

Forest Management Plan

Landowner and Site Information

Landowner Name: Joseph K. Landowner Landowner Phone: 555.555.5555
Landowner Address: 1234 Center Rd., Maplewood, MI 12345
Landowner Email: jkl@example.com Alternate Phone: 555.555.5556
Property Location: Part of the SE ¼ of Sec. 12, T0N, R0E (Maplewood Twp., Northwoods Co., MI)
Plan Date: 1/1/2013 Acres in Plan: 63.2

Plan Writer Information

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Plan Acceptance

Landowner's
Signature: _____ Date: _____

Plan Writer's
Signature: _____ Date: _____

NRCS Signature: _____ Date: _____

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Appendix C – Invasive Species Management Information	Not included in example plan

ADDITIONAL MATERIAL INCLUDED IN PLAN

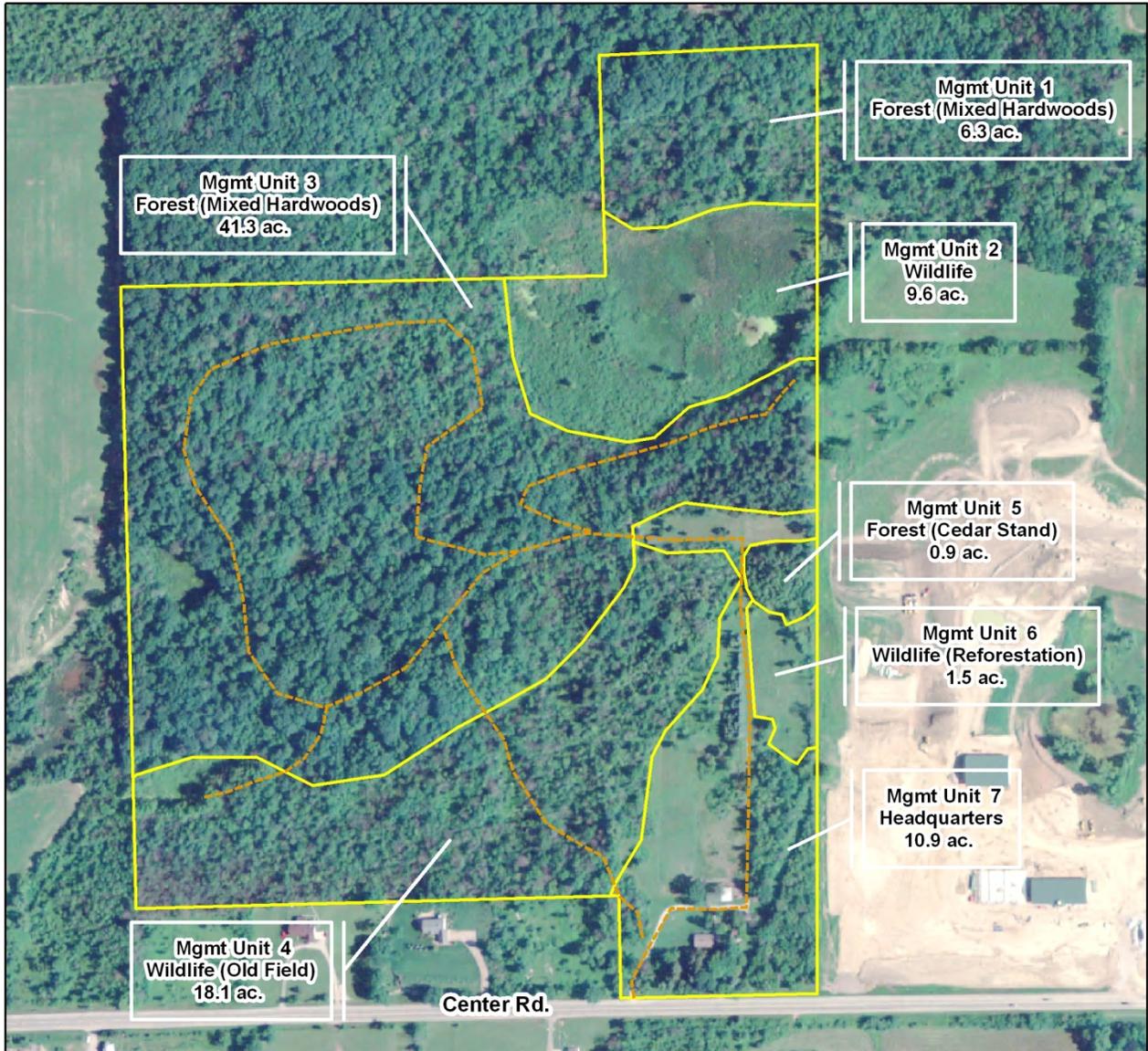
Forest Stand Improvement (666) Job Sheet – Management Unit 3
Tree/Shrub Site Preparation (490) Job Sheet – Management Unit 6
Tree/Shrub Establishment (612) Job Sheet – Management Unit 6
Resource Considerations Field Inventory Guide Sheet (Excerpt from form MI-CPA-52)

Joseph K. Landowner Plan Map

Date: 12/21/2009

Approximate Acres: 88.6
Part of the SE 1/4 of Sec 12, T0N, R0E (Maplewood Twp., Northwoods Co., MI)

Assisted By: John Forester



Legend

- Trails (Line)
- Joseph K. Landowner Land Units

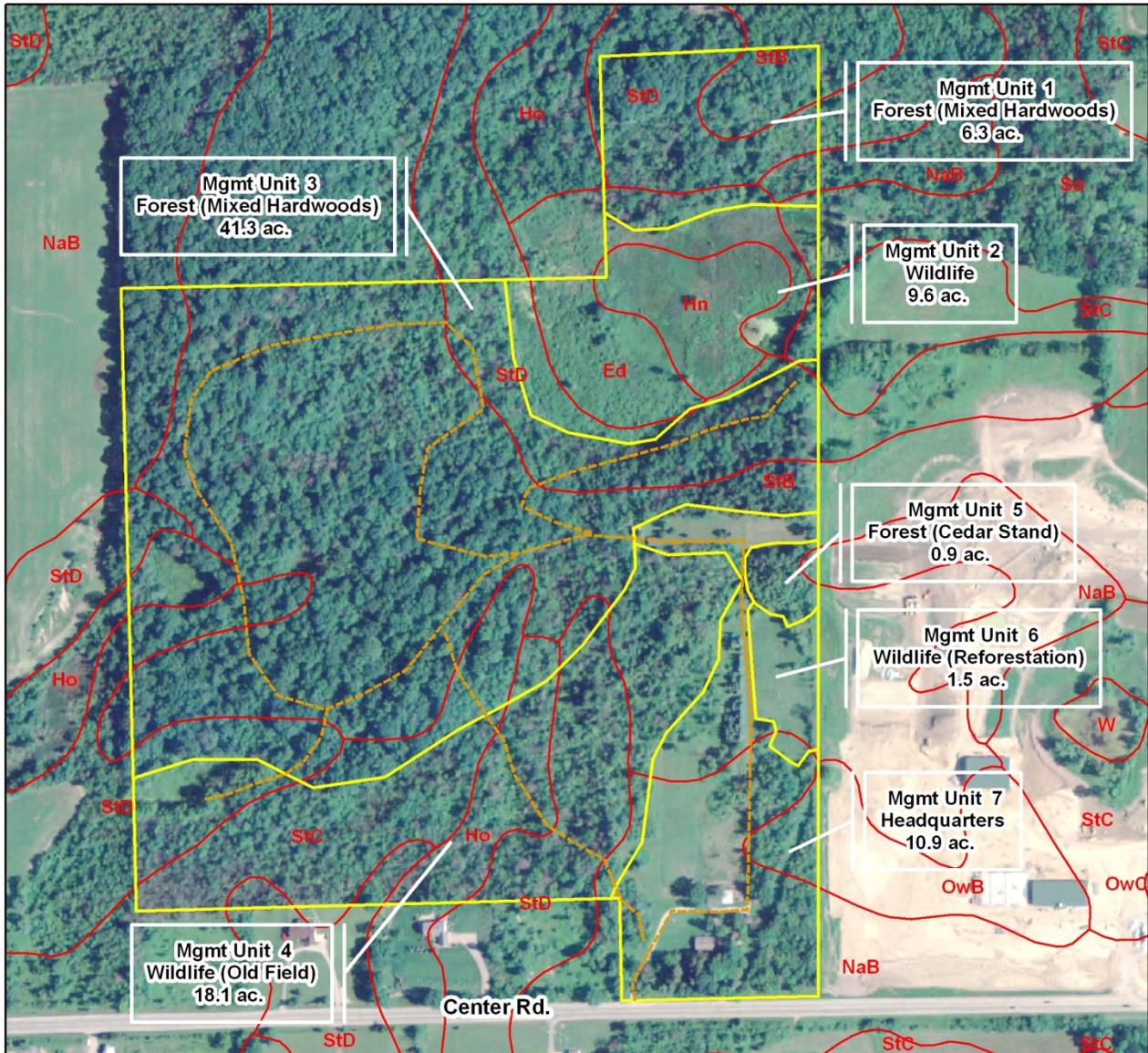


Joseph K. Landowner Soils Map

Date: 12/21/2009

Approximate Acres: 88.6
Part of the SE 1/4 of Sec 12, T0N, R0E (Maplewood Twp., Northwoods Co., MI)

Assisted By: John Forester



Legend

- Trails (Line)
- Joseph K. Landowner Land Units
- Soil (refer to Appendix A for soils information)



LANDOWNER OBJECTIVES

The landowner's objectives are to improve the value of and productivity of the timber on the property, while also improving the quality of habitat for a variety of woodland wildlife species, by increasing the diversity of cover and food available on the property. Additionally, maintaining a visual and recreational values are important to the landowner.

FOREST MANAGEMENT PLAN DEVELOPMENT

To collect data for development of this plan, a variable radius plot (point sampling) inventory was conducted. Tree data (species and diameter) was collected at 66 points distributed throughout the property. Additionally, an ocular assessment of understory vegetation, wildlife habitat elements, invasive species, etc., was conducted throughout the site. Soils information included in this plan was generated by <http://websoilsurvey.nrcs.usda.gov/>.

PROPERTY OVERVIEW

HISTORY

This property, located in Section 12 of Maplewood Township, Northwoods County, has been in the Landowner family for three generations. Historical aerial photographs indicate that in the majority of the upland acreage was devoid of trees in the early 1900s and likely was used for grazing livestock. Grazing ceased in the 1940s to 1950s and the majority of the current tree cover has grown up since. A few large scattered trees, primarily along old fencerows, likely predate the land clearing. A small clump of northern white cedar was planted at about this same time (Management Unit 5, 0.9 ac.), as were several red pines along the steep slope in Management Unit 3, south of Management Unit 2.

The current landowner indicated that one commercial timber harvest took place in the early 1980s. This selective harvest removed a small number of larger red oak, white oak and black walnut.

