. Stump sprouting is common and is a good choice when a secondary management objective is to maintain northern red oak as a minor component or when salvaging trees following insect and/or disease outbreaks. Recent with northern red oak regeneration harvests on the Forest indicate that site preparation in the form of scarification or prescribed burning provides favorable conditions for natural seed regeneration of northern red oak. Both mechanical scarification in the form of preharvest blade scarification and whole-tree skidding during harvests have proven effective. The best results for mechanical site preparation and subsequent regeneration occurred when scarification was performed during the fall in conjunction with acorn dispersal. This allowed the acorns to be mixed with or fall on top of bare mineral soil that was relatively free of competing vegetation. Carefully timed postharvest prescribed burning also has demonstrated its importance as a critical tool for preparing the seedbed and encouraging oak regeneration while reducing competition from shade-tolerant species. Burning usually is conducted during the spring or fall, the latter generally is favored for a hotter burn, because the presence of fallen deciduous leaves temporarily increases ground-layer fuels.

(1) Applicable Silvicultural Treatments

Northern red oak is managed with even-age silvicultural practices on the County Forest. In general, clearcutting is not an authorized harvest option when managing for northern red oak on the Forest unless objectives are to retain oak as a minor stand component (typically of stump sprout origin), species conversions, or when salvaging trees following outbreaks of damaging agents. The shelterwood method in conjunction with site preparation is the preferred silvicultural system for regenerating northern red oak on the Douglas County Forest. On good to excellent sites where individual trees exhibit good quality and vigorous growth and sawlog development is an objective, an intermediate entry in the form of thinning may be a viable alternative. The following are general guidelines used by the DCFD to manage northern red oak on the County Forest.
(A) Even-Age Management

Even-age 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 factors such as mean age, maximum tree size, mean annual increment, and economic or biological maturity. Typical rotation ages for northern red oak stands on the Douglas County Forest range from 75 to 120 years. Some of the factors that influence the decision of when to manage a stand for regeneration of northern red oak are current stand conditions (percentage of poor-quality and/or diseased trees), site potential, and species composition. The following methods are used to regenerate northern red oak.

(1) Intermediate Harvest

If the long-term goal is to manage a stand of northern red oak for sawlog development (site index greater than 55), but the stand is not yet ready to be regenerated, an intermediate harvest in the form of a crop-tree release thinning may be prescribed. This entails favoring dominant oak stems of seed origin and quality oak sprouts of stump origin while discriminating against or removing stems with poor form and vigor and undesirable species such as shade-tolerant sugar maple. Target stocking levels may vary slightly but generally range from 80 to 90 ft$^2$ of basal area per acre depending on the average quadratic mean stand diameter and species composition. Trees generally are marked for removal or to cut rather than to leave. Following thinning, the residual oak stems should build strong crowns that will aid in resisting environmental stresses, reduce epicormic branching following later harvests, and increase acorn production. Intermediate thinnings can be repeated in the same stand of oak several times over its lifetime. On dry-mesic sites, northern red oak should be thinned before age 50 and before stands become overstocked. On mesic sites, this age can be extended to 60 years. If stands are not thinned and allowed to become overstocked, the result will be an appreciable reduction in relative crown size, increased susceptibility to damaging agents, and an inability to respond favorably to release. Thinning frequency will vary depending on the growth potential of the site, rotation age, and residual stocking following the previous harvest, typically 15 to 30 years as the trees continue to grow.

(2) Two-Cut Shelterwood

The two-cut shelterwood harvest regenerates the stand with an initial regeneration harvest (first cut) and then releases the established regeneration with an overstory removal (second cut). The overstory serves to modify understory conditions to create a favorable environment for regeneration and provide a seed (acorn) source. A secondary function of the overstory is to allow additional development of quality residual stems during seedling establishment. A successful shelterwood harvest to regenerate northern red oak requires the removal of most if not all intermediate or suppressed saplings and poles because the smaller understory trees will suppress the development of vigorous oak seedlings. A three-cut (or more) shelterwood with intermediate thinnings before the regeneration harvest may be effective on good to excellent sites where individual trees exhibit good quality and vigorous growth, and where sawlog development is an objective.
The following is the preferred procedure for regenerating stands of northern red oak by the shelterwood method on the Douglas County Forest:

(1) In the initial harvest, leave 50 to 70 percent residual crown cover, evenly distributed, in northern red oak stems the best form and vigor. Since oak has great genetic variability, it is important that the most desirable stems (form and quality) be left for seed. Generally, the better the site, the more residual crown cover to leave. Paper birch, yellow birch, and basswood are good species to leave when northern red oak is unavailable. If aspen is a component, leave as many as possible (within crown-cover parameters) to discourage root suckering.

(2) During the late summer into the fall, scarify the site, mechanically and/or with a prescribed burn before the harvest or during the harvest (by whole-tree skidding) to expose mineral soil and reduce vegetative competition. The total disturbance area should be 50 to 75 percent. Generally, the greater the area and intensity of disturbance, the greater the potential for northern red oak regeneration. It is essential that site preparation be coordinated with a good acorn crop for successful regeneration. To improve the potential for natural seed germination, time the scarification and if possible, the initial harvest, with acorn drop (September to December) when the ground is neither frozen nor snow covered. If the initial harvest is completed in a year with a poor to fair acorn crop, site preparation can be postponed or performed post-harvest when a good acorn crop is anticipated during the same seasonal period.

(3) Monitor the establishment of desired northern red oak seedlings and consider controlling competing vegetation when a large percentage of oak seedlings is overtopped by undesirable species. Apply as many as three prescribed burns following the initial harvest to control competing vegetation and maintain favorable seedbed conditions. Intermediate fire frequency will allow fuel to accumulate and better control of undesirable species. Once adequate advanced oak stocking is established (see WDNR Silviculture Handbook), remove the overstory when the ground is frozen and snow covered to reduce potential damage to desirable seedlings.

(2) Determining Annual Allowable Harvest Levels

Table 830.5 shows the range of rotation ages used to manage northern red oak on the Douglas County Forest.

<table>
<thead>
<tr>
<th>Early Rotation Age</th>
<th>Standard Rotation Age</th>
<th>Extended Rotation Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 years</td>
<td>90 years</td>
<td>120 years</td>
</tr>
</tbody>
</table>

The standard average age of rotation for northern red oak on the Douglas County Forest is 90 years depending on site quality. Northern red oak stands growing on higher quality sites with good to
excellent relative growth potential and managed for sawlog production can be extended to 120 years before being regenerated. Conversely, stands that are developing on poor sites being managed for firewood or pulpwood production and/or are exhibiting signs of decline can be regenerated at 70 years.

Because of the current unbalanced age class distribution, i.e., northern red oak is not in a regulated condition, many variables must be considered when determining harvest levels. To reach a fully regulated condition, by which each age class contains approximately the same acreage, the annual allowable harvest must be adjusted constantly to compensate for the current age class distribution.

Over the next 15 year’s, the goal of northern red oak management on the Douglas County Forest will be to maintain and enhance the current acreage, attempt to expand the oak type where appropriate, and strive toward a regulated condition. Because of the current unbalanced age class distribution and average lifespan of northern red oak on the Forest, achieving a fully regulated condition may require multiple rotations. Some of the variables that could alter northern red oak harvest levels are; an unbalanced age class distribution, a rapid increase in mortality from insects, disease, drought, etc., natural disturbance, and improved inventory data. See Chapter 1000 for the estimated annual harvest levels (acres) of northern red oak over the next 15 years.

Because of its decline throughout the northern Great Lakes Region, northern red oak is a high-priority species for examining new management practices and silvicultural treatments that promote regeneration.

830.1.5 SCRUB OAK

Douglas County scrub oak is primarily offsite northern red oak and northern pin oak with some bur oak and white oak in areas to the south. Northern red oak and northern pin oak hybridize readily and have been classified as one species type. Scrub oak also is known locally as sand oak.

The history of scrub oak follows that of many oak stands on the Douglas County Forest in that fire played an important role in its development. Scrub oak developed on the droughty sand outwash plains in the southern and eastern regions of the County Forest. Stands of scrub oak range from pure oak to mixtures of oak and aspen, oak and jack pine, and on some better sites, oak, birch, and red maple.

In the past, these sites had low priority for harvesting. Stands with the lowest site indexes and poorest stocking levels were identified as nonproductive and were scheduled for artificial conversion to jack pine or red pine. Because many of these stands were abandoned agricultural lands and/or heavily burned during the early 1900’s, it was relatively easy to plant and establish these areas in productive and more desirable pine types. These were some of the earliest plantations in the County Forest dating back to the late 1930’s. Today, most of those original plantations are still found on the Forest and they have a natural appearance. By the late 1950’s, more than 1,000 acres of these nonproductive scrub oak lands were converted to valuable pine plantations.
Economics and market conditions during the 1930’s and 1940’s also played an important role in the early management of many scrub oak stands on the Forest. At the time, it was not economically feasible to remove the non-merchantable stems, perform site preparation, and plant all of the scrub oak stands in more desirable pine species. During the 1950’s, money for conversion of scrub oak to red pine was available for management on better sites or those on which the jack pine component had been harvested. Scrub oak stands that contained a merchantable aspen component were harvested followed by aspen enhancement and expansion projects to convert the stand to the aspen type. Many nonproductive scrub oak stands on poorer sites never were scheduled for management. The goal was to allow these stands to continue maturing, in hopes of eventually finding a market. Some of these stands remain in an unmanaged condition on the Forest today.

In the mid-1980’s, a market for fuelwood developed in northern Wisconsin. Mixed stands of scrub oak and other species were advertised for sale and harvested for chips. As the practice of buying low-value forest products and chipping them for fuelwood continued to grow, stands of scrub oak were revisited and some were established for sale. This fuelwood market provided sufficient economics to harvest stands of nonproductive scrub oak, perform site preparation, and convert to red pine or jack pine types.

From the 1990’s to the present, many of the scrub oak stands not scheduled for management continued to mature and some began to deteriorate as they became over-mature. Conversion to the red pine or jack pine types continued on some of these sites. During the last decade many of the non-converted, over-mature scrub oak stands have shown detrimental effects resulting from increased susceptibility to insects, diseases, and environmental stresses. Scattered areas of scrub oak mortality, some of considerable size, have become more prevalent throughout the County Forest.

The late 1990’s also brought an important shift in the management direction of the scrub oak type. Scrub oak stands on higher quality sites with good to excellent growth potential were managed specifically for that type. This shift in management direction is based primarily on the importance of scrub oak in providing breeding and foraging habitat for wildlife.

830.1.5(a) Historical Acreage Trends

Scrub oak acreage on the Forest declines steadily from 1977 until the 1990’s and then began to increase. Overall, there was a 19-percent decrease (882 acres) in scrub oak acreage from 1977 to 2006 (Fig. 830.17).
The major reason for the initial decrease in acreage was the conversion of scrub oak stands after they had been harvested to species such as red pine, jack pine, and aspen. The increase over the last decade is attributed to the previously mentioned shift in the management direction of scrub oak stands on higher quality sites with good to excellent growth potential, and the natural successional conversion from jack pine to scrub oak. Scrub oak is longer lived and more tolerant than jack pine and when both of these species occupy a stand with no disturbance, the primary jack pine component generally will convert to the scrub oak type.

Like northern red oak, future trends for the scrub oak type on the Douglas County Forest show a gradual decrease in acreage over time. Maintaining brushy, poorly formed scrub oak stands for wildlife habitat may be more practical and feasible than maintaining stands for timber production with a high percentage of large, single-stemmed trees. The absence of natural fire regimes due to human activity has lead to poor natural regeneration. Other than stump sprouting following harvest, regeneration of scrub oak has been inconsistent.

Scrub oak stands on poorer sites still will be considered for conversion to more productive timber species. Also, with higher priority given to maintaining the jack pine type on the Forest in recent years, fewer stands will convert naturally to the longer lived, more tolerant scrub oak type. Another significant factor in the predicted decline of scrub oak is the increase in both the type and severity of damaging agents such as the two-lined chestnut borer, gypsy moth, and oak wilt disease. Finally, climate changes and the resulting increase in severe weather events, particularly drought and windstorms, are expected to contribute to the predicted decline of scrub oak.
830.1.5(b) Current Status (2006)

As of 2006, there were 3,820 acres of manageable scrub oak on the Douglas County Forest. Scrub oak accounts for about 1.4 percent of the total Forested acreage (see Appendix E-III for the location of the scrub oak timber type on the Douglas County Forest).

Five secondary timber types are in association with 37 percent of the scrub oak stands on the Forest (Fig. 830.18), making silvicultural prescriptions for other species a viable management option under certain conditions. Distinct secondary types include; non-commercial, i.e. upland brush (608 acres), aspen (365), and jack pine (308).

Figure 830.18
Secondary Types Associated with Scrub Oak on the Douglas County Forest (percent)

The age class distribution for scrub oak on the Douglas County Forest is distributed relatively evenly from age 20 to 70. Figure 830.19 shows the total scrub oak acreage as of 2006 by 10-year age classes. Historically, the scrub oak type has not been managed in a highly regulated condition and the current age class distribution is a primarily a result of the red pine and jack pine planting program where mixed stands of planted pine and scrub oak developed following harvest. Scrub oak may be the primary type of many of these stands but management is directed toward jack pine or red pine. Fewer acres in the 0 to 19 class can be attributed to a more aggressive site preparation program over the last 20 years where advances in machinery and other technology provide greater control over scrub oak following harvests. The result is less competition from scrub oak and other woody vegetation and better survival rates in pine plantings.
830.1.5(c) Desired Future Condition

The primary long-term goal for scrub oak management on the Douglas County Forest is to regulate the scrub oak type, evenly distributing age classes to ensure a continuous supply of timber over time. The primary short-term goal is to identify scrub oak sites that will be maintained in and managed for that species. These sites will be of higher quality and have good to excellent growth potential for scrub oak. Sites with poor to fair growth potential will be considered for conversion primarily to red pine, jack pine, or aspen. Although conversions will continue, the amount of acres converted should continue to decrease over time as conversions take place.

Another goal is to maintain a scrub oak component on the Forest in a primary or associate role. It is important to retain scrub oak as a component of other timber types particularly because this species provides habitat for wildlife. Scrub oak acreage is dwindling throughout the northern Great Lakes Region, so it is in the County’s interest to maintain this type on appropriate sites.

830.1.5(d) Management

On the Douglas County Forest, scrub oak typically is a component within stands of jack pine, red pine, aspen, and to a lesser extent red maple and paper birch. Historically, stands of scrub oak containing a large percentage of seed origin stems have developed with a mix of other species...
following, catastrophic fires. Over time, many of these shorter lived associates (jack pine) have deteriorated in these mixed stands while scrub oak has become more dominate. Today, stands of scrub oak mixed with other species are developing primarily through stump sprouting following harvest where the percentage of seed origin stems has decreased dramatically in the absence of fire.

Management of scrub oak within the County Forest will focus on regenerating healthy, vigorous stands where the site quality is good to excellent for the scrub oak species and the potential for competition from aggressive species (aspen) is low. Sites with poor to fair growth potential will be considered for conversion primarily to red pine, jack pine, or aspen while maintaining a scrub oak component.

(1) Applicable Silvicultural Treatments

Even-age management is the primary silvicultural system for managing scrub oak on the Douglas County Forest. In general, clearcutting is the most common regeneration method for most scrub oak stands. Experience has shown that this treatment yields the most productive and vigorous scrub oak regeneration through vegetative stump sprouting. Clearcutting, in conjunction with site preparation to control competing vegetation and/or prepare the seedbed is the preferred treatment method when planning to convert a stand of scrub oak to a more productive timber species.

On good to excellent sites, the DCFD may attempt to use the shelterwood method in conjunction with site preparation to regenerate scrub oak from seed. On some of the best sites where individual trees exhibit good quality and vigorous growth and the development of high-quality stems is an objective, an intermediate entry in the form of thinning may be a viable alternative. The following are general guidelines used to manage scrub oak on the Douglas County Forest.

(A) Even-Age Management

Even-age silvicultural systems are designed to maintain and develop a single age class of trees. Stands are regenerated at a selected rotation age. Typical rotation ages for scrub oak stands on the Douglas County Forest range from 45 to 90 years depending on a variety of factors that can influence the decision as to when to manage a stand. Some of these include, current stand conditions (percentage of poor-quality and/or diseased trees), site potential, conversion considerations, and species composition.

(1) Intermediate Harvest

If the long-term goal is to manage a stand of scrub oak for high-quality stems (site index greater than 50) but the stand is not yet ready to be regenerated, an intermediate harvest in the form of a crop-tree release may be prescribed. Thinning methods generally follow the same procedures used with the northern red oak type.
(2) Clearcutting

This method is used when attempting to regenerate a stand of scrub oak from stump sprouting on fair to poor sites on the County Forest. Clumps of large-diameter trees may be retained for wildlife and/or aesthetic purposes so long as they meet management objectives. These clumps should be large enough so that the remaining area can be managed separately as a stand. When applied with adequate site preparation, clearcutting is the preferred treatment when converting a stand of scrub oak to a more productive timber species.

(3) Two-Cut Shelterwood

Although opportunities may be limited, this method is a good option when attempting to regenerate the scrub oak type from seed on good to excellent sites. Shelterwood harvests generally follow the same procedures used with northern red oak. These include; the initial cut, site preparation before, during, or after harvesting, and overstory removal.

(2) Determining Annual Allowable Harvest Levels

Table 830.6 shows the range of rotation ages used to manage scrub oak on the Douglas County Forest.

