Nobel Woods Forestry Management Plan

City of Fitchburg Department of Forestry
August, 2005

Part I. Introduction

Introduction

This assessment provides current and historical information to assist the Parks Commission in determining the best long term management plan for the area known as Nobel Park Woods located just north of the intersection of Research Park Drive and Gallagher Drive in Fitchburg Technology Campus. The four acre woodlot was dedicated to the City of Fitchburg in two phases in accordance with the Parks Dedication Ordinance. Currently there is no master plan for the woods but a small trail system that would provide recreation to local residents is projected to be put into place during the summer or fall of 2005.

Purpose of the Plan

The purpose of this plan is to:

- Investigate and discover the current state of the woods in terms of overall health, species composition, and wildlife presence.
- Provide a detailed inventory of the woods including location, size, species and health of individual trees; large scale and site specific soil characteristics; presence and abundance of understory flora; Wisconsin forest habitat classification type; and presence and abundance of wildlife species.
- Provide the city with several management prescription alternatives.
- Provide a schedule of specific operations and maintenance necessary to meet the prescription goals.
- Develop long-term goals for the management and maintenance Nobel Park Woods.

Visions and Goals

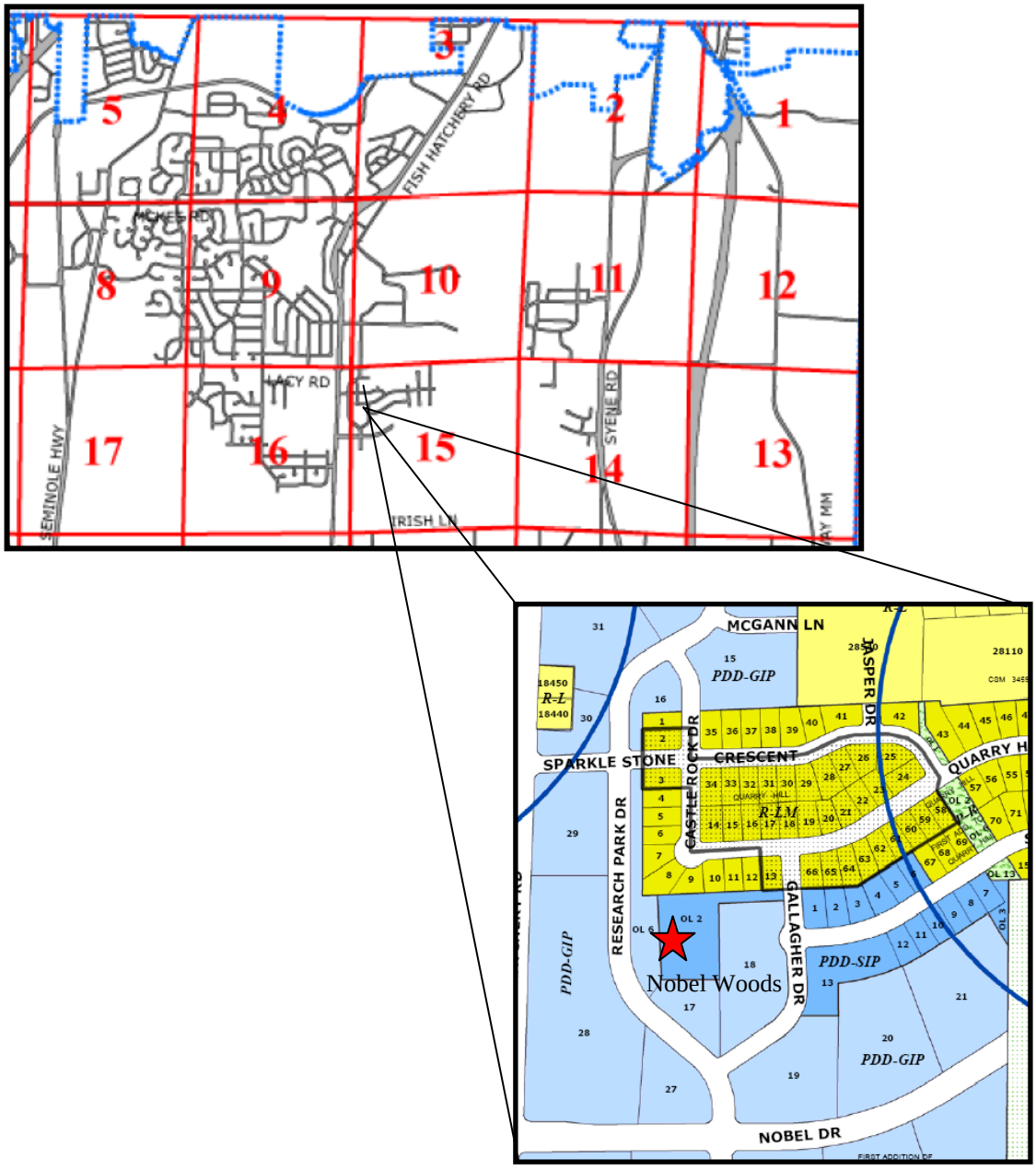
There are many potential outcomes for managing Nobel woods. Management plans range from no action, allowing the natural course of events to occur, to managing the woods for oak savanna. However, a specific management plan or vision cannot be seriously discussed until a thorough assessment is completed. The goal of this assessment is to provide the City Council with scientific, technical, and historical information to assist them in making a decision for the long-term (20+ years) management of Nobel Woods.

Part II. Regional and Site Assessments

Location and Legal Description

Nobel Woods is located just north of the intersection of Research Park Drive and Gallagher Drive in Fitchburg, Wisconsin. The four acre woodlot includes all of outlots 2 and 6, and lot 17 in the Fitchburg Technology Campus development. The legal description of the woodlot is N ½ SW ¼, NW ¼, S15, T6N, R9E Dane County, Wisconsin.

Fitchburg Location Map



Air Photo

Topography and Soils

Dane County straddles two distinct physical landscapes. The western portion of Dane County lies within the unglaciated Driftless Area of narrow stream cut valleys and angular outcroppings of sandstone and dolomite. The eastern two-thirds of Dane County, including the City of Fitchburg and Nobel Woods, experienced repeated glaciation over the past 790,000 years. This created a landscape consisting of mixed landforms such as outwash and till plains, drumlins, eskers, kames, kettles, and moraines as well as a distinct set of glacial soils.

Nobel Woods contains soils of the Dodge soil series. This series consists of deep, well-drained, gently sloping and sloping soils on glaciated uplands. These soils formed under mixed hardwoods in 26 to 36 inches of loess over sandy loam glacial till. A typical soil profile would include a surface layer of dark grayish-brown silt loam about 6 inches thick, a subsurface layer of brown silt loam about 3 inches thick, and a subsoil layer of brown silty clay loam about 20 inches thick. The Dodge soil series is part of the 2o1 Woodland suitability group. This group has moderately high potential productivity with a site index ranging from 67 to 71 and an average annual growth of 110 to 260 Bdft/yr.

Hydrology

Fitchburg lies within the Yahara River and Lake Monona watershed on a moraine that was formed during the Wisconsin Glaciation period. The Yahara River originates in the wetland regions of Colombia County and flows as a small stream through agricultural areas to where it empties into the Cherokee Marsh and eventually Lake Mendota. In the Madison/Fitchburg area the Yahara River serves as a relatively short connecting channel between several lakes in the watershed. Other important streams and lakes in this watershed include Murphy Creek, Nine Springs Creek, Starkweather Creek, Lake Monona, Upper Mud Lake, Lake Waubesa, and Lake Wingra. Rapid growth and development of areas within the Yahara River and Lake Monona watershed have led to increased urban runoff. In particular, sediments, nutrients, and various contaminants have become items of concern for resource managers in the region.

Land Use History

Prior to European settlement, the area which is now the city of Fitchburg was dominated by the oak savanna habitat type. This ecosystem type is characterized by areas of open-grown trees and considerable light penetration to the understory. Oak savannas, prairies, and most other Midwestern ecosystems are disturbance-maintained. Historically three types of disturbances predominated in this ecosystem: fire, drought, and herbivory. Fire was probably the most influential disturbance regime in oak savanna ecosystems reoccurring at intervals of once per year to once per decade. Fires helped to prevent fuel buildup and control woody plant invasion while maintaining the more fire-tolerant species such as oaks.

The first wave of European settlement arrived in Dane County between the late 1830's and the early 1840's. Early reports of good agricultural land being sold at minimal prices attracted the first settlers to the area. An early passerby, William Vroman, records his impression of the Fitchburg Township:

> "It is one of the best agricultural towns in the county, with very little or no waste lands, about equally divided between prairie and oak openings. The soil is very rich and climate healthy. There are several creeks and springs, of which the Nine Springs, situated in the northeast part of the town, are justly celebrated."

Accounts such as this one and reports from early settlers attracted even more families to the Fitchburg area during the mid to late 1800's. With an ever increasing population of farmers moving into the region, most of the prairies and oak savannas were converted to agricultural land and many of the wetlands were drained and made suitable for farming. Fires were suppressed in many areas around developments and many prairies were soon converted to woodlands.

Vegetation

Habitat Description and Site Classification

At the broadest scale, Nobel Woods is best classified as a Southern Upland Forest. These southern Wisconsin forests are dominated by oaks and maples. Nobel Woods is classified as a Southern Dry-Mesic Subtype. Following is a bulleted list of ecosystem descriptions adapted from the Wisconsin State Herbarium (www.botany.wisc.edu/wisflora/curtis.asp).

- Southern Dry Forest
  - white oak (*Quercus alba*) and black oak (*Q. velutina*) are dominant, often with admixtures of red and bur oaks (*Q. borealis* and *Q. macrocarpa*), and black cherry (*Prunus serotina*).
  - brambles (*Rubus* spp.), gray dogwood (*Cornus racemosa*) and American hazelnut (*Corylus americana*) are common in the shrub layer.
  - frequent herbaceous species are wild geranium (*Geranium maculatum*), false Solomon's-seal (*Smilacina racemosa*), hog-peanut (*Amphicarpaea bracteata*), sweet cicely (*Osmorhiza claytonii*) and Penn sedge (*Carex pensylvanica*).
- **Southern Dry-Mesic Subtype – Nobel Woods**
  - red oak is the dominant tree, but white oak, basswood (*Tilia americana*), sugar maple (*Acer saccharum*), and white ash (*Fraxinus americana*) are also frequent.
  - the herbaceous understory flora is more diverse and includes those species listed under Southern Dry Forest plus jack-in-the-pulpit (*Arisaema triphyllum*), enchanter's-nightshade (*Circaea lutetiana*), and large-flowered bellwort (*Uvularia grandiflora*).
- Southern Mesic Forest
  - occurs on rich, well-drained soils.

- the dominant trees species are sugar maple and basswood. Many other trees species are found in these forests, including those of the walnut family (Juglandaceae).
- the understory is typically open (brushy with species of gooseberry [*Ribes*] if there is a past history of grazing) and supports fine spring ephemeral displays with species of spring-beauty (*Claytonia*), trout-lilies (*Erythronium*), trilliums (*Trillium*), violets (*Viola*), bloodroot (*Sanguinaria canadensis*), blue cohosh (*Caulophyllum thalictroides*) and mayapple (*Podophyllum peltatum*).

- Savannas
  - partially forested upland communities, where tree canopies do not exceed about 50% coverage.
  - they are often maintained by fire and have a strong prairie or barrens component in the understory.
  - oaks, especially bur oak (*Quercus macrocarpa*) are the commonest trees.
  - The division of savannas and woodlands into subtypes is quite problematical
    - *Oak Barrens* have feature black oak (*Quercus velutina*) as the overwhelming dominant. Common herbs are lead plant (*Amorpha canescens*), hog-peanut (*Amphicarpaea bracteata*), flowering spurge (*Euphorbia corollata*), bracken-fern (*Pteridium aquilinium*), false Solomon's-seals (*Smilacina racemosa* and *S. stellata*), spiderwort (*Tradescantia ohioensis*), goat's-rue (*Tephrosia virginiana*), and lupine (*Lupinus perennis*).
    - *Oak Openings* have less than 50% tree canopy cover. Historically, they occurred on wet-mesic to dry sites. The few extant remnants are mostly on dry sites, with the mesic openings almost totally destroyed. Bur, white and black oaks (*Quercus macrocarpa*, *Q. alba* and *Q. velutina*) are dominant, often as large, open-grown trees. Shagbark hickory (*Carya ovata*) is sometimes present. American hazelnut (*Corylus americana*) is a common shrub, and the herblayer is similar to that of oak forests and dry prairies, with many of the same grasses and forbs present.
    - *Oak Woodlands* are intermediate between Oak Openings and Southern Dry Forests. The tree canopy is closed, but frequent low-intensity fires and, possibly (in pre-settlement times), browsing by herbivores such as elk, bison, and deer, kept the understory free of shrubs and saplings.

Habitat Type

Habitat typing is a finer-scaled classification system used by resource managers to guide them in creating management plans. The habitat type system is a method of site classification that uses floristic composition of plant community (understory species as well as trees) as an integrated indicator of those environmental factors that affect species reproduction, growth, competition, and therefore, community development.

Based on a recent inventory, Nobel Woods was found to best fit the ATiFrCi, Acer saccharum-Tilia-Fraxinus/Circaea quadrisculata (Sugar maple-basswood-white ash/Enchanter's nightshade) habitat type. Distinguishing characteristics of this habitat type are listed below.

