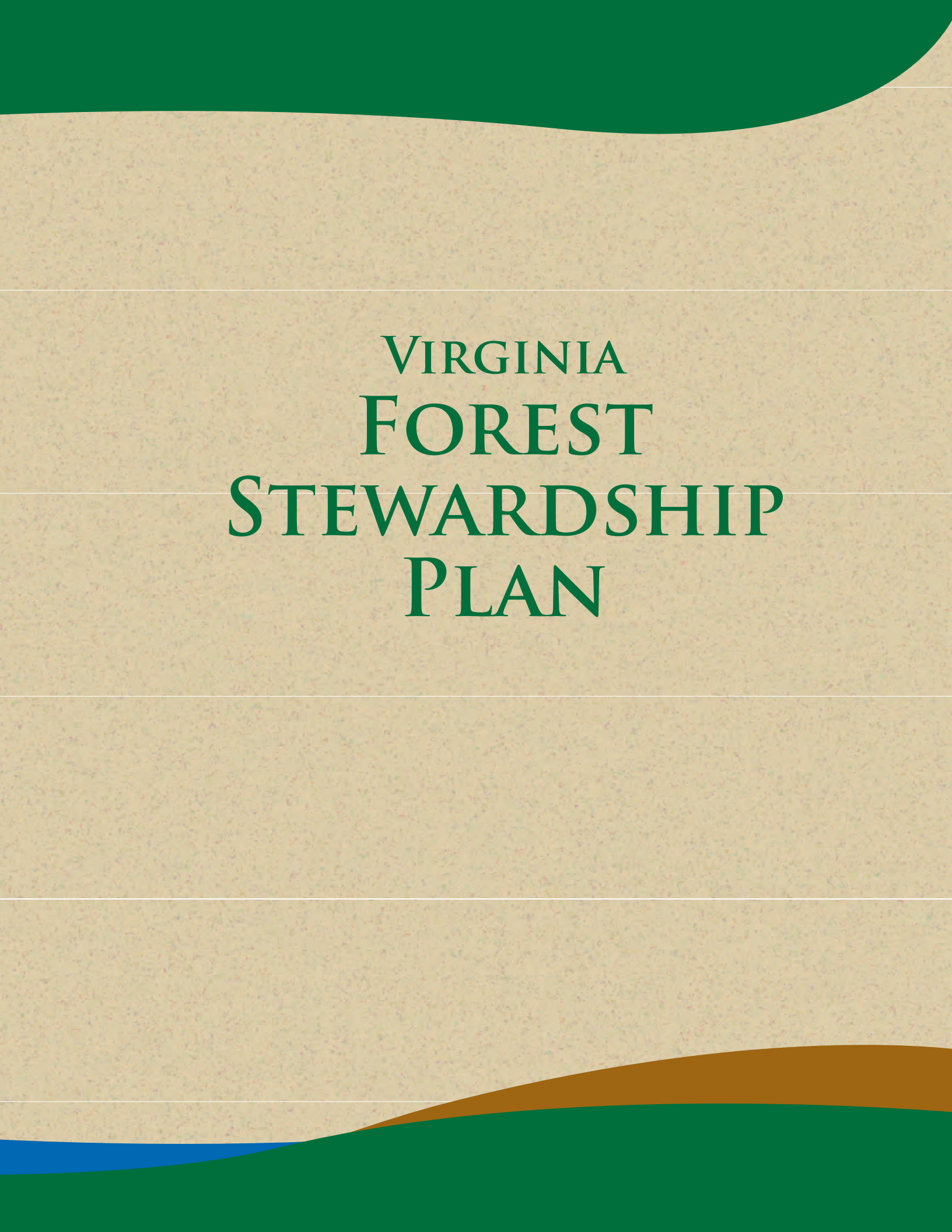




# VIRGINIA FOREST STEWARDSHIP PLAN

Virginia Department of Forestry





VIRGINIA  
FOREST  
STEWARDSHIP  
PLAN





***Congratulations on  
Becoming One of a Very Special Group of Virginians...  
A Forest Stewardship Landowner!***

When people hear the word “stewardship,” all kinds of thoughts and ideas come to mind. Yet, stewardship can be summed up in just six words: Your Land; Your Plan; Your Legacy! It’s truly that simple.

Working with a VDOF or consulting forester, you walk the land and discuss your goals and objectives. The forester takes those notes and prepares a customized blueprint – a stewardship plan – for you to follow. By implementing the recommendations, your goals can be realized. Whether you want to see more wildlife, grow bigger and better timber or help the environment, you will have made your land better than it was when you started, thereby leaving an enduring legacy for your family and friends.

Having a stewardship plan puts you into a very special group of Virginians, and I commend you for taking this important step toward enhancing your land. I invite you to use your blueprint as a roadmap to success. While, at times, you might find the journey to be long and somewhat arduous, you’ll be most pleased “when you arrive!” The result is sure to engender a spirit of pride, but remember that you won’t be alone. Your VDOF forester is just a phone call or email away should you have any questions or need to make some changes along the way.

Thank you for helping to ensure a healthy and vibrant forest for generations to come!

*Your State Forester*

*Insert Individual Stewardship Plan Here*




# VIRGINIA FOREST STEWARDSHIP PLAN APPENDIX

Virginia Department of Forestry

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[www.dof.virginia.gov](http://www.dof.virginia.gov)



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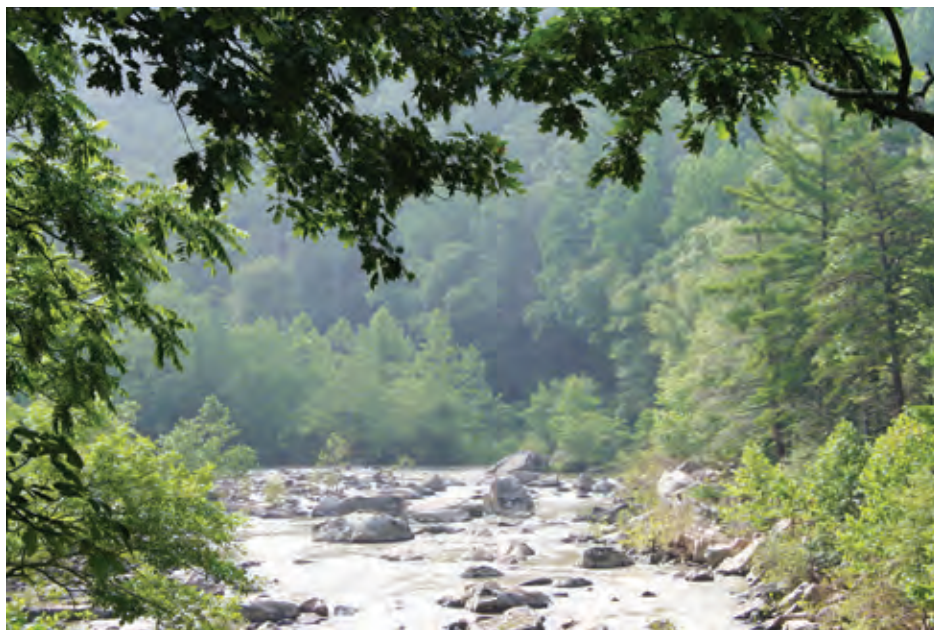
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## Forward

### Virginia's Forestland is "Our Common Wealth"

#### *Forested Land*

For 2013, more than 15.8 million acres – more than 62 percent of the Commonwealth – qualified as forestland. Of this forestland, 15.3 million acres are categorized as commercial timberland and 500,000 acres are categorized as reserved forestland (e.g., Shenandoah National Park, Virginia State Parks.) Hardwood forests make up 80 percent and softwood forests make up 20 percent of all Virginia timberland.

While the Commonwealth had been losing an average of 16,000 acres of forestland annually in recent years, the amount of forestland has stabilized for the past few years (possibly a reflection of the economic downturn). However, in 2012, the amount of forestland again experienced a net loss.

#### *Forest Ownership*

Most of Virginia's forestland is privately owned (more than 12.8 million acres). More than 373,600 individuals and families hold a total of 10 million acres. These private holdings average less than 75 acres in size, but range from a few acres to thousands of acres.

By 2012, ownership of forestland by forest products firms had declined to slightly more than one percent (186,700 acres) of the total forestland area. This is a reduction from seven percent in 2001 and 11 percent in 1992.

The balance of Virginia's forestland (18 percent) is owned by federal, state and local governments – the largest entity being the USDA Forest Service National Forest System lands at 1.7 million acres.

The Virginia Department of Forestry – through its 23 state forests – holds 68,359 acres of forestland.

## *Economic Value*

From the industrial base worth \$17 billion in annual total economic output to a wide-ranging array of forest-related value worth billions annually, forests in Virginia are healthy and diverse, yet are changing due to population and socioeconomic pressures.

The forest resource of the Commonwealth:

- ◆ Contributes \$17 billion annually to Virginia’s economy.
- ◆ Contributes \$257 million back to Virginia landowners for selling their timber.
- ◆ Generates more than 103,000 jobs.
- ◆ Contributes an additional \$9 billion and tens of thousands of jobs for forest-based services:
  - ✧ Provides recreational opportunities to two-thirds of citizens.
  - ✧ Protects Virginia watersheds from erosion and sedimentation.
  - ✧ Provides long-term carbon sequestration, which contributes to clean air and enhances our quality of life.
  - ✧ Provides important social benefits including attractive sites for homes, scenic beauty, wildlife habitat and a draw for visitors and potential new residents.

The forest products industry provides an economic base for Virginia. A continuing high level of management and protection is needed to maintain this invaluable forest resource now and for future generations.

The importance of forests to our economic health is well documented. We must recognize now, more than ever, Virginia’s forests are indeed our Common Wealth.

## **Virginia’s Stewards of the Forest. . .**

### *People Caring for Our Forest Resources*

Stewardship starts with landowners who care about their forestland. Forests cover 62 percent of Virginia – nearly 16 million acres. More than 82 percent of this renewable resource is owned by an estimated 373,600 individuals and businesses. Land ownership is one of the most valued rights for American citizens. However, ownership also carries the responsibility of good stewardship. Well-managed forests provide clean air and water; homes for wildlife; recreation; wood products, and scenic beauty – all of which improve our quality of life.

Through the Virginia Forest Stewardship Program, resource specialists work with landowners to design a comprehensive Forest Stewardship Plan that incorporates the landowner’s goals and interests. Technical assistance and cost-share programs may be available for forest management and conservation practices to improve environmental and economic benefits. Any private landowner with 10 acres or more in forestland may qualify for the Forest Stewardship Program. The Forest Stewardship Program is administered by the Virginia Department of Forestry with matching grants from the USDA Forest Service in cooperation with state and federal conservation agencies, consulting foresters, forest industry and landowner organizations.

The stewardship of our natural resources is the responsibility of all Virginians. With wise use, our forestlands can continue to provide multiple benefits for us, our children and their children. If you are interested in making the most of your woodlands, both now and for the future, the Virginia Forest Stewardship Program can help. Your decision to have a Forest Stewardship Plan developed is the first step in achieving your forestland goals and caring for our forest resource.

# CHAPTER 1

## LAND OWNERSHIP



# Property Location and Boundaries

While the old adage, “you can’t know where you’re going until you know where you’ve been” may not apply directly to forest ownership, it certainly helps to have as much information as possible when making management decisions. Good recordkeeping is essential for any landowner. You’ll need to refer back to these for taxes, estate planning, easements, forest management decisions, etc. In addition, learning the history and past land uses of your property can be fun.

There are a variety of sources of information and maps to assist with property boundary identification and evaluation of the characteristics of your property, such as topographic maps, NRCS soil maps, tax maps and aerial photographs (Table 1).



Tax map



USGS topographic maps

**Table 1. Property Location and Boundary Resources**

USGS Topographic Maps
U.S. Geological Survey (USGS) <a href="http://topomaps.usgs.gov">topomaps.usgs.gov</a> Department of Mines, Minerals and Energy <a href="http://www.dmme.virginia.gov/DMLR/MappingLandingPage.shtml">www.dmme.virginia.gov/DMLR/MappingLandingPage.shtml</a> Virginia Department of Forestry Logger Notification <a href="http://www.ifris.dof.virginia.gov/harvestnotification">www.ifris.dof.virginia.gov/harvestnotification</a>
Aerial Photographs
Natural Resources Conservation Service <a href="http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/dma">www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/dma</a> U.S. Department of Agriculture Farm Services Agency (FSA) <a href="http://www.fsa.usda.gov/FSA/apfoapp?area=apfohome&amp;subject=landing&amp;topic=landing">www.fsa.usda.gov/FSA/apfoapp?area=apfohome&amp;subject=landing&amp;topic=landing</a> Virginia Department of Forestry Field Offices <a href="http://www.dof.virginia.gov/aboutus/contact-us.htm">www.dof.virginia.gov/aboutus/contact-us.htm</a> Virginia Department of Transportation District Offices <a href="http://www.virginiadot.org/about/districts.asp">www.virginiadot.org/about/districts.asp</a> Virginia Department of Forestry Logger Notification website: <a href="http://www.ifris.dof.virginia.gov/harvestnotification">www.ifris.dof.virginia.gov/harvestnotification</a>
Soil Surveys
Natural Resources Conservation Service <a href="http://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=VA">www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=VA</a> Web Soil Survey This is an excellent site for mapping your tract, getting soils information and management direction by using soil types. <a href="http://websoilsurvey.nrcs.usda.gov/app/">websoilsurvey.nrcs.usda.gov/app/</a>



NRCS soil surveys

## Deeds and Plats

A deed is a legal public record stating the legal description of a piece of property and the owner of that property. Deeds also contain information on the grantor (seller), the grantee (buyer) and the property's legal description. Plats are maps of property including distances and directions usually completed by a surveyor. Searching for deeds and plats in Virginia can be handled by contacting the county Circuit Court Clerk in which the property is located since the Clerk of the Circuit Court handles all land transfers in the county. In addition to sellers and buyers names, useful information that may be found in deeds and plats include:

- ◆ Legal description (needed to find property lines)
- ◆ Liens on the property
- ◆ Restrictions or covenants on the property
- ◆ Easements (i.e. utility lines, roads, water rights, etc.)
- ◆ Rights-of-way (access to the property or across it)
- ◆ Names of adjoining property owners at time of sale or survey
- ◆ Genealogy (names of relatives of sellers and buyers are often listed)

Another resource available in most counties in Virginia is a county GIS (geographic information system). Simply put, GIS is a computer-based system that ties data to areas on a map. Landowners can find the approximate location of their property, as well as a host of other information – adjoining landowner names and addresses, tax assessment values and zoning are just a few of the datasets tracked in these systems. You can typically view county GIS information at the County Clerk's office or online.

## Aerial Photography

Aerial photographs are one of the most useful tools for mapping and forest management available to landowners and resource professionals. Seeing your land and the surrounding landscape from above can help you plan for a timber harvest, layout a road, plan wildlife habitat improvement projects and much more. Aerial photos are now readily available from multiple sources (Table 1) and can be viewed online and with portable devices, such as smart phones, or printed and taken into the field.

Cropland, pasture, water and major forest types are easily identified on aerial photographs. Each type has distinctive characteristics:

- ◆ **Cropland:** Crop rows and ditching are often evident.
- ◆ **Pasture:** Pasture appears as smooth and uniform with little variation in color or texture.
- ◆ **Water:** Water appears dark gray to black and flat, with no variation in texture.
- ◆ **Forest Types:** Forest stands appear as contiguous, rough-textured areas. Pines appear darker than deciduous hardwood forest.

Roads, power lines, buildings, ponds and lakes are all visible in aerial photos. Knowing their location in relation to other land uses and features can help with management decisions. For example, when laying out a timber sale, an aerial photo could be used to determine if existing roads are adequate to access all areas of the sale. This would save money if an additional road is not needed. Property lines are sometimes visible on aerial photos. These often appear if large trees are left on the property line or where adjacent land use is different. Property lines also run concurrent with easily-identified features like roads, streams, swamps or fences.

Historic aerial photographs can also be of great interest, helping you to see how your land has changed over time.

Federal organizations have amassed a large and diverse group of imagery acquired from 1937 to the present. Paper copies and high-resolution digital images are available from the U.S. Geological Survey (USGS) and

U.S. Department of Agriculture Farm Service Agency (FSA). Both have online searchable databases that let you find available photos by identifying your land's location on a map.



Sample aerial photograph

## Property Boundary Marking

As a forest landowner, establishing and maintaining well-marked property lines can save you money, liability and litigation. All forest management activities must be conducted within the confines of one’s property. Clearly-marked property lines will help avoid conflicts and potential encroachment on adjoining lands. While simply locating and marking corners might suffice on residential property, it is inadequate for forest property where corners can be thousands of feet apart.

Unmarked property can be susceptible to timber theft and can even lead to a loss of land through adverse possession. Land boundaries that are uncontested for a period of as little as 15 years can lead to a loss of land by the original owner.

Property ownership comes with many responsibilities and obligations to invited and uninvited users. Well-marked or posted boundaries can help minimize landowner liability, especially in the cases of recreation where no fees are exchanged.

The most efficient way to maintain property lines is to start after a recent survey has been completed. In the absence of a recent survey, deeds and/or plats of the property or adjoining property can be used to determine the approximate location of most corners. Then, with the use of a compass and fiberglass tape, approximate property



Property corner marking



Property boundary marking

boundary locations can be identified. **Be forewarned that while any landowner or forestry consultant can establish a property line, they must understand that they become responsible and thus liable for damages due to any erroneous location.** If there is any doubt about the location, a professional survey is the only choice. In Virginia, movement of a property corner is a crime, even when it appears to be incorrectly placed. Leave corrections to licensed professionals.

Marking property lines in forested areas is best done by painting blazes on trees, directly on or close to the property line. One widely-used method for painting lines uses a series of painted bands or blazes to mark the line and corners.

This method includes:

- ◆ A vertical line for center-line trees (located on the line). Paint a two-inch by six-inch vertical mark at the point that the lines enter the tree on both sides.
- ◆ One band for interior trees adjacent to the property line. Paint a single three-inch- to four-inch-wide band facing the property line. Only paint the half of the tree facing the line.
- ◆ Two or three bands to mark a property corner. Corner trees located within five feet of the corner receive a triple two-inch-wide band on the side of the tree directly facing the corner stake or monument.

In addition, any monuments or marks left by the surveyor, such as slash marks in line trees, can be painted to preserve their location. To prepare the tree for painting, use a drawknife or machete to scrape smooth the five- to six-inch band in the outer bark at roughly eye level. Always use exterior grade oil-based paint for maximum durability. Boundary line specific paint is available from forestry supply companies in highly-visible colors and increased durability of 10 or more years.

Well-marked property lines can last for many years, but plan to refresh the markings every 10 or so years.

### Fences

Fences frequently delineate a property boundary. Most land was farmed in the past and fences were used to mark the boundary, keep livestock contained or keep wildlife out of the fields. Once the farms were not used, these fields reverted to forests. The old fences remained and act as boundary markers now. Fences are a good starting point to determine the boundary but should not take the place of a survey. When planning a harvest, ensure that these boundary fences are maintained.

### Trespass

Unwanted trespass and poaching can be minimized by marking and posting property; limiting access points, and monitoring. Virginia state law forbids hunters and fishermen to enter private lands without permission from the landowner. Although verbal consent is required for use of unposted lands, this provision is difficult to enforce. **A landowner who wants effective control of access will have to post. Hunting, fishing or trapping on posted land without written permission of the landowner is a misdemeanor punishable by a fine.** Posting laws are enforceable by game wardens, sheriffs and all other law enforcement officers of Virginia.

In Virginia, the sign need only say **POSTED** to be legal. Signs should be systematically placed along the boundary. Routine inspection and replacement of weathered or vandalized signs, and a commitment to patrol for and prosecute violators is essential to let would-be trespassers know that you mean business. Signs of various materials, shapes and sizes are available. Aluminum signs will last the longest and a highly-visible color should be chosen. Signs should be tacked to a board to prevent wind damage. Mount the board 3 to 6 feet high in a tree

and remove any branches that obscure the sign. This will make it more difficult to vandalize and easier to see. Leave one-half to one inch of the nail out of the tree to accommodate tree growth. Aluminum nails will last longer and neither stain the wood nor ruin saw blades. Signs should be displayed conspicuously along the property line.

Another method of posting property is outlined in the Virginia state code. It can be used in place of or in conjunction with the procedure outlined in this appendix. This method of posting property requires landowners to paint a mark of aluminum color consisting of a vertical line at least two inches in width and at least eight inches in length, no less than three feet and no more than six feet from the ground or normal water surface and visible when approaching the property.

Posting property lines with paint instead of signs should last longer and is less likely to be vandalized.



"Posted" sign



Aluminum vertical line meaning "Posted"



## Easements and Rights-of-Ways

Your right to own land doesn't preclude others from also having a type of right over your land as well. Easements and rights-of-way are property rights that can grant others a right of use over your property. **Easements** describe general property rights by others over your land while a **right-of-way** describes a specific property right.

### Easements

Basically, an easement is the right to use the property of another. Easements come in two types: gross easements and appurtenant easements. A **gross easement** is a right over use of your property held by a specific individual. Gross easements give a right over use of your property to those adjoining lands no matter who owns them. **Appurtenant easements** are a right over use of your property for the benefit of adjoining lands, such as access to a public road from a landlocked property.

### Rights-of-Way

A right-of-way is an easement that allows another person to travel or pass through your land. The most common form of right-of-way easement is a road or path through your land. The right-of-way easement road is meant to benefit a particular person or another parcel of land not owned by you. Right-of-way easements extend reasonable use for travel through others' lands to holders of the easements.

### Granting of Easements

An easement, including a right-of-way, is typically granted by one landowner to another landowner. Generally, easements are granted by will, deed or contract. However, an easement can also be granted by adverse possession, which is known as a **prescriptive easement**. In real estate, "adverse possession" is often called "squatting." A prescriptive easement is gained by one person's open, notorious, continuous and adverse or hostile use of the land of another.



Powerline right-of-way



# CHAPTER 2

## FOREST MANAGEMENT



# Forest Management

What is a forest? It is more than just trees. A forest is an ecological system made up of all the organisms that inhabit it – trees to mosses, birds to bacteria. All are interdependent, and it is the myriad of interactions among the living components of the forest and the physical environment that keep a forest productive and self-sustaining for many years.

Forests come in many varieties: different tree species dominate different sites; some forests are more or less dense; some forests are more productive than others, and tree ages vary. The type of forest that naturally exists on a particular site is the result of many factors, including conditions of the physical environment (e.g., type of soil, water availability, slope, aspect and climate) and the history of disturbance at that site (e.g., past agricultural practices, weather events, fire). In

addition, nearly all of the forests in Virginia have been extensively modified by human activities during the past 200 years.

Very few forest areas have escaped being harvested. Most of the Piedmont and Coastal Plain were cleared for agricultural use in colonial times.

It is important to recognize that forest processes, such as succession, maturation and decay, are continuously at work. The natural science of silvics uses these principles regarding the growth and development of types of trees and the forest as a unit. The forest ecosystem functions with or without human intervention. When we decide to actively “manage” a forest, we are deciding to modify what occurs on a forested site relative to what would happen if we did not intervene. Silviculture is the art of producing and tending (or managing) a forest using the science of trees and forest. It guides forest establishment – the types of trees, how they are arranged and how they grow. For example, we often choose to harvest mature trees rather than let them reach maturity, fall and decay, as they would in the natural forest. When we choose to create openings to benefit game species, it may be at the expense of birds and plants that live in forest interiors. Each management activity favors some species or enhances some forest processes but has consequences on others.



## Forest Management Practices

Managing forests is both an art and a science. There are many practices that are used in the active management of forests. Since the life cycle of forests is long, practices may be spread out over years or decades, but forests are ever-changing. Many practices involve cutting trees, which affects the amount of sunlight, moisture and nutrients available for remaining or new trees. Systems used to manage forests are often characterized by the harvesting method. When a forest is mature, good planning is needed to maximize the benefit of the existing stand, and provide for the regeneration of the new stand of trees. All stages of forest management including: harvesting, site preparation, tree regeneration, competition control and intermediate practices are interdependent and impact the long-term results.

The forest may be harvested and regenerated using several methods. There may be practices needed to prepare the site for the new forest – practices to control competing plants and practices to control density of the new forest. A professional forester can assist in evaluating your forest and determining the best course of action.



Professional foresters can evaluate and assist

### Harvesting Methods

Several methods are used to harvest forest stands with each method influencing the character of the “new” stand. Stands may develop that are even-aged (all trees are essentially the same age), or uneven-aged (trees are many ages, from young seedlings to mature trees and everything in between).

Harvesting methods that produce even-aged stands are clearcut, seed tree and shelterwood. Those that produce uneven-aged stands are single-tree selection and group selection. Even-aged methods should be used for reproducing tree species that prefer full light conditions (shade intolerant). Uneven-aged methods can be used where favoring tree species that can reproduce well under shade (shade tolerant). A two-aged stand may be a good compromise for species of intermediate shade tolerance, or where leaving some standing timber between harvests is appropriate. Each method has advantages and disadvantages (Table 2). Once established, forest stands may need a thinning to allow the healthy, more valuable trees space to continue to grow.



Clearcut

**Table 2. Forest Benefits of Various Harvest Methods**

Management Method		Forest Benefits
Even-Aged Management	Clearcut	<ul style="list-style-type: none"> <li>◆ Used when advanced regeneration is already present, or when artificial regeneration (tree planting) is planned.</li> <li>◆ Provides economic return all at once.</li> <li>◆ Allows efficient and cost-effective harvest (especially when managing large land parcels).</li> </ul>
	Seed Tree and Shelterwood	<ul style="list-style-type: none"> <li>◆ Becomes necessary when adequate advance regeneration (&gt; 1,000 stems per acre of the desirable species greater than 4½ feet tall) is not available in the stand.</li> <li>◆ Provides economic return in two to three stages.</li> <li>◆ Provides firewood and specialty products.</li> <li>◆ Uses wood lost to natural competition.</li> </ul>
Uneven-Aged Management	Single-Tree Selection	<ul style="list-style-type: none"> <li>◆ Provides effective regeneration of shade-tolerant species (e.g., beech, maple).</li> <li>◆ Maintains continuous forest canopy at all times.</li> <li>◆ Increases control of forest species, size and distribution.</li> <li>◆ Provides firewood and specialty products.</li> <li>◆ Uses wood lost to natural competition.</li> </ul>
	Group Selection	<ul style="list-style-type: none"> <li>◆ Regenerates small patches of shade-intolerant species within a stand composed primarily of shade-tolerant trees.</li> <li>◆ Increases control of forestry species composition.</li> </ul>

### ***Clearcut Method***

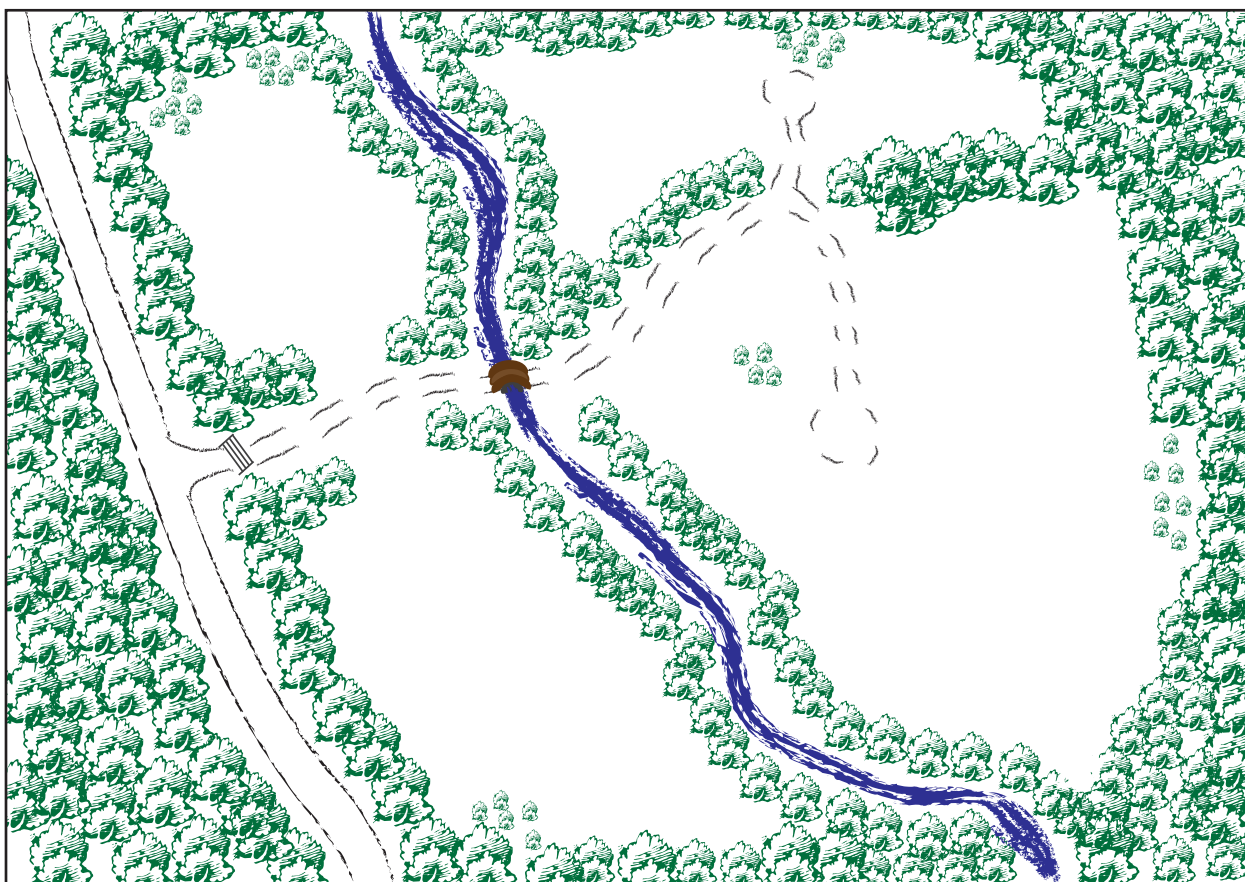
The main objective of clearcutting is to reproduce the forest with shade-intolerant species that require full sunlight and are best managed biologically and economically in even-aged stands. The method is used equally well with shade-intolerant early successional pines or with shade-intolerant hardwoods. It is the method used for establishing new species (introduced species) from those harvested. But, the method is technically sound for reproducing many native species of pines and hardwoods. Release of advanced reproduction, germination of new seed, and creation of abundant sprouts and root suckers are all benefits

of clearcutting. Many species of forest trees and individual trees of the same species benefit from even-competition. Clearcutting can be used effectively with one species (pine) or with mixtures of species as with hardwoods.

This method involves harvest or otherwise felling all trees above 1½ inches in diameter or about six feet tall to remove overhead shade and competition. Clearcutting has considerable biological and economical advantages in managing numerous Virginia tree species.

As with any harvest method, careful planning is essential (Figure 1).

**Figure 1. Clearcut Planning**



Clearcuts should be small and irregular, following the natural contour of the land. Timber should not be harvested near any streams or rivers; travel corridors should connect other forested tracts.

## Seed-Tree Method

The seed-tree method reproduces forests that have light, wind-dispersed seeds. These are usually early successional pine species that are shade intolerant and managed in even-aged stands. Species must be wind-firm enough to withstand the elements as they stand exposed. Trees left as seed trees must have seed bearing capacity, or must be developed as seed bearers prior to timber harvest. In Virginia, loblolly pine is readily reproduced with seed trees in the Coastal Plain and white pine in the Mountains. This method involves “clearcutting” all timber except the designated seed trees, which are retained as a seed source. Generally, eight seed trees per acre are left after the harvest. All other trees above 1½ inches in diameter or about six feet tall are removed (harvested commercially or otherwise felled to remove shade and competition).

Seed trees are usually of a single species. They are selected prior to the harvesting process and should be the most dominant, well-formed, genetically superior and most prolific seed-bearing trees in the stand.

Once a successful crop of young trees has been attained, the seed trees should be removed in a second harvest. Another option is to retain them as insurance, if for some reason the first stand is destroyed or the seeds fail to germinate. Disadvantages to leaving seed trees are potential loss or damage by wind, lightning strike or insects. Also, the limited timber volume per acre in seed trees may make the area uneconomical to harvest.

The seed-tree method can be successful. However, due to the variability of seed crops, it can often lead to areas with too many or too few new trees. Additionally, if hardwood seedlings or shrubs are present under the existing stand, these can dominate and overgrow the new pine seedlings. Virginia has a Seed Tree Law that covers loblolly and white pine stands [{See Pine-Specific Management - Seed Tree Law}](#).

## Shelterwood Method

Shelterwood cutting leads to conditions suitable for the establishment of shade-intolerant, intermediate and tolerant tree species. Natural reproduction starts under the protection of the older stand and is finally released when it becomes desirable to give the new crop full use of the growing space. Managing shade provides the opportunity to regulate species composition in the new stand. To ensure regeneration success, site preparation may be necessary. As with the clearcutting and seed-tree methods, shelterwood gives rise to even-aged stands.

The shelterwood system usually involves a three-phase sequence of harvests over a 5- to 10-year period, but not to exceed one-fifth the stand rotation age. The three cuts are:

- 1) **Preparation Cuttings** – those that set the stage for regeneration
- 2) **Establishment or Seeding Cuttings** – those to induce actual establishment of seedlings
- 3) **Removal Cuttings** – those to release the established seedlings for development

The cutting sequence of shelterwood generally involves a prescription for cutting the worst first. This leaves those most vigorous, best-formed individuals of desirable species for the final harvest. The **BEST** trees are left to provide seed for the new crop, while they continue to increase in size, volume and value.

Natural conditions may negate the need for intermediate cuttings prior to the removal cut. Reproduction may have been established so well that neither preparation nor establishment cuttings are needed. Thus, the first reproduction cutting will be a removal cutting. New regeneration may be almost pure, or of mixed species, but some control over composition of reproduction can be maintained through managing the intensity of sunlight.



There are several advantages to the shelterwood method:

- 1) Control of site conditions for the regeneration of even-age stands
- 2) Effective for distribution of heavy-seeded species (e.g., oaks, hickories)
- 3) Control over regeneration composition, amount and distribution
- 4) Flexibility since it is applicable to tolerant and intolerant species
- 5) Good soil and site protection
- 6) High aesthetic qualities
- 7) Short period of time between income-producing harvests

There are some disadvantages to the shelterwood method:

- 1) Much more planning and supervision is required
- 2) Success is dependent upon timely seed crops
- 3) The stand is entered multiple times, which:
  - a) Lowers the volume for each harvest, and
  - b) Increases the chance for damage to residual trees

### *Single-Tree Selection Method*

Under the single-tree selection method of forest harvest, individual trees are marked and cut. The objective of the method is to maintain a self-sustaining forest of multiple age/size classes. Stand structure is regulated by harvesting a specific number of trees in each size class. The cutting pattern is repeated at regular intervals throughout the stand rotation. The single-tree selection method maintains continuous forest cover and provides frequent entries for harvest of forest products. It leads to the creation of uneven-aged stands.

Single-tree selection favors the reproduction of shade-tolerant Virginia species, such as American beech, blackgum, flowering dogwood, elms, hemlock, eastern hophornbeam, red maple and sugar maple. Where these species are not desired, single-tree selection should be avoided. This method is not a good choice for the long-term management of oak forests.

### *Group Selection Method*

Group selection as the term implies is similar to single tree selection in design, stand attributes and benefits, but differs in that groups of trees together are removed to create small openings. These openings are actually small “clearcuts,” which technically do not exceed in width approximately twice the height of the surrounding timber. Group selection provides for continuous forest cover and frequent entries for harvesting. Uneven-aged stands of small groups are created.

As with single-tree, group selection favors the reproduction of shade-tolerant species, although those of intermediate tolerance can be maintained near the center of the group.

With both single-tree and group selection, timber harvest is both tedious and time consuming if damage to residual growing stock is to be minimized. Minimizing damage is very important in the growing of high-value, quality timber.

## *Two-Aged Stand Method*

A two-aged stand alternative, sometimes called a deferment cut, is a good compromise for regenerating shade-intolerant species, which benefit from full sunlight and even-aged conditions. A form of shelterwood, two-aged management is an improved aesthetics method, which retains the benefits from clearcutting while maintaining some high forest cover. In its most desirable form, approximately 12 trees of the dominant crown position and having quality potential are retained per acre. All other trees above 1½ inches in diameter or about six feet tall are removed or felled. The two tree levels (understory of even-aged reproduction and overstory of large trees) are then allowed to develop together until the end of the next rotation. Then during harvesting, other trees are retained for high forest cover. This method allows for the development of potentially very large valuable trees; the establishment and growth of the new regeneration, and the retention of some benefits associated with continuous cover.

## *Diameter-Limit or High-Grading (not recommended)*

**This harvesting practice is not recommended for the continued growth and health of the forest.** Diameter-limit cutting is the practice of harvesting trees above a certain specified stump or stem size rather than by design within all size groups. Diameter-limit cutting is often used synonymously with selection cutting. This is inaccurate and results in cutting only the largest trees, which may or may not be the most mature trees. Actually, they often are the best genetically-constituted trees, the best inherent competitors, the fastest growers, the best quality, the less mature and the best future investment. Diameter-limit cutting can more accurately be referred to as high-grading, or cutting the best and leaving the rest. Ultimately, this practice of harvest, although favoring short-term economic advantages, leads to devaluation of timber quality, value and other benefits.

