

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSERVATION PRACTICE STANDARD**  
**FOREST STAND IMPROVEMENT**

(Ac.)

CODE 666

**DEFINITION**

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

**PURPOSE**

- Increase the quantity and quality of forest products by manipulating stand density and structure.
- Timely harvest of forest products
- Development of renewable energy systems.
- Initiate forest stand regeneration.
- Reduce wildfire hazard.
- Improve forest health 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.

This standard is not applicable for the following Indiana (IN) Field Office Technical

**Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office, or download it from the electronic Field Office Technical Guide for your state.**

Guide (FOTG) Standards (311) Alley Cropping, (379) Multi-story Cropping, (380) Windbreak/Shelterbelt Establishment, and (650) Windbreak/Shelterbelt Renovation.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Forest Stand Improvement must be planned and implemented to meet all federal, state, and local laws and regulations.

Selected method(s) for vegetation control will be appropriate to the target species. Competing vegetation will be controlled by using the following method(s) and appropriate herbicides as necessary to obtain satisfactory control:

- cutting
- girdling
- frilling
- stem injection
- basal bark spray

Protect woodlands from grazing livestock except as part of a grazing plan to facilitate removal of undesirable understory vegetation to allow the restoration of native plants.

The harvest-regeneration strategy will be identified for all planned forest improvement harvesting.

The extent or size of treatment area will achieve the intended purpose.

Preferred tree species will be identified and retained to achieve all planned purposes.

The method, felling direction and timing of tree cutting for harvesting will protect site resources, e.g., residual trees, wetlands,

wildlife, cultural resources, improvements and utilities. Felling direction must be compatible with trail layout as specified by IN FOTG Standard (655) Forest Trails and Landings.

Time tree cutting operations to avoid buildup of insect or disease populations.

Forest stand improvement activities will be performed to minimize soil erosion, compaction, rutting, and damage to remaining vegetation and maintain hydrologic conditions. Refer to the IN FOTG Standard (560) Access Road, for roads associated with forest stand improvement activities.

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.

**Additional Criteria to Increase the Quality and Quantity of Forest Products**

**Crop Tree Management**

Commercial use and local demand will determine what species are considered crop trees.

To improve species composition and tree growth, crop trees will be identified, retained, and released from competition.

- Crop trees will be released from crown competition on at least 2 sides by controlling competing vegetation using appropriate methods.
- All detrimental vines greater than 1 inch in diameter on crop trees will be controlled using appropriate methods.

**Thinning Forest Stands**

Thinning forest stands can improve and sustain timber production by increasing tree growth rates in diameter and height. A professional forester will mark all thinnings.

All forest stands:

- Start thinning forest stands no earlier than 15 to 20 years of age. Additional

thinning can occur at 10-15 year intervals, up until three-fourths of the rotation age is reached.

- Improvement cuttings will be light enough (maintaining at least 60% stocking) to restrict the growth of undesirable species, to maintain full site utilization, and to reduce epicormic branching and basal sprouting.

Base thinning choices on:

- Relative tree position
- Relative crown position
- Crown condition
- Tree health
- Bole quality
- Species
- Management objectives

For even-aged stands with an average DBH of 6 inches or greater, use the following tables as a guide for minimum residual stocking after thinning:

Ave. Stand Diameter (inches)	Spacing (feet)	Basal Area (sq. ft.)	Trees Per Acre (no.)
<b>Hardwood Species</b>			
6	13	55	258
8	16	60	170
10	19	65	121
<b>Pine Species</b>			
6	12	60	304
8	14	75	222
10	16	90	170

**Additional Criteria to Harvest Forest Products**

Trees harvested will be in accordance with the objectives for the site and will be completed to minimize damage to the residual stand.

Use the following to minimize site impacts from timber harvesting:

- Use directional felling
- Log when the soil is dry or frozen
- Align cut tree stems for efficient log skidding
- Use a well-organized skid trail system

- Follow the Indiana Division of Forestry, Indiana Logging and Forestry Best Management Practices, BMP Field Guide.

### **Additional Criteria to Initiate Forest Stand Regeneration**

The location, size and orientation of regeneration openings will be designed to achieve the desired regeneration goals. All desirable species within the regeneration area less than 10 inches in diameter (measured at 12 inches off the ground) will be cut at ground level or no higher than 10 inches off the ground to encourage coppice regeneration.

Within the regeneration area, control all woody vegetation greater than 2 inches DBH (diameter breast height), and/or woody vegetation greater than 12 feet tall.