<table>
<thead>
<tr>
<th>Early Rotation Age</th>
<th>Standard Rotation Age</th>
<th>Extended Rotation Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 years</td>
<td>60 years</td>
<td>90 years</td>
</tr>
</tbody>
</table>

The standard average age of rotation for scrub oak on the Douglas County Forest is 60 years depending on site quality. There are stands that may be left well past a rotation length of up to 90 years primarily for wildlife purposes and/or aesthetic purposes. Examples include travel corridors, protective cover, species diversity, and visual screens. Some stands may be harvested at an earlier rotation age to maintain sites in a more “brushy” condition that provides high-value wildlife habitat, e.g., dense cover, browsing areas, and nesting sites.

Many variables must be considered when determining harvest levels of scrub oak. To reach a fully regulated condition by which each age class contains about the same acreage in stands that are managed specifically for a primary scrub oak type, the annual allowable harvest must be adjusted constantly.

Over the next 15 years, the goal of scrub oak management on the Douglas County Forest will be to identify sites where scrub oak will be maintained as the primary type and strive toward a more regulated condition with scrub oak acreage. Unlike many other timber species on the forest, scrub
oak has a less economic value so management may be limited compared to other species. See Chapter 1000 for estimated annual harvest levels (acres) of scrub oak over the next 15 years.

830.1.6 RED PINE

Red pine is an ecologically and economically important species on the Douglas County Forest. It is regionally important to both the pulp and paper and dimensional lumber industries. Mature stands with good structure provide valuable wildlife and aesthetic benefits.

During the late 1890’s and early 1900’s, large-diameter red pine were highly desirable by lumbering companies and were removed from the landscape. Many of these stands naturally seeded and regenerated themselves following harvesting. By the early 1900’s, there were large acreages of red pine in the younger size classes while the older classes were being heavily depleted by overharvesting. Between 1900 and the 1930’s, many uncontrolled wildfires burned throughout Douglas County destroying entire stands of the younger red pine regeneration. Mature seed source trees became scarce and red pine nearly became non-existent on the County Forest. Today’s red pine that are more than 100 years old developed from isolated stands that avoided harvest and/or were on scattered, unburned areas.

It was recognized early in the history of the County Forest that many areas were well suited to red pine. This species was introduced to the Forest in 1939 when 51 acres were planted by hand. By 1954, 1,584 acres of red pine had been planted and approximately 28,000 acres of forest land consisting of open grassland, upland brush, and scrub oak conversions were recorded as possible planting sites. Planting took on a high priority and in 1955 the County purchased a wildland planter, the first such machine used on any County Forest in Wisconsin. As a result, 1,495 additional acres of red pine were machine planted by 1965.

By the 1970’s and continuing into the 1980’s, much of the red pine was being planted by contract machine planters (mostly Olson Bros of Brule, WI). Limited hand planting was being done by high school students, Boy Scouts, members of the Wisconsin Civilian Conservation Corps, prison inmates, and local residents who worked as volunteers or at minimum wage. Commercial hand-planting crews became more common in the 1980’s and along with minimal site preparation by mechanical means (Bracke scarifier, Leno scarifier, and disc-trenchers), cutover sites could be planted without waiting for stumps to “soften” (rot) enough to allow machine planting. Contract hand planting, initiated on Douglas County Forest in 1989, reduced associated costs while getting the job done more efficiently by companies specializing in such work. Contract planting continues to be the preferred planting method on the Forest.

Many sites that were planted to red pine previously had been considered non-productive. Red pine plantations on these sites have been established by many methods over the years. Sites were burned or cleared with larger crawler-type tractors and planted in furrows left by the tractors or wildland planted. Beginning in 1955, sites with the heaviest vegetative competition were treated with herbicides (2 4-D or 2, 4, 5-T) by aerial application. These sites consisted mostly of red pine
plantations overtopped by undesirable scrub oak. By 1964, herbicide had been identified as the most effective and cost efficient method on the Forest (less than $5 per acre) to control deciduous vegetation and create planting areas. In 1964 alone, 400 planting acres were created through the effective use of herbicides. Old homesteads were some of the richest and easiest sites to plant because little to no site preparation was needed. Each new plantation took on the name of the previous land owner, e.g., the Frahm plantation. Most of the names have since been lost to history due to the changing manpower and longevity of red pine.

Between 1955 and 1980, planting on the County Forest was almost exclusively to red pine when 4,819 acres were planted compared to only 30 for jack pine. Goals of the planting program were to plant large areas where possible as managing fewer large blocks was easier than scattered small areas, and to incorporate fire breaks and access roads around and throughout the plantations for fire protection. From the date of the first planting in 1939 through 2006, more than 11,000 acres of red pine have been planted throughout the Douglas County Forest.

The earliest plantations from the 1940’s were first entered and thinned during the 1970’s. Stands as young as 25 years old were thinned. Penta Wood Products of Siren, Wisconsin was the primary market for these first thinnings. The cut products were used to produce treated posts and poles. Penta, which operated from 1953 until about 1990 (with the heaviest production during the 1960’s and 1970’s), bought both cut products from Douglas County Forest producers and stumpage which their own crews produced. Pulp mills using red pine (such as Mosinee Paper Co.) also consumed a portion of this thinned red pine volume. By 1980, Penta’s production was dropping and red pine “juvenile” wood was causing many problems with pulping and papermaking processes in regional mills. The market for red pine crashed and the juvenile wood that made up the bulk of the harvested products from these first thinnings was identified as the cause of the problem. Mills stopped taking deliveries of young red pine and with no market, first thinning entries in red pine plantations on the Forest came to a halt. By the late 1980’s, mills had developed advanced technologies capable of utilizing the younger red pine fiber and markets opened up. The DCFD was able to again treat plantations through the sale of forest products that continues today. On average, red pine stumpage has brought the greatest price of all species offered for sale on the Douglas County Forest over the last two decades.

830.1.6(a) Historical Acreage Trends

Red pine acreage on the Douglas County Forest increased steadily from 1954 to 2006. Currently, red pine acreage on the Forest (10,812 acres) is more than eight times that in 1954 (Fig. 830.20).
Most of this increase is attributed to the conversion of old agricultural sites and stands of scrub oak and jack pine to red pine plantations. Future trends for red pine show a continued increase in acreage although at much reduced rates, and a general leveling due to a decrease in conversion acreage. Red pine is less susceptible to damaging agents than jack pine and white pine. However, severe weather, fire, overbrowsing, insects, diseases, and road salt can injure red pine and cause localized and/or widespread mortality.

830.1.6(b) Current Status (2006)

As of 2006, there were 12,228 acres of manageable red pine on the Douglas County Forest. An additional 97 acres have been classified as unmanageable due to site sensitivities or proximity to streams and lakes. Red pine accounts for about 4.5 percent of the total forested acreage (see Appendix F-III for the location of the red pine timber type on the Douglas County Forest).

Of the 12,325 acres of red pine on the Forest, 26 percent (3,228 acres) are of natural seed origin and 74 percent (9,097 acres) are of plantation seedling origin that were planted by hand or machine (Fig. 830.21). Conversions from many of these artificially planted plantations to natural stands will be attempted once they reach rotation age.
Secondary types are in association with 38 percent of the red pine stands on the Forest (Fig. 830.22). Distinct secondary types include noncommercial, i.e., upland brush (1,832 acres), scrub oak (1,357), jack pine (764), and aspen (482). Although these species may provide a limited option for alternative silvicultural prescriptions, primarily conversions, converting the red pine type usually is discouraged on the Douglas County Forest. Some of these species are deliberately maintained as secondary types in red pine stands because of the valuable ecologic and wildlife values they provide.
The age class distribution for red pine on the Douglas County Forest is distributed relatively evenly until age 70. The 10 to 19 and 20 to 29 age classes have moderate spikes in acreage that can be attributed to the aggressive planting program from the late 1970’s to the mid-1990’s that focused on red pine as the preferred species. Figure 830.23 shows the total red pine acreage as of 2006 by 10 year age classes. Stands older than 70 years are natural stands that still are managed today. Currently, the DCFD continues to plant red pine each year, though the planting program since 2002 has focused on reestablishing jack pine and reducing the amount of converted jack pine acres to red pine. Compared to jack pine, red pine generally has an economic edge and is less susceptible to deer browsing and widespread insect damage.
The most significant threat to red pine on the Forest is a disease complex that includes several species of root rot and lower stem feeding insects along with their fungal symbiants commonly referred to as red pine pocket decline. Many areas in Wisconsin have seen a dramatic increase in the number of pockets observed in stands of red pine since 2002. Once introduced, fungal hyphae spread through the extensively grafted root system of red pine stands, stressing new trees. These otherwise healthy trees then become susceptible to attack by the red turpentine beetle and other bark beetles, which creates an expanding border of stressed and dead trees. Unless root grafts are severed, harvesting symptomatic trees will not halt the spread of the fungus to healthy trees. The WDNR is investigating new treatments and management approaches to control its spread.

830.1.6(c) Desired Future Condition

The long-term management goal for red pine on the Douglas County Forest is to bring the age class distribution closer to a regulated, evenly distributed condition and to aggressively maintain the current acreage in a healthy and vigorous state. Another goal is to reduce the conversion of jack pine and scrub oak stands to red pine plantations. Conversions to new red pine plantation acres should increase only slightly in the future. This increase will be attributed to planting failed jack pine sites and poorly stocked scrub oak stands consisting of mostly upland brush. The DCFD also
will maintain red pine and jack pine in a diverse patchwork of stands across the Forest and attempt to convert artificial plantations to natural stands once they reach rotation age through natural-regeneration methods.

830.1.6(d) Management

Management of red pine on the Douglas County Forest will focus on establishing healthy, vigorous stands through artificial planting or natural regeneration from seed. This will include attempting to maintain current plantations and natural stands and converting other sites on a limited basis through forced type maintenance. It is not uncommon for red pine to occur within many others species types throughout the Forest and many of these scattered trees and small clumps are reserved when managing for these other types. Red pine is important to wildlife and aesthetics and should be retained as a minor associate as much as possible. Most sites on the Forest have good to excellent potential for growing large-diameter, high-quality red pine and should be managed for long-term sawtimber production.

(1) Applicable Silvicultural Treatments

Red pine is managed with even-age silvicultural practices on the Douglas County Forest. Clearcutting generally is not an authorized harvest option when managing for red pine except for species conversion or when salvaging trees following outbreaks of damaging agents. Intermediate entries in the form of thinnings leading to a shelterwood harvest, along with site preparation is the preferred silvicultural practice for red pine on the Forest.

Site preparation in the form of scarification or exposure of mineral soil is essential for natural seed regeneration of red pine. Mechanical scarification is preferred, prescribed burning may provide acceptable results. An adequate seedbed for the germination, establishment, and recruitment of red pine is prepared by mixing mineral soil with organic and/or humus material on 50 to 75 percent of the area. An additional benefit of site scarification is the initial control of competing vegetation. The best results for site preparation and subsequent regeneration have occurred when the scarification was 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 of competing vegetation. The guidelines are used by the DCFD managing red pine.

(A) Even-Age Management

Even-age 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 depends on factors such as mean age, maximum tree size, mean annual increment, and economic or biological maturity. Typical rotation ages for red pine stands on the Douglas County Forest range from 75 to 150 years. Factors that can influence the decision as to when to manage a stand for the regeneration of red pine include but are not limited to current stand conditions (percentage of poor-quality and/or diseased trees), site potential, and species composition.
CHAPTER 800: INTEGRATED RESOURCE MANAGEMENT

(1) Forced Maintenance (Planting)

Regenerating red pine naturally is unpredictable and difficult to achieve due to factors such as long periods between good seed years, seed consumption by rodents, adequate moisture supply, and sensitivity to temperature. Post harvest replanting is commonly used to establish pure stands on the Douglas County Forest. Challenging obstacles to successful establishment of red pine plantations are vegetative competition, the diplodia fungus, and severe weather patterns of recent years.

Where a red pine plantation is planned entails intensive site preparation in the form of disk trenching, Bracke scalping, or tractor furrowing to control competing vegetation and prepare an area for seedling development. This type of preparation alone rarely provides adequate control of competing vegetation. Many sites first require aggressive mechanical preparation in the form of roller-chopping.

Actual planting is in early spring and is accomplished by hand planting preferably 2-year old stock seedlings at an approximate spacing of 9 by 6 feet (about 807 trees per acre). The importance of maintaining an adequate width (9 feet) between rows is evident when plantations are entered later for thinning and must be able to accommodate large harvesting equipment. Sites are monitored for seedling survival until about age 5. Sites can be affected by severe weather patterns and be severely damaged by the diplodia fungus. The entire red pine acreage planted in 2004 through 2006 incurred as much as 45 percent mortality due to harsh conditions resulting from drought during the summer months. The diplodia fungus causes shoot blight and stem canker of red pine in plantation stock. It usually attacks seedlings stressed by one or more of the following factors: poor site, drought, hail damage, snow damage, mechanical wounds, and insect activity. Diplodia causes tree mortality by killing the new foliage or by initiating girdling stem cankers on stressed trees. Because they are so fragile and sensitive, nursery seedlings die in the first year of infection. To control new infections, avoid planting infected nursery seedlings, do not plant red pine on poor sites, and minimize stresses that affect seedlings.

Of the many sites scheduled for replanting each year, some require an additional site-preparation treatment to control the advancing competing vegetation. Once a red pine plantation is established at more than 400 stems per acre (well established is at least 600 stems per acre), some sites will require yet another entry to further control advancing competing woody vegetation that can overtop young pine seedlings. Timber stand improvement (TSI) typically is performed by contracted crews using some type of mechanical hand brush saw to open and clear the area directly adjacent to each seedling in a circular fashion. Following this treatment, the plantation usually is left to develop until the first thinning entry.

(a) Alternative Planting Treatments

Although the use of herbicides currently is prohibited on the Douglas County Forest, this method of site preparation may need to be reexamined over the next 15 years as a possible solution to many of the current problems facing the planting program. Science and professional practice have demonstrated that herbicides are a safe and effective in managing forest vegetation. The benefits of
herbicides are evident: increased growth rates of crop trees, reduced fire susceptibility, improved wildlife habitat, easier access to timber stands, and control of invasive species. Herbicides can pose less of a risk to both living organisms and environmental resources than alternative methods for controlling vegetation and often require less energy to implement.

A typical planting site on the Douglas County Forest in 2006 required roller chopping of the entire site at approximately $155 per acre, disk trenching ($60 per acre), purchasing seedlings ($38 per acre), hand planting ($35 per acre), and a possible TSI treatment ($114 per acre). This initial cost ($300 to $400 per acre) is expected to continue to increase and failed sites often require more than one application of these steps. Incorporating the use of herbicides at approximately $100 per acre can significantly reduce total planting costs by nearly $200.00 or more per acre. In addition to the economic benefits derived from herbicide application this method has significantly reduced mortality and increased the growth of desired tree species by controlling vegetation that competes for light, water, and nutrients. Many neighboring forest managers have reported a substantial increase in survival rates in their plantings following the use of herbicide treatment(s).

(2) Intermediate Harvest

An intermediate harvest is an intermediate silvicultural treatment by which less desirable trees are targeted for removal primarily to improve composition and quality. Trees are removed before the stand is ready to be regenerated to encourage the growth of more desirable trees. This process entails favoring dominant red pine stems while discriminating against or removing stems of poor form and vigor and overstocked trees. Regular reductions of stand stocking to the lowest level at which full occupancy is maintained should result in the most rapid diameter growth than can be maintained without a loss in total merchantable volume yield.

Target stocking levels may vary slightly but generally are in the range of 90 to 140 ft² of basal area per acre depending on stand development and the average quadratic mean stand diameter. Red pine plantations typically are entered for a first thinning by a mechanical row treatment at approximately 30 years of age depending on basal area. Removing every third row (33 percent of the volume) is the preferred method, but removing every other row (50 percent of the volume) may be appropriate depending on stocking levels. 90 ft² of residual basal area per acre in red pine stems should be targeted for the first thinning entry. Subsequent thinnings generally occur every 10 to 15 years depending on the growth potential of the site, rotation age, and the residual stocking following the previous harvest. From 100 to 110 ft² of residual basal area per acre should be targeted for pole size (5 to 9 inches d.b.h.) stands, 120 ft² of residual basal area per acre should be targeted for small, sawtimber sized (9 to 15 inches d.b.h.) stands, and 140 ft² of residual basal area per acre should be targeted for large, sawtimber size (15+ inches d.b.h.) stands.

Trees are marked for removal or to cut rather than to leave. Following thinning, the residual stand should build strong crowns that should help the trees resist environmental stresses, add diameter growth to increase volumes for later harvests, and possibly increase seed production. Thinnings can be applied many times throughout the same stand of red pine over its lifetime to optimize growth and merchantable volume yield. If stands are not thinned and allowed to become overstocked, the
result is an appreciable reduction in relative crown size, decreased growth, increased susceptibility to damaging agents, and an inability to respond favorably to thinning. Thinning a stand too heavily or to the point at which it is understocked will result in an overall reduction in stand volume and growth over its lifetime.

(3) **Multi-Cut Shelterwood**

This method is preferred when managing and attempting to naturally regenerate the red pine type on the Douglas County Forest. Intermediate thinnings (initial cuts) before the regeneration harvest develop the desired crop trees needed for the shelterwood. The actual shelterwood harvest regenerates the stand with an initial regeneration harvest (first cut) and then releases the established regeneration with an overstory removal (second cut). The overstory serves to modify understory conditions to create a favorable environment for regeneration and provide a seed source. A secondary function of the overstory is to allow further development of quality residual stems during seedling establishment. A successful shelterwood harvest to regenerate red pine requires the removal of most if not all intermediate or suppressed saplings and poles because the smaller understory trees will suppress the development of vigorous red pine seedlings.