## Site Preparation

Following harvest, it may be necessary to implement practices to prepare the site for the new forest. This serves to eliminate any poor-quality residual trees from the previous stand and to minimize logging debris. It also reduces vegetation that may compete with desirable trees in the new stand. Site preparation is most often done prior to establishing new pine stands *{See Pine-Specific Management}*. However, the principles of site preparation would apply to some types of hardwood establishment as well *{See Hardwood-Specific Management}*. Possible types of site preparation are mechanical, prescribed burning and chemical herbicides. The cost of site preparation should always be weighed against the potential increased production and increased future economic gains.

## Tree Regeneration

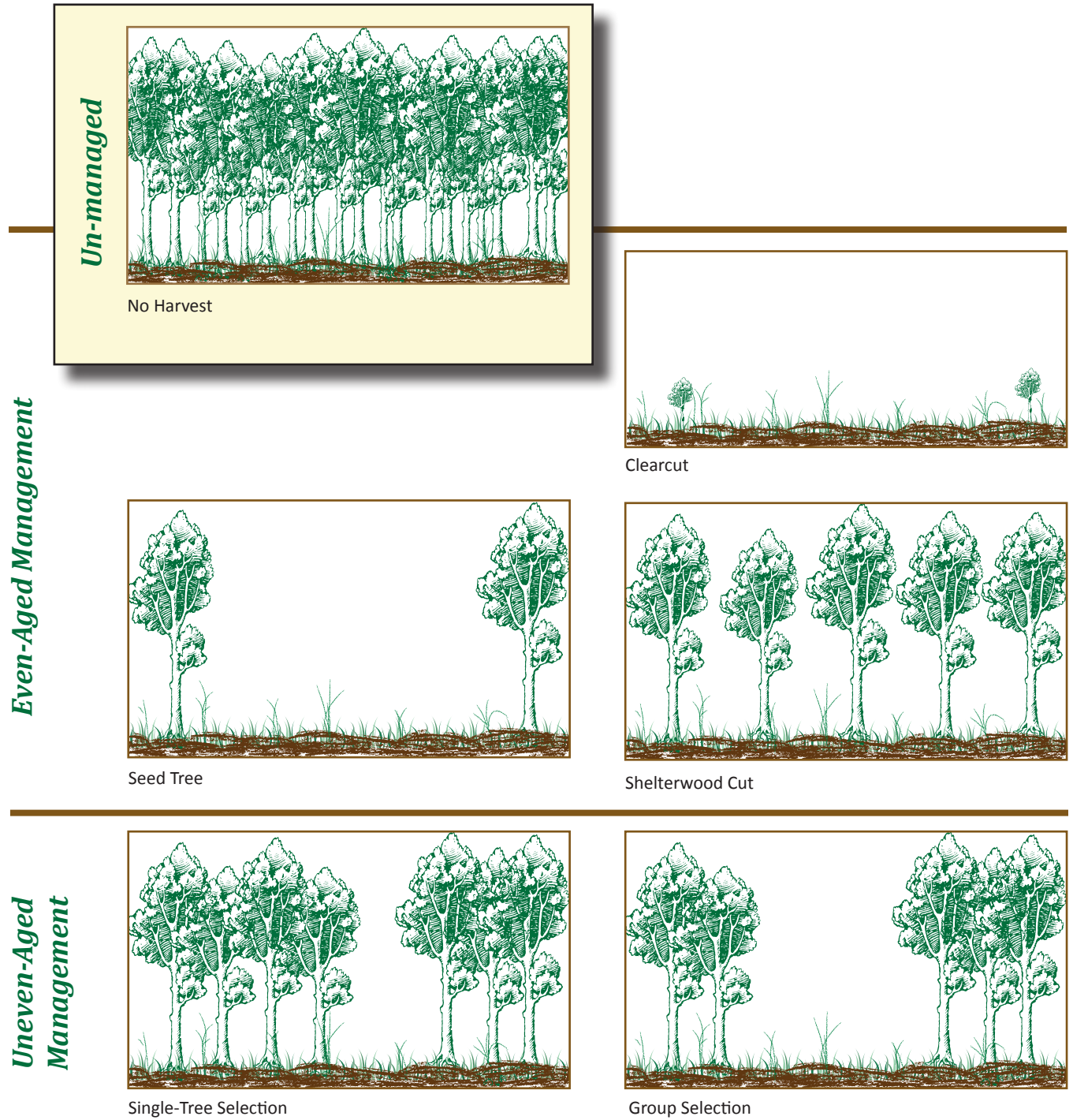
Many factors can play a major role in the regeneration of a particular site. Factors, such as man-made boundary patterns, soil conditions, topographic position and seasonal/climatic factors, can affect tree reproduction. Each factor will show influence on the species composition, age-class distribution, density, growth and other attributes of the new stand.

Forest trees rely on two general methods to reproduce – natural means and artificial means. Natural regeneration (as the name implies) is that established from seed, sprouts or root suckers of trees on or formerly occupying the site. Conversely, artificial regeneration is that established by humans through direct seeding or planting seedlings brought on site expressly for purposes of tree reestablishment.

## Soil Conditions

Soil conditions have a large impact on the suitability of the species that will grow in any specific location. Before deciding what species will be regenerated, the soil conditions should be evaluated. Make sure that the soils will support the desired species prior to planning any regeneration activity. Good hardwood soils are derived from parent rocks that contain high levels of the basic elements necessary for tree growth. Top soils should be deep and high in organic content. Soils should be moist, but with good internal drainage for most species.

Figure 2. Harvest Methods



Although published soil surveys are useful, they provide only generalized information. An experienced forester or soil scientist should be consulted for field work to identify specific planting locations and selection of proper species if they are not presently on site. When timber production is the major objective, select economically important tree species that are best suited to soils and sites. If wildlife, recreation, aesthetics or other non-timber uses are the objective, select the species accordingly.

### ***Topographic Position***

Topography is an important element in site productivity in extremely hilly or mountainous terrain. Generally, along the length of slopes, the top is poorer than the bottom. Coves, benches, drainages and floodplains are usually productive sites.



Topographic position is a key element in site productivity.

### ***Seasonal/Climatic Factors***

Season and climate have important effects on tree growth. Many factors, such as length of growing season; length of day; early and late frost dates; season, duration, intensity and amount of rainfall; prevailing wind direction and velocity, and other factors and extremes, have a major influence on the establishment and growth of quality hardwoods. Quality hardwoods require long rotations under relatively stable conditions.

Site index is the term used to define a site's productivity for growing trees and can be measured using tree height, soil characteristics, vegetative composition and others. High site-index numbers reflect potential for growing large volumes of better quality trees; low numbers just the opposite. Several technical sources of site information are available.

### ***Natural Regeneration***

Natural regeneration includes both seeding and vegetative reproduction. Most species of hardwoods combine both seed and vegetative regeneration for reproducing. Most pines reproduce principally from seeds. Hardwoods, such as oak, maple and yellow poplar, commonly sprout from the stump after being cut or burned. These sprouts often form clumps. Beech, sweetgum and black locust commonly sprout along the roots (suckering). Based on numerous factors, vegetative reproduction is fairly predictable. Follow-up management practices can be influenced significantly by the form of natural regeneration.

Successful natural seeding occurs when conditions are favorable: trees must be present that are old enough to produce seed; sufficient numbers of healthy, viable seed must be produced and survive to germinate; the seed must be carried to and distributed on a site favorable for germination, and conditions must remain favorable until the seed germinates and establishes itself. The results of natural seeding are often erratic and fail without proper planning, or without an "element of luck from Mother Nature."



Natural regeneration

## Artificial Regeneration

Because natural regeneration often is less predictable and slow, artificial methods are commonly used to establish desired species on prepared sites before favorable site conditions deteriorate. Artificial regeneration is synonymous with the term reforestation.

Two methods of reforestation are direct seeding and planting. While the two methods provide more control than natural regeneration, it is critical that the site be adequately prepared and that the species match the site conditions.

Direct seeding is most often used with “lightweight” seeds, such as loblolly and white pine, that in nature would be dispersed by wind. However, heavier seeds, such as oak acorns and black walnuts, that in nature are often dispersed by gravity, birds and animals, can be direct seeded in spots. Light seeds can be sown with specialized equipment (spot seeder, cyclone seeder or by helicopter). Heavier seed, such as black walnuts, can simply be placed by hand. While direct seeding can be relatively fast and low cost, creating a good seedbed and maintaining satisfactory conditions for seed germination and early tree growth are critical. Without proper attention to details, direct seeding is more uncertain than planting. Direct seeding is seldom used in Virginia.

Planting can be accomplished with a high degree of certainty and is a popular method of tree regeneration in Virginia. The method has been used extensively on harvested tracts and for converting idle fields and openings to trees, shrubs and wildlife plants.

Planting allows landowners flexibility to choose suitable species and to more effectively design areas for timber production; wildlife habitat; forest beauty and landscape; erosion control and water quality maintenance; Christmas tree production, or some combination of these objectives.

Seedlings are commonly planted by hand with various tools (shovel, planting bar or hoe-dad) on wet or rolling sites, or tracts with stumps or rocks. On other sites, such as large, relatively level areas, those free of large stumps and rocks, or abandoned agricultural fields, various

models of mechanical planting machines are used. Machine planting may be faster than hand methods and of higher quality on many sites. Some planting machines are equipped with special attachments (scalpers) to peel away competing sod.



Pine seedlings



Hardwood seedlings

## Competition Control

Once seedlings are regenerated and survive, they require sufficient sunlight and nutrients to become firmly established. Often, surrounding vegetation competes severely and must be controlled. Control of competing vegetation is called release. Release can be accomplished by mechanical or chemical means, or a combination.

### *Mechanical Release*

#### **Mowing, Brush Cutting and Hand Chopping**

Mowing, brush cutting or hand chopping are all mechanical ways to keep competing vegetation under control.

When planting open fields, provisions can be made to accommodate later mowing for grass control. Planted rows should be spaced at least two to three feet wider than the width of tractors and mowers. Depending on the tree species and expected product, mowing might be beneficial (Christmas trees) for three to five years. Frequent mowing is more likely the first year and is dependent on growing conditions. In following years, one mowing each growing season (performed in August) should be sufficient until the trees average four to five feet tall. After that, mowing should be discontinued unless a neat appearance is an important objective.

Brush cutting or hand chopping can be used effectively in pine plantations established on cutover forestland where hardwood sprouts are competition. Chopping may be used in combination with prescribed herbicides for greater effectiveness. To maximize economy, do not hand release more than necessary to keep the pine seedlings “free-to-grow.”

#### **Liberation**

After new reproduction of desirable species is assured, overtopping residuals from the harvest cut should be removed to release the new growth to full sunlight. Failure to do so results in retardation of the new trees.

Sound regeneration/harvest practices can eliminate the need for liberation since it is done

through harvest. When liberation cutting is needed, it can be performed by powersaw-felling, or with herbicides on all material above 1½ inches in diameter or about six feet tall. If limited finances are available for hardwood development, liberation cutting should receive priority.

### **Weeding and Cleaning**

If regeneration harvest is conducted effectively, weeding and cleaning may not be necessary. However, when needed, this timber stand improvement (TSI) practice is used to ensure the survival and early growth of desirable trees from competing vegetation, such as vines; heavy weeds and grasses, or undesirable trees.

This form of release can be accomplished with chemical herbicides, or “mechanically” by hand or machine. It is important when releasing the selected seedlings that climbing vines be cut or killed. “Climbers” on establishing hardwood reproduction can produce serious consequences during snow and ice storms and during heavy winds. Foliage from vines also proliferates in the upper tree canopies and “steals” valuable sunlight slowing down growth of developing trees.

When vine species are desirable for wildlife, they should be restricted to arbor areas. Weeding and cleaning practices can be excluded from these special areas.

Remember, it is not necessary to release all desirable seedlings in the stand. A few hundred well-distributed, free-to-grow seedlings per acre are all that are needed.

### *Chemical Herbicide Release*

Applying chemical herbicides is an effective and sometimes necessary means of controlling unwanted competing vegetation from planted pines. Use of herbicides for pine release normally occurs when pine seedlings are one, two or three years old. Chemical control (release) operations are normally conducted during the summer and early fall using “selective” herbicides that will suppress competing brush, but have little or no adverse effects on planted pines. Chemical release can be performed either from the ground or from the air.

There are several general methods commonly used in applying herbicides for release:

- ◆ **Strip spray** is the application of a path of herbicide about two feet wide along the row of planted seedlings.
- ◆ **Spot spray** is the application of herbicide confined to an area surrounding each seedling.
- ◆ **Broadcast spray** is the application of herbicide to the entire planted area. This can include aerial spray (normally using helicopters), or spray using various types of ground equipment.

When seedlings become firmly established, they can successfully compete with surrounding vegetation. Initial care for the first few years will provide long-term benefits to the forest.



Aerial application of chemical herbicides by helicopter

## Intermediate Practices

It is often helpful to reduce the density of trees to improve the health, growth and vigor of the best trees. Trees need sunlight, moisture and nutrients to grow well. Forest trees compete with each other for these essential factors. Thinning to remove a portion of the trees in a stand allows the best trees to maintain a competitive advantage and thrive. The best trees are retained as crop trees. Poorer trees are removed first and subsequently in later thinnings.

Dense pine stands will benefit from early or pre-commercial thinning to lower the tree density. In young hardwood stands, crop tree release is a practice used to thin around the best trees.

Once trees reach market-size, commercial thinning provides another opportunity to reduce the density yet again, leaving the best trees to grow.

## Pre-Commercial Thinning

Early successional species frequently seed naturally into areas in abundant numbers. Tree numbers exceeding 2,000 stems per acre are not uncommon. This overstocking can have serious consequences in early development of naturally-seeded stands. Effects of overstocking vary with tree species.

When recommended, overstocked stands should be pre-commercially thinned at an early age. In practice, this is most often done in pine stands. Trees should be small enough that stems can be cut with small equipment. Pre-commercial thinning can be “selective” (thinning around individual trees), or in strips where swaths are cut with mechanized equipment.

Pre-commercial thinning can shorten the time interval to the first commercial thinning. The need for thinning varies by site, species, density and uniformity of tree heights.



Pine pre-commercial thinning

### *Crop Tree Release*

Another timber stand improvement practice in young stands is crop tree release. This practice is typically performed in hardwood stands at the sapling-stage (one to five inches in diameter) and at least 12 years old. Trees should have started to show height dominance and be about 25 feet tall. The purpose of crop tree release is to maintain survival and growth on the best trees.

Crop trees should be good, healthy trees of desirable species. The trees can be good timber species, desirable for wildlife values or for aesthetics. Crop trees should be uniformly spaced throughout the stand where practical. Do not select crop trees on poor sites and where no good candidates exist. In sapling-size stands, 50 to 75 crop trees per acre should suffice.

Release the young crop trees by eliminating adjacent trees whose crowns are touching that of the crop tree. Also, cut or kill climbing vines on or near the crop tree. Competing trees are usually cut with chainsaws. Released trees should be exposed to full sunlight and free-to-grow overhead on at least three sides (hopefully four).

### *Commercial Thinning*

Once trees reach the minimum commercial size (pulpwood), thinnings can be conducted at a financial profit. The best trees should be retained as before to accumulate quality volume and accelerated value. The poorest trees or those less valuable to produce objective benefits should be removed first. Thinning can:

- ◆ Maintain tree vigor of the “leave” trees and resistance to insects and diseases.
- ◆ Enhance wildlife habitat.
- ◆ Obtain early financial returns to offset establishment and operational costs.
- ◆ Concentrate growth on the fewer best trees.
- ◆ Increase the rate of return on the forest investment by developing large trees that command high stumpage prices.

- ◆ Salvage trees that periodically die due to various causes, including suppression.
- ◆ Provide periodic income.
- ◆ Provide better access for fire equipment.
- ◆ Increase forest beauty.

Commercial thinnings can take many forms. Prescriptions will vary by species composition; site quality; tree size and quality; current rate of growth; incidence of insect and disease; tree defects; available markets for forest products, and, of course, the landowner’s objectives. Final spacing of the desired number of trees will be a function of all the factors discussed.



Commercial pine thinning



After a commercial pine thinning



Commercial thinnings can be categorized as “selective” and “corridor.” The numerous variations of selective thinning all work on the principle of individual trees. Corridor thinning can refer to row thinning in pine plantations, or thinning in natural stands of randomly established trees. In most cases, combinations of corridor and selective techniques are performed to accommodate the high level of mechanization.

## Final Harvest

Final harvest will be based on a number of conditions:

- ◆ Landowner’s objectives
- ◆ Stand health
- ◆ Natural maturity age of the species present
- ◆ Growth rate
- ◆ Product market conditions (prices, demand, etc.)

All of these factors should be considered before making the decision to do the final harvest as the forest management process begins again. A professional forester can assist with evaluating these factors and determining the best course of action. The decision to complete a final harvest should be carefully considered as it is a decision that will have long-term impacts. The harvest of the stand is the first step in creating a new forest; therefore, careful planning is needed. Regeneration plans should be an integral part of the harvest decision.

## Pine-Specific Management



Pine stand

There are numerous species of pines throughout Virginia. Loblolly, shortleaf, white and Virginia pine are the most common, but other species are both important and commercially valuable. Virginia's pines are early-successional species and benefit from full sunlight during growth and development. Once harvested, pines can be reproduced either through natural or artificial means, a planned program of selected forestry practices greatly improves long-term management options. Some common practices used with pines are: site preparation, planting, release and thinning.

### Harvesting Methods

The harvesting methods discussed previously in the Forest Management Practices section of this chapter cover the options for pine [{See Harvesting Methods}](#). The Clearcut, Seed Tree and Shelterwood harvests are the most common harvesting methods used in pine. The other methods are options, but are not as well suited for pine.

### Seed Tree Law

If you are planning a timber harvest, you must consider Virginia's seed tree law.

The Seed Tree Law, enacted by the State Legislature in 1951, applies to more than 10

acres where loblolly or white pine constitute 25 percent or more of the trees. The law requires that eight cone-bearing pine trees of the above species, 14 inches or larger in diameter, be left uncut and uninjured on each acre of land being harvested. If a seed tree 14 inches in diameter or larger is not present on a particular acre, two trees with the largest diameter must be kept in its place. However, before any harvesting is undertaken, a management plan approved by the State Forester may be designed that will allow the harvest of all trees, as long as the landowner agrees to reforest.

Usually these plans call for the reforestation of the area with pine seedlings. If any seed trees are retained, they may be harvested in three years. Land clearing for agriculture or building development is also allowed.

### Site Preparation

In many cases, it pays to reduce competing vegetation and logging debris before planting or natural regeneration. Initial costs of treatments must be weighed against increased production and future economic gains and on-site conditions that might be influenced by selected treatments. Often, too extensive a site treatment is uneconomical, or may actually decrease soil-site productivity. Ideally, site preparation reduces competition without removing or destroying top soil and organic matter. Classes of site preparation are mechanical, prescribed burning and chemical herbicides. [{See Site Preparation}](#)

### Mechanical

**Drum chopping** can effectively reduce woody competition with a minimum of soil disturbance when large amounts of small diameter trees or brush are left after harvest. Drum chopping can be used alone, or in combination with prescribed burning.

**Shearing** is used to remove large numbers of stems that are too large to disk or drum chop. Most debris that would hinder planting is removed. Debris is piled in windrows or piles. Frequent gaps should be made in windrows for access by planting crews and firefighting equipment. Large piles and windrows deteriorate slowly, and occupy more

of the planting site. Use care to keep the windrows narrow, piles small and to keep topsoil disturbance at a minimum.

**Disking** is an effective method of cutting and turning under low brush and finer logging debris. Similar to plowing, disking also has benefits of incorporating organic material into mineral soil, breaking up compaction and increasing infiltration of water into soil. Care must be taken to minimize erosion.

**Scalping** is a very specialized form of plowing. Only a limited corridor of competing vegetation is removed from the path of the planted rows. The practice can be applied using conventional farm plows or special attachments on planting machines. The threat of soil erosion is minimal with scalping if rows are on the contour.

**Mowing** of open fields prior to planting is beneficial on areas more occupied by weeds and fine grasses than those of coarse, dense, more-competitive vegetation. Mowing affords temporary reduction of competing vegetation, exposes rodents to predators and improves planting efficiency.

### ***Prescribed Burning***

Prescribed burning for site preparation is a very effective tool in reestablishing forest stands. It is most commonly associated with loblolly pine, but is very useful with other species. It is by far the simplest and least expensive method of preparing planting sites.

Prescribed burning has a three-fold purpose:

- ◆ Remove dense logging debris and expose more plantable area.
- ◆ Control competing underbrush and other biological agents, thus improving planting bed conditions and opportunities for survival, early growth and development.
- ◆ Provide heat sufficient to kill the overstory competition and thus reduce the overhead shade and competition for moisture and sunlight.

Prescribed burning is a highly technical job requiring a knowledge of fire behavior, suppression techniques and the environmental effects of fire. Prior to its use, a prescribed burning plan should be prepared. The actual fire should be skillfully applied according to plan.



Prescribed burning for site preparation

### ***Chemical Herbicide***

Chemical herbicide for site preparation is another effective means for creating site conditions suitable for forest regeneration. Herbicides can be used singularly, in mixtures or in combination with prescribed burning for desired results. Prescriptions for use should be developed by a professional forester.

When herbicide application is used for site preparation, work can be performed during the spring, summer or early fall depending on species, site conditions and prescriptions. Materials, formulations and rates are selected to meet conditions of season and vegetation growing conditions and environmental considerations.

Site preparation using herbicides minimizes the problem of soil erosion and potential site degradation. Site recovery is rapid following application. Grasses and herbaceous vegetation generally cover the site the first growing season after pine planting. This recovery also has wildlife habitat benefits. Where appropriate, herbicides can save considerable time, effort and money.

## Pine Regeneration

### Artificial Regeneration

Both loblolly pine and white pine are covered by the Virginia Seed Tree Law. Virginia landowners must abide by the provisions of this law, or other suitable regeneration provisions as alternative options in an Alternate Management Plan.

There are two planting options and numerous variations under each option: hand planting and machine planting. Where sites are open fields, or large well-prepared cutover tracts, machine planting may be the most effective and economical. But, hand planting is more efficient on small areas, where terrain is steep or rough; where stumps are numerous or of large diameter, or where residual logging debris impedes the use of machines. *{See Tree Regeneration}*

#### Hand Planting

Simple equipment is necessary for hand planting: “dibble” planting bar or hoedad, and a planting bag for carrying and protecting seedlings.

Seedlings should be planted one tree per hole, upright and no folding of the roots. Be very careful to keep the central tap root straight (no “J” root). Root-pruning should be avoided in the field since most seedlings are root-pruned at the nursery. Pine seedlings should be planted tight so that seedlings can not be pulled out by pulling on three needles.

#### Planting Time

For conventional planting of pine seedlings, the most favorable time is during the dormant season (February to early April). Avoid planting when the ground is hard – either frozen or dry; or, when it is too wet or sticky.



Hand planting

Planting when the soils are in poor condition results in misplanted seedlings, low survival, poor planting production and poor growth.

#### Spacing

Before ordering seedlings, decide what spacing to use. No standard spacing can be recommended because of differences between species, site quality, local survival patterns, products desired or other factors. A professional forester can prescribe the number of seedlings to be planted.

#### Machine Planting

Specific planting machines are not recommended due to the variation of conditions throughout Virginia. Fortunately, a number of good machines with specialized features are available for rent from the Virginia Department of Forestry or through private contractors. One or more will be particularly suited to each site.

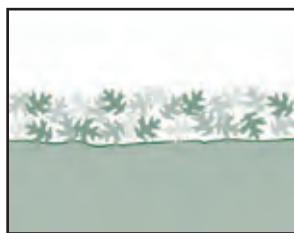
As with hand planting, protecting seedlings from drying out during machine work is very important. Seedlings must remain covered and the roots kept moist.

In all planting, check frequently to ensure that seedlings are being planted properly.

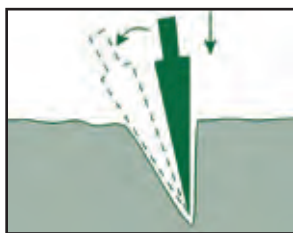


Machine planting

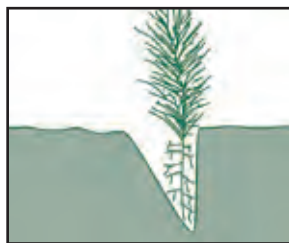
**Figure 3. Hand Planting Bare-root Seedlings**



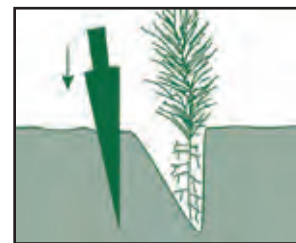
1. Brush aside loose organic material such as leaves, grass, etc., from the planting spot to expose mineral soil. If organic matter gets into the planting hole, it can decompose and leave air spaces. Roots will dry out when they grow into these spaces.



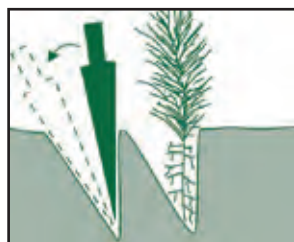
2. Insert bar straight down and pull backward to open hole, making sure the hole is deep enough for the roots to be fully extended. If the roots are curled or bunched up, the tree will often weaken or die, or may blow down later due to poor root structure.



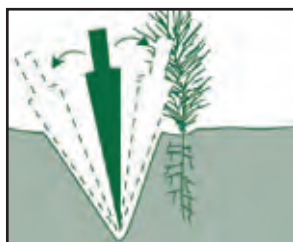
3. Remove bar and place seedling upright at correct depth with roots straight. Hold the seedling in place in the hole, making sure the roots are straight and fully extended, and the seedling is at the proper planting depth.



4. Insert bar straight down behind last hole.



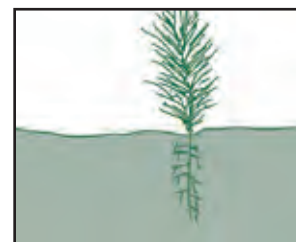
5. To hold seedling, pull bar handle back toward the planter to close hole at the bottom of the roots.



6. Push bar handle forward to close hole at the top of the roots. Rock bar back and forth to pack soil firmly against roots.



7. Fill in the last hole by tamping with the heel. If mineral soil is not firmly packed around the roots, there will be air pockets that can dry out the roots, and the seedlings may be weakly anchored.



8. Proper planting techniques will increase survival and promote healthy trees in the long term.

### Direct Seeding

In the past, direct seeding of pine was used to regenerate pine forests. Direct seeding has been done by air or by hand-spreader. These methods often result in stands that are too dense. Advances in pine genetics have made it more economical and efficient to plant seedlings rather than direct seeding.

### Natural Regeneration

Pines reproduce from seeds rather than sprouting. Therefore, a seed source must be present to naturally regenerate pine. Pine seeds are dispersed by the wind and can travel several hundred feet. Pine seed trees or seeds blown in from adjacent stands can provide the necessary seed source. Pine seeds need open conditions or bare-mineral soil to germinate and grow. Natural pine regeneration is often sporadic because good seed crops occur only periodically. This results in stands that are often too dense or too sparse. Also, competing vegetation from shrubs and hardwood sprouts often interfere with successful establishment. Advances in reforestation practices and pine genetics have made planting seedlings a preferred option.

### Competition Control

Once pine seedlings are planted and survive, they require sufficient sunlight and nutrients to become firmly established. Often surrounding vegetation competes severely and must be controlled (until pine seedlings attain four to five feet in height). Control of competing vegetation is called release. Release can be accomplished by mechanical or chemical means, or a combination.

The different methods of competition control were discussed earlier in this chapter *{See Competition Control}*. However, the most common competition control is with chemical herbicides or by a pre-commercial thinning operation.

When seedlings become firmly established, they can successfully compete with surrounding vegetation.

Initial care for the first few years will provide long-term benefits to the forest.

Pine management is not difficult, but it is complex. There are numerous biological, economical, social and business considerations to be measured, analyzed, compromised and decided upon. Even legal provisions need to be considered in particular cases. Good plans made well in advance, then methodically implemented in a business-like approach will assist landowners in maximizing returns for multiple objectives from forestland. Professional foresters are available and should be consulted to assist with analyzing, planning and implementing the various forestry options introduced.



Aerial herbicide application



After aerial herbicide application



Pine thinning



Logging deck for a pine thinning



Following pine thinning

## Intermediate Practices

If stands are established properly with an optimal number of seedlings and competition is controlled, there are few early intermediate practices needed. If the new stand is overstocked, a pre-commercial thinning may be necessary to return the stand to optimal stand density for growth and development.

When stands reach commercial size (usually 15 to 20 years), thinning is a highly-desirable practice. Thinning will remove the smaller, poorly-formed trees, while leaving the best trees. This provides ample sunlight and moisture for the continued growth and health of the crop trees. Thinning should be performed whenever the stand grows to an overcrowded condition and can be commercially accomplished. *{See Intermediate Practices}*

## Final Harvest

It is important to consider the natural life span of the pine species present when determining the age of final harvest (rotation age). In general, pines don't live as long as hardwoods and have a faster rotation. Because many landowners grow pine for financial returns, the economic rotation age is often shorter than the natural life span. For some landowners, when the growth rate of the trees is less than their desired financial rate of return, they choose to harvest the stand. The final harvest decision will also be based on the desired products (e.g., pulpwood, sawtimber) to be produced and market conditions for those products. Again, this is based on the landowner's objectives. In all circumstances, a professional forester should be consulted prior to harvest and consideration given to regeneration plans. *{See Final Harvest}*

## Hardwood-Specific Management

There are many species of hardwood trees throughout Virginia. Individual species and groups of species are specifically associated with the region of the state and site. Hardwood forests are very diverse and harbor many benefits including those associated with timber production, game and non-game wildlife, aesthetics and landscape, recreation, quality water production and soil protection. Biological diversity of flora and fauna is great in hardwood ecosystems.

Like pine forests and other agricultural crops, hardwood forests should be managed properly to attain even greater benefits than those solely provided by nature. However, management of hardwood forests is more complex and thus very challenging due to the various mixtures of tree species. Each different species has inherent needs for sunlight, nutrients, water and other biological support which affect growth and development. Management in hardwood stands is much different than management in pine stands. Professional forestry assistance should be consulted well in advance of any timber harvesting in hardwood stands. Important differences in site productivity, species composition present, potential species and numerous other distinctions must be defined. Often, damage to the present stand and serious loss of potential or destruction occurs before technical advice is sought.

Hardwood trees grow on a wide range of sites. Some sites are dry and relatively infertile while others are nutrient rich and moist. Site differences must be defined early to set production guidelines. Growing quality hardwoods economically over longer rotations will require the best sites. Poorer sites should be chosen for pine conversion (species less demanding), or for short rotations of small-size hardwoods (pulpwood, fuelwood or small sawtimber). Forest management recommendations will vary greatly between hardwood stands. This section will address techniques more associated with growing large, high-quality, high-value hardwood trees on good sites.



Professional foresters should analyze hardwood forest conditions and prescribe necessary practices to meet landowner objectives while retaining biological integrity. Recommended forest management activities and stand prescriptions (with schedules) should be outlined in a detailed forest management plan. Practical balance between timber production and other values can be planned and controlled. Management activities can speed the change for positive benefits.

Regeneration/site preparation includes all activities associated with developing site/soil conditions suitable for natural or artificial reforestation. Those activities include preparing site conditions suitable for germination of seed (natural regeneration), direct seeding/planting seedlings (artificial regeneration) and survival/development of the seedlings.

Intermediate treatments include all the cultural work and thinnings performed in the development of the hardwood stand to maturity. These include many forms of thinnings often referred to as timber stand improvements (TSI).

Harvesting of mature timber includes the cutting of the final product (the crop trees). No final harvest should be made until advanced regeneration is in place, seed is on site, or other plans are concrete for the establishment of the new forest.



Large, high-quality, very valuable hardwood trees are more site sensitive than many species of pines. Sensitivity varies considerably among species. For instance, growing tall, large diameter, limb-free black walnut trees will require the deepest, most nutrient rich, moist, but well-drained soils. Whereas, chestnut oak can thrive relatively well on shallow, rocky and dry soils.

## Harvesting Methods

The harvesting methods discussed previously in the Forest Management Practices section cover the options for hardwood [{See Harvesting Methods}](#). Hardwood regeneration is most commonly achieved by natural methods. The type of harvest selected determines the regeneration process.



Shelterwood hardwood harvest

## Site Preparation

In hardwoods, the harvest method is designed to create conditions optimal for the natural establishment of the new stand through seeds or sprouts. In most cases, additional site preparation is not needed. An exception would be the removal of poor-quality residual trees from the previous stand. These non-desirable trees should be eliminated through mechanical or chemical means. [{See Site Preparation}](#)

## Hardwood Regeneration

[{See Tree Regeneration}](#)

### Natural Regeneration

If properly managed, hardwood stands should be harvested and regenerated at the end of the planned rotation. These are final cuts and are separate from cuts performed for intermediate stand improvements. Exact timing of the harvest can be flexible to coincide with favorable market conditions. Proper management requires that provisions for establishing the new forest are firmly established before final harvest cutting occurs.

Unfortunately, many hardwood stands are in need of restoration. These are stands dominated by low-quality trees and reduced volumes resulting from a history of improper cutting and follow-up, or from incomplete harvesting. The all-too-common practice of “high-grading” (removing the best trees and leaving the worst) has created many such stands. In those stands, provisions must be planned for starting anew in establishing a stand of desirable trees.

Hardwood reproduction will originate from natural means (seed, sprouts, root suckers and advanced reproduction of trees formerly occupying the site). **Natural means are most commonly used on sites formerly in forest.** Artificial means (planting or direct seeding) are limited to areas where natural regeneration is unlikely (open fields, non-forested riparian areas).

The best way to regenerate hardwood forests is through natural means involving careful planning and harvest of existing stands. New trees and forests result from seed and from sprouting of stumps of harvested trees. Planting hardwood seedlings under existing forests or harvested land is difficult, expensive and rarely successful. This is primarily due to extreme competition from well-established native trees and plants to a small planted seedling with a limited root system. This would be recommended only in special cases and limited areas where desirable native species are completely absent.

Timing the harvest cut will have a considerable influence on the composition and quality of the reproduction. Harvesting the original stand from November through March favors coppice development (stump sprouts) and takes advantage of current-year seed crops. Summertime cutting has other effects on reproduction and favors different species.

Following a harvest, poor-quality, broken or damaged trees may remain that will interfere and shade out desirable new trees. It is important to assess areas following harvest and fell, or kill in place, these poor-quality trees (source of snags for wildlife). A few poor-quality residual trees can spoil a new forest.

### Artificial Regeneration

**Planting or direct seeding of hardwoods, as described below, is for non-forested open land where hardwoods are desired and where natural regeneration is unlikely.**

Planting and direct seeding of hardwoods involves intensive site preparation, establishment, cultural release, corrective pruning or optional training with interplanted conifers. Planted hardwoods must receive abundant moisture for survival and early development. Thus, moisture must be available for hardwood seedling use and not consumed by competing vegetation. Planting and direct seeding of hardwoods should be focused on the most favorable sites and where sufficient time and funding is available to perform needed work. Some success has been reported on direct seeding of hardwoods, particularly oaks.

Hardwood seedlings account for about one percent of the total seedlings produced in southern nurseries. Of the timber species, highest production is for black walnut, yellow poplar, green ash, white ash and several oaks. Important factors to consider when planning for the artificial establishment of hardwoods:

- ◆ Best sites are rich bottomlands, stream terraces, coves, lower-slopes and north- and east-facing slopes.

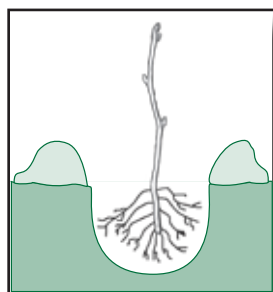
- ◆ Hardwood species are very site specific. Particular sites need to be identified before planting or seeding.
- ◆ Choose the right seedlings for the site.
  - ✧ **Wet sites:** willow oak, cypress, pin oak, swamp chestnut oak, water oak, alder, black gum and other wet-tolerant species.
  - ✧ **Dry sites:** black oak, chestnut oak, southern red oak, hickory, persimmon, apple and other species for dry sites.
- ◆ Soils should be deep, fertile and well-drained.
- ◆ Newly planted hardwood seedlings cannot compete with natural regeneration. Planting and seeding of hardwoods is not necessary on harvested sites where desirable species are or will be established by nature.
- ◆ Complete project by **April 15** in the Coastal Plain and Piedmont and by **May 1** in the Mountains.
- ◆ Hardwood seedlings must be large, healthy seedlings (root-collar diameter of at least ¼ inch, a live terminal bud and well-developed root system).
- ◆ Store seedlings in a cool, dry place, such as a basement, barn or similar outbuilding. Maintain a temperature below 40 degrees, if possible, but avoid letting the seedlings freeze.



