Purdue University - **Forestry and Natural Resources**

FNR-182

A Landowner's Guide to
Sustainable Forestry
in Indiana

Part 3. Keeping the Forest Healthy and Productive

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Environmental Factors Affecting Forest Growth and Development

- *Climate*
- *Soil*
- *Topography or lay of the land*
- *Fungi, plant & animal interactions*
- *Disturbances*

A remarkable variety of forests grow in Indiana. Over 100 different native species of trees intermingle in various combinations. They flourish in swamps, anchor sand dunes, cling precariously to limestone precipices, bind riverbanks against ravaging spring floods, and sink tap roots deep into rich, fertile loam.

Trees, like all other green plants, require sunlight, heat, water, nutrients, and space to thrive. Environment determines the availability of essential requirements. Foresters refer to this availability as **site productivity**. Heredity determines the individual tree's ability to use its environment as it competes for survival.

Ron Rathfon

Deep soils and ample soil moisture on this northeast-facing, upland site promote the growth of a lush understory shrub layer and fast-growing, well-formed trees.

Sustainable forest management requires an understanding of site productivity and hereditary factors that affect forest growth and development, as well as factors like climate, soil, topography or lay of the land, and how fungi, plants, and animals interact and help or harm each other. Sustainable forest management also requires knowledge of each species' unique needs and adaptations, how a forest changes over time, and how it responds when disturbed by fire, insect outbreak, tornado, or timber harvesting.

Basing forest management decisions on this knowledge and working with nature results in healthy forests,

Ron Rathfon

Forests growing on shallow, rocky soils on south-facing slopes, such as this post oak glade in Perry County, indicate a dry site.

Ron Rathfon

Only uniquely adapted tree species thrive in the frequently flooded environment along our large rivers and associated wetland environments like this oxbow on the Patoka River.

Ron Rathfon

Tulip tree seed

Ron Rathfon

Mature tulip poplar

A mature tree is the product of its heredity and environment. The embryo curled and folded inside a tulip poplar seed contains the potential to grow into a majestic, stately giant, 150 feet tall and 5 feet in diameter. This potential can only be achieved if the tree's environment is favorable . . . and with a little luck.

thriving populations of wildlife, a diverse flora, and more productive soils. You and your heirs also benefit from increased long-term income from timber or other forest products and continued personal enjoyment. Decisions made in ignorance of natural laws result in diminished productivity and profits, at best; or, at worst, ecological catastrophe from which it takes many decades to recover.

Principles of sustainable forest management for keeping the forest healthy and productive include:

- Maintaining and enhancing site productivity;
- Improving tree growth, health and timber quality; and
- Appropriately regenerating the forest.

The remainder of this chapter is devoted to explaining these principles.

Maintaining and Enhancing Site Productivity

Some environmental factors affecting site productivity are not easily altered or improved. Climate and topography are examples. Sustainable forest management is confined by the limits these factors impose. Other factors are within partial control of the forest manager and owner, such as protecting and building the soil, favoring selected species of vegetation, and controlling livestock and deer.

Checklist

Maintain & Enhance Site Productivity

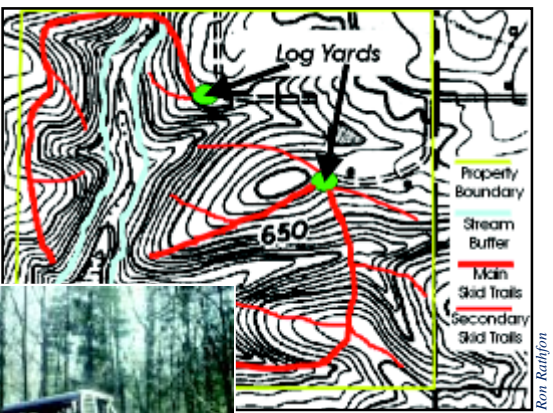
- ☑ Prevent soil erosion
- ☑ Reduce soil compaction
- ☑ Fence out livestock
- ☑ Maintain the leaf layer on forest floor
- ☑ Allow logging slash and other dead wood to decompose

Soil

Soil is the product of millennia of soil-building processes. This life-sustaining substance has been abused, squandered, degraded, and lost during recent history. Though we cannot speed the chemical and physical weathering of rocks and minerals to build new soil, sustainable forest management protects that which we have. Most importantly, forests build soil.