GENERAL SITE DESCRIPTION

The majority of the property is forested, with Management Units 1 and 3 containing a high quality stand of mixed hardwood trees.

Management Unit 4 to the south is an old field, containing large clusters of woody shrubs including gray dogwood, staghorn sumac, autumn olive and multiflora rose. In much of this area, pole-sized American elm, black cherry, and cottonwood have become established.

The soils on the site range from well drained loams in much of the upland portions of the property to muck in the wetland (Management Unit 2).

The site is relatively flat to somewhat rolling, except for the area directly around the wetland (Management Unit 2). For 200 to 300 feet out from the wetland's edge, the slopes are 12 to 18%.

Natural and Cultural Features

There are no known significant natural or cultural features on any of the management units.

Noxious and Invasive Species

No invasive species were found at the time of the forest inventory, except for as noted in Management Unit 3. However, several invasive species are known to be in the general area. Regular monitoring for

invasive species should be conducted. See Appendix C for information on invasive species management.

Existing Conservation Practices and Activities

The Landowner family owns the property primarily for the recreational value, being avid birdwatchers, deer, turkey, and squirrel hunters, and cross country skiers. They have maintained the foot/ski trails and have done some very limited firewood cutting, concentrated mostly on dead trees and hazard trees near trails.

They also have expressed an interest in taking a more active roll in forest management and view the timber crop as an important long term investment for the family. The existing trail network is adequate access for their recreation and management needs.

SUMMARY TABLE OF SCHEDULED CONSERVATION PRACTICES

Date	Land Unit	Practice	Extent
January 2013	3	Forest Stand Improvement (666)	36.0 ac.
March 2013	3	Herbaceous Weed Control (315)	2.0 ac.
April 2013	6	Tree/Shrub Site Preparation (490)	1.5 ac.
October 2013	6	Tree/Shrub Establishment (612)	1.5 ac.
May 2014	6	Herbaceous Weed Control (315)	1.5 ac.
May 2015	6	Herbaceous Weed Control (315)	1.5 ac.
May 2016	6	Herbaceous Weed Control (315)	1.5 ac.

===== MANAGEMENT UNIT 1 =====
FOREST (MIXED HARDWOOD FOREST)

CURRENT CONDITIONS

Land Unit		Average Tree	
Acres:	<u>6.3</u>	Diameter:	<u>7.2</u>
Basal Area:	<u>97 sq. ft./ ac.</u>	Stocking Level	<u>219</u>
	St. Clair Clay Loam (see Appendix A for	(trees per acre):	
Soil Type:	<u>more information)</u>	Site Index:	<u>66 (northern red oak)</u>

Species Composition

The majority of this stand of timber can be classified as an oak-hickory forest, a forest type dominated by red and white oak, hickories, basswood, ash, and black cherry. This forest type is usually found in the drier soils in this part of Michigan. As is fairly common in many stands in this area, this stand also contains species more typical of a mesic (moist) forest as well – sugar maple and American beech, specifically. Also, a fair number of soft maples (red and silver maple) are here, commonly in the wettest forested areas.

Other trees present include American elm, black cherry, black walnut, ironwood (hop hornbeam), and pin cherry.

Stand Density

The unit has good stand density and tree distribution. It currently has a basal area of 97 sq. ft./ac. Basal area, a measure of stand density, is the sum of the cross-sectional area of all trees [measured at breast height, 4.5'] expressed as a per-acre amount. Ideal basal area for this forest type is between 70 and 110 sq. ft./ac. When basal area is too low, the stand is underutilized, and may result in trees that are excessively branchy, or prone to windthrow damage. If basal area is too high, the growth of individual trees is stunted due to competition for resources, and trees may become more prone to pest damage.

This stand has an overabundance of small diameter trees (4 to 8" dbh) and a slight deficit of trees in larger size classes. The species mentioned above are fairly evenly distributed throughout all size classes.

Wood Products Potential

This stand has good potential for growing high quality hardwood sawtimber and veneer, but due to its small size and lack of access – it is effectively landlocked from the property by the wetland (Management Unit 2) – the stand will not be managed intensely for timber but rather to maintain good species diversity and provide valuable wildlife habitat.

Topography

There is a steep gradient on the majority of this management unit, with a south aspect, towards the wetland (Management Unit 2). There is no evidence of erosion concerns, currently, but the site should be monitored regularly. Additionally any management activities should be done in accordance to "Sustainable Soil and Water Quality Practices on Forest Land," the Michigan Department of Natural Resources' Forestry Best Management Practices guide (see Appendix B).

Natural and Cultural Features

See "General Site Description," page 3.

Roads and Trails

There are no roads and trails in this management unit.

Forest Health

There is no significant wildfire or pest risk in this management unit.

Wildlife and Wildlife Habitat Elements

From a wildlife standpoint, the species composition is quite good. The oaks, hickories, beech, and walnut all provide an important hard mast food source for deer, turkey, squirrels (all regularly seen in this management unit) and other species. Many of the other trees provide additional food source from soft mast (such as the cherries) and/or from buds, leaves and twigs.

Noxious and Invasive Species

See "General Site Description," page 3.

Water Features

There is no surface water present in this management unit and no known ground water issues.

Existing Conservation Practices

See "General Site Description," page 3.

Harvest History

The harvest history of this management unit is unknown.

Desired Future Condition

This unit will be largely unmanaged due to access restriction. It is anticipated that over time, a portion of the oak and hickory component will be replaced by more shade tolerant sugar maple and beech, which are already present in lower numbers. The stocking and density will ultimately reach equilibrium as the stand begins to exhibit more "climax forest" characteristics (larger, shade-tolerant trees, more woody debris, etc.). This condition, however, is not as conducive to timber production, as tree vigor will be reduced.

Recreation will be the key use of this management unit. The landowner has a "verbal agreement" with the neighbor allowing foot traffic/ski access to this site. The likely eventual conversion to a sugar maple dominated stand (and loss of oaks) will provide some diversity and contrast to the remainder of the property.

PLANNED CONSERVATION PRACTICES

No conservation practices are planned on this management unit.

ADDITIONAL MANAGEMENT CONSIDERATIONS

Monitoring

This management unit should be monitored for invasive species on a regular basis, at least annually. If any new invasive species are noted, contact the NRCS office or the plan writer for information on control. Also, refer to Appendix C for general information on invasive species.

Similarly, forest health, erosion and other potential concerns should be monitored regularly.

===== MANAGEMENT UNIT 2 =====
WILDLIFE (BUTTONBUSH SWAMP)

CURRENT CONDITIONS

Land Unit		Average Tree	
Acres:	<u>9.6</u>	Diameter:	<u>n/a</u>
Basal Area:	<u>n/a</u>	Stocking Level	<u>n/a</u>
	Edwards & Houghton Muck (see	(trees per acre):	<u>56 (red maple)</u>
Soil Type:	<u>Appendix A for more information)</u>	Site Index:	<u>(see Appendix A for more SI's)</u>

Species Composition

The majority of this management unit is a swamp dominated by sedges, bulrushes, and forbs with several large clusters of buttonbush, and to a lesser extent winterberry, and black elderberry. This low, flat area transitions quite abruptly to the surrounding uplands. There are a few lowland hardwoods (primarily eastern cottonwood, silver maple and American elm) in this narrow transitional area.

Stand Density

n/a

Wood Products Potential

n/a

Topography

This unit is extremely flat and transitions abruptly into the steep surrounding upland forests.

Natural and Cultural Features

See "General Site Description," page 3.

Roads and Trails

There are no roads and trails in this management unit.

Forest Health

There is no significant wildfire or pest risk in this management unit.

Wildlife and Wildlife Habitat Elements

The primary wildlife habitat element provided by this management unit is the surface water which is present in at least some of the unit perennially. Additionally cover from the grass and grass-like plants can be important for a number of species. Ducks, geese, great blue herons, sandhill cranes, and many other water birds have been seen using this area.

Noxious and Invasive Species

See "General Site Description," page 3.

Water Features

Surface water is present in most of this unit for several weeks in the spring and for shorter periods following significant rain events. The site is not known to have ever dried up completely. There are no known water quality concerns in this management unit.

Existing Conservation Practices

See "General Site Description," page 3.

Harvest History

The harvest history of this management unit is unknown, although it is unlikely that commercially valuable timber ever grew here.

Desired Future Condition

This unit will be largely unmanaged to maintain its current condition.

Recreation, particularly bird (and other wildlife) watching will continue to be the key use of this management unit.

PLANNED CONSERVATION PRACTICES

No conservation practices are planned on this management unit.

ADDITIONAL MANAGEMENT CONSIDERATIONS

Monitoring

This management unit should be monitored for invasive species on a regular basis, at least annually. If any new invasive species are noted, contact the NRCS office or the plan writer for information on control. Also, refer to appendix C for general information on invasive species.

Similarly, water quality, plant health, erosion and other potential concerns should be monitored regularly.

===== MANAGEMENT UNIT 3 =====
FOREST (MIXED HARDWOOD FOREST)

CURRENT CONDITIONS

Land Unit		Average Tree	
Acres:	41.3	Diameter:	11.8
Basal Area:	120 sq. ft./ ac.	Stocking Level	
	St. Clair Clay Loam (see Appendix A for more information)	(trees per acre):	236
Soil Type:		Site Index:	66 (northern red oak)

Species Composition

This stand is very similar to Management Unit 1, described above. The majority of this stand of timber can be classified as an oak-hickory forest, a forest type dominated by red and white oak, hickories, basswood, ash, and black cherry. This forest type is usually found in the drier soils in Southern Michigan. As is fairly common in many stands in southeast Michigan, this stand also contains species more typical of a mesic (moist) forest as well – sugar maple and American beech, specifically. Also, a fair number of soft maples (red and silver maple) are here, commonly in the wettest forested areas.

Other trees present include American elm, black cherry, black walnut, ironwood (hop hornbeam), pin cherry, and spruce. It should be noted for the purposes of this forest inventory, some species were grouped together. For example, black oaks were listed together with red oaks, bur oak is grouped with white oak, red maple and silver maple are grouped together as soft maple, and all the hickory species are grouped together.

Stand Density

The stand is in good with regards to stand density and tree distribution, although with a current basal area of **120 sq. ft./ac.**, a light thinning could make it more productive. This stand has a slight overabundance of pole-sized trees (8” to 12” dbh). The species mentioned above are fairly evenly distributed throughout all size classes.

Wood Products Potential

This stand has a good potential for growing high quality hardwood sawtimber and veneer, particularly red and white oak, black cherry, and sugar maple. Currently, there is an overabundance of hickory trees, a lesser valued species, relative to the oaks. Management should strive to correct this.

Topography

The majority of this management unit is relatively flat to gently rolling. There is no evidence of erosion concerns currently, but the site should be monitored regularly, especially along trails and where management has altered the stand. Any management activities should be done in accordance to “Sustainable Soil and Water Quality Practices on Forest Land,” the Michigan Department of Natural Resources’ Forestry Best Management Practices guide (see Appendix B).