The following procedure is used by the DCFDto regenerate stands of red pine on the County Forest with the shelterwood method after they have been thinned periodically:

(1) In the initial harvest, leave 65 to 75 percent residual crown cover, distributed evenly, in red pine stems that having the best form and vigor. If aspen is a component, leave as many as possible (within crown-cover parameters) to discourage root suckering.

(2) During the late summer into the fall, scarify the site, mechanically and/or with a prescribed burn before the initial harvest to expose mineral soil and to reduce competing vegetation. The total area of disturbance should be 50 to 75 percent. Generally, the greater the area and intensity of disturbance, the greater the potential for red pine regeneration. It is essential that site preparation be coordinated with a good seed crop for successful regeneration. Good seed crops occur at intervals of 3 to 7 years with one bumper crop in every 10 years. To improve the potential for natural seed germination, time the scarification and if possible, the initial harvest, with seed dispersal (October to December) when the ground is neither frozen nor snow covered. If the initial harvest is completed during a poor to fair seed crop year, site preparation can be postponed or performed post-harvest when a good seed crop is anticipated during the same time period.

(3) Monitor the establishment of desired red pine seedlings and consider controlling competing vegetation when a large percentage of pine seedlings is overtopped by undesirable species. Remove the overstory when the ground is frozen and snow covered to reduce potential damage to established seedlings. Desired regeneration should be adequately stocked (400 stems per acre) and at least 2 to 4 feet tall upon release. Where there is low Diplodia risk, scattered residual overstory trees can be retained on the site (one tree for every 4 to 6 acres) to enhance aesthetic and/or wildlife values with little to no risk of adversely affecting the regeneration. If aesthetics are of critical
importance, consider retaining additional overstory trees after taking into account potential reductions in seedling growth and Diplodia risk.

(B) Uneven-Age Management

Although uneven-age management may be feasible on some sites, this method is seldom used on the Douglas County Forest and should be prescribed only to accommodate significant aesthetic concerns or other forest-dependent resources. If prescribed, the group-selection method is the preferred uneven-age system. With this method, trees are removed periodically in groups to create conditions that favor the regeneration and establishment of new age classes. In general, the openings are larger (1/4 to 1/2 acre) due to the relative intolerance of red pine. Openings will require site preparation for natural regeneration or artificial planting. Gaps usually are cleared of all noncrop trees and nonmerchantable material to remove competing vegetation. Structural diversity is promoted by scattering openings across the stand. During harvest entries and when openings are being created, thinning can occur throughout the remainder of the stand to improve quality and maintain space requirements for harvesting equipment.

Groups selected for harvest to create the openings usually are at rotation age for the stand. A common group-selection treatment for red pine is developing a stand structure guide that is based on a percentage of stand area. A maximum desired stand rotation age is set and this number is divided by the number of entries supported by growth rates in the stand. The percentage of acreage for each age class in the stand is relatively uniform across the stand. For example, a stand with a 150-year rotation age that can support entries every 30 years would have 20 percent in each of the five age classes represented. Although possible, uneven-age management of red pine by group selection is difficult and should only be used where aesthetics values are an important concern.

(2) Determining Annual Allowable Harvest Levels

Table 830.7 shows the range of rotation ages used to manage red pine on the Douglas County Forest.

<table>
<thead>
<tr>
<th>Early Rotation Age</th>
<th>Standard Rotation Age</th>
<th>Extended Rotation Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 years</td>
<td>90 years</td>
<td>150 years</td>
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The standard average age of rotation for red pine on the County Forest is 90 years depending on site quality. Red pine stands growing on higher quality dry-mesic sites with good to excellent relative growth potential can be extended to 150 years before being regenerated. Conversely, stands that are developing on dry poor sites and/or are exhibiting signs of decline can be regenerated at 70 years.
As they reach the rotation age, some stands can be left indefinitely because they provide high wildlife and/or ecologic value (e.g., thermal cover).

The age class distribution for red pine on the forest is distributed relatively evenly throughout the age classes, so the harvest level should remain fairly steady in the future. However, over the next 15 years, this will require modest adjustments to the annual allowable harvest. See Chapter 1000 for the estimated annual harvest levels (acres) of red pine over the next 15 years.

830.1.7 JACK PINE

Most of the mature jack pine stands on the Douglas County Forest are directly related to catastrophic fire at intervals of 10 to 100 years that occurred throughout much of the jack pine type. Planting jack pine plantations began in the late 1930’s and small scattered stands developed on the fringes of older, mature stands following disturbances. Pure, fully stocked stands of jack pine on poor to good sites are not as common today as they once were on the Forest. However, jack pine remains a major component in many aspen, scrub oak, and red pine types.

The jack pine type provides food and cover for numerous wildlife species. Jack pine seeds are eaten by many species of rodents and birds and white-tailed deer and snowshoe hare browse the stems and shoots. Especially important is the native pine barrens habitat that is found primarily in conjunction with jack pine. This mixture of grassland openings and younger forests is characteristic of the presettlement vegetation that once covered much of northwestern Wisconsin, where droughty sand soils predominate. Frequent fires played a critical role in maintaining this habitat that is now being lost in many areas it once dominated as the result of human fire suppression. The federally endangered Kirtland's warbler is endemic to jack pine barrens. Its nests are located on the ground near or at the edge of fairly dense stands of young jack pine.

As a short-lived, early successional species, jack pine is susceptible to many damaging agents such as fire, drought, flooding, over-browsing, insects, and diseases. The naturally occurring jack pine budworm alone has killed thousands of acres of jack pine throughout the County Forest. Entire blocks were devastated by the budworm following outbreaks that occurred in 1992-94 and 2004-06.

Jack pine has evolved as a fire-dependent species. It serotinous cones, which have a waxy outer coating to protect the seeds, remain on the tree rather than dropping to the forest floor. Seeds can remain viable on the tree for 20 years or longer. When a fire occurs, the thick cone protects the jack pine seed from the intense heat. In fact, seeds have been known to be viable after exposure to heat approaching 1000 0F. Such heat, opens the scales of the cone and releases the seed onto the ground where the fire has removed much of the existing vegetation and natural litter. Jack pine seeds require contact with mineral soil to germinate, so fire serves to prepare the seedbed, reduce competition from other plants, and release the seed. The short height of jack pines makes crown fires highly likely and these fires are necessary to release the seeds from dormancy.

As human fire-suppression activities continued, fewer jack pine stands regenerate naturally,
planting this species was one of the few viable options for establishing new stands. Jack pine was first planted on the County Forest in 1938 when 160 acres were planted by hand. Over the next 16 years, jack pine was the preferred plantation species and 5,041 total acres of jack pine plantations had been established. However, the planted stands were not as productive as natural stands and 1954 was the last year until 1977 where jack pine was again planted on the Forest. It was during this time that jack pine seed orchards were being established by forest industry and public agencies to provide that seed that eventually produced more productive jack pine plantations. Red pine became the preferred plantation species from 1954 up until the 1990’s because of its high productivity. It had a superior economic edge in the market and was less susceptible to deer browse and widespread damage from insects. Jack pine was considered an inferior species and most managed stands were converted to red pine after harvest. Only 30 acres of jack pine was planted in 1977 and it wasn’t until 1981 that this species was planted on an annual basis. However, most of these plantings were small and located on poor sites or contained large frost pockets where red pine does not grow well.

Contract planting, initiated in 1989, was a way to reduce associated costs and get the job done more efficiently. In 2002, jack pine again became the priority plantation species and many more acres of jack pine were being planted than red pine to reduce losses in the jack pine type. From 1938 through 2006, nearly 9,000 total acres of jack pine have been planted throughout the County Forest.

Jack pine is the preferred pine species for pulping and market conditions for this species have been fairly stable. Along with on-off markets for sawable jack pine, jack pine pulp has been shipped to distant markets by rail since the 1940’s.

On early Douglas County Forest timber sales, then cut volume of jack pine came from scattered and rare mature stands, stands sustaining wind damage, or budworm damage. In the 1960’s and 1970’s jack pine stands that originated after fires in the early 1900’s began to mature. By the late 1970’s, allowable cut of jack pine was about 650 acres per year. The large 5-mile fire that occurred in the Wascott Township during the spring of 1977 raised concerns about the fire danger of large contiguous blocks of the jack pine type. These blocks were considered as high-hazard areas because of heavy fuel loads and high fuel flammability. Non-salvaged wind and budworm-damaged jack pine only added to the fuel loads in many of these stands. By 1980, salvaging these damaged, high-risk stands and breaking up large, contiguous stands became a priority on the Douglas County Forest. The early 1980’s also saw a peak in jack pine stumpage prices. This was quickly followed by a total collapse in the market several years later. However, by the late 1980’s, the market demand for jack pine was back on the rise. Many jack pine sales were sold and harvested, but reforestation efforts fell behind. This resulted in former jack pine sites being left open and nonproductive or converted to red pine.

By the early 1990’s, site preparation, planting, and seedling costs had increased dramatically. Red pine stands on some of the poorer and drier sites were not performing as well as expected. Jack pine management took on a new approach and was recommended for many sites. One of the primary goals of this new approach was to drastically reduce the conversion of jack pine stands to red pine plantations. Establishing jack pine regeneration took on new significance and by 1992, jack pine
reforestation was pursued at an accelerated rate. In 1993, the first pre-harvest blade-scarification treatment trials were conducted on the Forest to regenerate jack pine naturally. By 1995, blade scarification proved a reliable option for regenerating jack pine and became the primary means of management. Anchor chaining was first used as a site-preparation method for jack pine in 1996 but produced mixed results. Natural regeneration will continue to be the preferred method of managing the jack pine type on the Douglas County Forest.

830.1.7(a) Historical Acreage Trends

Jack pine acreage on the forest decreased significantly from 1977 to 2006. Overall, there was a 40 percent decrease (8,089 acres) in the jack pine acreage during that period (Fig. 830.24).

The overall decrease in jack pine acreage is attributed to several factors. The absence of natural fire regimes on the landscape due to suppression activities has prevented many jack pine stands from regenerating naturally. This has resulted in the Forest’s natural progression from shorter lived jack pine to overgrown stands of longer lived scrub oak and thick upland brush mixed with red maple and northern hardwoods in some stands.

Another significant factor in the decline of jack pine is the forced type conversion to red pine plantations. The general frame of thought throughout much of the Forest’s history was that red pine was superior to jack pine both economically and in growth potential, and that jack pine was an inferior species. Figure 830.25 shows historical acreage trends for both red pine and jack pine. The
conversion of jack pine to aspen after harvesting also has contributed to this progression. Aggressive naturally regenerated aspen quickly occupies sites and outcompetes jack pine seedlings. Successfully establishing jack pine by artificial planting presents its own set of complex problems that have contributed to the decline. The jack pine budworm and severe weather events have also been significant contributing factors. As a result, future trends for the jack pine type on the Douglas County Forest are difficult to predict. The current decline might be offset to some degree by fewer conversions to red pine, limited expansion opportunities from scrub oak stands, and consistent natural-regeneration treatments over time.

Figure 830.25

830.1.7(b) Current Status (2006)

As of 2006, there were 11,646 acres of manageable jack pine on the Douglas County Forest. An additional 301 acres have been classified as unmanageable due to site sensitivities or proximity to streams and lakes. Jack pine accounts for about 4.4 percent of the total forested acreage (see Appendix G-III for the location of the jack pine timber type on the Douglas County Forest).

Of the total 11,947 acres of jack pine on the Forest, 68 percent (8,140 acres) are stands of natural seed origin and 32 percent (3,807 acres) are of plantation seedling origin that were planted by machine or by hand (Fig. 830.26).
Secondary timber types are found in association with 55 percent of the jack pine stands on the Forest (Fig. 820.27). Distinct secondary types include; scrub oak (3,484 acres), noncommercial, i.e., upland brush (1,615), and aspen (1,317). These species provide a limited option for alternative silvicultural prescriptions, primarily conversions, though converting the jack pine type usually is discouraged. Scrub oak, aspen, and red pine are deliberately maintained as secondary types in many jack pine stands because of the valuable ecologic and wildlife values they provide.
Stands of jack pine on the County Forest are primarily in an unregulated condition due to large differences between individual age classes. The largest portion of jack pine acreage is in the 0 to 29 age classes followed by the 50 to 69 classes. The relatively fewer acres between age 30 and 49 is attributed to conversions to the red pine stands and the subsequent lack of jack pine planting during this period. Total jack pine acreage as of 2006 by 10 year age classes is shown in Figure 830.28. The relative spike in the 0-9 age class can be attributed to increased jack pine recruitment as a result of an intensified planting program and greater focus on naturally regenerating the jack pine type in recent years. All stands at least 60 years old have been designated as high-priority stands for management.
Figure 830.28
Jack Pine Acreage on the Douglas County Forest as of 2006 by Age Class

The jack pine budworm has caused extensive mortality and topkill in vast acreage of jack pine on the County Forest. This insect is native to North America and has evolved to play an integral part in perpetuating the jack pine ecosystem. Tree mortality and topkill create fuel for intense wildfires. Dense stands of jack pine typically require a hot fire to regenerate, eventually serving as food for future generations of jack pine budworm. Budworm outbreaks occur every 10 to 12 years and feeding cycles last for 2 to 4 years. The budworm has one generation per year and moths are present only for several days during the mating and egg-laying period in midsummer. Newly emerged caterpillars do not feed and spin silk cocoons for over wintering under bark scales or in needle scars. They become active the following spring, usually between mid-May and early June. Initially, caterpillars feed on pollen in male flowers. Eventually, they migrate to the new expanding shoots and web together new needles and shoots to form feeding shelters. Caterpillars feed on old needles after new needles from crowns have been consumed. Feeding is completed in about 6 weeks, usually by early July. Pupation occurs on infested needles and shoots where adult moths emerge from pupae in 6 to 10 days.
830.1.7(c) Desired Future Condition

The long-term management goal for jack pine on the Douglas County Forest is to bring the age class distribution closer to a regulated, evenly distributed condition and to aggressively maintain the current acreage in a healthy and vigorous state. Another goal is to reduce the conversion of jack pine stands to red pine plantations. However, repeated planting site failures may lead to red pine or other species conversions. Scrub oak sites with poor to fair growth potential or poorly stocked stands consisting primarily of upland brush will be considered for conversion into more suitable jack pine. Other goals will be to maintain jack pine and red pine in a diverse patchwork of stands indicative of natural fire regimes, minimize mortality from budworm outbreaks, and convert artificial plantations to natural stands once they reach rotation age through natural-regeneration methods.

830.1.7(d) Management

Management of jack pine within the Douglas County Forest will focus on establishing healthy, vigorous stands through artificial planting or natural regeneration from seed. This will include attempting to maintain current plantations and natural stands as well as converting other sites on a limited basis through forced type maintenance. Over the next 15 years, priority will be given to naturally regenerating stands rather than relying on planting for regeneration. However, artificial planting will continue to be used where needed and appropriate. Stands will be scheduled for prompt harvest at rotation age. Fewer stands will have extended rotation ages including those on higher quality sites, due to the inherent problems associated with advanced understory brush and lower stocking levels. Stands will be managed to reduce growth loss and mortality from the jack pine budworm by following recommendations aimed at minimizing the intensity of outbreaks. Age class diversity will be promoted in jack pine throughout the Forest to benefit wildlife. Large contiguous blocks of the same age should be discouraged by managing for multiple age classes and/or intermixing red pine plantations to achieve the patchiness that occurs under a natural fire regime.

(1) Applicable Silvicultural Treatments

Jack pine is managed with even-age silvicultural practices on the Douglas County Forest. As one of the most shade-intolerant species, it requires full release and maximum exposure for successful regeneration. Clearcutting in conjunction with site preparation is the preferred silvicultural system for regenerating jack pine naturally on the Forest. Alternative silvicultural options include the shelterwood and seed-tree methods. Depending on opportunities and site objectives, each of these treatments is a viable management option with adequate site preparation. On higher quality sites or in heavily stocked stands, an intermediate entry in the form of thinning also may be a viable option. The following guidelines are used by the DCFD to manage the jack pine type.
(A) Even-Age Management

Even-age 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 is defined by factors such as: mean age, maximum tree size, mean annual increment, and economic or biological maturity. Typical rotation ages for jack pine stands on the Douglas County Forest range from 40 to 60 years. Some of the factors that can influence the decision as to when to manage a stand for jack pine regeneration include current stand conditions (percentage of poor-quality and/or diseased trees), site potential, and species composition.

(1) Forced Maintenance (Planting)

Natural regeneration of jack pine is unpredictable and can be difficult to achieve due to factors such as low stocking levels, advanced understory brush, inadequate seedbed conditions, seed consumption by birds and rodents, high soil temperatures, and inadequate moisture. Post-harvest replanting is commonly used to establish pure stands on the Forest. Converting sites to the jack pine type is initially accomplished through a forced type planting. The most significant factors that present challenging obstacles to planting and successfully establishing a jack pine plantation on the Forest today are vegetative competition, overbrowsing by deer and severe weather patterns of recent years.

Where a jack pine plantation is planned entails intensive site preparation in the form of disk trenching, Bracke scalping, or tractor furrowing to control competing vegetation and prepare the site for seedling development. This type of preparation alone rarely provides adequate control of competing vegetation. Many sites first require aggressive mechanical preparation in the form of roller-chopping. Although not currently authorized for use, herbicide application has the potential to significantly reduce mortality and increase the growth of jack pine seedlings by controlling non-crop vegetation that competes for light, water, and nutrients. See Section 830.1.6(d)(1)(A)(1)(a) above and 505.3.1(b) for additional information on the potential benefits of herbicide use in the planting program.