When forest soils are trafficked with heavy equipment such as tractors or log skidders or by large animals such as cows or horses, compaction occurs. Regardless of the methods used, the harvest and removal of timber disturbs and compacts soil. Sustainable forestry practices limit soil erosion and compaction. Part 5 of the *Sustainable Forestry* series, entitled *Forests and Water* (FNR-184), provides more information on preventing erosion.

A well-planned logging job, choice of logging equipment, and logger skill and initiative can limit the amount of soil compaction. Your forester, working with the logger, helps minimize soil damage. Purdue Cooperative Extension Publication FNR-101, *Timber Harvesting and Logging Practices for Private Woodlands,* provides more information on sustainable logging practices.



Ron Rathfon

Ron Rathfon

A well-planned logging job locates log yarding areas and skid trails prior to the start of logging to reduce damage to the soil, water, and timber.

There are many reasons for fencing livestock out of the forest. One is to protect the soil from compaction and erosion. Livestock trampling also damages the fine feeder roots of trees that are close to the soil surface. These roots supply the tree with the majority of required

Ron Rathjen

Fencing livestock out of the forest prevents soil erosion and compaction and damage to tree roots and bark.

nutrients. Damage to roots and bark weakens the tree and leaves it vulnerable to insects, disease, and decay.

Dead Wood

Dead wood from limb fall, natural death of trees, and from logging or other forest management activities contributes to soil building in the forest. Although not as high in plant nutrients as leaf matter, it provides a rich source of carbon for building up soil organic matter. Such organic matter has the ability to absorb and hold large quantities of water and nutrients for later uptake by tree roots. It forms miniature dams on the soil surface to slow surface water runoff and trap sediment. Dead wood, in the form of standing dead trees, called **snags**, and fallen logs, also provide wildlife habitat. See Purdue Cooperative Extension Publication *FNR-102, Woodland*

Ron Rathjen

Tree tops left after logging is complete may affront our sensibilities, but they contribute nutrients to the soil and provide habitat for wildlife.

Wildlife Management for more information on how dead wood benefits wildlife.

When timber is logged, the tops of the trees are usually left lying in the forest — they simply are not useable by most sawmills or veneer mills. Tree tops and other logging debris are referred to as **slash**. Some forest owners regard this slash as unsightly and want it removed. Conveniently located tops can be cut for firewood, but the remainder should be left in place to build soil and provide wildlife habitat. Part 6 of the *Sustainable Forestry* series, entitled *Maintaining the Aesthetic Beauty and Enhancing the Recreational and Cultural Values of Your Forest (FNR-185),* discusses logging aesthetics.

Ron Rathjen

No need to fret over an occasional dead or dieing tree; nature will put it to good use as with this wildlife apartment house.

Between timber harvests, an occasional tree dies or blows over. If the dead trees are of such species and quality to make them very valuable, it may be worthwhile to salvage them. Otherwise, you need not fret over an occasional dead tree. Nature does not allow anything to go to waste.

Improving Tree Growth, Health, and Timber Quality

Forest researchers and the lumber industry have documented the decline in timber quality over the last century as the last of the old growth hardwood timber has been cut. Today, nearly 100% of the timber harvested in Indiana is second growth; i.e., timber that grew up following previous logging. This second growth timber is generally of lower wood quality than previous generations of timber, largely because we don't let it grow 150 to 200 years before harvesting it. The average harvesting age in Indiana is closer to 70 to 90 years old. Because

Most of Indiana's old growth timber, like this large log being brought to a mill in Jasper, has been cut (ca. 1900). Virtually all timber cut today is second growth.

Checklist

Improving Tree Growth, Health, and Timber Quality At Timber Harvest (Improvement Harvest):

- ☑ Allow crop trees to grow to maturity.
- ☑ Thin to proper stocking (number of trees per acre).
- ☑ Remove dying, diseased, decaying, and poor quality trees.
- ☑ Protect trees from logging damage.
- ☑ Use low-impact logging methods where feasible.

Between Timber Harvests (Timber Stand Improvement):

- ☑ Control grape vines.
- ☑ Release crop trees from competition.
- ☑ Thin dense areas.
- ☑ Kill cull trees.
- ☑ Prune selected crop trees to produce more clear lumber.