- white oak and red maple are the most common dominant tree species
- shagbark hickory, white ash, basswood, and sugar maple being important associates.
- the shrub layer is well developed and consists of black cherry, choke cherry, and serviceberry.
- the most common ground flora include: pointed-leaf tick trefoil, enchanter's nightshade, sweet cicely, Virginia creeper, riverbank grape, and wild geranium.
- Communities on this type also contain several species that are absent or uncommon on other habitat types in the region. Some of these are: White avens, jack-in-the-pulpit, touch-me-not, and lopseed.
- primarily found on glaciated soils where parent material is more loamy than is typical for pitted outwash, or where particle size stratification results in increased moisture in the profile.

Disturbance and Succession

The current species composition at this site is most likely the result of fire disturbances in the past. Soil characteristics and understory flora indicate that tolerant mesic hardwoods (maple, bass, and ash) are well suited to this site. They are absent only because an adequate seed source has not been present.

Wildlife

Several species of wildlife have been observed within Nobel Woods but a formal wildlife inventory has not been completed. Bird species observed within Nobel Woods include blue jays, American robins, black-capped chickadees, orioles, American crows, purple finches, and woodpeckers. Mammal species sighted within the forest include eastern chipmunk, gray squirrel, and raccoons.

Dead standing trees (snags) are vital for many wildlife species and are important to consider in any forest management plan. The Wisconsin Department of Natural Resources recommends that between 2 and 4 large trees per acre be present on any forested site.

Wolf trees are also an important habitat component to wildlife because they produce large seed crops and provide opportunities for wildlife to forage, nest, and perch. These trees are characterized by their short stems and large open branching structure. Wolf trees often appear in forests ecosystems that were formerly savannas.

Part III. Neighborhood Developments

Fitchburg Technology Campus

Nobel Woods lies within Fitchburg Technology Campus (FTC), a 71-acre development originally designed as a mixed-use neighborhood offering opportunities for commercial, office, and residential development. According to development plans, FTC is to have 13 single-family homes, 14 two-family homes, and 77 multi-family homes when construction is fully completed. Various commercial developments will also be interspersed throughout the FTC area.

Parks and Recreation

The City of Fitchburg's park dedication ordinance states a subdivider/developer must dedicate sufficient land area to provide adequate park, playground, recreation and open space to meet the needs to be created by and to be provided for the land development, land division or subdivision. In particular, at least 2,900 square feet of land are to be dedicated for each residential dwelling unit within the land development. The parks and dedication ordinance also states that if no suitable land is available within the proposed development, or if the dedication of land would not be compatible with the City Master Plan, or the Park Commission determines that a cash contribution will better serve the public interest, the Park Commission may require the developer to pay a fee in lie of making the required land dedication.

In the case of FTC, park and open space land was dedicated to the City of Fitchburg in two phases. The Parks Commission accepted three acres of Nobel Woods in June 2002 and additional acre in October 2003. The dedication of land did not fully cover the park and open space land requirements outlined above and therefore a fee in lieu of dedication was required. The developer was 31,308 square feet short of the required 75,400 square feet of land dedication and was forced to pay $21,600. This money was set aside for the future management of Nobel Woods.

Part IV. Stand Analysis

A forest inventory of Nobel Woods was completed during the summer of 2005. All trees greater than or equal to 6 inches DBH were flagged and numbered in order to give each tree a unique identity. Species, trunk diameter, health class, and crown class were recorded for each tree inventoried. (For a detailed description of inventory protocol see appendix A.) A Microsoft Access database was created and a detailed stand analysis was conducted using the software's querying capabilities. General characteristics of Nobel Woods are as follows:

- 871 trees of at least 6 inches diameter are estimated to occupy Nobel Woods.
- Shagbark hickory and black oak dominate the composition of the stand in terms of both basal area and total number of stems.
- The majority of trees in Nobel Woods are between 8 and 14 inches in diameter with a limited number of trees greater than 20 inches in diameter and few trees are below 6 inches in diameter.
- Shagbark hickory accounts for the majority of basal area in size classes 6-10, while black oak accounts for the majority of basal area in size classes 12-22. Intuitively this makes sense because shagbark hickory is a smaller, shorter-lived species than black oak.
- Burr oak is the largest tree on average with a mean DBH of 22.8 inches. Although burr oak accounts for only one percent of the basal area it is a very important component of the woodlot providing food and habitat to many wildlife species.
- Weedy/Invasive tree species (black locust and box elder) account for 20.6% of the total trees inventoried and 20.1% of the total basal area.
- 82% of all trees inventoried are in good health while 18% of all trees inventoried are in less than good health. About 23 trees (2.6%) are snags (standing dead trees). Snags are an important component of forest wildlife habitat.
- Black locust, box elder, and elm are the least healthy species in the woodlot.

Stand analysis results in the form of graphs and tables are listed in the appendix B&C.

Part V. Management Prescription Options

Forest management plans are important tools which enable resource managers to identify the resources and opportunities that are available to them and plan for the long-term management of their forest resources. In the simplest sense, a forest management plan provides a framework for meeting some future goal. It identifies where you want to be at a given point in time and what you have to do to get to where you want to be. In addition, good management plans can help save time, money, and heartache by avoiding costly mistakes associated with poor planning and exploring all possible options.

No Management

The no management option is a simple as it appears. The forest would be left unmanaged and eventually, after years of forest succession, Nobel Woods would be dominated by shade-tolerant species such as sugar maple. In the meantime, as the oaks and hickories decline they would be replaced by weedy and pioneer species such as boxelder, black locust, and perhaps aspens. Invasive species would also thrive in the woodlot having a negative impact on the populations of native plants and animals.

Advantages	Disadvantages
• Low cost • Most likely to avoid public outcry associated with felling trees	• Plant/wildlife diversity will likely decrease as the forest becomes dominated by sugar maple • Invasives will likely increase in number and geographic distribution • Oaks would eventually disappear from the forest leading to habitat loss for species adapted to ecosystems with an oak component

Manage for Invasives

Invasive species are considered harmful to forest ecosystems because they often out-compete and eventually replace native species. Managing for invasives would include removing all invasive and weedy species in the woodlot. These species include black locust, box elder, common buckthorn, garlic mustard, multi-flora rose, and common burdock. Typically herbicide treatments or manual labor are used to remove invasive shrubs and understory plants whereas mechanical removal (felling) is used for invasive trees.

Advantages	Disadvantages
• Relatively low cost • Removes invasive seed source from the woodlot • Improves habitat for native fauna and flora • Volunteers could possibly be utilized	• Many years of effort would be needed to completely eradicate invasives from the woodlot • Fails to address the management and regeneration of desirable tree species • Oaks would eventually disappear

Manage for Mixed Southern Hardwoods

Mixed southern hardwood species often include black oak, burr oak, pin oak, white oak and hickories on dry sites, and red oak, red maple, sugar maple, and basswood on more mesic sites. Under most circumstances management options in mixed southern hardwoods are often driven by the species present in the forest and the amount of advance regeneration established in the forest understory. To maintain the species composition currently present in Nobel Woods, even-aged management techniques would need to be applied in order to establish a new cohort of desirable trees.

Advantages	Disadvantages
• Maintains species diversity while improving overall forest health • Provides food and habitat for wildlife species adapted to this type of ecosystem • Removes many of the invasive species from the forest	• Potentially high cost • Chance of failure • Large-scale tree removals in an urban setting are likely to spark public outcry/protest.

Manage for Oak Regeneration

Oak forests cover an extensive area in the central and eastern United States but are rapidly declining for many reasons including: widespread successional displacement of oaks by more shade tolerant species, the absence of fire, increased mortality of oaks caused by gypsy moth defoliation, conversion of oak forests to pasture and cropland, and road construction. Oak forests in the central and eastern United States are home to over 75 tree species, more than 230 species of wildlife, and numerous other forest vegetation. Common methods used to regenerate oaks include the shelterwood method, seed tree method, group selection, and single tree selection.

Advantages	Disadvantages
• Oak forests provide better habitat quality and greater species diversity than most other southern WI forest types • Citizens often value oaks above other species • Provides future habitat for wildlife species that have become adapted to Nobel Woods oaks • Removes many invasive/weedy species from the forest	• Costly • Oak regeneration is difficult to implement and is sometimes unsuccessful • Large openings are often needed/created to promote understory regeneration • Large removals may spark public outcry/protest

Manage for Oak Savanna

Oak savannas and oak openings once covered the majority of Fitchburg and the surrounding areas. In fact, Nobel Woods was likely an oak savanna before it was cleared for agriculture or maintained as a woodlot. Due largely to the absence/suppression of fire and conversion of oak savannas to agricultural fields, oak savannas have nearly disappeared from the southern Wisconsin landscape. In addition, many of the plants and wildlife species that have become adapted to the oak savanna habitat type have either had to find less desirable places to subsist or have largely disappeared from the landscape altogether. Regeneration of an oak savanna would be accomplished by removing all trees, shrubs, and plants with the exception of oak species and underplanting native savanna grasses and forbes.

Advantages	Disadvantages
• Restore the area to the native ecosystem that once existed • Provide habitat for species adapted to oak savanna ecosystems • Removes all invasive species currently present in the forest	• Costly • Removing nearly every tree would surely spark public controversy • Many health/desirable tree species would be lost • Species that have become adapted to subsisting in Nobel Woods would have to find habitat elsewhere • Provides opportunities for new/additional invasives to move into the site if not closely monitored

A detailed description of management descriptions is provided in appendix E.

Part VI. Recommendations

Mixed Southern Hardwoods

After a thorough review of forest management possibilities, the City of Fitchburg Forestry Staff recommends managing Nobel Woods for Mixed Southern Hardwood Species. This decision is based on a number of considerations including the social, economic, and ecological consequences associated with each management prescription.

From an ecological standpoint managing for mixed southern hardwoods makes sense considering the current stand composition. Nobel Woods is presently a maturing mixed southern hardwood forest stand. Without forest management, Nobel Woods is expected to progress into a mature or climax forest consisting of shade-tolerant species such as sugar maple and basswood. Current trends of fire suppression and uneven-aged forest management prescriptions are converting many of the regions forests into maple dominated ecosystems. This so called “maplization” of the regions forests is of great concern to local resource managers because species adapted to other forest ecosystems may be hard pressed to find suitable habitat in the future. Instead of allowing Nobel

Woods to follow successional pathways leading to a shade-tolerant forest ecosystem, Fitchburg Forestry Staff recommends managing the forest for the less common mixed southern hardwood habitat type.

Managing Nobel Woods for mixed southern hardwood species also makes sense from a social perspective as it would likely cause less public consternation than other forest management practices. For instance, managing for oak regeneration or oak savanna would require large scale removal of trees in addition to a higher probability of failure. Mixed southern hardwood forestry prescriptions also involve removing trees, but the number of trees removed and the aesthetic impact is far less intrusive than other management prescriptions.

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Appendix A.
Nobel Woods Inventory Protocol and Data

Tree Inventory Protocol

- Measure the diameter of each tree at breast height (4.5 ft.) in inches for all trees greater than 6 inches in diameter.
- Record the genus and species of each tree
- Assess the health and vigor of each individual tree
- Record the crown class of each individual tree (will give us information about the trees' relative position in the canopy).

Understory Shrub and Flora Inventory Protocol

- Randomly locate a few plots within the forest stand.
- The exact # of plots depends on plant cover heterogeneity. A curve of average percent cover for each species versus number of plots helps estimating the ideal number of sampling plots.
- Rule of thumb: Sampling plots for vegetation sampling should be at least twice as large as the average canopy of the largest species.
- Record genus and species of plants and shrubs. Record the number of each individual species in each plot.
- Estimate the percent cover that each species occupies within the plot
    - 0 = Rare
    - 1 = Less than 5 % cover
    - 2 = Found only occasionally
    - 3 = 5-25 % cover
    - 4 = 50-75 % cover

Inventory Data

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
1	Elm	6.0	Poor	Overtopped	
2	Shagbark hickory	15.5	Good	Dominant	Good Form
3	Shagbark hickory	8.0	Good	Intermediate	
4	Elm	7.0	Fair	Overtopped	
5	Elm	7.0	Poor	Overtopped	
6	Black cherry	13.7	Good	Dominant	
7	Black cherry	13.3	Good	Dominant	Good Form
8	Black cherry	9.1	Good	Intermediate	
9	Black oak	15.1	Fair	Intermediate	
10	Black oak	19.5	Good	Codominant	Specimen?
11	Shagbark hickory	8.2	Good	Codominant	
12	Carya glabra	9.5	Good	Codominant	
13	Black oak	11.5	Poor	Codominant	DBH taken above defect; Racoon home
14	Black oak	12.9	Fair	Intermediate	
15	Black oak	19.1	Fair	Dominant	
16	Black oak	16.1	Fair	Dominant	
17	Shagbark hickory	7.5	Good	Intermediate	
18	Shagbark hickory	8.6	Good	Dominant	Good Form
19	Shagbark hickory	8.4	Good	Codominant	Good Form