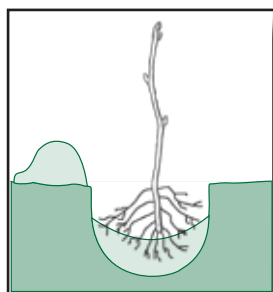
Riparian hardwood planting

- ◆ Prepare the site by removing heavy fescue or other plants that harbor mice and voles.
- ◆ Avoid doubling, twisting or crowding the roots when planting. Use planting mattocks, shovels or hole augers.
- ◆ Scalp the planting spot by removing grass roots, which will compete with the seedling.
- ◆ Control grasses and herbaceous vegetation until tree seedlings have outgrown the weeds. Registered herbicides are effective.
- ◆ Plant seedlings on a spacing that will permit mechanized cultivation or mowing.
- ◆ When planting, take care of the roots! Keep bundles closed or in plastic bags to keep them from drying out.

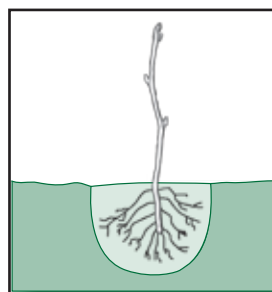
**Figure 4. Hand Planting Bare-root Hardwood Seedlings**



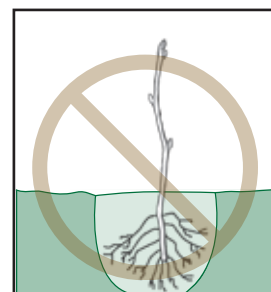
Dig hole large enough to spread out roots.



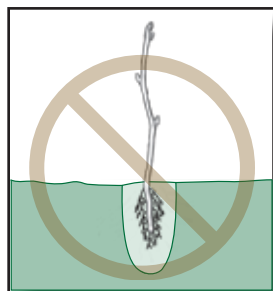
Set seedling with the root collar at ground level.



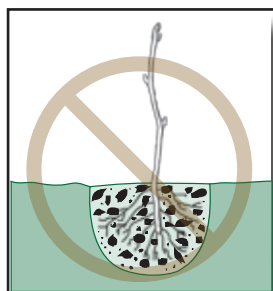
Fill hole, firm soil so there are no air pockets.



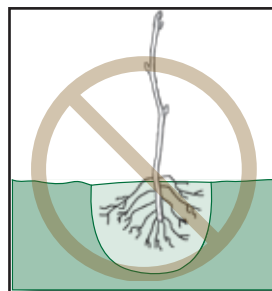
Hole too deep, root collar below ground level .



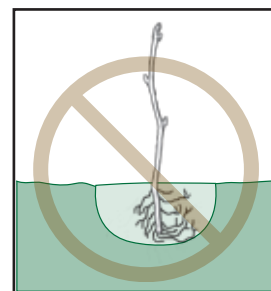
Compacted roots, hole too narrow.



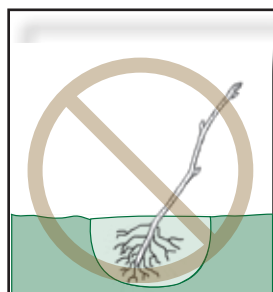
Air pockets and debris in hole.



Exposed roots, not planted deep enough.



"L" or "J" roots, hole too shallow.



Tree not vertical, hole too shallow.

### Tree Shelters

- ◆ Use four-foot tree shelters to protect from deer.
- ◆ Install shelter two to three inches below ground to protect from mice and voles, with the flared end up. If using flat sheet shelters, be sure to overlap the sides to provide secure closure when assembling.
- ◆ Use white oak, treated pine or other durable wood stakes. Place the stake on the north side of the shelter so it does not shade the seedling.
- ◆ Attach the shelter to the stake with releasable ties.
- ◆ Install bird nets on top of the shelter leaving a one-inch hole in the top.
- ◆ Install three foot by three foot grass control mats with the shiny, smooth side up; lay them flat, and secure with pins.

Consult a professional forester for technical advice before planting or seeding hardwoods. Site examinations may reveal that the practices are unnecessary. If artificial establishment is needed, sound advice should direct the considerable investment needed in time and money.



Four-foot shelter 2 to 3 inches below the 4 foot-mark



Treated wooden stake with releasable tie



Bird net with one-inch hole in top



Degradable shelter with perforated line



Hardwood seedling and planting supplies

## Maintenance

- ◆ Check the planting annually for needed maintenance.
- ◆ If livestock are active adjacent to the planting, check fences frequently to ensure livestock do not access the planting area. Flash grazing should not be permitted in plant areas.
- ◆ Replace broken stakes. Hammer in loose stakes.
- ◆ Straighten any leaning shelters. Be sure the shelter is seated two to three inches in the ground.
- ◆ Remove wasp nests or vegetation inside the shelter that will compete with the seedling for light and nutrients.
- ◆ Be sure the bird netting is pulled down to leave a one-inch hole, remove the net when the seedling reaches the top of the shelter.
- ◆ Check for and control invasive species.
- ◆ Leave the shelter in place until the seedling is two to three inches in diameter, unless mold or fungus forms on the seedling bark.
- ◆ If the shelter is degradable and has a perforated line so it will split, leave it on until it splits off. Tubes without a perforated line should be cut off when the seedling is two to three inches in diameter. Check after spring frost.
- ◆ Start corrective pruning on black walnut at about five years. Other hardwoods can be correctively pruned as well.

## Intermediate Treatments

Carefully regulated harvesting techniques to support regeneration often preclude the need for early cultural practices in natural stands. On the other hand, cultivation and mowing are beneficial in hardwood plantations. As discussed previously, some intermediate practices associated with the development of quality hardwoods of natural origin on good sites are: liberation; weeding and cleaning; crop tree release, and commercial thinning. [{See Intermediate Practices}](#)

## Final Harvest

Depending upon the species, the natural life span for hardwoods can be up to several hundred years. However, good management practices can shorten the rotation for producing quality hardwoods. Product markets will have a large impact on the final harvest decision. Markets for hardwoods vary widely depending on tree quality and size. Historically, prices for small, poor-quality hardwoods are very low, while prices for large, high-quality hardwoods can be excellent. Landowner objectives will greatly impact the timing of the final harvest. A professional forester can guide the landowner in planning the harvest and regeneration of the new stand. [{See Final Harvest}](#)



Hardwood stand

# Specialty Forest Management

There are several unique forest management opportunities for forest landowners: restore diminished species, grow trees for specific markets and provide biodiversity.

## Restore Diminished Species

Three important tree species in Virginia have diminished over time. There are efforts underway to restore these to the landscape.

### *American Chestnut*

The American chestnut was once a very important forest species throughout its native range. It was used for timber products and was very important for wildlife due to the prolific production of seed. It has been devastated by the chestnut blight that has wiped out the majority of native trees. There is an ongoing effort to re-establish the chestnut with a resistant variety of chestnut.



American chestnut

### *Longleaf Pine*

Longleaf pine historically occurred on an estimated 1.5 million acres in southeast Virginia. It was exploited by early residents by tapping for its resinous sap, used for tar and pitch (naval stores) and for its high-quality lumber. By 2000, only a few hundred native trees remained in Virginia. Longleaf is well-adapted to fire, and the resulting open and grassy understory makes excellent and diverse habitat for plants and animals. The VDOF and a number of other agencies and groups are working to restore this stately tree using native seed, establishing a seed orchard, and new plantings on public and private lands. Due to these growing efforts, there are now several thousand acres of young longleaf in Virginia.



Longleaf pine

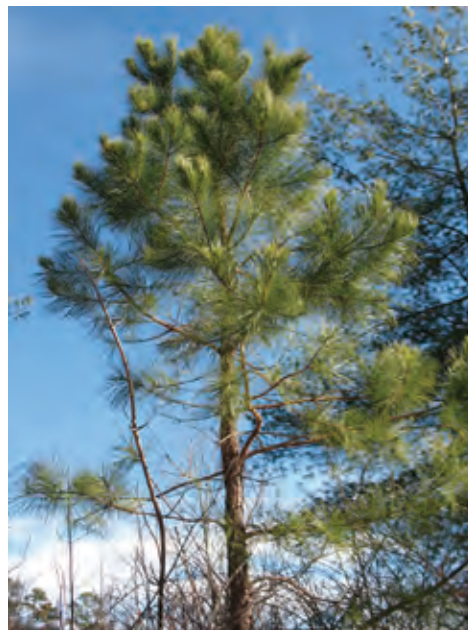
## Shortleaf Pine

Shortleaf pine is the most widely-distributed pine in Virginia, and previously was found in nearly every county in Virginia. Its moderate to slow growth and straight form produces excellent quality lumber. Shortleaf is well-adapted to disturbed areas like old farm fields and areas that have seen fire. As these conditions are less common today, and due to replacement by faster-growing pines, the acreage of shortleaf in Virginia has dropped drastically since the 1940 Forest Survey. Echoing southeast Regional efforts, Virginia is working to restore shortleaf pine across the state.

## Grow Trees for Specific Markets

The market for Christmas trees provides an opportunity for managing your forest resources. This option will provide income every six to eight years, but is very labor intensive. It takes a very hands-on approach to management with some labor required every year throughout the rotation. In addition, there may be market opportunities for greenery, wreaths and roping.

There are other markets discussed in the Forest Products Marketing chapter [{See Forest Products Marketing: Non-Timber \(Specialty\) Forest Products}](#).



Shortleaf pine



Christmas tree farm

## Getting Assistance

There are many benefits to owning and managing forestland, but it does take good planning and implementation to fully realize these benefits. Forest management is a long-term endeavor and many of the practices occur only occasionally over periods of time, making it challenging for landowners to develop skills or keep current. Fortunately, there are professional foresters and contractors with skills and services that can provide guidance and help landowners do the very best in managing their land.

Professional foresters are those who have training and experience in forest management and implementation of plans and generally fall into three categories: Virginia Department of Forestry foresters, private consulting foresters and foresters employed by forest industry. These foresters can assist with planning and implementation of practices. In addition, they can coordinate with specialized forestry contractors to complete practices.

### Virginia Department of Forestry Foresters

Since 1914, the Virginia Department of Forestry (VDOF) has offered a variety of services to Virginia landowners to help them meet their goals and objectives. VDOF field staff are available across the Commonwealth to assist landowners with their questions and direct them to the resources necessary to develop, manage and protect healthy forests.

#### Forest Management and Health

- ◆ Conduct field visits to provide forest management recommendations.
- ◆ Develop multi-resource management plans.
- ◆ Provide insect and disease identification and control recommendations.



- ◆ Conduct prescribed burning for site preparation and wildlife habitat improvement.
- ◆ Coordinate tree planting.
- ◆ Facilitate herbicide application for site preparation and release.
- ◆ Marking timber.
- ◆ Assist landowners with state and federal financial assistance applications.

#### Timber Harvesting and Water Quality

- ◆ Conduct field visits and provide harvest recommendations.
- ◆ Develop pre-harvest plans.
- ◆ Assist with Riparian Buffer Tax Credit application.
- ◆ Provide recommendations for the stabilization of forest soils.
- ◆ Inspect logging operations for water quality protection.

\* The Department of Forestry, by policy, does not provide timber inventory, appraisal or marketing services.

#### Land Conservation

- ◆ Discuss available forest conservation options.
- ◆ Develop forest conservation easements for interested landowners.
- ◆ Hold conservation easements on working forestlands.



### **Tree Seedling Production**

- ◆ Produce and sell pine and hardwood seedlings for reforestation, soil protection and wildlife habitat projects.
- ◆ Collect seeds from Virginia trees for propagation.

### **Resource Protection**

- ◆ Educate landowners about protecting their property from wildfire.
- ◆ Assist communities in the development of wildfire protection plans.
- ◆ Respond to wildfires to protect lives, property and natural resources.



### **Private Consulting Foresters**

Private consulting foresters are either self-employed or work with a firm that provides valuable fee-based forestry services for landowners. Some of the services include timber inventory and appraisal; timber sales and marketing, and coordination of forestry contractors.

- ◆ Boundary line location and boundary marking.

- ◆ Timber appraisal to provide an inventory of the species, size, quantity and quality of standing timber within the sale area. This information is critical. Without it, the landowner has no basis for determining a fair market price for the timber.
- ◆ Harvesting plan to locate haul roads, log decks and stream crossings. A good road system is a capital improvement with long-term benefits for management, recreation and fire control.
- ◆ Tax planning prior to a timber sale and preparation of a reforestation budget.
- ◆ Timber sale contract preparation and serving as the landowner's agent in conducting the sale and overseeing the harvesting operation. Retaining a consulting forester in almost every case ensures the highest return for the timber and a sale with fewer problems for the landowner.
- ◆ Coordination of forestry contractors for road construction, harvesting, site preparation, tree planting, herbicide spraying and timber stand improvement.

### **Finding a Consulting Forester**

The Association of Consulting Foresters is a national organization with a Virginia chapter that provides professional parameters for consulting foresters ([www.acf-foresters.org](http://www.acf-foresters.org)). There is no licensing requirement in Virginia for forestry consultants. The Virginia Department of Forestry maintains a list of consulting foresters who work in Virginia ([www.dof.virginia.gov](http://www.dof.virginia.gov)). This list includes only someone who has a B.S. degree in forestry or higher from an accredited institution, or 10 years' experience (qualifies to use the title "Forester" as outlined in State Code). As with any service provider, it is recommended to contact more than one, and to inquire about their experience and references. The consultant may work on a per hour, per job, per acre basis, or, if a timber sale is involved, on a percentage of the timber sale revenue. Increased sale returns will generally more than offset the consultant's fee.

## Forest Industry Foresters

Some forest products companies (e.g., sawmills or paper mills) employ foresters who can provide services to landowners. These would vary by the company and could include planning, inventory, timber sales assistance, obtaining harvesting or planting contractors, or tree seedlings. Establishing a relationship with a company may have short- and long-term benefits to the owner. In exchange for these services, the company may ask for some type of commitment from the landowner. An example might be an agreement by the landowner to allow the company to bid on any timber that the landowner may sell. Again, the landowner should exercise due diligence by seeking references and communication with other landowners before entering into any agreement. Virginia Department of Forestry offices maintain a list of forest products companies and timber buyers.

## Forestry Contractors

There are many tasks related to forest ownership and management. They may be general in nature, or very specialized. Examples could include boundary line location and marking; road layout and construction; harvesting; thinning; fire line construction; prescribed burning; bulldozing; tree planting; herbicide application, and timber stand improvement. Professional foresters (e.g., VDOF, consulting foresters, industry foresters) generally know contractors who provide these services in local areas and can often help the landowner with coordinating the work. Before engaging a contractor, check references, insurance, appropriate licenses and certifications. A written agreement with a contractor helps to ensure understanding and clarity, and serves to protect both parties. There are often many advantages in choosing reputable contractors who specialize in forestry work.

## Virginia Tech and Virginia State University

The Virginia Tech College of Natural Resources and the Environment ([www.cnre.vt.edu](http://www.cnre.vt.edu)) and Virginia State College of Agriculture ([www.agriculture.vsu.edu/special-programs/cooperative-extension/forestry](http://www.agriculture.vsu.edu/special-programs/cooperative-extension/forestry)) provide education, research and information for students, citizens and forest landowners. Outreach is provided through the Cooperative Extension Program. The Virginia Forest Landowner Education Program ([www.forestupdate.frec.vt.edu](http://www.forestupdate.frec.vt.edu)), in conjunction with numerous state, federal and private partners, offers a wide variety of science-based educational opportunities for new and experienced forest landowners. These include publications, conferences, tours and on-line courses. In addition to extension staff at the universities, there are several forestry and natural resource district agents located across Virginia.

*A professional forester can assist in evaluating your forestland and determining the best plan for your individual forest.*





# CHAPTER 3

## FOREST PRODUCTS

### MARKETING



## Economic Value of the Forest

The “value” of Virginia’s forests is many things to many people. To some, the value lies in the beauty of the forests. Landowners and the forest products industry consider the utilization of the resource as the most valuable asset. Whatever the “value,” we must recognize that Virginia’s forests provide a renewable natural resource that extends from harvesting timber to natural beauty. Whether it’s a walk in the urban forest or a hunter in the rural forest, all Virginians can enjoy this resource as it continues to provide a necessary framework for our daily lives.

Virginia is blessed with very diverse, healthy forests and forest industries that provide billions of dollars annually to the economy and millions to forest landowners from products obtained from their lands. These can range from the more traditional timber products, such as lumber, poles, pulp and paper, to non-timber or specialty products like Christmas trees, recreation, hunting leases and shiitake mushrooms, to emerging markets focused on energy and environmental products. Although all markets are not available to all forest landowners, awareness of potential opportunities can help maximize the benefits that they receive and help minimize conflicting uses.



## Traditional Timber Markets

Forests have been harvested for generations to provide the products that we depend on and income to landowners. To maximize income, timber needs to be harvested efficiently and wood used in the highest-value products as possible. These markets will vary depending on species, quantity, quality and size of trees; local mills, and product demands. One advantage with timber is that it can be harvested when it is most beneficial to the owner. If markets are down, the harvest can be

delayed allowing the trees to continue to grow until conditions are better. Timber is usually harvested into a few general products that are then sorted and sent to specific markets. In many cases, pine and hardwoods go to different mills for processing (Table 3). Some landowners may have unique species or situations that will require finding specialized markets for their wood. Using professional foresters can help ensure landowners receive the best value.

**Table 3. Traditional Timber Markets**

Product (high to low value)	Softwood Use	Hardwood Use
Veneer, Peeler Logs	Construction Use - Plywood, Oriented Strand Board (OSB), Panel Products, Veneer	Furniture/Architectural Use - Plywood, Panel Products, Veneer, Oriented Strand Board (OSB)
Sawlogs, Poles	Utility Poles, Pilings, Construction Lumber, Flooring, Paneling, Pressure-Treated Lumber, Pallets	Grade Lumber for Furniture and Cabinets; Flooring, Paneling, Ties and Cants, Pallets
Pulpwood	Pulp and Paper, Posts, Wood Pellets, Shavings, Chemicals	Pulp and Paper, Wood Pellets, Firewood, Chemicals
Biomass (tops, branches, misc.)	Boiler Fuels, Mulch	Boiler Fuels, Mulch
Additional information on timber products can be found at: American Hardwood Information Center <a href="http://www.hardwoodinfo.com">www.hardwoodinfo.com</a> Southern Forest Products Association <a href="http://www.southernpine.com">www.southernpine.com</a> American Forest and Paper Association <a href="http://www.afandpa.org">www.afandpa.org</a>		



Traditional forest products: fence posts



Traditional forest products: pulpwood

## Selling Timber

Forest landowners generally make timber sales only a few times in their lives. They may invest 20 or more years growing a timber crop and can lose much of its value if not sold and harvested correctly. Unless the seller is a forester or an experienced timber dealer, there is no way he or she can make an accurate appraisal of the value of the timber. Using professional foresters (much like a realtor selling a house) – who are familiar with selling and harvesting timber – can help landowners get the best value from their forestland. A sound timber sale is the result of careful planning, management and marketing. The landowner with timber for sale and prospective buyers need to know exactly what is being offered for sale.

For a fee, consulting foresters can offer private landowners numerous forestry services, including timber appraisal, contract development, sale administration and harvest operation supervision.

The Virginia Department of Forestry website has contact information for their local foresters and private consulting foresters at [www.dof.virginia.gov](http://www.dof.virginia.gov).

### Professional Assistance

Virginia Department of Forestry foresters can provide:

- ◆ Forest Management Plans (fee applies)
- ◆ Advice on what and when to sell
- ◆ List of consulting foresters
- ◆ List of timber buyers
- ◆ Timber sale contract suggestions
- ◆ Advice and monitoring of harvesting and water quality Best Management Practices (BMPs)
- ◆ Tree planting assistance
- ◆ Advice on Seed Tree Law requirements

Consulting foresters can provide, for a fee:

- ◆ Forest Management Plans
- ◆ Timber appraisal (cruise)
- ◆ Timber sale administration and monitoring
- ◆ Logging operations inspections
- ◆ Act as landowner’s agent
- ◆ Reforestation

Forestry industry foresters can provide:

- ◆ Forest Management Plans
- ◆ Other services, depending on the company

### When to Sell

Ideally, timber harvesting is part of an overall plan of management for a forestland property and is performed at scheduled times during the growth of the timber stand. Periodic harvests or cutting are necessary in a properly-managed forest to improve growing conditions in immature stands, or to harvest mature stands before insects and disease start to kill trees with poor vigor. When deciding whether to cut timber, the landowner should keep in mind his or her goals and what he or she wants from his or her forestland. A harvesting or timber-cutting decision should be made with the landowner’s ultimate forest management objective in mind. Both private and public foresters are available to help develop your forest management plan and to provide you with information about your timber sale options.

### Designated Trees or Areas for Harvest

Areas and trees to be cut should be clearly marked. This may be done by marking trees around the area with paint or by designating easily recognizable physical features, such as roads or streams. Maps or aerial photographs are very helpful in showing the areas to be cut and in identifying boundary lines. Well-marked boundary lines are advisable to prevent cutting of trees outside the designated area or on a neighboring property.

In deciding the type of harvest and what trees to remove, consider your future timber stand, species, tree size and quality, available markets, relative prices for different



products and quantity of timber suitable for each product. In some sales, especially selective sales (where only selected individual trees are cut), the decision on what the trees are to be sold for – pulpwood, sawtimber, veneer and poles – should be made before trees are marked or otherwise designated for removal. This enables the marker to consider each tree's present and future value for various products. By delaying the cutting of some trees for a few years, they may become suitable for a higher-value product. A professional forester should help you make decisions.

### *Measure Material for Sale*

Timber is sold in units of measure, such as board feet, cords or weight. Measuring the trees usually can be done as they are being marked for cutting. Although measurements of cut logs, loads of pulpwood or stacked lumber give more accurate results than estimates of these products in standing trees, they cannot be made until after the sale is made and cutting has begun. Although some accuracy may be sacrificed when selling on the basis of estimates of volume of standing trees, this disadvantage is usually outweighed by the convenience and economy of avoiding measurements of cut products. Even if weight or volume of harvested materials is used as a basis for payment, an estimate of tree volume is still helpful in attracting buyers and in evaluating bids. The services of a consulting forester should be utilized to measure the volume and estimate the value of your standing timber before it is sold.

### *Types of Timber Sales*

Sales of standing timber will fall into two basic types: **lump sum sales** or **unit sales**.

In **lump sum sales**, all timber on a tract that meets certain standards is sold for a fixed, single payment. Lump sum sales are generally better for the landowner, provided that he/she has an accurate estimate of the volume of merchantable timber, and its current fair market value is assessed before the timber sale. Since title passes immediately to the buyer, the seller is freed from the risk of losses to fire, insects, disease, wind and theft. Potential problem areas with this sales method are timing the sale to get the best price and selecting a good logger who will protect your land and residual trees during harvest.

**Unit sales** are those in which payment is directly tied to the units of timber involved. Payment is based on an agreed price per unit of measure (cords, tons, thousand board feet) and is made in installments as cutting progresses. Unit sales may be of benefit when the total sale volume is either very small or very large, or where there are some unusual problems that might affect lump sum bids. Potential problems in unit sales are that the buyer might cut only the best timber or the easiest part of the tract, a practice called high-grading, or may not accurately provide harvest volume or product receipts. The best protection, if you sell by weight, is to work with the buyer on developing a weight-per-unit volume that is an accurate measure for your timber. In most cases, you will need a forester's help with this type of transaction. Close supervision of the harvesting operation is necessary to ensure that unmarked trees are not cut and that the trees are cut for the highest-value forest product (e.g., veneer, poles or sawlogs).

### **Sealed Bid Sales**

Sealed bid selling involves taking bids from several buyers and opening them at a specific time and place. Each bidder makes only one bid, and no bids are allowed after the bid closing. Make sure to retain the right to reject all bids in case you are not happy with the high bid. An invitation to bid should be sent to all known timber buyers in the area in sufficient time for them to evaluate the sale offering. Bid invitation should include any restrictions or criteria that must be followed to ensure that bids are comparable. It may be desirable to arrange a group tour of the sales area. Bids should be opened in public and each one announced as it is opened.

### **Negotiated Sales**

Negotiated sales are those in which the price is established by face-to-face bargaining between the buyer and the seller. This method is widely used by buyers of veneer, quality sawtimber, poles and specialty woods, such as rare hardwood. It is also used for unique harvesting or property situations, such as small acreage or timber volumes, or where unusual operations are needed. If done with a knowledgeable seller, negotiated sales can bring better value to the landowner.

## Timber Values

Regardless of how you sell your timber, its price will be based on the value of the timber to each buyer and the cost of buying and harvesting the trees. Sometimes, this value difference will be as much as 50 percent of the highest bid.

The low bid is not an attempt to “steal” the timber, but may reflect that the low bidder doesn’t critically need the wood, is marketing for a lower-priced product or would have higher costs in harvesting and hauling the wood.

If you are selling by the unit, the sales-agreement should use a standard wood measurement. The most common measure for trees sold for lumber and plywood is thousand board feet, sometimes abbreviated as MBF. Pulpwood may be measured in tons or cords. There are several differing “log rules,” which give different volume estimates for the same tree. The standard ones used in Virginia are the International ¼ inch, Scribner and the Doyle Log Rules.

**\*Be sure that all bidders are using the same wood volume measurement system.**



Logging deck of a timber harvest

## Consider Tax Implications

Advance planning may result in tax savings on income from timber sales. How timber is sold and when money is received, along with allowable expenses, will affect tax liabilities. Information on timber taxes is available on the web at [www.timbertax.org/publications/fs](http://www.timbertax.org/publications/fs).

## Timber Sales Contracts

To finalize a timber sale, a contract should be developed between the buyer and the seller. Timber should always be sold under a written contract, never an oral agreement. A written contract protects both the buyer and seller by listing and clarifying the responsibilities of each party. An attorney should be consulted for all written contracts.

Contracts usually convey the right to cut timber, with title to the timber passing to the buyer when the contract is signed or when timber is severed. Key points that should be in every contract:

- ◆ Provisions that specify the amount, manner, time and method of payment
- ◆ A description of the timber being sold, its locations and marking method
- ◆ Provisions that specify the time period covered by the contract
- ◆ Penalties that the buyer must pay if unmarked trees are cut
- ◆ Provisions prohibiting excessive damage to unmarked trees and improved property
- ◆ Provisions that assign liability for losses due to fire if caused by the buyer or his agents
- ◆ Provisions that protect soil, water and recreational values
- ◆ Provisions that protect the seller from workman’s compensation claims, liability lawsuits and property damage claims
- ◆ Provisions that allow the sale agreement to be assigned to another logger only with the written consent of the seller

### Common Problems

A well-drawn contract or deed does not, in itself, assure that there will be no misunderstanding or problem in timber cutting. Problems can be minimized and usually corrected before they become serious if the seller or his agent will make frequent inspections of the harvest while in progress. The contract is made between the seller and a buyer, who usually contracts a logger to do the actual harvesting. The logger might not be fully aware of all the terms of the contract, but these points should be made known to him before harvesting starts.

The seller should require notification from the buyer several days before any work begins. He or his agent should meet with the buyer and the harvesting contractor at the sale area on the first day of operation. Potential problems can be discussed at that time. Common problems to watch for include: cutting undesigned trees, cutting across the property line, damaging streamside areas and damaging residual trees and young growth.

Virginia law requires that Virginia Department of Forestry be notified of the harvest as well [{See Water Quality: Logging Notification}](#).

### Resolving Disputes

The seller and buyer or their designees, who are qualified to act as their representative and can visit the job site frequently, should identify any violations of the contract and have them settled immediately, not after the work has been completed.

### Concluding the Sale

After timber harvesting is completed, a final inspection of the sale area should be made. It is important to see that all requirements of the sale contract have been met and all violations corrected or compensation made. When the landowner is satisfied that all terms of the agreement have been met and full payment has been received, the contract can be terminated. A letter to the buyer acknowledging satisfactory completion and releasing him from any further obligation is an appropriate way to conclude. Ending the sale in a cordial and businesslike manner helps to create a good relationship for future timber sales.

## Prepare For Establishing the Next Forest

Planning for the future forest should begin before the harvest is started. This is particularly important where clearcuts have been made and pine is planned for the forest. Prompt attention to pine reforestation may mean the difference between a valuable pine forest or a poor-quality stand of trees. If you are selling loblolly or white pine timber, your cutting operation may come under the provisions of the Virginia Seed Tree Law.

Sustaining quality hardwood forests is also dependent on harvesting and reforestation activities. Although in most situations, hardwoods do not need to be replanted after a harvest, the number, quality and species of trees in the residual stand will greatly influence the next forest. If significant poor-quality and damaged trees are left after harvest, they will not allow room for young or healthier trees to grow leading to a poorer quality forest in the future. It is important to minimize damage to residual trees and focus on leaving the healthiest young trees of the desired species for the future. Enough open areas are also needed to allow new seedlings the light needed to grow. In any event, you should contact your local forester for advice and assistance on reforestation practices and procedures.

## Non-Timber (Specialty) Forest Markets

Virginia’s forestlands provide a wide variety of products and economic benefits to the state and landowners. Many do not come from the traditional harvest of timber or are a by-product of the operation and are considered non-timber or specialty forest products. These products typically have unique market conditions, such as limited quantity or demand, distribution of the resource, seasonality of produce or market, processing needs, perishability and/or types of customers. They also include income-producing activities, such as recreation and hunting leases.

Non-timber forest products can demand more involvement from landowners with marketing resources, production and value-added processing than most traditional or commodity forest products, to be successful. Although some non-timber products depend on specific forest types or areas, opportunities do exist for most forest landowners. In many cases, agroforestry/forest farming practices, where forestry and agricultural activities are integrated to enhance the benefits of both, can be used.

[nac.unl.edu](http://nac.unl.edu)

### Medicinals/Herbals

For thousands of years, all of our medicines came from the forests, fields and other natural areas around us. Even today, many pharmaceuticals are derived from biological sources and the demand for natural medicines and supplements is high. Common examples include witch hazel (astringent), willow bark (pain relief), wild cherry bark (cough relief), mint (stomach relief) and ginseng (tonic/stress relief).

Landowners can profit by wild gathering or cultivating plants like ginseng. Care needs to be taken when wild harvesting to be sure that collections are sustainable and any regulations are followed. It can take several years for plants like ginseng to mature for harvest. Markets vary for different plants from regional wholesalers, to local herbalists or direct sales.

Virginia Cooperative

Extension and National Agroforestry Center can provide information on cultivation of the most common plants.

[www.uky.edu/Ag/CDBREC/introsheets/wildcraftoverview.pdf](http://www.uky.edu/Ag/CDBREC/introsheets/wildcraftoverview.pdf)

[www.pubs.ext.vt.edu/354/354-313/354-313.html](http://www.pubs.ext.vt.edu/354/354-313/354-313.html)

[www.ces.ncsu.edu/fletcher/programs/herbs/crops/medicinal/native-botanicals.html](http://www.ces.ncsu.edu/fletcher/programs/herbs/crops/medicinal/native-botanicals.html)

### Mushrooms

Virginia’s forest are the home of hundreds of mushrooms and can be a source of unique edibles for personal use or sale. Wild collecting of edible mushrooms, such as the spring search for morels, is a tradition in many areas, but care must be taken to positively identify the species to prevent possible poisoning.

Whether wild collected or cultivated, mushrooms can be fun and profitable. Locally, edible forest mushrooms include morel, oyster, chanterelle, chicken of the woods and hedgehog. The most common cultivated forest mushrooms are the oyster and shiitake. Although



Shiitake mushroom logs

shiitake mushrooms are native to Japan, they are very popular and grow well in Virginia’s climate. With just a few supplies, some small logs and patience, growers can produce a delicious crop of mushrooms for personal use or sale. Markets include restaurants, retail stores and direct sales through venues like farmer markets.

[www.uky.edu/Ag/CCD/introsheets/mushrooms.pdf](http://www.uky.edu/Ag/CCD/introsheets/mushrooms.pdf)

## Natural Lump Charcoal



Natural lump charcoal

Charcoal use has a long history of production and use in the United States. Well into the 20th century, it was the primary source of cooking fuel in many homes and apartments in the rapidly growing cities of the Eastern Seaboard. Today, although many people think of briquette-style charcoal as the product they might use for outdoor grilling, natural lump charcoal is enjoying a resurgence in use among backyard grilling enthusiasts who demand its superior qualities without the additives found in briquettes.

Enterprising forest landowners and individuals in the logging or arboriculture industry may find a business opportunity in making and selling locally-produced charcoal as a value-added and business-diversity product. While firewood and pulpwood are always options, charcoal production represents an additional value-added product that may make good forestry more economically viable. By finding more uses for underutilized wood, we can encourage more practices like timber stand improvement, invasive species control, fuel reduction

and better harvesting efficiency. High-quality charcoal can be produced from most species common to Virginia including invasives like *Ailanthus* (tree-of-heaven), which, if left behind in a forest disturbance, will quickly out-compete many native species and drastically change the ecology of the area. Tree tops, storm damage and urban waste wood all make good charcoal.

A charcoal kiln can be as basic as a dirt oven, like is still used in many third-world countries, or a 50-gallon drum, a slightly more complex modified chicken feed hopper or even a commercial-grade kiln. The function of a charcoal kiln, whatever the design and material used, is to moderate the combustion such that it distills the wood to its raw carbon form. This is accomplished through a low oxygen burn that not only drives all the moisture away but also ignites a chemical reaction exuding gases and tar, resulting in nearly pure carbon.

Once produced, the charcoal can be sold in bulk to restaurants and barbequers or packaged for sale at stores or directly to customer is through venues like farmer markets.

[www.web1.cnre.vt.edu/forestry/charcoal](http://www.web1.cnre.vt.edu/forestry/charcoal)



Natural lump charcoal is an economic opportunity in Virginia

## Natural Cooking Woods

Like the increased demand for natural lump charcoal, there is growing interest in outdoor cooking and using more natural flavorings. To get the flavorings or cooking experience desired, specific species, size and quality of wood is needed. Although most of the wood is used to add flavor through smoking, cooking wood and baking boards are also used. In Virginia, hardwoods are typically used with the most desirable being fruit woods like apple and cherry along with hickory and oak. To prevent mold and other degrade that could affect flavor or use, the wood should be dry and clean of all contaminants. Depending on how the wood will be used, it could be in the form of sawdust, chips, chunks or sticks. The wood is usually packaged by individual species to provide the desired flavor.

[www.fpl.fs.fed.us/documnts/usda/agib666/aib66606.pdf](http://www.fpl.fs.fed.us/documnts/usda/agib666/aib66606.pdf)



Apple wood, as well as the apples, can offer another economic opportunity.

## Specialty Wood

Specialty woods are unique forest products that are usually ignored during traditional harvests because they do not make the standards needed for lumber or veneer. They are selected more for their character, unique look or properties that can be used in custom or one-of-a-kind items. Burls; highly-figured or spalted wood; exotic species; twisted or disfigured trees, and wood crotches are all items that can be valuable to wood turners, custom furniture and cabinet makers and architects. Value is usually based on its demand and rarity.

[www.fpl.fs.fed.us/documnts/usda/agib666/aib66616.pdf](http://www.fpl.fs.fed.us/documnts/usda/agib666/aib66616.pdf)



Bench made from invasive Ailanthus (Tree-of-Heaven) wood

## Christmas Trees

The Virginia Christmas tree industry is made up of thousands of growers. The size of any Christmas tree farm ranges from less than an acre to as large as several hundred acres, with a few growers having a thousand or more acres. It is estimated that there are over seven million Christmas trees growing in Virginia today. Every year, approximately one to two million Virginia-grown Christmas trees are sold with a wholesale value of \$20 million to \$40 million. All of these trees were planted by Christmas tree farmers and are replanted yearly. Besides planting, there is annual maintenance that includes tree trimming and weed control. Depending on species and size, trees usually take six to 10 or more years to grow to Christmas tree size.

Most Christmas tree growers come from varied backgrounds and do not rely on these sales as their sole source of income.

In Virginia, growers are fortunate in that most species sold as Christmas trees can be grown in some region of the state thus allowing the consumer a wide variety of a fresh Virginia-grown product. Most popular trees include Fraser fir, balsam fir, white pine, Scotch pine and spruce. Landowners can sell their Christmas trees by setting up choose-and-cut farms, retail lots or wholesaling to chain stores.

[www.virginiachristmastrees.org](http://www.virginiachristmastrees.org)

[www.pubs.ext.vt.edu/420/420-080/420-080.html](http://www.pubs.ext.vt.edu/420/420-080/420-080.html)



Christmas tree industry

## Holiday Greenery

Associated with the Christmas tree industry is the greenery industry. Branch tips of white pine, Fraser fir and other evergreens are cut in the fall of the year and sold to local manufacturers. The tips are used for Christmas wreaths, rope garland and other holiday decorations. This regional cottage industry provides income and seasonal employment to several hundred residents and landowners with sales exceeding \$16 million annually.

Landowners can profit from this market in several ways – by planting trees that can supply the foliage and selling it to pine tippers; tipping the trees themselves and selling to wreath and garland manufacturers to produce the final product, and selling it themselves.