Anytime:

- ☑ Promote tree species diversity.
- ☑ Monitor your forest for insect and disease outbreaks.
- ☑ Cooperate with government agencies in controlling forest insect and disease outbreaks.
- ☑ Prevent wild fire.

trees are harvested at a younger age, they have less clear, knot-free, defect-free wood.

The wood manufacturing industry has adapted to the decline in timber size and quality. New technologies enable mills to cut more quality lumber from today's lower grade logs and to utilize low quality lumber in new ways. Nonetheless, premiums are still paid for timber of exceptional quality. Where site quality is high enough (i.e., good soils and adequate moisture), sustainably managed forests grow high quality timber. With a little loving attention, your forest will grow greater quantities of valuable, high quality timber.

Improvement Harvest

Due to a long history of neglect, mismanagement, and abuse, many Indiana forests need some rehabilitation work to bring them into a productive, healthy condition. In forests that contain trees of harvestable size, the first practice often applied is a timber harvest called an **improvement harvest**. Trees that are declining in health or are damaged, diseased, or of poor quality are harvested to make room for more vigorous trees of better quality, species, or value. The remaining **crop trees** are then allowed to grow to maturity before being harvested.

Ron Rathfon

Harvesting timber, when done according to sound forest management principles, can improve the health and productivity of the forest. Care must be taken during logging to protect the remaining trees from damage caused by falling trees and heavy equipment. Well-trained, conscientious loggers and a good timber sale contract minimize such damage. Employing the services of a professional forester can help ensure a good logging job. You may request that only loggers who have completed logger training courses be permitted to work in your forest.

Galen Wright

Ron Rathfon

It requires great skill to remove long logs from the forest with large skidding equipment without doing a lot of damage to the remaining trees. Such damage to a tree's bark allows wood boring insects and decay fungi to attack and destroy the interior wood and weaken the tree.

Timber Stand Improvement

A practice called **Timber Stand Improvement (TSI)** may need to be applied in forests not yet ready for a harvest. TSI is a broad term encompassing a variety of practices designed to favor the growth of those trees that will best meet your management objectives and promote the long term health and productivity of the forest. Some practices included under TSI include grape vine control, pruning, thinning, crop tree release, and cull tree killing or removal.

Ron Rathfon

(Left) Though usually not a threat to people, out-of-control grapevines wreak havoc on trees. (Right) Cutting grape vines may be the most beneficial thing you can do to promote the growth of quality timber, and it can be done without special training and equipment.

Grape vine control is one of the simplest and most productive practices to improve growth and quality of trees. Left uncontrolled, grape vines grow over the tops of trees, shading them out, deforming them and even breaking their crowns. Vines should be cut at least two to three years prior to a timber harvest. This eliminates the need to spray herbicide on the vine stumps. If vines are cut immediately prior to or following the harvest of timber, an herbicide should be used. Otherwise, vine stumps and roots resprout vigorously.

Ron Rathfon

(Left) This woods in northern Indiana was poorly managed in the past. Timber stand improvement will help bring it back into full productivity. (Right) A well-managed forest grows high-quality timber.

Although damaging to trees, grape vines are an important source of food and cover for birds. It may be desirable to leave some vines on the edge of the forest and in some low quality trees in order to accommodate wildlife needs.

Thinning dense areas and killing **cull trees** (trees with no useable wood volume or commercial value) improves the health and increases the rate of growth of the **crop trees.** Crop trees are those that help you meet your management objectives. Crop trees are selected based on desirable traits such as species, trunk straightness, fast growth, wildlife food value, or resistance to insects and disease.

By no means should all defective, undesirable trees be removed in TSI. Only those whose removal will help us accomplish our management objectives to improve the health and productivity of crop trees and new tree growth should be killed or cut. A professional forester can help you in planning how best to treat your forest to make it healthy and vigorous.

Pruning may be done to maintain a straight trunk and to remove lower branches. Pruning is as much art as science, so professional advice is an important part of making decisions on what and how to prune. Purdue Cooperative Extension Publication FNR-76, *Corrective Pruning of Black Walnut for Timber Form*, provides more information on pruning.

TSI $

Timber stand improvement (TSI) improves timber growth and quality and provides a favorable return on your investment.

Species Mix

In Indiana, sustainable forest management should favor managing our forests for a mixture of species, encouraging those best adapted to a given site. This is the natural pattern. **Monocultures**, forests composed primarily of one tree species, are at higher risk for catastrophic insect and disease outbreaks. They lack the complexity and structure needed to achieve a diverse habitat, capable of supporting a large variety of plant and animal life.

