

Forest*A*Syst

**A self-assessment guide for
managing your forest for**

timber production

wildlife

recreation and aesthetics

water quality

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Preface

*This version of Forest*A *Syst is a national model. States are encouraged to mold it to their own needs and purposes. Tables, figures and pictures of local tree and wildlife species should be added, as well as the state's Best Management Practices (BMPs) and regulations.*

Any management activities or techniques that don't fit the state should be omitted, e.g. prescribed or controlled burning simply doesn't fit in the Northeast U.S. and in areas of air quality concern. Chapters can be used individually or in combinations to meet the objectives of a targeted audience. For example, with more advanced audiences, increasing the technical level of the information presented will give a more in-depth understanding of forest resource management.

Also, feel free to change the tenor of this document to emphasize ecological concerns of the state or a particular region. It can also be changed to focus on non-management benefits.

The ultimate objective of this publication is to encourage owners of forests – large or small – to manage that forest for recreation, wildlife and timber, while protecting our vital water quality resources. In that process, many will need help, counsel and advice. Be sure to include a list of local sources of assistance.

Rick Hamilton

A forest is more than trees

Trees take a long time to grow, so today's decisions have long-term impacts on forests and water quality. Forest*A*Syst helps you plan what you want your forest and wooded acreage to be and set out the steps you need to take to get there.

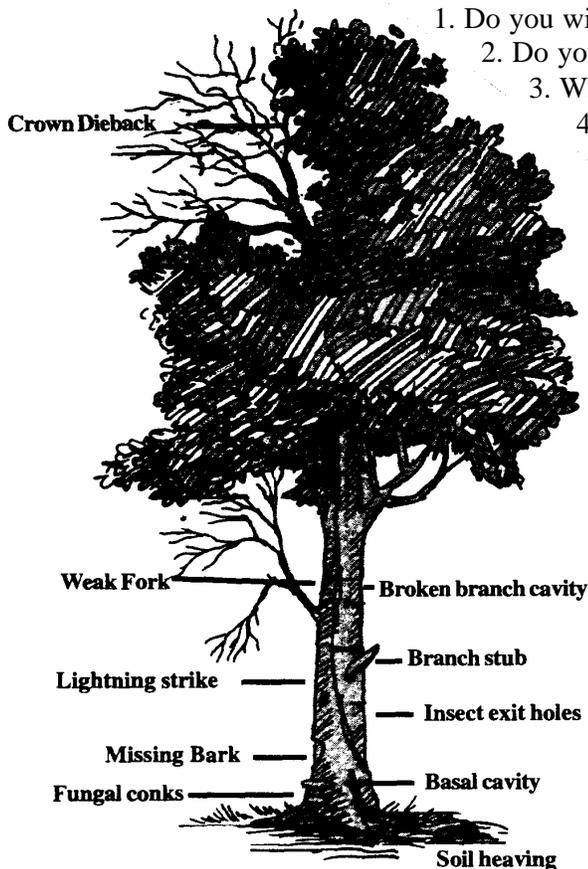
High quality water is the product of well-managed forests.

Your decisions are influenced by many things, including your family situation, income needs, philosophy about land ownership and the environment. You also have to consider your resources, skills, time constraints and applicable regulations in your location. Then you can sit down with your professional forester to create a flexible plan that you and your heirs can follow to reach your goals for your forest, while protecting the quality of water and the environment.

Where do I begin?

With your forester, you need to evaluate your property's physical attributes and your management activities and the steps you can take to safeguard the environment (*Best Management Practices*). This lets you find out where your starting point is. Questions you need to answer are:

1. Do you wish to hunt or observe wildlife in your forest? Yes/No
2. Do you want your forest to produce income? Yes/No
3. Will you or others use the forest for recreation? Yes/No
4. Is the beauty of your forest important to you? Yes/No



Now you need to rank your preferences in order of importance (1 being most and 5 being the least):

- Wildlife _____
- Timber Production _____
- Recreation _____
- Beauty (aesthetics) _____

This will assist you in making the choices in balancing your desires for managing your forest. Wanting income through timber production need not be in conflict with environmental concerns. By having a flexible plan, it is possible to compatibly link choices such as wildlife food and habitat with timber production.

The health of your forest may depend on active forest management. It is a misconception that a healthy forest is always an untouched forest. A forest management plan is the road map to successful long-term management of your forest.

Considering the plan

Think of your own operation as you consider these concepts.

- | | | | |
|---|-----|----|-----|
| 1. Do you have a forest management plan? | Yes | No | N/A |
| 2. Is it a written forest management plan? | Yes | No | N/A |
| 3. Do you follow the plan? | Yes | No | N/A |
| 4. Does following the plan achieve your landowner objectives? | Yes | No | N/A |
| 5. Do you review your plan every five years? | Yes | No | N/A |
| 6. Have you revised your plan when you feel it no longer meets your objectives? | Yes | No | N/A |

Elements of a Management Plan

Planning is not a single event, but a series of continuous steps leading to a desired goal. Forest Management Plans are, by necessity, long-term. The plan guides activities for decades, providing continuity through successive generations of owners. The plan can be as detailed (short-term recommendations) or as general (long-term recommendations) as you desire. The first step is to determine your priorities, set goals and identify the management activities to reach those goals.

Forest resource management plans traditionally follow a common format. They should be written and revisited periodically to update or change according to your wishes. The assistance of professional foresters, wildlife biologists, soil and water specialists, recreation specialists and others are recommended as you develop your plan.

Typical parts of a forest resource management plan

Statement of landowner goals and objectives

A well-written plan should begin with a statement of the landowner's goals for ownership. Long-term (more than 10-year) goals are usually general. Short-term goals are more targeted, with specific practices and timetables. These include: **timber stand** improvement activities, stand **thinning** schedules, timber harvests, **site preparation** timetables and re-growth or re-planting (**regeneration**) methods and timings.

Location

Your plan should have a large enough map and/or aerial photograph showing the location of the property and how the property can be accessed. Boundaries should be clearly marked and described.

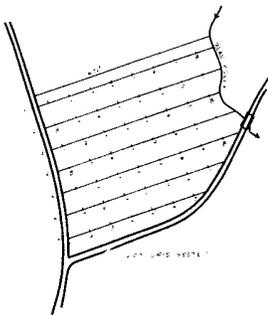
Protection and maintenance

Include a description of your activities (or planned activities) relative to the following key protection and maintenance requirements:

- ❖ Marking and maintaining property lines and corners
- ❖ Road, trail and access control
- ❖ Fire protection practices
- ❖ Insect and disease inspection, protection and salvage
- ❖ Timetable for review and update of the management plan

Stand descriptions and inventory data

Each stand should be described and correctly marked on the property map and/or the aerial photograph. Soil types, number of acres, tree species, stand age, **stocking** (trees per acre), range of tree diameters, average tree height, standing timber volume, tree condition and health, and unique water quality or drainage



information are essential. For owners with wildlife, recreation, aesthetic or other objectives, a description of the stand's importance to other plant species and to wildlife should also be included.

Forest management prescribed activities

The "real meat" of a forest management plan is applying your objectives and goals to the actual forest stands you own and then creating a timetable of planned activities. These scheduled/prescribed activities can be included in the previous, "Stand Description and Inventory Data," section, or can be in a separate section linked to each timber stand. Prescribed activities include:

- ◆ Timber harvests
- ◆ Re-growth or re-planting (regeneration) practices: site preparation, tree planting, natural regeneration recommendations
- ◆ Forest fertilization
- ◆ Commercial timber thinning
- ◆ Pre-commercial thinning
- ◆ Weeding and/or timber stand improvement practices
- ◆ Establishing and maintaining wildlife management practices
- ◆ Installing and maintaining water quality protection practices (BMPs)
- ◆ Enhancing the stand's aesthetics, recreational use, diversity of plants and wildlife species and appeal to wildlife.
- ◆ Other: requirements to comply with federal/state regulations such as the Endangered Species Act, Clean Water Act, state water quality laws, etc.

You may wish to develop your own plan or seek the assistance of a professional forester. Regardless of who prepares the plan, several key points apply to all plans:

- No plan is set in stone and can be modified at any time. The plan you develop is an operating plan which, based on current conditions and facts will help you in meeting your objectives.
- Plans are unique to each owner and forest.
- Plans should be reviewed and updated at least every 5 years or as conditions change or the objectives of the owner(s) change. All owners and heirs, if possible, should be included in developing and modifying a long- or short-term plan to insure continuity of forest resource management activities.

Sample:

Stand 1

1992: Site preparation by felling cull trees

1993: Plant improved black walnut

1994: Control weeds and prune

2018: Thin to 80 crop trees per acre

Assessing your management plan

	Most desirable	Desirable	Least desirable
<i>Written Plan</i>	A written comprehensive plan, including goals, location, protection and maintenance, stand descriptions, forest management recommended activities and time schedule for reviewing.	A written plan including stand description, forest management recommended activities and time schedule for reviewing.	No written plan
<i>Plan Assistance</i>	Plan developed with the assistance of natural resource professionals in consultation with family and heirs.	Plan developed in consultation with family and heirs.	No plan.

What type of forest management do you want?

Think of your own operation as you consider these concepts.

- | | | | |
|--|-----|----|-----|
| 1. Do you want to maintain your forest's health? | Yes | No | N/A |
| 2. Do you want your forest to provide income? | Yes | No | N/A |
| 3. Do you want your forest to provide periodic timber income? | Yes | No | N/A |
| 4. Do you want your forest to provide future timber income? | Yes | No | N/A |
| 5. Do you want to maximize your forest's timber income? | Yes | No | N/A |
| 6. Do you want to manage for timber production and wildlife or recreation? | Yes | No | N/A |

Managing a forest

One objective of many landowners is timber production. Even lands managed primarily for wildlife, recreation or water protection can produce timber. Forest management can be both environmentally friendly and profitable.

When selecting how to operate your forest, you need to carefully assess 1) your goals; 2) your financial and physical limitations; 3) the size, condition and capabilities of your forest; 4) the availability of technical and contractual services in your area; and 5) expected markets.