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
20	White oak	12.3	Fair	Codominant	
21	Black oak	14.0	Fair	Codominant	
22	Shagbark hickory	12.8	Good	Codominant	
23	Carya glabra	13.6	Good	Dominant	Good Form
24	black oak	15.8	Fair	Codominant	
25	Shagbark hickory	11.0	Good	Dominant	
26	Black oak	16.5	Fair	Codominant	One leader is dead
27	Shagbark hickory	10.8	Good	Codominant	
28	Shagbark hickory	7.8	Good	Intermediate	
29	Black cherry	11.6	Fair	Codominant	Woodpecker holes, Declining
30	Shagbark hickory	11.2	Good	Dominant	
31	Shagbark hickory	10.8	Good	Codominant	
32	Shagbark hickory	7.7	Good	Intermediate	
33	Black oak	13.0	Fair	Codominant	
34	Shagbark hickory	6.4	Good	Overtopped	
35	Black oak	13.2	Fair	Intermediate	Leaning
36	Shagbark hickory	9.9	Good	Codominant	
37	Black oak	17.3	Fair	Codominant	
38	Black oak	17.7	Good	Dominant	
39	Elm	9.4	Poor	Overtopped	
40	Shagbark hickory	8.1	Fair	Intermediate	
41	Black oak	14.5	Fair	Codominant	
42	Black oak	13.0	Fair	Codominant	
43	Black oak	18.7	Good	Codominant	Good Form/ Specimen?
44	Black oak	13.2	Fair	Codominant	Sprout clump
45	Black oak	10.1	Poor	Intermediate	Sprout clump
46	Black oak	13.8	Good	Dominant	
47	Black oak	13.1	Good	Dominant	
48	Shagbark hickory	7.5	Good	Codominant	
49	Shagbark hickory	11.7	Good	Codominant	
50	Black oak	17.7	Good	Dominant	Sprout clump
51	Black oak	12.8	Fair	Codominant	Sprout clump
52	Black oak	12.1	Fair	Codominant	Sprout clump
53	Black oak	20.9	Fair	Codominant	
54	Elm	9.5	Poor	Overtopped	
55	Elm	8.3	Good	Codominant	
56	Shagbark hickory	10.8	Good	Codominant	
57	Shagbark hickory	6.1	Good	Intermediate	
58	Black cherry	18.5	Good	Dominant	Specimen?
59	Black cherry	14.0	Fair	Intermediate	Leaning
60	Shagbark hickory	7.8	Good	Intermediate	
61	Black oak	14.0	Good	Codominant	Sprout clump
62	Black oak	14.7	Good	Codominant	Sprout clump
63	Shagbark hickory	9.4	Good	Codominant	Good Form
64	Box elder	8.2	Fair	Codominant	
65	Black oak	11.5	Dead		
66	Black oak	16.4	Fair	Codominant	
67	Shagbark hickory	12.0	Good	Dominant	
68	Black oak	17.7	Good	Codominant	Sprout clump
69	Black oak	14.8	Good	Codominant	Sprout clump
70	Black oak	16.9	Good	Codominant	Sprout clump