[www.extension.umd.edu/sites/default/files/\\_docs/programs/woodland-steward/RES\\_03HolidayGreenery.pdf](http://www.extension.umd.edu/sites/default/files/_docs/programs/woodland-steward/RES_03HolidayGreenery.pdf)

[www.dof.virginia.gov/mgt/white-pine-tipping.htm](http://www.dof.virginia.gov/mgt/white-pine-tipping.htm)



Holiday greenery industry

**Table 4. Non-Timber Forest Markets**

Product	Hardwood Forest	Softwood Forest	Exotic/Invasive
Mulch (chip and bark)	X	X	X
Pine Straw		X	
Animal Bedding		X	
Packing Materials	X	X	
Decorative Wood	X	X	X
Burls	X	X	X
Walking Sticks/Canes	X	X	X
Basket Materials/Vines	X	X	X
Custom Furniture	X	X	X
Dyes	X	X	X
Pine Cones		X	
Christmas Trees/Greenery		X	
Floral Products	X	X	X
Native Transplants	X	X	
Aromatic Oils	X	X	
Medicinals and Pharmaceuticals	X	X	
Syrups, Drinks, etc.	X		
Berries, Nuts and Wild Fruit	X	X	X
Honey	X		
Mushrooms	X	X	
Natural Charcoal	X	X	X
Smoking and Flavor Wood	X		
Hunting and Recreational Leases	X	X	

[www.fpl.fs.fed.us/documnts/usda/agib666/aib666in.pdf](http://www.fpl.fs.fed.us/documnts/usda/agib666/aib666in.pdf)

[www.forestry.about.com/cs/alternativeforest/a/alt\\_nontimber.htm](http://www.forestry.about.com/cs/alternativeforest/a/alt_nontimber.htm)

[www.usda.gov/wps/portal/usda/usdahome?navid=agroforestry](http://www.usda.gov/wps/portal/usda/usdahome?navid=agroforestry)

[www.agriculture.vsu.edu/special-programs/cooperative-extension/forestry/alternative-forest-production-systems.php](http://www.agriculture.vsu.edu/special-programs/cooperative-extension/forestry/alternative-forest-production-systems.php)



## Emerging Forest Markets

As demands for products and services change and increase, new markets are created that may provide economic benefits to forest landowners. These emerging forest markets continue to change and opportunities to benefit from them will vary over time.

### Ecosystem or Environmental Services

Nearly 65 percent of Virginia is forestland. This represents a significant potential to contribute critical benefits essential to human life and a high standard of living. These forests are our natural capital that provide vital ecosystem services.

Ecosystem services are the goods and services that people obtain from the environment: clean water and air; forest products; fish and wildlife habitat; scenic beauty; recreational opportunity; carbon sequestration; open space; mitigation of global climate change, and energy independence. Ecosystem services provide critical functions that help prevent ecosystem degradation. There is an important linkage between these services and human well-being. Economic sustainability is becoming strongly linked to environmental sustainability. Forestland and the ecosystem services provided from forests have played and will continue to play a huge role in that relationship.

This link between economic and environmental sustainability is driving the emergence and development of new ecosystem service markets. Recent developments in the markets for ecosystem services will present some new opportunities for forest landowners and land managers. There is increasing recognition of the importance these services provide to society. Many of these services, such as clean air and water, have been provided by forestland with little consideration of their market value to the landowner.

In the past, many of these ecosystem services have been considered as free public goods and forest landowners have not been adequately compensated. If we are to slow the alarming trend of forestland being converted to other land uses, we must begin valuing these ecosystem services and financially compensating our forest landowners. Using Forest Inventory



Analysis (FIA) data and based on a rolling 10-year average, Virginia annually loses approximately 16,000 acres of forestland to conversion to other land uses. We need to develop processes and markets to begin transferring some of this ecosystem service value to private forestland owners to help slow this trend of forestland conversion.

Some of the key ecosystem service opportunities are discussed below. This information is meant to be only an introduction to current market-based developments that are being explored.

### *Carbon Sequestration*

Levels of carbon dioxide (CO<sup>2</sup>) in the atmosphere are now capturing considerable interest. CO<sup>2</sup> is one of the major greenhouse gases. Greenhouse gases have been linked to climate change. Forests play a major role in the global carbon cycle through the ability of trees to withdraw or sequester carbon from the atmosphere. In Virginia, it is estimated that our forests sequester approximately 20 percent of all carbon emissions that occur in the state. This amounts to approximately 6.42 million metric tons of carbon sequestered annually.

Market-based mechanisms are one way to regulate greenhouse gas emissions.

Sectors of the economy that contribute to carbon dioxide emissions can offset their emission levels through purchasing carbon credits generated through forest management and tree planting projects. An example of this would be a company that desires to limit its emissions of greenhouse gases at a specific capped level. The business would be able to purchase carbon “credits” to help offset its emissions to stay at or below its capped level. Generally, a carbon credit is equivalent to a metric ton of carbon sequestered through forest management.

The development of the carbon market is leading to some forest landowners being compensated through the sale of carbon sequestration credits.



Carbon storage

### Water Quality

Unlike carbon markets, which can be global, water quality markets are usually geographically limited to a local or regional watershed. This is because water quality markets are usually driven by local or regional issues, such as a wastewater treatment plant needing to keep nutrients like nitrogen and phosphorus discharge at a permitted level. Nutrient credit trading helps regulated dischargers of wastewater meet their permitted allowances.

In time, Total Maximum Daily Loads (TMDL) may create a market for agricultural and forestry offset projects. Water bodies are classified as



Protecting water quality

“impaired” when they exceed the determined TMDL for a particular pollutant. The TMDL implementation plan for some pollutants may allow forestry and agricultural practices to mitigate addressing the impairment.

The preceding factors all help contribute toward creating a market for the water quality ecosystem service. Water quality trading provides a market-based process for interested purchasers to buy water quality “credits.” Whether this credit is to promote forest cover in a municipal water supply watershed or to help mitigate wastewater treatment concerns, the markets work towards compensating landowners for establishing forest cover on their property.

### Wetlands and Species Mitigation Banking

Species, stream restoration, and wetland mitigation banking are other potential markets for ecosystem services. When land developers disturb or destroy wetlands or the habitat of an endangered species, they are required by regulation to obtain a permit. This permit will require the developer to offset any loss to wetlands or endangered species habitat.

Wetland and species mitigation banks are comprised of projects that create and enhance wetlands and endangered species habitat. These banks then sell credits to developers to satisfy permit requirements. Regulatory agencies approve a set number of credits, usually based on acreage, that are used to mitigate

development activities. Wetlands and species mitigation banking is a new industry that has emerged in the United States with the expressed purpose of providing developers and private landowners with mitigation credits they need to get their development projects approved. In Virginia, the Department of Environmental Quality is the regulatory agency that manages the wetlands mitigation program.

Some good websites for additional information on ecosystem services include:

[www.fs.fed.us/ecosystemservices](http://www.fs.fed.us/ecosystemservices)

[www.inforest.frec.vt.edu](http://www.inforest.frec.vt.edu)

[www.pubs.ext.vt.edu/442/442-138/442-138.html](http://www.pubs.ext.vt.edu/442/442-138/442-138.html)

[www.ecosystemmarketplace.com](http://www.ecosystemmarketplace.com)

## Bioenergy

Bioenergy is energy derived from renewable, organic-based materials. The move to find alternatives to fossil fuels has increased the demand for more renewable, locally-derived fuels. This has led to new markets where traditionally unused forest materials or dedicated biomass crops are used to produce energy directly or manufactured into solid or liquid fuels. Landowners can take advantage of this increasing demand for biomass to improve management and health of their forests while diversifying income. Including biomass crops can provide early returns since most are harvested in only a few years. Harvests for bioenergy can be included as part of a traditional timber rotation or from dedicated biomass crops. Check with forest professionals to see what local opportunities may exist.

[www.fs.fed.us/research/biomass-bioenergy](http://www.fs.fed.us/research/biomass-bioenergy)

## Destination-Based Markets

Forest landowners may take advantage of peoples' desires for fun, adventure and knowledge for economic gain. There is growing demand for destination-based activities where people will pay to experience specific activities, or to find products or services, such as demonstrations, tours, hikes, events and local products. Agro-tourism, eco-tourism and nature-based tourism are all examples of this type of market.

[www.pubs.ext.vt.edu/310/310-004/310-004\\_pdf.pdf](http://www.pubs.ext.vt.edu/310/310-004/310-004_pdf.pdf)



Nature-based tourism activities like hiking



Maple syrup industry generates tourism as well as marketable products

## Forest Certification

In addition to Stewardship Certification under the Forest Stewardship Program, there are several nationally- and internationally-recognized forest certification programs that may be of interest to and benefit Stewardship landowners. Forest certification and certified forest products promote activities and markets that reward forest landowners for sustainable management of their forests. The belief is that, given a choice, educated consumers will prefer products from independently-certified, sustainably-managed forests more than products from those that use degraded or destructive practices. This should lead to higher demand and value for certified products. The demand for certified forest products and the timber needed to produce them is increasing.

### An Overview of Forest Certification

Forest certification is a voluntary process that evaluates forest management practices against a set of sustainable forestry standards. This evaluation is typically performed by an independent third party. Certification can assure consumers that they are buying forest-related products that were grown, harvested and processed sustainably.

### First Steps

Landowners should research the available programs or talk with a forestry professional to help decide whether certification makes sense and which system might be the best fit for their property.

A first step in any certification program is to obtain a written forest management plan. The forester writing the plan should be made aware of intentions to certify, to ensure the proper components are addressed in the plan.

### Types of Forest Certification

There are two broad categories of forest management certification for landowners: standard and group. **Standard certification** is for an individual landowner. Forest management practices are audited by a third party each year, and the landowner pays the cost of the audit. **Group certification** collectively certifies a group of landowners under one certificate, which is issued to a group manager. This structure reduces costs to individual landowners since only some of the properties in the group are audited each year.

Forest management certification also factors into an end-product certification called **Chain of Custody**. This certification tracks wood from certified forests to finished products, which are usually marked with a logo identifying the certification system. Keeping track of individual trees as they are moved from the woods, to a mill, to a store is a complicated process, but it lets consumers make purchasing decisions based on sustainable forest practices.

### Certification Benefits

Certification can benefit a landowner in several ways.

1. **Increased access to markets:** A growing number of consumers are seeking wood and paper products from certified forests. Thus, private landowners whose woods are certified may receive preferential treatment by timber buyers.
2. **Acknowledgement of good forest management:** Certification publicly recognizes landowners who are implementing sustainable management practices. This recognition alone may be enough for many landowners to certify their lands.
3. **Potential for better forest management:** Landowners with certified forests are required to have current, written management plans, and they have access to additional educational materials and opportunities. Together, these can result in more sustainably managed forests, as well as benefits to wildlife, water quality and recreation.

[www.pubs.ext.vt.edu/ANR/ANR-50/ANR-50.html](http://www.pubs.ext.vt.edu/ANR/ANR-50/ANR-50.html)

## Certification Options

Each certification system has its own standards, but they all address timber and non-timber forest values; maintenance of forest productivity and biodiversity; protection of soil and water, and aesthetic, recreational, cultural and wildlife benefits. While similar in many aspects, there are some key differences among the systems. An individual landowner’s management goals and his or her land base will help determine which system, if any, is best for him or her.

### Program Specifics

The three major certification systems in Virginia are the Forest Stewardship Council (FSC), the American Tree Farm System® (ATFS) and the Sustainable Forestry Initiative (SFI). All three certification systems require a written forest management plan.

#### American Tree Farm System

The ATFS is open to non-industrial private forest landowners. The Virginia Tree Farm Committee is the organization that coordinates ATFS certification activities for this program. ATFS is endorsed by the Programme for the Endorsement of Forest Certification (PEFC), an umbrella organization over many certification systems worldwide.

[www.treefarmssystem.org](http://www.treefarmssystem.org)

#### Sustainable Forestry Initiative

SFI certification was developed for forest industry-owned lands, but many large landowners and state lands have also certified under SFI. The Virginia State Implementation Committee is the organization that coordinates SFI certification activities. SFI also supports private forest landowners through a mutual agreement with the ATFS. SFI is also endorsed by the Programme for the Endorsement of Forest Certification (PEFC).

[www.sfiprogram.org](http://www.sfiprogram.org)

#### Forest Stewardship Council

Under FSC, landowners may be individually certified, or the Southern Forests Network holds a group certificate that Virginia landowners can join. FSC is not a part of PEFC but is also internationally recognized.

[www.fscus.org](http://www.fscus.org)

[www.fsc.org/smallholders](http://www.fsc.org/smallholders)

#### Programme for the Endorsement of Forest Certification

PEFC is the organization that reviews and monitors many certification systems. Additional, non-biased information on certification can be obtained from Dovetail Partners Inc., the Pinchot Institute for Conservation and the Sustainable Forests Partnership.

[www.pefc.org](http://www.pefc.org)

[www.dovetailinc.org](http://www.dovetailinc.org)

*Chain of Custody  
From Certified Forest to Finished Products*



Figure 5. Sustainable Forestry Programs

**Sustainable Forestry Programs**

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**American Tree Farm System (United States)**  
 Mission - To promote the growing of renewable forest resources on private lands while protecting environmental benefits and increasing public understanding of all benefits of productive forestry.  
<http://www.treefarmssystem.org/>
- 

**Forest Stewardship Council (International)**  
 Mission - to promote environmentally appropriate, socially beneficial, and economically viable management of the world's forests.  
<http://www.fsc.org/>
- 

**Forest Stewardship Program (United States)**  
 Mission - to encourage the long-term stewardship of non-industrial private forest lands, by assisting the owners of such lands to more actively manage their forest and related resources.  
<http://www.fs.fed.us/spf/coop/programs/loa/fsp.shtml>
- 

**Programme for the Endorsement of Forest Certification Schemes (International)**  
 Mission - to conserve forests and their invaluable biodiversity, and the communities and families that own, work, and live in and around forests.  
<http://www.pefc.org/>
- 

**Sustainable Forestry Initiative (United States & Canada)**  
 Mission - to promote sustainable forest management in North America.  
<http://www.sfiprogram.org/>

## Buy Local Effort

### Virginia Grown Forest Products Program

The Virginia Grown Forest Products program was developed in partnership with the Virginia Department of Agriculture and Consumer Services to make citizens aware of the value of purchasing and using wood products made from trees grown in the Commonwealth. Launched in 2012, the program aspires to better connect consumers and the forest products industry in the important areas of jobs, economic impact and the sustainability of our forests. By increasing the recognition of and the demand for Virginia forest products, we are supporting an industry that accounts for 103,000 Virginia jobs, contributes \$17 billion to the state's economy and ensures the sustainability of our forest resources. We can educate consumers to know more about the forest products they purchase and use. Research has shown that a significant number of people are concerned about the sustainability of our forests and may turn from forest products for fear of depleting what, in reality, is a renewable resource.

The Virginia Grown Forest Products program is designed to effectively brand these home-grown wood products and to reassure consumers that their purchases of products derived from locally-grown trees are actually helping and not hurting the forests of Virginia. And, as you well know, healthy forests provide benefits for everyone!

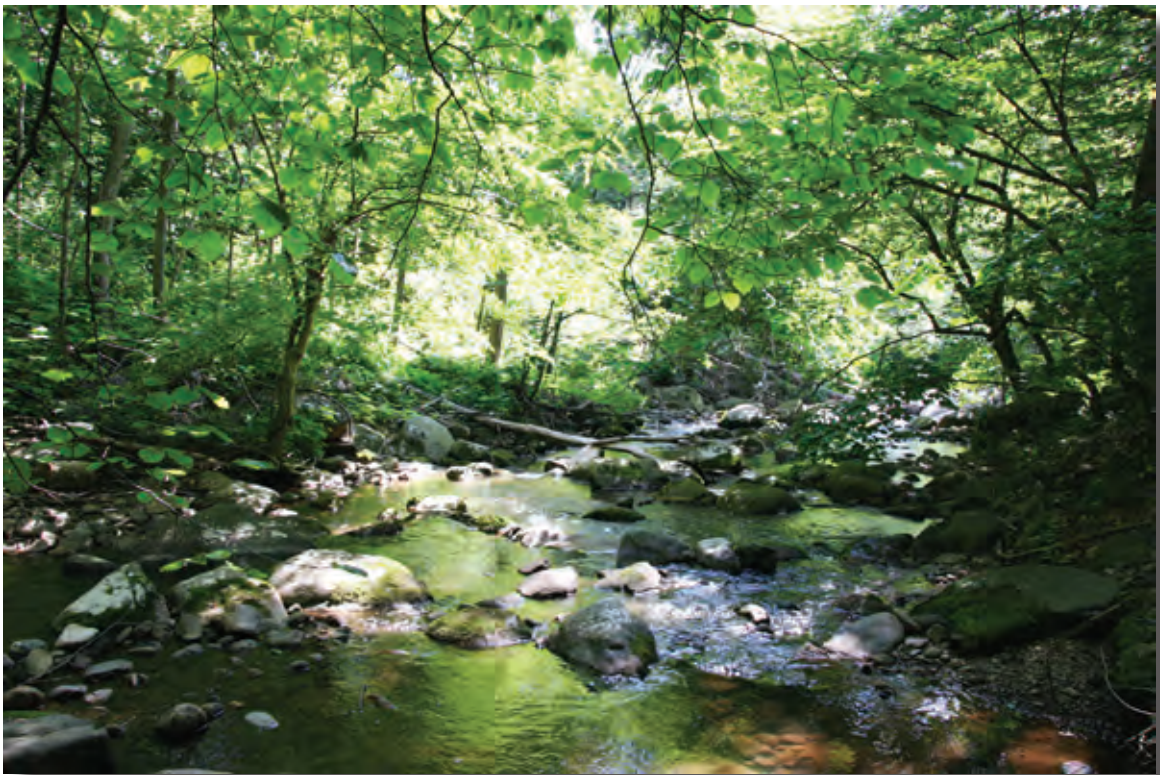






# CHAPTER 4

## WATER QUALITY



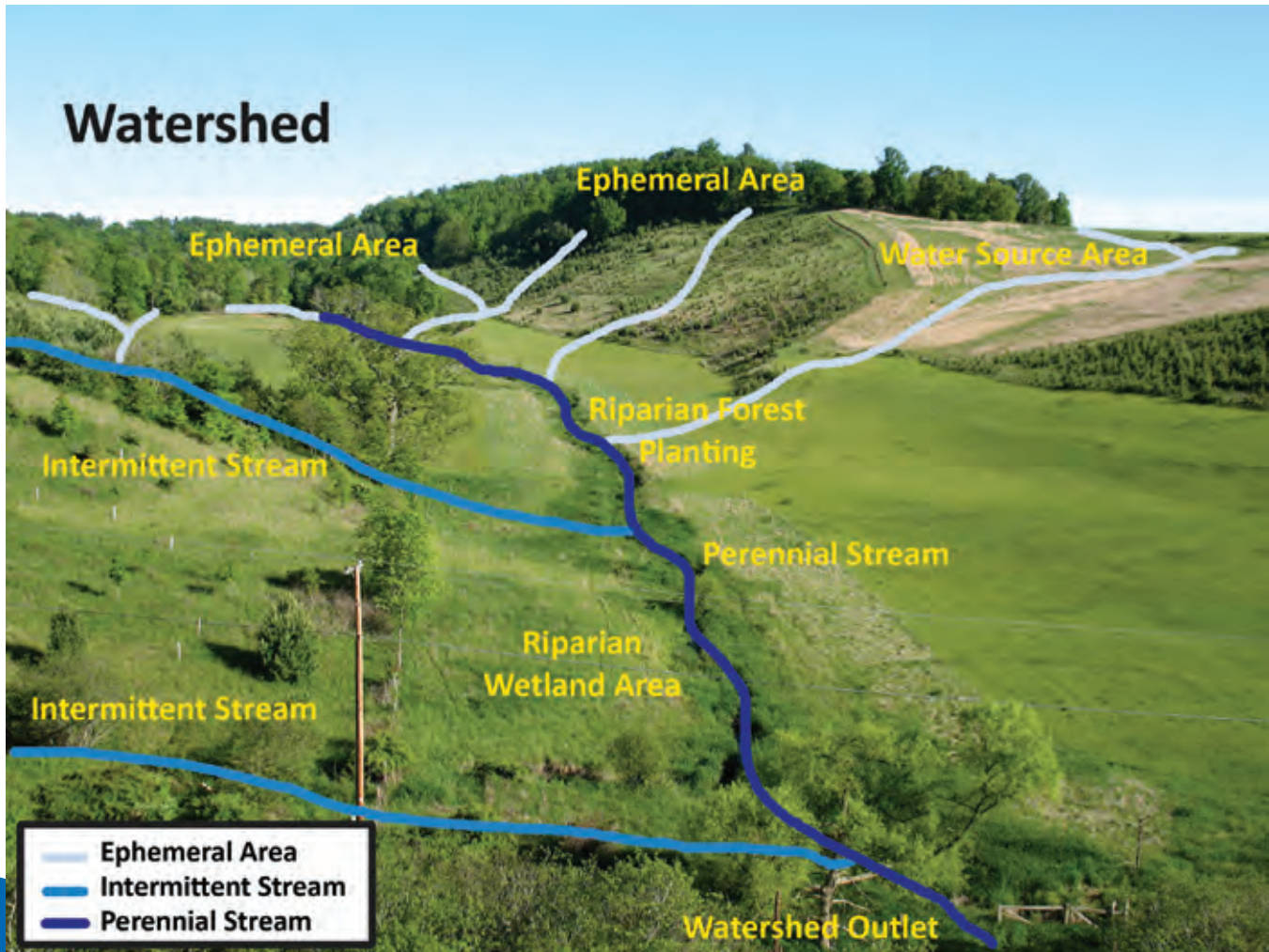
# Forests and Water Quality

Forested watersheds are known to exhibit superior ecological integrity particularly with regard to water quality. Forests generally provide superior protection for the soil resource, which in turn reduces soil erosion, water pollution and stream flooding by encouraging infiltration of precipitation and overland flow of water.

As rain falls through the various layers of a forest canopy, its energy is diminished and it is intercepted and absorbed by the porous layers of the forest floor. The vegetation; fallen leaves and twigs, and humus and roots all act to hold the soil in place and infiltrate water into the ground. This water is then slowly released through underground water to replenish springs and streams

and recharge groundwater supplies. Large amounts of water are also absorbed by the trees and returned to the atmosphere through transpiration, thus continuing the cycle of water in the environment. Forestland is also able to absorb and retain nutrients, such as nitrogen and phosphorus, which might otherwise pollute waterways.

With other land uses that don't protect the soil as well, higher levels of erosion and sedimentation occur and more rapid runoff contributes to flooding after heavy rains. Many of the water quality problems and frequent flooding experienced in some areas are attributed to the fact that the forestland has been converted to other uses.



## Timber Harvesting and Best Management Practices

The key to maintaining good forest watershed conditions lies in proper management of the forest floor. Even when moderately disturbed, forest litter effectively reduces soil movement and encourages water infiltration. These two properties reduce the likelihood of polluted runoff making its way to a stream and further emphasizes the importance of forest floor protection during forestry activities.

Timber harvesting at periodic intervals, using systems compatible with site, soil, slope and stream characteristics, permits timber production and watershed protection to continue together.

### Forest Aesthetics

Forestry operations are highly visible and are subject to the perceptions and opinions of an environmentally aware public. These operations may have a dramatic visual impact on the forest landscape. The image of forest management is directly influenced by the scenic quality of forest operations. Conducting these operations in an aesthetically acceptable manner is important to the future of forest management. Therefore, planning for aesthetic quality is an integral part of the comprehensive plan of future activities.

All practices will need to consider the visual impact of the practice.

### Roads

To soften the visual impacts of forest roads:

- ◆ Avoid tracking mud onto the paved highways
- ◆ Avoid steep grades entering the site
- ◆ Avoid rutting
- ◆ Avoid runoff reaching the paved roads
- ◆ Construct entrances at an angle to the paved road to reduce the line of sight from the road
- ◆ Maintain roads at all times during the operation
- ◆ Close out roads once the operation is complete using grass, gravel or other means

### Harvests

Harvest planning significantly reduces the impact of timber harvesting on visual quality. Important considerations are:

- ◆ The timing of a harvest should consider weather conditions and any local recreational activities nearby.
- ◆ If the harvest can be seen from a major road or is near residential, commercial or recreation areas, consider small irregularly shaped harvest areas.
- ◆ The loading decks should be left in good condition. Consider dispersing the harvesting debris away from the loading area, especially if it is located next to the road.
- ◆ Consider planting the deck with grasses to control erosion and for aesthetic purposes.

*Source: Forestry Aesthetics Guide, Image and Opportunity, American Pulpwood Association and the American Forest and Paper Association*



A properly-conducted harvest will have minimal negative impact on future forest aesthetics, streams and soils.

## Pre-Harvest Plan



Consult a professional forester to complete a pre-harvest plan.

Advance planning of the logging operation can prevent much of this erosion. Roads should be located on ridges, not in or near stream beds. Locate roads just to one side of the ridge line to improve drainage. When roads traverse the hillside, they should follow the contour and roll with the grade to avoid excessive cut and fill slopes. Road grades of three to five percent are desirable; however, sustained grades of six to eight percent are acceptable when following best management practices. An occasional short pitch of up to 15 percent can be tolerated if proper road drainage is built into the road to avoid erosion.

Use dips frequently to break long grades. Construct cross-drains as needed and out-slope road beds where possible. Locate the roads far enough from water courses to provide an effective forested filter strip, a 50-foot minimum from the edge of the water. Keep trucks, tractors, skidders and logs away from drainage channels. When logging is over, smooth out ruts and holes to prevent channeling runoff; install cross-drains and clean culverts (if used), and cultivate or rip and seed the abandoned roads with grass/legume seed mixture, including some preferred by wildlife species.

Skidding should be uphill on designated skid trails. Winching logs to this trail will minimize the number

of skid trails, lower restoration costs and restrict the land area that will be subject to reduced growth potential.

Roadway and culvert drainage should be dispersed and slowed to inhibit runoff and encourage vegetation/forest floor filtering. Stabilize the streambank or channel by planting trees and fostering a vigorous, healthy timber stand.

For many years, timber harvesting was associated with the deterioration of forestland and streams. Research and experience have shown that the mere cutting of trees is not the cause of erosion damage in the forest, but a lack of BMPs on roads and trails can create pollution problems.

## Forest Roads and Trails

It is important to plan road systems that can provide permanent and efficient access throughout the woodland without damaging the watershed value of the forest.

The following checklist can control erosion on roads:

- ◆ Avoid logging during wet seasons or periods.
- ◆ Place skid trails on grades of less than 15 percent.



Logging road following seeding

- ◆ Place roads on slopes less than 10 percent.
- ◆ Use approved stream crossings, bridges and culverts.
- ◆ Do not leave slash or tops in streams.
- ◆ Provide for proper drainage of skid trails and roads.
- ◆ Gravel roads where needed.
- ◆ Seed roads, skid trails and log decks.

## Road Maintenance

To prevent vehicle traffic during wet weather, access to roads and trails needs to be controlled by gates or other methods.

Logging decks should be covered with slash, vegetation or gravel to prevent erosion. In some cases, food plots can be established to protect the soil and provide forage for wildlife. Logging and farm roads should be maintained for proper access and erosion control. These areas can be seeded with lespedeza or other wildlife food; periodically mowed or disked, and replanted for maintenance. Any constructed fire lines may be kept open by mowing every other year. If mowed, please follow the instructions in the wildlife section included with your management plan. These paths will also provide access and walking paths for yourself and other visitors to the property.

## Best Management Practices

The major detriments to water quality in the forest environment are the sediments carried by precipitation runoff. This has generally been labeled non-point source pollution (NPS) due to its diffuse nature. Best Management Practices (BMPs) are an extensive set of physical practices that have been developed to prevent sediment pollution from forestry activities. Research has shown that BMPs are very effective at preventing sediment pollution from silvicultural practices when they are implemented properly.

When timber is harvested, areas adjacent to waterways called streamside management zones (SMZs) should be managed to prevent significant soil disturbance and maintain adequate canopy (50 percent) and an intact forest floor to protect the

underlying soil. These SMZs should be at least 50 feet wide when measured from the stream bank to the edge of the harvest area. These “buffers” will act as filter strips to trap sediment and allow water to infiltrate into the soil or enter the stream. It is important to note that careful timber harvesting within these buffers is acceptable and may even enhance the filtering capacity of some SMZs.

During harvesting operations, roads and skid trails should be located such that slopes and stream crossings are held to a minimum. Avoiding stream crossings greatly reduces the likelihood that sediment will enter a stream.



Immediately following logging operation, logging roads seeded and strawed



Four months following logging operation, logging roads stabilized

Roads should be constructed and maintained with ditches, turnouts, gravel, vegetation and broad-based or rolling dips to divert water away from the road surface and encourage water infiltration into the adjacent forest floor.

When a harvesting job is complete, roads, decks and other exposed soil should be stabilized with appropriate close-out BMPs as described above.

A complete BMP guide for Virginia can be obtained at your local VDOF office and is available online at:

[www.dof.virginia.gov/water/index-BMP-Guide.htm](http://www.dof.virginia.gov/water/index-BMP-Guide.htm)

## Laws Pertaining to Forestry and Water

### Silvicultural Water Quality Law (§10.1-1181.2)

There are several forestry based laws that help protect Virginia's waterways. The most prevalent and most often enforced is the Silvicultural Water Quality Law (§10.1-1181.2), which prohibits pollution of streams as a result of silvicultural activity. An order may be issued to correct a problem if water is polluted or is likely to be polluted by a forestry activity.

A stop work order may be issued if a severe problem exists. This law primarily pertains to logging in a manner that allows sediment to enter a stream. Substantial financial penalties can be levied by the State Forester against all land/timber owners and operators if appropriate water protection measures are not taken as needed. The Department of Forestry enforces these laws and is available to answer questions or provide any assistance upon request.



Proper culverts or stream crossings protect water quality during logging operations

### Debris in Streams Law (§62.1-194.2)

Another important law is the Debris in Streams Law (§62.1-194.2). This law states that it is unlawful for any person to throw or otherwise dispose of trash, tree laps, logs or felled timber that will obstruct the passage of boats, canoes or fish in

any river, creek, stream or swamp for a period longer than one week. Violations of this law are punishable as a misdemeanor and each day for which any violation continues without removal of such obstruction, on and after the tenth day following service of process on the violator shall constitute a separate offense punishable as a misdemeanor under §18.2-12.

### Chesapeake Bay Preservation Act (CBPA) (§10.1-2100 through §10.1-2116)

The Chesapeake Bay Preservation Act (CBPA) (§10.1-2100 through §10.1-2116) has implications for silvicultural operations in applicable counties mostly in Eastern Virginia. Silvicultural operations are exempt if they adhere to the voluntary best management practices (BMPs) guidelines in the Resource Protection Area (RPA). The RPA is the most critical area for water quality maintenance and is normally found along tidal shores; tidal and non-tidal rivers, and critical areas. If a silvicultural operation located in an RPA is shown to be in violation of the BMP guidelines, the Department of Forestry is obligated to notify the governing body in the locality. The locality could then enforce the CBPA ordinance and require stabilization and a revegetation plan. The landowner is the legally responsible party for such violations and corrections of any problems associated with them.

Forest management activities often occur in areas with jurisdictional wetlands. Although silvicultural operations are exempt under Section 404 of the Clean Water Act, one must be careful not to go beyond the boundaries set forth in the associated US EPA and Virginia DEQ regulations and convert these lands to uplands. The U.S. Army Corps of Engineers is the principal agency that administers the wetlands program.

## Logging Notification

Prior to but no later than three working days after commencement of an operation, the owner or operator shall notify VDOF by on-line website or by calling the toll-free number.

**This is a requirement of the law. Failure to notify can result in a Civil Penalty of \$250 for a first offense and up to \$1,000 for subsequent violations.**

To notify of a timber harvest, you must obtain a notification identification number from VDOF. This is simply an assigned number that you will use to identify your company when you notify VDOF of timber harvests.

You will be asked for your phone number; when logging will begin; the county where it will occur; the location; the size of the operation, and contact information for the landowner. You will receive a confirmation number when you notify. Retain this confirmation number as proof of notification.

This information will be sent to the appropriate VDOF office.

The VDOF will assist with pre-harvest planning if requested. Pre-harvest planning guidance prior to moving equipment on the tract may lessen the chance of BMP or water quality problems later.





## Wetland Values

Wetlands are found all across Virginia, but the vast majority occur in the eastern portion of the State. Wetlands include marshes, bogs and swamps and may include other areas that are flooded or saturated only for fairly short periods of time. Non-tidal wetlands are identified on the ground by the presence of wetland hydrology, wetland soils and wetland vegetation. Many of these wetlands are forested.

### Flood Control

Flood water flows naturally into stream and river channels as it drains off the land. When surface water moves through wetlands adjacent to water courses, flood flows are temporarily retained by dense stands of vegetation in wetlands and slowly released downstream. In many cases, wetlands direct water into the ground and recharge the aquifer.

### Sediment Control

Wetlands also help maintain water quality by absorbing sediment. Sediment carried by runoff will tend to be trapped in wetlands and held by ground vegetation. In shallow waters, submerged aquatic vegetation acts as a filter, as sediment clings to plants instead of floating in the water. Aquatic plants also reduce water velocity, so additional sediment tends to sink to the bottom instead of floating freely. Shoreline vegetation decreases the force of wave action and reduces erosion in tidal areas.

### Nutrient Retention and Removal

Wetlands also function to remove nutrients, such as nitrogen and phosphorus, from the environment. The nutrients are absorbed by wetland plants for their own growth so they become less available for algae. Otherwise, algae blooms in open water may dominate the system so that little oxygen is available for other aquatic life. It is important to remember that wetlands are efficient nutrient removers to a certain point. The algae blooms in the Chesapeake Bay result from nutrient overload to the system to such an extent that wetlands and aquatic plants cannot remove all of them.



Protection of wetlands

## Riparian Forests



Riparian forest buffers left along streams and rivers protect water quality.

### Wildlife Values

Forests along streams and rivers can be classified as riparian forests. Riparian forests differ from upland forests in their hydrology, plant community, soils and topography. These features determine the potential abundance of animal populations.

The riparian forest supports a greater diversity of wildlife than nearly all non-aquatic areas or upland forests. The reason for this is the numerous habitat features found in these areas. Forested riparian corridors function as connectors between isolated blocks of forested habitat. Riparian forests are often surrounded by low-quality wildlife habitats and, therefore, support higher densities and diversities of migratory birds. In agricultural areas where extensive forests are not present, riparian forests provide critical habitat and may be the only edge cover available.

### Water Quality

Recent studies have shown that riparian forests as narrow as 50 feet in width can remove significant amounts of excess nitrogen as it moves from farm fields through the forests to the adjacent stream. These forested areas also filter sediments and phosphorus, thereby acting as buffers to nutrient inputs to streams. Nutrient retention by a 100-foot forest adjacent to agricultural land is estimated at 80 percent for phosphorus and 89 percent for nitrogen. Streamside Management Zone (SMZ) widths of 25 to 50 feet have been shown to be adequate for timber harvesting. The retention varies depending on width of forest, slope and other factors. Tree roots help stabilize streambanks by holding soil in place. Riparian forests also lower surface flow velocities during high-water events often causing some sediment to settle out.

A major concern to the aquatic environment is the increased nutrients entering a watercourse during and after a harvest operation. Nitrogen and phosphorous are the most common nutrients increased in streams directly following a harvest, and the slight increase will generally convert to its geological rate in three years. As with sediment, leaving a buffer of 50 feet has been shown to greatly reduce nutrient pollution.

### Management Considerations

During timber harvest or other forestry activity, a riparian buffer (SMZ) of at least 50 feet in width on each side of the stream should be maintained. Careful harvesting in the buffer is acceptable as long as soil disturbance is kept to a minimum and at least 50 percent of the original crown cover is left.

## The Importance of Soils

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Forests are dependent on soils and, to a certain extent, good soils are dependent upon good stewards. Soils are the natural bodies on which plants grow. We enjoy and use these plants because of their beauty and because of their ability to supply fiber and food for ourselves and animals.

Many landowners are not alarmed by soil erosion because it can be a slow process, scarcely perceptible to the human eye except during unusual weather events. With genetically improved crop varieties and new technology, a rise in productivity over time may be seen in spite of the fact that each year the topsoil is slightly less capable of holding moisture, providing nutrients and supporting the crop.

Eroded sediment is a tremendous problem in Virginia. It clogs roadside ditches and culverts, driving up the cost of county road maintenance. Some may get into a local stream, where it smothers streambed gravels, changing the stream ecology so that fish no longer thrive. Some gets into a larger river, where a town gets its drinking water and the cost of filtration and purification goes up accordingly. And finally, some of that landowner's topsoil ends up in a major river, where expensive dredging is then required to maintain navigation and commerce.

In time, the landowner will suffer as well, and a future landowner will need, at the very least, to spend years of good stewardship to help nurse the topsoil back into good condition. If the topsoil is destroyed, it may take up to 100 lifetimes for nature's processes to replace it. Soil productivity will play a major role in shaping the future forest landscape – for better or for worse.

In forestry, soil productivity is the ability of soil to supply and sustain the physical, chemical and biological needs of trees. It is a reflection of the quality, and sometimes quantity, of prior management activities on the site. The types and number of forestry activities employed by the landowner will influence the potential output of a site.