Well-managed forests generally have several common features:

- Tree species that are suited to the local climate, soils and markets
- **Crop trees** with adequate room to grow
- Minimal numbers of damaged, diseased or insect-infested trees
- Protection from fire and destructive grazing
- Easy access
- Best Management Practices (BMPs) to prevent erosion, **sedimentation** to protect water quality
- Boundaries and corners are clearly marked and maintained
- A written forest management plan that governs activities

Even-aged stands

Certain tree species grow in **even-aged** stands, where all the trees are approximately the same age. Strategies for managing even-aged stands are best suited to tree species that do not grow well in the shade. Normally, these stands are harvested by **clearcutting** or other techniques which allow maximum sunlight to reach the forest floor.

This type of management is often used for small forests, and requires a very simple management plan

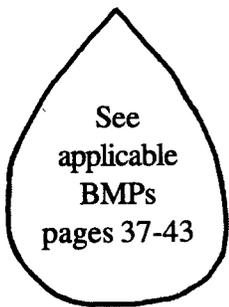
Two-aged stands

While similar to even-aged stands, these have two distinct age classes.

Uneven-aged stands

Trees of more than two ages and size classes are present in **uneven-aged** stands. Species which thrive in full or partial shade are best suited to these stands. The harvesting and regeneration systems used are **single- or group-tree selection**. Considered more pleasing to the eye, these methods do require more access roads and trails when managing for timber harvests. Extreme care must be used to prevent damage to trees left after each selective harvest.

This type of management is complex. It is better suited to larger forests, particularly where the owner wants repeated, frequent timber harvests and income.



Establishing and managing timber stands

Again, while you can devise your own management plan, it is recommended that you seek the assistance of a professional forester in developing one. Generally, management practices fall into three categories depending on the age and condition of the forest: 1) forest establishment or regeneration; 2) intermediate stand management practices; and 3) harvest systems.

The range of practices used over the life of a forest is called the "silvicultural system." It is the linking of timber harvesting, regeneration and intermediate stand management treatments in a logical sequence to meet your goals and objectives.

The young stand

Establishing or regenerating a forest can be achieved by either artificial means – primarily planting trees – or by natural methods – which rely on seed, sprouts and/or naturally occurring seedlings. These practices are used to re-stock the forest with desirable trees.

Site preparation

Removing undesirable vegetation or preparing a seedbed may not be needed if the site is clean enough. Site preparation is one of the most intensive, disturbing activities that must be done using BMPs to protect water and soil quality.

Depending on the soil type, soil moisture, geographic region and the type and the density of the weed population of the site, different methods can be used to clear the site. These include fire, herbicides, manual labor or heavy mechanical equipment.

Natural regeneration

This is the cheapest method to reproduce a stand. It relies on available seed, stump sprouts and existing seedlings to produce the new stand. Success depends on whether there is adequate seed, seedling or sprout supply; adequate moisture; a well-prepared seedbed; and control of competing vegetation. Careful planning is required to ensure success.

Artificial seeding

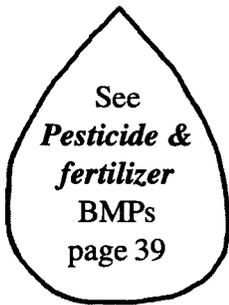
Seed can be sown by either spreading from ground-level or by broadcasting by air over the site or in spots. Success will be determined by many of the same factors that affect natural regeneration.

Tree planting

This lets you pick the type of tree (species) and the spacing of the seedlings. It will be successful if the selected species is/are well adapted to the site, of high quality, healthy and carefully planted. In rare instances, seedlings may need to be treated with insecticides or fungicides to protect from early death. Tree planting



may be done by hand or machine. Planting on the contour is advised to protect water quality.



Weed control

This can be done by hand, mechanical means or herbicides to control grasses, brush and annual or perennial weeds, which choke out or stunt the growth of seedlings. Extreme care must be used to avoid water contamination with pesticides.

Fertilization

If a soil test indicates a critical shortage of one or more nutrients, the best time to adjust fertility is at the time of the stand's establishment. Best management practices dictate that only the needed amount of fertilizer is applied and care is taken to prevent water pollution from fertilizer.

The middle-age stand

Your forest will be healthier and more productive if it is tended. Managing established intermediate stands includes manipulating: the stocking (number of trees per acre); species composition; and competition levels. Generally speaking, trees or weeds that do not contribute to your objectives for timber production, wildlife, aesthetic or recreational goals can be eliminated in favor of more desirable components in your stand.

Weeding

This is usually done in very young stands by hand, mechanical or chemical methods. Usually both brush and herbaceous weeds are not marketable, so are killed in place. As they rot, the recycled nutrients become valuable to your forest.

Release

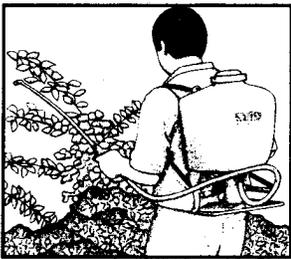
This is a form of weeding, but concentrates on removing the *overtopping* shade from desirable crop trees. It is not uncommon for hardwood sprouts to grow rapidly, quickly overtopping planted seedlings. Without release, crop tree seedlings' early growth can suffer, or they may die.

Thinning

Enough space is needed for the development of selected crop trees. Pre-commercial thinning removes small trees, which are not yet marketable. In older stands, thinning may produce some income from the removed trees.

Thinning is usually done in even-aged stands when the tree crowns become so dense the trees start to shade each other. Failure to thin will cause the growth rate and vigor of the crop trees to diminish. Also, unthinned stands are more vulnerable to disease and insect infestations and they will take longer to reach marketable size.

By allowing more sunlight to reach – not only the total crown of selected crop



Backpack sprayer



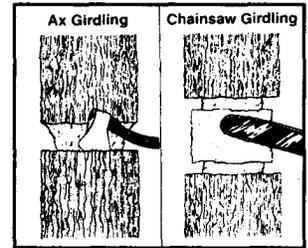
**Commercial
Thinning**

trees – but also the forest floor, low vegetation will grow and provide food and cover for many wildlife species.

Improvement cutting and timber stand improvement

Timber stand improvement (TSI) is a cutting or culling of undesirable species, usually in a sapling stand of less than 4-inches in diameter. By removing undesirable species and poorly formed, diseased or insect-infested trees, TSI improves the species composition and stand quality.

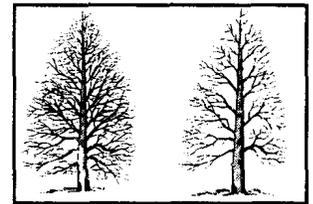
Trees may be ***girdled*** or killed in place by herbicide, or removed to use as firewood. Improvement cuttings are done in older stands to accomplish the same result, but the stems removed are sold.



Girdling

Pruning

Removing persistent low branches improves wood quality by keeping knots to the center of the tree and increases the percentage of valuable clear and knot-free wood production. Pruning is best done when branches are less than 2-inches in diameter and the stem diameter is less than 4-inches.



Pruning

Controlled or prescribed burning

This lowers the risk of wildfire, as well as the population of undesirable wood species. Many species, such as some pine are tolerant of `cool' fires under controlled conditions. It can be used to get rid of buildups of leaves, needles and other fuels that can ignite and cause a major wildfire, as well as removing less fire-tolerant tree and brush species.

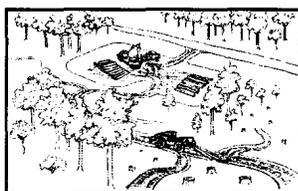
An added benefit to prescribed burning is the stimulation of many herbaceous species of plants that provide food and cover for certain wildlife species.

Fertilization

Unlike fertilization applied at establishment, intermediate stands need nitrogen to increase the growth and yield of the forest. When there is enough sunlight, water and other nutrients, trees – just like corn – will respond to nitrogen with larger, more productive foliage. To determine if this would be a cost-effective practice for use in your forest, it is best to talk to a professional forester.

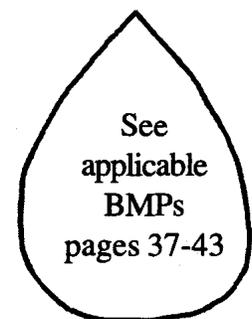
Harvesting the mature forest

Several options can be used that relate to your forest regeneration planning strategy. Actual removal of trees can be by hand or machine felling; moving (***skidding***) of the stems to a loading area (***deck***) by machine or livestock; and the loading and hauling of the cut timber to market.

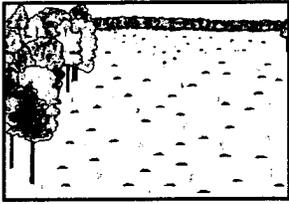


Deck

Timber harvesting, skidding and hauling on forest roads and trails are potential causes of erosion, soil degradation and sedimentation. With the assistance of



a professional forester, you can make a pre-harvest plan that will result in a good timber sale and harvest contract and adequate oversight of the process to minimize environmental impacts.



Clearcutting

Clearcutting

This removes the entire marketable portion of the stand in one cutting. It is the most efficient and easiest to administer and is appropriate for mature stands or where the stand is of poor quality and even-age regeneration is desired.

While clearcutting creates a drastic landscape change that some people object to, many valuable species must have full sunlight for regeneration. However BMPs dictate that it should not be done right next to streams or water bodies.



Seed tree

Seed tree

This method also produces an even-aged forest. It is similar to clearcutting, but four to 20 high quality seed producing trees are left per acre to naturally re-seed the site after harvest. It is crucial to plan the timing of the harvest to assure adequate seedfall. Planning is also required to remove the seed trees after regeneration, since loggers are reluctant to return where there are few trees left.

Risks include either not enough number of seeds or too many seeds, resulting in an under-stocked or overstocked stand.



Shelterwood

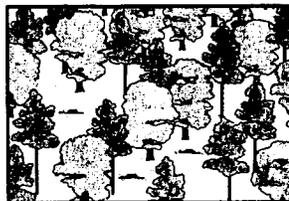
Shelterwood

More seed trees - 21 to 60 - are left per acre in this method, which can be described as a heavy seed tree harvest. This harvest is a preferred even-aged natural regeneration system for non-prolific seed producing species, and as a visually appealing system for hardwood and conifer species.

It provides an abundance of seed and shelter for seedlings, as well as residual shade to control weeds. Since there is a larger number of trees left, loggers are more willing to return and remove the shelter trees after regeneration is established, usually within three to five years.

Shelterwood with reserves

Also called deferment cuts, these selected trees are left to mature until they grow large enough to produce a valuable saw log.