Insects and Disease

Historically, major insect and disease outbreaks occur infrequently in Indiana and rarely cause widespread forest destruction. Dutch elm disease and chestnut blight are exceptions. These diseases eliminated or reduced American chestnut and American elm in the forest landscape. An occasional outbreak of defoliating insects, like forest tent caterpillars, or loopers, may cause localized death, with individual forest landowners suffering economic loss. This is rare, however. Chronic diseases, such as ash yellows, and drought contribute to the gradual decline and death of individual trees and small groups of trees.

A bacterium called Bt (Bacillus thuringiensis) is one of the materials available to control gypsy moths. It targets moth larvae and is considered environmentally safe. Organic farmers use Bt as an alternative to chemical pesticides.

Mindy Jasmund

Cliff Sadof

For more information on gypsy moth in Indiana contact:

Indiana Department of Natural Resources,
Division of Entomology & Plant Pathology

402 W. Washington Street, Rm. W-290
Indianapolis, IN 46204-2649
(317) 232-4120
www.state.in.us/dnr/entomolo

Purdue Cooperative Extension Service publishes a series of extension publications and maintains a Web site on the gypsy moth. For more information contact:

Purdue University,
Department of Entomology

West Lafayette, IN 47907-1158
1-888-EXT-INFO
www.entm.purdue.edu/Entomology/ext/Moth

Gypsy moth, a native of Europe, was brought to Massachusetts in 1869. It spread westward, defoliating vast areas of forest throughout the northeast, into the upper southeast and across Ohio and Michigan. It has a varied palate but prefers oak foliage. Gypsy moth has reduced the predominance of oaks in many northeastern U.S. forests, opening up the forest to other tree species. Red maple has replaced oak as the dominant species in some areas of the northeastern states.

The Indiana Department of Natural Resources, Division of Forestry, and Division of Entomology and Plant Pathology, in cooperation with other state and federal agencies and Purdue University, aggressively monitor and attack gypsy moth introductions to Indiana. In spite of efforts to slow the spread of gypsy moth, most forestry officials agree that it will spread to all parts of the state and become a permanent resident of our forests.

A healthy, vigorous, species-diverse forest is the best defense against this destructive invader and most other insects and diseases. You can cooperate with gypsy moth control efforts by allowing officials to locate monitoring traps on your property, learning what gypsy moth caterpillars and other signs and symptoms of the moth look like, and reporting when you observe it. If an outbreak occurs in your forest, cooperate with officials in combating it.

Fire

Fire can be a friend or foe of Indiana's forests. Wild fire damages and kills standing trees. Damaged bark allows insects and decay fungi to enter and destroy a tree's interior wood. Controlled burning, however, is a useful tool in certain circumstances. Part 4 of the *Sustainable Forestry* series, entitled *Conserving Nature* (FNR-183), discusses fire as a forest management tool.

You can protect the health and quality of timber by preventing wild fire, providing fire access trails for fire fighters, and observing guidelines issued by public officials during periods of high fire danger.

Regenerating the Forest

Regenerating a forest refers to its renewal with new, young trees. Foresters use the term "**regeneration**" interchangeably to refer to new trees, seedlings, and young sprouts, or to the management activity that promotes the growth and development of those new trees. Ironically, the regeneration of a forest necessarily involves the death or cutting of larger, mature trees.

Checklist

Regenerate the Forest

- ☑ Plan timber harvesting with natural regeneration in mind.
- ☑ Encourage tree species best adapted to the site.
- ☑ Plant trees in native forest under the guidance of a forester.
- ☑ Release regeneration from overhead competition following a timber harvest.
- ☑ With the help of a forester, choose an appropriate timber harvesting method to obtain the desired regeneration and to meet other objectives.
- ☑ Protect regeneration from deer.
- ☑ Avoid high grading and diameter-limit cutting.
- ☑ Consult with a forester before selling timber.

Ron Rathfon

Regenerating a forest is its renewal with new, young trees.

Nature accomplishes the regeneration of a forest through wind, ice, tornado, insect, disease, fire, or natural death. Sustainable forestry mimics natural disturbance, with foresters using professional judgment and experience based on scientific research rather than nature's randomness. Foresters carefully plan and select the right trees to remove in a timber harvest to stimulate desirable regeneration, as well as achieve other management goals.