## Soil Management

Sound management of forest soils can enhance the next generation of trees. The objective of soil management is to provide trees with the best physical, chemical and biological conditions possible for optimum production. Protecting and improving productivity requires cost-effective measures that influence tree growth, development and the ability of soil to supply needed nutrients. Therefore, a land manager or tree farmer must know how to manipulate the forest environment before, during and after tree removal.

Best management practices (BMPs) for silvicultural activities should always be used to prevent soil damage and loss.



# CHAPTER 5

## FOREST HEALTH



## Forest Health and the Decline Concept

A healthy forest might seem to be an intuitive concept, but forest health is actually quite difficult to define. Health is actually an abstract concept and has no definition that applies universally. Tree health is quite different from forest health. Generally speaking, a tree is considered healthy if it exhibits no symptoms or signs of injury or disease. Beyond this, there is no commonly accepted basis for characterizing tree health. It is meaningless to ask how healthy a tree is. In reality, what we usually address is not health, but “sickness” because it is more concrete, and we have some experience in dealing with it.

Forest health usually refers to the biological and environmental functions of forests, relative to human wants and needs. Perspectives vary, but the ideas of diversity and sustainability are common to most definitions. Dead and unhealthy trees are natural components of healthy forests. This manual attempts to address both health and sickness as they apply to managing the private forests of Virginia.



Tornado damage

This brings us to the concept of “decline,” which is defined as a gradual failure in the health of a tree or stand of trees, eventually resulting in death from a combination of abiotic and biotic factors. The key point with any decline

syndrome is that no single agent is responsible. Decline may be thought of simply as a mechanism of forest succession since more often than not it affects older, senescent trees. Oak decline is the most common type of decline seen across Virginia’s forests.

The tree-decline concept, developed by forest pathologists decades ago, is usually divided into three stages with various factors leading to tree mortality that operate in succession: predisposing factors, inciting factors and contributing factors.

**Predisposing factors** are often abiotic and usually have to do with the underlying conditions of the site such as poor soils (e.g. low nutrients or moisture-holding capacity), exposure to extreme weather events, compaction or conditions associated with urban environments. Over time, these predisposing factors weaken trees to the point where they can become more susceptible to insects, diseases and weather disturbances.

**Inciting factors** can include one-time or recurring events that injure trees in some way. These may include things like drought, insect defoliation or a late frost. Rarely do



Dead locust

inciting factors kill trees outright. Rather, it can often take multiple events over a number of years before we see significant tree mortality.

**Contributing factors** are those agents that typically “do the tree in.” In the case of oaks, there are diseases associated with decline, including fungi like *Armillaria* (shoe-string rot) and hypoxylon canker, as well as insects like the two-lined chestnut borer. The presence of contributing factors usually portends that death is imminent, and for this reason, these factors are more often blamed directly as the cause of tree death.

It’s worth mentioning that while most native insects and diseases are widespread, they typically exist at low densities most of the time and usually do not pose much of a threat to “healthy” trees or stands. However, once trees are weakened by predisposing or inciting factors, they are less able to invest energy in defensive chemicals that would normally fight off these latter contributing factors. Therefore, if asked why a particular oak tree died, it might be more instructive or truthful to blame “old age” (predisposing) or “drought” (inciting) than “two-lined chestnut borer” (contributing), which would not have been an issue but for the previous two conditions.

Applying these concepts to forest management – it is the predisposing factors that are most important because these are the ones we have the most control over through the practice of silviculture. There are usually very few options for dealing with inciting or contributing factors. For example, we might utilize insecticides or fungicides to prevent or knockdown pest outbreaks, but more often than not, this is impractical in all but the most intensively-managed forest settings. On the other hand, we can address predisposing factors before problems occur, such as with fertilization, disking or mulching to improve soil characteristics; thinning to promote growth and limit competition, or harvesting over-mature and declining trees before they begin to die. Probably the most important thing we have control over that every forestry student learns in his/her first silviculture class is to plant the appropriate species on the appropriate site using local seed sources and to encourage species diversity; under many circumstances, doing these things alone will help prevent many future problems.



Emerald ash borer galleries

Note that when dealing with invasive species, such as hemlock woolly adelgid or emerald ash borer, the decline concept often does not apply very well. That is, otherwise healthy trees can be killed outright, and the invasive pest could be considered the sole cause without requiring predisposing or inciting factors to overcome the tree. This is often true for two main reasons: 1) our native trees have no co-evolutionary history with the new pest organism, and therefore they do not have natural defenses that are well adapted to fight off these pests, and 2) invasive species populations normally arrive to new areas absent the many insects, diseases and other natural enemies that keep them in check back in their native habitats. Therefore, population growth rates for invasive species can be explosive. That is why classical biological control programs, where natural enemies of a pest organism are brought over from the pest’s native habitat to its new habitat and released, are often employed as a tactic.

## Guidelines for Promoting Tree and Forest Health

The following generalities should be considered when making management recommendations, but they are only guidelines, not rules:

- 1) Tree species tend to survive and grow best within their natural ranges; artificially extending these ranges involves risk. Occasionally it's worth the risk; many species perform well even on foreign continents. Experience is the only reliable guide. Trees do not always grow best on the sites where they normally occur; they just compete best in those places. When competition is not a factor, most species tend to grow best on deep, moist, well-drained, fertile soils.
- 2) If management objectives don't require pure stands, encourage species mixes. Mixed stands tend to be less susceptible to attack and less vulnerable to damage from pest organisms.
- 3) It is the crown that uses light energy to produce cellulose (a complex carbohydrate) from carbon, hydrogen and oxygen; roots only provide water and nutrients to support the process. A full crown is necessary for optimum health and growth; give crowns all the light they can use. This will also ensure that roots have adequate space.
- 4) Trees usually respond quite slowly to environmental changes. They may decline over a period of several years before succumbing to prolonged stress, and it may take many years of favorable conditions before they recover fully from a weakened state. A tree's apparent health does not always reflect current conditions.
- 5) Injuries to boles and branches often lead to defect, degrade and decline, particularly among hardwoods. Thinnings and other partial cuts should be planned so that injuries are minimized and damaged trees can be removed as cutting progresses. This usually means beginning in the least accessible parts of a tract.
- 6) Roots are damaged by soil compaction, grade change and mechanical injuries. Expect tree decline and mortality following significant soil disturbance. Design access for partial cuts and construction sites so that soil disturbance is minimized around residual trees.
- 7) Vigor decreases with advanced age; trees can live longer than people, but they don't live forever. Harvest trees when they mature, or expect them to deteriorate.
- 8) Well-designed and properly-constructed roads help ensure long-term forest health – they have to be installed only once; they help protect trees against injury; they protect water quality, and they minimize site degradation from management activities.
- 9) Unusual habitats tend to include species and environmental conditions that can be difficult to reestablish if lost. Protection of these areas from disturbance is often an easy and effective way to help maintain or enhance diversity.





## Diagnosing Tree Problems

When the cause of a health problem is not obvious, there are always clues that can help with diagnosis. It is naive, however, to expect a satisfactory explanation for every condition. Many tree problems result from combinations of factors. Often some abiotic (non-living) influence, such as drought, makes trees more susceptible to invasion by biotic (living) agents, such as fungi and insects. Fortunately, good advice does not always rest on complete understanding. The following tips should lead toward good advice:



Fusiform rust

- 1) Problems caused by physical, chemical and environmental factors usually affect most or all plant species present, whereas problems caused by organisms seldom affect more than a few species, and often just one.
- 2) Symptoms caused by organisms usually vary in space and develop over time; symptoms that appear suddenly, are relatively uniform and stabilize quickly are probably not caused by an organism.
- 3) Healthy buds support a prognosis of recovery; dead or unhealthy buds suggest that recovery is unlikely.
- 4) Wilting indicates that water is not moving through the tree fast enough. The most common causes of wilting are root disease, vascular disease and drought. Vascular disease is usually caused by microorganisms. Root disease can stem from physical or chemical injury, excess moisture, infection by microorganisms, and feeding by various animals.
- 5) Symptoms often result from the effects of secondary agents, not the primary agent. Trees weakened by adverse weather, unfavorable site conditions, injury, competition or advanced age become more susceptible to infections and infestations by secondary organisms. Treatment related to these secondary agents will provide temporary benefits at best, unless the primary problem is also addressed.
- 6) Agents that affect only foliage are unlikely, in themselves, to result in tree mortality, but they can reduce growth and predispose trees to other problems. Agents that affect only heartwood (e.g., some decay fungi) can increase the likelihood of stem breakage, and can make trees un-merchantable, but they might have little affect on tree life span.



Wood borer chips



Locust leafminer

- 7) Symptoms that seem to be associated with aspect, exposure, drainage or disturbance are very likely to involve an important environmental component; but organisms could still be the primary agent(s).
- 8) Check with a hand lens before ruling out organisms. Look for frass, silk, eggs, shed skins, holes or life stages of mites and small insects. If you suspect fungus infection, look for fruiting bodies, lesions, cankers, resin or sap flow, resin soaking of stems or roots, or sapwood stain near the transition between healthy and diseased tissue.
- 9) Genetic factors can have a noticeable effect on tree response to adverse conditions. Symptoms of ozone injury and needle cast infection, for example, can vary greatly among trees of the same species growing right next to each other.



Fall webworm

## Making Recommendations

Although the potential causes of tree problems are countless and complex, practical treatment options are relatively limited and simple. You can often provide good advice without specific and detailed knowledge about causal agents. The following guidelines should help you evaluate what is practical to do in most cases.

Landowners expect foresters to know something about yard trees as well as forest trees. In both cases, good advice hinges on knowing ownership objectives. Yard trees present such different circumstances from forests that they will be discussed separately.

### Yard and Landscape Trees

Trees in yards are usually valued for beauty, shade, screening, wildlife habitat, fruit, real estate enhancement or some combination of these. What matters most are appearance and expected life span; defect and degrade are often unimportant except when they create unacceptable hazards.

Regardless of the cause or nature of yard tree problems, there are only a few practical treatment alternatives available to most homeowners: **mulching, fertilization, sanitation, watering and pesticide application**. Often the appropriate treatment(s) can be chosen without specific information about causal agents. Yard tree problems resulting from environmental stress or moderate site disturbance can usually be alleviated by improving soil conditions. Even healthy trees benefit from attention to soil quality. Important soil characteristics include aeration, moisture retention, fertility and drainage. The simplest way to improve and maintain soil characteristics is through mulching. Apply a layer roughly two inches thick over as large an area as suits the landscaping scheme. This also helps reduce injuries from lawn mowers and other equipment. Organic mulch is preferable; avoid piling it against the bole. Where soil compaction is already severe, aerate before mulching. Watering during drought helps, but is often impractical except for small trees and new transplants because of the large volumes required; occasional thorough soaking is best. Nitrogen fertilization is usually beneficial for trees in decline. Avoid changing grade level or drainage characteristics around established trees. Select species adapted to poorly drained

soils, or install drainage and condition the soil before planting in wet areas.

Yard tree problems resulting from infestation or infection by organisms can sometimes be ignored or reduced through sanitation. Removal of dead, dying or fallen twigs and foliage is usually harmless and often helpful. When removing infected twigs, cut well back into healthy tissue; sanitize pruning instruments between cuts if transmission of microorganisms is likely. Use of registered pesticides should be considered only after the landowner is aware of alternatives, consequences, costs and benefits and when unacceptable damage can be prevented through pesticide application. For large trees, pesticide applications should be left to companies that have the specialized knowledge and equipment required for such treatments. The cost per tree is usually high. In general, treatment of large trees or a significant number of trees – especially treatments requiring special skills or equipment like pruning, hazard tree assessment, and maintenance and pesticide application – should be done by an ISA- certified (International Society of Arboriculture) arborist.



Pine needlecast

## Forest Trees

Private forests are usually valued for recreation (including wildlife benefits), screening, environmental protection, income, investment, financial reserve, inheritance or some combination of these. High timber value is an asset even when it is not an ownership objective.

The benefits of preventing or treating forest tree problems depend largely on the perspective and disposition of the landowner. Prevention through proper thinning, sanitation and protection is usually most

practical. Heed these tenets to establish and maintain healthy forests: **match species to site; favor species mixes where practical; protect unusual habitats; give desired trees plenty of light and growing space; prevent or avoid unnecessary site disturbance and tree injury; remove undesirable trees, and harvest trees before their quality begins to decline.** Pesticide applications and other special treatments are expensive and should be subjected to cost/benefit analysis. Sometimes, the value of a single, high-quality tree is enough to cover the management costs for several acres.



Emerald ash borer damage

## Forest Health Problems In Pine Forests

This section is intended to provide good advice about tree and forest health, with an emphasis on problems within loblolly, shortleaf and Virginia pine stands. It is not a substitute for the many detailed references that help to identify and treat specific pest problems. Detailed information is limited to conditions that are common or important enough in Virginia to gain frequent attention.

Bark beetles represent the greatest threat to pine plantations and natural pine stands in Virginia, and, therefore, they will receive the most attention. Other insect pests like the pales weevil, sawflies and pine tip moths can occasionally be significant, but damage is typically very localized and short term. Likewise, several pine diseases are important but rarely cause widespread significant damage – we will focus on pine needle cast, fusiform rust and two root diseases, littleleaf and annosum.



Loblolly pine plantation with adequate spacing between trees

### Southern Pine Beetle (SPB)

Southern pine beetle (*Dendroctonus frontalis*) outbreaks periodically cause extensive pine mortality. Removal of infested trees is the only practical control in most cases. The following information will help you understand the problem and decide what to do.

In most years, southern pine beetles are hard to find in Virginia; usually they attack only weak or injured pine trees, such as those struck by lightning. Healthy trees resist beetles with heavy pitch (resin) flow. Loblolly, shortleaf and Virginia pines are most readily attacked, but other pines are susceptible too, and even spruces are sometimes infested. During outbreaks, trees that are stressed from competition, injury, drought or old age are most likely to die; but any pine can be killed if beetle populations are large enough. Compared to other bark beetles like Ips and the black turpentine beetle, SPB has the unique ability to mass attack and kill healthy trees once their populations build up to significant levels. This is why southern pine beetle “spots” can continue to grow and result in outbreaks that spread across the landscape, provided there is sufficient host material nearby to keep them going. No one knows exactly why outbreaks occur or why they end, but rarely do they last more than a few years.

Southern pine beetles are about the size of a grain of rice. Adults bore through the bark and lay eggs where bark meets wood – the cambium layer. The eggs hatch into tiny cream-colored grubs that feed just under the bark. These develop into adult beetles in about a month during warm weather; it takes much longer in winter. This cycle is repeated three or more times each year.

Heavy attacks kill trees by disrupting the normal movement of water and nutrients. Adult beetles introduce a blue staining fungus that plugs up the water-conducting tissue and developing grubs destroy the inside bark.



Southern pine beetle spot



Southern pine beetle spot in Accomack



Southern pine beetle damage and clearcutting in progress

As new beetles move from tree to tree, spots of dead and dying pines begin to appear. These spots can grow from one to hundreds of trees in a single year. In summer, the foliage of infested trees gradually changes from green to yellow and then red before needles drop off. As spots grow, they include trees in all stages, green and yellow ones on the edge, red to bare trees in the middle. Beetles usually complete development and leave a tree well before its needles fall. By the time trees turn red, beetle broods have vacated the tree and moved on. In winter, trees can die and remain green, so that spots are hard to detect. Not all spots keep expanding; sometimes a few trees are infested and die and no more trees are attacked.

To determine if pines are infested, look first for standing, bare trees next to ones that have red or yellow foliage. Closer inspection may reveal many globs of dime-sized pitch (pitch tubes), like little pieces of popcorn on the tree trunk, where beetles bored into the bark. If, in addition to these pitch tubes, you see dozens of small holes in the bark (about the diameter of pencil lead), then the beetles have already left that tree. On green trees, pitch tubes that are pink and soft to the touch indicate new attacks.

Once a spot is actively growing, it can either be left alone or actively managed. Whether to allow a spot to run its course or take immediate action depends on many factors:

- 1) The initial size of the spot relative to the size of the stand at risk;
- 2) The basal area and age of the stand;
- 3) The distance before the expanding spot runs into barriers, such as hardwood forest, roads, open fields, etc.;
- 4) The accessibility of the stand, and
- 5) The current market for pine.

Southern pine beetle spots that are small (less than an acre) are less likely to expand rapidly and often die out on their own without intervention. This is particularly true if the pine basal area of the stand is less than 80 square feet per acre; average diameter at breast height is less than nine inches, and the forested

landscape is more fragmented. Higher-risk spots are more than an acre in size and contain sawtimber-sized pines with basal areas that exceed 120 square feet per acre. If spots fall in between these two extremes, they may go one way or the other depending on other variables.



Southern pine beetle damage

The only effective management tactic for halting the growth of active beetle spots is to clearcut the part of the infestation with active brood (not including bare or red-topped trees, which beetles have already vacated) along with a buffer strip of green, uninfested trees cut where the head of the spot is actively moving (determined by marking all fading yellow trees and green infested trees with fresh pitch tubes). As a rough guide, the buffer strip is normally as wide as the height of the nearest codominant trees in the stand – typically 50 to 75 feet. For very large spots of more than 10 acres, a 100-foot buffer strip is recommended. Trees should be felled towards the center of the active spot and away from uninfested trees outside the buffer zone. Depending on accessibility, markets and other factors, cut trees can either be harvested or left on site. Cut-and-remove has a very high success rate. Cut-and-leave can be successful, too, especially when done during the summer months when beetle broods are most likely to die inside the felled trees due to sun exposure and rapid drying out of their host material. Even if some beetles do emerge from felled trees, they will not be many in number and have a farther distance to go to find fresh host material. This combination of factors is often enough to disrupt further

spot growth. Cut-and-leave is sometimes necessary when there are high-risk spots but pine markets are down.

## Ips and Black Turpentine Beetle



Black turpentine beetle pitch tubes

There are several species of pine bark beetles in the genus *Ips*, along with the black turpentine beetle (*Dendroctonus terebrans*), which are considered “secondary” pests. That is, they do not aggressively attack healthy trees like the southern pine beetle. Normally, trees and stands attacked by secondary bark beetles are under environmental stress from drought or a recent logging operation that left mechanical injuries to residual trees. The southern pine beetle often attacks trees that are similarly weakened and is then able to attack nearby healthy trees by explosive population growth and mass-attack behavior. However, *Ips* and turpentine beetles do not behave in this way – if a tree is attacked by one of these species, there is usually an underlying health issue involved. Drought is the most common underlying cause of widespread *Ips* or turpentine beetle activity. Unlike SPB spots, however, which can grow unchecked and cover hundreds or even thousands of acres under the right circumstances, *Ips* and turpentine beetle spots tend to be very small, usually not more than several trees in one clump, and tend not to grow and spread from a single spot. However, such spots can be numerous throughout a stand. If numerous enough that damage levels approach unacceptable levels, clearcutting the entire stand may be appropriate. In many circumstances, however, mortality from

secondary bark beetles is sporadic and requires no action. In fact, these bark beetles can play an important role in naturally thinning out weaker trees that may be injured or suppressed and least likely to withstand drought due to diseased root systems, which leaves more room and less competition for remaining crop trees. Pine stands with Ips or turpentine beetle activity should be monitored carefully and managers should be ready to take appropriate action if needed, but it is also important not to overreact if less than 10 percent of stand volume is affected because these events tend to stabilize on their own without further losses.

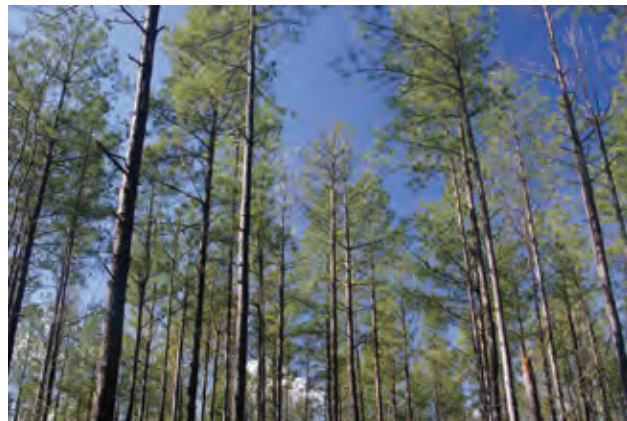
### Challenges to Diagnosing and Managing Bark Beetle Spots

It is worth mentioning that southern pine beetle, Ips and turpentine beetles can be present in a stand all at the same time. Quite often, if southern pine beetle is present, Ips or turpentine beetle will follow soon after, but it is the southern pine beetle that is driving the system. Other than the pattern of mortality within the stand, it is difficult to tell the difference between attacks of Ips and southern pine beetle. Pitch tubes can occur anywhere on the tree trunk with either species and are about the same size. Black turpentine beetle pitch tubes, on the other hand, tend to be large and more copious, about the size of a quarter rather than a dime, and almost always occur around the root collar up to about six feet. Beyond those signs, it is best to remove bark and observe the different gallery patterns, or even collect actual adult specimens from the galleries, to make a firm diagnosis. Since beetles may attack higher up on the tree trunk and be out of reach, it is sometimes necessary to fell a tree or two to recover specimens or observe galleries.

Because bark beetle activity can take several months to develop and be noticed by foresters or landowners who don't visit a particular site very often, discovery often occurs during the fall and winter. Diagnosing bark beetle spots during these seasons can be challenging. Spots often are discovered long after the trees have been killed, which means the bark beetle culprit is long gone since they feed on live phloem tissue.

Therefore, identification through recovery of an

adult specimen is really difficult unless you happen to find a dead one. Secondly, in older spots, bark beetle gallery patterns become very difficult to see or diagnose due to a considerable overlap with these galleries of many secondary insects that arrive afterwards, particularly the large larvae of buprestid and cerambycid wood borers. Finally, during drought conditions, trees often do not produce any pitch tubes when attacked, presumably because the resin system is compromised. This is likely why many of the less-aggressive species of Ips beetles are able to exploit trees in the first place. Without pitch tubes, green infested trees that might be on the periphery of the spot are undetectable as such. In summary, winter spot detections may reveal old dead trees with red crowns and peeling bark, no yellow faders and no detectable green infested trees. Under these conditions, it's very difficult to find trees with active brood and, therefore, difficult to ascertain whether these spots are due to SPB or Ips, and whether they will resume activity once spring arrives.



Pine stand decline

Therefore, as a guideline during this time of year, the forester or landowner should keep an eye on the stand as it begins to warm up in April and May. If a small spot suddenly seems to expand quickly to cover acres, you probably have an SPB problem. If you continue to see a slow, gradual decline among tree clusters here and there dying over a period of months, it's likely due to Ips or black turpentine beetle (or both). If drought conditions dissipate and rainfall patterns return to normal, the Ips problems should slowly dissipate, too – assuming no other stress factors are a major issue, such as overstocking or a recent thinning that may have left mechanical wounds on



residual trees, for example. Theoretically, any residual Ips populations are not going to be able to spread to healthy trees, which is why spots tend not to grow very large before they lose steam.

## Pales Weevil

Pales weevils (*Hylobius pales*) can have serious impacts on a recently-planted pine crop due to adult feeding on bark and cambial tissues that can girdle small seedlings. In extreme cases, an entire plantation can fail if population pressure from pales weevil is significant and mortality to greater than 50 percent of seedlings occurs. In the old days, the best method to prevent undue damage from pales weevil was to wait out one growing season after a pine harvest that occurred after July 1. If the harvest occurred before July 1, this was usually enough time for the stump-infesting larvae to develop into adults and leave the site before new seedlings were planted the following spring. After July 1, adult weevil emergence from the remaining stumps often coincides with a new crop of fresh seedlings and potentially led to disaster for the crop. With the advent of effective insecticide treatments in the nursery, most newly-planted seedlings are sufficiently resistant to pales weevil attack making that delay of planting for one to one and a half years after harvest an outdated and unnecessary tactic.

However, on occasion, pales weevil damage and unacceptable mortality of seedlings has been found in plantations that used insecticide-treated seedlings. If the local population pressure of pales weevil is high enough, insecticide-treated seedlings can be overcome and sometimes be killed at an unacceptable rate. Since it does not take a lot of weevil feeding to girdle a seedling, a large number of adults attacking at once may cause just enough damage before succumbing to the insecticide that the seedling is still killed. Thus, one should not rely blindly on insecticide-treated seedlings to prevent weevil damage if there are reasons why the weevil population may be unusually high. For example, if a nearby pine stand was damaged from fire, or a recent harvest that left very large pine stumps over many acres occurred – both scenarios would attract adult pales weevils to lay eggs and could result in a huge reservoir of larvae waiting to feed on new seedlings upon their eventual emergence as adults. If recurring problems with pales weevil are observed in an area, even when treated seedlings are being

used, delayed planting still remains an effective tactic. It may cost the landowner some money to leave a clearing fallow for an extra year, but it would cost considerably more to replant after losing half a crop of seedlings.

## Sawflies

Sawfly larvae are very similar in appearance to caterpillars, although they are in the same insect order as the ants, bees and wasps. Severe defoliation can occur to pines, typically in younger stands with significant sun exposure. There are quite a few species of sawflies that affect pine plantations – but the most common and damaging in Virginia is probably the red-headed pine sawfly (*Neodiprion sertifer*). Unlike many other sawfly species, the red-headed pine sawfly has several generations per year, so repeated damage can occur from spring until late summer. Normally, the worst defoliation occurs in the springtime on previous year's needles. Defoliation is also wasteful, and often the needle bases are left behind in a fascicle, which leaves a characteristic appearance to trees bearing sawfly defoliation. Sawfly defoliation can occasionally be severe. When this occurs over multiple generations or multiple years, it can even kill pine trees, especially smaller seedlings and saplings. However, this rarely occurs, and most outbreaks are very localized and crash on their own due to disease and parasitism from other insects. Preventative treatments using insecticides, such as carbaryl, are effective but rarely needed.



Red-headed pine sawfly

## Nantucket Pine Tip Moth

The Nantucket pine tip moth (*Rhyaciona frustrana*) negatively impacts the early growth of southern pines more than any other insect pest. Eggs are laid on terminal buds and shoots, where larvae bore in and feed at the tips. Mortality is rare, but with high infestations trees can become stunted and deformed, and growth rates dramatically reduced. Pine tip moths are rarely an issue outside of intensively managed stands where early growth losses can result in extended rotation times. While this can result in economic losses, this is very difficult to measure over the course of a rotation, making the cost-benefit analysis of control options exceedingly difficult. The traditional use of insecticides to control tip moth has been problematic due to the need to employ spray timing models. In addition, spraying each tip moth generation (anywhere from 2-4 throughout the range in VA) over multiple years is impractical, requiring the need for spray schedules. Determining an optimal spray schedule for multiple generations and years has been attempted, but cost-benefit analyses of these practices have been limited and, therefore, industry has not readily adopted them. Furthermore, while insecticide sprays are most effective during spring and early summer, tip moth becomes harder to control during the later generations in late summer and fall due to asynchronous development of life stages. New, effective systemic insecticides are available that can be applied at tree planting. These insecticides are absorbed through the root system and generally provide protection from tip moths during the first two years of plantation development. While expensive, they can be cost effective in intensively managed stands where heavy tip moth damage is anticipated.



Sawfly damage



Sawfly defoliation



Nantucket pine tip moth damage

## Pine Needlecast

This condition is caused by several different pathogens that typically prefer one type of tree species over another. However, most needlecasts are relatively harmless except in extreme situations. Needlecast outbreaks are sometimes observed over very large areas, especially with successive wet or humid spring weather. During the year of infection, yellow needles eventually appear, which progresses to browning of the entire needle by the following spring. The sudden browning of trees during spring, which can sometimes be alarming, can lead to the belief that the trees are dying from southern pine beetle or some other destructive agent. However, on closer inspection it is observed that only the older needles from previous years turn brown or partly brown, while new growth is unaffected. As the summer progresses, the older brown needles are “cast” off, while new growth emerges and trees gradually green up again. There is a strong genetic component to needlecast resistance among pines, which is why some trees that appear completely brown are adjacent to others of the same species that remain green or are only lightly affected. Needlecast outbreaks on loblolly pine appear to be the most common – but rarely have a significant impact on the resource.



Pine needlecast

## Fusiform Rust

Fusiform rust (*Cronartium fusiforme*) produces stem and branch swellings that are tapered on each end, principally on loblolly pine. All rust fungi have alternate hosts as part of their life cycle; in the case of fusiform, the alternate hosts are oaks, with water and willow oak being the most susceptible. Infections can occur in the nursery if seedlings are not treated with fungicides, or can be acquired in the plantation from spores infecting twig or stem injuries. Historically, Virginia has not had many problems with fusiform rust compared with farther south. However, a major rust infection in our Garland Gray nursery during 2004-2005 led to the outplanting of many infected seedlings throughout the Commonwealth, although damage was significant only in a few cases. It has not been too uncommon to find young loblolly pine plantations with rust infestations that can be traced back to that year of infection. VDOF now routinely treats all pine seedlings in the nursery to protect them from fusiform rust. Several newer examples of rust infection have surfaced in far southeastern Virginia – in Isle of Wight and Southampton counties. Infections usually are picked up during the first five years after plantation establishment. If the main stem is rust free after five years, it will normally remain so for the remainder of the rotation. Therefore, young plantations with less than 25 percent rust infection on the main stem by age five should not be greatly affected if no action is taken. However, fusiform rust infections on the main stem make such trees more prone to breakage, and, therefore, those trees should be culled out of the stand during the first thinning opportunity.



Fusiform rust



Fusiform rust



Annosum root disease



Littleleaf Disease

## Annosum Root Disease

Annosum (*Heterbasidion annosum*) is a root-rotting fungus that is most prevalent on sites in the Coastal Plain with deep, sandy soils. It impacts all species of pine, but loblolly and white pines are the most common hosts. Eastern red cedar is also susceptible. It is often difficult to detect, but is characterized by infection centers that gradually radiate outwards. In addition, needles often appear short and stunted, leading to thinning crowns with low leaf area indices. The fungus sometimes produces a characteristic fruiting structure or conk at the base of the tree – but often goes undetected since it emerges from basal roots just under the duff layer. Infection centers normally begin after a thinning, when fungal spores infect recently exposed stump surfaces and grow into the root systems. The fungus can then spread easily through grafted root systems and through soil to other pines, thus radiating outward from the cut stump. The best defense is to avoid planting on high-risk sites; avoid thinning, or apply a fungicide, such as Borax, to cut stumps immediately after a thinning. This root disease is probably a lot more widespread than is reported, in part due to diagnosis difficulties.

## Littleleaf Disease

This disease is caused by a fungus-like organism, *Phytophthora cinnamomi*, which is actually a protozoan with swimming spores that can move rapidly through wet soil, infecting root systems. Its greatest impact is to shortleaf pine, but loblolly pine, Virginia pine and several hardwoods like chestnut are also susceptible. Areas of highest risk for littleleaf disease occur in the clay soils of the Piedmont region. The pathogen can fester at low levels and remain undetected in high-risk soils, but spore loads can suddenly explode and spread rapidly after a heavy rainfall that floods the soil. Littleleaf disease may be an important pre-disposing or inciting factor leading to other problems affecting pines throughout the Piedmont Province across the South. Although just a hypothesis, the high risk of littleleaf disease infecting pines on clay soils may explain why, historically, the southern pine beetle has been far more damaging in the Piedmont region than in the Coastal Plain, a trend that is consistent across the South.

## Forest Health Problems In Hardwood Forests

Due to the inherent diversity of most hardwood forests and associated silvicultural practices, forest pest problems are too numerous and varied to discuss individually in this manual. Pest problems also tend to be less distinct than with pines, and fall more within the realm of multi-agent causal factors, which contribute to decline. Avoiding forest health problems in hardwood forests, as a generalization, mostly requires that some basic guidelines are followed, which were outlined earlier: **match species to site; favor species mixes where practical; give desired trees plenty of light and growing space; prevent or avoid unnecessary site disturbance and tree injury; remove undesirable trees (don't high-grade), and harvest trees before their quality begins to decline.**



Hardwood forest

Due to the prevalence and importance of the oak-hickory and oak-pine forest types in Virginia, the health and prosperity of oaks is of major importance. Therefore, this discussion will emphasize oak decline and oak pests, although this is not meant to be comprehensive or a substitute for the many detailed references that help to identify and treat specific hardwood pest problems. Problems associated with oaks today have little to do with insect and disease pests directly (with the exception of gypsy moth) and more to do with an aging cohort of mature trees; past and current silvicultural practices like high-grading, and poor regeneration potential. Silviculturally, oaks are at a competitive disadvantage because of their intermediate shade tolerance: poplars out-compete them in full

sunlight and maples out-compete them in full shade. Fire exclusion and heavy deer browsing have taken a heavy toll on oak regeneration as well. Silvicultural prescriptions that favor oaks, such as group selection or shelterwood cuts and prescribed fire are rarely applied. Even if these practices are employed, their success at restoring a viable oak component is further complicated by invasive plants.



Dying ash

Data from the USDA Forest Service Forest Inventory and Analysis (FIA) plot system suggest that statewide species, such as tulip poplar, loblolly pine and red maple, are increasing dramatically in volume. While six oak species were ranked in the top 20 by volume in the latest survey, most are showing a decline in overall percentage of forest volume during the last 15 years. A more revealing statistic from the FIA data is the number of overall stems for each species, which is an indicator of regeneration potential. Once again, the top three species in terms of number of stems include red maple, loblolly pine and tulip poplar.

White oak and chestnut oak are ranked number seven and nine; scarlet oak is number 20, and northern red, southern red and black oaks are out of the top 20 altogether. This suggests that, over time, oaks will likely show a significant drop in overall volume as mature trees die off.

There are diseases commonly associated with oak decline, including fungi like *Armillaria* and *Hypoxyton* canker, as well as insects like the two-lined chestnut borer or oak carpenterworm. Decline and death can occur over a period of years or within one season, although leaves that turn brown will remain attached during the whole season. The more rapid declines tend to occur on stressful sites, such as drought-prone areas, ridges or areas that experience regular flooding. Oak decline usually affects a large number of widely scattered trees over an extensive area, rather than occurring in tightly-clustered pockets. We'll discuss several of the most important pests and pathogens associated with oak decline in Virginia. Keep in mind that most of these will attack many other hardwood species that are under stress besides oaks.

## Cankerworms and Other Hardwood Defoliators

Defoliators are generally considered inciting factors within the tree-decline concept framework. There are several common native defoliators of hardwoods that periodically reach outbreak levels and can result in severe defoliation. Among the most common are the fall cankerworm, spring cankerworm, variable oakleaf caterpillar, elm spanworm and the buck moth. Although all of these species feed on a variety of hardwood hosts, oaks are typically favored and most heavily defoliated.

The fall cankerworm (*Alsophila pometaria*) is probably the most common of the native defoliators to reach outbreak levels. This pest can be hard on oaks, especially when two or more years in a row of severe defoliation occur. Cankerworm outbreaks historically have been most common in mountainous areas and along ridge tops where trees are more vulnerable to other stressors. However, several huge cankerworm



Cankerworm



Cankerworm defoliation

outbreaks have also occurred in the Piedmont and Coastal Plain, especially around the Richmond area. Cankerworm outbreaks also tend to recur in the same areas, perhaps in part because adult female moths have no wings and are incapable of flight. Tree mortality can be significant in certain areas, particularly where chestnut and red oaks are prevalent and have been defoliated two years in a row. Fortunately, cankerworms, like other native defoliators, have a large number of natural enemies that usually cause their populations to crash a year or two after severe outbreak levels are reached. Thus, widespread tree mortality from these pests is

rare. Light to moderate defoliation can actually benefit the forest as a whole since falling insect excrement (frass) can cause a pulse of nutrient inputs to the forest floor, and soil and caterpillars provide food for birds and other fauna. As a generalization, most hardwoods that are in good health have more leaves than they really need and can withstand as much as 50 percent defoliation without serious, long-term consequences to health. Given these facts, it is normally not necessary to do any proactive management to deal with native defoliators other than to remove dying or dead trees.

The next three issues are considered contributing factors within the tree decline concept framework:

## Hypoxylon Canker

This fungus is classified by pathologists into several different species, but *Hypoxylon punctulatum* is probably the most common on hardwoods in this part of the country. It can be found across Virginia, affecting primarily oaks, but is also known to colonize birch, hickory, chestnut, beech and elm. Most foresters have probably seen evidence of this fungus hundreds of times without knowing at what they were looking.



Hypoxylon canker

*Hypoxylon punctulatum* is ubiquitous throughout our forests but does not act as an aggressive pathogen. Typically it resides in

healthy oak tissues as an “endophyte,” unnoticeable until environmental stress, particularly drought, releases this opportunistic pathogen. The fungus becomes visible after a mat of tissue called a “stroma” develops in the cambial region, pushing outward as it grows so that the bark begins to flake off the tree. Once exposed, the stromata (pl.) release millions of spores into the air. Stromata can be black to brown, or gray depending on whether the sexual or asexual form of the fungus is present. Exposed stromata typically occur some months after the tree is dead; therefore, Hypoxylon canker is rarely detected while the affected tree is still alive.

The prevalence of Hypoxylon across the Commonwealth and in other eastern states can be seen not as an indication of an aggressive pathogen at work but, rather, as an indication of cumulative environmental stress, mainly drought, which is the most common stress factor on the landscape. Typically, affected trees are found individually rather than in large clumps, which reflect the random nature of drought impacts relative to a tree's position in the landscape.