Single tree

Selection

This system regenerates uneven-aged stands of shade tolerant tree species. **Single tree selection** removes scattered individual trees, while **group selection** removes scattered groups of trees to create openings of 1/40 to 1/2 acre in size.



Group tree

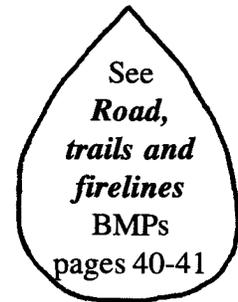
Selective harvest doesn't work with valuable shade intolerant or moderately shade tolerant species, including many pine and quality

hardwoods. While this method removes financially mature and high risk trees, care must be taken to not just remove the biggest and best trees, leaving poor quality trees behind. This practice, *'high grading'*, results in a badly degraded forest with little timber value.

There are many advantages to selective harvest—frequent income and visual attractiveness. A major disadvantage is that it requires more roads and trails, which greatly increases the potential for erosion and sedimentation.

Other considerations

Wildfire, insects, diseases and overgrazing are destructive to your forest. Frequent visits by you and a professional forester are recommended to ensure firebreaks are maintained, provide evaluation of your forest's health and vigor, and protect your investment.



Landowner Profile

Bob and Audrey are in their early 60s and own 250 acres of woodland on which they live. They are not physically able to do manual work and need income from their forest to offset management expenses and to supplement their fixed retirement income. Their three children will inherit the family forest.

They are very proud of their forest and are environmentally responsible. They want their forest management activities to be compatible with wildlife management, personal recreation and soil and water protection.

Long-term goals

- To leave the forest in better condition than when we received it
- To have a productive forest which generates income while protecting water quality and soil productivity
- To provide good habitat for quail, rabbits and deer
- To maintain a system of trails and roads which support the forest operation and enhances hiking and other outdoor activities

Management practices

- Improve the attractiveness of the forest edge by thinning large, poorly formed trees during the next harvest
- Thin one-half of the large sawtimber in the mature pine stands to generate income and improve the growth and vigor of future crop trees.
- Improve recreational access and water quality by reseeding logging roads and improving stream crossings
- Create more habitat for small game – particularly quail and rabbits – by controlled burning in alternate years, edge mowing and timber thinning.

Assessing your management plan

	Most desirable	Desirable	Least desirable
<i>Using BMPs</i>	Forestry Best Management Practices (BMPs) are carefully selected to protect water quality during all forest management activities. BMPs are included in the written forest management plan.	BMPs are included on an as-needed basis where believed necessary, but not included in the written plan.	BMPs are not considered during forest management activities.
<i>Forest health</i>	Recommended forest management activities produce a healthy, vigorous forest which meets goals for timber production, while enhancing wildlife, water quality, recreational and aesthetic goals.	The forest is not being managed for timber production, but meets goals for forest health, wildlife, water quality, recreation and aesthetics.	The forest is not being managed. As a result, forest health is declining and other goals are not being accomplished.
<i>Tree species</i>	Planned and implemented forest establishment practices result in adequate populations of forest trees suited to the area. Selected tree species meets goals for timber, wildlife, water quality, recreation and aesthetics.	Forest is adequately populated/stocked, but the species mix is not ideal to meet all forest management goals.	Forest is inadequately populated/stocked with species that match soil conditions. Species don't meet management objectives.

	Most desirable	Desirable	Least desirable
<i>Tree population/ stocking</i>	Appropriate intermediate stand management practices (weeding, release, thinning, timber stand improvement, pruning, controlled burning, fertilization) manipulate the stocking, species composition and competition levels within management goals.	Established forest meets less than all management goals and needs some intermediate stand forest management practices.	Forest is overstocked or under-stocked, lacks vigor, is not of ideal species composition, does not contribute to forest management goals or sustain a healthy forest.
<i>Harvesting</i>	Timber harvests (by clearcut, seed tree, shelterwood, irregular shelterwood or selection method) are planned and conducted using BMPs to protect water quality; meet sunlight and site requirements of tree species; are monitored by a professional forester.	Timber harvests are planned and conducted using BMPs without the assistance of a professional forester or other natural resources professional.	BMPs are not used. Timber buyer or logger plans and implements the harvest with no land owner or natural resources professional oversight.

Determining your wildlife management interests

Think of your own operation as you consider these concepts.

- 1. Do you want to improve wildlife diversity? Yes No N/A
- 2. Do you want to attract specific wildlife species (game, songbirds, etc.)? Yes No N/A
- 3. Do you want to hunt in your forest? Yes No N/A
- 4. Do you want others to hunt for fee or lease in your forest? Yes No N/A
- 5. Do you want to provide endangered species protection? Yes No N/A

Managing for wildlife habitat

Wildlife and forest management are not only compatible, but are interrelated. Developing an active management plan allows you to place a special emphasis on wildlife species you are interested in, while improving forest productivity and increasing *bio-diversity*, beauty and personal enjoyment.

Linking the forest and wildlife

Wildlife have four basic requirements: food, cover, water and space. Different wildlife species require different stages of forest growth to meet these needs. Several aspects of your property determine how many species can live and thrive in your forest - plant cover, harvest operations, water resources and topography.

Your forest may have streams, swamps, rivers, ponds, and areas that adjoin fields, pastures, roads and other openings. Even managing these "*edges*" of your forest is crucial to abundant populations of some wildlife species. The relationship between vegetation management and wildlife species habitat is well established. Understanding relationships is the first step in determining how your own forest can be managed to promote the wildlife species you want to attract.

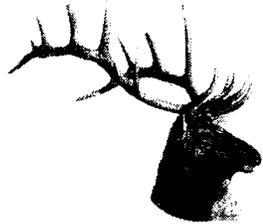
For example, quail and partridge feed on seeds of annual and perennial weeds and grasses that occur in young stands of timbers, where sunlight reaches the forest floor. This is *early successional habitat*. Pileated woodpeckers depend on dead and rotting trees found in mature forests. This is *late successional habitat*. Still other wildlife prefer *mid-successional habitat*.

Management practices impacts on wildlife

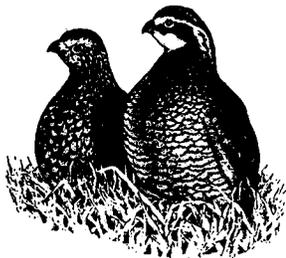
Even-aged forests

Young, even-aged forests benefit early successional wildlife species by encouraging *forbs*, grasses and brush. The size and shape of harvest areas is important. There are several ways you can improve the value of even-aged harvest/regeneration areas for wildlife.

- Small harvest areas (up to 50 acres) scattered over the landscape provide more edge and landscape diversity
- Irregularly shaped areas provide more edge than square or round areas
- Separating harvest areas with 100-foot (or wider) areas of uncut timber enhances diversity of habitats and provides travel corridors between fragmented habitats
- Buffer strips on streams protect water quality, but



Bear



Quail



Wood duck



Great Horned owl

are also critical wildlife corridors

- * Islands of uncut timber within harvest areas will enhance wildlife habitat by leaving *mast* (food) producing trees. Oaks, hickories, dogwoods, persimmons and berry producing shrubs are excellent hard and soft mast species to leave

Uneven-aged forests

This method simulates minor natural disturbances such as *windthrow*, insect and disease mortality, or spot fires. Mid and late successional habitat types are maintained with single tree selection. Group selection provides pockets of early-successional vegetation interspersed within the mid and late successional habitat.



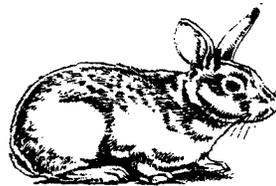
Screech Owl

Thinning

Thinning stands allows more sunlight to reach the forest floor resulting in more vigorous understory growth. This practice sets back succession at the ground level, yet leaves some mid and late successional trees in the overstory.

Controlled or prescribed burning

This controls woody vegetation, releases nutrients and increases seed germination and herbaceous vegetation – including legumes and grasses. Controlled burning in stands of fire resistant tree species sets back succession just as a raging wildfire would do, but without the damage to potential timber crop trees. Burning cannot be used in many regions and certain types of forests.



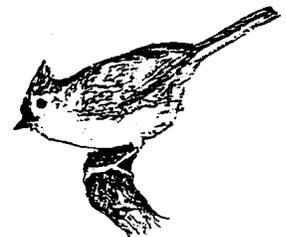
Cottontail rabbit

Very light, cool burns are now being used in hardwood forests, particularly to favor oaks which produce important hard mast. Before conducting any burn, consult a professional forester.

Den trees and mast trees

These trees are critically important for food and cover. Den trees have one or more cavities used by birds, reptiles and mammals for roosting or nesting. As a rule, two to four den trees per acre should be left in any thinned or harvested area.

Small den trees might house chickadees, woodpeckers, screech owls or flying squirrels. Large den trees are used by squirrels, raccoons, wood ducks and occasionally, even a bear. Mast trees produce fruits and nuts used by wildlife for food. Hickory, oaks, beech, persimmon, serviceberry, black gum, hollies, hawthorns, dogwoods, grapevines and many other species are valuable to wildlife. The ideal time to select and mark den and mast trees is *before* you thin or harvest your timber.