Actual planting is in early spring and is accomplished by hand planting preferably 2-year old stock seedlings at an approximate spacing of 9 by 5 feet (about 950 trees per acre). Sites are monitored for seedling survival until about age 5. Sites can be affected by over-browsing and severe weather. Deer have been the primary cause of survival failure on many sites. In years with lower than average snow depths, more than 75 percent of planted seedlings have been killed by browsing (see Section 505.4). Nipping and girdling of the stem by snowshoe hare also can cause significant seedling mortality on planted sites. The entire jack pine acreage planted in 2004 through 2006 incurred as much as 40 percent mortality due to harsh conditions resulting from drought conditions during the summer of 2006.

Of the many sites scheduled for replanting each year, some require a second site-preparation treatment to control the advancing competing vegetation. Once a jack pine plantation is established at more than 400 stems per acre (well established is at least 700 stems per acre), the plantation
usually is left to develop. In rare instances a plantation may require yet another entry in the form of a TSI treatment to further control competing woody vegetation. This method of treatment is similar to that discussed for red pine.

(2) Intermediate Harvest

An intermediate harvest in the form of thinning may be considered if the long-term management goal for a stand on a high-quality site (site index greater than 60) is quality sawlog development, but the stand is not yet ready to be regenerated. Thinning also should be considered when managing against the jack pine budworm by reducing densities to minimize stand stress. The minimum stocking level to warrant a thinning on a good site is 130 ft² of basal area. Target stocking levels may vary slightly are generally range from 80 to 100 ft² of basal area per acre depending on stand development and the average quadratic mean stand diameter. Potential growth gains should be weighed against the post sale mortality that nearly always accompanies a thinning and can affect goals for residual stocking. Thinning jack pine plantations has produced mixed results on the County Forest but a mechanical row treatment may be considered. Because of the relative short lifespan of jack pine, a commercial thinning entry, if prescribed, typically occurs only once before the regeneration harvest. Sapling-size stands (0 to 5 inches d.b.h.) on sites with poor to fair growth potential (typically site index less than 50) that are stocked with more than 2000 stems per acre should be non-commercially thinned to 800 to 1200 stems per acre. Stands on higher quality sites thin themselves through natural suppression.

(3) Clearcutting

Clearcutting is the preferred method when attempting to regenerate a stand of jack pine of natural seed origin on the Douglas County Forest. If present, scrub oak and other desirable species can be left in clumps, corridors, and/or as scattered individual trees to promote diversity and benefit wildlife so long as they meet management objectives. Scrub oak should be incorporated into the harvest to encourage and maintain the oak type as an associate through stump sprouting. A clearcut harvest requires the removal of most if not all intermediate or suppressed saplings and stems because the smaller understory trees suppress the development of vigorous jack pine seedlings. Unit boundaries can be designed strategically to minimize negative visual effects of the harvest and enhance aesthetic values, though too much edge can lead to intense outbreaks of the jack pine budworm.

Site preparation in the form of scarification or exposure of mineral soil is essential for successful natural seed regeneration of jack pine. Both mechanical scarification and prescribed burning can produce acceptable results. In general, the greater the intensity of disturbance, the greater the potential for jack pine establishment. Achieving a mixture of mineral soil with organic material and providing non-compacted bare mineral soil that is relatively free of vegetative competition is highly desired on 50 to 75 percent of the area. Scarification should be performed just prior to or during the harvest to maximize potential seed germination on top of bare mineral soil that is relatively free of competing vegetation. Blade scarification before and during harvesting, whole-tree skidding and post-sale anchor chaining have been used on the County Forest. Slash containing cones should be
lopped and scattered evenly over the scarified areas to achieve maximum seeding.

The DCFD plans to develop a more aggressive jack pine site-preparation and regeneration program over the next 15 years. The use of machines mounted with large attachments such as roller-choppers, disks, scalpers, and heavy and aggressive anchor chains, that effectively prepare sites will be further considered. The DCFD is interested in expanding its prescribed burn program to favor successful jack pine regeneration, but complications associated with planning and conducting burns have made this expansion difficult. However, fire will continue to be incorporated as a management tool for jack pine regeneration on the Forest where practical and feasible. Direct seeding by airplane, broadcast seeder, or controlled mechanical seeding also is being considered.

(4) Two-Cut Shelterwood

This method is a good option when attempting to regenerate the jack pine type from seed on sites with high aesthetic value. The harvest regenerates the stand with an initial regeneration harvest (first cut) and then releases the established regeneration with an overstory removal (second cut). The overstory serves to modify understory conditions to create a favorable environment for regeneration and provide a seed source. Secondary functions of the overstory are to allow further development of quality residual stems during seedling establishment and to maintain a high level of aesthetics on the site. A successful shelterwood harvest requires the removal of most if not all intermediate or suppressed saplings and stems because the smaller understory trees suppress the development of vigorous jack pine seedlings. Clearcutting is preferred when managing the jack pine type on the Douglas County Forest, though the shelterwood method is a viable option where conditions warrant.

The following is the preferred procedure for regenerating stands of jack pine on the Forest with the shelterwood method:

(1) Initial harvest. 30 to 50 percent residual crown cover (typically 50 to 60 ft² of basal area per acre) is left distributed evenly in jack pine stems with the best form and vigor.

(2) The site is mechanically scarified before or during the initial harvest to expose mineral soil and reduce competing vegetation when the ground is neither frozen nor snow-covered.

(3) The establishment of desired jack pine seedlings is monitored. If regeneration is inadequate, additional site preparation will be required to prepare the seedbed. If the number of non-serotinous cones on the site is inadequate, direct seeding will be considered. If a large percentage of pine seedlings is overtopped by undesirable species, additional control of competing vegetation will be considered. The overstory will be removed when the ground is frozen and snow-covered to reduce potential damage to established seedlings. Desired regeneration should be adequately stocked (400 stems per acre) and well established (2 to 4 feet tall) upon release. Scattered residual overstory trees may be retained on the site (one tree for every 2 to 4 acres) for aesthetics and/or to benefit wildlife with little to no risk of adversely affecting the regeneration. Where aesthetics is of critical
importance, additional overstory trees may be considered for retention but the potential reductions in seedling growth will be taken into account.

(5) Seed Tree

With this method, about 10 phenologically desirable seed trees that support large cone crops are left per acre to provide a seed source for regeneration. This method differs from a shelterwood in that residual stocking is more sparse and insufficient to modify the understory environment. Upon harvest, the remaining slash may be treated with a hot prescribed burn to prepare the seedbed and expose seed from the serotinous cones. If regeneration is inadequate, direct seeding may be required. Additional site preparation will be considered if seedbed conditions do not favor seedling establishment. Once regeneration is well-established, residual seed trees may or may not be removed depending on economic and management objectives.

(2) Jack Pine Budworm

Harvesting and other management activities can avoid budworm-caused tree mortality and reduce the threat of damaging wildfires while still providing suitable conditions for natural regeneration of jack pine. Stands should be maintained in a healthy and vigorous condition to minimize effects from infestations. This includes harvesting stands promptly at rotation age, managing against overstocked stands by controlling stand density, and promoting the jack pine type on quality sites with good growth and survival potential. Male flower production should be minimized to limit the survival of budworm caterpillars during outbreaks. This includes maintaining adequate stocking to discourage large-crowned, open-grown “orchard” or “wolf” trees that produce abundant male flowers, discouraging multistructured or uneven-aged stands, and minimizing stand edge effect where edge trees produce abundant male flowers and support large numbers of budworm caterpillars.

Following the budworm outbreak of 1992-94, the DCFD reacted aggressively and salvaged many of the stands symptoms of defoliation. Jack pine products are merchantable only for 12 to 24 months after tree death and also contribute to high fuel loads that increase the risk of fire. Some of these stands showed minor symptoms from first-year defoliation such as the characteristic reddish crowns. Others showed severe second-year symptoms in the form of heavy defoliation. Following the next large-scale outbreak in 2004-06, the DCFD again reacted aggressively and salvaged many infected stands. However, many younger stands were not immediately scheduled for salvage and a “wait and see” philosophy was adopted to assess how well these stands responded to the outbreak. This resulted in salvaging only those stands that suffered the greatest degree of damage and/or the highest levels of mortality. Most of these harvested stands were overmature and already under multiple stresses before being killed by the budworm. Many of the younger stands that appeared severely damaged have since rebounded, allowing the DCFD to better protect and manage the jack pine resource. The DCFD will continue to implement management practices that limit the intensity of budworm outbreaks and investigate other treatments as they become available.
(3) Determining Annual Allowable Harvest Levels

Table 830.8 shows the range of rotation ages used to manage jack pine on the Douglas County Forest.

<table>
<thead>
<tr>
<th>Early Rotation Age</th>
<th>Standard Rotation Age</th>
<th>Extended Rotation Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 years</td>
<td>50 years</td>
<td>65 years</td>
</tr>
</tbody>
</table>

The standard average age of rotation for jack pine on the Douglas County Forest is 50 years depending on site quality. Jack pine stands growing on higher quality sites with good to excellent relative growth potential can be extended to 65 years before being regenerated. Conversely, stands that are developing on dry, poor sites and/or are exhibiting signs of decline can be regenerated as early as 40 years.

To reach a fully regulated condition, whereby each age class contains about the same acreage, the annual allowable harvest must be adjusted constantly to compensate for the current age class distribution. Over the next 15 years, the goal of jack pine management on the Douglas County Forest will be to maintain and enhance the current acreage, expand the jack pine type where appropriate, and strive toward a regulated condition.

As a result of the two most recent budworm outbreaks and difficulties associated with regenerating jack pine naturally due to the inherent problems that advanced understory brush and lower stocking levels present in older stands, annual allowable harvest levels have been accelerated in recent years.

In 2005, the DCFD developed an aggressive 3-year age class restructuring program. Mature and over-mature age classes were targeted for complete removal to ensure that large acreages of jack pine were not lost to mortality due to over-maturity. By the end of 2008, most of these mature and over-mature stands will have been harvested and regenerated so that the age class distribution will be more manageable. Following 2008, the annual allowable harvest will be reduced substantially to compensate for the decrease in acreage in the 30 and 40 year classes.

Many variables must be considered when determining harvest levels of jack pine. Annual harvest levels are subject to change upon receiving updated inventory data and in response to natural weather events and insect/disease outbreaks. Chapter 1000 includes estimated annual harvest levels (acres) of jack pine over the next 15 years.
830.1.8 WHITE PINE

Eastern white pine is an important part of the history of the northern Great Lakes Region and symbolizes the “northwoods” for many people. In the early years of the timber industry lumbermen of the region. Considered white pine as the premier timber species because its light and easily workable wood was ideal for construction purposes and easily transported by water. Fueled by the rapid development of the great prairies of Illinois, Iowa and southern Wisconsin, lumbering activities quickly surpassed mining and fur trading as the State’s top industry. Harvesting that provided raw materials for a thriving timber industry and a growing nation began in earnest around 1840 and peaked in 1892. Indicators such as old logging camp sites, historical access routes, and river log landings are evident on the Douglas County Forest today. By 1910, most of the white pine in northern Wisconsin, including Douglas County, had been harvested and much of what remained was destroyed by wildfires or on land that was converted to agricultural use.

Large stands of white pine seedlings became well established prior to the removal of the massive overstory trees by the lumber companies during the mid to late-1800’s. Small, non-merchantable stems were released and grew rapidly. Scattered pockets of stems that survived the catastrophic fires of the early 1900’s grew into many of the natural white pine stands found on the County Forest today.

White pine blister rust was first introduced into North America from Europe around 1900 on white pine seedlings grown in European nurseries. By the 1950’s the fungal pathogen had spread to most of the commercial white pine regions, including northern Wisconsin and the Douglas County Forest, where it began to infect healthy stems. Manpower was plentiful during the days of the Wisconsin Civilian Conservation Corps, so a campaign was initiated to rid the northern woods of gooseberry, the alternate host to white pine blister rust. Many hours were spent destroying gooseberry plants throughout the northern region of the State. This effort continued in Douglas County until the mid 1960’s but even the most diligent attempts at eradication were largely unsuccessful became blister rust spores are carried long distances by the wind.

Investing in and establishing new white pine stands on the County Forest began in 1937 before the full effects of blister rust were known. In fact, white pine was the first species that was artificially planted on the Forest. From 1937 to 1947 more than 200 acres of white pine plantations were established. However, by the 1950’s, white pine was no longer considered for planting due to its high susceptibility to blister rust. As a result, most of the original plantations have long since given way to other species.

Damage from blister rust and the tip weevil and the lack of a market for white pine pulp led to planting of more profitable species. Mature stands were treated primarily to remove infected trees. In extreme cases, on sites that had a high potential for infection, some stands were targeted for completed removal.

In the early 1980’s, the WDNR and the USDA Forest Service initiated a blister rust research program in which grafts of putative blister rust-resistant eastern white pine were used to establish a
10 acre clonal seed orchard in Washburn County. Increasing quantities of seed have been collected annually from this orchard for use in State nurseries and seedlings made available to the County for purchase. These sparked renewed interest in incorporating white pine back into the planting program and small experimental plantations were established on the County Forest in 1995. These sites are being monitored for growth potential and relative levels of resistance to blister rust. The goal is to provide a seed source for natural regeneration well into the future for the white pine type and reestablishing this once dominant species on the Forest.

830.1.8(a) Historical Acreage Trends

White pine acreage on the County Forest has been increasing steadily since 1954. Overall, white pine acreage on the Forest today is more than 10 times (593 acres) that in 1954 (Fig. 830.29).

Most of this increase is attributed to stands of other species converting naturally to the more climax white pine type, conversion of other types to white pine through harvesting, resurgence of white pine in the planting program, and inventory corrections based on more accurate field observations. Future trends for the white pine type will rely heavily on the ability of the DCFD to artificially replant seedlings. If current experimental plantation trials with the resistant seedling stock prove successful, additional acreages will be planted with white pine. However, should the plantation trials fail and/or other obstacles are encountered in the planting program, the future trend for white pine indicates a relative leveling that might be preceded by a slight increase in acreage.
White pine is susceptible to numerous damaging agents, the most important of which are fire, over-browsing, air pollution, white pine blister rust, white pine tip weevil, and Armillaria root disease. However, because of the small amount of white pine acreage on the Forest, today, any large outbreak or attack by other insects or diseases could drastically reduce this acreage.

830.1.8(b) Current Status (2006)

As of 2006, there were 616 acres of manageable white pine on the Douglas County Forest. An additional 36 acres have been classified as unmanageable due to site sensitivities or proximity to streams and lakes. White pine accounts for about 0.2 percent of the total forested acreage (see Appendix H-III for the location of the white pine timber type on the Douglas County Forest).

Secondary timber types are found in association with 79 percent of the white pine stands on the Forest (Fig. 830.30). Distinct secondary types include aspen (173 acres), northern red oak (117), red pine (83), and paper birch (67). These species provide a limited option for alternative silvicultural prescriptions, primarily conversions, though converting the white pine type usually is discouraged.

The white pine type on the Douglas County Forest is primarily in an unregulated condition due to large differences between individual age classes. However, the total acreage of only 652 acres is minor compared to that of other important commercial timber types. White pine is identified as the primary type in only 75 individual stands throughout the entire Forest, ranging in size from 117 to less than 1 acre (the average is about 9 acres). Regulating this timber resource by distributing age
classes more evenly has been proven impractical. About 40 percent of the total acreage is at least 90 years old. The oldest stands are nearly 200 years old, Figure 830.31 shows the total white pine acreage as of 2006 by 10-year age classes. The relative spike in the 0-9 class can be attributed to renewed interest in incorporating white pine into the planting program and greater focus on regenerating the white pine type naturally in recent years.

**Figure 830.31**
White Pine Acreage on the Douglas County Forest as of 2006 by Age Class

<table>
<thead>
<tr>
<th>Age-Class</th>
<th>Suitable Acreage*</th>
<th>Unsuitable Acreage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>101</td>
<td>0</td>
</tr>
<tr>
<td>10-19</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>20-29</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30-39</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40-49</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>50-59</td>
<td>43</td>
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</tr>
<tr>
<td>60-69</td>
<td>140</td>
<td>0</td>
</tr>
<tr>
<td>70-79</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>80-89</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>90-99</td>
<td>130</td>
<td>0</td>
</tr>
<tr>
<td>100+</td>
<td>115</td>
<td>0</td>
</tr>
</tbody>
</table>

*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, or silvicultural constraints. These areas generally are re-evaluated every 10-years to determine their management status.

The most significant damaging agents to the white pine type on the Douglas County Forest today are the white pine blister rust and the white pine tip weevil. White pine blister rust, caused by a fungus, requires two different hosts to complete its life cycle. It infects both white pine and herbaceous plants in the genus Ribes, e.g., gooseberries. Infection of white pine occurs in late summer or fall by basidiospores produced from teliospores on Ribes leaves. Basidiospores are relatively fragile and do not spread over long distances but may travel for several miles and remain viable when the climate and topography are favorable. In general, cool, moist conditions favor their survival, germination, and entry into the pines. Basidiospore germ tubes enter pine needles through stomata and the fungus grows into the branches where the fungal mycelium becomes established, forming a blister rust canker that continues to develop and expand. The canker eventually girdles branches, killing them, and needles distal to the canker become a distinct red. The fungus may grow into the main stem from branch cankers located near the trunk. When the canker girdles the bole,
the portion of the tree above the canker dies and the foliage fades to yellow and finally red. Mostly bole cankers are low enough to kill the tree but on larger trees, only the top branch or several branches may be killed, leaving the lower crown unaffected. These trees may live for many years, though the weakened stems are susceptible to attack by damaging agents. Occasionally, the main stem of young trees is infected directly via needles attached to the stem; these trees within several years. Most infected seedlings die soon after infection.