Encourage Best-Adapted Species

Encouraging the species that are best adapted to a site is the primary consideration when regenerating a forest. Forests should be regenerated to maintain species diversity. Rarely should native forest be converted to a monoculture or a single species forest. Within these parameters, you can choose species that help you fulfill your objectives; e.g., valuable timber species, wildlife food and cover, aesthetic appeal, or enhancing species diversity.

Planting Trees or Natural Regeneration?

Many people think new trees must be planted following timber cutting. In fact, the overwhelming majority of Indiana's forests regenerate naturally. They grow from seeds that drop to the ground or are buried by squirrels, that blow on the wind or that float on river currents to eventually land on suitable soil, germinate, and compete for their place in the forest. Some trees originate as sprouts growing on the stump of a cut or fire-killed tree. There are no laws in Indiana requiring trees to be planted in the wake of logging.

There are no laws requiring tree planting following logging. Indiana's hardwood forests regenerate naturally.

"Return of the Native"

American Chestnut on the Verge of a Comeback.

American Chestnut Foundation

The American chestnut was at one time one of the most common tree species of the Eastern United States. They were highly prized for their rot-resistant, attractive, easily-machined lumber and, of course, for their delicious nuts.

Chestnut blight was first discovered in this country, in New York City, in 1904. The blight, a fungus that is native to Asia, forms cankers on the trunk of the tree, ultimately girdling it and killing its top. Roots of infected trees persist and send up new shoots. These shoots are also killed back once they reach between 10 to 30 years of age. Rarely does an infected American chestnut attain a seed-bearing age or size.

By 1950, virtually all of this once-numerous and valuable tree species were reduced to shrubby sprouts with no future but virtual extinction from its native range. Plant pathologists and tree breeders spent many years trying to develop an American chestnut with blight resistance. Chinese chestnut, which has natural resistance to the blight, was crossbred with American chestnut. The trick was to get a tree that was close to 99% American chestnut and 1% Chinese chestnut, the 1% being its resistance to the blight.

After many decades of breeding, collecting seed, waiting for promising crosses to grow big enough to test for blight resistance and produce seed, and continuing to breed, researchers are getting closer to a blight-resistant American chestnut. It is now conceivable that blight-resistant American chestnut will be planted in Indiana forests by 2040, thus fulfilling the long awaited "return of the native."

For more information contact:
The American Chestnut Foundation
469 Main Street, P.O. Box 4044
Bennington, VT 05201-4044
www.chestnut.acf.org

American Chestnut Foundation

Natural regeneration is almost always preferred over human-planted trees in a native forest. Occasionally your plans might call for "enrichment plantings" or planting much-desired species of trees or shrubs to augment natural regeneration. This can be done to ensure that a particular species maintains its representation in the forest. Tree planting in native forests can also be done to increase species diversity, so long as the species being introduced are adapted to the site and are native in the area. It can be used to reintroduce a species that once grew in the area, but, through disease or over cutting, has since disappeared. Tree planting can also be a means to improve and diversify the gene pool of the forest. Trees grown from parents possessing desirable traits, such as faster growth, good form, or disease resistance can be introduced into forests that have been degraded over the years through poor logging practices.

Consult a forester before attempting to plant trees in a native forest. Without proper care, natural vegetation will quickly out-grow all the planted trees, resulting in a total loss and a waste of your time, sweat, and money. Although tree planting is not frequently encouraged in native forests, foresters and other conservationists enthusiastically promote it on cleared land. Purdue Cooperative Extension Publication FNR-36, *Tree Planting in Indiana*, provides more information.

Release Regeneration

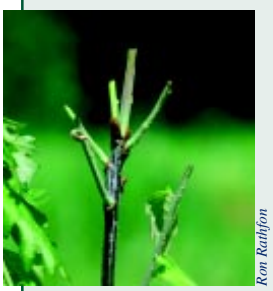
Timber stand improvement should be done immediately following a timber harvest. Undesirable, poorly formed, low vigor, defective trees that are competing with crop trees should be cut or killed. Regeneration openings where groups of trees have been harvested should have remaining trees cut or killed to complete the opening and allow full sunlight to reach the regeneration. In these openings, trees of desirable species, but perhaps less desirable form (crooked, twisted, stunted, etc.), can be cut close to the ground. This usually stimulates sprouting from the cut stump. These sprouts generally make good regeneration. This is an especially effective way to regenerate oak. Grape vines should be controlled two to three years prior to the harvest to protect young regeneration.