a songbird

See
Site
preparation &
regeneration
BMPs
page 42

Road construction and maintenance

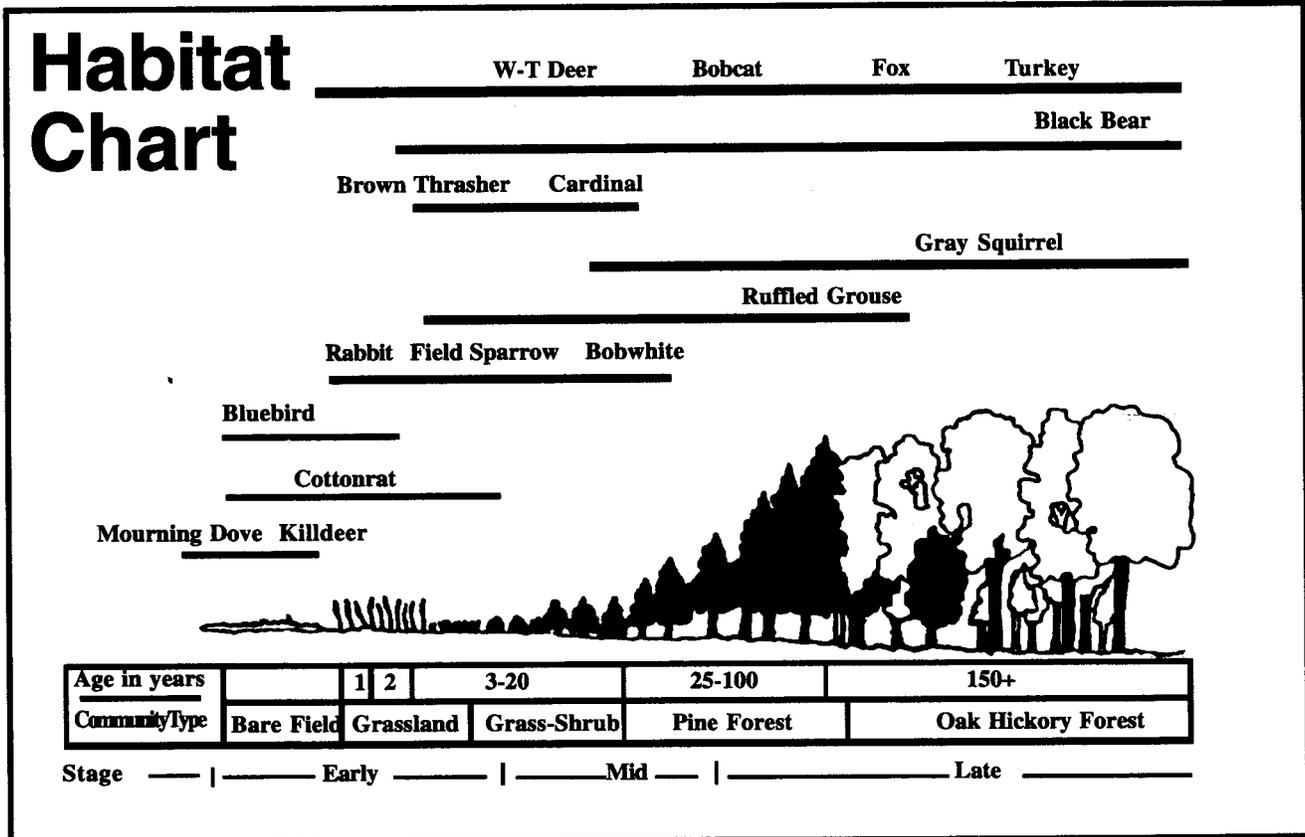
Access to your property is essential and can provide multiple benefits. Proper location, design and construction increases the value and enjoyment of your forest. One practice that benefits wildlife is *'daylighting.'* In this process, trees shading the road surface are removed. Sunlight on the road surface enhances the growth and proliferation of grasses and weeds which are food plants for wildlife. Insects attracted to the vegetation are also an important food source for many wildlife species.

Restricting vehicle traffic also increases wildlife use, particularly during nesting season.

Establishing ground cover or wildlife food plots

Along roads, forest edges, logging decks, in created openings, food and ground cover vegetation controls erosion, improves water quality and can enhance wildlife food and cover.

Seeding and establishment recommendations vary widely depending on geographic region, soil type, moisture availability and fertility. Successful plantings require soil testing, fertilization, adequate seedbed preparation and planting at the appropriate time. Most ground covers require maintenance by mowing, discing, burning, fertilization or liming. Consult a natural resources professional for specific recommendations for your area.



Landowner Profile

Eric is single and in his late 30s. He, his sister and two brothers inherited their 150-acre, non-working farm from their father. While there is a sentimental attachment to the property, it will eventually be subdivided and sold.

Currently all four siblings live several hours away, although Eric comes home most weekends and has primary responsibilities for management. He enjoys hunting deer and game birds (including turkeys and pheasants), fishing, cutting firewood for the farmhouse and friends, and riding his four-wheeler around the property. His siblings enjoy the quiet beauty and solitude of the property.

It is mostly wooded hills, but also a large meadow with a high quality trout stream running through it, apple orchards, berry patches and a ridge that was formerly a hay field that has a spectacular view of many miles. One field adjacent to the meadow is rented out to raise corn.

Long-term goals

- To maintain the forest as good habitat for deer and game birds
- To have a productive forest which generates enough income to pay property taxes and general maintenance while protecting water quality
- To maintain a system of trails and paths which enhances hunting, hiking, four-wheeling and other outdoor activities

Management practices

- Improve the attractiveness of the forest edge by thinning large, poorly formed trees and using them for firewood
- Thin one-half of the mature hardwood stands to generate income
- Improve recreational access by keeping paths and trails daylighted and building bridges to protect water quality

Assessing your wildlife habitat management

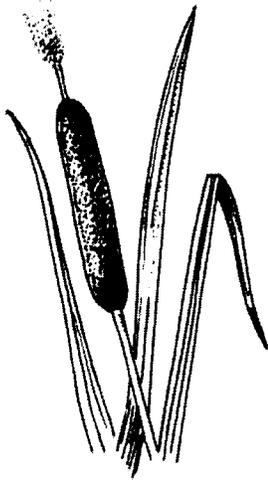
	Most desirable	Desirable	Least desirable
<i>Habitat</i>	Forest management plan prescribes practices, which are implemented to create ideal habitat (food, cover, water and space) for the desired species.	Forest is managed to protect some habitat components of desired species.	Wildlife habitat protection or enhancement is not addressed in a plan or not implemented.
<i>Young even-aged habitat</i>	Young even-aged stands are small, scattered and irregularly shaped to provide maximum edge and are separated by uncut areas bordered by stream buffer strips where needed. Island of uncut timber provide mast.	Young even-aged stands are planned to provide some habitat requirements.	Young even-aged stands are large (more than 120 acres), square or rectangular, and lack uncut areas or buffers.
<i>Intermediate and older stands</i>	Intermediate and older stands are improved for habitat by thinning, controlled burning, and den and/or mast tree protection.	Some level of stand improvement is used in intermediate and older stand to improve habitat.	Intermediate and older stands are not managed to create habitat diversity or protect den and mast trees.
<i>Roads, trails and openings</i>	Roads, trails and openings are daylighted; seeded to vegetation agreeable to wildlife.	Roads, trails and openings are seeded.	Roads, trails and openings are bare, eroding and provide no food or cover for wildlife.

Determining your interest in recreational and aesthetic management

Think of your own operation as you consider these concepts.

1. Do you want to bird watch?	Yes	No	N/A
2. Do you want to ride horseback?	Yes	No	N/A
3. Do you want to bike or hike on trails?	Yes	No	N/A
4. Do you want to cross-country ski?	Yes	No	N/A
5. Do you want to camp?	Yes	No	N/A
6. Do you want to fish?	Yes	No	N/A
7. Do you want to boat?	Yes	No	N/A
8. Do you want to harvest berries, etc., in your forest?	Yes	No	N/A
9. Do you want flowering trees?	Yes	No	N/A
10. Do you want a park-like appearance?	Yes	No	N/A
11. Do you want to observe fall color?	Yes	No	N/A
12. Do you have historic or unique areas in your forest?	Yes	No	N/A
13. Do you want to allow others to use your forest?	Yes	No	N/A

Recreation and aesthetics



Cattails

Many landowners do not realize that they can simultaneously manage their forest for profit, wildlife habitat, investment, recreation and beauty. In fact, properly planned forestry activities can enhance visual appearance, improve recreational opportunities and sustain and increase wildlife populations.

Enhancing visual appearance

Integrating forest management for scenic beauty and diversity can be viewed as landscaping on a grand scale. It is the arrangement of sizes, colors, textures and form across your forest.

Protecting, shaping and creating open spaces

It is preferable to protect and manage existing openings rather than to create new openings from scratch. However, large tracts of similar age or species can be made more diverse by creating openings. They can enhance views, improve wildlife habitat and increase plant diversity.

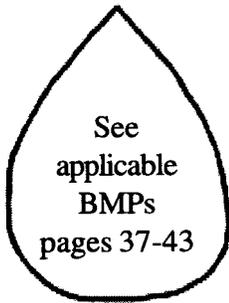
Maintenance activities include:

- Mechanical clearing: periodically mowing or discing strips on an alternating two to three year cycle keeps woody vegetation in check. However, mowing should be restricted in the spring to allow ground nesting wildlife to rear their young without disturbance
- Herbicide control: using selective herbicides to maintain the species composition of the opening. A legally-labeled, safe and effective herbicide that is known to control the targeted species should be selected
- Controlled burning: prescribed or controlled burnings should be conducted at two to seven year intervals, based on a cycle compatible with wildlife, aesthetics and timber objectives
- Farming: while farming techniques maintain fields and open spaces, edge treatments can be modified or intensified to meet wildlife, aesthetic and diversity objectives
- Timber harvesting: thinning young trees or harvesting mature trees creates openings and dramatically changes the forest landscape. Your plan should lay out the timber sale area, log decks, skid trails, roads and accumulation areas to match your aesthetic objectives
- Controlled grazing: to control growth in pastures and fenced clearings, supervised livestock grazing can be used

Managing the forest edge

Minimizing the contrast between the opening and the forest is the primary goal in managing aesthetics on the forest edge. It defines the shape and texture of the forest setting. A soft transition from the low vegetation of the opening to shrubs and then to taller trees is desired. Considerations include:

- ◆ Create or maintain wavy edges with indentations to improve visual diversity
- ◆ Introduce irregularity to straight forest edges



Songbird

- ◆ Establish or maintain irregular outlying clumps of trees to create a natural appearance of the forest edge
- ◆ Favor a mixture of hardwood and conifer species for variety of the edge
- ◆ Retain or establish trees and shrubs of varied shape, form, flower or foliage color

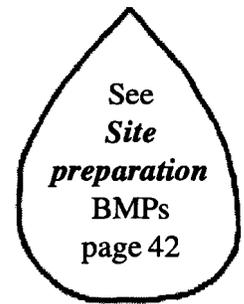


Reforestation

These activities set the direction, shape and appearance of the ensuing stand. Reforestation is an opportunity to establish attractive, diverse forest edges. Alignment and spacing of planted trees and the intensity of site preparation and competition control create different looks.