Natural and Cultural Features

See “General Site Description,” page 3.

Roads and Trails

There is a loop trail that leads to three additional trails as indicated on the map. The trails are wide enough to accommodate vehicles if needed, but are primarily only used for foot and cross country ski traffic. There are no apparent erosion concerns, but the trails should be monitored. The steepest

portion of the trail (and highest erosion risk) is the switchback portion of the trail just south of the wetland (Management Unit 2).

Forest Health

There is no significant wildfire risk in this management unit.

There are a few red pine trees scattered along the steep hillside south of the wetland that are exhibiting signs of decline (pine bark beetle activity, tree mortality), primarily due to competition from hardwood trees, and having been planted on a poor site for this species. Due to the abundance of hardwoods, and the small number of pines, these will be allowed to die on their own. There is a minor white ash component scattered throughout the uplands, as well as some green ash in some of the lower areas. These are likely to succumb to emerald ash borer in the next few years. These will be targeted for removal as appropriate during Forest Stand Improvement activities.

Wildlife and Wildlife Habitat Elements

From a wildlife standpoint, the species composition is quite good. The oaks, hickories, beech, and walnut all provide an important hard mast food source for deer, turkey, squirrels (all regularly seen in this management unit) and other species. Many of the other trees provide additional food source from soft mast (such as the cherries) and/or from buds, leaves and twigs.

Noxious and Invasive Species

A few scattered areas of garlic mustard were identified in this management unit. These will be addressed with Invasive Species Control (797) (see below).

Additionally, regular monitoring for invasive species should be conducted. See Appendix C for information on invasive species management.

Water Features

There are a few isolated seasonal wetlands throughout the stand. Forest Stand Improvement activities will be conducted in such a way as to minimize disturbance to the site. See "Sustainable Soil and Water Quality Practices on Forest Land," in Appendix B and the Forest Stand Improvement Specifications for more information.

Existing Conservation Practices

See "General Site Description," page 3.

Harvest History

A light selective harvest of red and white oak, and black walnut (and likely a few other species) was done in the early 1980s.

Desired Future Condition

This unit will be managed both for recreational value and to increase the timber production. A reduction of basal area down to approximately 70 sq. ft./ ac. through crop tree management will help to encourage oak regeneration. A reduction of hickories and an increase in all oak species, as well as black cherry, and black walnut is desired.

This will provide both good hard and soft mast for wildlife and maintain the high visual quality of the stand as well.

PLANNED CONSERVATION PRACTICES

Forest Stand Improvement (666) – 36.0 acres, Jan. 2013

Install practice according to the attached Forest Stand Improvement (666) Job Sheet.

Herbaceous Weed Control (315) – 2.0 acres, March 2013

This practice is the control of invasive plant species whose presence is or is likely to cause economic or environmental harm or harm to human health.

This practice will be used to control garlic mustard which occurs in only a few isolated “islands” along the west property boundary. The primary method of control will be hand pulling. This can be done anytime that second year plants are present. Pulled plants should be disposed of in a heavy duty black garbage bag. If left out in the sun, the garlic mustard in the bag will be killed by the heat. First year plants (rosettes) may be killed using a targeted application of herbicide. This can even be done in early spring (before native wildflowers emerge), provided the temperature is within the herbicide labels allowance. Consult with Michigan State University Extension at 555-555-5555 for product recommendations.

Since the plants occur in low density clusters, surrounded by native vegetation, planting to revegetate the site will not be necessary.

Monitor the treatment sites at least every 3 months following treatment, and continue treatment as needed. Monitor the remainder of the Management Unit at least annually for new garlic mustard populations.

ADDITIONAL MANAGEMENT CONSIDERATIONS

Monitoring

This management unit should be monitored for invasive species on a regular basis, at least annually. If any new invasive species are noted, contact the NRCS office or the plan writer for information on control. Also, refer to appendix C for general information on invasive species.

Similarly, forest health, erosion and other potential concerns should be monitored regularly.

Roads and Trails

Access roads and trails should be maintained by mowing, seeding, etc. In steep areas or in areas adjacent to water bodies, consideration should be given to the Best Management Practices. See “Water Quality Management Practices on Forest Land” in Appendix B for details.

Wildlife Management

Most of the tree species present provide a good variety of food for many species of forest wildlife. Additional management considerations for wildlife can include construction of brushpiles, and creation of nest boxes for bats, wood ducks or other species of interest. See the enclosed information for details on these practices.

===== MANAGEMENT UNIT 6 =====
WILDLIFE (REFORESTATION)

CURRENT CONDITIONS

Land Unit		Average Tree	
Acres:	<u>1.5</u>	Diameter:	<u>n/a</u>
Basal Area:	<u>n/a</u>	Stocking Level	<u>n/a</u>
	<u>St. Clair Clay Loam (see Appendix A for more information)</u>	(trees per acre):	
Soil Type:		Site Index:	<u>66 (northern red oak)</u>

Species Composition

This management unit contains a mix of cool season grasses (smooth brome, tall fescue, orchardgrass, etc.) and has been maintained for several years with periodic mowing.

Wood Products Potential

n/a

Topography

This management unit very flat.

Natural and Cultural Features

See "General Site Description," page 3.

Roads and Trails

The main access road to the forest is adjacent to this Management Unit along the west side.

Wildfire and Pest Risk

There is no significant wildfire or pest risk in this management unit.

Wildlife and Wildlife Habitat Elements

The mowed grass cover provides very little food or cover for wildlife.

Noxious and Invasive Species

See "General Site Description," page 3.

Water Features

There is no surface water present in this management unit and no known ground water issues.

Existing Conservation Practices

See "General Site Description," page 3.

Harvest History

n/a

Desired Future Condition

This unit will be planted to white spruce to provide a visual barrier and to provide some additional thermal cover for wildlife. 605 trees per acre will be planted (907 total).

PLANNED CONSERVATION PRACTICES

Tree/Shrub Site Preparation (490) – 1.5 ac., Apr. 2013

Install practice according to the attached “Tree/Shrub Site Preparation (490)” Job Sheet.

Tree/Shrub Establishment (612) – 1.5 ac., Oct. 2013

Install practice according to the attached “Tree/Shrub Establishment (612)” Job Sheet.

Herbaceous Weed Control (315) – 1.5 ac., May 2014; 1.5 ac., May 2015; 1.5 ac., May 2016

This practice will be used to control vegetation around the planted seedlings to minimize competition during the first three years after planting.

Apply a broad-spectrum post emergent herbicide labeled for tree plantation use, in a 3' diameter circle around each seedling using a backpack sprayer or similar. Apply in accordance with the label. Contact the MSUE office for herbicide recommendations – 555-555-9999.

Inspect the plantation once per month during the growing season. If weed competition is significant, apply a second application of herbicide.

ADDITIONAL MANAGEMENT CONSIDERATIONS

Monitoring

This management unit should be monitored for invasive species on a regular basis, at least annually. If any new invasive species are noted, contact the NRCS office or the plan writer for information on control. Also, refer to Appendix C for general information on invasive species.

Similarly, forest health, erosion and other potential concerns should be monitored regularly.

APPENDIX A: SOILS

The soil types present on this property are (see included soils map):

Note: See also Forestland Productivity table.

Ed - Edwards Muck

Edwards muck. This is a level or slightly depressional, very poorly drained organic soil underlain by marl at depths of 16 to 50 inches. Permeability is moderately slow to moderately rapid in the mucky part of the soil. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface from early fall to late spring.

Hn - Houghton Muck

Houghton (Lupton). This is a very poorly drained, deep organic soil. Permeability is moderately slow to moderately rapid. Available water capacity is high. Runoff is very slow or ponded. The seasonally high water table is at or above the surface from early fall to late spring. Natural fertility is high.

Ho - Hoytville Silty Clay Loam

Hoytville. This is a very poorly drained clayey soil. Permeability is moderately slow and the available water capacity is moderate. Surface runoff is very slow or ponded. This soil has a seasonal high water table near or above the surface in winter and spring. Natural fertility is high.

NaB - Nappanee Silty Clay Loam, 2 To 6 Percent Slopes

Nappanee. This is a somewhat poorly drained clayey soil. Permeability is slow and the available water capacity is moderate. Surface runoff is slow or very slow. The seasonal high water table is at a depth of 1 to 2 feet in winter and spring. Natural fertility is medium.

OwB - Owosso-Miami Complex, 2 To 6 Percent Slopes

Miami. This is a well drained loamy soil. Permeability is moderate in the upper part of the Miami soils and slow in the lower part. The available water capacity is moderately high in the Miami soil. Surface runoff is slow to rapid depending on slope. Natural fertility is medium.

Owosso (Saverine, Ubly). Owosso soils are well drained loamy soils. Permeability is moderate and the available water capacity is high. Runoff is slow or medium. Natural fertility is medium.

StB - St. Clair Clay Loam, 2 To 6 Percent Slopes

St. Clair. This is a well drained and moderately well drained, clayey soil. Permeability is slow or very slow and the available water capacity is high. The seasonally high, perched water table is at a depth of 2 to 3 feet from March to May on the lesser sloping areas of this soil. Natural fertility is moderately high.

StC - St. Clair Clay Loam, 6 To 12 Percent Slopes

St. Clair. This is a well drained and moderately well drained, clayey soil. Permeability is slow or very slow and the available water capacity is high. The seasonally high, perched water table is at a depth of 2 to 3 feet from March to May on the lesser sloping areas of this soil. Natural fertility is moderately high.

StD - St. Clair Clay Loam, 12 To 18 Percent Slopes

St. Clair. This is a well drained and moderately well drained, clayey soil. Permeability is slow or very slow and the available water capacity is high. The seasonally high, perched water table is at a depth of 2 to 3 feet from March to May on the lesser sloping areas of this soil. Natural fertility is moderately high.

Map Unit Description (Brief, Generated)

Northwoods County, Michigan

[Minor map unit components are excluded from this report]

Map unit: Ed - Edwards muck

Component: Edwards (90%)

The Edwards component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions. The parent material consists of herbaceous organic material over marl. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, September, October, November, December. Organic matter content in the surface horizon is about 82 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 70 percent.

Map unit: Hn - Houghton muck

Component: Houghton (90%)

The Houghton component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions. The parent material consists of herbaceous organic material. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, September, October, November, December. Organic matter content in the surface horizon is about 82 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.

Map unit: Ho - Hoytville silty clay loam

Component: Hoytville (90%)

The Hoytville component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions. The parent material consists of clayey till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2w. This soil meets hydric criteria.

Map unit: NaB - Nappanee silty clay loam, 2 to 6 percent slopes

Component: Nappanee (90%)

The Nappanee component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on drainageways. The parent material consists of clayey till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 15 percent.

