

## Forest Stand Improvement (Acre) 666

### DEFINITION

The manipulation of species composition, stand structure, and stocking by cutting or killing selected trees and understory vegetation.

### PURPOSES

- To increase the quantity and quality of forest products, e.g., sawtimber, veneer, wood fiber, poles, pilings, maple syrup, naval stores, nuts, and fruits.
- To harvest forest products.
- To initiate forest stand regeneration.
- To reduce the potential of damage from wildfire, pest, and moisture stress.
- To restore natural plant communities.
- To achieve a desired understory plant community.
- To improve aesthetics, recreation, and open space values.
- To improve wildlife habitat.
- To improve water conservation and yield.
- To achieve a desired level of crop tree stocking and density.
- To increase carbon storage in selected crop trees.
- For renewable energy production.

### CONDITIONS WHERE PRACTICE APPLIES

All forest land where improvement of forest resources is needed.

### CRITERIA

#### General Criteria For All Purposes

All management decisions shall be based on a forest inventory and the intended purpose. Crop tree inventories, zigzag transects, and point or line sampling methods are examples of forest inventories. See Michigan electronic Field Office Technical Guide (eFOTG), Section IV, C. Michigan Conservation Sheets, 3. Forestry, Forest Stand Improvement for instructions and data sheets for completing an inventory. Pre-treatment and post-treatment stocking for crop tree inventories will be expressed in terms of crop trees and cut trees per acre and average diameter of crop trees and cut trees. Basal area inventories will be reported in terms of pre-treatment and post-treatment basal area and average diameter of cut trees and leave trees. Zigzag transect inventories will be reported in terms of trees per acre, between tree spacing, and basal area by species and size class. See Michigan Technical Note Forestry #25 – Forest Stand Improvement in eFOTG, Section I for more information.

Desirable tree and understory species are identified and retained to achieve the intended purpose. Refer to Forest Stand Improvement (FSI) Job Sheets and Conservation Sheet described above for guidance in determining desirable tree species and tree characteristics.

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.

Mechanical cutting, girdling, or frilling may need to be followed by application of a suitable herbicide to increase mortality and decrease stump sprouting.

Consult NRCS Michigan eFOTG, Section II – H. Water Quality and Quantity, Windows Pesticide Screening Tool (WIN-PST) to choose herbicides, review leaching and runoff potential, persistence, and toxicity ratings of chemical formulations. Use the safest available herbicide. Pesticides used improperly can be injurious to humans, animals, and plants. Follow all label precautions.

The method, felling direction, and timing of tree cutting for harvesting shall facilitate efficient and safe tree removal and protect sensitive areas such as wetlands, riparian zones, cultural resources, and structures. See conservation practice standard and conservation sheet RIPARIAN FOREST BUFFER (391) for management of riparian areas and forested wetlands.

Forest stand improvement activities shall be performed to minimize soil erosion, compaction, rutting, damage to remaining vegetation, and hydrologic conditions. For more information, see conservation practice standard and conservation sheet FOREST HARVEST TRAILS AND LANDINGS (655). Comply with applicable laws and regulations, including Michigan's Best Management Practices (BMPs) for forestland contained in the handbook entitled: Water Quality Management Practices on Forest Land, published by the Michigan Department of Natural Resources, 1994.

Limit damage to the site by:

- Using directional felling
- 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.
- Protecting all forestland from livestock grazing.

Slash and debris left on the site after treatment will not present an unacceptable fire, safety, environmental, or pest hazard. Such remaining material will not interfere with the intended purpose or other management activities.

Comply with applicable federal, state, and local laws and regulations during the installation, operation, and maintenance of this practice. Appropriate cultural resources review will be conducted before beginning any practice that results in soil disturbance.

Base forest stand improvement choices on the following as described in Forest Stand Improvement (FSI) Job Sheets and Conservation Sheet:

- Relative tree position and spacing.
- Crown size, position, and condition.
- Tree and forest health.
- Bole quality.
- Species.

#### **Additional Criteria To Improve Or Sustain Timber Production**

In eastern hardwoods (oak-hickory) and bottomland hardwoods (elm, ash, cottonwood, silver maple, red maple, etc.), crop tree management is the preferred FSI method. A crop tree is any tree that has been identified as desirable and worth retaining. Crop tree management is the selective removal of less desirable trees that compete with crop trees. See Michigan Job Sheet 666-EBH in eFOTG Section IV., Michigan Conservation Sheets for more information on crop tree management. Eastern and bottomland hardwoods are two of the more common forest types in the Southern Lower Peninsula.