Practices include:

- ★ Vary site preparation techniques to favor species diversity
- ★ Plant seedlings in rows that follow the natural contour of the land
- ★ Mix the species composition where practical
- ★ Vary planting density, leave openings and opt for mixed stands, especially where practical from an economic and soil productivity standpoint
- ★ Establish or protect streamside management zones to enhance water quality, provide wildlife habitat and scenic diversity



Controlled or prescribed burning

Burning is an inexpensive tool to manage some thick barked fire-tolerant tree species. It is an often overlooked opportunity to impact the visual diversity of the landscape.

Controlled burning creates an open stand and stimulates the growth of many fire-enhanced flowers and legumes. With aesthetics as a consideration:

- ◇ Leave unburned islands around critical habitat or highly-valued areas
- ◇ Level and re-seed plowed *firelines* with scenic and wildlife-friendly plant mixtures
- ◇ Mimic a natural transition or edge around the burned area by curving the firelines

Improving recreational opportunities

Many people enjoy hiking, bird watching, hunting, camping, picnicking, picking berries and just being in the great outdoors, but the majority of land suitable for outdoor recreation is privately owned. Some owners open their lands up to the public, while others restrict the use of their land.

Controlling public access

This can be managed in several ways.

Open public use requires no effort. Preferably, you should require verbal or written permission from recreationists, but this is difficult to enforce. Uncontrolled public use often decreases the quality of recreational opportunities available to you or your friends.



Road closed

Sample lease agreements are available through your county Cooperative Extension Service office



Hiking

Restrict access to family, friends, neighbors and responsible recreationists who ask permission. This requires that the land be posted and/or that you issue guest permits. The obvious advantages of posting and granting written permission are better control of activities on your land and reduced abuse of your property.

Lease your land for recreational access. Landowners who lease recreational rights usually charge at least enough to pay their property taxes. Often the lessee posts the land, polices trespassers, maintains roads, trails and gates and picks up litter.



Permit daily use for a fee. Daily written permits are issued by the owner. This is often used by owners of hunting and fishing preserves, campgrounds and waterfowl impoundments.

Form a cooperative with neighbors. Landowner cooperatives build a sense of community among neighbors with similar recreational goals. The acres entered into the cooperative can be for personal enjoyment or made available to the public through one of the methods above.

Constructing roads and trails

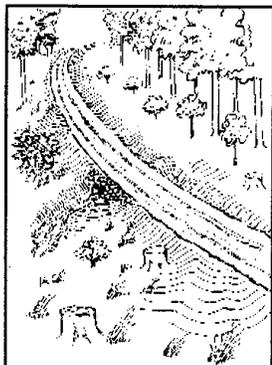
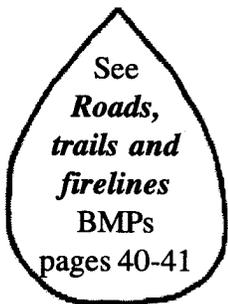
Correct construction of road and trails is essential for timber, wildlife, scenic beauty or recreation. Roads should be built with proper drainage and adequate slope and grade to minimize erosion and maintenance. Roads and trails should be posted and gated to deter trespassing.

Roads and trails provide access for harvesting timber, monitoring the growth and health of your forest, exercising, recreation, education and observing nature. Well planned roads or trails provide low-cost access and require minimal maintenance.

The first step is to pre-plan the road or trail using aerial photographs, topographic maps, field maps, and personal knowledge of the property. Try to avoid areas with wet soils; frequent flooding; unstable or highly erosive soils; steep slopes; hazards, such as cliffs and ledges; locations requiring expensive bridges and culverts; environmentally sensitive areas; and high maintenance areas, such as heavily vegetated areas requiring constant mowing or pruning.

For best results:

- ◆ Manage roadsides with perennial vegetation to enhance wildlife, visual quality and erosion prevention
- ◆ Plan road placement to minimize the number and extent of roads and skid trails
- ◆ Keep slopes below 10 percent grade to minimize erosion and maintenance
- ◆ Expand openings adjacent to roads (*daylighting*) to enhance plant diversity and for rapid drying of the road surface
- ◆ Place roads and trails on the contour, taking advantage of natural curves



Constructing roads

within the
landscape

- ◆ Develop narrow paths into environmentally sensitive areas, instead of roads or major trails
- ◆ Surface heavily used roads with low-cost native or natural materials, such as wood chips, bark or mulch
- ◆ Vary the direction of the road or trail for variety, points of interpretive interest and to maximize users' exposure to natural features, water bodies and vegetative changes.
- ◆ Provide trail markers, benches, and picnic tables to increase the enjoyment of recreational trails and roads.



Scenic beauty and recreational opportunities can be enhanced by good forest management. Public access to your property can be controlled by providing a well-designed road and trail system.

Landowner Profile

Lil and Mike are in their early 30s and live 140 miles from the 40 acres of forest land they own. It is used as a summer residence and for recreational enjoyment - hiking, biking and wildlife observation.

They are in good health and can do much of the physical work required to maintain the property. Financially, they are comfortable and able to hire labor to do tasks that require specialized equipment or are too time consuming. Currently, they have no children.

Long-term goals:

- A park-like property
- Abundant wildlife
- Maintaining a healthy forest through careful, periodic harvesting
- Protection of a high-quality trout stream, which runs through the property

Management practices:

- Build a half-mile exercise and nature trail
- Plant dogwoods, native shrubs and wildflowers on field border to improve property's beauty
- Establish wildlife cover and food plots for quail, rabbits and turkey broods in several existing openings in the forest
- Annually target one acre for removal of dead and dying trees for firewood
- Periodically conduct a selective timber harvest over the entire forest to produce income and create conditions for forest regeneration.

Assessing recreation and aesthetics management

	Most desirable	Desirable	Least desirable
<i>Planning for the visual</i>	Written management plan uses practices (visual enhancement, reforestation, controlled burning, access, roads and trails) which enhance recreational and aesthetic goals.	Some practices are used which protect the visual and recreational values of the property.	Visual and recreational values are not linked to your management activities.
<i>Enhancing the visual</i>	Visual appearance of forest is enhanced by creating openings and edges; reforesting with attractive species and planting designs; burning stands to stimulate wildflowers.	Some visual appearances are protected during activities.	Visual appearance is not considered, protected or enhanced during management activities.
<i>Public Access</i>	Public access is controlled by: legally posting the land, requiring written permission; by leasing; or daily permit user fees.	Public access is controlled by legally posting the land.	Access is uncontrolled.
<i>Roads and trails</i>	Roads and trails for recreation are built using BMPs; provide compatible access for other management activities (timber harvesting, wildlife, hunting, etc.).	Roads and trails are constructed for timber harvesting using BMPs.	Roads and trails are not built using BMPs.

Determining --your level of water quality protection

Think of your own-operation as you consider these concepts.

1. Do you install road stabilization practices?	Yes	No	N/A
2. Do you carefully plan and select BMPs before site disturbance?	Yes	No	N/A
3. Do you leave protective buffer strips next to streams and water bodies?	Yes	No	N/A
4. Do you establish vegetative cover on bare areas?	Yes	No	N/A
5. Do you restrict cattle from woodlots and streamside areas?	Yes	No	N/A
6. Do you test your soil to determine fertilizer rates?	Yes	No	N/A
7. Do you protect water quality when constructing stream crossings?	Yes	No	N/A
8. Do you routinely inspect roads, stream crossings and BMPs?	Yes	No	N/A

Using BMPs to protect - water quality

The role of forests in stabilizing soils and protecting watersheds is universally recognized. Best Management Practices (BMPs) by definition are practical and efficient technologies to protect water quality. When a forest is disturbed the potential for erosion and degrading water quality increases. Water quality is affected by sediment levels, water temperature, streamflow, nutrient levels, dissolved oxygen levels. BMPs can minimize, eliminate or reverse water quality impacts.

The following forest management practices require BMPs regardless of whether the purpose is for timber, wildlife, recreation, aesthetic or other reasons:

- Road and trail construction, maintenance and use
- Timber harvesting and skidding logs to loading areas
- Mechanical equipment operation
- Controlled burning, particularly fireline construction
- Site preparation by hand, chemical or mechanical methods
- Fertilizer application, particularly near water bodies
- Minor drainage alterations
- Pesticide applications

Disturbing the soil includes activities such as timber harvesting, site preparation, fertilizer or pesticide application, controlled burning, road and trail construction or maintenance, planting food for wildlife, etc. BMPs should be used.

Planning Phase

The BMPs you select to manage your property will be a unique mix. Prior to beginning any activities, you need to walk your property and identify such things as restrictive/sensitive zones around water bodies and streams; soil types; areas of steep slopes; unique natural areas; and wildlife habitats.

Pre-harvest planning

Roads, trail and log decks should be kept at the minimum number to allow efficient timber harvesting while protecting water quality. Determine what type of logging equipment will have the least environmental impact on your forest.

Site preparation and regeneration planning

Select the practice(s) which accomplish the required vegetation control and seedbed preparation with the minimum soil/site impact.

Fertilizer or pesticide application planning

From a planning standpoint, learn the chemical characteristics, topography, soils, drainage, and other factors that might be important for preventing water pollution during application.

Roads, trails and firelines planning

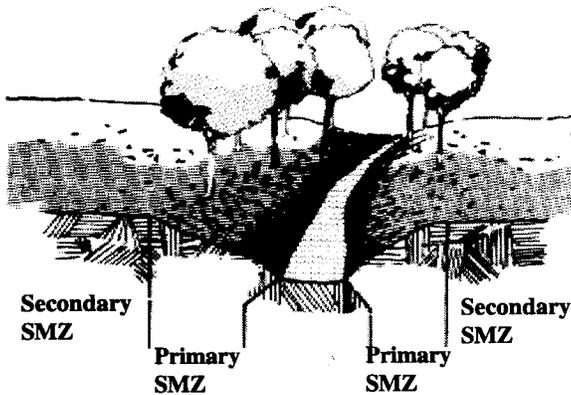
Roads, trails and firelines are the major source of *sediment* from forestry operations. A well-planned road, trail and fireline system minimizes the number of stream crossings, fits the topography of the site, locates the roads, trails and firelines outside of critical streamside areas and uses appropriate drainage and water control structures. Hand constructed firelines should be used on steep terrain.

Operational BMPs

Streamside Management Zones (SMZ)

An SMZ is an area or zone along an intermittent or perennial stream (which flows more than 30 percent of the year) where extra precaution is used during activity.

Its purpose is to slow and spread surface water flow, and trap and filter *suspended sediments* before they reach the stream channel. SMZs also provide stream shade and function as buffers to filter and capture fertilizers, pesticides, and other potential pollutants.