Map unit: OwB - Owosso-Miami complex, 2 to 6 percent slopes

Component: Owosso (50%)

The Owosso component makes up 50 percent of the map unit. Slopes are 2 to 6 percent. This component is on knolls. The parent material consists of loamy glaciofluvial deposits over loamy till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5 percent.

Map Unit Description (Brief, Generated)

Northwoods County, Michigan

Map unit: OwB - Owosso-Miami complex, 2 to 6 percent slopes

Component: Miami (30%)

The Miami component makes up 30 percent of the map unit. Slopes are 2 to 6 percent. This component is on knolls. The parent material consists of loamy till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 15 percent.

Map unit: StB - St. Clair clay loam, 2 to 6 percent slopes

Component: St. Clair (85%)

The St. Clair component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on knolls. The parent material consists of clayey till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during March, April, May. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 25 percent.

Map unit: StC - St. Clair clay loam, 6 to 12 percent slopes

Component: St. Clair (85%)

The St. Clair component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on hills. The parent material consists of clayey till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during March, April, May. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 25 percent.

Map unit: StD - St. Clair clay loam, 12 to 18 percent slopes

Component: St. Clair (85%)

The St. Clair component makes up 85 percent of the map unit. Slopes are 12 to 18 percent. This component is on ridges. The parent material consists of clayey till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during March, April, May. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 25 percent.

Forestland Productivity

Northwoods County, Michigan

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
Ed:				
Edwards	Green ash	---	0	---
	Red maple	56	29	
	Silver maple	---	0	
	Swamp white oak	---	0	
	Tamarack	---	0	
	White ash	---	0	
Hn:				
Houghton	Green ash	---	0	---
	Northern white-cedar	37	57	
	Quaking aspen	60	57	
	Red maple	56	29	
	Silver maple	82	29	
	Tamarack	52	43	
	White ash	56	43	
Ho:				
Hoytville	Eastern cottonwood	---	0	Northern white-cedar
	Northern red oak	55	43	
	Red maple	---	0	
	Silver maple	---	0	
	White ash	---	0	
NaB:				
Nappanee	American beech	---	0	Eastern white pine, Northern white-cedar, White spruce
	American sycamore	---	0	
	Blackgum	---	0	
	Northern red oak	66	57	
	Pin oak	---	0	
	Red maple	---	0	
	Swamp white oak	---	0	
	White ash	---	0	
OwB:				
Owosso	American basswood	---	0	Black walnut, Eastern white pine, Tuliptree, White ash
	Northern red oak	---	0	
	Quaking aspen	80	100	
	Red maple	---	0	
	Sugar maple	---	0	
	Tuliptree	65	43	
	White ash	---	0	

Forestland Productivity

Northwoods County, Michigan

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
OwB:				
Miami	American beech	---	0	Black walnut, Eastern white pine, Red pine, White ash
	Northern red oak	69	57	
	Sugar maple	---	0	
	White ash	---	0	
	White oak	---	0	
StB:				
St. Clair	American beech	---	0	Eastern white pine, White spruce
	Black oak	---	0	
	Northern red oak	66	57	
	Sugar maple	---	0	
	White ash	---	0	
	White oak	---	0	
StC:				
St. Clair	American beech	---	0	Eastern white pine, White spruce
	Black oak	---	0	
	Northern red oak	66	57	
	Sugar maple	---	0	
	White ash	---	0	
	White oak	---	0	
StD:				
St. Clair	American beech	---	0	Eastern white pine, White spruce
	Black oak	---	0	
	Northern red oak	66	57	
	Sugar maple	---	0	
	White ash	---	0	
	White oak	---	0	

FOREST STAND IMPROVEMENT

JOB SHEET - Forestry Series

666



Natural Resources Conservation Service



Michigan

Client/operating unit:	Joseph K. Landowner	County:	Northwoods	Tract #:	100
Planned installation date:	January 2014	Specifications date:	1/1/2013	Field #:	3



Forest stand improvement leaves a stand well-stocked in seedlings, saplings, poles, and saw log-sized trees.

DEFINITION

Forest Stand Improvement (FSI) is the manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation.

FSI can refer to both pre-commercial (intermediate) treatments and commercial harvesting operations.

PURPOSES

- Increase the quantity and quality of forest products by manipulating stand density and structure
- Harvest forest products
- Initiate forest stand regeneration
- Development of renewable energy systems
- Reduce wildfire hazard

- Improve forest health by reducing the potential of damage from pests and moisture stress
- Restore natural plant communities
- Achieve or maintain a desired native understory plant community for special forest products, grazing, and browsing
- Improve aesthetic and recreation values
- Improve wildlife habitat
- Alter water yield
- Increase carbon storage in selected trees

CONDITIONS WHERE PRACTICE APPLIES

All forest land.

CRITERIA

General Criteria Applicable to All Purposes

Base all management decisions on a thorough and current forest inventory and the intended purpose. Refer to Michigan Forestry Technical Note # 29 for information on conducting a forest inventory.

Base forest stand improvement choices on the following selection criteria:

- Tree and forest health
- Tree size, position and spacing
- Crown size, position, and condition
- Bole quality
- Species
- Species diversity

Kill unwanted trees, shrubs, and vines by any of the following means:

- Cutting
- Girdling
- Frilling
- Stem injection of herbicides
- Foliar or basal bark spraying of herbicides

If needed, supplement mechanical cutting, girdling, or frilling with an application of herbicide to increase mortality and decrease stump sprouting.

Use the safest available herbicide. Pesticides used improperly can be injurious to humans, animals, and plants. Follow all label precautions.

Conduct tree cutting in forest stands that contain oak species only during dormant seasons, October 1 through March 1, to reduce chance of infection to the residual stand by oak wilt disease (*Ophiostoma fagacearum*).

Limit damage to the site by:

- Using directional felling compatible with skid trail layout
- Aligning cut tree stems for efficient skidding
- Cutting out forks and large branches
- Limiting trails to less than 15% of the site
- Logging when soils are dry or frozen
- Using the lowest-impact equipment available
- Using well-organized access trails

Refer to the Forest Trails and Landings (655) conservation practice standard for more information about trail establishment and maintenance.

Comply with applicable laws and regulations, including Michigan's Best Management Practices (BMPs) for forestland contained in "Sustainable Soil and Water Quality Practices on Forest Land," published by the Michigan Department of Natural Resources, 2009.

Protect all forestland from livestock grazing.

Retain a minimum of 2 large (>12" DBH) active den trees per acre, if possible.

Retain or create a minimum of 2 large (>12" DBH) snags per acre, if possible.

Treat slash and debris such that they do not present an unacceptable fire, safety, environmental, or pest hazard and will not interfere with the intended purpose or other management activities.

If burning is used to reduce slash and other debris on-site, follow the Prescribed Burning (338) Conservation Practice Standard.

Additional Criteria to Increase the Quantity and Quality of Forest Products

For uneven-aged stands (hardwoods, conifers, or mixed forest types), perform Forest Stand Improvement when basal area is greater than 110 sq. ft. per acre. Remove 20 to 33% of the basal area, ensuring that residual basal area is no lower than 75 sq. ft. per acre, to regenerate shade tolerant species, e.g., sugar maple, and no lower than 60 sq. ft. per acre to regenerate shade intolerant or intermediate species, e.g., red oak.

For even-aged hardwood stands, perform Forest Stand Improvement when basal area is greater than 110 sq. ft. per acre. Remove 20 to 33% of the basal area, ensuring that residual basal area is no lower than 75 sq. ft. per acre.

For even-aged hardwood stands, these criteria can be achieved by following the guidance in Table 1.

For even-aged conifer stands, perform Forest Stand Improvement when average tree spacing is less than D+4 or crown is less than one third of the total tree height. Increase average tree spacing to D+6, if possible, but do not remove more than half the trees in one treatment. Refer to Table 2, for guidance on thinning to these spacing requirements.

Additional Criteria to Harvest Forest Products and to Initiate Forest Stand Regeneration

Use a harvest-regeneration system appropriate for the growth characteristics and shade tolerance of the species and forest cover type to be regenerated:

- For uneven-aged systems, follow guidance in previous section.
- For management of, or conversion to, even aged system, including pine plantations and aspen stands, use even-aged harvest-regeneration strategies, e.g., shelterwood, seed tree harvests, and clearcutting.

If natural regeneration is not likely, or is not present two years after the harvest, initiate reforestation. Refer to the Tree/Shrub Establishment (612) Conservation Practice Standard.

Additional Criteria to Reduce Wildfire Hazard

Reduce stocking rates of trees to minimize crown-to-crown spread of fire.

Remove “ladder” fuels to minimize the risk of crown fires.

Further treat or eliminate slash accumulations next to roads and trails.

Reduce or eliminate species with high volatility.

For additional wildfire risk and damage reduction, refer the Firebreak (394) Conservation Practice Standard.

Additional Criteria to Improve Wildlife Habitat

Manage for a variety of native tree species and stocking rates that meet desired wildlife and pollinator species food and cover requirements.

Create and/or maintain 2 to 5 snags per acre (12” DBH+), and 2 to 5 den trees per acre (12” DBH+), if possible, depending on the requirements of the desired wildlife species.

Create and/or maintain adequate down woody material to meet requirements of desired wildlife.

Minimize improvement actions that disturb seasonal wildlife activities.

Table 1. Thinning Guidelines for Even-aged Hardwoods

Existing stand:			Thin the stand to:		
Avg. DBH (in.)	Trees per acre	Avg. spacing between trees (ft.)	Trees / Ac.	Avg. spacing between Trees (ft.)	Basal Area (sq. ft. per acre)
5	≥ 770	≤ 7	681	8	95
6	≥ 535	≤ 9	436	10	87
7	≥ 393	≤ 11	302	12	82
8	≥ 301	≤ 12	258	13	90
9	≥ 238	≤ 14	194	15	85
10	≥ 193	≤ 15	151	17	83
11	≥ 159	≤ 17	134	18	90
12	≥ 134	≤ 18	109	20	86
13	≥ 114	≤ 20	90	22	83
14	≥ 98	≤ 21	82	23	88
15	≥ 86	≤ 23	70	25	86
16	≥ 75	≤ 24	60	27	84
17	≥ 67	≤ 26	56	28	88
18	≥ 59	≤ 27	48	30	85
19	≥ 53	≤ 29	43	32	85
20	≥ 48	≤ 30	40	33	87
21	≥ 44	≤ 32	36	35	87
22	≥ 40	≤ 33	32	37	84
23	≥ 36	≤ 35	30	38	87
24	≥ 33	≤ 36	27	40	85

Table 2. Thinning Guidelines for Even-aged Conifers

Existing stand:			Thin the stand to:		
Avg. DBH (in.)	Trees per acre	Avg. spacing between trees (ft.)	Trees / Ac.	Avg. spacing between Trees (ft.)	Basal Area (sq. ft. per acre)
5	≥ 538	≤ 9	360	11	50
6	≥ 436	≤ 10	302	12	60
7	≥ 360	≤ 11	258	13	70
8	≥ 302	≤ 12	222	14	78
9	≥ 258	≤ 13	194	15	85
10	≥ 222	≤ 14	170	16	94
11	≥ 194	≤ 15	151	17	101
12	≥ 170	≤ 16	134	18	106
13	≥ 151	≤ 17	121	19	111
14	≥ 134	≤ 18	109	20	117
15	≥ 121	≤ 19	99	21	122
16	≥ 109	≤ 20	90	22	126
17	≥ 99	≤ 21	82	23	130
18	≥ 90	≤ 22	76	24	134
19	≥ 82	≤ 23	70	25	138
20	≥ 76	≤ 24	64	26	140
21	≥ 70	≤ 25	60	27	145
22	≥ 64	≤ 26	56	28	148
23	≥ 60	≤ 27	52	29	150
24	≥ 56	≤ 28	48	30	151

Refer to the Early Successional Habitat Development/Management (647), Rare and Declining Habitat Management (643), Upland Wildlife Habitat Management (645), and Wetland Wildlife Habitat Management (644) Conservation Practice Standards to further develop and manage wildlife-related activities.