In northern hardwoods (sugar maple, basswood, yellow birch, etc.) and pines (red and/or white), it is important to maintain adequate tree stocking or density per acre to fully utilize the site and create optimum growing conditions. See Michigan Job Sheet 666-NHP in eFOTG Section IV., Michigan Conservation Sheets for more information. Northern hardwoods and pines are more common in the Northern Lower Peninsula and the Upper Peninsula.

Area-wide thinning is an alternative approach to FSI. With area-wide thinning, ideal between-tree-spacing and trees per acre are determined, based on average tree diameter. The difference between present spacing and trees per acre and the ideal is calculated and a recommendation is made for reducing the trees per acre and achieving ideal spacing. If area-wide thinning is the preferred method, it should be started when growth of the desirable species is reduced from excess density (see Michigan Conservation Sheet, Forest Stand Improvement – Area-Wide Thinning).

Spacing, density, and amounts of preferred trees and understory species to be retained will follow established guidelines for the species and the purposes they are being managed (see References).

### **Additional Criteria For Wildlife Habitat**

#### **Primary Objective**

If wildlife is a primary goal, use the following minimum recommendations:

- See Michigan Job Sheets 666-EBH and 666-NHP for specific crop tree and basal area criteria for wildlife.
- Maintain hard-mast producers (oak, hickory, walnut, butternut, and beech) and conifers.
- Leave or establish 7 snags and 7 den trees per acre, ranging in size from 6 to 20 inches DBH.

- Leave 4 to 6 vines per acre. Favor trees with vines that will be left as den trees or oak species greater than 10 inches DBH.
- Create 3 to 4 brush piles per acre with material removed during improvement work. “Living” brush piles that are hinged and/or partially cut should be included to provide long-lived shelter. (Refer to Michigan NRCS Standards Wildlife Upland Habitat Management (645) and Field Border (386), and applicable Job Sheets for additional wildlife management guidelines.)
- Maintain core areas of old age stands to benefit targeted species.
- Create clearcuts of aspen, white birch, and jack pine to improve habitat for grouse, woodcock, hares, rabbits, and songbirds. Larger clearcuts of 40-60 acres will benefit deer. (See Michigan NRCS Technical Note Forestry #25 and Conservation and Job Sheets for further information on cutting practices to benefit wildlife.)

#### **Secondary Objective**

If wildlife enhancement is a secondary goal, use the following minimum recommendations:

- Leave or establish 2 snags and 2 den trees per acre, ranging in size from 6 to 20 inches DBH.
- Leave 2 to 4 vines per acre. Favor trees with vines that will be left as den trees or oak species greater than 10 inches DBH.
- Create 2 or 3 brush piles per acre with material from forest stand improvement work.

### **Additional Criteria For Visual Quality And Recreation**

This activity is strongly influenced by subjective values and interest. Forest stand improvements should be directed towards:

- Opening vistas.
- Installing trails.
- Increasing the diversity of vegetation (shape, texture, color, size).
- Removing safety hazards near pedestrian use areas (snags, large dead limbs, etc.).
- Creating visual screens.

For additional guidelines, refer to Michigan NRCS conservation practice standards Recreation Area Improvement (562), Recreation Trail and Walkway (568), and Forest Harvest Trails and Landings (655).

### **CONSIDERATIONS**

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

Wildlife food and cover can be retained by minimal modifications to composition and spacing regardless of the purpose for treatment.

These guidelines are intended to help identify and determine basic forest stand improvement activities. Consult a local Conservation District Forester, Michigan Department of Natural Resources Cooperative Forest Management Forester, Michigan State University Forestry Extension Specialist, industrial forester, or a professional consulting forester in field implementation on large or complex sites.

Pine stands with known occurrences of root collar weevil (*Hylobius radialis*) and those stands within 1/8 mile of a Scots pine plantation should be considered as high risk stands.

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.*).

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

Forested wildlife corridors and riparian forest buffers can minimize fragmentation effects on wildlife habitat.

If chemicals are used to control vegetation, the potential for surface and/or groundwater contamination exists.

### **PLANS AND SPECIFICATIONS**

Specifications for applying this practice shall be prepared for each site and recorded using Michigan NRCS Forest Stand Improvement (666) Job Sheets or Conservation Sheet, technical notes, and narrative statements in the land user's conservation plan, forest management plan, or other acceptable documentation. Minimum documentation for specifications will include: location map, area of preferred tree and understory species, intended purpose(s) of forest stand improvement, spacing, density, size class, number, and/or the amount of trees and understory species to retained and removed. The method, timing, and type of equipment to be used will be documented. Impacts to soil, water, cultural resources, and threatened and/or endangered wildlife or plant species as a result of this practice will be documented.