The recommended width of an SMZ will vary from 50 to 200 feet depending on the stream, the soils, and the topography. Limited tree harvesting is allowed in the SMZ if trees can be felled away from the stream channel and removed with extreme care – leaving the forest floor and ground cover vegetation largely undisturbed. Heavy equipment use is discouraged in the SMZ.

Effective SMZ's have the following characteristics:

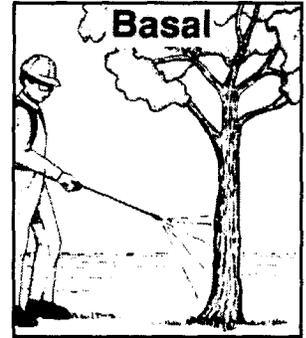
- * Wide enough to capture and filter soil and other pollutants before they reach the stream or water body
- * Has no more than 40 percent bare ground, evenly distributed
- * Wheeled or tracked-type equipment is excluded
- * Enough shade is retained to maintain stream shade and temperature –

SMZ width table

Type of stream or water body	Percent slope of adjacent lands				
	0-5	6-10	11-20	21-45	46+
<i>Intermittent</i>	50	50	50	50	50
<i>Perennial</i>	50	50	50	50	50
<i>Perennial, trout waters</i>	50	66	75	100	125
<i>Public water supplies (streams and reservoirs)</i>	50	100	150	150	200

normally 75 percent of the pre-harvest level

- * Broadcast pesticide or fertilizer application is prohibited
- * Controlled burning is not allowed
- * Chemicals, hazardous wastes or fuels are stored outside the SMZ
- * Roads and trails are located outside of the SMZ, except where stream crossings are essential, or where physical or topographic restrictions require the placement of a road in the SMZ
- * Bare soil areas are promptly re-planted or mulched
- * Sawmills, log storage areas and log decks are not located inside the SMZ



Application method

BMPs for fertilizer and pesticide application

Assess the rates, timings and application technologies (delivering the right amount of chemical to the right place at the right time) for optimum effectiveness, and minimal water quality impact.

Applicable BMPs for fertilizers include:

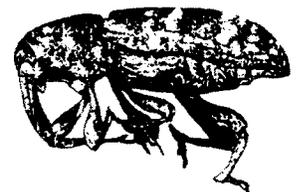
- + Perform a soil test to determine fertilizer needs
- + Carefully apply fertilizer, avoiding direct and indirect entry of fertilizer into streams or water bodies.

Applicable BMPs for *pesticides* (herbicides, insecticides, fungicides and rodenticides) include:

- ❖ Apply only according to ***label directions***, using the minimal rate to accomplish the desired result
- ❖ Carefully apply pesticides, avoiding direct and indirect entry of pesticides into streams or water bodies
- ❖ Do not broadcast apply in SMZs; utilize ***injection, stump treatment*** or ***directed spray*** in areas immediately adjacent to open water
- ❖ Comply with applicable federal and state regulations for buffer zones/filters strips, such as around roads, schools, residences, etc.
- ❖ Mix chemicals and clean tanks only where spills will not enter streams, lakes or ponds
- ❖ Maintain and adjust application equipment to prevent spillage and excessive application
- ❖ If a spill should occur, immediately contain it (*Note: some spills require immediate notification of appropriate authorities*)
- ❖ Dispose of containers according to label recommendations and applicable state laws
- ❖ If hiring a custom applicator, require a written contract and proof of appropriate licenses, insurance and bonding of the contractor
- ❖ Aerial application will cease when 1) wind speeds exceed six miles per hour; 2) temperature reaches 90 degrees F; 3) in advance of/or during unstable weather patterns
- ❖ Aerial and ground equipment and techniques used are designed to assure maximum control of the spray swath (width) with minimal drift



Treating a stump



Weevil

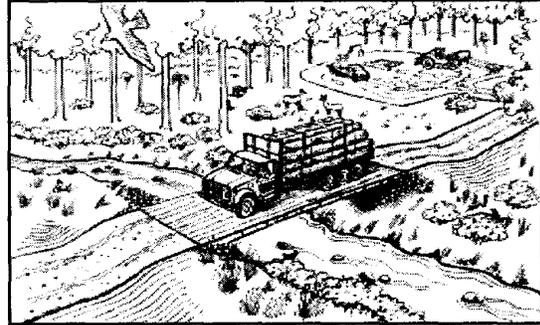
BMPs for roads, trails and firelines

A road system, temporary or permanent, provides access for timber harvesting and management activities, recreation or wildlife enjoyment. Improper road construction and maintenance is the major cause of erosion and sediment from forestry activities.

Consult a professional forester when selecting the techniques to be used on your property.

Well-designed road and trail systems have the following characteristics:

- Roads should be allowed to stabilize/settle before use
- Roads should be as narrow as possible
- Roads should be on gentle slopes, avoiding flood plains when possible
- Roads should be placed outside of SMZs
- Roads should cross streams at right angles using bridges, culverts or constructed fords
- Roads should be daylighted to maximize drying and promote vegetation
- Water should be effectively controlled through diversion or drainage
- Frequent inspection and maintenance



Well-designed road

Planning will identify the specific BMPs that will assure that your road and trail system is water quality friendly.

Road BMPs include:

Water Turnouts

Water turnouts are ditches, trenches or waterways that divert water away from the road surface. They carry water into an undisturbed area where the flow slows and sediments are filtered and trapped.



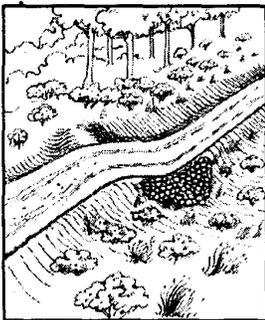
Water turnout

Cross-road drainage by culvert

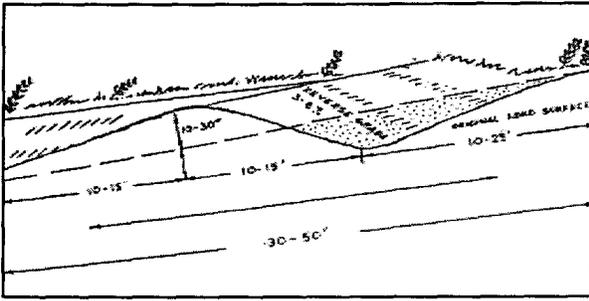
Cross-road drainage is the transfer of water across or under the road, usually by a round culvert. It is used on any road or trail where storm water runoff, ditch-to-ditch transfer, slope or overland seepage might cause erosion. Pipe culverts 14 inches or larger are normally installed on permanent roads and trails.

Broad-based drainage dip

Broad-based dips create a reverse uphill slope in a road surface, effectively slowing and moving water off the road surface into an undisturbed adjacent area.



Broad-based drainage dip



Rolling dip

dip provides cross drainage and slows water flow and holds up better under heavy traffic.

Water bars

Water bars are a combination mound/trench built into a road or trail and sloped slightly downslope to move water off the road surface into an undisturbed, adjacent area. Water bars are usually installed after the road is no longer used.



Water bar

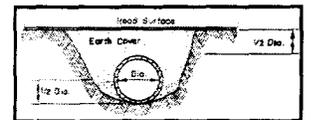
Stream-crossing BMPs

Forest harvesting and management activities often require crossing *intermittent* or *perennial* streams. Plan to use as few crossings as possible. Road and trail approaches to stream crossings must have good surface drainage that turns water into undisturbed areas away from the stream course.

Streams may be crossed in several acceptable ways:

Pipe culverts

Considered expensive, they are usually used on permanent roads. However, following use on temporary roads and trails, they can be carefully removed to minimize soil disturbance. It is important that culverts be of adequate diameter to handle above-normal water flows; long enough to extend slightly upstream and downstream from the crossing, and be installed with a 2-4 percent downstream angle to aid in flushing out debris. A single culvert, sized to handle the water flow, is less likely to clog than several smaller stacked culverts.

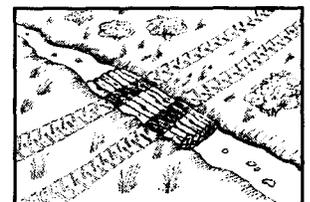


Pipe culvert

Backfill material should be free of debris and the culvert should be covered with fill to a depth of one-half the diameter of the culvert, or a minimum of one foot.

Bridges

Temporary or permanent, there are numerous styles of bridges used to cross streams where culverts won't handle the stream flow. Bridges should be built to handle heavy loads using the proper type, size and materials. Professionals can help design your bridge. Stream channel and stream banks should be protected from erosion during construction by continual mulching or vegetated ground cover. Abutments and headwalls may be needed to handle flood conditions and stabilize the approaches to the crossing area. Use vegetation or ground cover to stabilize road approaches and road banks.



Temporary log bridge



Ford

Fords

For temporary or minimum-use crossings, fords should only be used where the stream has an applied or existing firm base. Riprap stone, brush, poles or other materials stabilize the road or trail approach to a ford, and the streambed to protect the stream channel. Stone is usually not removed after road use ceases, but poles, brush and other materials are.

Site preparation and regeneration BMPs

The condition of the tract, the desired species you wish to regenerate and environmental concerns including water quality need to be addressed. SMZs, road layout and design, equipment limitations, and management options should be planned in detail and documented on the ground and/or on a map. There are numerous options for site preparation including bulldozers (**chopping, discing, rake and pile, bedding**, furrowing, scalping), hand tools, herbicides and fire. Site preparation techniques which create bare soil conditions increase the risk of erosion.

Site prep and regeneration BMPs include:

- Use the least site disturbing activity to accomplish the planned result
- A SMZ should be maintained on all perennial and intermittent streams
- Soil disturbance in **ephemeral** (flows less than 30% of the year) stream channels should be minimized or avoided
- On steep terrain and/or on fragile soils, herbicides, controlled fire or manual site preparation is preferred over heavy equipment
- No debris, oil or other waste should be placed in or close to streams
- Machine planting of trees should be done on the contour. Steep slopes should be hand planted

Permanent stabilization

At the conclusion of any silvicultural activity:

- * All temporary stream crossings should be carefully removed
- * Roads, trails and firelines should be inspected to be certain that all water control structures are in place and functional
- * All toxic waste, tires, oil and trash should be removed and properly disposed
- * Mulch, brush or vegetative cover should be provided on bare soil areas to stabilize the area and reduce the potential for surface runoff and accelerated erosion

Use common sense and applicable BMPs to prevent water quality degradation in the project close-out phase.