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
71	Box elder	9.3	Poor	Intermediate	Leaning
72	Black oak	12.9	Good	Intermediate	
73	Black oak	8.7	Fair	Intermediate	
74	Black oak	15.0	Fair	Dominant	Near woodlot edge
75	Shagbark hickory	7.5	Good	Intermediate	
76	Shagbark hickory	7.6	Good	Overtopped	
77	Black cherry	13.5	Good	Dominant	
78	Black cherry	9.4	Good	Intermediate	
79	Black cherry	20.1	Good	Dominant	
80	Black cherry	14.2	Good	Codominant	
81	Box elder	6.7	Poor	Overtopped	
82	Elm	7.5	Poor	Overtopped	Declining
83	Shagbark hickory	8.7	Good	Codominant	
84	Shagbark hickory	13.2	Good	Dominant	Good Form
85	Black oak	13.0	Fair	Codominant	
86	Black oak	14.5	Good	Codominant	
87	Black oak	17.0	Good	Codominant	
88	Shagbark hickory	7.7	Good	Intermediate	
89	Shagbark hickory	7.8	Good	Overtopped	
90	Carya glabra	10.9	Good	Codominant	
91	Shagbark hickory	7.6	Dead		
92	Shagbark hickory	8.4	Good	Codominant	
93	Elm	26.9	Good	Codominant	Specimen Tree
94	Elm	14.8	Fair	Codominant	Trunk Damaged, Bark Peeling Off
95	Black cherry	11.5	Fair	Dominant	
96	Black cherry	16.4	Good	Dominant	
97	Shagbark hickory	6.9	Good	Intermediate	
98	Black oak	16.2	Fair	Dominant	
99	Box elder	11.2	Good	Codominant	
100	Box elder	6.9	Poor	Overtopped	Leaning
101	Box elder	7.0	Fair	Overtopped	
102	Box elder	9.1	Good	Codominant	
103	Box elder	8.9	Good	Codominant	
104	Box elder	7.5	Fair	Overtopped	
105	Box elder	13.7	Good	Codominant	
106	Elm	12.1	Good	Dominant	
107	Box elder	7.5	Fair	Overtopped	
108	Box elder	6.6	Fair	Overtopped	
109	Shagbark hickory	7.5	Good	Codominant	
110	Box elder	7.0	Poor	Overtopped	
111	Box elder	13.0	Good	Codominant	
112	Box elder	9.6	Good	Intermediate	
113	Shagbark hickory	6.0	Good	Intermediate	
114	Shagbark hickory	12.9	Good	Dominant	
115	Black oak	23.9	Good	Dominant	Near woodlot edge
116	Shagbark hickory	9.1	Good	Codominant	
117	Elm	8.4	Fair	Intermediate	
118	Shagbark hickory	10.7	Good	Intermediate	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
119	Elm	7.5	Fair	Intermediate	
120	Box elder	9.1	Fair	Overtopped	
121	Black oak	13.3	Fair	Codominant	
122	Black oak	17.8	Good	Codominant	
123	Shagbark hickory	7.8	Good	Intermediate	
124	Black oak	11.1	Poor	Overtopped	Declining
125	Elm	6.8	Poor	Overtopped	Declining
126	Carya glabra	10.8	Good	Dominant	Good Form
127	Shagbark hickory	8.1	Dead		
128	Box elder	13.1	Fair	Dominant	
129	Shagbark hickory	13.6	Good	Dominant	
130	Black oak	15.5	Fair	Codominant	
131	Black locust	14.9	Poor	Codominant	Split upper stem
132	Black locust	17.5	Good	Dominant	
133	Black locust	19.5	Fair	Dominant	Rot on north side
134	Black oak	12.7	Fair	Codominant	
135	Black oak	10.3	Fair	Codominant	
136	Black oak	11.1	Fair	Codominant	Leaning
137	Black cherry	17.8	Good	Dominant	
138	Black cherry	16.4	Good	Dominant	
139	Black cherry	7.5	Fair	Overtopped	
140	Elm	14.7	Good	Codominant	Good Form
141	Shagbark hickory	10.0	Good	Codominant	
142	Box elder	10.6	Good	Codominant	
143	Box elder	14.1	Fair	Codominant	
144	Shagbark hickory	6.6	Good	Codominant	
145	Common hackberry	15.0	Good	Dominant	Good Form
146	Box elder	7.8	Poor	Overtopped	
147	Shagbark hickory	7.6	Good	Intermediate	
148	Black cherry	10.7	Good	Codominant	
149	Shagbark hickory	13.4	Good	Dominant	Good Form
150	Shagbark hickory	12.5	Good	Dominant	
151	Shagbark hickory	7.7	Good	Overtopped	
152	Shagbark hickory	12.5	Good	Intermediate	Near woodlot edge
153	Elm	6.5	Fair	Overtopped	
154	Shagbark hickory	7.0	Good	Intermediate	
155	Black oak	18.1	Good	Dominant	
156	Carya glabra	10.8	Good	Codominant	Good Form
157	Shagbark hickory	10.1	Good	Codominant	
158	Black locust	9.0	Poor	Overtopped	Leaning/ Declining
159	Elm	6.8	Poor	Overtopped	
160	Carya glabra	7.1	Good	Intermediate	
161	Shagbark hickory	13.1	Good	Dominant	
162	Elm	8.0	Fair	Overtopped	Leaning
163	Black locust	15.3	Good	Dominant	
164	Black locust	11.6	Good	Codominant	
165	Shagbark hickory	10.6	Good	Codominant	
166	Elm	6.0	Good	Intermediate	
167	Shagbark hickory	9.2	Good	Codominant	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
168	Black locust	12.6	Good	Dominant	
169	Shagbark hickory	10.8	Good	Codominant	
170	Shagbark hickory	6.1	Good	Intermediate	
171	Black cherry	17.3	Fair	Dominant	Wounded 10 ft. up
172	Elm	6.0	Fair	Overtopped	
173	Shagbark hickory	8.7	Fair	Intermediate	
174	Black cherry	10.0	Good	Codominant	
175	Box elder	15.4	Fair	Codominant	Leaning
176	Black cherry	11.5	Poor	Codominant	Declining
177	Black oak	10.8	Poor	Intermediate	Declining
178	Black cherry	16.5	Good	Dominant	Specimen?
179	Black oak	9.0	Fair	Intermediate	
180	Black oak	7.9	Good	Intermediate	
181	Black oak	9.3	Good	Codominant	
182	Elm	8.5	Fair	Intermediate	
183	Shagbark hickory	6.3	Good	Intermediate	
184	Black cherry	13.8	Good	Codominant	
185	Black cherry	12.6	Good	Dominant	
186	Black oak	10.5	Good	Intermediate	
187	Black oak	15.1	Good	Codominant	Sprout clump
188	Black oak	16.6	Good	Codominant	Sprout clump
189	Shagbark hickory	7.5	Good	Intermediate	
190	Black oak	27.7	Good	Dominant	Specimen Tree
191	Shagbark hickory	6.9	Good	Intermediate	
192	Shagbark hickory	7.2	Fair	Intermediate	
193	Shagbark hickory	7.3	Good	Intermediate	
194	Black locust	15.3	Good	Dominant	
195	Black locust	14.0	Good	Codominant	
196	Elm	9.8	Good	Intermediate	
197	Elm	6.9	Good	Overtopped	
198	Shagbark hickory	10.7	Dead		
199	Black locust	14.3	Good	Codominant	
200	Black locust	13.7	Good	Dominant	
201	Box elder	7.5	Fair	Overtopped	
202	Black cherry	17.1	Good	Codominant	
203	Black locust	12.6	Good	Codominant	
204	Shagbark hickory	7.6	Good	Intermediate	
205	Black locust	11.0	Poor	Codominant	
206	Black locust	12.8	Fair	Codominant	
207	Black locust	12.6	Good	Codominant	
208	Black locust	8.4	Good	Intermediate	
209	Box elder	6.0	Poor	Overtopped	
210	Black locust	12.3	Good	Overtopped	
211	Shagbark hickory	6.8	Good	Intermediate	
212	Black locust	13.8	Fair	Codominant	Declining
213	Elm	7.4	Fair	Overtopped	
214	Black locust	12.4	Fair	Codominant	
215	Shagbark hickory	6.7	Good	Codominant	
216	Black locust	11.1	Good	Codominant	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
217	Black locust	11.8	Good	Codominant	
218	Carya glabra	7.3	Good	Codominant	
219	Black locust	13.2	Good	Codominant	
220	Black locust	16.2	Good	Dominant	
221	Black cherry	13.5	Good	Codominant	
222	Black cherry	15.2	Good	Codominant	
223	Black oak	12.5	Good	Codominant	
224	Black cherry	12.7	Fair	Codominant	
225	Shagbark hickory	8.5	Good	Codominant	
226	Shagbark hickory	9.2	Good	Codominant	
227	Black oak	8.2	Poor	Intermediate	Declining
228	Black oak	13.5	Good	Codominant	
229	Black oak	17.1	Good	Codominant	
230	Black oak	14.7	Good	Codominant	
231	Black oak	18.4	Good	Codominant	Specimen ?
232	Black oak	18.6	Good	Dominant	
233	Shagbark hickory	10.2	Good	Codominant	
234	Black cherry	15.6	Good	Dominant	
235	Black cherry	12.5	Good	Codominant	
236	Black cherry	12.9	Good	Codominant	
237	Black locust	14.5	Good	Codominant	
238	Carya glabra	8.6	Good	Intermediate	
239	Shagbark hickory	8.8	Good	Codominant	
240	Shagbark hickory	6.6	Good	Intermediate	
241	Shagbark hickory	7.9	Good	Codominant	
242	Box elder	6.8	Poor	Overtopped	Leaning
243	Shagbark hickory	10.8	Good	Codominant	
244	Black locust	15.8	Good	Codominant	
245	Black locust	15.0	Good	Dominant	
246	Black locust	14.7	Good	Codominant	
247	Black locust	14.8	Poor	Codominant	
248	Elm	8.8	Good	Overtopped	
249	Black locust	14.6	Good	Codominant	
250	Black locust	16.2	Good	Codominant	
251	Black locust	12.5	Good	Codominant	
252	Black cherry	12.9	Good	Codominant	
253	Elm	14.0	Good	Codominant	
254	White oak	11.1	Fair	Intermediate	
255	Black locust	16.0	Good	Dominant	
256	Shagbark hickory	6.3	Good	Intermediate	
257	Shagbark hickory	11.3	Good	Codominant	Good Form
258	Black oak	15.0	Good	Codominant	
259	Black oak	8.0	Dead		
260	Black cherry	13.6	Good	Codominant	
261	Black locust	13.8	Fair	Codominant	
262	Shagbark hickory	6.9	Good	Intermediate	
263	Shagbark hickory	7.4	Good	Intermediate	
264	Shagbark hickory	10.5	Good	Codominant	
265	Shagbark hickory	9.4	Good	Codominant	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
266	Shagbark hickory	9.2	Good	Intermediate	
267	Shagbark hickory	6.7	Good	Intermediate	
268	Shagbark hickory	6.6	Good	Codominant	
269	Shagbark hickory	6.0	Dead		
270	Shagbark hickory	9.7	Good	Codominant	
271	Shagbark hickory	9.4	Good	Codominant	
272	Shagbark hickory	11.0	Good	Dominant	
273	Carya glabra	8.7	Good	Codominant	
274	Common hackberry	15.5	Good	Codominant	Specimen?
275	Shagbark hickory	6.1	Good	Overtopped	
276	Shagbark hickory	6.1	Good	Overtopped	
277	White oak	22.6	Good	Dominant	Specimen tree near corner house
278	Shagbark hickory	9.4	Good	Codominant	
279	Box elder	7.3	Poor	Overtopped	Declining
280	White oak	9.2	Fair	Dominant	Near woodlot edge
281	Box elder	10.3	Fair	Intermediate	Leaning
282	Shagbark hickory	7.4	Good	Intermediate	
283	Shagbark hickory	7.4	Good	Intermediate	
284	Shagbark hickory	7.1	Good	Intermediate	
285	Shagbark hickory	11.1	Good	Codominant	
286	Shagbark hickory	8.7	Good	Intermediate	Sprout clump
287	Shagbark hickory	9.3	Good	Codominant	
288	Shagbark hickory	7.8	Good	Codominant	
289	White oak	20.2	Good	Codominant	Specimen, Research Drive
290	Shagbark hickory	13.1	Good	Dominant	
291	Burr oak	27.8	Good	Dominant	Specimen, Research Drive
292	Shagbark hickory	7.9	Fair	Intermediate	
293	Shagbark hickory	7.2	Fair	Intermediate	
294	Shagbark hickory	8.7	Good	Codominant	
295	Black locust	8.9	Good	Codominant	
296	Shagbark hickory	8.4	Good	Codominant	
297	Shagbark hickory	6.0	Good	Overtopped	
298	Shagbark hickory	8.4	Good	Codominant	
299	Black cherry	12.5	Fair	Codominant	
300	Black locust	7.3	Fair	Intermediate	
301	Box elder	8.2	Fair	Intermediate	Leaning
302	Black locust	6.3	Good	Intermediate	
303	Shagbark hickory	15.0	Good	Dominant	
304	Shagbark hickory	11.1	Good	Codominant	
305	Black locust	7.2	Good	Intermediate	
306	Black locust	7.0	Good	Overtopped	
307	Black locust	8.8	Good	Intermediate	
308	Box elder	6.8	Fair	Overtopped	
309	Black locust	9.0	Good	Codominant	
310	Box elder	7.5	Good	Overtopped	
311	Box elder	12.3	Fair	Codominant	
312	Black locust	10.2	Fair	Overtopped	
313	Black locust	7.8	Good	Intermediate	
314	Black locust	8.5	Good	Codominant	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
315	Shagbark hickory	8.9	Good	Codominant	
316	Shagbark hickory	11.7	Good	Codominant	
317	Shagbark hickory	8.5	Good	Intermediate	
318	Black cherry	8.3	Fair	Intermediate	
319	Black cherry	13.4	Good	Codominant	
320	Black locust	8.9	Good	Codominant	
321	Black locust	13.7	Good	Dominant	
322	Box elder	8.2	Fair	Intermediate	Leaning
323	Black locust	9.9	Good	Codominant	Sprout clump
324	Black locust	10.8	Good	Codominant	Sprout clump
325	Black oak	13.8	Good	Codominant	
326	Black locust	7.2	Fair	Intermediate	
327	Shagbark hickory	7.7	Good	Overtopped	
328	Shagbark hickory	6.4	Good	Overtopped	
329	Black locust	7.9	Fair	Intermediate	
330	Box elder	7.7	Poor	Codominant	Leaning
331	Shagbark hickory	7.1	Good	Overtopped	
332	Black oak	22.4	Good	Dominant	Specimen
333	Shagbark hickory	6.4	Good	Overtopped	
334	Shagbark hickory	8.1	Good	Codominant	
335	Black cherry	7.3	Fair	Overtopped	
336	Shagbark hickory	7.0	Good	Overtopped	
337	Shagbark hickory	6.8	Good	Overtopped	
338	Black cherry	6.6	Fair	Overtopped	
339	Shagbark hickory	15.1	Good	Dominant	
340	Shagbark hickory	12.2	Good	Codominant	
341	White oak	21.9	Good	Dominant	Specimen
342	White oak	16.7	Good	Dominant	Sprout clump
343	White oak	15.8	Good	Dominant	Sprout clump
344	White oak	12.3	Fair	Codominant	
345	Black oak	16.2	Good	Dominant	
346	Shagbark hickory	7.7	Good	Intermediate	
347	Shagbark hickory	7.5	Good	Overtopped	
348	Shagbark hickory	7.6	Good	Intermediate	
349	Shagbark hickory	8.6	Good	Codominant	
350	Shagbark hickory	7.1	Good	Overtopped	
351	Shagbark hickory	8.5	Good	Intermediate	
352	Shagbark hickory	6.9	Fair	Overtopped	
353	Black oak	14.8	Fair	Intermediate	
354	Black oak	12.3	Good	Codominant	
355	Shagbark hickory	7.8	Good	Intermediate	
356	Black oak	7.9	Good	Intermediate	
357	Black oak	18.6	Good	Codominant	
358	Black oak	23.0	Good	Dominant	
359	Black oak	17.7	Good	Dominant	
360	Shagbark hickory	9.1	Good	Codominant	
361	Shagbark hickory	7.5	Good	Intermediate	
362	Shagbark hickory	8.7	Good	Intermediate	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
363	Shagbark hickory	12.3	Good	Dominant	
364	Shagbark hickory	6.0	Good	Overtopped	
365	Black locust	10.2	Fair	Codominant	
366	Shagbark hickory	11.2	Good	Overtopped	
367	Shagbark hickory	6.2	Good	Overtopped	
368	Shagbark hickory	9.5	Good	Codominant	
369	Shagbark hickory	10.2	Good	Overtopped	
370	Shagbark hickory	7.8	Good	Overtopped	
371	Black locust	15.1	Good	Codominant	
372	Black locust	13.2	Good	Codominant	
373	Black locust	10.8	Good	Codominant	
374	Black locust	11.4	Poor	Intermediate	Trunk is rotting
375	Shagbark hickory	8.2	Good	Intermediate	
376	Shagbark hickory	6.6	Good	Codominant	
377	Black locust	9.5	Poor	Overtopped	
378	Box elder	9.5	Good	Unknown	
379	Box elder	8.8	Good	Unknown	
380	Box elder	12.0	Good	Unknown	
381	Black cherry	14.5	Dead	Unknown	
382	Shagbark hickory	11.5	Good	Unknown	
383	Black oak	10.9	Poor	Unknown	
384	Elm	9.0	Good	Unknown	
385	Red oak	8.5	Dead	Unknown	
386	Red oak	17.0	Good	Unknown	
387	Black oak	12.8	Good	Unknown	
388	Black oak	8.6	Poor	Unknown	
389	Black oak	15.0	Poor	Unknown	
390	Shagbark hickory	12.5	Good	Unknown	
391	White oak	23.5	Good	Unknown	
392	Box elder	12.2	Good	Unknown	
393	Shagbark hickory	9.0	Good	Unknown	
394	Shagbark hickory	10.5	Good	Unknown	
395	Shagbark hickory	12.3	Good	Unknown	
396	Shagbark hickory	12.1	Good	Unknown	
397	Black cherry	10.7	Good	Unknown	
398	Shagbark hickory	12.9	Good	Unknown	
399	Burr oak	27.3	Good	Unknown	
400	Box elder	10.7	Poor	Unknown	
401	Black oak	16.0	Good	Unknown	
402	Black oak	10.4	Good	Unknown	
403	Black cherry	12.3	Good	Unknown	
404	Black cherry	15.2	Good	Unknown	
405	Black oak	17.4	Good	Unknown	
406	Black oak	14.3	Good	Unknown	
407	Black cherry	11.7	Good	Unknown	
408	Red oak	18.1	Good	Unknown	
409	Shagbark hickory	10.2	Good	Unknown	
410	Common hackberry	14.9	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
411	Shagbark hickory	8.6	Good	Unknown	
412	Shagbark hickory	10.5	Good	Unknown	
413	White oak	22.4	Good	Unknown	
414	Shagbark hickory	9.5	Good	Unknown	
415	White oak	19.0	Good	Unknown	
416	White oak	12.0	Good	Unknown	
417	White oak	16.0	Good	Unknown	
418	Black oak	16.4	Good	Unknown	
419	Black oak	10.7	Poor	Unknown	
420	Black oak	22.0	Good	Unknown	
421	White oak	21.9	Good	Unknown	
422	Shagbark hickory	11.9	Good	Unknown	
423	Shagbark hickory	15.0	Good	Unknown	
424	Shagbark hickory	8.5	Good	Unknown	
425	Black oak	14.7	Good	Unknown	
426	Black oak	17.9	Good	Unknown	
427	Black oak	11.8	Good	Unknown	
428	Black oak	10.2	Good	Unknown	
429	Shagbark hickory	8.2	Good	Unknown	
430	Black oak	20.7	Good	Unknown	
431	Shagbark hickory	9.1	Good	Unknown	
432	Shagbark hickory	9.4	Good	Unknown	
433	Shagbark hickory	10.7	Good	Unknown	
434	Shagbark hickory	8.1	Good	Unknown	
435	Shagbark hickory	9.3	Good	Unknown	
436	Shagbark hickory	8.3	Good	Unknown	
437	Shagbark hickory	9.1	Good	Unknown	
438	Black oak	9.7	Good	Unknown	