Additional Criteria to Increase Carbon Storage in Selected Trees

Manage for tree species and stocking rates that have higher rates of growth and potential for carbon sequestration.

CONSIDERATIONS

Use of a professional forester (Conservation District forester, professional consulting forester, etc.) to mark and layout practice will generally yield better results. This should be considered especially for large or complex sites.

The U.S. Forest Service North Central Research Station's "Manager's Handbook" series of publications provide excellent type-specific guidance for a variety of cover types. Search for "Manager's Handbook" here:

<http://www.ncrs.fs.fed.us/pubs/search.asp>.

Silvicultural objectives and harvest-regeneration strategies may change over time and may be limited by prior management.

The extent, timing, size of treatment area, or the intensity of the practice should be adjusted to minimize cumulative effects (onsite and offsite), e.g., hydrologic and stream alteration, habitat fragmentation, nutrient cycling, biodiversity and visual resources.

To encourage regeneration of oaks and other species with intermediate shade tolerance, consider group selection to permit more sunlight to reach the forest floor.

Cut material can be arranged into 3 to 4 brush piles per acre to provide additional wildlife cover.

Time the practice to minimize disturbance of seasonal pollinator and wildlife activities.

Landowners should secure a written contract with any service provider that specifically

describes the extent of activity, duration of activity, liability and responsibilities of each party and amount and timing of payments for services provided.

Slash, debris and other vegetation (biomass) removed during stand improvement may be used to produce energy. Management alternatives should consider the amount of energy required to produce and convert the biomass into energy with the amount produced by the biomass. Wildlife and sustainability requirements should also be considered.

Control invasive or noxious woody vegetation.

Advise clients of their wildfire control responsibilities and consider the development of a wildfire control plan including "defensible" space, access routes, fire-season water source, and location of wildfire control facilities.

Timing of treatment and retention of dead or dying trees will minimize impacts on nesting wildlife.

Thinning of pine stands during the growing season (especially during dry periods) without proper treatment of logging slash, may subject the stand to increased risk of attack by bark beetles (*Dendroctonus spp.* and *Ips spp.*).

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FOREST STAND IMPROVEMENT (666) SPECIFICATIONS

GENERAL INFORMATION:

Client name*:	Joseph K Landowner	Tract no.:	100	Field no. *:	3
Specifications date:	1/1/13	Planned implementation date*:			1/2014
Total stand Acres:	41.3	Total acres of practice planned*:			36.0
Map of site* – attach a sketch, map, or aerial photo indicating the location of area to be treated with FSI.					

PURPOSES (check all that apply)*:

<input checked="" type="checkbox"/>	Increase the quantity and quality of forest products by manipulating stand density and structure
<input type="checkbox"/>	Harvest forest products
<input type="checkbox"/>	Initiate forest stand regeneration
<input type="checkbox"/>	Development of renewable energy systems
<input type="checkbox"/>	Reduce wildfire hazard
<input checked="" type="checkbox"/>	Improve forest health by reducing the potential of damage from pests and moisture stress
<input checked="" type="checkbox"/>	Restore natural plant communities
<input type="checkbox"/>	Achieve or maintain a desired native understory plant community for special forest products, grazing, and browsing
<input checked="" type="checkbox"/>	Improve aesthetic and recreation values
<input checked="" type="checkbox"/>	Improve wildlife habitat
<input type="checkbox"/>	Alter water yield
<input type="checkbox"/>	Increase carbon storage in selected trees

STAND INFORMATION:

Forest Cover Type/Dominant Spp. *:	Oak-Hickory type, dominated by red and white oak, hickories, basswood, ash, and black cherry				
Dominant Soil Types:	St. Clair Clay Loam	Site Index:	66 (S.I. Spp.: N. Red Oak)		
Silvicultural (Harvest/Regeneration) System (complete applicable section below):					
<input checked="" type="checkbox"/> Uneven-aged System*			<input type="checkbox"/> Even-aged System*		
Basal Area:	120 sq. ft./ac. *	Avg. DBH*:	Trees per Ac. *:		
Type of Intermediate FSI Treatment*:	<input checked="" type="checkbox"/> Single tree selection <input type="checkbox"/> Group selection <input type="checkbox"/> Other:	Type of Intermediate FSI Treatment*:	<input type="checkbox"/> Single tree selection <input type="checkbox"/> Row thinning <input type="checkbox"/> Other:		
Type of Harvest FSI Treatment*:	<input type="checkbox"/> Single tree selection <input type="checkbox"/> Group selection <input type="checkbox"/> Other:	Type of Harvest FSI Treatment*:	<input type="checkbox"/> Shelterwood <input type="checkbox"/> Seed Tree <input type="checkbox"/> Clearcut <input type="checkbox"/> Other:		

*REQUIRED for certification of practice completion.

FOREST STAND IMPROVEMENT IMPLEMENTATION DETAILS:

Diameter class* ^{1/} :	Existing (pre-treatment)*:	Removals*:		Residual (post-treatment)*:
	<input checked="" type="checkbox"/> Trees/Ac. or <input type="checkbox"/> B.A. (ft ² /ac.)	Trees/Ac. or B.A. ^{1/}	Species	Trees/Ac. or B.A.
4	84			84
6	36			36
8	25	6	concentrate removals on hickory, elm, soft maple, and basswood	19
10	29	16	same	13
12	20	10	same	10
14	18	10	same	8
16	8	2	same	6
18	6			6
20	5			5
22+	5			5
Total Trees/Ac.:	236	44*		192
Total BA:	120*	34*		86*

^{1/} Specify Diameter in two-inch classes, e.g., 6 = 5.0 – 6.9”, or by timber size class, e.g., saplings, poletimber, sawtimber.

<p>Additional information, including equipment to be used, and O&M details, necessary to install and maintain practice*:</p>	<p>Note: The steep areas adjacent to Management Unit 2 (approximately 5.3 acres) should be excluded from this treatment to protect soil and water resources.</p> <p>Trees can be marked anytime using paint or flagging tape. Tree cutting should be conducted in the winter when the ground is completely frozen to minimize soil compaction from equipment. This is especially critical in the lower, wetter areas.</p> <p>Cut trees with a chainsaw. Trees may be used for firewood for personal use. Install according to the general criteria, all applicable additional criteria, and as detailed in this specification sheet.</p>
--	--

***REQUIRED for certification of practice completion.**

DESIGN APPROVAL:

I certify this practice has been designed with specifications to meet the conservation practice standard and that the client has been advised of installation and layout elements:

--	--

NRCS or TSP Signature

Date

CLIENT REVIEW AND ACCEPTANCE:

The client acknowledges that:

- a. They have received a copy of the specifications and understand the contents including the scope and location of the practice.
- b. They have obtained all necessary permits and/or rights in advance of practice application, and will comply with all ordinances and laws pertaining to the application of this practice.
- c. No changes will be made in the installation of the job without prior concurrence of the NRCS.
- d. Operation and Maintenance of the installed work is necessary for proper performance during the life of the practice. The practice life is 10 years.

I have reviewed all specifications and agree to install as specified:

--	--

Client Initials

Date

INSTALLATION CERTIFICATION:

The Forest Stand Improvement on the management unit described above has been installed and managed in accordance to the specifications in the conservation plan and the Michigan NRCS Forest Stand Improvement (666) Conservation Practice Standard:

--	--	--	--

NRCS Representative Signature

Date

Client Initials

Date

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TREE/SHRUB SITE PREPARATION

CONSERVATION DESIGN SHEET - Forestry Series

490



Natural Resources Conservation Service

Michigan



Client/operating unit:	Joseph K. Landowner	Farm no.:	1000	Tract no.:	100
Farm/ranch location:		Field no.:	6	Program:	
Specifications date:	1/1/2013	Planned installation date:	4/2013		
Proposed treatment acres:	1.5				



Site preparation eliminates weed competition from the area to be planted to trees and/or shrubs, helping to get the plants off to a good start.

Purpose of this Document

This Conservation Design Sheet describes the techniques used to prepare a site for tree and/or shrub planting.

In addition to the primary practice, e.g., Tree/Shrub Establishment (612), Windbreak/Shelterbelt Establishment (380), also refer to following Michigan NRCS Conservation Practice Standards and associated job sheets for additional considerations for tree and shrub establishment:

- Herbaceous Weed Control (315)
- Mulching (484)
- Cover Crop (340)

Additional practices may also be required to address additional resource concerns, e.g., Brush Management (314), Access Control (472).

Site Preparation

Site preparation prior to tree/shrub planting or direct seeding is necessary on any site with existing vegetation to reduce competition and assure tree survival. Site Preparation likely is not be needed on bare or very sparsely vegetated sites – recently tilled, following an annual crop (e.g. annual grains, soybeans), moss, sparse Junegrass, etc.

Site preparation can be accomplished through either mechanical or herbicide treatment or both. Long-term techniques such as fabric weed barriers and mulch can be good alternatives for weed control as well.

Site preparation can be done to the entire field (where risk of soil erosion is minimal), in 36” wide strips centered on the planting rows, or in 36” x 36” square, or 36” diameter spots centered on individual trees planting sites.

Mechanical Treatment

This will provide initial control of weed competition. Follow-up weed control will be needed during or after the first growing season to provide adequate control of competition. Generally disking will remove broadleaf weeds but plowing may be necessary to remove grass weeds.

Mechanical site preparation can yield good results when done in the fall prior to a spring planting. On highly erodible sites, mechanical site preparation should be done in the spring prior to planting, and the need for a cover crop should be assessed.