Adult white pine tip weevils hibernate in the duff beneath host trees. In early spring they emerge and crawl up tree trunks. After reaching the terminal shoot of the host, males and females begin feeding just below the terminal bud cluster during the egg-laying period. Feeding by larvae girdles the stem, causing the new shoot to wilt and the needles to turn reddish brown. A successful attack always kills the previous year's growth, though 3 or 4 years' of growth often are affected.

Weevil attacks reduce growth rates, deform stems, increase tree susceptibility to wood-decay organisms, and kill trees, though mortality is rare and occurs only in small trees (less than 4 feet tall) growing vigorously in full sunlight. Each weevil attack reduces tree height growth by 40 to 60 percent in that year. Stem deformation is common because one or more laterals assume terminal dominance on the attacked tree. When two or more laterals become dominant, a forked and often bushy tree results. If only one lateral gains dominance, the stem often develops a crook. Stem deformities can result in wood defects such as compression wood and bark-encased knots that significantly reduce the quality and value of wood products. Part of the dead leader can persists for many years and may act as a point of entry for organisms such as red heart rot of pine, the major heart rot disease in older eastern white pine.

830.1.7(c) Desired Future Condition

The long-term management goal for white pine on the Douglas County Forest is increasing the acreage by establishing white pine plantations and encouraging additional natural regeneration in stands where white pine already is a component. Once the acreage is increased, there will be a better chance to bring the age class distribution closer to a regulated condition.

830.1.7(d) Management

Management of white pine within the Douglas County Forest will focus on establishing healthy, vigorous stands through artificial planting or natural regeneration from seed. This will include attempting to maintain current plantations and natural stands as well as converting other sites on a limited basis through forced type maintenance. Over the next 15 years, priority will be given to naturally regenerating stands rather than relying on planting for regeneration. However, artificial planting will continue to be used where needed and appropriate.

Browsing by deer is the primary obstacle to establishing white pine stands by natural or artificial regeneration (see Section 505.4). Potential white pine plantations should be selected on the basis of the local deer population and the effect deer are having on white pine in the area. Measures to deter deer browsing may be implemented in the future.
Stands will be managed to reduce growth loss and mortality from the many damaging agents that attack white pine by following recommendations aimed at minimizing the intensity of outbreaks. It is not uncommon for white pine to occur within many others species types throughout the Forest. Many of these scattered or “centennial” trees should be reserved when managing for these other types. White pine should be retained as a minor associate as much as possible to enhance wildlife and aesthetic values.

(1) Applicable Silvicultural Treatments

White pine is managed with even-age silvicultural practices on the Douglas County Forest. Clearcutting generally is not an authorized harvest option when managing for white pine except for species conversion or when salvaging trees from the following outbreaks of damaging agents. Intermediate entries in the form of thinnings leading to a shelterwood harvest, along with site preparation is the preferred silvicultural practice for managing white pine on the Forest. The following guidelines are used by the DCFD in managing the white pine.

(A) Even-Age Management

Even-age 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 depends on factors such as mean age, maximum tree size, mean annual increment, and economic or biological maturity. Typical rotation ages for white pine stands on the Douglas County Forest range from 80 to 175 years. Factors that can influence the decision as to when to manage a stand for the regeneration of white pine include but are not limited to current stand conditions (percentage of poor-quality and/or diseased trees), site potential, and species composition.

(1) Forced Maintenance (Planting)

Regenerating white pine naturally is unpredictable and difficult to achieve due to numerous factors. Post-harvest replanting is commonly used to establishing pure stands on the County Forest. Converting sites into the white pine type is initially accomplished through a forced type planting conversion. Challenging obstacles to successful establishment of a white pine plantations on the Forest today are vegetative competition, overbrowsing, and severe weather patterns.

Actual planting is in early spring and is accomplished by hand planting preferably 2-year old stock seedlings at an approximate spacing of 9 by 5 feet, (about 950 trees per acre). Sites are monitored for seedling survival until about age 5. Sites can be severely damaged by deer browsing, weather disturbances. Deer have been the primary cause of regeneration failure, for many sites, particularly in years when the protective snow depth is below average (see Section 505.4). The drought during the summer of 2006 also contributed to seedling mortality throughout many plantations.

Because of these obstacles to regeneration, many sites are scheduled for replanting each year. Some
sites require a second site-preparation treatment to control the advancing competing vegetation. When over-browsing is the primary reason for regeneration failure, white pine often is not scheduled for a second and a less susceptible species such as red pine is selected. Once a white pine plantation is adequately established at more than 400 stems per acre (well established is at least 700 stems per acre), the plantation usually is left to develop. In rare instances, a plantation may require yet another entry in the form of a TSI treatment to further control the competing woody vegetation.

(2) Intermediate Harvest

An intermediate harvest is an intermediate silvicultural treatment by which less desirable trees are targeted for removal primarily to improve composition and quality. Trees are removed before the stand is ready to be regenerated to encourage the growth of more desirable trees.

Target stocking levels may vary slightly but generally are in the range of 90 to 150 ft² of basal area per acre depending on stand development and the average quadratic mean stand diameter.

Although experience has been limited on the Forest, pole-size (5 to 9 inches d.b.h.) stands can be pruned to increase sawlog quality. White pine can producing high-quality sawtimber products on most sites but pruning is essential because this species does not self-prune well like red pine. Pruning not only increases sawlog quality but also reduces infection courts for blister rust, removes infected branches, and helps confine the spread of red rot within the tree. Pruning could significantly increase the number of crop trees in pole-size plantations by removing competing leaders that develop following terminal damage.

(3) Multi-Cut Shelterwood

This method is preferred when managing and attempting to naturally regenerate the white pine type on the Douglas County Forest. Intermediate thinnings (initial cuts) before the regeneration harvest develop the desired crop trees needed for the shelterwood. The actual shelterwood harvest regenerates the stand with an initial regeneration harvest (first cut) and then releases the established regeneration with an overstory removal (second cut). The overstory serves to modify understory conditions to create a favorable environment for regeneration and provide a seed source. A secondary function of the overstory is to allow further development of quality residual stems during seedling establishment. A successful shelterwood harvest to regenerate white pine requires the removal of most if not all intermediate or suppressed saplings and poles because the smaller understory trees will suppress the development of vigorous white pine seedlings.

The following procedure is followed by the DCFD to regenerate stands of white pine with the shelterwood method after they have been thinned periodically:

(1) Initial harvest. 50 percent residual crown-cover is left distributed evenly in white pine stems with the best form and vigor. If aspen is a component, as many as possible will be left (within crown-cover parameters) to discourage root suckering.
(2) The site is scarified mechanically and/or with a prescribed burn, during the late summer into the fall to expose mineral soil and to reduce competing vegetation. The total area of disturbance should be 50 to 75 percent. Generally, the greater the area and intensity of disturbance, the greater the potential for white pine regeneration. It is essential that site preparation be coordinated with a good seed crop for successful regeneration. Good seed crops occur at intervals of 3 to 5 years, making coordination difficult. Scarification and the initial harvest, if possible, should be timed with seed dispersal (September to December) when the ground is neither frozen nor snow-covered to improve the potential for natural seed germination. If the initial harvest is completed during a poor to fair seed crop year, site preparation should be postponed or performed post-harvest when a good seed crop is anticipated during the same time period.

(3) The establishment of desired white pine seedlings is monitored. If a large percentage of pine seedlings is overtopped by undesirable species, additional control of competing vegetation will be considered. The overstory will be removed when the ground is frozen and snow-covered to reduce potential damage to established seedlings. Desired regeneration should be adequately stocked (400 stems per acre) and well established (2 to 4 feet tall) upon release. Scattered residual overstory trees may be retained on the site (one tree for every 2 to 4 acres) for aesthetics and/or to benefit wildlife with little to no risk of adversely affecting the regeneration. Where aesthetics is of critical importance, additional overstory trees may be considered for retention but the potential reductions in seedling growth will be taken into account.

(4) **Seed Tree**

With this method, at least four well-distributed, phenologically desirable seed trees that support large cone crops are left per acre to provide a seed source for regeneration. When the ground is neither frozen nor snow covered, the site is mechanically scarified before, during, or after the initial harvest to expose mineral soil and reduce competing vegetation. If regeneration is inadequate, artificial means, i.e., planting, may be necessary. Additional site preparation will be considered if the seedbed is not favorable for seedling establishment. Once adequate regeneration is well established, residual seed trees may or may not be removed depending on economic and management objectives.

**(B) Uneven-Age Management**

Although uneven-age management may be feasible on some sites, this method is seldom used on the Douglas County Forest and should be prescribed only under extraordinary circumstances. Methods used for uneven-age management are similar to those discussed for red pine (see Chapter 830.1.6(d)(1)(b)).
(2) Determining Annual Allowable Harvest Levels

Table 830.9 shows the range of rotation ages used to manage white pine on the Douglas County Forest.

<table>
<thead>
<tr>
<th>Early Rotation Age</th>
<th>Standard Rotation Age</th>
<th>Extended Rotation Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 years</td>
<td>120 years</td>
<td>175 years</td>
</tr>
</tbody>
</table>

The standard average age of rotation for white pine on the Douglas County Forest is 120 years depending on site quality. White pine stands growing on higher quality dry-mesic to mesic sites with good to excellent relative growth potential can be extended to 175 years before being regenerated. Conversely, stands that are developing on very dry to dry sites and/or are exhibiting signs of decline can be regenerated as early as 80 years. As they reach the rotation age some stands can be left indefinitely because they are unique on the landscape and provide high wildlife (e.g., thermal cover) and/or ecological value.

Currently, there is no annual harvest level for white pine on the Douglas County Forest. White pine acreage on the Forest is minor compared to that of other primary commercial timber types, and most of the stands are old and poorly stocked or very young plantations. Older stands are managed infrequently to provide a seed source for possible natural regeneration. Harvest levels are subject to change upon receiving updated inventory data and/or when it is necessary to respond to insect or disease outbreaks or weather events. Over the next 15 year period, sustained management of the white pine type will be pursued on the Douglas County Forest.

830.1.9 FIR-SPRUCE, TAMARACK, CEDAR, SWAMP HARDWOOD, SWAMP CONIFER, BLACK SPRUCE, HEMLOCK, AND RED MAPLE

On the Douglas County Forest, several commercial timber types occupy the more wet-mesic and hydric sites, including those found in wetland related habitats. This grouping includes balsam fir, white spruce, tamarack, northern white-cedar, black ash, black spruce, hemlock, and red maple. Most of these species are associates in a swamp hardwood or swamp conifer primary type; others fall into their own type. There are considerable acreages of some of these species on the Forest.

Management of most of these species and types on the Douglas County Forest has been limited. Because they are generally located in sensitive harvest areas, are difficult to access, or are of lower quality than the surrounding upland types. These types are managed individually when conditions warrant and when the quality is relatively high and access is not a concern. More commonly,
smaller stands of these types that are inclusions within or directly adjacent to more upland types are managed as part of these upland types.

(1) Balsam Fir - Balsam fir is a common secondary species in many stands on the Forest. Pure stands are rare because the poor longevity of balsam fir resulted in early deterioration and succession to other species. Few of the stands that originated with a balsam types following early fires in the 1920’s and 1930’s still can be considered that type today. Balsam fir is found on a variety of site types; the most vigorous stands are on more mesic to wet-mesic sites.

That balsam fir once enjoyed a steady local market for sawbolts can be assumed from early Forest timber sale records. Apparently, most of the local sawmills used balsam fir for sawing framing lumber. In the early 1960’s, Tomco Stud mill of Superior, Wisconsin began operation and sawed exclusively balsam fir for 2 by 4 studs until its closing around 1975. Balsam fir pulpwood markets were distant and limited until the Lake Superior Paper Industries mill in Duluth, Minnesota, opened in 1987. This mill uses a ground-wood pulping process for balsam fir and spruce. It created a market for fir and brought the spruce market closer. Many fir stands were established, sold, and cut, while the new mill was beginning operations.

Today, balsam fir is harvested as a secondary species on many timber sales and the volume of fir produced on the Forest is consistently one of the largest of any county forest in the State. Fluctuating merchantability standards for fir products over the last decade are related to size, quality, and moisture content. Increased costs associated with sorting cull has made the fir market fairly unpredictable.

Balsam fir was not severed as part of the aspen maintenance projects of the 1970’s and 1980’s. Fir trees were reserved benefit to wildlife grew in small, scattered stands. Fir trees that survived this extreme release developed into good-quality sawtimber and still may provide a limited harvest opportunity even though they are well concealed by the dense aspen regeneration.

(2) Tamarack - Tamarack is a distinctive conifer that is common in many wet areas of the Forest. It is associated with black spruce and other swamp conifers. Tamarack is not an important commercial timber species, on the Douglas County Forest, though stands have been managed for pulpwood production. However, this species is important in enhancing wildlife and aesthetic values.

(3) White Cedar - Northern white-cedar is found throughout the County Forest, particularly around lakes in peatland bogs with alkaline soil. However, cedar can grow under a variety of site conditions and grows on most areas of the Forest. On the Douglas County Forest, northern white-cedar is not aggressively managed on a commercial basis, but it has been harvested and used for the post and specialty product markets. It is important to wildlife, especially deer during the winter months and cedar forests support many rare plants and animals. Currently, no cedar stands on the Forest are under active management because of the inherent difficulties in regenerating this species amid high deer populations (see Section 830.3.1(b)).
(4) Swamp Hardwood - The deciduous swamp hardwood type once was characterized by black ash and American elm until the latter was nearly extirpated by Dutch elm disease. Since the 1980’s, these stands have mostly become black ash. Black ash swamps occur throughout the Douglas County Forest in a variety of topographic and hydrologic settings, usually where groundwater seepage is significant. They often are found on the edges of larger wetlands and river floodplains adjacent to upland slopes where seepage occurs, or as small, seepy pockets within a larger matrix of upland types. They also are found in depressions at or near the headwaters of creeks and streams. The surface topography usually is hummock and hollow with fluctuating surface-water levels between the hummocks. Black ash swamps are important to wildlife due to the diverse herbaceous layer under the tree canopy and many tall scrubs in the understory.

On the Douglas County Forest, black ash is not managed aggressively on a commercial basis because it usually is associated with an extremely poor logging opportunity. Otherwise, ash would be marketable as a dense hardwood pulp and specialty sawtimber. To a limited degree, black ash has been used for fuelwood, pallets, and specialty products such as flooring and cabinetry. There also was a strong export market for black ash veneer logs to Japan during the late 1980’s and early 1990’s. Stands of relatively pure black ash swamps on the Forest were sold periodically in the past 20 years, but the use of harvesting equipment on fragile soils proved too challenging. These sales continued sporadically in the hopes that an exceptionally cold winter would create favorable harvesting conditions. Although partially completed, most of these sales were closed before being completed.

Today, black ash is harvested as a small species component on many timber sales. Internal black ash inclusions also are reserved while managing the upland type. This includes leaving multiple corridors and fingers of standing swamp hardwood trees with irregularly shaped edges to provide cover for wildlife that travel between them. These corridors benefit forest aesthetics, experience some of the greatest post-harvest wildlife use, and have become a primary consideration in sale design. Leaving scattered black ash trees after a treatment such as an aspen coppice harvest has become common on the Forest. These trees provide additional vertical habitat and add to forest aesthetics with a low risk of suppressing the desired regeneration. Black ash that is growing offsite or encroaching the upland from the lowland is harvested to provide more available area for desired upland species.

The greatest threat to the black ash resource on the Douglas County Forest is the emerald ash borer (EAB), an exotic insect pest from Asia. This insect has devastated millions of ash trees in Michigan, Ohio, and Indiana. The EAB recently was identified in northern Illinois and scientists predict it is only a matter of time before this insect pest arrives in Wisconsin. On the basis of recommendations and guidance provided by the WDNR, USDA Forest Service, Wisconsin Department of Agriculture, Trade and Consumer Protection, and the U.S. Department of Agriculture, the DCFD will attempt to reduce the chance of infestation and minimize the detrimental long-term effects of an infestation. This may require an aggressive harvest plan that covers extensive acreage. Multiple objectives, some of which may be in direct conflict with others, will have to weighed against one another in developing a response plan.
(5) **Black Spruce** - Black spruce is primarily a peat bog and wetland species that is common on wet, low-nutrient soils throughout the Forest. It frequently grows in pure stands on lowland organic soils and less frequently in mixed stands on more upland transitional mineral soils. Common associates are tamarack and northern white-cedar. Most of the black spruce stands on the Douglas County Forest are slow growing, even-age, and of fire origin. Following fire, stands release a large seed supply onto burned areas that allows for rapid seedling establishment. Few seeds are destroyed by fire because the tightly compacted cone clusters are in the upper part of the crown where they are least likely to burn. Black spruce on the Douglas County Forest is not a primary commercial timber species, but scattered stands are managed periodically when conditions warrant. The principle commercial value of black spruce is pulpwood because its long fibers produce a high-quality pulp. Black spruce swamps and bogs also provide habitat for many species of amphibians, songbirds, reptiles, mammals, and insects.

(6) **Hemlock** - Eastern hemlock is a long-lived, shade-tolerant, slow-growing tree that is a frequent associate of the northern hardwood type on the highest quality wet-mesic and mesic sites. Since these types of sites only occur on a small percentage of the Forest, the presence of hemlock is extremely limited. The hemlock-hardwood type is the most uncommon of all commercial timber types on the Douglas County Forest. It usually is not managed aggressively on a commercial basis, but hemlock has been harvested for the pulpwood and specialty product markets. Historically, this species was harvested for the tanning industry, which made use of tannins in the bark. Hemlock provides shade to aquatic ecosystems and thermal cover for wildlife, especially deer, during the winter, and large, hollow trees are commonly used by cavity dwellers. Currently, no hemlock stands are under active management on the Douglas County Forest due to inherent difficulties in regenerating this species amid high deer populations.