439	Black oak	12.2	Good	Unknown	
440	Black oak	16.7	Good	Unknown	
441	Black cherry	16.1	Good	Unknown	
442	Black oak	9.0	Good	Unknown	
443	Black cherry	13.6	Good	Unknown	
444	Elm	8.0	Good	Unknown	
445	Black cherry	15.7	Good	Unknown	
446	Black cherry	18.4	Good	Unknown	
447	Elm	14.3	Good	Unknown	
448	Box elder	13.8	Good	Unknown	
449	Common hackberry	14.2	Good	Unknown	
450	Box elder	8.7	Good	Unknown	
451	Box elder	10.2	Good	Unknown	
452	Shagbark hickory	9.8	Good	Unknown	
453	Black cherry	15.9	Good	Unknown	
454	Black oak	14.6	Good	Unknown	
455	Box elder	13.3	Good	Unknown	
456	Elm	11.6	Good	Unknown	
457	Box elder	9.3	Good	Unknown	
458	Box elder	8.7	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
459	Shagbark hickory	9.2	Good	Unknown	
460	Northern red oak	16.0	Good	Unknown	
461	Black cherry	18.0	Good	Unknown	
462	Black oak	14.5	Good	Unknown	
463	Box elder	12.1	Good	Unknown	
464	Elm	12.3	Good	Unknown	
465	Box elder	10.2	Good	Unknown	
466	Box elder	8.2	Good	Unknown	
467	Shagbark hickory	10.3	Good	Unknown	
468	Black oak	20.6	Good	Unknown	
469	Box elder	10.7	Good	Unknown	
470	Black oak	12.9	Good	Unknown	
471	Black oak	18.4	Good	Unknown	
472	Black oak	13.4	Good	Unknown	
473	Black oak	12.8	Good	Unknown	
474	Black oak	17.4	Good	Unknown	
475	Box elder	9.1	Good	Unknown	
476	Shagbark hickory	11.0	Good	Unknown	
477	Box elder	10.7	Good	Unknown	
478	Elm	24.0	Good	Unknown	
479	Black cherry	11.1	Good	Unknown	
480	Shagbark hickory	9.3	Good	Unknown	
481	Black oak	10.3	Good	Unknown	
482	Black oak	12.7	Good	Unknown	
483	Black oak	8.9	Good	Unknown	
484	Black oak	10.3	Good	Unknown	
485	Black cherry	11.5	Good	Unknown	
486	Box elder	15.8	Good	Unknown	
487	Shagbark hickory	8.6	Good	Unknown	
488	Black cherry	9.8	Good	Unknown	
489	Black oak	12.4	Good	Unknown	
490	Black cherry	12.8	Good	Unknown	
491	Shagbark hickory	11.0	Good	Unknown	
492	Black oak	14.6	Good	Unknown	
493	Black oak	8.0	Good	Unknown	
494	Black cherry	18.2	Good	Unknown	
495	Black locust	13.6	Good	Unknown	
496	Shagbark hickory	11.0	Good	Unknown	
497	Black locust	10.2	Good	Unknown	
498	Shagbark hickory	12.2	Good	Unknown	
499	Shagbark hickory	9.2	Good	Unknown	
500	Shagbark hickory	8.9	Good	Unknown	
501	Black oak	12.7	Good	Unknown	
502	Black locust	10.7	Good	Unknown	
503	Box elder	8.3	Good	Unknown	
504	Black locust	13.4	Good	Unknown	
505	Black locust	8.2	Good	Unknown	
506	Black cherry	13.4	Good	Unknown	
507	Black locust	10.0	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
508	Shagbark hickory	8.9	Good	Unknown	
509	Shagbark hickory	11.7	Good	Unknown	
510	Shagbark hickory	8.3	Good	Unknown	
511	Shagbark hickory	10.7	Good	Unknown	
512	Shagbark hickory	9.8	Good	Unknown	
513	Black locust	13.2	Good	Unknown	
514	Black locust	10.5	Poor	Unknown	
515	Black locust	10.6	Good	Unknown	
516	Black locust	15.0	Good	Unknown	
517	Black locust	14.8	Good	Unknown	
518	White oak	11.0	Good	Unknown	
519	Black locust	15.8	Good	Unknown	
520	Elm	13.2	Good	Unknown	
521	Black cherry	12.6	Good	Unknown	
522	Black locust	12.2	Poor	Unknown	
523	Black locust	15.2	Good	Unknown	
524	Black locust	11.0	Good	Unknown	
525	Black locust	11.6	Good	Unknown	
526	Black locust	16.0	Good	Unknown	
527	Black cherry	14.8	Good	Unknown	
528	Black cherry	17.0	Good	Unknown	
529	Black oak	15.4	Poor	Unknown	
530	Black locust	18.8	Good	Unknown	
531	Black locust	17.4	Good	Unknown	
532	Black locust	14.5	Good	Unknown	
533	Shagbark hickory	13.8	Good	Unknown	
534	Black oak	14.3	Good	Unknown	
535	Black oak	16.5	Good	Unknown	
536	Shagbark hickory	10.9	Good	Unknown	
537	Shagbark hickory	8.4	Good	Unknown	
538	Shagbark hickory	8.3	Good	Unknown	
539	Black oak	17.1	Good	Unknown	
540	Shagbark hickory	9.8	Good	Unknown	
541	Black oak	12.8	Good	Unknown	
542	Black oak	17.6	Good	Unknown	
543	Black oak	13.4	Good	Unknown	
544	Black oak	16.0	Good	Unknown	
545	Shagbark hickory	9.7	Good	Unknown	
546	Black cherry	11.8	Good	Unknown	
547	Black oak	14.6	Good	Unknown	
548	Elm	9.5	Poor	Unknown	
549	Black oak	12.9	Good	Unknown	
550	Shagbark hickory	11.0	Good	Unknown	
551	Shagbark hickory	11.2	Good	Unknown	
552	Black oak	16.2	Good	Unknown	
553	Shagbark hickory	9.9	Good	Unknown	
554	Shagbark hickory	10.5	Good	Unknown	
555	Black oak	15.5	Good	Unknown	
556	Shagbark hickory	13.5	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
557	Shagbark hickory	12.5	Good	Unknown	
558	Box elder	10.0	Good	Unknown	
559	Shagbark hickory	13.8	Good	Unknown	
560	Black oak	21.8	Good	Unknown	
561	Black oak	16.5	Good	Unknown	
562	Black cherry	8.8	Good	Unknown	
563	Black cherry	13.6	Good	Unknown	
564	Black cherry	13.8	Good	Unknown	
565	Black oak	12.8	Good	Unknown	
566	Shagbark hickory	12.9	Good	Unknown	
567	White oak	13.3	Good	Unknown	
568	White oak	12.2	Good	Unknown	
569	Shagbark hickory	8.3	Good	Unknown	
570	Shagbark hickory	8.3	Good	Unknown	
571	Shagbark hickory	8.3	Good	Unknown	
572	Black oak	19.0	Good	Unknown	
573	Black oak	15.8	Good	Unknown	
574	Shagbark hickory	12.9	Good	Unknown	
575	Shagbark hickory	8.5	Good	Unknown	
576	Shagbark hickory	10.3	Good	Unknown	
577	Shagbark hickory	8.7	Good	Unknown	
578	Black oak	11.0	Good	Unknown	
579	Shagbark hickory	8.0	Good	Unknown	
580	Shagbark hickory	10.5	Good	Unknown	
581	Box elder	12.8	Good	Unknown	
582	Shagbark hickory	10.0	Good	Unknown	
583	Shagbark hickory	10.3	Good	Unknown	
584	Black cherry	15.2	Good	Unknown	
585	Black locust	15.0	Good	Unknown	
586	Black locust	11.4	Good	Unknown	
587	Black locust	12.5	Good	Unknown	
588	Black locust	9.0	Good	Unknown	
589	Shagbark hickory	10.5	Good	Unknown	
590	Black locust	13.0	Good	Unknown	
591	Black locust	12.3	Good	Unknown	
592	Black locust	13.3	Good	Unknown	
593	Black locust	12.0	Good	Unknown	
594	Black locust	14.0	Good	Unknown	
595	Black locust	14.0	Good	Unknown	
596	Box elder	10.7	Poor	Unknown	
597	Black locust	8.1	Dead	Unknown	
598	Black locust	14.6	Poor	Unknown	
599	Elm	8.1	Good	Unknown	
600	Black locust	14.9	Good	Unknown	
601	Shagbark hickory	8.0	Good	Unknown	
602	Shagbark hickory	10.5	Good	Unknown	
603	Shagbark hickory	10.4	Good	Unknown	
604	Black locust	8.4	Good	Unknown	
605	Box elder	11.7	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
606	Black locust	8.6	Good	Unknown	
607	Black cherry	12.3	Good	Unknown	
608	Shagbark hickory	15.0	Good	Unknown	
609	Shagbark hickory	8.4	Good	Unknown	
610	Shagbark hickory	8.2	Good	Unknown	
611	Black locust	8.4	Good	Unknown	
612	Black locust	8.0	Dead	Unknown	
613	Black locust	9.5	Dead	Unknown	
614	Black locust	8.5	Poor	Unknown	
615	Black locust	13.2	Good	Unknown	
616	Black locust	12.3	Good	Unknown	
617	Black locust	13.0	Good	Unknown	
618	Black locust	13.5	Good	Unknown	
619	Black cherry	17.1	Good	Unknown	
620	Black locust	10.9	Good	Unknown	
621	Black locust	9.9	Dead	Unknown	
622	Black locust	12.7	Good	Unknown	
623	Black locust	9.0	Good	Unknown	
624	Black cherry	14.9	Good	Unknown	
625	Shagbark hickory	12.7	Good	Unknown	
626	Black oak	17.8	Good	Unknown	
627	Black oak	13.1	Good	Unknown	
628	Shagbark hickory	15.4	Good	Unknown	
629	Elm	9.0	Good	Unknown	
630	Elm	10.2	Good	Unknown	
631	Shagbark hickory	12.3	Good	Unknown	
632	Black cherry	14.3	Dead	Unknown	
633	Black oak	13.7	Good	Unknown	
634	Black oak	14.6	Good	Unknown	
635	Black oak	19.3	Good	Unknown	
636	Shagbark hickory	8.1	Good	Unknown	
637	Shagbark hickory	8.9	Good	Unknown	
638	Black oak	22.1	Dead	Unknown	
639	Black cherry	11.1	Dead	Unknown	
640	Black cherry	18.0	Good	Unknown	
641	White oak	17.2	Good	Unknown	
642	Black cherry	19.6	Good	Unknown	
643	Black locust	29.2	Poor	Unknown	
644	Black oak	14.5	Good	Unknown	
645	Black oak	17.8	Good	Unknown	
646	Shagbark hickory	10.0	Good	Unknown	
647	Shagbark hickory	12.4	Good	Unknown	
648	Black locust	12.9	Good	Unknown	
649	Black locust	15.1	Good	Unknown	
650	Shagbark hickory	10.0	Good	Unknown	
651	Black locust	13.8	Good	Unknown	
652	Black locust	13.7	Good	Unknown	
653	Black cherry	18.6	Good	Unknown	
654	Black locust	13.0	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
655	Elm	13.0	Good	Unknown	
656	Shagbark hickory	10.3	Dead	Unknown	
657	Black locust	14.1	Good	Unknown	
658	Shagbark hickory	8.5	Good	Unknown	
659	Shagbark hickory	8.3	Good	Unknown	
660	Shagbark hickory	8.4	Good	Unknown	
661	Shagbark hickory	13.1	Good	Unknown	
662	Burr oak	27.0	Good	Unknown	
663	White oak	19.9	Good	Unknown	
664	Shagbark hickory	8.9	Good	Unknown	
665	Shagbark hickory	8.6	Good	Unknown	
666	Shagbark hickory	10.9	Good	Unknown	
667	Shagbark hickory	10.5	Good	Unknown	
668	Shagbark hickory	14.2	Good	Unknown	
669	Shagbark hickory	14.3	Poor	Unknown	
670	Burr oak	15.6	Good	Unknown	
671	Shagbark hickory	12.3	Good	Unknown	
672	Black oak	12.1	Good	Unknown	
673	Shagbark hickory	11.1	Good	Unknown	
674	Shagbark hickory	10.5	Good	Unknown	
675	Black cherry	12.3	Good	Unknown	
676	Black oak	10.3	Good	Unknown	
677	Shagbark hickory	11.0	Good	Unknown	
678	Black cherry	11.6	Good	Unknown	
679	Black cherry	12.3	Dead	Unknown	
680	Black cherry	13.5	Good	Unknown	
681	Black cherry	10.0	Dead	Unknown	
682	Black oak	19.7	Good	Unknown	
683	Northern red oak	22.4	Good	Unknown	
684	Shagbark hickory	9.0	Good	Unknown	
685	Shagbark hickory	10.5	Good	Unknown	
686	Shagbark hickory	11.1	Good	Unknown	
687	Shagbark hickory	9.0	Good	Unknown	
688	Black oak	17.2	Good	Unknown	
689	Black oak	13.4	Poor	Unknown	
690	Shagbark hickory	11.0	Good	Unknown	
691	Shagbark hickory	8.6	Good	Unknown	
692	Box elder	8.8	Good	Unknown	
693	Shagbark hickory	11.5	Good	Unknown	
694	Shagbark hickory	13.3	Good	Unknown	
695	Black oak	22.9	Good	Unknown	
696	Black oak	13.7	Good	Unknown	
697	Black cherry	15.1	Good	Unknown	
698	Black cherry	12.3	Good	Unknown	
699	Black oak	8.9	Poor	Unknown	
700	Black oak	9.5	Good	Unknown	
701	White oak	22.4	Good	Unknown	
702	Shagbark hickory	8.5	Good	Unknown	
703	Black oak	11.5	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
704	Black oak	14.0	Good	Unknown	
705	Shagbark hickory	18.4	Good	Unknown	
706	Shagbark hickory	9.5	Good	Unknown	
707	Shagbark hickory	11.6	Good	Unknown	
708	Shagbark hickory	10.1	Good	Unknown	
709	Shagbark hickory	9.0	Good	Unknown	
710	Black cherry	14.8	Good	Unknown	
711	Shagbark hickory	10.3	Good	Unknown	
712	Shagbark hickory	11.2	Good	Unknown	
713	Box elder	12.5	Good	Unknown	
714	Shagbark hickory	9.8	Good	Unknown	
715	Black oak	10.6	Good	Unknown	
716	Shagbark hickory	9.4	Good	Unknown	
717	Shagbark hickory	9.0	Good	Unknown	
718	Black oak	12.7	Good	Unknown	
719	Black oak	9.0	Good	Unknown	
720	Black oak	9.8	Good	Unknown	
721	Shagbark hickory	8.3	Good	Unknown	
722	Shagbark hickory	8.2	Good	Unknown	
723	White oak	15.9	Good	Unknown	
724	Shagbark hickory	9.0	Good	Unknown	
725	Shagbark hickory	9.3	Good	Unknown	
726	Black oak	8.9	Dead	Unknown	
727	Black oak	15.4	Good	Unknown	
728	Black oak	14.0	Good	Unknown	
729	Shagbark hickory	10.9	Good	Unknown	
730	Black locust	15.5	Good	Unknown	
731	Shagbark hickory	10.9	Good	Unknown	
732	Shagbark hickory	12.3	Good	Unknown	
733	Shagbark hickory	8.1	Good	Unknown	
734	Shagbark hickory	9.1	Good	Unknown	
735	White oak	18.0	Good	Unknown	
736	White oak	30.0	Good	Unknown	
737	Black locust	11.9	Good	Unknown	
738	Shagbark hickory	8.4	Good	Unknown	
739	Elm	14.0	Good	Unknown	
740	Shagbark hickory	17.1	Good	Unknown	
741	Black oak	13.0	Good	Unknown	
742	Black locust	15.4	Good	Unknown	
743	Shagbark hickory	10.3	Good	Unknown	
744	Shagbark hickory	9.5	Good	Unknown	
745	Black locust	18.7	Good	Unknown	
746	Shagbark hickory	10.5	Good	Unknown	
747	Burr oak	32.3	Good	Unknown	
748	Shagbark hickory	8.4	Good	Unknown	
749	Shagbark hickory	10.1	Good	Unknown	
750	Black oak	10.4	Good	Unknown	
751	Northern red oak	12.4	Good	Unknown	
752	White oak	23.8	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
753	Black oak	10.1	Good	Unknown	
754	Shagbark hickory	11.0	Good	Unknown	
755	Black cherry	14.1	Good	Unknown	
756	Black oak	14.3	Poor	Unknown	
757	Black oak	13.9	Good	Unknown	
758	Black oak	13.5	Poor	Unknown	
759	Black oak	18.0	Good	Unknown	
760	Shagbark hickory	10.9	Good	Unknown	
761	Shagbark hickory	12.3	Good	Unknown	
762	Shagbark hickory	9.8	Good	Unknown	
763	Shagbark hickory	9.8	Good	Unknown	
764	Shagbark hickory	11.5	Good	Unknown	
765	Elm	11.4	Good	Unknown	
766	Elm	8.9	Good	Unknown	
767	Shagbark hickory	8.4	Good	Unknown	
768	Shagbark hickory	10.8	Good	Unknown	
769	Shagbark hickory	14.2	Good	Unknown	
770	Black cherry	13.5	Good	Unknown	
771	Shagbark hickory	8.5	Good	Unknown	
772	Black cherry	10.3	Good	Unknown	
773	Black oak	11.3	Good	Unknown	
774	Black oak	15.4	Good	Unknown	
775	Black cherry	9.6	Good	Unknown	
776	Elm	10.4	Good	Unknown	
777	Shagbark hickory	8.7	Good	Unknown	
778	White oak	14.6	Good	Unknown	
779	Shagbark hickory	8.1	Good	Unknown	
780	Shagbark hickory	8.5	Good	Unknown	
781	Shagbark hickory	9.4	Good	Unknown	
782	Shagbark hickory	9.4	Good	Unknown	
783	Shagbark hickory	9.8	Good	Unknown	
784	Burr oak	18.6	Good	Unknown	
785	Box elder	9.6	Good	Unknown	
786	Elm	10.0	Good	Unknown	
787	Black oak	9.3	Good	Unknown	
788	Shagbark hickory	10.3	Good	Unknown	
789	Elm	8.0	Good	Unknown	
790	Shagbark hickory	8.7	Good	Unknown	
791	Elm	8.4	Good	Unknown	
792	Elm	9.1	Good	Unknown	
793	Black locust	9.4	Good	Unknown	
794	Shagbark hickory	11.2	Good	Unknown	
795	Shagbark hickory	16.7	Good	Unknown	
796	White oak	22.8	Good	Unknown	
797	Shagbark hickory	12.5	Good	Unknown	
798	Shagbark hickory	15.7	Dead	Unknown	
799	Black oak	12.9	Good	Unknown	
800	White oak	19.6	Good	Unknown	
801	Box elder	9.5	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
802	Common hackberry	15.5	Good	Unknown	
803	Elm	15.5	Good	Unknown	
804	Elm	17.0	Good	Unknown	
805	Elm	13.5	Good	Unknown	
806	Burr oak	16.7	Good	Unknown	
807	Shagbark hickory	14.6	Good	Unknown	
808	Box elder	8.7	Good	Unknown	
809	White oak	20.2	Good	Unknown	
810	Black cherry	10.9	Good	Unknown	
811	Black cherry	9.5	Good	Unknown	
812	Black oak	15.3	Good	Unknown	
813	Black oak	15.2	Dead	Unknown	
814	Black oak	14.7	Good	Unknown	
815	Black oak	10.8	Good	Unknown	
816	White oak	14.0	Good	Unknown	
817	Black oak	22.4	Good	Unknown	
818	Box elder	15.4	Good	Unknown	
819	Elm	11.2	Good	Unknown	
820	Shagbark hickory	9.7	Good	Unknown	
821	Shagbark hickory	9.8	Good	Unknown	
822	Shagbark hickory	9.2	Good	Unknown	
823	Box elder	10.3	Good	Unknown	
824	Shagbark hickory	11.5	Good	Unknown	
825	Black oak	13.6	Good	Unknown	
826	Shagbark hickory	19.0	Good	Unknown	
827	Elm	8.0	Good	Unknown	
828	Box elder	10.0	Good	Unknown	
829	Box elder	10.6	Good	Unknown	
830	Burr oak	16.7	Good	Unknown	
831	Shagbark hickory	13.3	Good	Unknown	
832	Elm	9.3	Good	Unknown	
833	Box elder	8.8	Good	Unknown	
834	Black oak	17.2	Good	Unknown	
835	Shagbark hickory	8.3	Good	Unknown	
836	Shagbark hickory	12.4	Good	Unknown	
837	Black cherry	18.6	Good	Unknown	
838	Black oak	18.0	Good	Unknown	
839	Shagbark hickory	11.5	Good	Unknown	
840	Black oak	12.5	Good	Unknown	
841	Black oak	20.0	Good	Unknown	
842	Elm	8.2	Good	Unknown	
843	Shagbark hickory	8.5	Good	Unknown	
844	Elm	9.4	Good	Unknown	
845	Shagbark hickory	8.2	Good	Unknown	
846	Shagbark hickory	8.2	Good	Unknown	
847	Shagbark hickory	11.2	Good	Unknown	
848	Shagbark hickory	8.2	Good	Unknown	
849	Shagbark hickory	9.8	Good	Unknown	
850	Shagbark hickory	9.9	Good	Unknown	
851	Shagbark hickory	8.8	Good	Unknown	