Select the mechanical site preparation techniques from the following:

- Bare ground, light cover of vegetation (moss, open sand, light Junegrass, etc.): No site preparation is necessary.
- Medium cover of vegetation (medium density Junegrass, light quackgrass, etc.): Kill or destroy the sod layer with one of the following methods:
 - Use tillage (plowing, disking, etc.).
 - Use shallow (2 to 4" deep) furrowing.
 - Use mechanical or hand scalping on sands, sandy loams, and loamy sands with light to moderate grassy and/or herbaceous competition.
- Heavy cover of vegetation (dense Junegrass, dense quackgrass, hayland/pasture, sweet fern, etc.): Kill or destroy the sod by plowing or other tillage early in the fall before spring planting. It may be necessary to spray with an herbicide either in late fall or early spring to finish the kill on sod-forming grasses.

Herbicide Treatment

This will provide initial control of weed competition but repeated applications will be needed to provide adequate control of competing vegetation for three or more years after planting. Select chemical site preparation techniques from the following:

- Spot or band treat an area a minimum of 36" wide around the tree/shrub planting site. Use only herbicides labeled for the species being planted, the intended use of the trees and shrubs, and the weeds to be controlled. Read and follow herbicide label instructions. See References for further information on herbicide use.
- For spring plantings, when dense vegetative cover is present, herbicide should be applied in late summer or early fall prior to the planting year, if possible. This practice normally will provide optimum weed control and better tree/shrub survival. An assessment of the weed re-growth should be made in the spring prior to planting, with herbicide applied if needed.
- For fall plantings (only recommended on well and moderately well drained sands, loamy sands, and sandy loams due to frost-heave potential), apply herbicides in the previous spring if

possible to assure a weed-free planting bed. An assessment of the weed re-growth should be made in the fall prior to planting, with herbicide applied if needed.

Additional Considerations:

Site Preparation for Direct Seeding

Prepare the seeding bed by exposing mineral soil using mechanical or chemical methods described above on the entire field, prescribed burning, or a combination of these methods. If possible, mix humus in with the mineral soil to prepare a seedbed.

Fabric Weed Barriers and Mulch

Fabric weed barriers are porous, yet opaque material that is installed over a tree or shrub seedling. They permit water to seep through to the seedling, but prevent weed growth. They are installed as 3' x 3' squares over individual plants, or as long rolls that can be rolled out over rows of trees.

Mulch is organic or inorganic material that is spread around the individual seedling to help retain soil moisture, moderate soil temperature, and prevent weed growth. Apply mulch in a 3' diameter circle around each seedling, 2 to 3" deep, and pulled back from the plant stem slightly. Straw or other similar mulch generally should be avoided as it can encourage mice and other small herbivores that may damage the seedlings.

If weed barriers or mulch will be used for follow-up weed control, site preparation may not be required. However, in sites with aggressive difficult-to-kill weeds (e.g., reed canary grass), mechanical or chemical site preparation should be used prior to planting and installation of the weed barriers or mulch.

If fabric weed barriers or mulch are to be used, refer to the NRCS-MI Mulching (484) Conservation Practice Standard.

Cover Crops

Cover crops or permanent sod strips may be needed between tree/shrub rows on sandy or highly erosive sites in order to prevent erosion and damage to seedlings by sandblasting. Cover crops are also used to minimize the risk of more aggressive or invasive vegetation (e.g., Canada thistle) establishing. If cover crops are to be used, refer to the Michigan NRCS Cover Crop (340) Conservation Practice Standard.

References:

- Bonner, Franklin T. and Robert P. Karrfalt (eds.). 2008. The Woody Plant Seed Manual. Ag. Handbook No. 727. USDA Forest Service. Washington, D.C.
- Dornbush, Laurie J and M.R. Koelling. 1992. Growing Christmas Trees in Michigan. Michigan State University Extension Bulletin E1172. East Lansing, MI. <http://forestry.msu.edu/extension/ExtDocs/xmastree.htm>.
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TREE/SHRUB ESTABLISHMENT

Job Sheet - Forestry Series

612

	Natural Resources Conservation Service Michigan	
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Client/Operating Unit:	Joseph K. Landowner	Farm No.:	1000	Tract No.:	100
Farm/Ranch Location:		Field No.:	6	Program:	
Specifications Date:	1/1/2013	Planned Installation Date:		10/2013	
Proposed Treatment Acres:	1.5				



Matching the woody plant species with the planting site, together with good weed control and planting techniques make for successful reforestation.

INTRODUCTION

This Job Sheet describes the necessary techniques to establish woody plants for conservation purposes.

The general information presented in the text along with the custom site-specific information developed by the plan writer and presented in the “Specifications” section will provide you with most of the details necessary to successfully install a tree and shrub planting. However, as this document can’t address all situations, it is strongly recommended to review the publications listed in the “References” section for additional information.

This document does not completely cover the facilitating practices often used in conjunction with Tree/Shrub Establishment such as site preparation

and follow-up weed control that are also necessary to ensure plant survival. For these practices, refer to the Tree/Shrub Site Preparation (490), Herbaceous Weed Control (315), Mulching (484) and/or other applicable conservation practice standards and associated job sheets.

Also, this job sheet does not apply to establishment using direct seeding. For this technique refer to the Tree/Shrub Establishment (612) conservation practice standard and “Illinois Direct Seeding Handbook” at: <http://www.il.nrcs.usda.gov/technical/forestry/dshndbk.html>.

PURPOSES

This conservation practice can be used to establish woody plants for:

- forest products such as timber, pulpwood, etc.
- wildlife habitat
- long-term erosion control and improvement of water quality
- treating waste
- storing carbon in biomass
- reducing energy use
- developing renewable energy systems
- enhancing aesthetics

SPACING AND LAYOUT REQUIREMENTS

Tree/shrub spacing and densities vary depending on the purpose of planting, and the type of stock being planted. Typical ranges are listed below.

Seedlings (bare root or plugs and cuttings):

- Timber production:
 - Hardwoods - 545-900/ac.
 - Conifers - 600-1000/ac.
- Wildlife Plantings: 302-1200/ac. Certain wildlife plantings may require densities outside this range. Contact the Michigan NRCS State Biologist for guidance.
- Christmas Trees: 726-1200/ac.
- Supplemental Underplanting: 200-300 /ac. evenly distributed over the area needing treatment.
- Erosion control: 1000-1200 /ac.
- For other applications or approval of planting densities outside these listed ranges, contact the Michigan NRCS State Forester or State Biologist.

Larger stock, including air-root pruned, containerized, and balled and burlapped stock:

- 20+ per acre if natural regeneration is expected.
- 50+ trees per acre if natural regeneration is not expected.

For minimum planting stock sizes, refer to the next section.

Table 1 - Common Tree/Shrub Spacings

Spacing (feet)	Plants/Acre
6 x 6	1210
6 x 8	907
5 x 10	871
6 x 10	726
7 x 7	889
7 x 10	622
8 x 8	681
8 x 10	544
8 x 12	453
9 x 9	538
10 x 10	436
10 x 12	363
12 x 12	302

Plan the minimum setback distance from the outside tree or shrub row to adjacent property line or contrasting land use areas to be equal to the 20-year height of the tree or shrub, unless the 20-year height

is > than 20' in which case use a minimum setback of 20 feet. Refer to the Conservation Tree/Shrub Guide (CTSG) Tool in eFOTG, Section II for 20-year plant heights.

Where subsurface drains (tile lines) cross through a tree/shrub planting, and where these drains will remain functional, install a sealed conduit through the planting and extending a minimum of 100 feet beyond large trees and 75 feet beyond small to medium sized trees and shrubs.

Additional Layout information for Supplemental Underplanting

Ensure that there is adequate sunlight available for the species to be planted. Use the CTSG tool to determine the shade tolerance of the species to be underplanted.

- Intolerant tree/shrub species (I) require full sun and require openings ½ to ⅔ acre in size (diameter of opening: 160-200 feet, measured at tree crown level).
- Species with intermediate shade tolerance (M) require canopy closure of 30-50%, which can be approximated with openings ¼ to ½ acres in size (diameter of opening: 120-160 feet, measured at tree crown level).
- Shade tolerant species (T) can grow in full shade, although 60-80% canopy closure will accelerate the growth and development of underplanted trees/shrubs when compared to 100% canopy closure. Small openings of 1/10th acre or less (diameter of opening: 80 feet or less, measured at tree crown level) will favor regeneration of shade tolerant species.

All underplanted seedlings will benefit from additional cutting or killing of overstory trees 2 or more years after establishment to maintain or increase the amount of light reaching the ground.

MINIMUM PLANTING STOCK SIZE

Bare-root Stock

Conifers: Minimum height 9 inches with a minimum root length of 8 inches OR minimum caliper 3/16 inch.

Hardwoods: Minimum height of 12 inches with a minimum root length of 8 inches OR minimum caliper* of ¼ inch. Exceptions: hickory species may have a minimum height of 6 inches and root length of 8 inches OR ¼ inch caliper*.

Containerized Stock

One year old plug container seedlings must have root volumes of at least 7 cubic inches.

Potted Stock

Minimums for potted stock, including air-root pruned: height 3 feet, container size 1 gallon, caliper* 3/8 inch.

Cuttings (Hybrid Aspen, Willow, Cottonwood, etc.)

Minimum 10 in. in length with 3/8 in. caliper*.

Balled and Burlapped Stock

Conifers:

Tree Height	Minimum Diameter Ball
18-24 in.	10 in.
2-3 ft.	12 in.
3-5 ft.	14 in.
5-6 ft.	20 in.

Hardwoods:

Tree Height	Minimum Diameter Ball	Caliper*
5-6 ft.	12 in.	1/2 in.
6-8 ft.	14 in.	3/4 in.
8-10 ft.	16 in.	1 in.

* Caliper (diameter at ground level) shall be measured at the root collar.

COVER CROPS

Cover crops or permanent sod strips may be needed between tree/shrub rows on sandy or highly erosive sites in order to prevent erosion and damage to seedlings by sandblasting. Cover crops are also used to minimize the risk of more aggressive or invasive vegetation (e.g., Canada thistle) establishing.

Ideally, cover crops should be allowed one growing season prior to planting the trees. This will provide flexibility in case the cover crop doesn't establish adequately, due to unfavorable weather conditions, for instance. If cover crops are needed, use the Cover Crop (340) conservation practice standard.

SITE PREPARATION

Site preparation prior to tree/shrub planting is typically necessary on any site with existing vegetation to reduce competition and assure tree survival. Site preparation likely is not needed on bare or very sparsely vegetated sites – recently tilled,

following an annual crop (e.g. annual grains, soybeans), moss, sparse Junegrass, etc. Refer to the Tree/Shrub Site Preparation (490) conservation practice standard and job sheet for more information.

CARE OF SEEDLINGS

Proper care of seedlings prior to and during the planting process is critical to ensuring a successful planting. Seedlings that have had roots dried, frozen, or subjected to mold or high temperature should be assumed dead and not suitable for planting.

Seedlings should be packed and shipped in wet moss or other similar medium, kept cool (ideal temperature between 33 and 37 degrees F) and moist through the planting process. Make plans for cold storage in case planting is delayed, if possible. Exposure to direct sun and wind can kill a seedling in less than 30 seconds.