(7) **Red Maple** - Red maple, commonly called soft maple, is a relatively fast-growing and shorter lived species that occupies a wider range of sites than any other commercial timber species on the Douglas County Forest. It is well adapted to wet sites where it is commonly associated with black ash and less commonly with tamarack, balsam fir, and black spruce. Red maple also is well adapted to more well-drained upland sites where it grows in mixed stands of aspen, northern hardwoods, paper birch, and northern red oak. Because of its wide ranging and adaptive nature, red maple is one of the most common commercial timber species on the Forest. A subclimax species, red maple can occupy the overstory space in stands but eventually it is replaced by other species through natural successional pathways. Large volumes of red maple are harvested annually on the County Forest. Most of this volume is harvested on timber sales managed for other types. During the last decade red maple has become more desirable as a commercial species and a market for this species has continued to develop as the result of regional mills expanding efforts to better use maple in their pulping processes. Commonly known as soft maple, the wood is close-grained and resembles that of sugar maple but is softer in texture and not as heavy. The most common commercial use of this species is for pulpwood, though red maple growing on higher quality sites can produce quality sawtimber. Red maple is a prolific stomp sprouter and highly desirable by wildlife for browse. Deer especially
prefer the current-season’s new growth, which can be an important source of nutrition during the
winter months. The seeds of red maple provide food for small mammals and some birds species.

830.1.9(a) Historical Acreage Trends

Figure 830.32 and Figure 830.33 show the acreage trends for various timber types from 1954 to
2006. Figure 830.34 shows acreage trends for the red maple type between 2000 and 2006 (data
prior to 2000 was not available). The acreage trend for the hemlock hardwood type at 67 acres in
2000 and 57 acres in 2006, was not plotted. Acreage in the black spruce, swamp conifer, tamarack,
and cedar types has fluctuated over the last 50 years but show no distinct pattern. However, acreage
trends for the fir-spruce, swamp hardwood, and red maple types reveal noticeable patterns. The
steady decrease in acreage of fir-spruce since the late 1970’s has accelerated in recent years. The
swamp hardwood type shows a steady increase in acreage since inventory data were first available
for this species in 1954. This increase has accelerated over the last decade. The red maple type
also shows a steady increase in acreage since inventory data were first available for this type in
2000.

Figure 830.32
Acreage Trends for Fir-Spruce and Swamp Hardwood on the
Douglas County Forest 1954 to 2006
Figure 830.33
Acreage Trends for Black Spruce, Swamp Conifer, Tamarack, and Cedar on the Douglas County Forest 1954 to 2006

Figure 830.34
Acreage Trends for Red Maple on the Douglas County Forest 1954 to 2006
Fluctuations in the acreage of the black spruce, swamp conifer, tamarack, and cedar types is attributed to poor inventory data that since have been corrected. The other primary contributing factor is natural successional pathways resulting from natural disturbances. Future trends for these types show relatively minor changes due to the infrequent management and minimal opportunities for species conversions. Factors that could cause localized and/or widespread mortality for these types include weather, fire, insects, or diseases and, in the case of cedar and hemlock, over-browsing by deer.

The decrease in the fir-spruce type acreage is attributed largely to species conversions. The primary species conversion most commonly occurs when stands of fir-spruce with an aspen component are harvested. The subsequent aggressive aspen regeneration quickly occupies sites and out-competes fir-spruce seedlings. However, fir-spruce will develop in the understory as a secondary species once aspen is 5 to 10 years old. As with other types, one reason for the decrease in fir-spruce acreage is poor forest-inventory data that since have been corrected. Future trends for this type indicate a continued decrease in acreage, though at a reduced rate.

The increase in the swamp hardwood type is attributed primarily to corrected inventory data and natural succession. Species such as northern hardwoods or red maple that typically develop with black ash on wet-mesic to hydric sites are not well suited to the wet conditions and eventually suffer heavy mortality while black ash persists. Over time, as the percentage of these species is reduced in many stands, the percentage of black ash increases. Future trends for the swamp hardwood type indicate a continued increase followed by a gradual leveling. However, localized and/or widespread mortality of black ash trees could occur should the Forest be invaded by the EAB.

The increase in the red maple type is attributed primarily to inventory-data corrections, species conversions, and natural succession. Occasionally, stands of northern hardwoods on poor sites have been converted to aspen and/or red maple. Red maple is better adapted to many of these poorer sites than northern hardwoods and has more growth potential. Over time, some stands of primarily aspen, and white birch, convert naturally to more moderately shade-tolerant to tolerant red maple. Future trends for this type indicate a continued increase over time, though possibly at a reduced rate.

**830.1.9(b) Current Status (2006)**

Table 830.10 shows the number of acres and percentage of total acreage on the Douglas County Forest for the fir-spruce, tamarack, cedar, swamp hardwood, swamp conifer, black spruce, hemlock hardwood, and red maple timber types as of 2000 (see Appendix I-III for the location of these timber types on the Douglas County Forest).
CHAPTER 800: INTEGRATED RESOURCE MANAGEMENT

Table 830.10
Number of Acres and Percentage of Total Acreage for Various Timber Types on the Douglas County Forest as of 2006

<table>
<thead>
<tr>
<th>Fir-Spruce</th>
<th>Tamarack</th>
<th>Cedar</th>
<th>Swamp</th>
<th>Swamp</th>
<th>Black</th>
<th>Hemlock</th>
<th>Red Maple</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hardwood</td>
<td>Conifer</td>
<td>Spruce</td>
<td>Hardwood</td>
<td></td>
</tr>
<tr>
<td>5,378</td>
<td>874</td>
<td>2,133</td>
<td>22,976</td>
<td>2,357</td>
<td>8,109</td>
<td>57</td>
<td>1,980</td>
</tr>
<tr>
<td>1.97%</td>
<td>0.32%</td>
<td>0.78%</td>
<td>8.42%</td>
<td>0.86%</td>
<td>2.97%</td>
<td>0.02%</td>
<td>0.73%</td>
</tr>
</tbody>
</table>

Many secondary timber types are found in association with large percentages of these various primary types on the Forest. Under certain circumstances, these secondary types provide a limited option for alternative silvicultural prescriptions, primarily conversions. Table 830.11 shows the two most common secondary types on the Forest for of these various primary types as of 2006 (see Section 820.1 for definitions of type abbreviations).

Table 830.11
Secondary Types Associated with Various Timber Types on the Douglas County Forest (percent)

<table>
<thead>
<tr>
<th>Fir-Spruce</th>
<th>Tamarack</th>
<th>Cedar</th>
<th>Swamp</th>
<th>Swamp</th>
<th>Black</th>
<th>Hemlock</th>
<th>Red Maple</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hardwood</td>
<td>Conifer</td>
<td>Spruce</td>
<td>Hardwood</td>
<td></td>
</tr>
<tr>
<td>A – 53%</td>
<td>SB – 40%</td>
<td>SH – 33%</td>
<td>SC – 8%</td>
<td>SH – 38%</td>
<td>T – 10%</td>
<td>SH – 32%</td>
<td>A – 41%</td>
</tr>
<tr>
<td>BW – 5%</td>
<td>SC – 11%</td>
<td>SC – 27%</td>
<td>NonC – 7%</td>
<td>NonC – 8%</td>
<td>NonC – 5%</td>
<td>SB – 25%</td>
<td>NH – 35%</td>
</tr>
</tbody>
</table>

NonC - noncommercial types.

Many of these timber types on the Douglas County Forest are primarily in an unregulated condition due to large differences between individual age classes. Since many of these types are managed only on a limited basis, regulating them is largely impractical. Table 830.12 shows the total acreages for these types as of 2006 by 10-year age classes.
### Table 830.12
Acreage for Various Timber Types on the Douglas County Forest as of 2006, by age classes

<table>
<thead>
<tr>
<th>Type</th>
<th>0-9</th>
<th>10-19</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70-79</th>
<th>80-89</th>
<th>90-99</th>
<th>100+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fir-Spruce</td>
<td>758</td>
<td>427</td>
<td>50</td>
<td>22</td>
<td>169</td>
<td>258</td>
<td>486</td>
<td>1,853</td>
<td>963</td>
<td>327</td>
<td>65</td>
</tr>
<tr>
<td>Tamarack</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>65</td>
<td>52</td>
<td>195</td>
<td>233</td>
<td>92</td>
<td>197</td>
</tr>
<tr>
<td>Cedar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>58</td>
<td>127</td>
<td>1,921</td>
</tr>
<tr>
<td>Swamp Hardwoo</td>
<td>0</td>
<td>38</td>
<td>63</td>
<td>361</td>
<td>124</td>
<td>698</td>
<td>819</td>
<td>1,600</td>
<td>2,586</td>
<td>4,544</td>
<td>12,143</td>
</tr>
<tr>
<td>Swamp Conifer</td>
<td>0</td>
<td>14</td>
<td>82</td>
<td>18</td>
<td>17</td>
<td>181</td>
<td>416</td>
<td>442</td>
<td>506</td>
<td>110</td>
<td>571</td>
</tr>
<tr>
<td>Black Spruce</td>
<td>10</td>
<td>122</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>102</td>
<td>910</td>
<td>1,801</td>
<td>1,651</td>
<td>2,121</td>
<td>1,352</td>
</tr>
<tr>
<td>Hemlock Hardwoo</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>0</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Red Maple</td>
<td>37</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>173</td>
<td>492</td>
<td>685</td>
<td>550</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

Acreages for many of these types are concentrated heavily in the older age classes. Since management is limited for most of these types, most of the regeneration that occurs is from natural disturbances or succession. Although not represented in the table, some of these species are being regenerated through management and fall within the younger age classes as stand associates rather than as primary types.

830.1.9(c) Desired Future Condition

The primary long-term goal for managing these species on the Douglas County Forest is to maintain current acreages. Only some of these species will be actively managed. Many sensitive or unique areas on the Forest such as State Natural Areas and habitats with exceptional features contain these types. Stands displaying poor growth or that have poor-quality trees may be converted to species more suited to a particular site. It is important to retain many of these species as minor associates of other timber types because of their wildlife and ecologic value.

830.1.9(d) Management

(1) Applicable Silvicultural Treatments

The DCFD sometimes manages these timber types using even-age silvicultural practices. Management decisions depend on factors, such as; location, access, volume, costs, stand condition,
mean age, growth potential, and economic/biological maturity. The following guidelines are used by the DCFD in managing these types.

(1) **Fir-Spruce** - In the fir-spruce type, periodic thinnings based on site capabilities may be incorporated, especially within artificially planted white spruce plantations. The shelterwood system in conjunction with adequate site preparation in the form of soil scarification is the preferred method for regenerating the fir-spruce type on the Douglas County Forest. Clearcutting may be an authorized harvest option on the Forest when objectives are species conversions or when salvaging trees following outbreaks of damaging agents.

(2) **Tamarack** - Strip clearcuts and the seed-tree system are the preferred methods for regenerating the tamarack type on the Douglas County Forest. Both methods require adequate site preparation in the form of soil scarification to prepare the seedbed for seedling establishment. On good to excellent sites with high relative growth potential, an intermediate entry in the form of thinning based on basal area control may be a viable option before the regeneration harvest. Direct seeding and/or artificially planting seedlings also may be viable alternatives.

(3) **Cedar** - Currently, no white-cedar stands are under active management on the Douglas County Forest because of the inherent difficulties in regenerating cedar amid high deer populations (see Section 830.3.1(b)). Occasionally, stands of other types with a cedar component will be managed and the cedar will be reserved.

(4) **Swamp Hardwood** - The shelterwood system in conjunction with periodic thinnings based on site capabilities and residual crown-cover control is the preferred method for regenerating the swamp hardwood type on the Douglas County Forest. Black ash is difficult to regenerate on a successful and consistent basis and the wet sites that it occupies can pose significant operational problems for mechanized harvesting equipment. Therefore, management of black ash will be limited within the Forest and any management will be monitored closely post-harvest. Alternative management approaches may be necessary to salvage trees following outbreaks of EAB and to minimize localized and/or widespread mortality.

(5) **Black Spruce** - Strip clearcutting is the preferred method for regenerating the black spruce type on the Douglas County Forest. Under certain conditions, an area clearcut may be a viable option, but direct seeding will be needed for regeneration. Both methods require adequate site preparation in the form of soil scarification to prepare the seedbed for seedling establishment. Within some stands, an intermediate entry in the form of thinning based on basal area control may be a viable option before the regeneration harvest to regulate stocking levels.

(6) **Hemlock** - Hemlock is difficult to regenerate and very uncommon on the Forest where only 57 total acres exists. Occasionally, stands of other types, primarily northern hardwood, with a hemlock component are managed and the Hemlock will be reserved. Over the next 15 years, there may be limited opportunities to manage hemlock in stands that are deteriorating due to aging. However, any management will be limited in scale and focus on maintaining the hemlock hardwood type.
(7) **Red Maple** - The shelterwood system in conjunction with periodic thinnings based on site capabilities and basal control is the preferred method for regenerating the red maple type on the Douglas County Forest. Soil scarification is not essential for red maple but can be prescribed to regenerate and maintain common associates such as paper birch, northern red oak, and/or white pine. Clearcutting and regeneration through coppice sprouting may be a harvest option on lower quality sites with poor growth potential and where access is difficult. Clearcutting for the red maple type should be restricted to periods when the ground is frozen to maximize vegetative sprouting. Red maple is commonly managed as a associate in many stands as well by natural seeding and vegetative stump sprouting.

(2) **Determining Annual Allowable Harvest Levels**

The average rotation age for these timber types on the Douglas County Forest will vary depending on species, site quality, and non-timber management objectives. The primary goal for each type will be to promote and maintain desired landscape conditions throughout the Forest, including balancing the age class distribution for a sustainable forest structure over time. The range of rotation ages used to manage these species will follow guidelines in the WDNR Silviculture Handbook where appropriate. Because the some of these species are uncommon on the Forest and enhance ecological, aesthetic, and/or wildlife values, certain stands will be maintained on extended rotations or left indefinitely on the landscape.

Currently, there is no annual harvest level for any of these types on the Douglas County Forest. Most stands are managed infrequently when stand conditions warrant and harvesting is practical and feasible. Harvest levels are subject to change upon receiving updated inventory data or when responding to insect or disease outbreaks and/or weather events. Over the next 15 years, sustained management of these types on the Douglas County Forest will continue to be explored and the DCFD will continue to investigate and evaluate new management approaches as they become available.

**830.2 LOCALLY UNCOMMON TREE SPECIES**

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 human-caused (e.g., logging, farming) disturbances. The following tree species are considered uncommon on the Douglas County Forest and perhaps to some extent throughout the region: American elm, eastern hemlock, northern white-cedar, black cherry, and white ash.

**830.2.1 American Elm**

American elm particularly large trees, are uncommon on the Douglas County Forest primarily due to mortality caused by Dutch elm disease. Where found, elm is associated with the swamp hardwood type and is normally left uncut to provide seed sources for the future.
830.2.2 Black Cherry

Black cherry is found occasionally in northern hardwood stands throughout the Forest. The quality is poor because Douglas County is on the western edge of its range. This species usually is left uncut because of its uniqueness.

830.2.3 Butternut

Butternut is rare on the Douglas County Forest except for small, scattered pockets. The quality is poor because Douglas County is on the extreme northwestern edge of its range. This species is commonly left uncut because of its uniqueness and to provide seed sources for future regeneration.

830.2.4 White Ash

White ash is found occasionally as a minor component in northern hardwood stands throughout the Forest. The DCFD attempts to maintain and even increase its presence when white ash is found in hardwood stands under management. White ash usually is left uncut and surrounding trees are marked for removal to increase the amount of sunlight that reaches the forest floor to accommodate the light requirements for successful regeneration.

830.3 Plant Species of Concern

830.3.1 Tree Species of Concern

830.3.1(a) Eastern Hemlock

Eastern hemlock generally is a minor component in stands of northern hardwoods. There are few pure stands of hemlock on the Douglas County Forest. Hemlock contributes to the diversity of hardwood stands in the northern Great Lakes Region and provides habitat for many wildlife species, including migratory songbirds as well as a seed source for regeneration. Management is keyed to maintaining hemlock as a component of northern hardwood stands and improving the health and vigor of this species. Hemlock is currently not harvested on the Forest because there is little to no market for this species and regeneration has proven difficult due to overbrowsing by deer. Special silvicultural techniques in conjunction with deer repellents, fencing, and/or bud capping may prove effective in regenerating hemlock and increasing its future presence on the Forest.

830.3.1(b) Northern White-Cedar

Most of the northern white-cedar on the Douglas County Forest is in small, isolated pockets. Cedar contributes to the diversity of the northern Great Lakes Region’s forested wetlands and provides habitat for migratory songbirds as well as a seed source for regeneration. Cedar also provides thermal cover for white-tailed deer during the winter months and is an important food source. It is difficult to regenerate this species because of overbrowsing by deer. Silvicultural techniques in
conjunction with the use of deer repellents, fencing, and/or bud capping may prove effective in regenerating cedar and increasing its future presence on the Forest.

830.3.2 Exotic Plant Species of Concern

Exotic or non-indigenous invasive plant species can cause significant ecological and economic damage to the Forest. For example, the common and glossy buckthorn eliminate wildflowers and also limits the regeneration potential of certain tree species. Preventing these plants from dominating the understory is essential for the long-term health and economic viability of the Forest.

Over the last two decades, there has been an increase in invasive plants on the Forest. With proper training, vigilance, and effective control efforts, new infestations can be managed or eliminated. Prevention and early control efforts are critical in managing infestations. Although currently prohibited on the Douglas County Forest, herbicides are the most efficient and effective methods for controlling invasive plants. Currently, many highly invasive plant species that are threatening to invade much of the northern forests in the State. Section 615.1 includes a discussion of the risks posed by invasive plants and Appendix H-II includes a decision guide for timber harvesting in connection with invasive species.