Tree #	Common Name	DBH	HealthClass	CrownClass	Comments
852	White oak	26.7	Good	Unknown	
853	Elm	10.6	Good	Unknown	
854	Shagbark hickory	8.3	Good	Unknown	
855	Shagbark hickory	11.4	Good	Unknown	
856	Elm	17.2	Good	Unknown	
857	Elm	17.7	Good	Unknown	
858	Elm	14.3	Good	Unknown	
859	Shagbark hickory	19.2	Dead	Unknown	
860	Elm	14.3	Good	Unknown	
861	Elm	14.9	Dead	Unknown	
862	Elm	9.0	Good	Unknown	
863	Shagbark hickory	9.6	Good	Unknown	
864	Black oak	24.6	Good	Unknown	
865	Black oak	18.9	Poor	Unknown	
866	Elm	20.6	Good	Unknown	
867	White oak	20.5	Good	Unknown	
868	White oak	25.5	Good	Unknown	
869	White oak	23.4	Good	Unknown	
870	White oak	27.0	Good	Unknown	
871	Black oak	13.5	Good	Unknown	

Appendix B.
Stand Characteristics

Table 1: Summary of basic stand characteristics

Species	Number	Percent of Total	Basal Area by Species (ft3)	Percent Basal Area of Total	Mean DBH (inches)
Black cherry	84	9.6	72.7	9.4	13.5
Black locust	114	13.1	89.7	11.6	12.4
Black oak	177	20.3	127.8	16.5	14.5
Box elder	65	7.5	65.7	8.5	9.9
Burr oak	8	0.9	8.6	1.1	22.8
Common hackberry	5	0.6	4.0	0.5	15.0
Elm	61	7.0	51.0	6.6	10.9
Northern red oak	6	0.7	6.0	0.8	15.7
Shagbark hickory	316	36.3	301.2	38.9	9.8
White oak	35	4.0	48.6	6.3	18.7
TOTAL	871	100.0	775.3	100.0	

Table 2: Nobel Woods Forest Health Characteristics

Condition	Number	Percent of Total	Percent of Basal Area
Good	719	82.5	85.1
Fair	82	9.4	8.1
Poor	47	5.4	4.3
Dead	23	2.6	2.4
Total	871	100	100.0

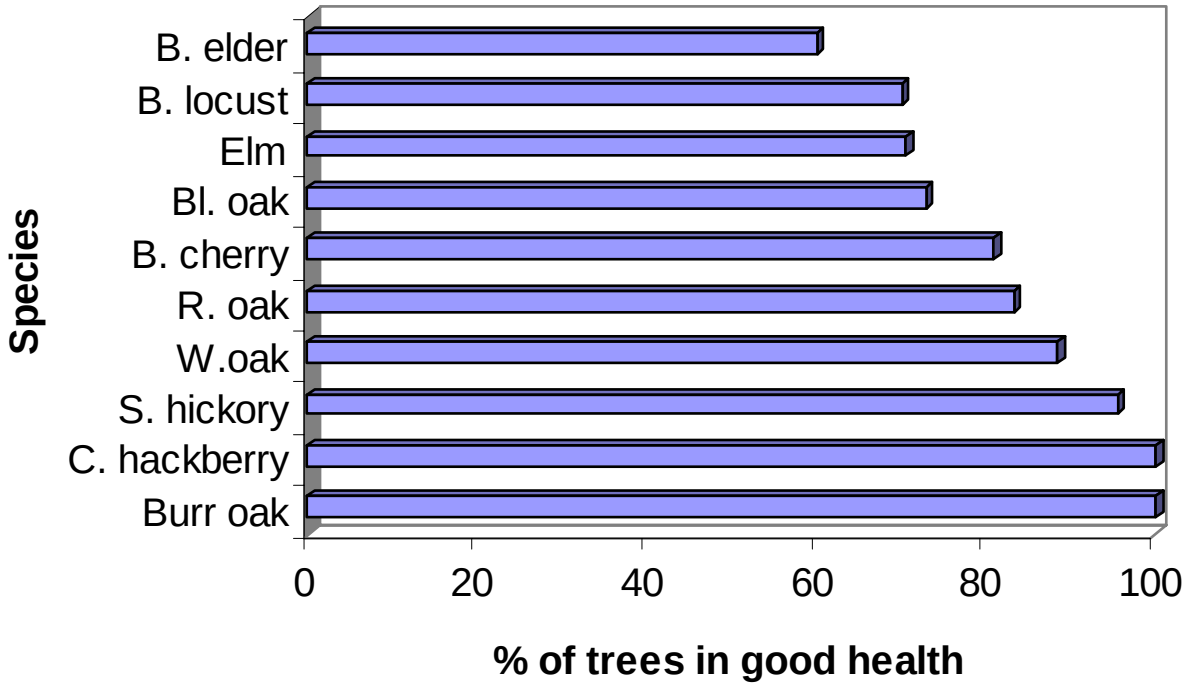

Figure 1: Percentage of trees in good health by species

Appendix C.
Diameter Distributions

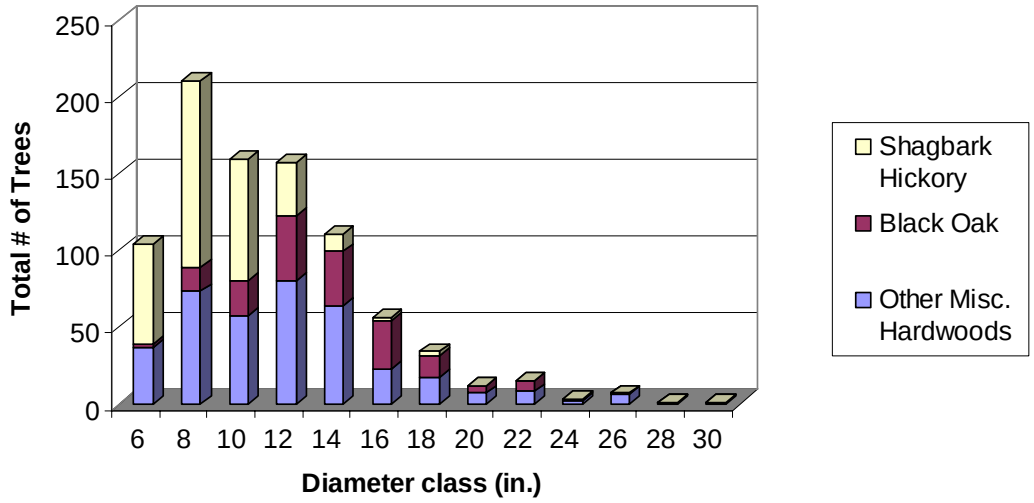

Figure 1: Nobel Woods diameter distribution: All standing trees with 6 inch or greater DBH included.

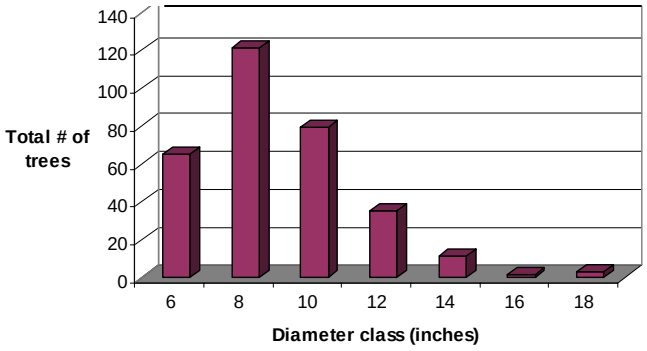

Figure 2: Shagbark hickory diameter distribution

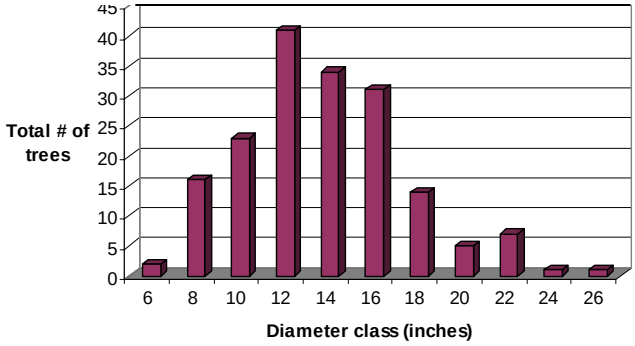

Figure 3: Black oak diameter distribution

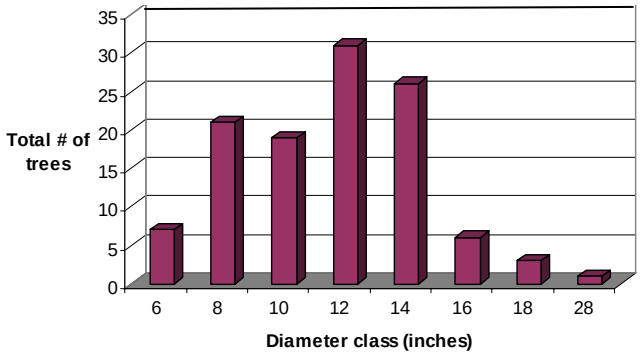

Figure 4: Black locust diameter distribution

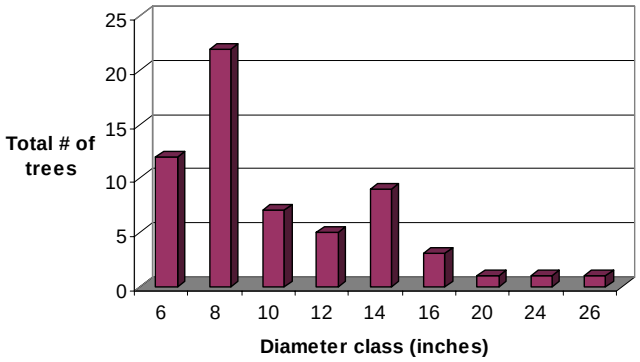

Figure 5: Elm diameter distribution

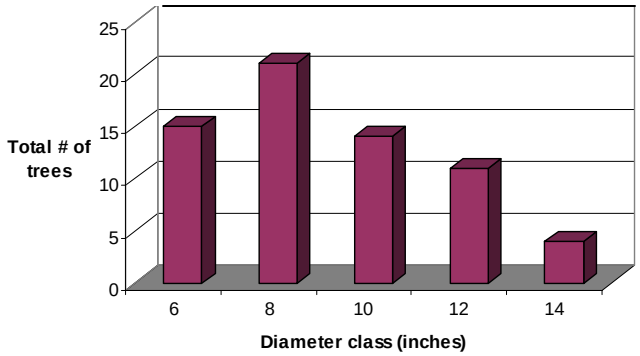

Figure 6: Box elder diameter distribution

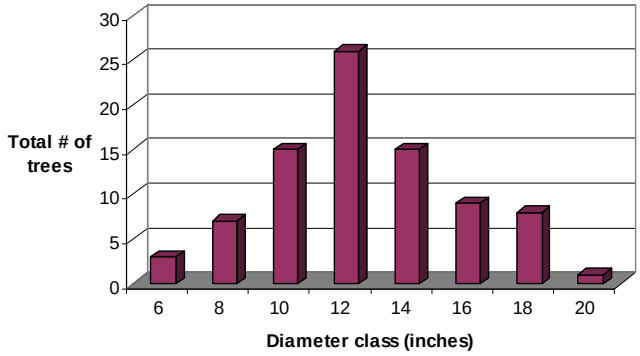

Figure 7: Black cherry diameter distribution

Appendix D.
Description of Management Prescriptions (DNR Silviculture Handbook)