Ron Rathfon

Stump sprouts are often an important part of forest regeneration.

Deer and Trees

Whether planted or natural, new tree seedlings may need protection. Insects, disease, and fire are possible threats. Perhaps the biggest threat to new forests, however, is browsing deer. Since their re-introduction to Indiana in 1934, deer populations have steadily increased to current peak levels. Excessively large deer herds devastate new tree plantings and recently regenerated forests. They also contribute to declines in other native plant species, including shrubs and ground flora. This, in turn, impacts the food, nesting, and cover of many species of wildlife. Imbalances in deer populations contribute to declines in rare and endangered plants and animals.

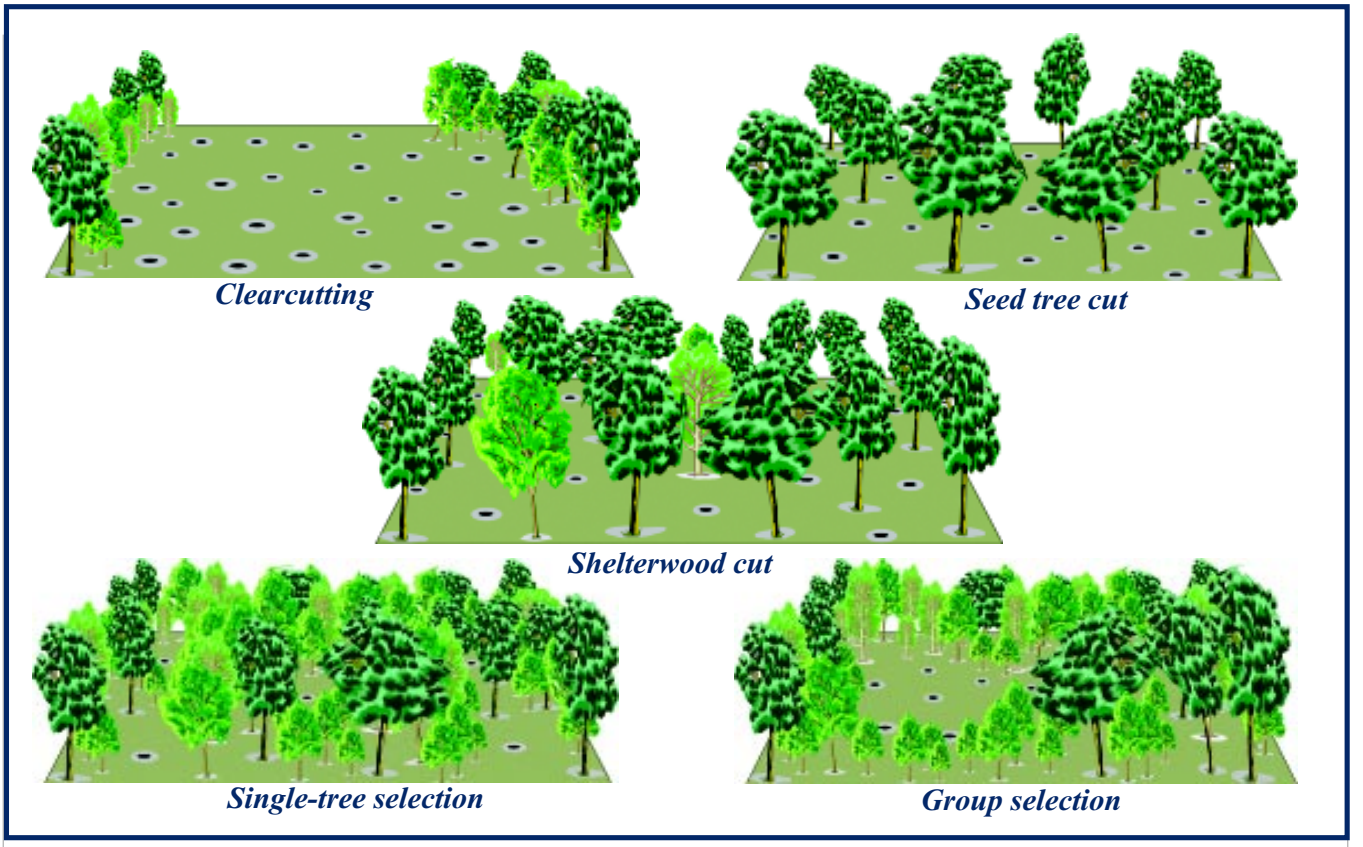


Ron Rathfon

Many methods for protecting newly planted trees from deer damage have been devised; e.g., fencing, a wide variety of concoctions for making the trees smell or taste repulsive, metal rods, paper or fabric bud caps, protective plastic netting, and plastic tree tube shelters. Some methods have research to support them, while effectiveness information for others is anecdotal. The most cost-effective means of protecting young trees from browsing deer is to control the size of the herd through hunting. Where deer damage may be a problem, encourage deer hunting. Depredation permits may be obtained to shoot additional deer above the legal bag limit. The Indiana Department of Natural Resources, Division of Fish and Wildlife issues depredation permits. Deer play an important role in the sustainably managed forest. Like most things, having "too much of a good thing" can actually be counterproductive.

Regeneration Methods

Regeneration methods include **clearcutting**, **shelterwood**, and **seed tree** cuts, which produce a new forest of trees of all the same or nearly the same age.



There are five generally recognized methods of regenerating the forest, each with a number of variations. A) ***Clearcutting*** *removes all trees within an area five acres or more in size. B) A* ***seed tree cut*** *removes all but a few scattered trees to provide desired seed for regeneration. C) A* ***shelterwood cut*** *leaves between 50% and 60% of the trees as a source of desirable seed. It also provides partial shade, which favors the establishment of certain species of regeneration, like the oaks. Once desired regeneration is well established, the shelterwood trees are harvested. D)* ***Single-tree selection*** *harvests carefully select individual trees that are widely scattered throughout the forest. E)* ***Group selection*** *removes groups of trees, resulting in small openings in the forest that range in size from one-half acre to five acres.*

Single-tree selection and **group selection** methods result in a forest of many different aged trees.

Clearcutting removes all trees within a given area, usually five acres or more in size. Shelterwood and seed tree cuts prescribe one or two initial cuts to give more growing space to desired seed trees to expand their crowns and increase seed production. When desired regeneration has established itself, the remaining over-story trees are harvested. Single-tree selection involves judiciously selecting individual trees to cut. Group selection harvests groups of trees to create small openings in the forest ranging in size from one-half acre to five acres.