## Armillaria

Signs of Armillaria root rot, or shoe-string rot, include black rhizomorphs (collections of fungal strands surrounded by a black protective layer) along the base and roots of the tree that grow into the soil and can spread to other trees; white mycelial fans or fungus mats underneath the bark, and honey-colored mushrooms around the base of the tree in autumn. Any of these signs usually means that tree death is soon to follow due to girdling and root killing. Like Hypoxylon canker, Armillaria can be found everywhere but typically is not noticed because infections are often small, localized and non-aggressive. When numerous stressors begin to accumulate and weaken trees, however, these localized infections can expand rapidly from a widely-distributed network of fungal populations that are already in place. There are several different species of Armillaria that may produce a variety of symptoms. Small or thinning leaves, chlorosis, branch dieback or other crown symptoms may occur but are not very diagnostic.

## Two-lined Chestnut Borer and Other Hardwood Borers

The two-lined chestnut borer (*Agrilus bilineatus*) is a “wood-boring” beetle that feeds in the cambium. This feeding results in meandering galleries or feeding tunnels in the inner bark and outer sapwood, which can eventually girdle branches or the entire tree bole when populations are at high enough levels. The borers will attack the upper branches first, but as trees decline and branches die back, subsequent populations will move to the main bole of the tree after several years. Once the main bole is girdled, the entire tree dies quickly.

Note that there are numerous other “true” woodborers that bore directly into the sapwood and heartwood of weak and dying trees. Some of the more notable ones include the red oak borer, white oak borer, flat-headed apple tree borer, the oak carpenterworm and the clearwing moth.



Oak mortality



## Non-Native Invasive Insects and Diseases



Emerald ash borer mortality

Pests that are relatively new to a region and have no evolutionary or ecological history with local flora and fauna are labeled non-native. Any kind of organism can be labeled a pest, but within the realm of forestry, we are mostly talking about insects, diseases (fungi) and plants (or weeds). Invasive species are generally aggressive competitors that can sometimes “take-over” or overwhelm a community or ecosystem. However, not all invasive species are necessarily non-native: think striped maple, rhododendron or spicebush, all of which can grow so thick as to dominate the shrub layer of a forested site, under the right conditions. Likewise, most non-native species, in fact, are not aggressive or invasive. But those that are have a tendency to be very bad for ecosystem health and sustainability. In the worst case scenario, entire species that act as hosts for these pests can be under threat or disappear in a relatively short time – like the American chestnut did from a fungal blight during the early 20th century. As noted previously, the forest decline concept does not always apply very well when dealing with invasive species. A lethal disease like the chestnut blight or an aggressive insect like the emerald ash borer will kill healthy trees as well as sick ones, rendering predisposing or inciting factors more or less irrelevant. However, a defoliator like gypsy moth that is somewhat less lethal can fit in nicely as an inciting factor within the decline concept.

### European Gypsy Moth

Periodic buildups of European gypsy moth (*Lymantira dispar*) populations

have resulted in significant defoliation in Virginia since 1984. The gypsy moth is found across most of the Commonwealth, with the exception of the extreme southwest. The most severe defoliation events over the last 25 years have occurred in the mountainous western portion of the state, particularly in the northwest corner where outbreak populations have been present the longest. A large proportion of the hardest hit areas are on federal lands, including much of the George Washington National Forest and Shenandoah National Park. Compared with the Piedmont and Coastal Plain, the mountains bear the brunt of the impacts from gypsy moth for a number of reasons: 1) large areas of contiguous forest that are unbroken for many miles, allowing for easy dispersal and high survival of gypsy moth; 2) a high concentration of preferred host types – particularly chestnut oak and red oaks, and 3) poor site and soil conditions, including many xeric ridges with low nutrients and poor moisture-holding capacity. With these predisposing factors in place, trees, such as chestnut oak, that grow competitively there are none-the-less under greater stress, particularly during drought conditions. During such conditions, tree resistance to insects and diseases is considerably less than what one would see in a more fertile cove or bottomland. While major gypsy moth outbreaks generally begin in high-elevation habitats, they are fully capable of spreading well into mid-slope and lowland areas and impact those forests and tree species, too. While hundreds of different tree and shrub species may be defoliated, it is oaks that are most preferred and more frequently killed by the moth.

Oak decline, as a natural process, would be occurring in these areas with or without the presence of gypsy moth. This is especially true since many oaks are entering an older-age cohort across Virginia after filling in the forest gaps left by the demise of American chestnut over the last century. However, it is fair to say that with gypsy moth operating as a significant and recurring “inciting factor,” it is greatly speeding up the process of oak decline.

Resilience of forests to gypsy moth can be bolstered by selectively harvesting oaks and promoting resistant species like poplar before gypsy moth outbreaks occur. Oak restoration following major loss of oak canopy may or may not be simple depending on whether there is viable regeneration in the understory. Even so, deer browse and competition are often problematic,



Gypsy moth larva



Gypsy moth oak mortality

particularly when aggressive invasive plants are suddenly released by a loss of overstory.

### Oak Wilt

Oak wilt is a non-native disease that can act alone and not have any association with oak decline per se. Oak wilt is a condition caused by a single, exotic organism, *Ceratocystus fagacearum*, which can very rapidly kill trees with no history of abiotic stress. Often, affected trees are isolated or in small pockets. Unlike oak decline, oak wilt acts much more rapidly and is usually lethal on species within the red oak group. White oaks are fairly resistant to the disease and are rarely killed. In Virginia, oak wilt is most common in the Appalachians and has never been found on trees east of the Blue Ridge Mountains. The main symptom of oak wilt is a sudden wilting of leaves throughout the tree, usually from the top down. Leaves with blackened petioles begin to fall off the tree before turning brown, and the whole tree may be defoliated in three to six weeks. Some three to nine months after wilting, there may be dark streaking of the outer sapwood and oval-shaped fungal mats underneath the bark. These fungus mats are often exposed as the outer bark above them begins to peel off. They also produce a fruit-like odor that is attractive to fungus beetles, which can spread the disease to other trees by carrying fungal spores on their bodies. The disease can also spread to other trees through root grafts, leading to “infection centers.” On white oaks, oak wilt is much more difficult to distinguish from oak decline. Often, only a single branch is affected and the leaves usually remain on the tree. Usually only the terminal portion of the leaves will turn brown. Because only individual branches are affected, white oaks can exhibit the same “stagheaded” appearance as is commonly seen with oak decline. Fungus pads under the bark are relatively rare. In the rare instance where a white oak species is killed, this can take from one to four years.

## Emerald Ash Borer (EAB)

Emerald ash borer (*Agrilus planipennis*) is a relatively new insect pest that threatens to rapidly deplete the ash resource. Foresters should learn all they can about this invasive beetle and be prepared when it shows up in their region. Proactively, not much can be done on the management side other than pre-emptive harvesting of valuable ash logs. This can be done in response to a new EAB infestation where ash timber is recovered before unacceptable degrade occurs. It is difficult to know long term what the fate of all ash will be and whether science will eventually come up with a solution for this problem. In the mean time, it is best to assume ash will become a rare species and that most ash timber will be lost to this pest in the coming decades.



Emerald ash borer galleries



Emerald ash borer mortality



Emerald ash borer galleries

### Other Pests and Pathogens

Several other pests and pathogens threaten the very existence of other tree species. While research to combat these problems is ongoing, there are usually no silver bullets. Therefore, forest managers should be aware of these pests and consider them when making management decisions and recommendations. While there is no space to go into this growing list of problems, several of the more important ones are listed below. To the extent that threatened tree species are important for a particular region or forest under management, extensive literature exists on all of these pests and should be consulted, when appropriate.

Additional tree species under threat and/or currently in decline, and the non-native invasive species responsible include:

- ◆ Flowering dogwood due to dogwood anthracnose (Note: resistant dogwood varieties exist)
- ◆ Butternut (becoming rare) due to butternut canker
- ◆ American elm due to European elm bark beetle, which transmits the fungus that causes Dutch elm disease (Note: resistant varieties of American elm exist)
- ◆ Eastern and Carolina hemlock due to the hemlock woolly adelgid
- ◆ Black walnut due to the walnut twig beetle, which transmits the fungus that causes thousand cankers disease
- ◆ American beech due to beech scale and beech bark disease
- ◆ Maples due to the Asian long-horned beetle



Black walnut decline associated with thousand cankers disease

## Non-Native Invasive Plants

Increasingly, non-native invasive (NNI) plants are invading our forests, complicating management strategies and increasing management costs. Some species, such as mile-a-minute or wavy leaf basket grass, are relatively new to Virginia. Many others were imported hundreds of years ago for one perceived value or another, and have now become so widespread that there is no prospect for eradication. All are characterized as being aggressive colonizers of exposed or disturbed sites. Most are heavy seed producers or highly efficient at vegetative reproduction, or both. As well, some NNI plants are extremely shade tolerant. Some species even inhibit growth of other flora by releasing chemicals into the soil, a phenomenon called “allelopathy.” The end result is that a mix of exotic plants can take over disturbed sites and gradually encroach upon less disturbed areas, out-competing native flora. Not only does this reduce biodiversity, it can also have significant negative effects on forest community dynamics, wildlife habitat, recreational opportunities, aesthetics and timber production.



Oriental (Asian) bittersweet

While foresters have always employed herbicides in moderation to achieve certain management goals, the scope of the NNI plant problem is such that traditional herbicide treatments are no longer effective at controlling a site. With the variety of invasive plants across the landscape – including trees, shrubs, vines, herbs, forbs and grasses – herbicide treatments have, by necessity, become more frequent, more diverse and more complicated. This increases

management costs and the probability that realistic forest management goals will eventually become cost-prohibitive. The diversity of problematic weeds out there, alone or in combination, means there is no one-size-fits-all approach. Increasingly, a careful blend of chemical and silvicultural tactics are necessary to reach the intended management objectives.



Wavy leaf basket grass

In Virginia, a list of the most important (widespread and problematic) NNI plants includes the following:

- ◆ Tree-of-Heaven (*Ailanthus altissima*)
- ◆ Japanese honeysuckle (*Lonicera japonica*)
- ◆ Oriental (Asian) bittersweet (*Celastrus orbiculatus*)
- ◆ Multi-flora rose (*Rosa multiflora*)
- ◆ Japanese stiltgrass (*Microstegium vimineum*)
- ◆ Kudzu (*Pueraria montana*)
- ◆ Autumn olive (*Eleagnus umbellata*)
- ◆ Garlic mustard (*Alliaria petiolata*)
- ◆ Chinese privet (*Ligustrum sinense*)
- ◆ Bush honeysuckles (*Lonicera spp.*)

Of course, there are many other species that may be more prevalent or significant in a specific area or habitat.

Invasive plant problems can interact with problems posed by other non-native insects and diseases. For example, if gypsy moth defoliation leads to mortality of overstory oaks, aggressive NNI plants that are lingering in the understory would suddenly be “released” by extra sunlight reaching the forest floor and are likely to take over the site. Likewise, any insect or disease “disturbance” that prematurely takes out multiple trees can have similar impacts. Forest managers, to be effective, need to consider all of the multiple risks posed by invasive species long before problems get out of hand. This is a huge challenge, but one that cannot be ignored. Otherwise, the costs associated with managing forests into the future may be prohibitive, while doing nothing will likely only make the problems worse. Under this scenario, landowners may be more inclined to convert forested holdings to other uses.



Striped maple regeneration

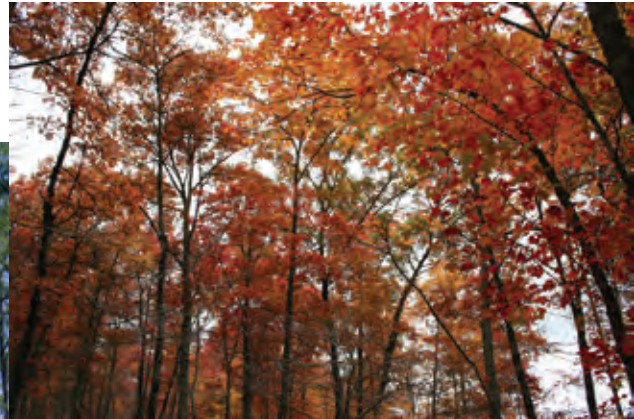


Garlic mustard



Periwinkle

*Proper forest management to maintain the health and vitality of your forestland is your best defense against forest health insects and diseases.*







# CHAPTER 6

## FIRE



## Fire and the Environment

Whether caused by lightning or by the hand of a person, fire has been a part of the natural world for centuries. In Virginia, prior to European settlement, American Indians set fires intentionally for hunting, protection, warfare, agriculture, vegetation management and food gathering. On flat terrain, fires would burn over large areas until some natural barrier or rainfall event was encountered. Today, unrestrained fire represents a hazard to public safety and property, but the benefits of carefully prescribed and controlled fire can still be realized. Fire is recognized as a cost-effective land management tool by silviculturalists, wildlife managers and natural area managers. Prescribed burning is practiced today using skillful methods and rigid safety specifications.

Prescribed burning is the intentional use of fire in a particular time and place, under established conditions and specifications, to accomplish a biological or resource management goal. The Virginia Department of Conservation and Recreation uses prescribed burning when this practice benefits particular fire-dependent natural communities and species. Secondary benefits derived from regular burning include opening aesthetically pleasing landscapes; impressive displays of wildflowers; greater numbers and enhanced visibility of wildlife, and a profusion of blueberries, huckleberries and raspberries.

Vegetation succession is the natural process by which one type of vegetation is replaced by another leading toward increased biomass and altered vegetation structure. The theoretical “end point” of succession is referred to as the climax, or steady-state condition in which the community is more or less self-sustaining. Throughout much of Virginia, succession left unchecked would result in dense, closed canopy forest. Maintaining open, early-successional types of vegetation, such as prairie, savanna, woodland and glade, and the species dependent on these communities, necessitates fire management as a means of “setting back” the process of succession.

Fire contributes to maintaining Virginia’s natural heritage in many ways. Entire forest types, such as longleaf pine forest, pitch pine forest and table mountain pine forest, are created and perpetuated by fire. The grassy savannas created by fire provide the necessary breeding habitat for rare Bachman’s Sparrows and other forms of wildlife. Prairie vegetation still exists in Virginia largely because of frequent accidental fires along railroad tracks. Lastly, there are more than 100 rare plant species which either depend on or benefit from fire. Fire liberates the rare plants from competing woody vegetation and sometimes enhances seed germination. The case of the Virginia endemic, Peter’s Mountain Mallow, is dramatically illustrative. Just four naturally-established individual plants remained until an experimental burn was conducted at the site. Four hundred new plants appeared after the fire! Using prescribed fire management has effectively rescued this species from the brink of extinction.



Utilize a professional certified burn manager to ensure a safe and effective prescribed burn.



A few days following a properly-conducted prescribed burn, the debris on the forest floor is reduced and minimal vegetation remains.



One month following a prescribed burn, lush new vegetation is filling in the forest floor.

## Fire as a Resource Management Tool

**BEFORE** any plan is developed that includes the use of fire in managing your natural resources, you must become knowledgeable of using fire as a tool **OR** secure the assistance of someone who does. Virginia has a Certified Prescribed Burn Managers program that provides training along with benefits to becoming certified.

Virginia Certified Prescribed Burn Managers Program:  
[www.dof.virginia.gov/fire/prescribed](http://www.dof.virginia.gov/fire/prescribed)

Virginia Prescribed Fire Council:  
[www.dof.virginia.gov/fire/vpfc.htm](http://www.dof.virginia.gov/fire/vpfc.htm)

Additional prescribed fire sites:  
[www.GoodFires.org](http://www.GoodFires.org)  
[www.visitmyforest.org](http://www.visitmyforest.org)

### Reasons for Prescribed Fire In Forest Resource Management

#### *Reduce Hazardous Fuels*

Forest fuels accumulate rapidly especially in pine stands on the Coastal Plain. In five to six years, heavy “roughs” can build up, posing a serious threat from wildfire to all forest resources.

Prescribed fire is the most practical way to reduce dangerous accumulations of combustible fuels under southern pine stands. Wildfires that burn into areas where fuels have been reduced by prescribed burning cause less damage and are much easier to control. The appropriate interval between prescribed burns for fuel reduction varies with several factors, including the rate of fuel accumulation, past wildfire occurrence, values at risk and the risk of a fire. The time interval between fires can be as often as every year although a three- or four-year cycle is usually adequate after the initial fuel-reduction burn.

#### *Dispose of Logging Debris*

After harvest, unmerchantable limbs and stems are left either scattered across the area or concentrated at logging decks, depending upon the method of logging. This material is an impediment to both people and planting equipment. If a wildfire occurs within the next few years, fire line construction can be severely hindered; the result being larger burn acreages and higher regeneration losses. Although not all large material will be consumed by a prescribed fire, what is left will be exposed so it can be avoided by tractor-plow operators. In stands that produce a large amount of cull material, the debris is often windrowed and burned. This practice should, however, be avoided whenever practical because of smoke management problems and the potential for site degradation. Broadcast burning is generally a much better alternative. If the debris must be piled before burning, construct round “haystack” piles when the debris and underlying ground are both fairly dry. This step will limit the amount of dirt in the pile. Piles containing large amounts of dirt can seldom be burned efficiently. They almost always smolder for long periods, creating unacceptable smoke problems.

#### *Prepare Sites for Seeding or Planting*

Prescribed burning is useful when regenerating southern pine by direct seeding, planting or natural regeneration. On open sites, fire alone can expose adequate mineral soil and control competing vegetation until seedlings become established. Where competing vegetation cannot be adequately reduced by fire, follow up with mechanical or chemical treatment. The fire will improve visibility so that equipment operators can more easily see the stumps of the harvested trees, as well as any other hazards. In addition, if the area is to be bedded before planting, burning first consumes much of the debris. The result is more tightly packed beds and thus better seedling survival. Where herbicides are used to kill competition, subsequent burning will give additional vegetation control. This step also permits more efficient and easier movement of hand-planting crews. Prescribed fire also recycles nutrients, making them available for the next timber crop.

### ***Improve Wildlife Habitat***

Prescribed burning is highly recommended for wildlife habitat management where loblolly, shortleaf, longleaf or slash pine is the primary overstory species. Periodic fire tends to favor understory species that require a more open habitat. A mosaic of burned and unburned areas tends to maximize “edge effect,” which promotes a large and varied wildlife population. Deer, dove, quail and turkey are game species that benefit from prescribed fire. Habitat preferences of several endangered species are also enhanced by burning. Wildlife benefits from burning are substantial. For example, fruit and seed production is stimulated. Yield and quality increases occur in herbage, legumes and browse from hardwood sprouts. Openings are created for feeding, travel and dusting.

Selecting the proper size, frequency and timing of burns are crucial to the successful use of fire to improve wildlife habitat. Prescriptions should recognize the biological requirements (such as nesting times) of the preferred wildlife species. Also consider the vegetative condition of the stand and, most importantly, the changes fire will produce in understory stature and species composition.

### ***Manage Competing Vegetation***

Low-value, poor-quality, shade-tolerant hardwoods often occupy or encroach upon land best suited to growing pine. Unwanted species may crowd out or suppress pine seedlings. In soils with high clay content and in areas with low rainfall during parts of the growing season, competition for water, nutrients and growing space may significantly lower growth rates of the overstory. Furthermore, understory trees and shrubs draped with dead needles and leaves act as ladder fuels allowing a fire to climb into the overstory crowns. In most situations, total eradication of the understory is neither practical nor desirable. However, with the judicious use of prescribed fire, the understory can be managed to limit competition with desired species while at the same time reducing wildfire risk.

Burning is most effective in controlling hardwoods less than three inches in diameter at the ground line. Periodic fires throughout the rotation can keep competing vegetation below this three-inch threshold. The most desirable season for burning and the frequency of burns will vary somewhat by species and physiographic region.

Generally, a winter (dormant season) fire results in less root kill than a late spring or summer burn. One system recommended in both the Piedmont and Coastal Plain is a dormant season burn to reduce initial fuel mass, followed by two or more annual (if enough fuel is present) or biennial summer burns.

If not controlled, the hardwoods will form a mid-story and capture the site once the pine is harvested. If a large pine component is wanted in the next rotation, these unmerchantable hardwoods must be removed during site preparation – an expensive proposition. Generally, fire is required in combination with other treatments involving heavy equipment, chemicals or both. In many locations, the preferred system is a combination summer burn and herbicide treatment.

### ***Control Insects and Disease***



Prescribed fire can benefit the forest ecosystem when handled properly and done at the right time.

Brownspot disease is a fungal infection that may seriously weaken and eventually kill longleaf pine seedlings. Diseased seedlings tend to remain in the grass stage. Control is recommended when more than 20 percent of the seedlings are infected or when some of the diseased seedlings are needed for satisfactory stocking. Once the seedlings become infected, burning is the most practical method of disease control. Any type of burning that kills the diseased needles without killing the terminal bud is satisfactory. Burning the infected

needles reduces the number of spores available to infect the seedlings. Generally a fast-moving winter heading fire under damp conditions, as exist after passage of a strong cold front, is best. Height growth of the seedlings often begins the first post-fire growing season.

### *Enhance Appearance*

Prescription burning improves recreation and aesthetic values. For example, burning maintains open stands, produces vegetative changes and increases numbers and visibility of flowering annuals and biennials. Burning also maintains open spaces and creates vistas. Unburned islands increase vegetative diversity, which attracts a wider variety of birds and animals. A practical way to maintain many visually attractive vegetative communities and perpetuate many endangered plant species is through the periodic use of prescribed fire.

Using fire to manage landscapes and enhance scenic values requires judiciously planned and executed burns, especially where exposure to the public is great. Burning techniques can be modified along roads and in other heavily used areas to ensure low flame heights, which in turn will reduce crown scorch and bark char while still opening up the stand and giving an unrestricted view.

### *Improve Access*

Burning underbrush prior to the sale of forest products improves the efficiency of cruising, timber marking and harvesting. Removing accumulated material before harvesting also provides greater safety for timber markers, loggers and naval stores operators due to better visibility and less underbrush. The reduced amount of fuel helps offset the greater risk of wildfire during harvesting. Moreover, the improved visibility and accessibility often increase the stumpage value of the products. Hikers and other users also benefit from easier travel and increased visibility. Hunters are more likely to get a clear shot.

### *Perpetuate Fire-dependent Species*

Many plants have structural adaptations, specialized tissues or reproductive features that favor them in a fire-dominated environment.

Such traits suggest a close association with fire over a very long period of time. Many endemics are found only the first one to two years after a fire. Changes in the “natural” fire pattern as a result of attempted fire exclusion have led to dramatic decreases in many of these fire-tolerant or fire-dependent species. Many picturesque flowers, including several orchids, listed as threatened or endangered are benefited by fire.

Prescribed burning, however, does not automatically help perpetuate plant and animal species because fires are not necessarily conducted during the same season in which the site historically burned. The interval between prescribed fires as well as fire intensity may also differ from those of the past. The individual requirements of a species therefore must be understood before a fire can be prescribed to benefit that species.

### **The Written Plan**

A written prescribed-burning plan prepared by a knowledgeable person is needed for each area to be burned. The plan should be completed well before the burning season and preparations made for when the prescribed weather occurs. Some plans may be quite short and simple while others will be complex. Individual blocks can vary from a few acres to more than 1,000, but topography and amount and type of fuel in a unit should be similar within a burn block. The plan can consist of a series of blocks in the same compartment or management unit as long as the same objectives apply and the fuel is similar. No two burns are the same. Each burn requires a burn plan developed specifically for the conditions in the burn unit.

Large areas should be divided into one-day burning blocks or smaller areas. Use existing barriers, such as roads and creeks, as much as possible. Be sure barriers are effective at the time of the burn.

***NO WRITTEN PLAN  
– NO BURN –***

## Wildfires in Virginia

While controlled fire can be beneficial to the forest resource and environment, uncontrolled wildfire can be devastating to life, property and the forest resource.

### Wildfire Causes

Wildfires, sometimes referred to as forest fires or brush fires, occur in all areas of Virginia and are mostly caused by human carelessness. The largest number of fires occurs in February, March, April and May. This is known as spring fire season. There is also a fall fire season in October, November and December. Fire causes and the percentage of the totals for Virginia are as follows:

**Table 5. Wildfire Causes in Virginia**

Cause	Percent
Open Burning	30%
Arson	20%
Smokers	14%
Miscellaneous (house, vehicle, aircraft, etc. that spread to the forest)	11%
Children	9%
Equipment Use	7%
Railroads	5%
Lightning	3%
Campfires	1%
	100%

During an average year, the forest and woodland homes of Virginia are threatened and burned by more than 1,300 fires, which burn approximately 12,000 acres. Each year, people are injured or killed, buildings are destroyed and significant damage to the forest and environment occurs.

The Virginia Department of Forestry is responsible for the control of wildfires in counties and some cities. Fire departments and many volunteers work together with the Department of Forestry to save life, property and forest resources. The Virginia Department of Forestry investigates all forest fires to find the person responsible; collects suppression costs, or issues a summons to court for forest fire law violations. Since most fires are caused by human actions, they can be prevented by using common sense, following fire safety rules and obeying fire laws.



Firefighting is a cooperative effort in Virginia.

### Open Burning

- ◆ A safety zone should be cleared that is wide enough to prevent the escape of the fire.
- ◆ Burn after 4 PM (State Law: February 15 to April 30) and when the wind has calmed.
- ◆ Obey forest fire laws and air pollution regulations.
- ◆ Do not leave the fire unattended (State Law: year 'round).
- ◆ Have water, a shovel and rake with you as well as having access to a phone to call 911 in case of emergencies.

## *Arson*

- ◆ Report acts of arson to the fire department, police, sheriff or Virginia Department of Forestry.
- ◆ Report details such as: description of suspect, car, license number, etc.

## *Smokers*

- ◆ Use deep ashtrays or extinguish smoking materials on bare ground and be sure they are “dead out.”
- ◆ Hold matches until cold.

## *Miscellaneous*

(House, Equipment, Hot Ashes)

- ◆ Report all fires to the fire department.
- ◆ Dispose of charcoal and ashes in a metal container. Keep ashes in the metal container for several days and mix with water before dumping them on the ground.
- ◆ Store gasoline and flammable materials in approved containers.

## *Children*

- ◆ Teach children safe camping behaviors.
- ◆ Supervise all activities involving the use of fire.

## *Equipment Use*

- ◆ Refuel lawn mowers, power saws, etc. only after the engine and mufflers have cooled. Use approved gasoline containers.
- ◆ Keep approved mufflers and spark arrestors installed and maintained.
- ◆ Construct and maintain electric fences so they do not come in contact with dry weeds, brush or ground.

- ◆ Park vehicles so that the exhaust system does not come in contact with dry grass, weeds or leaves.
- ◆ Notify the electric power company when dead trees or overhanging limbs endanger the electric wires. The wires may touch each other or the ground causing sparks that start fires.

## *Campfires*

- ◆ Clear a 10-foot safety circle of all leaves, pine needles and flammable material.
- ◆ Never leave a campfire unattended.
- ◆ Adults should drown the fire “dead out” with water before leaving it.



## Virginia's Burning Law in Brief: §10.1-1142

- ◆ No burning until after 4 p.m. from February 15 through April 30 of each year, if the fire is in or within 300 feet of woodland, brushland or field containing dry grass or other inflammable material.
- ◆ Fire shall not be left unattended if within 150 feet of woodland or dry fuel.
- ◆ No new fires set or fuel added after midnight.
- ◆ Law applies to campfires, warming fires, brush piles, household trash, stumps, fields of broomstraw and brush or anything capable of spreading fire.
- ◆ The law provides for a penalty of up to \$500, plus payment of court costs and fire suppression costs if the fire escapes.
- ◆ An exemption may be approved for prescribed burning between February 15 and April 30 if the fire is conducted in accordance with a prescription; managed by a certified prescribed burn manager, and all law requirements in §10.1-1142-C are met.



VDOF enforces the Virginia Burning Law.

## Protect Your Home from Wildfire

The number of homes being built in or near forested areas is increasing rapidly in Virginia. This area is referred to as the Wildland-Urban Interface. When a fire occurs around one of these homes, it often extends into the forestland, threatening other homes and forest resources. Wildfires often threaten and burn homes and structures built in wooded areas. There are many things homeowners can do that will help protect their homes from the threats of a wildfire. Fire safety precautions include:

- ◆ Have a cleared area at least 30 feet wide around all structures. Homes built in pine forests should have a minimum 75-foot clearance.
- ◆ Have properly designed driveways that will accommodate firefighting equipment.
- ◆ The house address should be clearly displayed.
- ◆ Keep leaves and debris cleared from under decks and porches so that they will not be set on fire by blowing sparks and embers.
- ◆ Roofs should be of fire-resistant materials. Remove pine needles and leaves from the roof and gutters so that they will not be set on fire by blowing sparks and embers.
- ◆ Have outside water spigots and at least 100 feet of garden-type hose readily accessible for fire control until the fire department arrives.
- ◆ Should the situation become life threatening or an evacuation order be given by fire officials, leave immediately and go to the designated evacuation shelter. Do not return until an all-clear message has been given by fire officials.
- ◆ Dispose of ashes and charcoal briquettes in a metal container, mix with water and allow them to stay in the container for at least 48 hours. Do not dump hot ashes on the ground.

If you have any questions about protecting your property from wildfire, please visit the Virginia Department of Forestry's website ([www.dof.virginia.gov](http://www.dof.virginia.gov)).

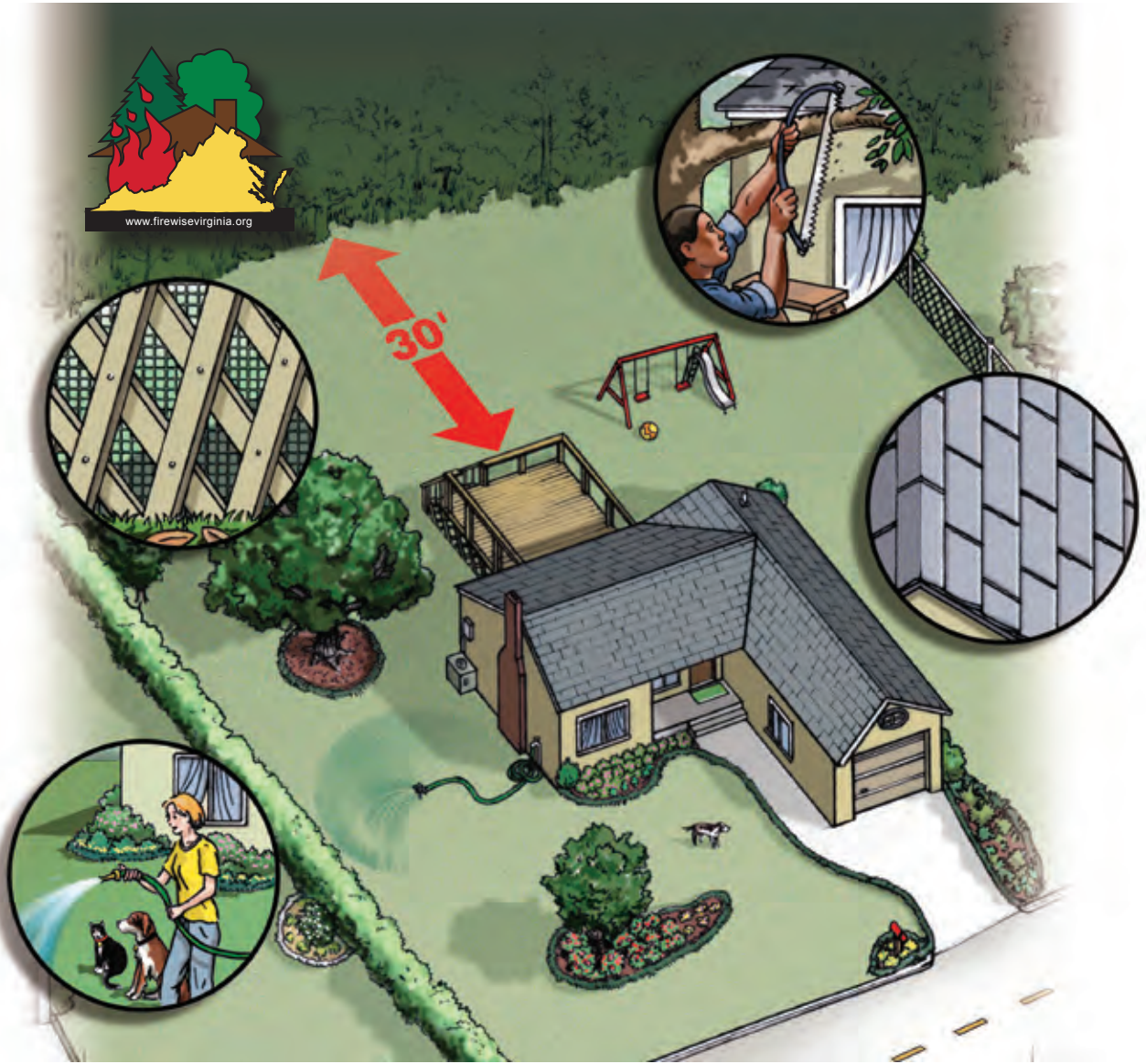


Maintain sufficient clearances around your home.



Firewise practices can save your home.

Figure 6. Make Your Home Firewise



**NOTES**

Lined area for notes.

# CHAPTER 7

## FORESTS AND WILDLIFE



## Forests Benefit Wildlife

Many forest management practices greatly benefit wildlife. The greater the diversity of timber types and age classes that are developed, the wider the range of wildlife habitats produced.

The early stages of a regenerated stand, such as those following a clearcut, provide abundant deer browse. Likewise, grouse prosper in these early stages when fruit, seed and buds of volunteer vegetation are prolific. Quail prefer nesting along the edge of the forest, in forest openings or in grass growing under an open forest. While squirrel, turkey and bear mainly use older timber stands, the creation of small clearings are very attractive to them.

When planning for a timber harvest, some den and perch trees should be left standing along with mast-producing trees. The choice of species includes oaks, hickory, beech and walnut. It is best to leave these in clumps rather than as singles. Dogwood, huckleberry, blackberry, grapevine and other shrubs – wildlife food-producing species – can be encouraged by cutting trees that shade them out. Old home sites usually contain an abundance of plants that benefit wildlife. Often abandoned cemeteries are discovered in forestland and deserve protection for wildlife habitat along with preservation of our ancestral heritage. It is recommended that these areas be left undisturbed in their natural state. Small open areas can also be planted in shrubs for habitat improvement. Bicolor lespedeza and bristly locust are shrubs that provide excellent food and cover for wildlife and are available from the Virginia Department of Forestry at nominal cost. In addition, springs and seeps are inviting to wildlife and should be protected during logging operations.

Planting haul roads and log loading decks with grain, clover or wildlife shrubs will improve the habitat for many game and non-game animals by providing food and nesting cover along with soil stabilization. Leaving undisturbed buffer strips (streamside management zones), also called SMZs, along stream banks helps preserve water quality for



fish, aquatic life and waterfowl. Grazing livestock in woodlands, like wildfire, can be very destructive to wildlife habitat.

## Habitat Management Practices for Forested Areas

### Clearcutting

Clearcutting permits sunlight to reach the ground allowing growth of herbaceous plants, which are important to some wildlife species. Clearcuts should be kept fairly small, 10 to 40 acres, depending on management objectives. If edge is important for the desired wildlife species, then clearcuts should be long, narrow and irregular in shape to take advantage of natural contours.

When harvesting timber from any appreciable acreage, leave some areas with good hard and soft mast-producing trees. This will ensure a varied and dependable food source for many wildlife species while forest regeneration is occurring. Often these uncut areas can be buffer strips along streams or drainage corridors where harvesting should be limited to protect water quality. Retaining 50- to 100-yard-wide buffer areas helps to diversify extensive clearcuts providing both food and travel corridors.

*{See Forest Management: Clearcut Method}*

### Selection Cutting

By allowing more sunlight to reach the forest floor, selection harvests promote growth of understory plants and release overtopped young trees. Trees selected to be removed should be overmature, poor mast-producers or have no value as a cavity/den tree. Good quality, young trees must exist and be protected from damage for this type of harvest to be successful. Individual tree selection must be done carefully, with guidance from an experienced forester, to protect the value of the stand. Harvesting based only on size, referred to as diameter-limit cutting, often removes all commercially valuable timber and leaves the poor-quality trees, resulting in a “high-graded” stand. **High-grading** reduces future timber and wildlife values and should be avoided.

*{See Forest Management: Single-Tree Selection Method}*

*{See Forest Management: Group Selection Method}*

### Thinning/Crop Tree Release

Mast, both hard and soft, is important in helping numerous wildlife species survive the winter. Thinning around mast-producing trees can boost production. This operation is most successful in a young, crowded stand 25 to 40 years of age. Over a two- to three-year period, mark the best mast-producing trees during the fall when acorns, nuts and fruit are present. Non-producing trees can be removed or girdled. Do not remove oak species that are not bearing during the current year but that might bear in succeeding years. Some oak species produce well only on alternate years. Thinning operations should maintain a balance of red and white oak species in the stand to ensure that a failure to produce acorns by one species will not result in a complete failure of mast production during a particular year. You should also favor other species of mast producers including hickory, blackgum, viburnum, dogwood, holly, red cedar and serviceberry.