830.3.3 Legally Protected Plant Species

Certain plants in Wisconsin are protected under the Federal Endangered Species Act and/or the State Endangered Species Law (s. 29.604 Wis. Stats. and NR 27 Wis. Adm. Code). Under State law, no one may possess or sell a wild plant that is listed as endangered or threatened without a valid permit. Likewise, on public lands or lands one does not own, or lease, or has not obtained permission from the landowner, no one may cut, root up, sever, injure, destroy, remove, transport, or carry away a listed plant without a permit. An exception is the removal of legally protected plants in connection with authorized forestry, agricultural, or utility activities on public lands.

The WDNR’s Bureau of Endangered Resources NHI program compiles information on these species in the State, including those on the Douglas County Forest. See Appendix W-I for a list of threatened or endangered species in Wisconsin.

830.3.4 Other Plant Species and Natural Communities of Concern

The WDNR’s NHI program also compiles information on rare species and natural communities, (see Appendix W-I).

830.3.4(a) Plants of Special Concern

These plants are considered potentially threatened or endangered due to low abundance and/or poor distribution. The WDNR maintains a list of these species of special concern occurring on the Douglas County Forest.
830.3.4(b) Natural Communities

Similarly, information on natural communities of concern on the Douglas County Forest is compiled by the WDNR. Twenty-seven natural communities have been recorded on or near the Forest. These include boreal forest, dry cliff, Great Lakes beach, Great Lakes dune, inland beach, mesic floodplain terrace, northern dry forest, northern dry-mesic forest, northern mesic forest, pine barrens, alder thicket, black spruce swamp, emergent marsh, floodplain forest, hardwood swamp, interdunal wetland, seepage lakes, bogs, northern sedge meadow, northern wet-mesic forest, northern mesic forest, poor fen, spring pond, springs, streams, submergent marsh, and tamarack swamp.

840 WILDLIFE MANAGEMENT

Wildlife management on the Douglas County Forest is facilitated by the use of sound management methods that create desirable habitats across the entire landscape. Examples include commercial timber harvests and TSI projects that provide food and/or shelter for wildlife.

840.1 Background

For purposes of this Plan, wildlife includes all native birds, mammals, fish, amphibians, reptiles, and insects. Wildlife biologists will emphasize habitat management that interrelates wildlife benefits and sound forestry practices. Concerns about biological diversity on the Forest and its regional, continental and global perspective, may cause wildlife managers to emphasize specific components of the forest community. Practices related to climax conditions, snags and den trees, access, forest openings, pine barrens, jack pine, aspen, and oak are all a part of dynamic forest-management. A primary goal of wildlife management on the Douglas County Forest is to provide a diversity of healthy ecosystems necessary to sustain native wildlife populations.

Habitats typically managed for on the Douglas County Forest include open water, permanent openings, conifer stands that provide thermal cover, pine barrens, wetlands and bogs, oak stands, den sites, and stands of timber in various age classes. Practices such as leaving buffer strips of unbroken forest cover along streams or reserve areas in harvest units create a contiguous habitat. This allows travel corridors for crossing wildlife and can link important wildlife habitats.

840.1.1 Technical Planning

The Director of Forestry and Natural Resources, WDNR Liaison Forester, and WDNR Wildlife Biologist will formulate management plans and use appropriate management techniques to protect and enhance the forest community, of which wildlife is a key component.
840.1.2 Guidelines

Wildlife planners will refer to the following WDNR Manual Codes: 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).

840.1.3 Inventory

Habitat needs will be determined by analyzing of forest-inventory data that are based on Integrated Resources Management Units (see Section 860). Wildlife populations will be inventoried periodically by WDNR wildlife/endangered resources personnel and other cooperators. Species will be sampled by the following methods:

(1) Deer - registration, sex-age kill computations, summer doe/fawn surveys, and winter deer yard surveys.
(2) Bear - registration, aging, and bait survey.
(3) Ruffed grouse - spring drumming count and summer brood observations.
(4) Woodcock - spring singing ground survey.
(5) Furbearers and snowshoe hare - winter track index.
(6) Eagle and osprey - aerial activity and productivity survey.
(7) Ducks and geese - spring aerial wetland and pair counts.
(8) Timber wolf - pack and population monitoring.
(9) Herpes - annual frog and toad count.

Additional survey data used in analyzing habitat needs may be obtained from other agencies, non-profit wildlife organizations, and individuals, e.g., Christmas bird count, Natural Area inventories, and Federal waterfowl surveys.

840.1.4 General Management Policies

Commercial timber harvests will continue to be the most important tool for effecting wildlife habitat on the Douglas County Forest. The value of wildlife habitat depends on the size, shape, location, timing, and cutting requirements of timber harvests. In certain situations, managers may modify forest-management practices in benefiting wildlife and promoting biodiversity. The following will be considered by management planners:

(1) Timber types, habitat conditions, and impacts on affected wildlife.
(2) Access (roads and trails) management and impacts on wildlife (see Chapter 700).

(3) Even-age regeneration harvests that vary in harvest unit size and shape.

(4) Management activities that promote a diversity of stand ages, sizes, and species.

(5) Providing additional edge habitat by creating a patchwork of small stands harvested at different times or larger stands with irregularly shaped boundaries.

(6) Retaining mast-bearing trees and shrubs where feasible to provide food for wildlife.

(7) Leaving dead standing trees (snags) of varying size and species when harvesting stands.

(8) Retaining live den trees with cavities for squirrel, raccoon, and other cavity dwellers.

(9) In clearcuts, leaving scattered live trees to provide additional vertical habitat as well as future snag/den tree recruits.

(10) Under certain circumstances, conducting large regeneration harvests that favor species that require large, young forest areas initially and then large, interior areas as the stand ages.

(11) Scatter corridors, fingers, and peninsulas of standing trees throughout harvest units to provide cover for wildlife species that need to cross through them.

(12) For added diversity and to provide winter thermal cover in large acreages of deciduous stands, plant scattered stands of slow-growing conifers such as white spruce.

(13) Seed harvest-unit landings and skid trails with ground-cover mixes that benefit wildlife.

(14) Enforce requirements related to utilization standards, harvest systems permitted, season of operation, residual stem retention, slashing prescriptions, slash treatment and special treatments within a riparian or streamside management zone.

(15) Maintain early successional forests such as aspen, jack pine, and scrub oak because of their importance to songbirds, small mammals, deer, grouse, woodcock, and snowshoe hare. (Aspen should be considered the most important early successional forest for wildlife).

(16) Emphasize the maintenance of representative areas of mid to late-successional forest stages for their unique wildlife and biological values.

(17) Develop detailed plans and seek professional advice in managing endangered and threatened species. Management recommendations will be submitted to the WDNR Liaison Forester and the Director of Forestry and Natural Resources for their consideration.

(18) Retain large woody debris for amphibians, reptiles, insects, and mammals that require this habitat niche.
840.2 Wildlife Habitat Development Grants

The WDNR offers financial support to Douglas County for planning, development, or maintenance projects that improve wildlife habitat on the Forest. County conservation aids and wildlife habitat development grants are available annually for the following qualified projects:

(1) Maintenance, renovation, and development of wildlife openings.

(2) Forest access management - maintenance of existing trail, renovation, gating and closing of trails, and new trail development.

(3) Post-sale aspen management - e.g., shearing alder to increase marginal aspen stand area.

(4) Jack pine maintenance - seeding, planting, and site preparation.

(5) Oak management - burning, planting, and scarification.


(8) Barrens management - burning and seeding, planting, and habitat management.

(9) Land acquisition for critical wildlife habitat.

(10) Education - Interpretative signs and brochures focused on wildlife.

(11) Equipment purchase.

(12) Beaver control devices on water-drainage structures.

(13) Wetland habitats development and maintenance.

840.3 Habitats of Importance

Important habitat types are cover types of importance to certain native wildlife and whose absence would significantly reduce populations at a local or broad scale.

840.3.1 Forested Habitats

The following habitat types on the Douglas County Forest are considered important to wildlife:

840.3.1(a) Aspen

The aspen type provides unique habitat for a variety of wildlife species that require early successional forest conditions. This type will continue to be regenerated, and managers will consider reserving scattered den and mast-producing trees and leaving travel corridors of varying size and shape.
840.3.1(b) 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. Natural regeneration with pre- or post-sale scarification will be attempted where possible.

840.3.1(c) Lowland Conifers

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

840.3.1(d) Oak

Oak habitat (the scrub oak and northern red oak types), is important to wildlife because of its cavity-forming potential, and the brushy cover it provides at a young age, and for mast production. Management will focus on maintaining and regenerating this type in the habitats in which it is found, including northern red oak on mesic sites, pin, black, and bur oak on sandy sites, and bur oak on red clay soils.

840.3.1(e) Pine Barrens and Savannas

Pine barrens are classified as a true savanna type. They are associated with sandy and gravelly soils in the pitted outwash of glacial deposits or sediments of extinct lakes. The term savanna is used where trees are a component but their density is so low that grasses and other sun-seeking herbaceous vegetation dominate. Pine barrens are unique among savannas in that the shrub component is much more extensive than in other savanna types. Pine barrens originally covered 2.3 million acres and oak barrens covered 1.8 million acres of the Wisconsin landscape. Fire, soils, and topography dominate the development and maintenance of Pine barrens. Humans have greatly influenced this type as intensive fire-suppression activities have nearly eliminated the large, frequent fires which once occurred naturally in the Pine barrens. In the absence of fire, natural plant succession and intensive tree planting have converted virtually all of Wisconsin’s pine barrens to forested habitats. Currently, less than 1 percent of the original barrens habitat is being managed.

On the Douglas County Forest, pine barrens will be managed in the Douglas County Wildlife Area (see Section 840.4.2), a 4,000 acre area located in the central part of the County west of State Highway 53. This area will be maintained in an early successional stage of grasses/shrubs by prescribed fire to provide habitat for plant and animal species that are associated with the pine barrens.

In addition to the maintained Douglas County Wildlife Area, a pine barrens management component consisting of connected and satellite surrogate or floating barrens will be established on the Forest. On any given year, mature stands of jack pine are harvested. These harvested areas will
be regenerated naturally when possible and continue to provide barrens habitat until the regeneration reaches a height of about 10 feet. Across the landscape, these areas will make up the floating barrens habitats which along with the remaining forested blocks throughout the barren region will provide a diverse matrix of sand habitat cover types: scattered grass and shrub openings, scrub oak, aspen, birch, oak, jack pine, and red pine.

Barrens management in Douglas County is not limited solely to the County Forest. Wausau Paper Co. maintains a similar floating barrens program throughout the southern and eastern regions of the County. These floating barrens are maintained by harvests on a regularly scheduled rotation of sites. Most of these barrens are large, temporary openings that provide habitat conditions similar to those on pine barrens.

840.3.2 Nonforested Habitats

Section 820.2 includes specific data and descriptions of upland and lowland nonforest cover types on the Douglas County Forest. Many of these habitats are used by wildlife and provide diversity throughout the Forest.

840.3.2(a) Upland Nonforest Habitats

(1) Forest Openings. These include upland grasses such as prairie brome, june grass, slender wheatgrass, big and little bluestem, and Indian grass, and abundant forbs such as asters, milkweed, bracken fern, clover, and goldenrods. On disturbed sites, tame grasses such as fringed brome, timothy, bluegrasses, and quack grass may dominate.

Permanent grass and herbaceous openings are essential to achieve well-balanced wildlife habitat. Openings provide an abundance of insects for songbirds, grouse, snakes, and amphibians, fruits and nuts for chipmunk, squirrel, songbirds and bear, and forage for deer and rabbit. Sources of these openings are forest access roads, harvest landings, abandoned recreational trails, and areas developed for wildlife. In cooperation with Douglas County, the WDNR maintains by mechanical and hand treatment 554 openings on the Douglas County Forest totaling about 650 acres. These openings are maintained on a 4-year rotation of treatments. Intensive maintenance of permanent openings will depend on future budget allocations and priorities.

Wildlife openings are a dynamic component of the Douglas County Forest. Over time, the location of some of these openings may change. In cooperation with the WDNR, the addition and removal of wildlife openings will be an ongoing process on the Forest.

(2) Brush Prairie. Consist of ground cover composed primarily of prairie plants that include grasses such as big and little bluestem, poverty oat grass, prairie brome, and junegrass. Herbaceous vegetation consists of several sunflowers, blazing star, wild bergamot, prairie phlox, and pasque flower. Brush prairie shrubs include sweetfern, blueberry, new jersey tea, bearberry, and ground cherry.

(3) Shrub Openings. Primarily upland sites less than 10 percent stocked with tree species but where half
or more of the area is stocked with taller, persistent shrubs such as hazel, gray dogwood, juneberry, sumac, red elderberry, black and choke cherry, nannyberry, and hawthorn.

(4) Rock Outcrops and Sand Banks. Rock outcrops that include rocky tallus and bedrock material.

**840.3.2(b) Lowland Nonforest Habitats**

(1) Shallow Marshes. Wetlands characterized by persistent emergent vegetation such as bur-reed, bulrush, arrowhead, cattails and pickerelweed, and water depths to 1.5 feet.

(2) Sedge Meadow. These are wetlands characterized by sedges and Canada bluejoint grass. Surface water is up to 6 inches deep in winter and early spring; the saturated soil surface is exposed in summer.

(3) Fresh (wet) Meadow. These wetlands are dominated by grasses such as red-top and Canada, bluejoint, and by forbs such as giant goldenrod growing on saturated soils. In some areas, the invasive, nonnative, reed canary grass has replaced bluejoint as the dominant grass.

(4) Low Prairie. These wetlands contain open, herbaceous plant communities covered by low-growing plants. They are dominated by native grasses and forbs associated with prairies, e.g., prairie cordgrass, big bluestem, and New England aster.

(5) Open Bog. These wetlands are composed of living sphagnum moss growing over a layer of acid peat. Herbs and low shrubs colonize the mat and immature or stunted trees of black spruce and/or tamarack are scattered throughout the area. The County Forest contains the largest and best examples of open bog communities in the State.

**840.4 Special Wildlife Management Areas**

The County Forest is home to abundant and diverse wildlife, both game and non-game species. Opportunities abound to view numerous songbird species and waterfowl species, as well as white-tailed deer, ruffed grouse, black bear, bald eagle, and river otter. Although wildlife is found throughout the Forest, the DCFD manages certain areas intensely for specific habitats and species. These areas provide opportunities to observe, hunt, and/or photograph a variety of species, and are distinct from the special management areas discussed in Section 530.

**840.4.1 Special Grouse Management Areas**

Three blocks of the County Forest are designated as special grouse management areas. Enrolled in the Ruffed Grouse Society’s Special Management Area Program, they include the Spruce River, Poplar River, and the Empire Grade Grouse Management Areas. Total acreages are 18,200, 1,700, and 8,200, respectively (see Appendixes O-IV, P-IV, Q-IV, and R-IV for the location of these areas on the Forest).
Management objectives for each area are to enhance habitat for ruffed grouse and woodcock by:

(1) Maintaining and expanding aspen and oak acreage.

(2) Establishing harvest areas of varying sizes and with irregular boundaries to maximize the creation of forest edge.

(3) Discouraging encroachment by coniferous species into the aspen and oak types.

(4) Creating and maintaining structural and age class diversity in the aspen and oak types.

(5) Managing motorized access.

Management for woodcock habitat may become more important should the current decline in populations of this species continue. The woodcock has been identified in Wisconsin’s Comprehensive Wildlife Conservation Plan as a species of greatest concern because the young forests and shrubland habitats used by this species are declining throughout the State. Management practices that favor woodcock habitat include harvesting uplands directly to the edge of lowland habitat, providing young forest habitat, and creating disturbances in brushy lowland habitats to encourage new growth. Some of these methods may conflict somewhat with BMP applications. In these situations, extra precautions will be taken to protect water quality and soil structure while creating the targeted habitat.

**840.4.2 Douglas County Wildlife Area**

The Douglas County Wildlife Area, (DCWA), also commonly called the Bird Sanctuary, is located between Solon Springs and Gordon Wisconsin, 35 miles south of Superior. This 4,000 acre area was established to develop and maintain the pine barrens type that once was common in northwestern Wisconsin.

Never abundant in the densely forested, pre-settlement northern Wisconsin, populations of the sharptail grouse reached an all-time high in the early 1900’s when wildfires that roared through the region increased the bird’s habitat. From the 1920’s to the 1950’s, the grassy brushlands and young forests were ideal sharptail habitat and provided excellent hunting. But as early as the 1940’s, the range of this species began to shrink as open country gave way to natural forest succession, tree planting, declining agriculture, and improved wildfire suppression methods.

Today, sharptails in Douglas County are found only as small, scattered flocks in young pine forests, pine clearcuts and rough farmland. Recognizing the uncertain future for this species, the DCWA was designated as a sharptail grouse management area in 1948 by the Wisconsin Conservation Commission. A total of 2,480 acres was leased by the WDNR from the County for 50 years. A new lease and management plan was negotiated in 2003. The State currently owns about 1,000 acres in fee title with about 3,000 additional acres leased from the County.

Except for a 240 acre Scientific Area, which is an example of brush/savannah, the entire property is
designated as a fish and wildlife management area. With a log clubhouse, kennels, and horse stables, use of the DCWA by groups other than hunters and anglers continues to grow. The clubhouse is used for family and group activities and field trips to the Scientific Area by high school and university students are common. The DCWA also is used by berry pickers, mushroom gatherers, birdwatchers, cross-country runners, skiers, hikers, horseback riders, and nature photographers.