Invasive species management

Each individual plant species may display a unique set of phenotypical characteristics. For instance, some plants begin to flower in early spring and typically initiate seed dispersal in early to late summer, while other plants begin to flower in early to late summer and begin dispersing seeds in the fall. For this reason, it is important to plan the management of invasive plant species according to their natural phenologies.

Garlic Mustard (*Alliaria petiolata*)

Garlic mustard is a member of the garlic family (Brassicaceae). It is a biennial plant having a two-year life cycle. In the first year of growth (seedling stage), the plant develops kidney shaped leaves with scalloped edges and remains within 6-8 inches of the ground. During the second year of growth (rosette stage), garlic mustard typically displays rapid shoot elongation during early spring reaching heights 3 to 4 feet. Flowering usually begins in April or June in Wisconsin, and seed dispersal occurs during early to mid-summer. Individual plants may produce 350 to 7,900 seeds.

Because garlic mustard is a disturbance-adapted plant, all management efforts should strive to reduce soil and vegetation disturbance to prevent giving further advantage to garlic mustard. Garlic mustard usually spreads from a core infestation along an invasion front and spreads to new areas (satellite infestations) via human, rodent, and bird transport mechanisms (Fig. 1). Where garlic mustard is not well established, efforts should focus on detecting and removing satellite infestations before a new seed bank develops. This may be accomplished by hand-picking individual plants or using spot herbicide treatments.

Once garlic mustard has been well established on a site, efforts should focus on limiting seed dispersal until the entire seed bank is exhausted. Depending on site characteristics and infestation severity, pulling, cutting, applying herbicide and or repeated fire will be required.

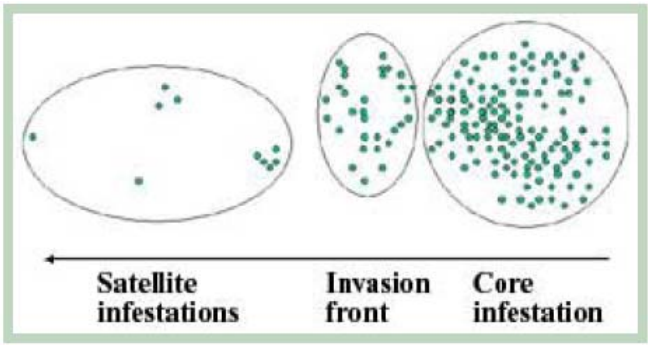

Figure 1: Pattern of garlic mustard spread

These techniques should be applied in spring or before the plant has begun to produce seeds.

Common Buckthorn (*Rhamnus cathartica*)

Common buckthorn was introduced in the New England area prior to the 1800's and started to invade habitats probably after the early 1900's. Buckthorn exists as a small tree or coarse shrub growing 6.5 to 20 feet in height. The fragrant, yellow-green flowers of buckthorn appear in early spring and its dark purple fruit containing 3 to 4 seeds each appear in the fall. Birds and mammals, especially starlings, blackbirds, woodducks, deer, robins, blue jays, and mice, eat the fruit of buckthorns and are the primary mechanism by which buckthorn is spread to new areas. Buckthorn affects the survival of co-occurring species and is therefore a threat to native ecosystems. Other woody plants, such as viburnum and dogwood may be replaced by buckthorn, or are unable to invade established buckthorn thickets.

Cultural controls that have been used for managing buckthorn include cutting, mowing, herbicide treatment, girdling, excavation, burning, and underplanting. Careful spraying with a 1-2 % aqueous solution of glyphosate herbicide has had some success in forested areas. Herbicide applications are best done in late fall when native species are dormant and have lost their leaves. Girdling may be done all winter, does not disrupt the soil, and does not affect sensitive areas. Repeated cutting, which reduces plant vigor, is recommended twice per growing season for two or three years. A combination of cutting and herbicide treatments may be used if resprouting poses a problem.

Exotic Bush Honeysuckles *(Lonicera spp.)*

Exotic bush honeysuckles are upright, multi-stemmed, oppositely branched, deciduous trees or coarse shrubs that range from 4 to 20 feet in height. Reproduction of bush honeysuckles is almost entirely by seed. Birds and mammals eat the red fruiting-bodies of honeysuckle and transport the seeds to new areas. Bush honeysuckle is widely considered an aggressive, highly successful weedy complex because it spreads rapidly and competes for resources more efficiently than native species.

Control and management techniques for honeysuckle are generally the same as those used for common buckthorn. *(See above)*

Manage for Southern Hardwoods

In order to perpetuate a new generation of central hardwood species in Nobel Woods some type of disturbance is needed to reduce the crown cover and increase the amount of light reaching the understory. In managed forests this disturbance usually comes in the form of a planned harvest. Three silvicultural systems that can be used to regenerate central hardwood species are as follows.

Shelterwood

A. Definition and Description (WDNR)

A silvicultural method used to regenerate a stand by manipulating the overstory and understory to create conditions favorable for the establishment and survival of desirable tree species. The method is designed to regenerate an even-aged stand and normally

involves removal of most of the overstory in two or more subsequent cuttings after the new stand is established. The overstory serves to modify understory conditions, create a favorable environment for reproduction, and provide a seed source. A secondary function of the overstory is to allow further development of quality overstory stems during seedling establishment to increase the efficient use of growing stock. The system is characterized by a preparatory cut (optional), seeding cut(s), and overstory removal. The most vigorous trees are normally left and less vigorous trees removed.

B. Characteristics (WDNR)
- Even-aged
- Seed origin (high forest)
- Overstory modifies understory conditions - protects natural reproduction
- Overstory is removed only after regeneration established
- Method allows for variations in regeneration over space and time
- Overstory generally provides most seed

C. Contrast with Other Methods (WDNR)

Initial shelterwood cuttings usually resemble heavy thinnings. Natural reproduction starts under the protection of the older stand and is finally released when it becomes desirable to give the new stand full use of the growing space. This method differs from uneven-aged, selection methods in that it promotes an even-aged stand structure. It differs from clearcutting and coppice methods in that the next stand is established on the site prior to overstory removal. Shelterwood differs from seed tree cutting in that the overstory serves to protect the understory as well as distributing seed. The system partly mimics natural deterioration of the overstory, only at an accelerated rate, but is dissimilar because most coarse woody debris is removed.

D. Variations to This Method (WDNR)

1. *Uniform Shelterwood***:** A shelterwood method applied to the entire stand, designed to regenerate the entire stand at the same time.
2. *Strip Shelterwood:* A shelterwood method in which the stand is regenerated in strips progressing across the stand over a period of time. Cutting is concentrated in certain strips while the rest of the stand remains temporarily unharvested.
3. *Group Shelterwood:* A shelterwood method in which the stand is regenerated using patches of existing desirable regeneration which are gradually enlarged over time through overstory and understory manipulation adjacent to these patches. Patches of regeneration are often the result of natural disturbance or prior cutting. In the absence of existing regeneration, stand manipulation can occur to cause reproduction to become established.

E. Application (WDNR)

Cover type specifics and applicability of the shelterwood method are addressed in appropriate cover type chapters of this Handbook. The shelterwood method is a recognized method to regenerate the white pine, white birch, scrub oak, oak, red maple, **central hardwood**, northern hardwood, hemlock-hardwood, fir-spruce, swamp conifer, black spruce, cedar, swamp hardwood, and bottomland hardwood forest

cover types. The shelterwood method may have potential for use in regenerating jack pine, red pine, black walnut, and tamarack. This method does not apply to aspen.

General considerations in the application of the shelterwood method are:
- Site evaluation (suitable to meet nutrient-moisture needs of species)
Silviculture and Forest Aesthetics Handbook
5-21-03 21-12 HB24315.21
- Level/intensity of competition
- Overstory condition, health, and composition
- Seed tree condition, health, and composition (form, crown class, seeding potential, age)
- Determination of existing stand maturity
- Evaluation of existing reproduction
- May involve a preparatory cut
- Conduct seeding cut - allow stand to develop
- Seedbed preparation
- Control competition during good seed year (fire, mechanical, chemical)
- Monitor understory development
- Conduct removal cut

F. Advantages and Disadvantages (WDNR)
Advantages:
- Local, known seed source
- High seedling numbers
- Higher seedling/stand diversity
- Can be repeated if unsuccessful
- Reproduction generally more certain and complete than clearcutting or seed tree
- Overstory develops more rapidly and achieves larger size

Disadvantages:
- Techniques of application are not well-developed for every species
- Requires technical skill to apply this method
- May involve chemical use, scarification, noncommercial cutting or prescribed burning.
- More careful logging practices often required in overstory removal to protect understory.
- Seed or preparatory cuts may require care
- Timing to seed crop
- Added time for timber sale establishment

Clearcut

A. Definition and Description (WDNR)
A silvicultural method used to regenerate a stand by the removal of most or all woody vegetation during harvest creating a completely open area leading to the establishment of an even-aged stand. Regeneration can be from natural seeding from adjacent stands or from trees cut in the harvest operation. Regeneration is established during or following stand removal.

B. Characteristics (WDNR)

- Even-aged
- Seed origin (high forest)
- Used for shade intolerant, and exposure tolerant species
- New stand regenerates after the existing stand is harvested
- Best adapted for species that reproduce naturally after major disturbance

C. Contrast with Other Methods (WDNR)
Differs from seed tree and shelterwood regeneration methods in that no trees are left in the cut area for seeding purposes; rather, the seed source is from outside the cut area, or from the felled tops of harvested trees. Also, there is no overstory that offers protection to the regeneration. Differs from coppice in that regeneration in a clearcut is from seed. Unlike overstory removal, the regeneration in a clearcut is not present until after the harvest. Clearcut regeneration is even-aged, while that from the selection method is uneven-aged. This method partially simulates stand mortality due to major natural disturbance such as fire, but may be less patchy, removes all large wood, and produces different seedbed characteristics.

D. Variations to This Method (WDNR)

1. Uniform Clearcut: Entire stand is removed in one cut. Designed to regenerate the entire stand at the same time.
2. Alternate Clearcut (strip or patch): The stand is removed in two cuttings, occurring at separated periods in time. Generally, one half of the stand acreage is removed in each cutting. Cutting may be in patchwork design, or designated strips. The uncut area serves as a seed source. Stand removal is completed within a period of time, not exceeding 20% of intended rotation. The clearcut areas are best oriented so that they are at right angles to the direction of seed-dispersing winds.
3. Progressive clearcut (strip or patch): The stand is removed as above, except using a series of strips or patches harvested over three or more entries, usually covering an equal area on each occasion. The stand is removed within a period of time not exceeding 20% of intended rotation. In higher watertable areas, this method may be chosen to reduce water fluctuations and reduce windthrow. In steeply sloping areas, this method may reduce erosion and windthrow.

E. Application (WDNR)
Cover type specifics and applicability of the clearcut method are addressed in appropriate cover type chapters of this Handbook. The clearcut method is a recognized method to regenerate jack pine, white birch, scrub oak, oak, fir-spruce, swamp conifer, black spruce, tamarack, and cedar cover types. It may have potential for use in regenerating aspen, black walnut, central hardwood, and bottomland hardwood cover types. This method does not apply to red pine, white pine, red maple, northern hardwood, hemlock-hardwood, or swamp hardwood.
General considerations in the application of the clearcut method are:
- Seeding characteristics of desired species: maturation, viability, dispersal, germination, good seed crop
- Site capability
- Seed/seedling needs for establishment and survival
- Site preparation

- Existing and potential competition

F. Advantages and Disadvantages (WDNR)
Advantages:
- Local, known seed source which is adapted to the site
- Efficiency of harvesting operations
- No preparatory harvest is necessary
- Maintenance of shade-intolerant species in the landscape
- Complete overstory removal can result in dense stocking and vigorous regeneration and growth for many species
- Logistically easier to treat the site to control undesirable vegetation
- Longer time period between entries reduces some vehicle impacts to soils

Disadvantages:
- Timing relative to good seed years is difficult
- Coppice regeneration of unwanted species may dominate the site
- Dispersal, density and spacing pattern of desirable seed may be unsatisfactory
- Overexposure may cause seedling failure
- If regeneration is unsuccessful, seed source can be lost in uniform clearcut
- May require noncommercial cutting and extensive site preparation
- On wet sites, can have potential for water table changes
- Higher windthrow potential (strips, patches, adjacent stand)

Manage for Oak Regeneration

Regeneration of oaks typically requires different silvicultural prescriptions than regeneration of other species. Large enough canopy openings need to be created in order promote the regeneration of seedlings and saplings in the understory, but openings have to be kept small enough to hinder the establishment of shade intolerant species. The selection silviculture system is most commonly used to regenerate oak.