### Pine Conversion

Forested areas that have poor soil fertility can be planted to white or loblolly pine. South-facing slopes are ideal for creating evergreen stands because these areas receive the most sun and the trees protect wildlife from snow and winter winds. Pine conversions should be developed on sites too poor to grow quality hardwood. Extensive tracts of pines do not produce optimal habitat conditions for wildlife. Habitat diversity develops wildlife diversity.

### Pine Management

[www.dgif.virginia.gov](http://www.dgif.virginia.gov)

When preparing to plant pines, site preparation to remove logging debris and control hardwood sprouting will improve the area for wildlife as well as the pine seedlings. The use of prescribed fire should be selected whenever wildlife habitat enhancement is a goal.

Pine seedlings should be planted at a spacing that has at least 10 feet in one dimension. From a maximum density of 544 trees/acre (10x8) down to a minimum of 396 trees/acre (10x11), you would cover the range of economically viable planting rates, which would still provide some wildlife benefits. The wider the spacing the greater the value to wildlife.

It is important to thin as soon as possible, not only for the benefits to the stand, but also for the significant improvement to the quality of the habitat for wildlife. Residual stands should not exceed 65 sq. ft. of basal area per acre, although 50 sq. ft./acre is a much better goal for wildlife benefits.

Understory burning, if possible, can remove woody undergrowth and promote herbaceous growth, especially legumes. The first burn should come as soon after the first commercial thinning as possible (usually two years) and be repeated every two to three years thereafter. All burning should be done under safe conditions and by experienced contract burners.

## Maintenance of Cavity Trees

Snags and/or “wolf trees” with cavities should be retained during any timber harvest. These trees provide nesting, foraging and winter cover for a variety of wildlife species. Standing snags provide an important habitat component to a young timber stand. If you must remove snags or wolf trees, leave the largest sound trees with existing cavities. When possible, six to eight large well-spaced cavity trees per acre should be left standing in any timber harvest.

## Woody Debris Management

During a timber harvest, hollow logs, tree tops and limbs remain after the removal of the merchantable timber. A patchy distribution of limbs and tree tops in piles or short rows provides habitat for a variety of wildlife species. Logging debris can be “windrowed” and left along the outer edges of the cut. Do not leave debris in or near stream or drainage area. On slopes, orient the logs along the contours and place them near stumps

if possible. This reduces runoff and erosion and provides drumming logs for ruffed grouse.

Smaller piles of brush are beneficial as well. A long-lasting brush pile will have a base that supports the brush while providing tunnels and air spaces underneath. It will have a limby, leafy top that conceals the interior space and is dense enough to block rain and snow. Effective brush piles are at least six to eight feet wide – usually larger – and at least four to six feet tall. Good locations



Rotten logs are home to many species of wildlife.

for brush piles include woodland edges, field borders, fence corners, forest openings and open areas near water. A brush pile can help prevent soil erosion if placed at the top of a forming gully or on a bare slope. Two to four brush piles per acre are optimal, but even a single pile will benefit wildlife. Brush piles may attract animals like groundhogs and snakes that are not wanted near the home or garden, so it is best to build piles some distance from houses.

## Decks/Skid Trails

Decks and skid trails should be seeded with a mixture of legumes or grasses-legumes to provide brood habitat and feeding areas for wildlife. These permanent, grass-legume woodland openings can be maintained by controlled burns, selective herbicide application, bush-hogging or manual removal of woody material once every five years.



## Maintaining Soft Mast

Species like dogwood, wild grape vines, persimmons, black cherry, greenbriers and sassafras should be retained whenever possible. Favor these species when thinning or daylighting along roads, field edges and openings. Soft mast-producing trees, shrubs and vines are very important food sources for many forest wildlife species. Maintaining plenty of good soft mast producers within any timber stand is essential for ruffed grouse and a variety of other wildlife species.

## Stream, Creek and Drainage Management

Riparian zones are lands adjacent to streams, rivers, lakes and wetlands. They are highly productive ecosystems because they receive nutrients, water and energy from the adjacent uplands.

They are important habitats for wildlife because the vegetation is unique and diverse. Riparian zones tend to be linear and provide travel corridors between other habitat types. Riparian zones are vitally important for fish because the overhanging vegetation provides cover and the shade prevents extreme temperature fluctuations harmful to aquatic organisms. The streamside vegetation also provides food when insects fall in the water. Leaf material aids in maintaining aquatic insects. Special riparian areas that contain older trees, wetlands, threatened or endangered species or unique scenic values should be protected and managed as a unique resource.

Buffer zones should be created within 100 feet of a stream. No more than 50 percent of the timber volume should be removed per 10-year period. Trees along seasonal or intermittent drainages should also be maintained. The number of stream crossings for roads should be minimized and kept as narrow as possible. Seeding roadsides and ditches within the buffer zone is recommended.

## Woodland Openings

Openings in extensively forested areas may benefit certain wildlife species. Forest openings should be no smaller than one-quarter acre nor larger than 10 acres. These openings are best designed in irregular shapes to create maximum edge. Long, linear openings should be 50 to 200 feet wide by as long as possible to maximize edge.

These woodland openings can be planted to a grass-legume mixture and maintained as permanent openings or simply allowed to revert to forest. If you wish to maintain them in permanent openings, you may have to disk, mow, hand cut or use herbicides every few years to prevent woody plant invasion.



Woodland openings benefit many species of wildlife.

## Woodland Ponds

Small woodland ponds, approximately 30 to 40 feet across and with varying depths, can be created in log landings or small clearcut areas to provide habitat for numerous frogs, toads and salamanders. They will also be used by deer, turkey and other species of wildlife. Ponds should vary in depth from several inches to four or five feet deep. Brush can be placed in the shallow end to create habitat for amphibians and invertebrates. The perimeter around these ponds, with no steep embankments, should be seeded to a grass-legume

mixture. Contact DGIF for ideas and technical guidance on building ponds and water impoundments.

## Creation of Artificial Nesting Sites

Many species of wildlife depend on hollow trees or trees with cavities for their nesting and wintering habitat. All too often these are the first trees to be cut for firewood by the unknowing landowner or as part of timber stand improvement practices. On many farms, the forests and woodlots have been cut several times, leaving young woods with few den trees. In these areas, nest boxes

can increase the carrying capacity for cavity-nesting wildlife. There is evidence that bird, squirrel, raccoon and wood duck populations can be increased locally by the erection of artificial nest boxes in woodlots where natural cavities are scarce. Cavity trees suitable for wildlife should exist at a rate of no less than six to eight per acre. If you survey your woodlot and find less than this number, you can supplement natural cavities with artificial nest boxes. A squirrel box may have screech owls, kestrels, deer mice, flying squirrels, gray squirrels or fox squirrels using the box within a few years' time. Many predatory animals are attracted to nest boxes, so predator guards are recommended.

**Table 6. Wildlife Benefits of Various Harvest Methods**

Management Method		Forest Benefits
Even-Aged Management	Clearcut	<ul style="list-style-type: none"> <li>◆ Encourages vigorous growth of understory vegetation necessary for food production, brood cover and escape cover.</li> <li>◆ Results in new forest of desirable mast-producing trees (oaks, cherry, ash, walnut and tulip poplar).</li> </ul>
	Seed Tree and Shelterwood	<ul style="list-style-type: none"> <li>◆ Encourages vigorous growth of understory vegetation necessary for wood production, brood cover and escape cover.</li> <li>◆ Results in new forest of desirable fruit and seed mast-producing trees (oaks, cherry, ash, walnut and tulip poplar).</li> </ul>
Uneven-Aged Management	Single-Tree Selection	<ul style="list-style-type: none"> <li>◆ Provides habitat for species desiring continuous forested environment.</li> <li>◆ Provides specific den trees, snags and fruit-producing trees. Tops of harvested trees provide cover.</li> </ul>
	Group Selection	<ul style="list-style-type: none"> <li>◆ Provides needed browse, nesting cover, food and escape cover in heavily forested areas.</li> <li>◆ Provides habitat for a wide range of wildlife species.</li> <li>◆ Tops of harvested trees provide cover.</li> </ul>

## Habitat Management Practices for Agricultural Areas

A major problem facing “small game” is the lack of suitable reproductive and winter cover. The use of heavy, sod-producing grasses, such as KY 31 tall fescue, has almost eliminated this type of cover. Good management for small game makes use of techniques that disturb the soil on a frequent basis (every three to five years). Several methods to create soil disturbances beneficial to small game are described below.

### Fallow Fielding and Crop Rotation

One way to create small game cover is to incorporate a crop-rotation practice that will let recently cropped lands lie idle for a period of time. A crop-rotation pattern, such as corn, winter wheat, soybeans, hairy vetch (two years) and back to corn, will produce good results. Another good crop-rotation pattern might be corn, winter wheat and a legume (two years). You might also consider a rotation of corn or milo followed by three years of fallow field back to the row crop. Whatever crops you plant, including a year or two of fallow fielding or legume cover in the rotation will benefit many wildlife species.

### Strip Disking or Plowing

In less intensive agricultural situations (like an old field pasture or abandoned area), soil disturbance must be created specifically for small game. **Strip disking** or **plowing**, where the ground is simply plowed or disked and left alone, is often done for this purpose. Strip disking/plowing should be done in long linear strips 30 to 50 feet wide by as long as possible next to or paralleling brushy or woody escape cover. The disturbed area should be left fallow for three years following the disking. Usually after three years, the vegetation will become too thick for small game to use. Weedy species, such as foxtail, ragweed, partridge pea, Korean lespedeza and others, will volunteer in these fields. These are heavy seed-producing plants, which provide a high-energy food source for wildlife.

Any of the above soil-disturbance or fallow-fielding techniques can be enhanced further by overseeding a legume, such as Korean lespedeza or ladino clover. This should be done the winter following the creation of the food plot or field. Legumes

attract large numbers of insects, which are essential food items for young birds during their first two or three weeks of life.

### Mowing Hayland

Many game bird nests, young birds and deer fawns are lost each spring because of farmers mowing hay or bush-hogging fields. If possible, avoid mowing or clearing thick, bushy areas from April through early August. Late March and early April or mid-August and September are the best times to mow. Mowing at these times allows for sufficient plant growth to provide nesting or winter cover. If work is planned for a hayfield or weedy area, it is best to clear it before the nesting season (keeps hens from nesting there). If hay must be cut during the nesting season, drive a tractor around the field 40 to 50 yards from the edge to see if any hens flush. If nests or young deer are suspected, leave as much tall vegetation around the area as possible. Turkey hens may abandon a nest if it is disturbed one time. Subsequent disturbances almost guarantee an abandoned nest.

In areas where fields are to be maintained as open areas without grazing or haying, strip mowing or mowing in a mosaic pattern can increase habitat diversity for small game. Strip mowing should be done in long linear strips 30 to 50 feet wide by as long as possible. Using a mosaic technique involves mowing small patches in an irregular pattern. These mowing methods will maintain portions of fields in herbaceous vegetation while allowing clumps of blackberry, buckbrush and tree seedlings to develop. These clumps will need to be mowed to regenerate themselves when it looks as if the saplings and shrubs will soon get too big for your tractor and mower.

### Fire and Controlled Burning

Done correctly, burning on a periodic basis can improve the value of grass and brushland habitats for wildlife. Fire improves the quality of the habitat by removing accumulated dead plant material and litter that impede wildlife movement.

Fire encourages the growth of valuable seed-producing weeds and succulent, broadleaf forbs and stimulates legume germination through scarification (the breakdown of the tough seed coat surface) of the seed.

Fire management also releases nutrients that create lush herbaceous growth necessary for high insect production.

**BE CAREFUL. Not only is fire dangerous, but it does more harm than good if burns are done incorrectly or at the wrong time.**

Small controlled burns are recommended for areas too steep for tillage or mowing. The burns will set back woody vegetation and stimulate herbaceous vegetation. Burns should be kept small and controlled with fire breaks plowed around the perimeters. Slow burns into the wind ignited before February 15th are best. Always have enough people on hand at a burn to guard the fire break perimeters against the fire jumping the break. More information on fire management can be obtained by contacting your local forester or game biologist.

## Fencerow/Hedgerow and Travel Corridors

The easiest way to provide escape cover and travel corridors for small game is the creation of shrubby fencerow/travel lane habitat. This type of habitat can be created through mowing practices or by planting soft mast-producing shrubs. This type of habitat can also be created next to forestlands to increase the amount of edge present. Hedgerow habitat should be 30 to 45 feet wide to provide travel corridors and resting areas for small game. Narrow fencerows (15 feet wide) have little protective value when they divide clean agricultural fields.

Hedgerow habitat can be created by not mowing or tilling the area adjacent to fences on a yearly basis. Briars and tree seedlings will naturally establish themselves along this border. Once these areas have become established, they can be placed in a rotational mowing or burning pattern so they are controlled and do not become too large for the equipment available for the mowing.

Existing hedgerows can be thinned by cutting the large trees for firewood

to encourage dense shrub growth. In any particular field, one-quarter of the fence line might be treated in any one year. This type of habitat can be created without a fence at all or it may be created by moving a mower's width away from an actual fence to allow for easier fence maintenance.

If shrubs and trees are to be planted in a fencerow, clumpy growth species like sumac, wild plum, gray and silky dogwoods, crab apples, hawthorns, chokecherry and sassafras should be used. They should be planted in dense clumps. These shrubby clumps will provide good winter food and escape cover.

## Development of Roadside and Ditch Habitat

Roadsides and ditch banks can become important travel corridors for many wildlife species. Roadsides and ditches should not be mowed every year if possible. Mowing should be done on a three- to five-year rotation. These areas can also be planted to native grasses and wildflowers or shrubs, which increase their value to wildlife.



Wildlife edge planting

## Development of Brushy Areas

On most farms there are unused corners in fields or gullies that can be developed and maintained in brushy or woody cover. Gullies, steep hillsides and rock outcroppings should be allowed to naturally regenerate into brushy areas. These areas may also be allowed

to regenerate into forest. Natural succession can be advanced by planting dogwoods, hawthorns, sumac, crab apples, wild plums or chokecherry shrubs.

## Fall Plowing: Why Not?

A common problem for many farm wildlife species is the lack of adequate later winter food and cover. Fall plowing has become commonplace in Virginia and contributes to the problem of inadequate winter food and cover. By plowing under crop residues in the fall, the landowner creates an essentially barren piece of land. There is a tremendous amount of seed available to wildlife in harvested fields. This seed comes from the harvested grain and native plants. With mechanized harvesting, as much as 5 percent to 10 percent of the crop may be left in the field. Any waste grains that would be available for wildlife are lost as they are incorporated into the soil. The crop residues that may have provided some cover are also lost as they are turned under the soil. The practice is detrimental to wildlife and contributes to soil erosion.

Farmers who fall plow erroneously believe that they are saving time and money by getting the soil worked in the fall for the following spring's planting. Studies have shown this practice costs the farmer in both effort and money. By plowing under the crop residue in the fall, many of the nutrients released by decomposing plant materials are leached from the soils before the next crops are able to use them. This results in increased fertilization needs for the spring crops. Fall-plowed soils are also susceptible to erosion, losing valuable layers of the fertile topsoil.

Finally, over the winter the soils become compacted enough so they must be disturbed before planting, increasing time, labor and fuel costs for the farmer.

Wildlife, the farmer and the environment in general would greatly benefit if fall plowing was discontinued.

## Development of Grassland Borders

Leave a 25- to 50-foot strip of unmowed grassland along a field or forest edge for nesting, particularly near brushy cover. Maintain this cover by mowing every three to five years. If it is not possible to leave the strip unmowed, mowing should be delayed until August when most nesting has been completed.

If grassland habitat is not

present along field borders or adjacent to strip-disked areas or food plots, 25- to 50-foot grassland strips can be planted using a mixture of big bluestem, little bluestem, indiagrass and switchgrass.

## Development of Nesting Cover

Often times, nesting cover is a limiting factor for small game. Nesting cover should be developed next to wood or brushy cover. Nesting cover must be wide enough to be safe from predators.

Thus, nesting cover should be developed in patches, not strips. A 200- by 200-foot square (acre) of nesting cover is more difficult for a fox or skunk to hunt in than is a 20- by 2,000-foot long, narrow strip.

A variety of mixtures can be planted for nesting cover. A mixture of switchgrass, ladino clover and Korean lespedeza will provide adequate nesting and brood-rearing cover. If you plan on grazing or mowing the stand after the birds have raised their brood, a mixture of switchgrass, big bluestem and indiagrass will provide good cover. Another suitable mixture is orchard grass, ladino clover and Korean lespedeza. This mixture provides fair nesting cover but doubles as a deer or turkey food plot.



Nesting cover is essential for small game.

## Bobwhite Quail Habitat Management

Good quail habitat contains distinct components and characteristics that, if lacking, almost always means no birds. The ability to recognize these components is the best approach to evaluating current habitat conditions and for making future improvements.

Quail management is essentially the management of natural plant succession, the series of vegetative stages that occur over time if there is no intervention by man or nature. The greatest abundance of quail has always been found on lands in the early stages of succession, those recently tilled, burned or cut over and allowed to recover naturally.

Typical quail habitat is dominated by a vegetative cover of herbaceous (non-woody) plants, including a mixture of grasses and forbs (broad leaved herbaceous plants). Some woody vegetation is also often favorably interspersed. Old fields, wide, weedy field borders and hedgerows or recently cut over timberland are prime examples of the settings bobwhites seek. These settings often have in common the mixture of individual species and plant communities that bobwhites require to meet the majority of their daily and yearly needs. A diversity of plants and cover types better ensures the availability of shelter and food in close proximity that will be required for each of the bobwhite's activities. Man-made plantings won't accomplish all the vegetative diversity that quail require. However, special plantings for food or cover may help to satisfy specific needs.

The ground beneath the vegetative cover must be open with plant stems widely enough spaced for quail to pass through easily and the ground itself free of matted vegetation or the heavy accumulation of dead plant material. In addition to allowing quail to move easily, bare or nearly bare ground, under overhead cover, makes food items, such as greens, weed seeds and insects, easy to find. Where walking becomes a chore or searching for food becomes difficult, quail will disappear.

Periodic plowing, disking or burning – every three years is a rule of thumb – will set back vegetative succession and will help keep ground

conditions suitable for quail. Subsequent treatment will depend more on vegetative response than any particular time frame. Action is called for whenever most bare ground has disappeared or when emerging woody plants threaten to take over. Only about one acre in every three should be treated with a plow, disk or fire each year. Following any of these treatments, step back and let natural plant succession take its course.

To improve an old field, scattered clumps of blackberry, honeysuckle, shrubs and pioneer species of trees including persimmon, dogwood, sassafras or cherry should be encouraged and protected if the field is burned or disked. Clumps of vines, shrubs or saplings are often sanctuaries for quail using old fields. Many old fields, otherwise too heavily infested with fescue to be attractive to quail, will continue to hold a covey or two because of the natural vegetation control here and there on the ground that a dense, patchy overgrowth can provide. Many of the plants that provide this service to quail are also food producers.

An essential element of bobwhite habitat is the presence of dense, woody cover for escape and protection during severe weather. The most frequently used cover for escape is along a wood's edge, treeline or fence line where tree tops are widely spaced, allowing sunlight to enter, thus encouraging a thicket of shrubs and vines, often honeysuckle or greenbriar. Development of escape cover can be accomplished by shrub and tree plantings but be prepared to wait a while before it will be acceptable to quail for that purpose.



Photo by Va. Dept. of Game and Inland Fisheries

## Eastern Wild Turkey Habitat Management

The wild turkey is an omnivore with its annual diet consisting of 90 percent plant and 10 percent animal matter. Mast, fruits, seeds, greens and agricultural crops are the principal plant foods consumed. Acorns make up about one third of their diet. Soft-mast producing shrubs like wild grape, dogwood, black gum, wild cherry, hackberry and similar species are also important foods, particularly when hard-mast crops fail. Grasses and seeds are important winter and spring foods, while insects comprise the majority of the summer diet for young turkey poults.

A mixture of forested and open land provides the best turkey habitat. Open land should comprise 10 percent to 50 percent of the area and should favor a system of well-dispersed, smaller clearings. Turkeys typically do not use the center of clearings larger than 20 acres. Turkeys prefer mature woodlands comprised of a mixture of tree species with open understories growing with herbaceous (non-woody) plants. Turkeys usually select areas with dense brush, tall grass and fallen treetops, such as recent clearcuts, for nesting. Forested areas with moderate herbaceous understories, forest clearings, powerline rights-of-way, old home sites and spring seeps are important brood habitat. These areas usually have an abundance of insects and open vegetation, which allow the young poults to move freely. Brood range can be created in forested stands by thinning to a basal area of 40 to 60 and control burning the thinned stand.

Timberlands should be managed to optimize hard- and soft-mast production and to provide a dispersed system of permanent forest openings. The even-aged harvest method is recommended to maintain oak regeneration, to create open understory conditions and to provide stand diversity. Long timber rotations are recommended to provide a high percentage of trees of mast-producing age. Because white oaks live longer, longer rotation ages for this group are recommended. At least 60 percent of the trees should be at mast-producing age (50+ years). Rotations from 120 years to 200 years are recommended for wild turkey, depending on the forest type. A forest management plan to balance age classes should create a mix of older and younger stands. Timber operations should be dispersed and not concentrated. One example would be a rotation age of 120 years with eight percent of the timber removed every 10 years.

Clearcutting and modified shelterwood cuts are common silvicultural methods to ensure adequate oak regeneration in Virginia. The size of regeneration cuts should range from five to 20 acres and should be narrow with an undulating perimeter to maximize edge.

Grape arbors should be encouraged and grape vine control should not be practiced. Soft-mast producing trees and shrubs beneficial to wild turkey should be retained, including dogwood, black gum, serviceberry, crabapple and others. Spring seeps should be protected, and timber should not be harvested within a zone of at least 100 feet of a seep.

Pine plantations with short rotations offer poor turkey habitat. Conversion of hardwoods to pine is also considered detrimental to wild turkey populations. However, small pine plantings may increase habitat diversity for turkey because pines provide thermal cover and roost sites. Pine stands that have been control burned are also used by turkeys.

All existing open areas with grass/forb/legume mixtures should be maintained for young turkeys. Mowing and other mechanical means should be used to keep these habitats in a condition featuring moderate herbaceous growth and high insect levels. Fertilizing and liming are generally not necessary as heavy forage production prohibits turkey use. Disking fields encourages native plant diversity and generally improves habitat suitability as brood range. Mowing and disking should not be conducted during the nesting season (May-June). For brood habitat, roads should be daylighted or cut back 50 to 75 feet to increase sunlight and planted with a grass/forb/legume mixture. Prohibit vehicle access to maintain turkey use. The quality of large pastures and clearings can be improved by planting hedgerows of shrubs and trees to provide corridors to the interior of these areas. These hedgerows will provide access to the unused habitats and will also increase mast availability and diversity.

Dogs have been identified as serious predators of wild turkeys in the southeast and should be controlled during critical nesting and brood-rearing seasons.

## White-Tailed Deer Habitat Management

There is considerable interest in the aesthetic, economic and educational values of white-tailed deer, as well as the recreational opportunities they provide. With proper management of both habitat and population, our deer herd will continue to thrive.

While white-tails are adaptable to a wide variety of conditions, good quality food, water and cover are essential. Forested lands usually provide good habitat. Timber harvests can improve habitat quality for deer, if used to create a mixture of brushland, woodland and openings.

Deer have a varied diet and will eat practically anything green when necessary but certainly display preferences that seem to be based on nutritional quality. Forests should be managed to maintain good quantities of grasses, soft-stemmed plants, fruits, mushrooms and acorn-producing oaks. Generally, 50 percent of large forested tracts should be made up of mast-bearing oaks.

Woodlands should be thinned to encourage desirable understory vegetation. Thinnings should open the forest canopy so that sunlight strikes 50 percent of the forest floor at noon. Even if thinning an entire stand is not possible, much can be gained by thinning heavily along field edges, road corridors, and around openings. Openings in a forested area encourage the production of preferred food plants and may compensate for yearly and seasonal fluctuations in food supplies, like acorns. Natural openings in forests should be maintained by annual mowing. Openings of one to three acres in size should be located throughout an area to provide diversity and edge. Plant some openings in

annual crops such as corn, cowpeas, grain sorghums or winter wheat.

Cover is necessary for escape, breeding, rearing of young and rest. Brushy areas, cane thickets, old house sites and small pockets of dense, volunteer pines provide excellent cover and should be protected from damage during forest management operations. Streamside management zones and connecting corridors should be identified, protected and maintained.

Where food is adequate and deer are generally healthy, a regulated harvest will help maintain that condition and prevent over-use of habitat. Keeping deer in balance with available habitat is not difficult, but a specific recommendation, based on accurate records, is essential. The Deer Management Assistant Program (DMAP) is a program designed to use records of sex, date, antler development and productivity to create a harvest scheme that will meet your deer management objectives. For further information and a site-specific recommendation, contact your local DGIF wildlife biologist.



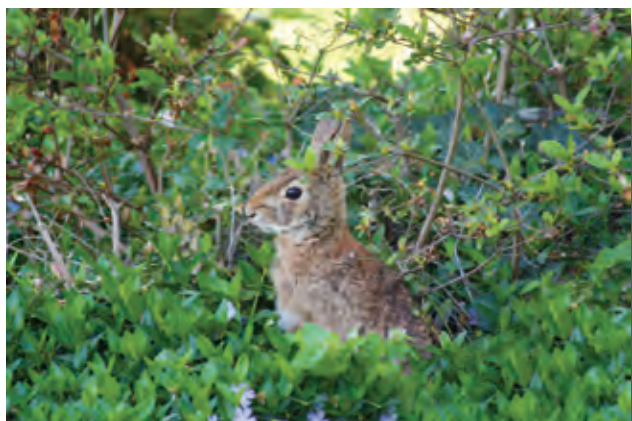
White-tailed deer



## Non-Game Species Habitat Management

The designation “non-game” is for those species that are neither hunted, trapped nor fished. It includes threatened and endangered species, such as the peregrine falcon, northern flying squirrel and many species of birds.

Overall habitat improvement will benefit game and non-game species. Diversity in habitat types and ages will support a variety of species. By providing mixed habitats that support all food types over the course of a year, it is possible to support many species that might occur in that area. Some key improvements include: monitor for and eliminate invasive plants that can take over natural areas; manage for a multi-level forest that includes ground-cover and understory plants; create woody debris piles in forested areas or openings to provide habitat for birds, small mammals, amphibians and reptiles; leave dead trees, limbs and litter on the forest floor to provide cover and food for invertebrates, and leave standing dead trees as foraging sites for woodpeckers and natural cavities for nesting.

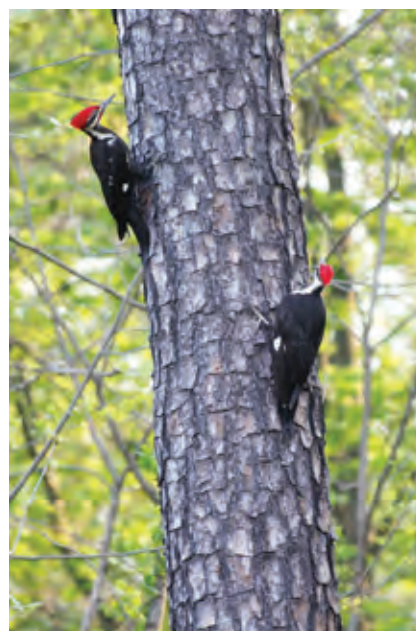


Rabbit

### Non-Game Birds

When managing forestland for non-game birds, one should consider the needs of all the birds that will occupy that land. Following are some general guidelines about different bird groups and what can be done to benefit them in basic forest management. This becomes somewhat difficult however, when we realize that there are at least three different populations of birds over the course of a year. There

are year-round residents, winter visitors and summer visitors. Their needs are perhaps better understood when their foods are considered. Year-round residents are the most versatile and can sustain themselves on a combination of seeds, fruits and insects. However, there are few fruits and insects in winter so most of our winter visitors depend on seed-bearing plants. Likewise, our summer visitors tend to be those species that have evolved to feed primarily on insects, which thrive in a diversity of plant types.



Pileated woodpecker

### Year-round Residents

These are the birds that we are most familiar with: cardinals, bluejays, chickadees, carolina wrens and bluebirds just to name a few. They are the residents of small farm woodlots as well as city parks. Although you can find some of them deep in the forest, they don't require that habitat. As long as there is food and available nesting sites, these birds are at home.

About half of our resident songbirds are cavity nesters, so the single biggest asset to them is a good mixed forest with different sizes of dead or dying trees or trees with natural cavities like beeches and gums. Although some of our residents are at home in pine forests, most prefer at least a mixture of hardwoods and tend to benefit more as the percentage of hardwood increases. This is largely due to the diversity of seeds and fruits generated by hardwoods, as well as the potential for cavities.

Mixed woodlots, a good diversity of tree and shrub species and a regular water source, such as a creek or stream, will greatly benefit resident forest dwellers. These birds also depend heavily on cover from hawks, particularly in the winter, so a sprinkling of holly, mountain laurel, sweetbay or similar plants make for a valuable mid-story component in woodlots or around yards.



Hawk nest

### Winter Visitors

Among those forest-dwelling species that spend their winters in Virginia are kinglets, creepers, juncos and several species of sparrows. Collectively they occupy almost all forest and field habitats. The kinglets and creepers surprisingly still manage to find insects in the winter, utilizing conifer forests, hardwoods and brushy edge habitats. The juncos and sparrows, however, are predominantly seed dependent and benefit from weedy fields, b r u s h y

hedgerows and forest/field edges. A plan of mixed forests and idle fields with hedgerows accommodates the needs of most winter visitors.



Chipping sparrow

### Summer Visitors

Summer brings about a whole host of birds not seen any other time of year. There are at least 65 species of forest-dwelling birds that occur in Virginia just during the warmer months. Most of these species spend their winters in Central and South America and are called neotropical migrants. Fortunately, almost all of them are insect eaters, so they don't destroy crops, and they help keep a lot of insect pests in check. Some of them have rather demanding habitat needs and many of them are suffering significant population declines in Virginia. Looking at the majority of these species and with particular emphasis on the ones in the most trouble, the preferred habitat types are large blocks of mature hardwoods.

Of course, if you don't have large blocks of hardwood forest, they are difficult to create. There are other measures that can be undertaken to improve songbird habitat. When harvesting timber out of any size stand, it is best to try to preserve as much of a core area as possible. In other words, if one is interested in managing for summer songbirds, one would consolidate cuts into one large area of clearcut, rather than cutting a number of smaller blocks out of the middle. You want to minimize edge when managing for interior species. One preferred timber management technique might be a selective cut, where a large

proportion of the overstory is left intact. The landowner should guard against high-grading when a selective cut occurs. Selective harvesting can generate rapid growth of the understory, which is also favorable because it initially produces a number of different types of plants, in regards to height, amount of foliage, etc. As insect eaters, these songbirds depend on a variety of plants that will support a number of different kinds of insects. For each type of forest habitat, there is at least one specialized bird species that can exploit its resources.



Wildlife habitat from understory growth following harvest

There are at least two reasons for promoting the management of large blocks of timber for songbirds. First, some of these species are known to be **area sensitive**. That is, they are dependent on a forest size that is actually much greater than they actually need to find a nest site or to locate food. This is one of the behaviors that makes them so specialized and, consequently, so hard to manage.

There is another problem that relates to small forest size. Birds that are forced to nest close to an edge are subject to greater problems from brown-headed cowbirds. Cowbirds are nest parasites. They lay their eggs in the nest of smaller songbirds. When the cowbird eggs hatch, the young are so big that they get all the food that the host parents bring back. The result is that the smaller songbird young do not survive and the cowbirds increase in number affecting more and more songbirds each year. Since cowbirds are not forest-dwelling species, they tend to look for their victims along forest edges. Therefore, larger blocks of forestland will provide more interior space for songbirds to evade the parasitic habits of the cowbirds.

Many of the migrant songbirds prefer transitional habitats, such as regenerating clearcuts. The only problem with clear-cuts is that they are only useful for about six to eight years until the regenerating pine stand closes in and shuts out the hardwood and herbaceous understory. Once the pines take over, there are very few songbirds that utilize monoculture pine stands as their primary habitat. It's not until the stand reaches maturity and establishes a hardwood mid-story that the forest regains its value to songbirds. Early and regular thinnings will improve pine stands for wildlife and improve your tree growth. Ideal areas for many summer songbirds would be habitats that could be maintained in a shrubby, mixed-vegetation state as in powerline corridors or young clearcuts.



Yellow-bellied sapsucker

Only a few landowners own large tracts of timber that can be managed to the benefit of nesting songbirds. However, there is a great deal the small landowner can do for migrating songbirds. Even with all the birds that nest in Virginia in the summer, there are many more migrating songbirds that just pass through Virginia on their way to nesting areas far to the north of us. We see them only as they travel through in spring and fall. What these birds need is a safe place to refuel during their journey. Waterways, swamps and riparian corridors tend to be vitally important to these migrating birds.

Increasing the width of forested buffers along streams, even to the point of doubling recommended BMPs when harvesting timber, is a highly recommended management practice for birds as well as other wildlife. Tree-lined fencerows and forested roadsides also serve as valuable travel corridors for migrating songbirds, especially if the corridor links two larger tracts of forest. These corridors provide a critical area for safe passage of birds and other wildlife migrating to nesting sites or just moving from one wooded patch to another.

For habitat information on specific non-game species, see publications available on the DGIF website.

[www.dgif.virginia.gov/wildlife](http://www.dgif.virginia.gov/wildlife)

## Threatened and Endangered (T&E) Species

Being “stewards of the forest” many landowners are very concerned about the myriad of threatened and endangered species that reside in Virginia. Like most private forest landowners, you probably purchased your land for a variety of reasons, including objectives such as hunting or watching wildlife, recreation, maintaining the health of the forest, privacy and harvesting timber. While many folks may welcome the presence of T & E species and look at it as an opportunity to conserve biodiversity, other landowners may shudder to think of having such a species on their land and may fear restrictions on their management opportunities, and of course, most of us fall somewhere along that spectrum. Regardless of how you feel though, you are required, by the federal Endangered Species Act (ESA) and Virginia’s endangered species regulations, to minimize negative effects on T & E species. For private landowners, there is one important difference to note between T & E wildlife and insects and T & E plants: you are exempt from T & E plant restrictions for activities on your own property. Note that this exemption does not apply if federal funds are supporting the project (e.g., if the project is being cost-shared by a Natural Resources Conservation Service program).



Pink lady slipper, rare species

In the preparation of the Forest Stewardship Plan, foresters have the ability to determine if there are any rare, threatened or endangered species near your property by using the DGIF’s Virginia Fish and Wildlife Information Service (VaFWIS). This query of the VaFWIS will provide information on any rare, threatened or endangered animal species within a two-mile radius of a given point on the property. Based upon any confirmed sightings of a rare, threatened or endangered species, foresters can provide recommendations in the Forest Stewardship Plan that will ensure the protection of these species and possibly improve the habitat needed for their survival or even the expansion of their population.

The good news is that only a small percentage of all land management activities in Virginia are ever affected. And, federal and state agency personnel are very willing to work with landowners to help you meet your management goals, even if T & E species are present. The key is to assess what, if any, species are present on your property before starting any habitat-altering project, like a timber harvest. If protected species are not present, management activities can proceed as planned, keeping in mind that there may be other requirements that must be met, such as Best Management Practices. If protected species or suitable habitat for protected species are present, what happens next depends upon whether the species is listed only in Virginia or is also listed at the federal level.

Having property that provides a home for T & E species is something of which to be proud. Typically, protecting these species will not prevent you from actively managing your forestland. The key is to determine what T&E species are present before you start a project.

*Some content from Virginia Tech.*

[forestupdate.frec.vt.edu/resources/endangered/index.html](http://forestupdate.frec.vt.edu/resources/endangered/index.html)

[www.dgif.virginia.gov/wildlife/virginiatescspecies.pdf](http://www.dgif.virginia.gov/wildlife/virginiatescspecies.pdf)



# CHAPTER 8

## FOREST RECREATION



## Recreational Benefits of Forests

Owning forestland affords you many uses of the forest, one of them is recreational opportunities. Not all forms of forest recreation are suitable for all forests. The key to successful planning is evaluating the nature of the land and whether it can support the desired type of recreation. Features, such as topography, soils, water, tract size, location and management objectives, should be considered.

Some of the most common forest recreation activities are observing nature, wildlife watching, hiking, camping, picnicking, hunting, fishing, bike riding, horseback riding and cross-country skiing. ATV usage is also a growing recreational activity that is enjoyed on forestland. Lakes, ponds and rivers provide fishing, canoeing and water sport opportunities.

As with all management activities, there are several factors to consider when deciding on what type of recreational activity to have on your forestland. You should consider:

- ◆ Who will use the property for recreation? *family, friends, neighbors, etc.*
- ◆ What are the limitations and possibilities that your tract offers for recreation? *topography, water features, size, etc.*
- ◆ How does the recreational activity interact with your other management goals for the tract? *timber management, wildlife management, etc.*

Whether your idea of recreation is simply enjoying the view, taking a walk through the woods or more active forms of recreation, your forestland can serve many purposes with proper planning.