Cut and treat all vines with herbicides that are labeled for this use.

### **Additional Criteria to Improve Wildlife Habitat**

When improving wildlife habitat is the **primary purpose**:

1. A professional biologist will develop a species-specific wildlife management plan.

When improving general wildlife habitat is a **secondary purpose**:

1. Create snags to benefit woodpeckers, and cavity-nesting species. A minimum of six (6) snags per acre from trees greater than six (6) inches DBH will be created. Preference will be given to unhealthy, poor formed, damaged trees, or trees that are not potential crop trees.
2. Preserve trees that possess active nests.
3. When present, one (1) large (>19 inch DBH), four (4) medium (10 – 19 inch DBH) and two (2) small (<10 inch DBH) den trees per acre will be preserved. Den trees have one or more hollow chambers which are used by a variety of

birds, mammals and reptiles for nests, roosts and cover. Trees with high potential to develop den sites include trees with dead branch stubs, wounds or small cavities in young trees.

4. When appropriate create brush piles for wildlife cover with materials left from forest stand improvement work. Brush piles will be distributed adjacent to clearings, roads, and along the outer edges of the site. Refer to Indiana [Wildlife Brush Pile Job Sheet](#) for more information.
5. When appropriate, use woodland edge feathering and forest regeneration openings to benefit the target wildlife species. See IN FOTG Standard (647) [Early Successional Habitat Development/Management](#) for additional guidance.
6. Retain the appropriate number of native soft and hard mast-producing trees for the target wildlife species. For general purposes, retain approximately 15 wildlife trees per acre, which may include snags, den trees, mast species, vines, etc.

When habitat for a specific species is a **secondary purpose**:

1. Biologists will consult with foresters to develop a species-specific wildlife components that are compatible with the primary objectives of the forest management plan.

### **Additional Criteria to Improve Aesthetics and Recreation**

Complete forest stand improvement to:

- Open vistas.
- Improve trails created from log roads and skid trails.
- Remove safety hazards near pedestrian areas (snags, large dead limbs, etc.).
- Release trees of unique aesthetic quality from crown competition on 2 sides to encourage tree health and vigor.

### **Additional Criteria to Develop Renewable Energy Systems**

Bioenergy intensity and frequency of energy biomass removals will be managed to prevent long-term negative impacts on the stand.

The harvesting of energy biomass shall be accomplished in a manner that will not compromise the other intended purpose(s) and functions. If applicable refer to State woody biomass Best Management Practices (BMPs).

### **CONSIDERATIONS**

Consider selecting tree species for management from the NRCS Soil Data Mart from the Forest Productivity Report.

A professional forester should be used to complete the practice or oversee the progress when the primary purpose is forest management.

Consider leaving an untreated 30 foot strip of woodland adjacent to open fields, highways, or open water areas to provide wind protection for the woodland, and contribute to the aesthetics of the community.

Potential landowner and operator liability should be assessed before forest stand improvement begins.

Grapevines are an excellent source of food and cover for wildlife. Consider leaving a minimum of five (5) grapevines per acre.

Consider leaving grapevines on snags, den trees, trees left for wildlife, and in areas where manipulation will be minimal, such as adjacent perennial streams.

Consider wildlife food and cover needs when making modifications to forest composition and tree spacing.

### **PLANS AND SPECIFICATIONS**

Specifications for applying this practice will be prepared for each site and recorded using approved specification sheets, job sheets, and narrative statements in the conservation plan, or other acceptable documentation

### **OPERATION AND MAINTENANCE**

Periodic inspections during and after treatment activities are necessary to ensure that purposes are achieved and resource damage is minimized, e.g., assessment of insects, disease, and other pests, storm damage, and damage by trespass. The results of inspections will determine the need for additional treatment under this practice.

### **REFERENCES**

USDA, U.S. Forest Service, North Central Forest Experiment Station 1977. Managers Handbook for Oaks in the North Central States; General Technical Report NC-37

USDA, U.S. Forest Service, North Central Forest Experiment Station 1977. Managers Handbook for Black Walnut, General Technical Report NC-38

Wenger, Karl 1984. Forestry Handbook, Second Edition

Indiana Division of Forestry, 1999. Indiana Logging and Forestry Best Management Practices, BMP Field Guide.

Payne and Bryant, 1994. Techniques for Wildlife Habitat Management of Uplands. 500 pages