Your local Cooperative Extension, Natural Resource Conservation Service, State Forest Service or Wildlife Agency office can give you detailed recommendations for seed bed preparation, liming, mulch and fertilizer recommendations, and seed mixtures to use for permanent stabilization in your area.

Parting advice

Whether you're managing for timber, wildlife, aesthetics or recreation, BMPs are common sense practices that apply to any site disturbing activity.

If roads or trails are built for recreation, use of road BMPs will protect water quality. If a site is prepared for the establishment of wildlife food plots or timber, BMPs will prevent erosion and sedimentation, protecting water quality.

The key is to plan for the protection of water quality ***BEFORE*** the activity begins and follow through with the use of appropriate Best Management Practices.

Assessing BMP management to protect water quality

	Most desirable	Desirable	Least desirable
<i>Pre-planning</i>	An overall written management plan is created and used prior to all activities, such as timber harvesting; site preparation; fertilizer or pesticide application; road, trail or fireline construction. All water quality BMPs are used. A natural resource professional is consulted.	A written management plan is created and used prior to all activities, such as timber harvesting; site preparation; fertilizer or pesticide application; road, trail or fireline construction.	There is no written management plan created or used prior to all activities.
<i>Streamside management zone</i>	Streamside management zones (SMZs) are identified and marked on the ground with the help of a natural resources professional. SMZs are wide enough to provide water quality protection and adequate stream shade. Harvesting in the SW is limited (and only when removal doesn't threaten water quality). Heavy equipment is excluded from SMZs. No broadcast fertilizer or pesticide application, controlled burning, chemical storage, or roads and trails are allowed in the SMZ.	N/A	Adequate SMZs are not delineated or marked on the ground. SMZ is not protected from harvesting, heavy equipment, broadcast fertilizer or pesticide application, controlled burning, chemical storage, roads and trails.

	Most desirable	Desirable	Least desirable
<i>Fertilizer and pesticide application</i>	Fertilizers are applied based on soil test results. Pesticides are used at the minimum rate to accomplish the objective. Extreme care is taken to avoid broadcast application in SMZs, or direct application to streams or other water bodies. Professional advice is sought.	N/A	Professional advice is not sought. BMPs are not used to protect water quality and other environmental resources.
<i>Roads, trails and firelines</i>	All BMPs required to prevent erosion from roads, trails and firelines and protect water quality are identified during the design and locating phase of building, which is done in consultation with a natural resources professional. All BMPs are installed on existing roads, trails and firelines to stop erosion. Roads, trails and firelines are frequently inspected, with BMP structures maintained.	N/A	Advice from a natural resources professional is not sought. BMPs are not used in installing new roads, trails and firelines or on existing ones. Existing roads, trails and firelines are eroding and there is no inspection or maintenance.
<i>Stream crossings</i>	Stream crossings are avoided unless absolutely necessary. BMPs are installed for all temporary and permanent culverts, bridges and fords. Advice from a natural resources professional is sought in designing and maintaining water-friendly stream crossings.	N/A	BMPs are not being used. Active temporary and permanent stream crossings are eroding or bare. Culverts, bridges and fords are not maintained. Advice is not sought from a natural resources professional.

	Most desirable	Desirable	Least desirable
<i>Site preparation</i>	The least disturbing methods of site preparation and regeneration are used. Machine planting is done on the contour. Herbicides, fire or manual methods are used on steep slopes or fragile soils. SMZs are not disturbed. Advice from a natural resources professional is sought.	N/A	Mechanical site preparation, controlled fire, or herbicide application is used in a SMZ. Advice from a natural resources professional is not sought.
<i>Permanent stabilization</i>	After site disturbing activities, permanent stabilization (mulch, brush and/or vegetative cover) is used in all bare areas of stream crossings, roads, trails and firelines. Structural BMPs are properly installed, inspected and maintained. All toxic wastes and trash are removed and properly disposed of.	N/A	After site disturbing activities, bare soil areas are not covered with mulch or vegetation. Erosion is occurring or imminent. Wastes and trash are left at the site.

A well-managed forest is a legacy

Whether you want your forest to produce income from timber harvesting or recreational activity; provide habitat for wildlife for hunting or merely viewing; for biking, hiking or camping; or for sheltering rare native plants, your goals can go hand-in-hand with protecting water quality. In fact, for some goals, high water quality is essential -eating fish caught in a polluted water is a danger to your family's health!

Now that you are aware of many of the key ingredients it takes to manage a forest, map out your plan, follow it and then

ENJOY!!

For more information

Advice from a natural resource management professional will enhance your forest's potential productivity, beauty, variety and environmental quality.

Contact your local representatives for assistance.

USDA's Cooperative Extension Service agents provide educational materials.
State Forester provides personalized on-site planning advice and assistance
USDA's Natural Resource Conservation Service District Conservationist also provides personalized on-site planning advice and assistance
State Wildlife agency for planning advice.

These are public agencies, such as the Natural Resources Conservation Service (NRCS), Forestry Service and Cooperative Research, Education and Extension Service that provide help for you, free of charge

Glossary of common forestry terms

The following list of terms are commonly used in conservation matters by foresters, loggers, soil scientists, biologists, engineers, conservation planners, etc. They are not necessarily used in the text.

<i>Accelerated erosion</i>	Any increase over the rate of natural erosion, as a result of land-disturbing activities.
<i>Access road</i>	A temporary or permanent access route.
<i>Acre</i>	An area of land measuring 43,560 square feet. A square 1-acre plot measures 209 feet by 209 feet; a circular acre has a radius of 117.75 feet.
<i>Aesthetics</i>	(a) Sensitivity to, or appreciation of, the forest's beauty through recognition of its unique and varied components. (b) Beauty through an orderly appearance.
<i>Barrier</i>	Obstructions to pedestrian, horse and/or vehicular traffic, intended to restrict such traffic to a specific location.
<i>Basal Area</i>	The area of the cross section of a tree stem near its base, generally at breast height, inclusive of bark. Expressed in square feet per acre.
<i>Bedding</i>	A site preparation method where special equipment is used to concentrate surface soil and forest litter into a ridge <i>six</i> to 10 inches high, on which forest seedlings are to be planted.
<i>Best Management Practice</i>	A method or combination of methods that is an effective and practical (including technologically and economically) way to prevent or reduce pollution.
<i>Biological (Bio) diversity</i>	The variety of life and its processes in a given area. Diversity can be categorized in terms of the number of species, the variety in the area's plant and animal communities, the genetic variability of the animals or a combination of these elements.
<i>Bottom lands</i>	The lowlands or flood plain adjacent to streams and rivers.
<i>Broad base dip</i>	A surface drainage structure built into the roadway to remove storm water from an access road.
<i>Burning</i>	Supervised burning under selected weather conditions to reduce litter, logging debris and unwanted vegetation. It permits tree planting, natural seeding or improves an existing stand for fire protection or wildlife habitat.
<i>Cable logging</i>	A technique of skidding logs to a landing by wire rope cable. Logs are lifted

partially, or totally, free of the ground during skidding.

<i>Channel</i>	A natural water carrying trough cut vertically into low areas caused by concentrated flowing water eroding the land. Also, a ditch or canal excavated for the flow of water.
<i>Check dam</i>	A small dam constructed in a gully or other small watercourse to decrease stream velocity, minimize channel scour and promote sediment deposits. Creates a miniature sediment basin.
<i>Chemicals</i>	Includes pesticides, fertilizers, desiccants, repellants, oil, salt, fire retardants used in controlled burning, dust control agents (other than water), and other natural or foreign materials added to the forest environment to accomplish specific management purposes.
<i>Clearcutting</i>	A silviculture system where all trees in a specified area are harvested in one operation.
<i>Contamination</i>	The introduction of chemical, organic or inorganic wastes or sewage, or microorganisms into water, which render the water unfit for its intended use.
<i>Contour</i>	An imaginary line on the surface of the earth or a line on a map connecting points of the same elevation.
<i>Controlled or Prescribed burning</i>	The use of fire under specific environmental conditions to achieve forest management objectives. Used to reduce hazardous fuel levels, control unwanted vegetation, favor desired vegetation and improve visibility and wildlife habitat. It is critical to the survival of some species, such as longleaf pine.
<i>Culvert</i>	A metal, plastic or concrete pipe which surface water can flow through under roads and trails.
<i>Cut</i>	Where earth has been removed by excavation or the depth below the original surface to the excavated surface.
<i>Cut-and-fill</i>	Process of excavating and then using the excavated materials for adjacent embankments or to spread over an area.
<i>Daylighting</i>	Cutting trees along the edges of roads, reducing the shade on the surface to allow faster drying.
<i>Den Tree</i>	A living or dead tree with a cavity suitable for animals to use for shelter, escape or as a nursery
<i>Dispersion, soil</i>	Breaking down soil aggregate into individual particles, resulting in a single-grain structure. More easily dispersed soil is more erodible.

<i>Diversion</i>	A drainage depression or ditch built across a slope to intercept surface or subsurface run-off or to divert surface water from the slope.
<i>Ephemeral stream</i>	See "Stream."
<i>Erodibility</i>	The susceptibility of soil to being transported away by wind, water and gravity.
<i>Erosion</i>	Process by which soil particles are detached and transported by wind, water and gravity to a downslope or downstream point.
<i>Erosivity</i>	Refers to the capacity of falling or flowing water to erode land surfaces.
<i>Felling</i>	The process of severing trees from stumps.
<i>Fertilizers</i>	Any substance or combination of substances used as a source of plant food or soil amendment.
<i>Fill slope</i>	The surface area formed where soil is deposited to build a road or trail.
<i>Firebreaks</i>	Naturally occurring or man-made barriers to the spread of fire.
<i>Fireline</i>	A barrier to stop the spread of fire by either removing fuel or rendering fuel inflammable.
<i>Flowing water</i>	Surface water movement due to the influence of gravity or tides.
<i>Ford</i>	A submerged stream crossing which will bear intended traffic.
<i>Forest floor</i>	A layer of accumulated dead organic material, consisting of partially or fully decomposed leaves, needles, twigs, etc., at the surface of a forest soil.
<i>Forestland</i>	All land which is capable of supporting a merchantable stand of timber and whose current use is not incompatible with timber growing.
<i>Forest management practice</i>	Any activity conducted on or directly pertaining to forestland and relates to growing, harvesting or processing timber, including: <ul style="list-style-type: none"> road and trail construction harvesting – final and intermediate pre-commercial thinning reforestation fertilization prevention and suppression of diseases and insects salvage of trees controlling of vegetation planting.