Foresters in Indiana most frequently use the combination of single-tree selection and group selection when marking a timber harvest. There are a variety of reasons for this: most Indiana forest landowners own relatively small forests (under 100 acres) and don't want to see the entire forest or large sections of their forest clearcut; foresters want to avoid the negative publicity associated with clearcutting; and foresters and landowners prefer not cutting smaller trees prior to their reaching full maturity. Immature trees of desirable species and quality are "money in the bank," often accruing value at a very handsome rate-of-return (See Purdue Cooperative Extension Publication FNR 138, *Tips on How to Get the Most From Your Timber Harvest.*)

Some of these methods, particularly clearcutting, receive harsh criticism for their perceived "destruction" of the forest. When appropriately employed, any of these methods are sustainable. It is a matter of choosing the best method to meet your objectives.

Non-Sustainable Harvesting Practices to Avoid

All too often, maximizing the immediate financial gain of the landowner or timber buyer is the sole criterion for deciding which trees to harvest. This is done at the expense of long-term productivity and income potential. Many forests in Indiana are degraded through **high grading** or **diameter-limit** cutting. High grading refers to timber harvesting where only high-value trees are cut,

Ron Rathjen

Foresters need the flexibility to mark for harvest some small, defective, poor vigor trees, and to leave some large, healthy trees in the forest.

leaving poor quality, low vigor or decadent trees of less desirable species. All too many Indiana forests have the oak, tulip poplar, walnut, and cherry logged out, leaving slow growing, stunted hickory and maple, hollow beech, and crooked elm. All these species have their rightful place in a sustainably managed forest. However, if they are the only species left, or if most remaining trees are in poor health or form, the forest has been degraded.

Diameter-limit cutting refers to the practice of cutting all trees above a certain diameter. This method requires little forest management knowledge or skill. Foresters need the flexibility to mark for harvest some small, defective, and poor vigor trees, and to leave some large, healthy trees in the forest, in order to maintain and even improve the health and productivity of the forest. Many diameter-limit cuts result in a forest consisting of trees that were formerly overtopped, stunted, and slow growing. Because of poor vigor, many never increase their growth rate in response to the additional sunlight, water, nutrients, and space suddenly available. Some are so distorted after decades of unsuccessfully trying to grow toward some little opening of light that they never can straighten out. Other trees have significant decay and continue to decline in health and value.