### **OPERATION AND MAINTENANCE**

Control erosion on forest roads, skid trails, landings, and adjacent areas by installing vegetative and mechanical practices as needed. See conservation practice standard and conservation sheet FOREST HARVEST TRAILS AND LANDINGS (655).

Periodic inspections during treatment activities are necessary to ensure that objectives are achieved and resource damage is minimized. Follow-up and ongoing management activities will be needed to obtain desired results. Forest Stand Improvement may be needed at 5 to 15 year intervals, depending on site type and site quality.

## REFERENCES

Crop Tree Management in Eastern Hardwoods. Perkey, A.W., B.L. Wilkins, and H.C. Smith, USDA-Forest Service, NE Area S&PF, Publication NA-TP-19-93, 1994.  
[http://www.fs.fed.us/na/morgantown/frm/perkey/ctm/ctm\\_index.html](http://www.fs.fed.us/na/morgantown/frm/perkey/ctm/ctm_index.html)

Controlling Undesirable Trees, Shrubs, and Vines in your Woodland. Ohio State University Extension Publication F-45.  
<http://ohioline.osu.edu/for-fact/0045.html>

Forest Stand Improvement, Michigan Technical Note Forestry #25, USDA-Natural Resources Conservation Service, electronic Field Office Technical Guide, Section I. Forestry.

Herbicides for Forest Management, Wisconsin Department of Natural Resources.  
<http://www.dnr.state.wi.us/org/land/Forestry/Fh/weeds/herbicides.htm>

Guide to Wildlife Tree Management in New England Northern Hardwoods, USDA-Forest Service, Northeastern Forest Experiment Station, General Technical Report NE-118.  
<http://www.treesearch.fs.fed.us/pubs/4165>

Improving Hardwood Timber Stands, R.P. Kidd and M.R. Koelling, Michigan State University Extension Bulletin E-1578, 1991.

Managing Michigan Wildlife: A Landowners Guide. Sargent, M.S and Carter, K.S., ed. 1999. Michigan United Conservation Clubs, East Lansing, Michigan. 297pp.  
[http://www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners\\_Guide/index.htm](http://www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/index.htm)

Northern Hardwood Forest Management. Neumann, D. and G. Peterson, 2001. Michigan State University Extension Bulletin E2769.  
<http://forestry.msu.edu/extension/extdocs/E2769.pdf>

Managing Red Pine Plantations for Utility Poles. Dickmann, D.I. and M.R. Koelling, 1997. Michigan State University Extension Bulletin E-2612.  
<http://web1.msue.msu.edu/imp/modft/26129701.html>

Manager's Handbook for Northern Hardwoods in the North Central States. Tubbs, C.H., 1977. USDA-Forest Service, General Technical Report NC-39.  
[http://www.ncrs.fs.fed.us/pubs/gtr/gtr\\_nc039.pdf](http://www.ncrs.fs.fed.us/pubs/gtr/gtr_nc039.pdf)

Revised Manager's Handbook for Red Pine in the North Central Region. Gilmore, D.W. and B.J. Palik, 2005. USDA-Forest Service, General Technical Report NC-264.  
[http://www.ncrs.fs.fed.us/pubs/gtr/gtr\\_nc264.pdf](http://www.ncrs.fs.fed.us/pubs/gtr/gtr_nc264.pdf)

Manager's Handbook for Oaks in the North Central States, USDA-Forest Service, North Central Forest Experiment Station, General Technical Report NC-37.  
<http://www.ncrs.fs.fed.us/pubs/viewpub.asp?key=102>

Silvicultural Standards for Forest Stand Improvement. Michigan Natural Resources Conservation Service electronic Field Office Technical Guide;  
[http://efotg.ncrs.usda.gov/efotg\\_locator.aspx?map=M](http://efotg.ncrs.usda.gov/efotg_locator.aspx?map=M) I, navigate to Section II, Forestry Information.

Silvicultural Systems. Michigan Society of American Foresters.  
<http://michigansaf.org/Business/MSAFguide/SilvSystems.htm>

Thinning Planted Red Pine in Michigan. Rudolph, V.J., et. Al., 1984. Michigan State University, Agricultural Experiment Station Res. Rep. 461. 18 pp.

Water Quality Management Practices on Forest Land, published by Michigan Department of Natural Resources, Lansing, Michigan, 1994.