Does not include tree marking, surveying, road flagging, removal or harvesting of vegetation (berries, ferns, greenery, mistletoe, herbs, mushrooms, etc.) which isn't expected to result in damage to forest soils, timber or public resources.

<i>Furrowing</i>	Site preparation work done by a V-blade or fire plow, pushing aside debris and vegetation and/or cutting a trench into the mineral soil to enhance tree planting.
<i>Grade</i>	Slope of a road or trail; the change in elevation compared to horizontal distance traveled. Usually expressed as a percentage.
<i>Ground cover</i>	Any vegetative growth, or natural or man-made material that renders the soil surface stable against accelerated erosion.
<i>Groundwater</i>	Phreatic water or subsurface water in the zone of saturation.
<i>Harvesting</i>	Felling, loading and transporting forest products, roundwood or logs.
<i>Herbicide</i>	Any substance or mixture of substances intended to prevent the growth of or destroy terrestrial or aquatic weeds (wood or non-woody undesirable vegetation).
<i>Herbicide mobility</i>	The ease with which the active ingredients can move away from the area of application through drift, evaporation, rain, runoff or the soil.
<i>Insecticide</i>	Any substance or mixture of substances intended to prevent, destroy, repel or control any insect or other arthropods.
<i>Infiltration capacity</i>	Rate at which water moves into the soil surface.
<i>Intermittent streams</i>	See "Stream."
<i>Landing</i>	Place where logs are gathered in or near the forest for further transport. Sometimes called a "deck."
<i>Logging deck</i>	Place where logs are gathered in or near the forest for further transport. Sometimes called a "landing."
<i>Logging debris</i>	Unwanted, un-utilized and unmarketable accumulation of woody material in the forest (large limbs, tops, cull logs and stumps) that remain after harvesting.
<i>Lops</i>	Tree tops and branches which remain after harvesting.
<i>Mast</i>	Fruits or nuts used as a food source by wildlife. Soft mast include most fruits with fleshy coverings, such as persimmon, dogweed seed or black gum seed. Hard mast refers to nuts, such as acorns, and beech, pecan and hickory nuts.
<i>Mill site</i>	Place where forest products are stored, altered or processed.

<i>Mineral soil</i>	Soil properties are predominantly of mineral matter and usually less than 20 percent of organic matter.
<i>Mulch</i>	Natural or artificial layer of plant residue or other materials covering the land which conserves moisture, holds soil in place, aids in establishing plant cover and minimizes temperature fluctuations.
<i>Nonpoint source pollution</i>	Pollution of diffuse origin – not resulting from any discernible, confined or discrete conveyances or readily identifiable source.
<i>Nutrients</i>	Mineral elements such as nitrogen, phosphorus or potassium that is naturally present, or may be added as fertilizer or a fire retardant. While these substances are necessary for the growth and reproduction of organisms, in whatever that promotes the growth of algae and bacteria (chiefly nitrates and phosphates).
<i>Organics</i>	Particles of vegetation or other biologic material.
<i>Organic soil</i>	Soil containing greater than 20 or 30 percent organic matter (depending on clay content).
<i>Partial cutting</i>	Removal of a portion of trees to leave an even-aged or uneven-aged stand of well distributed, healthy residual trees. Partial cutting does not include seed trees, shelterwood or other types of regeneration cutting.
<i>Percolation</i>	Rate at which water moves through the soil.
<i>Perennial stream</i>	See "Stream."
<i>Permeability</i>	The ability of a soil horizon to allow air or water to move through it. A whole soil's permeability may be limited by one layer of impermeable horizon, even though others are permeable.
<i>Persistence</i>	Ability of a pesticide to remain active over a period of time.
<i>Pesticides</i>	A chemical used to kill pests, including insecticides, herbicides and rodenticide.
<i>Pollution</i>	Presence of substances that impairs or renders harm to life, health and the productivity of the environment, or is offensive to the senses.
<i>Regeneration</i>	Process of replacing old trees with young through harvest or other means.
<i>Residual trees</i>	Live trees left standing after harvesting is completed.
<i>Rill erosion</i>	An erosion process where numerous small channels, only several inches deep, are formed. Occurs mainly on disturbed and exposed soils.
<i>Riparian</i>	Pertaining to the banks of a stream, river or pond.

<i>Riprap</i>	Relatively large stone placed on erodible sites to reduce the impact of rain or surface runoff.
<i>Rolling dip</i>	Shallow depression built diagonally across a road or trail to remove storm water (broad based dip).
<i>Runoff</i>	Portion of precipitation that flows from a drainage area or in open channels.
<i>Ruts</i>	Depressions in roads and trails from repeated passage of wheeled vehicles.
<i>Scalping</i>	Site preparation work by plow or blade removing unwanted vegetation by cutting and peeling back the upper layer of the mineral soil and forest floor.
<i>Scour</i>	Washes away or removes soil from stream banks by a swift current of water.
<i>Sediment</i>	See "Visible sediment."
<i>Seedbed</i>	Soil prepared by natural or artificial means to promote germination of seeds and seedling growth.
<i>Selection method</i>	Removing mature timber as scattered individuals or in small groups in relatively short intervals. Encourages continuous reproduction and uneven-aged stands.
<i>Sheet erosion</i>	Removing a fairly uniform layer of soil by water runoff.
<i>Silvicultural activities</i>	All forest management activities, including logging, log transport and forest roads (EPA's interpretation).
<i>Site preparation</i>	Readying an area prior to reforestation.
<i>Skid trail</i>	Temporary path used to drag or transport felled trees or logs and other material to a landing.
<i>Skidding</i>	Transporting felled trees or logs by dragging them behind heavy equipment to the log deck.
<i>Slope</i>	Degree of deviation of a surface from the horizontal, measured as a numerical ratio (2:1, first number is the horizontal distance – run, and second number as the vertical distance – rise), percent (a 2:1 slope is 50 percent) or degree (the angle from the horizontal plane. 90 degrees is the vertical maximum and 45 degrees being a 1:1 slope).
<i>Soil</i>	Unconsolidated mineral and organic material on the immediate surface of the earth, serving as a natural medium for the growth of plants.
<i>Soil conservation</i>	Protecting and using the soil within the limits of its physical characteristics.

<i>Soil productivity</i>	Capacity of soil to produce a specified plant, or sequence of plants, under a specific system of management.
<i>Soil texture</i>	Relative proportion of various size groups of individual soil particles.
<i>Spoil</i>	Excess material removed as overburden (cut) or generated during construction (road or land), which is not used as fill.
<i>Stream</i>	<p>A body of concentrated flowing water in a natural low area of land.</p> <p>a. "Ephemeral stream" means a stream that flows only during and for short periods following precipitation and flows in low areas that may or may not have a well-defined channel.</p> <p>b. "Intermittent stream" means a stream that flows only during wet periods of the year (30 to 90 percent of the time) and flows in a continuous, well-defined channel.</p> <p>c. "Perennial stream" means a stream that flows throughout a majority of the year (greater than 90 percent of the time) and flows in a well-defined channel.</p>
<i>Streamside Management Zone (SMZ)</i>	Area along both sides of perennial and intermittent streams and perennial water bodies where extra precaution is used in carrying out forest practices to protect water quality.
<i>Streambanks</i>	Usual, not flood, boundaries of a stream channel. Banks are named left and right facing downstream.
<i>Switchback</i>	A 180 degree change in a trail or road for climbing steep slopes.
<i>Thermal pollution</i>	Temperature rise in a body of water sufficient to be harmful to aquatic life in the water.
<i>Thinning</i>	Cutting or removing certain trees to allow those remaining to grow faster. Usually a commercial operation in younger stands which brings an income to the landowner while improving a forest.
<i>Timber stand</i>	A group of trees.
<i>Timber stand improvement (TSI)</i>	Improving the quality of a forest stand by removing or deadening undesirable species or trees to achieve desired stocking and species composition. TSI practices include applying herbicides, burning, girdling or cutting.
<i>Toxicity</i>	Being poisonous or harmful to plant or animal life; the relative degree or severity of this characteristic.
<i>Turnout</i>	<ol style="list-style-type: none"> 1. A widened space in a road to allow vehicles to pass one another. 2. A ditch that drains water away from roads.

<i>Uneven-aged or all-age management</i>	The practice of managing a forest by periodically selecting and harvesting individual trees or groups of trees from the stand while preserving its natural appearance. Most common in hardwood forests. A forest stand composed of trees of different ages and sizes.
<i>Utilization</i>	Branch of forestry concerned with the operation of harvesting and marketing the forest crop.
<i>Visible sediment & Suspended sediment</i>	Solid particulate matter (both mineral and organic) which can be seen with the unaided eye being transported by water (suspended), air, gravity or ice from its site of origin. Colloidal sized particles are not normally included.
<i>Waste</i>	Materials and substances usually discarded as worthless to the user.
<i>Water bar</i>	Diversion ditch and/or hump across a road or trail on the uphill side for carrying storm water runoff to vegetation, forest floor, ditch or dispersion area, preventing increased volume and velocity which causes soil movement and erosion.
<i>Water-body</i>	Natural or man-made basin that stores water. Does not include jurisdictional wetlands or beaver ponds.
<i>Water control structure</i>	Any structure used to regulate surface water levels.
<i>Water pollution</i>	Harmful or objectionable material added to water in concentration or sufficient quantities to adversely affect its usefulness or quality.
<i>Water quality</i>	Describes the chemical, physical and biological characteristics of water in respect to its suitability for a particular purpose.
<i>Watershed</i>	Area within which all runoff collects into a single stream or drainage system, exiting through a single mouth or outlet.
<i>Wildfire control</i>	Actions taken to contain and suppress uncontrolled fires.
<i>Wildfires</i>	Uncontrolled fires occurring in forestland, brushland and grassland.
<i>Working days</i>	Days (excluding Saturday and Sunday) during which weather conditions or soil conditions allow land-disturbing activities.

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