Plant seedlings as soon as possible after received, keeping roots moist throughout the planting process.

If seedlings can't be planted right away, store them in a cool, moist, shaded location up to 7 days. Do not stack bundles of trees in layers of more than two deep to allow adequate air circulation and prevent heating.

If planting is delayed for longer than seven days after receipt and they can not be kept in cold storage, heel in the seedlings in a shaded area and keep them moist. To heel-in seedlings: Dig a trench in the soil, place the seedling in the trench and cover the roots with soil, wetting the soil and roots during the process. Refer to Figure 3. Transplant heeled in seedlings and resume normal tree planting as soon as suitable conditions exist.

Do not immerse roots in water or wash soil off of seedling roots. Mist seedlings to keep them moist.

Water absorbent/retention dip may help conserve moisture on seedling roots when planting in dry weather.

PLANTING REQUIREMENTS

Planting Dates

Plant bare-root stock, seedling plugs, live cuttings, containerized stock or balled and burlapped stock during the dormant season in the Spring after the ground thaws until June 1 as soil moisture and local weather conditions permit or in the Fall, after October 1 until the ground freezes when soil moisture is adequate.

Do not plant seedlings (bare-root or plugs) in the Fall on soils subject to frost-heave action (clays, clay loam, silty clay loams, silts, silt loams, and loams).

Planting Seedlings

The planting trench or hole must be deep and wide enough to permit roots to spread out and down without J-rooting or L-rooting. If the roots are too long for the planting equipment, minimal pruning of small end roots may be needed. Do not prune back into the main root system or more than 25% of the total root length (excluding long individual fibrous roots), or to less than 8 inches. Pack soil around each plant firmly to eliminate air pockets after planting.

Plant trees/shrubs vertically with the root collars equal to or up to one inch below the soil surface to ensure adequate coverage of the roots with soil.

Planting Cuttings

Plant cuttings within 2 days of collection or shipping arrival in the spring before June 1. Plant, with buds pointing up, in firm ground with 1" of cutting exposed above ground.

Planting Containerized Trees

Dig a hole slightly larger than the container diameter. Gently remove plants from containers before placing in the ground and firmly pack soil around roots to eliminate air pockets. Before planting, loosen any spiraling or compacted roots. Water should be applied generously.

Planting Balled and Burlapped Trees

When handling stock, never lift a tree at the stem or trunk. Handle stock at the root ball. Dig a hole 1 1/2 times as wide as the root ball and about the same depth as the root ball. Remove any rope, wire, or plastic twine from the tree. Pull back burlap around trunk and fold down into the hole. Carefully place the tree in the hole and firmly pack soil around roots to eliminate air pockets. Water should be applied generously.

Other Planting Information

Use equipment and plant on the contour or across the slope, as possible to minimize erosion potential.

Use of a professional tree planting contractor has been shown to significantly increase the chances for successful tree establishment.

If damage from deer, rabbits or other herbivores is anticipated, use tree shelters or repellants to protect seedlings.

Refer to the illustrations on page 6 and to "Tree Planting in Michigan," MSUE Bulletin E-771.

MAINTENANCE

Weed Control

Maintain a 36" diameter weed-free area in all directions from planted seedlings or cuttings until average tree/shrub height is taller than the surrounding weeds. This will typically take 3 to 5 years. Use the Mulching (484) conservation practice standard for organic or inorganic mulch, including fabric weed barriers. Use the Herbaceous Weed Control (315) conservation practice standard for chemical or mechanical (tillage) weed control.

If tillage is used for weed control, care must be taken not to damage plant stems. Keep tillage depths shallow to avoid root damage.

Note: Mowing is not considered a weed control practices in field plantings, as it tends to stimulate root growth of grasses. It can be used between tree rows, however, to improve access, and reduce cover for potentially damaging herbivores.

Mulch and Fabric Weed Barriers

[Note: organic or inorganic mulch, including fabric weed barriers, should be specified as the Mulching (484) conservation practice. However, some additional guidance is provided here.]

Mulch is organic or inorganic material that is spread around the individual seedling to help retain soil moisture, moderate soil temperature, and prevent weed growth. Apply mulch in a 3' diameter circle around each seedling, 2 to 3" deep, and pulled back from the plant stem slightly. Straw or other similar mulch generally should be avoided as it can encourage mice and other small herbivores that may damage the seedlings.

Freshly chipped wood mulch should be aged for a few months to minimize the risk of heat damage to the seedlings (chips heat up significantly during the early stages of decay), and nitrogen deficiency problems (decaying organic matter can deplete the soil of nitrogen).

Fabric weed barriers are porous, yet opaque material that is installed over a tree or shrub seedling. They permit water to seep through to the seedling, but prevent weed growth. They are installed as 3' x 3' squares over individual plants, or as long rolls that can be rolled out over rows of trees.

If weed barriers or mulch will be used for follow-up weed control, site preparation may not be required. However, in sites with aggressive difficult-to-kill weeds (e.g., reed canary grass), mechanical or chemical site preparation should be used prior to planting and installation of the weed barriers or mulch.

Other Maintenance Information

Replant if survival drops below 80% of the minimum allowed stocking level (see “Spacing Requirements” above), or if the intended purpose is no longer achievable.

Protect trees and shrubs from fire, insects, disease, and animals until established. Refer to the Firebreak (398) conservation practice standard or other applicable standards as needed.

Pruning may be required to remove damaged, diseased or unwanted limbs to improve health and quality. Refer to the Tree/Shrub Pruning (660) conservation practice standard.

REFERENCES

Herman, R., D. Schmoker, B. Sloan, and T. Ward. 2002. Illinois Direct Seeding Handbook: A Reforestation Guide. Assoc. of IL SWCDs, USDA-NRCS, IL Dept. of Natural Resources, & IL Environmental Protection Agency. <http://www.il.nrcs.usda.gov/technical/forestry/dshndbk.html>

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Wisconsin Department of Natural Resources. 2009. Herbicides for Forest Management. Madison, WI. <http://dnr.wi.gov/forestry/Fh/weeds/herbicides.htm>

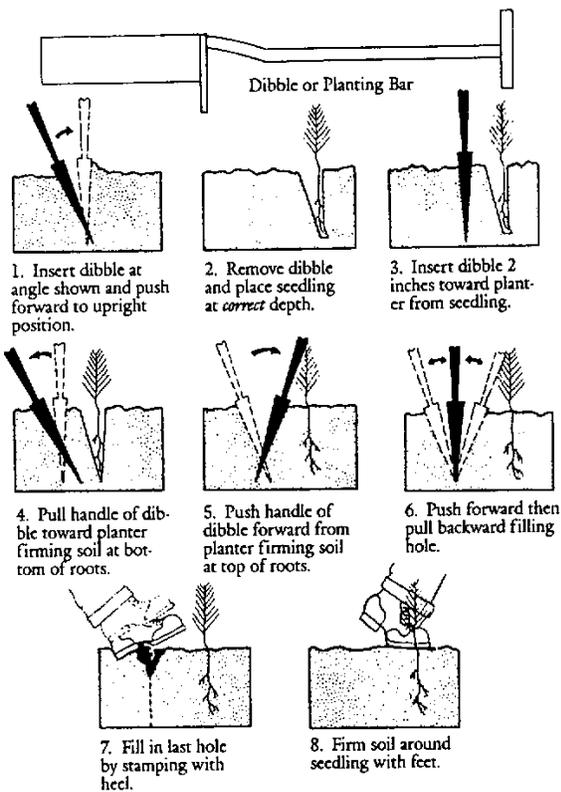


Figure 1 : Using a dibble (planting bar) to plant seedlings.

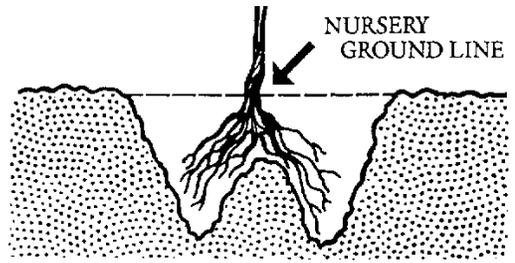


Figure 2 : An example of the hole and shovel method of planting seedlings.

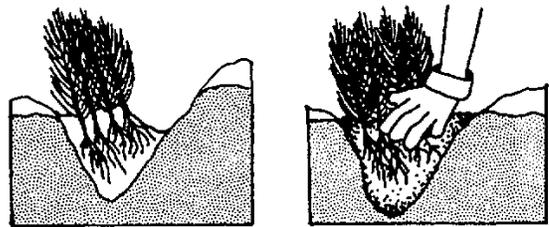
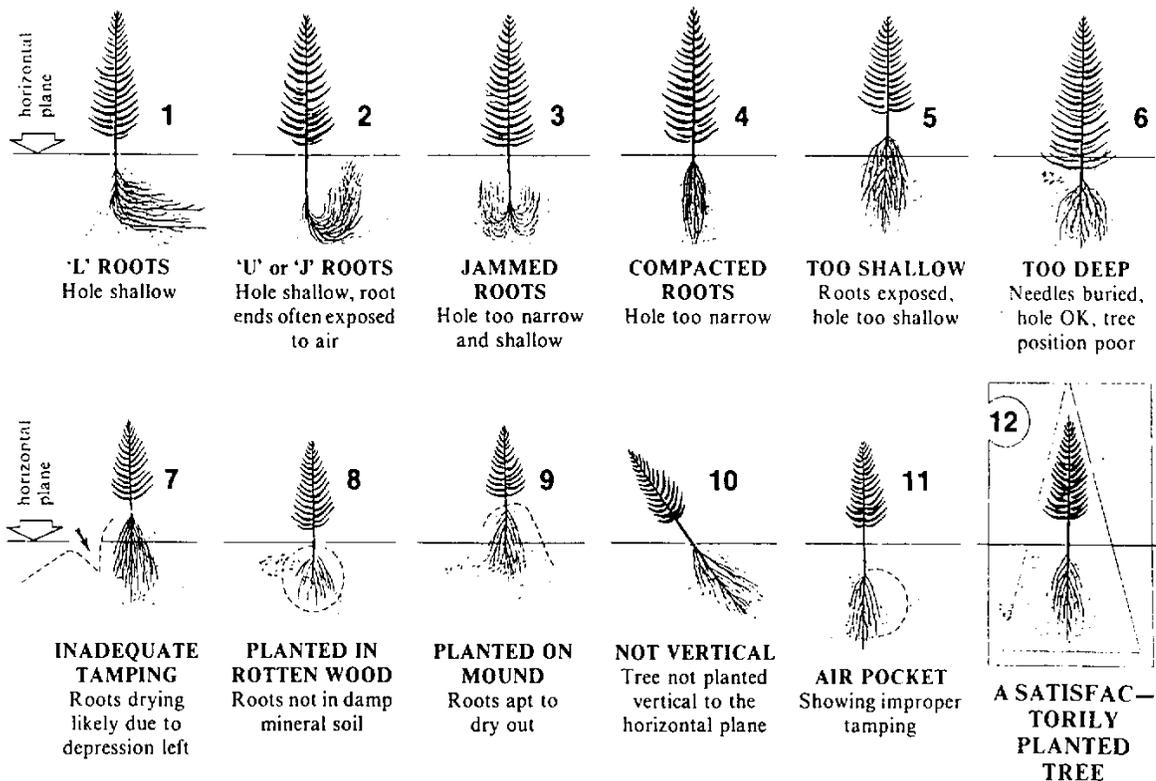


Fig. 3 . One method of long-term tree storage is the "heeling-in" technique. Roots must be packed tightly in soil and kept moist, and the heel-in trench must be shaded and protected from the wind.