Selection System

A. Definition and Description (WDNR)
A silvicultural method designed to regenerate and maintain uneven-aged stands by removing some trees at regular intervals. Trees are removed in various size classes, either singly or in small groups. An uneven-aged stand is maintained by periodically regenerating new age classes while manipulating the overstory structure to facilitate continual development of quality growing stock. Stand regeneration is achieved by periodically manipulating the overstory and understory to create conditions favorable for the establishment and survival of desirable tree species. Regeneration cuts, thinning, and harvesting usually occur simultaneously. Generally, most regeneration is seed origin (high forest method), although a component can be vegetative.

B. Characteristics (WDNR)
- Uneven-aged
- Seed origin (high forest)

- Overstory never completely removed – periodic removal of individuals and groups of overstory trees to recruit new
overstory trees and regeneration
- Overstory provides a seed source, and modifies understory conditions to create a favorable environment for the reproduction, competition, and growth of certain species
- Favors regeneration and maintenance of shade tolerant species; variations can favor mid-tolerants
- Method allows for variations in regeneration and structure (e.g. age class, composition, density) over space and time
- Regeneration cuts (gap creation), thinning, and harvesting usually occur simultaneously

C. Contrast with Other Methods (WDNR)

The selection regeneration method is utilized to develop and maintain uneven-aged stands, whereas the other five major methods are all even-aged. Residual stand stocking is at a specified level to promote development of quality boles and fully utilize the site. Natural reproduction is established and develops in association with a permanent multiaged overstory. The overstory serves to distribute seed and modify understory conditions, favoring the maintenance of shade tolerant and mid-tolerant species. The selection method resembles a thinning, but regeneration is facilitated through consideration of species regeneration requirements and gap creation. This method simulates natural mortality and disturbance (e.g. senescence and low to moderate intensity windthrow), but is more regulated and homogeneous, impacts younger stands, and removes most coarse woody debris.

D. Variations to This Method (WDNR)

1. Single-tree selection: Individual trees of various size and age classes are periodically removed to provide space for regeneration and to promote growth of remaining trees. Each regeneration opening (gap) covers an area equivalent to the crown spread of a single large tree that has been removed. The spacing of regeneration gaps is irregular, based on the location of large harvested trees.

2. Group selection: Trees are periodically removed in small groups to create conditions favorable for the regeneration and establishment of new age classes. In general, the openings created may range in size from fairly small (30 foot diameter circle is 0.02 acres) up to about one-half acre (166 foot diameter circle, representing approximately two tree lengths). In northern hardwood management, gaps generally are less than 0.1 acres in size. Smaller openings favor the regeneration of more tolerant species, while larger openings favor mid-tolerants (and some intolerants). Spatial distribution of gaps may be irregular and dictated by small variations in stand conditions, such as the vigor, health, and size of individual and small groups of trees. The remainder of the stand is thinned.

E. Application (WDNR)

Cover type specifics and applicability of the selection method are addressed in appropriate cover type chapters of this Handbook. The single-tree selection method is a

recognized method to regenerate the northern hardwood and hemlock hardwood forest cover types, whereas the group selection method is appropriate for the red maple, central hardwood, northern hardwood, and bottomland hardwood cover types. The single-tree selection method may have potential for use in regenerating the central hardwood, fir-spruce, swamp conifer, black spruce, and cedar cover types, whereas the group selection method may have potential for white pine, scrub oak, oak, black walnut, hemlock-hardwood, fir-spruce, swamp conifer, black spruce, white cedar, and swamp hardwood cover types. Neither method is applicable to jack pine, red pine, aspen, white birch, or tamarack. To convert even-aged stands to uneven-aged structure, several cutting cycles are needed to establish multiple age classes.

General considerations in the application of the selection method are:
- Site evaluation (suitable to meet moisture and nutrient demands of species)
- Stand composition, size and age class structure, condition, and health
- Potential seed and sprout sources – composition, condition, health
- Advanced regeneration
- Regeneration requirements (moisture, nutrients, light, heat) of desired species
- Competitive abilities of desired species, and potential levels of competition among species
- Seedbed preparation
- Competition control
- Overstory impacts on understory light and heat levels
- Gap management – smaller gaps favor shade tolerant species, and larger gaps favor mid-tolerants
> previous gaps needing expansion to release established regeneration
> number of new gaps to release advanced regeneration or establish new regeneration
> size and expected closure rates (crown expansion)
- Order of removal of overstory trees for gap creation, thinning, and harvest – generally the most vigorous crop trees
are left, and less vigorous and diseased trees are removed
- Cutting cycle and allowable cut
- Protection (residual stems, crowns, root systems, advanced regeneration) from logging damage

F. Advantages and Disadvantages (WDNR)

Advantages:
- Permanent forest with multiple age classes – the overstory is not completely removed
- Maintenance of a permanent overstory allows treatment adjustment and modification if problems arise or objectives are not initially achieved
- Relatively continuous full site occupancy
- Local, known seed source
- Reproduction relatively certain
- System favors shade tolerant species, and in some applications mid-tolerants
- For some species on some sites, there is little need for site preparation or competition control
- Periodic improvement of stand quality through judicious tending
- Maximizes growth and quality for some species (e.g. northern hardwoods)

- Can grow large, high quality trees – facilitates high levels of sawtimber production
- Periodic income can be relatively frequent (sustained yield)

Disadvantages:
- Requires technical skill and need to monitor stand conditions
- Techniques of application are not well-developed for every species, especially the mid-tolerants
- Not a good system to regenerate and manage intolerants
- Species diversity can be difficult to establish or maintain
- For some species, may require timing to seed crop
- Some site preparation techniques not feasible
- May involve chemical use, scarification, noncommercial cutting, or prescribed burning
- Careful logging practices required to protect overstory and advanced regeneration; some damage is unavoidable
- Frequent reentry increases the frequency of site disturbance
- Frequent reentry requires a more extensive and permanent network of access roads and skid trails
- For any given entry, income is less than for complete overstory removal
- Added time and cost for timber sale establishment
- Logging costs are relatively high to remove scattered sawtimber

Appendix E.
Glossary of Terms Used

General Defenitions

Artificial regeneration: Establishing a new forest by planting seedlings in the understory or by direct seeding of the understory.

Basal area: The area of the cross-section of a tree stem at breast height (4.5 feet above the ground).

Biodiversity: The diversity of plants, animals, and other living organisms in all of their forms and levels of organization, including genes, species, ecosystems, and the evolutionary and functional processes that link them.

Biota: All living things of an area, taken collectively.

Bole: Trunk of a tree.

Breast height: The standard height, 4.5 feet above ground level, at which the diameter of a standing tree is measured.

Canopy: The forest cover of branches and foliage formed by tree crowns.

Canopy Coverage: The horizontal extension of a tree's branch network in all directions from its trunk.

Climax Forest: A forest community that represents the final stage of natural forest succession for its environment.

Closed Canopy: The description given to a stand when the crowns of the main level of trees forming the canopy are touching and intermingled so that light cannot reach the forest floor directly.

Codominant: In stands with a closed canopy, those trees whose crown form the general level of the canopy and receive full light from above, but comparatively little from the sides.

Competing Vegetation: Vegetation that seeks and uses limited common resources (space, light, water, and nutrients) of a forest site needed by preferred trees for survival and growth.

Crown Class: Categorizing individual trees based on their general position in the canopy. Crown classes include, but are not limited to Codominant, Dominant, Intermediate, and Overtopped.

Disturbance: A discrete event, either natural of human-induced, that causes a change in the existing condition of an ecological system.

Dominant: Trees with crowns extending above the general level of the canopy and receiving full sunlight from above and partly from the side; taller than average trees in the stand with crowns well developed.

Duff: The layer of partially and fully decomposed organic materials lying below the litter and immediately above the mineral soil. It corresponds to the fermentation and humus layers of the forest floor.

Ecological Habitat Type: A forest site classification system that uses the floristic composition of the plant community (understory species as well as trees) as an integrated indicator of those environmental factors that affect species reproduction, growth, competition, and therefore, community development and forest succession.

Ecosystem: A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size-a log, pond, field, forest, or the earth's biosphere-but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, for example, forest ecosystem, old-growth ecosystem, or range ecosystem.

Ecosystem Management: The use of an ecological approach to achieve productive resource management by blending social, physical, economic and biological needs and values to provide healthy ecosystems.

Forest Floor: Layers of fresh leaf and needle litter, moderately decomposed organic matter, and humus or well-decomposed organic residue.

Forest Management: The practical application of scientific, economic and social principles to the administration and working of a forest for specified objectives. Particularly, that branch of forestry concerned with the overall administrative, economic, legal and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection and forest regulation.

Hazard Tree: A tree or any component of a tree that has sufficient structural infirmity to be identified as having a high risk of falling and causing personal or property damage.

Intermediate: Intermediate trees have crowns below, but still extending into, the general level of the canopy and receive a little direct light from above but none from the sides.

Native Species: Any species having arrived in the Dane County region since the last ice age without human assistance.

Natural Regeneration: The renewal of a forest stand by natural seeding, sprouting, suckering, or layering seeds be deposited by wind, birds, or mammals.

Overtopped: Trees with crowns entirely below the general level of the crown cover receiving little or no direct light from above or from the sides.

Prescription: A course of management action prescribed for a particular area after specific assessments and evaluations have been made.

Recreation Resource: A recreation feature, a scenic or wilderness feature or setting that has recreational significance or value or a recreation facility.

Regeneration: The renewal of a tree crop through either natural means (seeded on-site from adjacent stands or deposited by wind, birds, or animals) or artificial means (by planting seedlings or direct seeding).

Release: Freeing a tree or group of trees from more immediate competition by cutting or otherwise eliminating growth that is overtopping or closely surrounding them.

Restoration: The return of an ecosystem or habitat to its original community structure, natural complement of species and natural functions.

Sapling: A loose term for a young tree no longer a seedling but not yet a pole, about 1 - 2 m high and 2 - 4 cm DBH, typically growing vigorously and without dead bark or more than an occasional dead branch. Also, a young tree having a DBH greater than 1 cm but less than the smallest merchantable diameter.

Seedling: A young tree, grown from seed, from the time of germination to the sapling stage, having a DBH equal or less than 1 cm.

Shelterwood Silvicultural System: A silvicultural system in which trees are removed in a series of cuts designed to achieve a new even-aged stand under the shelter of remaining trees.

Silvicultural System: A planned program of treatments throughout the life of the stand to achieve stand structural objectives based on integrated resource management goals. A silvicultural system includes harvesting, regeneration and stand-tending methods or phases. It covers all activities for the entire length of a rotation or cutting cycle.

Silviculture: The art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands. Silviculture entails the manipulation of forest and woodland vegetation in stands and on landscapes to meet the diverse needs and values of landowners and society on a sustainable basis.

Silviculture Prescription: A site-specific operational plan that describes the forest management objectives for an area. It prescribes the method for harvesting the existing forest stand, and a series of silviculture treatments that will be carried out to establish a free growing stand in a manner that accommodates other resource values as identified.

Snag: A standing dead tree or part of a dead tree from which at least the smaller branches have fallen.

Specimen Tree: Any living tree that displays superior quality and characteristics when compared trees of the same species or other trees in the vicinity of the woodlot. For the purpose of this assessment a specimen tree must be dominant or codominant in the canopy, have a DBH of greater than or equal to 15 inches, and display good health.

Succession: The gradual and orderly process of ecosystem development brought about by changes in community composition and the production of a climax characteristic of a particular geographic region.

Understory: Any plants growing under the canopy formed by other plants, particularly herbaceous and shrub vegetation under a tree canopy.

Inventory Defenitions

Canopy Crown Classes

Codominant: In stands with a closed canopy, those trees whose crown form the general level of the canopy and receive full light from above, but comparatively little from the sides.

Dominant: Trees with crowns extending above the general level of the canopy and receiving full sunlight from above and partly from the side; taller than average trees in the stand with crowns well developed.

Intermediate: Intermediate trees have crowns below, but still extending into, the general level of the canopy and receive a little direct light from above but none from the sides.

Overtopped: Trees with crowns entirely below the general level of the crown cover receiving little or no direct light from above or from the sides.

Health Classes

Good: Tree is of good form and few or no problems or defects are visible.

Fair: Tree is relatively healthy but small defects are visible and/or the tree exhibits poor form.

Poor: Tree is in very poor condition with many defects and/or very poor form. Trees in poor health are generally declining and near mortality.

Dead: Tree exhibits no signs of life.

Comments

Specimen Tree: Any living tree that displays superior quality and characteristics when compared trees of the same species or other trees in the vicinity of the woodlot. For the purpose of this assessment a specimen tree must be dominant or codominant in the canopy, have a DBH of greater than or equal to 15 inches, and display good health.