The property has numerous developed trails and roads, including multiple-use recreational trails designated for year-round or winter use dog trial trails, and County Forest Roads. Because the DCWA Area is leased and purchased as State-managed property, all County and State statutes and ordinances apply (see map in Appendix P-III).

**840.4.3 Important Bird Areas**

The Important Bird Area (IBA) program is a global initiative that links local, State, national, and international conservation efforts to protect essential habitat for all birds. The IBA program is a voluntary, cooperative initiative that aims to identify and protect those sites that are most important to birds in any stage of their life cycle. These sites are considered to be exceptionally significant for bird conservation. There are two IBA sites on the Douglas County Forest.

**840.4.3(a) Peatlands**

The Douglas County Peatlands IBA is home to many bird species whose population densities are the highest in this part of the State. Boreal species such as Canada warbler, Connecticut warbler, blue-headed vireo, LeConte’s sparrow, and northern saw-whet owl thrive in these peatlands. Other species that require more open space e.g., northern harrier, short-eared owl, and golden eagle, also use this IBA. The golden-winged warbler, a species of special concern, is found in high numbers in these peatlands.

The Peatlands IBA encompasses County land from a line approximately following Chase Creek to Moose Lake to Amnicon Lake, then back to Black Lake. The DCFD voluntarily recognizes this area.

Management on this IBA will continue to optimize timber production using sound resource-management concepts and enhance recreation opportunities, though some activities may be modified to accommodate nesting birds or enhance bird habitat, for example, retaining more conifers in harvest areas (especially near alder-lined streams) or change the size of clearcuts to expand habitat for the golden-winged warbler. The DCFD may seek advice from WDNR bird-habitat experts. Recognition of this IBA does not affect any private land, although private landowners may choose to voluntarily participate in the program.

**840.4.3(b) Pine Barrens**

The Douglas County Pine Barrens IBA provides habitat for sharptail grouse (young barrens), field
sparrow (mid-age barrens), and Connecticut warbler (old barrens). This IBA encompasses County land in the northwestern sands east of the St. Croix River and north of Ounce River. The DCFD voluntarily recognizes this area.

Management on this IBA will continue to optimize timber production using sound resource management concepts and enhance recreation opportunities, though some activities may be modified to accommodate nesting birds or enhance bird habitat, for example, retaining more natural origin conifers or managing conifers in a shifting mosaic to provide early, mid-age and late barrens for bird species. The DCFD may seek advice from WDNR bird-habitat experts. Recognition of this IBA does not affect any private land, although private landowners may choose to voluntarily participate in the program.

840.5 Neotropical Migrant Birds

Neotropical migrant birds (NTMB) are songbirds that breed in North America and winter in Central and South America. More than 120 species of NTMB spend a portion of each year in Wisconsin using forest, shrub, and grassland habitats. Among these are warblers, tanagers, vireos, thrushes, swallows, and hummingbirds. NTMB play an important role in forest health by consuming large amounts of insects, including gypsy moths and forest tent caterpillars.

Two types of forest fragmentation have contributed to the decline of NTMB. There are two forms of forest fragmentation, each with different impacts on forest birds. Permanent fragmentation occurs when portions of a forest are converted to non-forest uses (urbanization and agricultural). This type of fragmentation poses the greatest threat to forest wildlife. Fragmentation of habitat or cover type occurs naturally due to local landscape features, catastrophic events such as wildfire and windstorms, and human activity (harvesting or development). Both kinds of forest fragmentation affect neotropical birds through changes in competition for resources, predation rates, and perceived quality of habitat. Each NTMB species responds differently to forest disturbance.

Since so many neotropical migrants use a variety of habitats and successional stages, it is difficult to determine the full impact of forest-management on the health of certain bird populations. Species such as the chestnut-sided warbler and mourning warbler benefit from early successional forest stands produced by even-age techniques such as clearcutting. By contrast, species that rely on more mature forests or interior forests may be adversely affected by intensive forest-management. To assure a rich diversity of NTMB in the County Forest, emphasis will be placed on activities that promote diverse NTMB habitats.

The DCFD will work closely with the WDNR in inventory existing bird populations, identifying needs, and maintaining valuable habitat types.
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840.6 Wildlife Species of Concern

840.6.1 Legally Protected Animal Species

The Federal Endangered Species Act of 1973 and the Lacey Act provide for the protection of wild animals threatened with extinction. The Wisconsin Endangered 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. 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, a legally protected species is protected wherever it occurs in Douglas County. Two Federally listed endangered wildlife species, found in Douglas County are Kirtland’s warbler and piping plover. The grey wolf recently was delisted as an endangered or threatened species and is now considered a protected species. In 2006, there were 18 known wolf packs in Douglas County, with at least 57 wolves observed. Many of these packs utilize the County Forest to meet their habitat needs. Five known State-listed endangered wildlife species found in the County include the piping plover, trumpeter swan, Caspian tern, common tern, and purple wartyback mussel. Eight State-listed threatened species found in the County include the cerulean warbler, yellow rail, osprey, greater redhorse, girt darter, wood turtle, Blanding’s turtle, and pygmy snaketail. Once a Federally-listed threatened species, the bald eagle has also been recently delisted and is now considered a protected species. The WDNR also maintains a list of endangered and threatened invertebrates and plants with records of occurrence in Douglas County (see Section 830.3 and Appendix W-I).

840.6.2 Other Animals of Special Concern - NHI

As with plants, the WDNR compiles information on rare animal species when their abundance is low and/or distribution is poor. The main purpose of this category is to focus attention on certain species before they become threatened or endangered. The WDNR maintains a continually updated list of species of special concern that are known to occur in Douglas County, including on or near the County Forest (see Appendix W-I). The most current list may be viewed on the WDNR website.

840.7 Fish and Waters Management

Public waters within the Douglas County Forest will be managed to optimize natural fish production, create opportunities for quality recreation, and maintain a healthy, balanced aquatic ecosystem. Emphasis also will be placed on land-use practices that improve and protect fish habitat and water quality.

840.7.1 Technical Planning

Management of all waters within the Douglas County Forest is the responsibility of the WDNR. Technical assistance will be provided by the WDNR water regulation specialists and Fisheries
Biologists. Management will be conducted in accordance with the WDNR Fish Management Handbook.

840.7.2 Water Surveys

Comprehensive lake and stream surveys on the Douglas County Forest will be conducted by the WDNR Fisheries Biologist as required. The publication “Surface Water Resources of Douglas County” published by the WDNR contains additional information relative to these waters.

840.7.3 Population Surveys

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

840.7.4 Watershed Management/Protection

Watersheds will be managed on the Douglas County Forest to protect watershed integrity and water quality. The overall goal of the watershed protection program on the Forest is to protect important watersheds and their associated waterways while minimizing adverse impacts on water resources. BMP’s will continue to be the DCFD’s primary tool utilized for water quality protection (see Section 810.1.6). A map of two of the most important watersheds found in the Forest (Lake Superior and Upper St. Croix – Eau Claire Rivers) can be found in Appendix J-III and Appendix K-III).

840.7.5 Lake Management

Management of lakes within the Douglas County Forest will take into account and protect the unique values associated with these resources.

840.7.6 Stream Management

Trout streams on the Douglas County Forest will be managed to protect and enhance their quality. Streams will be managed to perpetuate the inherent qualities of both warm-and cold-water species. Corresponding land-and water-use practices will be consistent with this management objective.

840.7.7 Outstanding and Exceptional Resource Waters

The WDNR manages Wisconsin's Outstanding and Exceptional Resource Waters Program that is designated to maintain the quality of the State’s cleanest waters. An outstanding resource water is defined as a lake or stream with excellent water quality, high recreational and aesthetic values, and high-quality fishing, and that is free of point-source or non-point-source pollution. An exceptional resource water is defined as a stream with the same high-quality values but that may be affected by point-source pollution or could receive discharges from a small sewer community (see Appendix V-
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I for a complete list of outstanding and exceptional resource waters in Douglas County).

840.7.8 Best Management Practices for Water Quality

Often the most practical and cost-effective method to assure that forest-management operations do not adversely affect water quality on the Douglas County Forest is to use BMP’s as described in “Wisconsin's Forestry Best Management Practices for Water Quality.”

In cooperation with the WDNR and the SFI forest certification program, BMP’s will continue to be the DCFD’s primary strategy for protecting soil and water resources on the Douglas County Forest during the next 15 years (see Section 810.1.6).

840.7.9 Water Access and Development

Water access and development activities on bodies of water within the Douglas County Forest are under the authority of the DCFD and will be reviewed on a case-by-case basis (see Chapter 700).

840.7.10 Water-Control Structures

The DCFD manages the following seven bodies of water with water-control structures to create recreational opportunities, enhance wildlife habitat, and promote ecological diversity. Appendix C-IV includes a map of these water bodies.

840.7.10(a) Cranberry Creek Dam

This dam was constructed in 1973 using earthen dikes, concrete abutments, a vertical concrete weir, and a concrete drawdown structure with a 24-inch metal gate. This dam has a head of 3 feet, and a structural height of 13 feet, and impounds about 70 surface acres of water. This dam is in a sparsely populated area and has received a low-hazard rating in 1995. It enhances wildlife habitat and increases ecological diversity on the County Forest.

840.7.10(b) Mooney Dam

This dam was constructed in 1938 and has a spillway about 40 feet wide, with four 9 foot wide stop-log bays. The head is about 5 feet with a structural height of about 12 feet that forms the 900 surface acre Lower Eau Claire Lake. A concrete apron extends 22 feet downstream. The dam provides recreational and fishing opportunities and serves numerous wateside residents. The dam received a low-hazard rating in 1995.

840.7.10(c) Jackson Box Flowage

This dam was constructed in the early 1960’s with earthen dikes and a corrugated metal pipe (CMP) of the whistle tube design with stop logs to control the water level. This dam has a head of 4 feet and impounds 45 surface acres of water. This dam enhances wildlife habitat and increases
ecological diversity on the County Forest.

840.7.10(d) Stateline Flowage

This dam was constructed in the late 1960’s with earthen dikes and a CMP of the whistle tube design with stop logs to control the water level. It has a head of 4 feet and impounds nearly 50 surface acres of water. This dam enhances wildlife habitat and increases ecological diversity on the County Forest.

840.7.10(e) Park Creek Pond

The original plans for this dam are not available but its estimated age is 40 years. It has a head of 9½ feet, a structural height of 12 feet, and impounds the 10 surface acre Park Creek Pond. The control structure is a CMP whistle tube with stop logs to control the water level. The dikes of the dam are the Old Highway 53 roadbed. The dam provides opportunities for young anglers and scenic viewing by residents of and visitors to the Solon Springs area. The impoundment is regularly stocked with trout by the WDNR. Extensive repairs of the dam’s structures were completed in 2006.

840.7.10(f) Gordon Dam

This dam was constructed in the 1930’s and was extensively rehabilitated in 1988. The spillway is about 140 feet wide with seven 14 foot and two 9 foot gates. The 14 foot gates have smooth crested concrete weirs with 3 feet of stop logs on top of the concrete. The 9 foot gates have stop logs extending to the bottom; which allows the water level to be lowered. This dam has a head of 9 feet and impounds the 1,900 surface acre St. Croix Flowage. The dam provides recreational and fishing opportunities, and serves waterside residents while enhancing habitat for wildlife.

840.7.10(g) Olson Meadows

This dam was constructed in 1973 with earthen dikes and a CMP of the whistle tube design with stop logs to control the water level. This dam has a head of 8 feet and impounds 15 surface acres of water. The dam enhances wildlife habitat and increases ecological diversity on the County Forest. The dam is in a sparsely populated area and received a low-hazard rating in 1995.

850 LANDSCAPE MANAGEMENT

The landscape approach to management provides commodity and noncommodity values throughout the Douglas County Forest by ensuring that all stand structures and other resource values are maintained across the landscape. By the approach, commercial timber is harvested in a sustainable fashion to maintain or create stand structures; improve wildlife habitat, provide fire protection, promote ecological diversity, and encourage overall forest health and productivity. Both intensive management and less intensive management of reserve areas are possible within the context of this
approach to the extent that these methods help maintain the balance of stand structures across the landscape, facilitate timber production, enhance forest aesthetics, improve wildlife habitat, and promote other important resource values.

**850.1 Biological Diversity**

For purposes of this Plan, biological diversity refers to 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 both forested and nonforested ecosystems. The landscape of the Douglas County Forest at a regional scale consists of a mosaic of plants and animals of various sizes and ages that are in constant flux due to succession from both natural and planned events.

Managing forests to maintain a diverse biological environment is important for the ecological health of the plants and animals and ultimately for the welfare of humans. The exact value of many elements in an environment may not yet be fully understood, and the abundance of organic matter and the wealth of organisms that characterize the landscape need to be better understood. Unique ecological characteristics, and imperiled ecosystems and organisms should continue to be identified and conservation efforts initiated.

Management of all species is important ecologically and economically. Economic health results from controlled, balanced harvests over several years. The Ecological health of northwestern Wisconsin and all of North America results from sound management practices. Regeneration cuts, variable harvest unit sizes, and the distribution and timing of harvests mimic natural disturbances such as wildfire and windstorm events and also promote biological richness. Special management guidelines emphasizing biodiversity on the County Forest will be considered during management planning.

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

**850.2 Habitat Fragmentation**

Ownership patterns, roadways, harvesting strategies, and planting regimes can fragment habitat into isolated units. As a result, biological entities can become separated from larger populations, reducing or changing the genetic material of some species through restricted mate selection and/or inbreeding. Localized extinction also can occur. Some forms of habitat fragmentation are naturally occurring and some ecosystems and organisms associated with them have evolved as a result of this process.

Management strategies developed cooperatively with neighboring forest owners and managers will help minimize fragmentation on a landscape level. A continued program of encouraging land acquisition within the County Forest’s blocking boundary and enrollment in the County Forest Law
will reduce the negative impact of fragmentation by land uses other than forestry.

850.3 Old Growth

What exactly constitutes a stand of old growth timber has been the subject of endless discussion. In general, true old growth is a forest at or near climax that has incurred few if any intrusions by humans. In other words, the forest is as it would have been found before humans began imposing their imprint. By this definition, there is virtually no old growth remaining on the Douglas County Forest because much of the Forest has been harvested several times throughout its history. Also, disease has removed major components of the Forest and the ecosystem structure has changed over time. Global climate change and the introduction of exotic species has added to this change.

If preserved, forest stands that are mature can reach a relative state exhibiting old-growth characteristics, such as a multilayered, uneven-age size-class structure typically characterized by longer-lived species as a major component, a lack of pioneer or shade intolerant species, a high degree of compositional and structural patchiness, and significant amounts of woody debris and tip-up mounds. As with certain endangered species, with care, effort, and sufficient time, old growth characteristics can be developed.

Managing old-growth characteristics on the Douglas County Forest will be accomplished through the development of additional plans targeted at specific stands/areas within the Forest. For the purposes of this Plan, old growth has been divided into three components.

850.3.1 Old Growth/Benchmark Stands

Old-growth reserves or benchmark stands that represent any of the natural cover types on the Douglas County Forest are designated by the DCFD.

850.3.2 Extended-Rotation Stands

These are forest stands managed for both forest products and the ecological and social benefits associated with older forests. Extended-rotation stands are dominated by biologically mature trees that are older than their traditional rotation age and younger than their average life expectancy. Management prescriptions on these sites generally are delayed beyond the normal rotation that is used on the balance of the Forest. Extended-rotation stands may be aspen, northern hardwoods, pine, or other species that create stand conditions associated with large-diameter trees, native plant conditions, course woody debris, and downed timber. A buffer of extended-rotation stands usually is maintained around old-growth sites to add to their intrinsic value.

850.3.3 Presumed Climax Forest Cover

With the development and acceptance of habitat classification as a management tool, land managers are gaining a better understanding of the natural successional patterns of different habitat groups and soil types in the northern Great Lakes region. Presumed climax forest-cover stands will be
associated with a specific habitat type. It is important to note that there often are multiple possibilities for a climax overstory on many habitat types in the Douglas County Forest, and that the climax overstory on certain sites may not be as socially and/or economically beneficial as early or mid-successional species.

850.4 Other Special Management Areas

See Section 530 for descriptions of Special Management Areas.

860 INTEGRATED RESOURCE MANAGEMENT UNITS

Previous chapters have outlined the planning objectives, decision guides, and management considerations for administering the Douglas County Forest. In the mid 1990’s the DCFD arranged the Forest into blocking units called Integrated Resource Management Units (IRMU). Each IRMU is defined as a geographically recognizable unit of forest land that forms the basis for planning, prescribing, implementing, monitoring, and recording operations undertaken by the DCFD.

Resource managers use IRMU’s when communicating resource management needs and accomplishments. Land-use and other 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 allow flexibility to adjust or modify management practices as authorized by the Director of Forestry and Natural Resources.

Each IRMU description includes a map of the area, the unit name and number, and summary information on:

1. Forest compartment numbers and County Forest acreage in the unit.
2. Forest cover-types (existing and desired).
3. Landforms, geology, and soils.
4. Landtype Associations.
5. Surface-water resources.
6. Recreation uses.
7. Historic and cultural sites.
8. Special Management Areas.
9. Protection needs.
10. Access management, roads, and trails.
11. Management issues, concerns, and opportunities.
When the Douglas County Forest was first divided into IRMU in the mid-1990’s, 25 units were identified. Easily identifiable boundary features such as roads, waterways, and land ownerships were used to delineate the units. In 2001, a further division resulted in 27 individual units (see Appendix Q-II).

As resource inventories are completed and additional information is collected on IRMU’s individual units will be included in this Plan (Chapter 4000). All 27 unit summaries are targeted for completion by the end of 2009.