Tree Planting – Specifications Sheet

GENERAL INFORMATION

Client Name*:	Joseph K Landowner	Tract no.:	100	Field no.:	6
Specifications date:	1/1/2013	Acres to be planted*:			1.5
Soil map unit(s):		Cons. Tree/Shrub Suit. Group:			
Map of site* – attach a sketch, map, or aerial photo indicating the location of area to be planted.					

PURPOSES* (check all that apply). Establish Woody Plants for...

<input type="checkbox"/>	Forest products such as timber, pulpwood, etc.
<input checked="" type="checkbox"/>	Wildlife habitat
<input type="checkbox"/>	Long-term erosion control and improvement of water quality
<input type="checkbox"/>	Treating waste
<input type="checkbox"/>	Storing carbon in biomass
<input type="checkbox"/>	Reducing energy use
<input type="checkbox"/>	Developing renewable energy systems
<input checked="" type="checkbox"/>	Enhancing aesthetics

SITE PREPARATION (For information only – include site preparation in plan as separate conservation practice: Tree/Shrub Site Preparation (490))

Initial site preparation method*:	herbicide + tillage	Date*:	4/2013
Additional information:			

TREE/SHRUB ESTABLISHMENT

Planting method*:	hand-dibble bar	Planting date*:	10/2013
Storage requirements, if any:			
Avg. spacing between rows*:	8	Avg. in-row spacing*:	9
Avg. stems/Ac. *:	605	Avg. seedling size/type:	2-0 seedlings

Number of Trees/Acre at Various Spacings:

Spacing	Stems per acre	Spacing	Stems per acre	Spacing	Stems per acre
5 X 5	1742	8 x 10	544	15 X 15	194
6 X 6	1210	9 X 9	538	16 X 16	170
6 X 8	907	9 X 10	484	18 X 18	134
6 X 10	726	10 X 10	436	20 X 20	109
7 X 10	622	10 X 12	363	30 X 30	48
7 X 7	889	12 X 12	302	40 x 40	27
8 X 8	681	14 X 14	222		

To calculate stems/acre for other spacings: 43,560 divided by (row spacing in feet x stem spacing in feet).

*required for certification of the practice.

SPECIES COMPOSITION

Species/cultivars*:		Form	Kind of stock ¹	Total stems
1	White Spruce	<input checked="" type="checkbox"/> Tree <input type="checkbox"/> Shrub	bareroot seedlings	907
2		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
3		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
4		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
5		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
6		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
7		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
8		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
9		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
10		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
11		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
12		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
13		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
14		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
15		<input type="checkbox"/> Tree <input type="checkbox"/> Shrub		
Total number of trees/shrubs needed for planting:				907

¹ Bareroot, container, cutting, balled and burlapped, etc. Include size, caliper, height, and age as applicable.

POST-PLANTING WEED CONTROL (For information only – include weed control in plan as separate conservation practice: Mulching (484), Herbaceous Weed Control (315), etc.)

Method/practice used*:	herbicide - spot app.	Date(s) planned*:	Annually, Apr. 2014, 2015, 2016
Additional information:			

ADDITIONAL INFORMATION

Additional information necessary to install and maintain practice, including other facilitating practices needed, and O&M details*:	Install according to the job sheet, all applicable additional criteria, and as detailed in this specification sheet.
---	--

*required for certification of the practice.

DESIGN APPROVAL:

I certify that this practice has been designed with specifications to meet the Tree/Shrub Establishment (612) conservation practice standard and that the client has been advised of installation and layout elements:

--	--

NRCS or TSP Signature*

Date*

CLIENT REVIEW AND ACCEPTANCE:

The client acknowledges that:

- a. They have received a copy of the specifications and understand the contents including the scope and location of the practice.
- b. They have obtained all necessary permits and/or rights in advance of practice application, and will comply with all ordinances and laws pertaining to the application of this practice.
- c. No changes will be made in the installation of the job without prior concurrence of the NRCS.
- d. Operation and Maintenance of the installed work is necessary for proper performance during the life of the practice. The practice life is 15 years.

I have reviewed all specifications and agree to install as specified:

--	--

Client Initials

Date

INSTALLATION CERTIFICATION:

Assessment of Survival (refer to Michigan NRCS Forestry Technical Note # 30 for survival assessment procedures)

	% Survival	Remaining Tree/Ac.	Comments
Year 1 *			
Year 2			
Year 3			

The Tree/Shrub Establishment (612) practice has been installed according to the Michigan NRCS Practice Standard and as specified above, and meets the minimum survival requirements.

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NRCS or TSP Signature*

Date*

Client Initials

Date

**required for certification of the practice.*

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RESOURCE CONSIDERATIONS (Optional)

Field Inventory Guide Sheet

Client/Plan Information:

Joseph K. Landowner

Identify the resource concern(s) that need to be addressed and the assessment tool(s) used for the evaluation.

SOIL	Erosion <input type="checkbox"/> Sheet and Rill <input type="checkbox"/> Wind <input type="checkbox"/> Ephemeral Gully	<input type="checkbox"/> Classic Gully <input type="checkbox"/> Streambank <input type="checkbox"/> Shoreline	<input type="checkbox"/> Irrigation Induced <input type="checkbox"/> Mass Movement <input type="checkbox"/> Road, Road Sides & Construction Sites	<input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	
	Condition <input type="checkbox"/> Organic Matter Depletion <input type="checkbox"/> Rangeland Site Stability <input type="checkbox"/> Compaction	<input type="checkbox"/> Subsidence <input type="checkbox"/> Contaminants-Salts & Other Chemicals <input type="checkbox"/> Contaminants-Animal Waste & Other Organics <input type="checkbox"/> Contaminants-Commercial Fertilizer	<input type="checkbox"/> Contaminants-Residual Pesticides <input type="checkbox"/> Damage from Soil Deposition		
Assessment tools, Problems & Notes: _____					
WATER	Quantity <input type="checkbox"/> Excessive Seepage <input type="checkbox"/> Excessive Runoff, Flooding, or Ponding <input type="checkbox"/> Excessive Subsurface Water <input type="checkbox"/> Drifted Snow <input type="checkbox"/> Inadequate Outlets <input type="checkbox"/> Inefficient Water Use on Irrigated Land <input type="checkbox"/> Inefficient Water Use on Non-irrigated Land <input type="checkbox"/> Reduced Capacity of Conveyances by Sediment Deposition <input type="checkbox"/> Reduced Storage of Water Bodies by Sediment Accumulation <input type="checkbox"/> Aquifer Overdraft <input type="checkbox"/> Insufficient Flows in Water Courses <input type="checkbox"/> Rangeland Hydrologic Cycle <input type="checkbox"/> Other: _____	Quality <input type="checkbox"/> Harmful Levels of Pesticides in Groundwater <input type="checkbox"/> Excessive Nutrients and Organics in Groundwater <input type="checkbox"/> Excessive Salinity in Groundwater <input type="checkbox"/> Harmful Levels of Heavy Metals in Groundwater <input type="checkbox"/> Harmful Levels of Pathogens in Groundwater <input type="checkbox"/> Harmful Levels of Petroleum in Groundwater <input type="checkbox"/> Harmful Levels of Pesticides in Surface Water <input type="checkbox"/> Excessive Nutrients and Organics in Surface Water <input type="checkbox"/> Excessive Suspended Sediment & Turbidity in Surface Water <input type="checkbox"/> Excessive Salinity in Surface Water <input type="checkbox"/> Harmful Levels of Heavy Metals in Surface Water <input type="checkbox"/> Harmful Temperatures of Surface Water <input type="checkbox"/> Harmful Levels of Pathogens in Surface Water <input type="checkbox"/> Harmful Levels of Petroleum in Surface Water			
	Assessment tools, Problems & Notes: _____				
AIR	Quality <input type="checkbox"/> Particulate matter less than 10 micrometers in diameter <input type="checkbox"/> Particulate matter less than 2.5 micrometers in diameter <input type="checkbox"/> Excessive Ozone <input type="checkbox"/> Excessive Greenhouse Gas - CO2 <input type="checkbox"/> Excessive Greenhouse Gas - N2O <input type="checkbox"/> Excessive Greenhouse Gas - CH4	<input type="checkbox"/> Ammonia (NH3) <input type="checkbox"/> Chemical Drift <input type="checkbox"/> Objectionable Odors <input type="checkbox"/> Reduced Visibility <input type="checkbox"/> Undesirable Air Movement <input type="checkbox"/> Adverse Air Temperature			<input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____
	Assessment tools, Problems & Notes: _____				
PLANTS	<input checked="" type="checkbox"/> Plants are not adapted or suited Condition <input type="checkbox"/> Impaired Forage Quality and Palatability <input type="checkbox"/> Threatened or Endangered Species	<input type="checkbox"/> Declining Species, Species of Concern <input checked="" type="checkbox"/> Productivity, Health and Vigor <input checked="" type="checkbox"/> Noxious and Invasive Plants <input type="checkbox"/> Wildfire Hazard <input type="checkbox"/> Other: _____			
	Assessment tools, Problems & Notes: On-site visual assessment, point sampling of trees. Unit 3 is overstocked with shade-tolerant spp. and hickories. Garlic mustard in small isolated areas.				
ANIMALS	Fish and Wildlife <input checked="" type="checkbox"/> Inadequate Food <input checked="" type="checkbox"/> Inadequate Cover/Shelter <input type="checkbox"/> Inadequate Space <input type="checkbox"/> Plant Community Fragmentation <input type="checkbox"/> Imbalance Among and Within Populations <input type="checkbox"/> Threatened and Endangered Species <input type="checkbox"/> Declining Species, Species of Concern	<input type="checkbox"/> Inadequate Water	Domestic Animals <input type="checkbox"/> Inadequate Quantities and Quality of Feed & Forage <input type="checkbox"/> Inadequate Shelter <input type="checkbox"/> Inadequate Stock Water <input type="checkbox"/> Stress and Mortality <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____		
	Assessment tools, Problems & Notes: On-site visual assessment. Species diversity is low in some areas; diversity could be improved. Thermal cover is limited. Landowner desires increased hard and soft mast production and increased den trees.				