Unfortunately, the damage caused by high grading and diameter-limit cutting to long-term forest health and productivity extends beyond the poor, rag-tag trees left. These remaining trees still occupy space and cast shade on the forest floor. This inhibits the growth of new trees that have a much better chance of growing into valuable timber trees and wildlife food producers. In addition, the poor-vigor trees left are most likely of poorer genetic quality. Thus, the seed source and the resulting regeneration is degraded genetic stock. **High grading and diameter-limit cutting methods have no place in sustainably managed forests.**

Ironically, the best management practice for forests that have been severely high-graded or subjected to a diameter-limit cut may be a clearcut. This allows the forest to start over again without the young trees having to compete with the "junk" residue left from the previous cut. If you have a high-graded forest, ask a forester how you can restore it to greater health and productivity.

The best protection against high grading and diameter-limit cutting is learning how to properly market timber marked for sale using sustainability guidelines. A forester can help ensure the right trees are harvested in order to regenerate the forest and meet your other objectives. Additionally, a forester can provide timber

Ron Rathjen

Diameter limit cutting often results in a forest of stunted, slow growing, low vigor, poorly formed trees.

What Do Hogs and Trees Have in Common?

High-grading and diameter-limit cutting are analogous to the hog farmer who sells off his fastest growing, most robust pigs and saves the sickly runts to breed. You don't need to be a farmer to understand how herd, profits, and hog farm might plunge into failure and bankruptcy. Likewise, high grading and diameter-limit cutting threaten to "bankrupt" Indiana's forests.

Duane Murphy

marketing assistance to help you get a fair price and ensure your forest is logged in a manner that protects its long-term health and productivity. Purdue Cooperative Extension Publication *FNR-111, Marketing Timber*, provides more information on how to go about selling timber.

Additional Information

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A Landowner's Guide to Sustainable Forestry in Indiana

Part 1. *Sustainable Forestry - What Does It Mean for Indiana?—FNR-180*

- Sustainable Forestry Described
- Historical Perspective
- Indiana's Forests Today
- How This Series Is Organized

Part 2. *Planning for the Future—FNR-181*

- The First Step - Who Can Help You?
- Your Objectives
- Gathering Information
- Planning Your Management Activities
- Using Legal Contracts

Part 3. *Keeping Your Forest Healthy and Productive —FNR-182*

- Maintaining and Enhancing Site Productivity
- Improving Tree Growth and Protecting Timber Quality
- Regenerating the Forest

Part 4. *Conserving Nature—FNR-183*

- Providing Wildlife Habitat
- Unusual Habitats
- Endangered Species
- Invaders! Harmful Exotic Species
- Forest Fire - Not Always as Bad as It Sounds
- Fragments of Forests

Part 5. *Forests and Water—FNR-184*

- Livestock
- Reforestation Benefits Water Resources
- Avoid Clearing Forest
- Forest Roads and Trails
- Best Management Practices (BMPs) for Timber Harvesting
- Pesticides
- Protecting Sensitive Water Resources

Part 6. *Maintaining the Beauty and Enhancing the Recreational and Cultural Values of Your Forest—FNR-185*

- Maintain Visual Buffers Next to Public Places
- Maintain Important Scenic Views
- Tips for a Better-Looking Logging Job
- Developing the Recreation Potential of Your Forest
- Protecting and Enhancing Cultural and Historic Values

Part 7. *Managing for a Diversity of Value-Added Forest Products—FNR-186*

- Forest Herbs
- Mushrooms
- Nature-based Tourism
- Christmas Trees and Greenery
- Maple Syrup
- Value-added Wood
- Do Your Homework!

Part 8. *Help!—FNR-187*

- Cost Share Grants
- Classified Forest and Wildlife Habitat Programs
- Leaving a *Forest Legacy* - Permanent Forest Protection Through Conservation Easements
- Tax Incentives and Estate Planning
- Forest Bank
- Forest Cooperatives
- Carbon Sequestration
- Forest Certification
- Education and Technical Assistance

Knowledge to Go
Purdue Extension

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