## Outdoor Fun

Simply being outdoors can be a recreational opportunity in itself. You may be simply observing nature, enjoying the sunshine, playing outdoor games with friends or brushing up on your photography skills.



## Hiking

Hiking through the forest is perhaps the most common forest recreation, valued by people of all ages and abilities, and enjoyed individually or in groups.

Even though you may be hiking your own familiar property, always follow basic guidelines:

- ◆ Wear appropriate clothing for the weather.
  - ✧ Long-sleeve top and pants are recommended even in warm weather, to help protect from bugs, scrapes, thorny plants, poison ivy, sun exposure, etc.
- ◆ Wear good hiking shoes with good traction and ankle support (waterproof shoes are recommended).
- ◆ Wear insect repellent to protect from mosquitoes, ticks and chiggers.
- ◆ Wear sunscreen; you get more sun exposure than you might think when going in and out of the shade of the trees.
- ◆ Stay hydrated by drinking water before your hike and every half hour throughout your hike.
- ◆ Hike during daylight to lower risk of tripping, getting lost or confronting wildlife.
- ◆ Take a hiking companion for company as well as safety in case you need help.
  - ✧ If you do hike alone, be sure someone knows where you will be and when to expect your return. Take a cell phone or noise-maker, such as a whistle, should you have an emergency.
- ◆ Carry navigational tools, such as maps, gps and compass, when hiking unfamiliar ground.

## Bike Riding

Your timberland may offer a good opportunity for bike riding. If there are access roads or trails, they offer a good place for enjoying the forest while getting exercise riding a bike. There are also opportunities for the use of mountain bikes in some areas that are more rugged and are harder to navigate. If you are constructing a bike trail, you should use the guidelines outlined in the trail section. The maximum grade should be 10 to 30 percent for 100 to 500 feet depending on the level of difficulty you want. Clearings should be 36 to 48 inches wide, 8 feet tall, with a turning radius of 4 to 6 feet and the tread width should be 12 to 24 inches wide.



## Horseback Riding

Horseback riding is a popular pastime for many people and there are clubs that are looking for tracts to exercise their horses. Forest roads and trails offer a good place for this activity. If you are constructing a horseback riding trail, you should use the guidelines outlined in the trail section. The maximum grade should be 15 to 30 percent for 200 to 500 feet. Clearings should be six to eight feet wide, eight to 10 feet tall, with the tread width of 24 to 36 inches. Care should be taken with stream crossings on horse trails to ensure that sedimentation will not enter the stream.



## Camping

A forested tract offers a good opportunity for camping, especially primitive campsites. These sites need to accommodate one or more tents but need little additional management. If you want to limit the area that is used for primitive campsites, you may want to construct some fire rings and trails to the sites. The campers should be expected to bring in the supplies and remove all debris from the camp site.

## Picnicking

Many people will use the forest for a picnic site to enjoy the quiet and beauty of the forest. The picnic sites should be located near a road or an access point to allow for easy entrance and exit. This also allows for the maintenance that is required on the picnic site. You can provide picnic tables and trash cans to keep the area clean. If this area is near a sensitive site, signs should be posted to inform the users of any rules pertaining to protecting the resources.

## ATV Use

There is increasing use of all terrain vehicles (ATV) by landowners and the general public who are looking for a place to ride their ATVs. The use of ATVs on your timberland should be treated as if it is a small road. All BMPs for roads should be considered when determining the use of these vehicles.

## Hunting and Trapping

All hunting and trapping laws and regulations should be followed at ALL times. Be sure to obtain the proper permits. Laws and regulations are found at the DGIF website: [www.dgif.virginia.gov](http://www.dgif.virginia.gov) .

When you are determining your management options for your timberland, you will need to determine what wildlife species for which you want to manage (deer, turkey, ducks, etc.). Once that has been determined, you can plan your forest management to meet the needs of that species. Food plots, travel corridors, small openings, field edges are some of the items that can be used to enhance the hunting experience.



## Fishing

All fishing laws and regulations should be followed at ALL times. Be sure to obtain the proper permits. Laws and regulations are found at the DGIF website: [www.dgif.virginia.gov](http://www.dgif.virginia.gov) .

If your tract has a pond or stream, then there is the opportunity for fishing. Prior to allowing any fishing in your pond, it should be tested to make sure that it is safe to eat the fish removed from the pond. Stocking the pond is an option if you want to ensure that you have an opportunity for someone to catch a fish. If you are allowing fishing in a stream on your tract, the stream should not be altered and any access point should be constructed to minimize sedimentation into the stream. If you are harvesting timber near a stream, a buffer should be retained on both sides of the stream to help control the water temperature.

## Canoeing and Kayaking

Ponds or rivers on your property may permit canoeing and kayaking. Prepare well and use safety precautions when engaging in water sports.

- ◆ Be aware of weather and dress appropriately.
- ◆ Learn proper canoeing and kayaking techniques to help prevent accidents.
- ◆ Take a cell phone for emergencies, enclosed in a waterproof bag that can be tethered to you.



## Wildlife Watching

Wildlife watching is something you can do alone or with the whole family. It can be frustrating, however, if you are just getting started and don't know much about what you're doing. Follow these tips from experienced behavior watchers to witness wildlife without startling them or sapping their energy. It's a feeling you'll always remember.

### *Fade Into the Woodwork*

- ◆ Wear natural colors and unscented lotions.
- ◆ Remove glasses that glint.
- ◆ Walk softly so as not to snap twigs or trample wildflowers.
- ◆ Crouch behind boulders or vegetation to blend your figure or break up your outline.

### *How to Use Binoculars*

- ◆ Find the subject with your unaided eyes.
- ◆ Bring the eyepieces just under your eyes.
- ◆ Sight the subject over the tops of the eyepieces.
- ◆ Slowly bring the binoculars to your eyes.



## Camera Tips

- ◆ Use at least a 400 mm lens.
- ◆ Have the sun at your back – afternoon light is best.
- ◆ Aim for featuring wildlife within its natural surroundings, not a full-frame profile.

## *Come to Your Senses*

- ◆ A wildlife encounter is a spectrum of sensations. Deepen awareness by tapping your sense of smell, taste, touch, hearing and sight.
- ◆ Use your peripheral vision rather than turning your head.
- ◆ Look above and below you. Animals occupy niches in all the vertical and horizontal layers of a habitat.
- ◆ Cup your hands around the back of your ears to amplify natural sounds.
- ◆ Silence can speak volumes. Animals may fall silent when a predator is passing through an area.
- ◆ Peer through a hand lens.

## *“Catch” a Fish View*

- ◆ Crouch when you approach a stream or lake bank to avoid being seen by watchful fish.
- ◆ Keep an eye on your shadow so it doesn't cross the water.
- ◆ Wear dull colors that won't contrast with your surroundings.
- ◆ Move like molasses: smooth and steady.
- ◆ Tread lightly to cut down on vibrations that carry into the water.

## *Let Animals Be Themselves*

- ◆ Resist the temptation to “save” baby animals. Mom is usually watching from a safe distance.
- ◆ Give nests a wide berth. Your visit may lead predators to the nest or cause the parents to leave, exposing eggs or young to the elements.

- ◆ Let animals eat their natural foods. Sharing your sandwich may harm wild digestive systems and get animals hooked on handouts.

### ***Think Like an Animal***

- ◆ Imagine how the animal you are seeking spends its days. Check field guides to find out about life history and preferred habitats.
- ◆ As a rule, the border between two habitats is a good place to see residents from both places.
- ◆ Look in high-visitation areas: trail intersections, perches, ledges overlooking open areas and drinking sites. Take note of the season and guess whether the animal will be searching for a mate, feathering its nest, fattening for the winter or preparing to migrate.
- ◆ Dusk and dawn offer best bets for viewing.
- ◆ Consider the weather. After a rain, for instance, many animals emerge to feed.

### ***Wildlife Are Watching***

- ◆ We've all had it happen. You look up from the trail just in time to see an animal dive out of sight - a swoop of wing, a flash of antler, a slap of beaver's tail.
- ◆ The truth is, most animals see, hear and smell us long before we catch their drift. They size us up and decide whether to stay, defend themselves or flee. Fighting and fleeing from us rob them of precious energy.
- ◆ Fortunately, there are simple ways you can help blend into an animal's surroundings. In return, you'll be treated to a wildlife show that makes your heart pound and your senses hum.

### ***Slow Down and Discover...***

- ◆ The ultimate wildlife watching experience is behavior watching – viewing animals without interrupting their normal activities. Instead of just a glimpse, you have an encounter – a chance not only to identify the animal, but to identify with it.

[www.tpwd.state.tx.us/exptexas/view/wildlife\\_watching](http://www.tpwd.state.tx.us/exptexas/view/wildlife_watching)

# Trail Location and Guidelines

Ideally, trails should be located to produce a minimum physical impact on the land, be visually pleasing, require minimum maintenance and functionally provide for the intended use. In addition to a knowledge of the criteria listed, the locator must have a feel for the way the final trail will look as he/she proceeds along the selected corridor. This feel or mental perspective is gained through experience in laying out trails, seeing them built and critiquing the final product against the original location criteria.

The locator must be aware of the adjacent terrain, vegetation, soil types and moisture conditions. All of these factors will directly influence how the trail should be located and subsequently how well the constructed trail will function.

The following steps should be used as a guide:

- 1) Use existing trails or trail-like areas as much as possible.
- 2) Routes should be usable most of the year while maintaining ecological variety.
- 3) Locate trails where suitable for both winter and summer activity to the degree that terrain and climatic patterns will accommodate it.
- 4) Trails should take advantage of scenic panoramas, historical and resource management situations for interpretations.
- 5) Trail grades should follow the contour rather than undulate up and over steep or hilly areas, avoiding sharp turns.
- 6) Avoid trail locations along heavily used roads. However, roads, skid trails, etc., having few travelers may be used



Trail specifications should match intended use.

to avoid the soil disturbance associated with new trail construction.

- 7) Provide vista, observation points or overlooks for observing wildlife in areas where they are likely to be seen.
- 8) Locate trails on stable soils.
- 9) Locate trails to overlook streams and lakes but not follow along the water's edge.
- 10) Avoid areas with hazards, such as rock slide areas, tree falls, etc., unless hazards can be removed.
- 11) Take advantage of natural vegetation and terrain to maintain an outdoor atmosphere where possible.
- 12) The ideal alignment will fit the trail to the ground and afford the user the best views from the trail.
- 13) As a general rule, the trail should have a grade of one percent to seven percent. Do not locate zero grades. Some grade is necessary for drainage.

## Trail Design

Trails should be designed in keeping with their proposed use. In general, the trail should be designed to produce

minimal disturbance to the natural environment and should consider the protection of the adjoining resources, the safety and enjoyment of the user and related economics. The design should incorporate features that reduce adverse impacts upon the environment that result in a trail of high quality and permanence and that provides the least cost to maintain.

Trail dimensions are based on the type of use anticipated for the trail, the stability of native materials and the terrain along the route. The trail should be no less than 18 inches minimum for foot trails and 24 inches minimum for horse trails. Thirty inches should be the

maximum width unless additional width is required for safety or other special purposes.

## Clearing

When constructing a trail, an area of four- to six-feet wide and a height of eight to 10 feet should be cleared around the trail. Horse trails should be cleared to accommodate a horse and rider without any hazards. Horse trails should be cleared eight feet in width and at least 10 feet in height. If a trail is to be used for nature and education, then wide spots should be placed in the trail where groups can gather around interpreters. In addition, cut trees located off the trail flush with the ground and cover the stumps with soil. Avoid unnecessarily cutting trees with a dbh (diameter breast height) greater than four inches. Cut any snags, leaners or hazard trees likely to drop across the trail at a later time. Cut limbs flush with the trunk or back to the next limb outside the clearance limits to encourage healing and promote a more natural-looking appearance. Leave annuals (ferns, grasses, etc.) to present a more attractive trail environment. Spread logs, branches and other debris away from the trail in such a way that will prevent an unnatural appearance to the trail user and a potential fire hazard.

## Drainage

Drainage control on a trail relates to two primary types of water control, **surface water** and **subsurface water**. Any provision for the discharge of surface water must include precautionary measures that will prevent silting, erosion or gullyng of areas off the trail. Rock placement at the discharge point will help dissipate the water and stop erosion.

**Surface water** is the water from rain or snow that, before the trail was built, flowed in a sheet along the natural ground surface but is now cut off and channeled into the trail. This water will flow along the trail and if allowed to accumulate above a certain critical combination for soil type, slope and velocity, will erode the trail surface. The methods of diverting surface water are by outslope,

grade dips, water bars, ditches and by varying the trail grade when it is constructed. Intercepting ditches appropriately located above the trail in wet, swampy areas and leading into the drainage structures located under the trail can also be used to minimize erosion on the trail. Trail-saver troughs are a useful tool in controlling flowing water, which may wash out sections of the trail.

The most troublesome drainage problem in trail construction is **subsurface water**. The best solution to extensive subsurface water on flat ground is to relocate the trail (if possible) and bypass the trouble.

If this is not practical, the next best solution is to lower the water table and permit the ground above to dry out sufficiently. Drainage ditches and methods of raising the trail level can be used to avoid subsurface water problems as well. Another method of diverting water is the use of water bars. Water bars are generally made with an eight-inch to 10-inch diameter log laid at a 20-degree to 25-degree angle with the trail and fastened in place with heavy stakes, posts or steel pins. Light rebars or wire mesh may be used for reinforcing if a soil cement installation is made. Well-embedded rock may be used if logs are not available. The water bar should be flush with the top of the trail.

## Stair Construction

Although difficult and expensive to construct, steps can contribute significantly to trail design by slowing the flow of water and easing hiker strain along very steep grades. Certain factors must be considered when constructing stairs: the slope of the land, the step spacing, width and length of steps and footing.

When constructing trails, layout, drainage, maintenance, the cost of the trail, purpose of the trail, trail specifications and constraints to building the trail must be considered. Following proper trail layout, design and construction specifications can provide the landowners with an enjoyable hiking experience for themselves and others.

Figure 7. Trail Building Guidelines

Trail Usage	Max. Grade	Grade Length	Clearing Width	Clearing Height	Tread Width
Hiking	20 – 30%	100 – 200 ft.	36 – 48 in.	8 ft.	12 – 24 in.
Horseback Riding	15 – 30%	200 – 500 ft.	6 – 8 ft.	8 – 10 ft.	24 – 36 in.
Biking	10 – 30%	100 – 500 ft.	36 – 48 in.	8 ft.	12 – 24 in.





# CHAPTER 9

## FOREST CONSERVATION



## Conservation Benefits

### Why Conserve

Forests cover 15.8 million acres in Virginia, and these forestlands make significant contributions to the natural and economic health of the Commonwealth. Unfortunately, over the past 10 years, the Commonwealth has lost an average of 16,000 acres of forestland annually. Most of these acres are converted to other uses, such as houses, shopping centers or roads. Loss of forested acres and the fragmentation of the remaining acres reduce the potential of the forest to provide the economic, social and ecological benefits on which we depend.

Virginia's working forests:

- ◆ Protect the water supply.
- ◆ Improve air quality.
- ◆ Provide wildlife habitat.
- ◆ Offer recreation opportunities.
- ◆ Provide revenue and jobs.
- ◆ Provide context for historic and cultural resources.
- ◆ Sustain scenic beauty for tourism.

Since 1914, the Virginia Department of Forestry (VDOF) has worked to protect and improve Virginia's working forests; these are forests that are managed for the sustainable production of forest products as well as environmental functions and values. Today, the VDOF is taking the lead in protecting working forests from conversion.

There are many options available to landowners to help them keep their woodlands in forest. Hopefully, landowners who are interested in forest conservation will progress toward stronger protection measures over time. In this way, each landowner can determine what role he or she will play in conserving Virginia's working forests.



## Conserving Your Land

There are many options available to landowners to help them keep their woodlands in forest. Each of the conservation tools and strategies below falls somewhere in the spectrum from strong to weak protection. Ideally, every forest landowner will find some conservation tool that is appropriate for their situation. And, hopefully, landowners who are interested in forest conservation will progress toward stronger protection measures over time.

### Conservation Easements

A conservation easement is a voluntary agreement between a landowner and a qualified conservation organization or public entity to limit the development of a property while allowing continued private ownership and rural use, such as farming or forestry. Conservation easements are typically perpetual.

When a landowner enters his/her property into a conservation easement he/she surrenders some or all of his/her rights to develop his/her property as well as the right to most industrial uses of the property. The landowner retains all the other rights of private ownership, such as the right to sell the property or leave it to his/her heirs. Conservation easements do not allow public access to the property. Easement agreements may allow for limited subdivision of the property and the construction of residences. Conservation easements typically allow for sustainable farming and forestry practices including the construction of roads and buildings.

The greatest strength of conservation easements is that they are different for every property, taking into account the needs of the individual landowner and the conservation values of the specific property.

The monetary value of a conservation easement is equal to the difference between the appraised value of the property before the easement and the appraised value of the property after the development rights are surrendered. Easement value is largely dependent on the development potential of the property and how restrictive the easement agreement is.



### *Donating Land to Virginia Department of Forestry*

Landowners who want to ensure that their land will be managed as forest forever may consider donating all or a portion of their land to the VDOF. VDOF forestlands are dedicated to forest management, education and demonstration, research and recreation and hunting depending on the property. Some larger properties may be designated as State Forests. Of course, the goals and wishes of the landowner are reflected in the management of the property by the VDOF.

Donations of land provide the same benefits described above for easement donations. VDOF ownership also provides the added knowledge that the property will



be managed for forestry forever. While conservation easements restrict the development of the land, VDOF ownership ensures that the land will be dedicated to forestry forever. State ownership can also provide public recreation and hunting opportunities that may not be available under private ownership. State ownership would also guarantee that the family will have access to the property in the future.

To be suitable for VDOF ownership, properties must be large enough and located in an area that would allow for forest management or recreation.



### ***Purchase of Development Rights (PDR)***

In a PDR program, the landowner sells the right to develop his/her property, typically to the locality. The obvious benefit of a PDR program is that the landowner is paid directly for all or a portion of the value of his/her development rights. This is unlike a donated conservation easement where the landowner benefits through tax credits and tax deductions. Another benefit of PDR programs is that they enable the locality to set priorities for conservation and focus funds on those properties.

The biggest limitation of PDR programs is the lack of local funding. Since 2007, the Virginia Department of Agriculture and Consumer Services (VDACS) has distributed \$4.25 million in matching funding for local PDRs. These matching funds are providing an incentive for more localities to initiate PDR programs.

### ***Forest Legacy Program***

This Federal program funds the purchase of land and conservation easements to protect working forest lands that are threatened by development. This is a nationwide competitive program through the USDA Forest Service to fund conservation of properties that have significant conservation values.

[www.fs.fed.us/spf/coop/programs/loa/flp.shtml](http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml)

## Virginia Land Conservation Fund

The Virginia Land Conservation Fund (VLCF) provides funding for the purchase of land and easements for significant properties. This is a statewide competitive program to fund the protection of working farms and forests, natural areas, parks and open space and historic sites. These funds are available to state agencies and private groups. Private organizations or landowners must provide a 50% match to receive funding. The VLCF holds competitive grant rounds when funding is allocated by the General Assembly.

[www.dcr.virginia.gov/virginia\\_land\\_conservation\\_foundation/index.shtml](http://www.dcr.virginia.gov/virginia_land_conservation_foundation/index.shtml)

## Conservation Agencies

**Virginia Department of Forestry (VDOF)** – Conservation of working forests dedicated to forest management, education and demonstration, research, recreation and hunting.

[www.dof.virginia.gov](http://www.dof.virginia.gov)

**Virginia Department of Conservation and Recreation (DCR)** – Conservation of open space for recreation, scenic areas, trails and natural heritage sites. Also provides oversight for state conservation efforts and tracking of conservation goals. Administers the Virginia Land Conservation Fund (VLCF).

[www.dcr.virginia.gov](http://www.dcr.virginia.gov)

**Virginia Department of Agriculture and Consumer Services (VDACS)** – Conservation of working farms, certification and funding for local PDR programs.

[www.vdacs.virginia.gov](http://www.vdacs.virginia.gov)

**Virginia Department of Historic Resources (DHR)** – Conservation of historic buildings and sites; battlefields, and cultural and archeological sites.

[www.dhr.virginia.gov](http://www.dhr.virginia.gov)

**Virginia Department of Game and Inland Fisheries (DGIF)** – Conservation of wetlands and wildlife habitat, as well as wildlife management areas.

[www.dgif.virginia.gov](http://www.dgif.virginia.gov)

**Virginia Outdoors Foundation (VOF)** – State body that is the primary holder of conservation easements in Virginia.

[www.virginiaoutdoorsfoundation.org](http://www.virginiaoutdoorsfoundation.org)

For additional information, contact your local VDOF office.

[www.dof.virginia.gov](http://www.dof.virginia.gov)

*Source: Forest Certification report produced by the Southern Group of State Foresters in 2011.*



# CHAPTER 10

## NATURAL HERITAGE AND HISTORIC RESOURCES



## Preserving Virginia's Natural Heritage

### Virginia's Natural Heritage

Virginia has been called an “ecological crossroads” for its vast range of distinctive natural communities, physiographic regions and natural features. Here, southern and northern ecosystems are found in proximity. From the Cumberland Plateau to the Eastern Shore, the Commonwealth encompasses a tremendous diversity of natural communities supporting an impressive array of plant and animal species, some of which occur nowhere else on earth.

Virginia is blessed with a rich natural heritage, a heritage increasingly endangered by the growing human impacts on our remaining natural lands. Being the proud caretakers of this heritage charges us with a responsibility to protect it for itself, for ourselves and for generations to come. The benefits of preserving our natural diversity lie not only in the scientific, recreational and aesthetic values, but in the present and future practical uses that mankind may find for these species.

Despite the growing impacts on our environment from a burgeoning population, areas of significant natural value still exist in the Old Dominion. Natural areas are living libraries that are essential for the study of natural history. They also represent havens for a multitude of plant and animal species, each occupying a unique place in the natural world. As the trend toward ecological awareness has underscored the interdependence of all living things, there has been a dawning realization that our natural resources must be carefully conserved to ensure people's continued well-being and ultimate survival. How can we balance our need to grow with our responsibility to protect Virginia's remarkable array of environments? The Virginia Department of Conservation and Recreation's Division of Natural Heritage represents a critical first step.



Inside the channels at Channels State Forest.

### *The Virginia Natural Heritage Inventory*

The Division of Natural Heritage represents the first comprehensive attempt to identify the Commonwealth's most significant natural areas through an intensive statewide inventory. Unlike previous natural-area inventories conducted over a set period of time and quickly outdated, the Division of Natural Heritage continually refines its data through biological survey, keeping the information base current and increasingly accurate.

This detailed information serves state, federal and private land and resource managers and minimizes costs to agencies in need of reliable ecological information. The Division of Natural Heritage serves as a centralized repository of data that exposes information gaps, guides future research and identifies



significant natural features for establishing conservation priorities.

### ***Natural Area Protection and Stewardship***

Once priorities for conservation have been set by the Division of Natural Heritage, work begins to protect the most important natural areas using a variety of conservation tools. Often this work involves other governmental agencies, private organizations and concerned citizens. The level of protection extended to an area depends on many factors, including the relative rarity or fragility of its natural features.

To assure the protection of critical environmental areas through acquisition, the Commonwealth of Virginia, in cooperation with The Nature Conservancy, created the Natural Area Preservation Fund. Money from this fund is used to acquire and manage natural habitats. Enabling legislation passed in 1989, entitled the Virginia Natural Area Preserves Act, codified the Natural Area Preservation Fund and charged the Department of Conservation and Recreation to establish a nature preserves system and to manage these natural areas for long-term protection.

A variety of other conservation tools including conservation easements, registry, administrative designation and dedication are utilized by the Division of Natural Heritage to protect public and privately owned natural areas identified through the Natural Heritage Inventory process.

- ◆ Conservation easements allow landowners to protect land in perpetuity while retaining ownership. With a conservation easement, the landowner conveys certain rights for future land-use. Easements are recorded on the deed and often landowners are compensated through tax incentives.
- ◆ The Virginia Registry of Natural Areas encourages voluntary preservation of important natural lands in private and public ownership. This is a non-binding, non-regulatory program designed to recognize property owners who act voluntarily to safeguard natural areas.
- ◆ Legal or administrative designations, such as Research Natural

Areas and Special Management Areas, are important protection on federally owned lands.

- ◆ Dedication as a State Natural Area Preserve affords a natural area formal recognition and stringent legal safeguards for preservation. The Division of Natural Heritage is responsible for dedication on public and private land, developing management plans and conducting stewardship activities on natural areas in the preserve system.

## **Natural Heritage Resources**

The inventory system focuses on identifying natural heritage resources in Virginia: A natural feature of particular interest because it is exemplary, unique, rare or endangered on a global or statewide basis. The Virginia Sneezeweed, the Shenandoah Salamander, freshwater tidal marshes and migratory bird concentration sites are but a few of the many resources that are inventoried.

Natural heritage resources are grouped in five major categories:

- ◆ Rare plants
- ◆ Rare animals
- ◆ Geologic landmarks
- ◆ Natural communities
- ◆ Other natural features

Natural Heritage staff scientists compile data on the location and status of all significant populations or examples of these natural heritage resources. This information is gathered from published data, museum collections, scientists and other knowledgeable individuals. Fieldwork is undertaken to verify known localities and to locate new occurrences.

The Heritage inventory is a cumulative process, becoming an increasingly valuable tool as more information is obtained and entered into the system. Computerized databases, as well as map and manual files, keep the growing knowledge well-organized and accessible for a variety of uses.

Through this natural heritage inventory, vital aspects of the Old Dominion's resources are being identified. Prime sites, rich in ecological diversity and havens for rare species, are being targeted for protection by the Natural Heritage staff.

Stewardship is the long-term management of land to maintain its natural resources and inherent natural beauty. Acquisition, nature preserve dedication and any other protected status does not ensure long-term preservation in the absence of management. The overriding objectives of Stewardship for most natural areas are to maintain the natural values of land to conserve biological diversity and to restore natural conditions to the extent possible. Restoration of natural conditions is important in preserving Virginia's natural diversity and preventing further degradation of these areas. Removal of invading species and reintroduction of natural processes, such as fire, require careful planning and proper implementation by experienced natural area managers. Private landowners can contribute significantly to preserving and protecting natural areas through their assistance with surveillance, education and monitoring and management projects.

## Balancing Our Needs

The protection of Virginia's natural heritage can be accomplished in harmony with other human activities if planning accompanies development. Information gathered by the Natural Heritage biologists can point to fragile areas, the use of which should be strictly limited. This information can also be used in planning the wisest use of our land. Protection of the environment means not only setting aside delicate areas, but planning for minimal environmental damage to other important sites.

The Natural Heritage inventory provides information to private industry and public agencies for making informed decisions and development plans. Each year, we respond to hundreds of environmental impact assessments and requests for information. With unbiased and accurate data for the Natural Heritage databases, planners, developers and other decision-makers can evaluate

the effects of alternative courses of action before large commitments of resources are made.

## What You Can Do

Natural Heritage staff scientists rely upon information from a wide variety of sources to develop and sustain the ongoing inventory. Concerned citizens are encouraged to make suggestions or provide information that could assist the Heritage staff in its mission. The loss of species and natural communities is often inadvertent. The more complete our information is on what exists where, the greater our chances of preventing such losses.

The support of all Virginians is needed to assure that the most significant natural areas are preserved for future generations. If you are interested in learning more about the inventory, protection and management of Virginia's Natural Heritage Resources, contact the Virginia Department of Conservation and Recreation - Division of Natural Heritage.

## Historic Resources

Historic properties provide communities with a sense of identity and stability. Preserving these properties significantly contributes to the vitality of today's communities and ensures that tangible reminders of the past will remain for future generations. The Department of Historic Resources is the state agency responsible for carrying out the state's historic preservation program.

The Department will assist the owners of a site in determining the manner in which a site or resource might best be managed, when other land-use needs or issues are a concern. The Department can also assist a site owner in locating an independent archaeological consultant.

The Department works with museums, libraries and schools throughout the state to develop programs that inform Virginians about the vast extent of the Commonwealth's archaeological resources. In an effort to bring awareness of archaeological preservation to the public, the Department regularly assists in the design of archaeological exhibits and loans artifacts on request.

Virginia's historic landmarks are an unparalleled and irreplaceable resource representing the culture and history of America from prehistoric times to the present. Preservation of these tangible reminders of our cultural heritage is in the best interest of all Virginians. The Commonwealth of Virginia has established policies that encourage the preservation, protection and proper management of Virginia's significant historic, architectural and archaeological landmarks. Virginia's special appeal and much of its income greatly depend upon the appropriate management of this resource, both as a major tool for urban revitalization and as a basis for the state's \$7 billion tourist industry.



The Charles Irving Thornton tombstone on Cumberland State Forest, with an inscription written by Charles Dickens, is on the National Register of Historical Places and the Virginia Landmarks Register.

### The Statewide Survey

A comprehensive, statewide survey of historic buildings and archaeological sites is an ongoing responsibility of the Department. Often working with the local governments and private organizations, the Department assembles historical, architectural and archaeological information, photographs, drawings and maps for each property surveyed and the resulting data are added to the Department's archives. This information is used in determining eligibility for nomination to the Virginia Landmarks Register and the National Register of Historic Places.

### The Archives

The Department maintains an ever-growing collection of data on historic structures and archaeological sites. Organized by county and city, this database, contained in nearly 100,000 files, includes resource evaluations, photographs, maps and drawings. A small working research library complements the files. All records are available to researchers and the general public.

### The Register Program

In Virginia, there are two registers. The Virginia Landmarks Register, containing more than 1,400 entries, is established in state law; entries into this register can be made only by the Board of Historic Resources. The National Register of Historic Places is established in federal law; additions to this register are made by the National Park Service, pursuant to nominations from the various states. Both registers reflect those properties that are most prominently identified with

the history and culture of the Commonwealth, from prehistoric times to the present. All properties listed on the state register are nominated to the National Register. The registers provide formal recognition designed to encourage the preservation of significant resources. Listing on the registers places no restrictions on the property owner using private funds.

## Environmental Review

Pursuant to federal law, the Department reviews all federally funded, licensed or sponsored projects in Virginia to assess the impact of these projects on significant cultural resources. The timely review, discussion and negotiation that are at the heart of this process most often produce a mutually satisfactory solution that minimizes any harmful effects the federal project might have on historic and archaeological resources. The Department also acts under state law to review all proposed alterations, remodeling, repairs and demolition of state-owned landmarks. The Department also issues permits for archaeological excavations of sites on state-owned land and for burial sites anywhere in the Commonwealth; it reviews permit applications for research in caves or on underwater archaeological sites.

## Certified Local Government

The Certified Local Government program provides an opportunity for the involvement of local governments in the national historic preservation program. Local governments, meeting special requirements set by the Department and the National Park Service, assume a formal role in identifying, evaluating and planning for the protection of the community's cultural resources.

Certified Local Governments are eligible for special

federal grants to carry out their local preservation programs.

## Preservation Easement Program

The Department solicits and accepts donations of preservation easements from private owners of registered landmark properties. The easement is a legal agreement between the state and the property owner that grants the state specific rights to the property, including restriction against inappropriate change and development. Because the easement donation is permanent, the perpetual protection and preservation of the property is guaranteed through an ongoing partnership between the Department and the property owner. Easements are an economical method for the state to ensure protection of historic resources. To qualify for easement protection, the property must be listed on the Virginia Landmarks Register or be a contributing building in a registered historic district. The donation of a preservation easement is considered a charitable contribution for tax purposes. The easement program is so far responsible for the permanent protection of more than 120 historic properties.



Old homestead site located on the Cumberland State Forest

## The Virginia Historic Preservation Foundation

The Virginia Historic Preservation Foundation is responsible for the administration of the Virginia Historic Preservation Fund. This revolving fund, made up of state appropriations and private gifts, is used for the purchase of threatened historic properties. After protective covenants have been put in place to ensure the perpetual preservation of the resource, the properties are re-sold to sympathetic buyers. Proceeds of the sale return to the revolving fund. The Director of the Department serves as Executive Secretary to

the Virginia Historic Preservation Foundation, whose members are appointed by the Governor.

## Archaeological Resource Management

In addition to addressing significant archaeological resources through survey, register, easements and all other functional programs, the Department has special responsibilities regarding archaeological resources.

- ◆ **Threatened Sites:** Department archaeologists conduct or sponsor excavations to document sites that are threatened by imminent destruction.
- ◆ **Curation:** As principal repository for scientifically excavated archaeological collections, the Department maintains a curatorial laboratory and a priceless collection of artifacts representing 12,000 years of Virginia's past from sites in virtually every county in the Commonwealth. A professional curatorial staff catalogues, curates and cares for this collection, making it available for use by researchers and educational institutions.

For more information, contact the Department of Historic Resources.



# CHAPTER 11

## TAXES AND FINANCIAL ASSISTANCE



## Financial Concerns

Practicing good forest management is not a passive activity; at times it takes hard work doing or overseeing various activities to ensure that they are being done correctly. Other times, a landowner may be able to stand back and watch his/her trees grow, but being alert to signs of poor tree health and potential wildfire danger. It is important for landowners to find forestry professionals who can assist them in managing their natural resources wisely.

Wise forest management also includes being aware of the financial implications of owning forestland and how it may affect land management. Property taxes as well as other management expenses are all part of owning and managing forestland. However, there are numerous federal and state incentive programs that are available to help landowners manage their forestland, and there are some tax programs to help reduce the cost of owning forestland. Working closely with forestry professionals can help landowners become more aware of the different programs that will fit their management goals and objectives.

### Financial Incentives for Virginia Landowners

There are several federal and state financial incentive programs available to help in meeting costs of conservation and reforestation practices. Each of the programs has different criteria for qualification and different cost-share rates. All programs will reimburse a portion of the expenses after project completion. Due to fund availability, it is important to know what time of year to apply. VDOF foresters serve as technical advisers for many of these programs and must provide technical approval on any proposed forestry practice. Project approval is required before the work can progress.

It is important to involve the VDOF Forester in the planning stages of proposed forestry practices to take full advantage of cost-share assistance opportunities available to landowners. Cost-share programs are subject to change

on an annual basis due to funding availability. The federal and state agencies that have forestry-related incentive programs include the USDA Natural Resources Conservation Service, the USDA Farm Service Agency, the Virginia Department of Forestry and the Virginia Department of Conservation and Recreation. More up-to-date information about the specific programs can be found on the agencies' respective websites.

However, for the most current information regarding cost-share programs, contact your local Virginia Department of Forestry forester.

### Forest Management Practices

The landowner's goals and objectives are essential when a professional forester develops practice recommendations within a Forest Management Plan. The recommended practices should help the landowner reach his/her short-term and long-term goals for his/her property. Once the management direction is set, there may be programs that will help the landowner move forward with his/her practices. However, it is very important that the landowner's management plan directs the activity or practice, not the cost-share incentive program. Some forest management practices that may have cost-share available are:

- ◆ Site preparation of harvested forestland or open lands
- ◆ Planting pine and hardwood trees
- ◆ Controlling unwanted or "weed" vegetation from young tree plantations
- ◆ Improving existing forestland by removing or killing unwanted trees
- ◆ Fencing livestock out and creating new forest buffers along waterways and water bodies
- ◆ Fixing old roads and trails that are eroding by reshaping, seeding and protecting the stabilized areas



### ***Financial Assistance Programs***

Some potential forestry programs and agencies that may have funding to help landowners with these practices are:

#### **USDA Farm Service Agency (FSA)**

- ◆ Conservation Reserve Program (CRP)
- ◆ Conservation Reserve Enhancement Program (CREP)

#### **USDA Natural Resources Conservation Service (NRCS)**

- ◆ Environmental Quality Incentive Program (EQIP)

#### **Virginia Department of Forestry (VDof)**

- ◆ Reforestation of Timberlands Program

#### **Virginia Department of Conservation and Recreation (DCR)**

- ◆ Agricultural Best Management Practices Program (AgBMP)

Contact your local Department of Forestry representative or visit your local USDA Service Center for more information about these or other programs.

## Timber Income Tax

Annual surveys consistently reveal that timber and estate taxation are the leading management concerns among private forest landowners. Careful planning and accounting practices will likely save you thousands of tax dollars and help preserve your estate for future generations. Tax laws pertaining to forest management are subject to interpretation and frequent change. The information provided below should not be considered an official interpretation of the federal and Virginia income tax codes, and you are strongly encouraged to seek the advice of a tax adviser on the applicability of the current tax law to your particular situation. In addition, consult with your forester and accountant to determine the best strategy to protect your assets.

Two excellent references for current tax information are the National Timber Tax website [www.timbertax.org](http://www.timbertax.org) and "Tax Tips for Forest Landowners for the Current Tax Year." This USDA Forest Service publication (Management Bulletin R8-MB 121) is available annually through your VDOF forester or on the Virginia Department of Forestry website [www.dof.virginia.gov/tax/planning/index.htm](http://www.dof.virginia.gov/tax/planning/index.htm).

### Keep Good Records

Recordkeeping is perhaps the easiest but most neglected task of the forest landowner. At a minimum, you should keep a journal of all expenses and income along with evidence of transactions, such as invoices, receipts, canceled checks, contracts, meeting agendas, mileage records, workshops attended and maps, that pertain to your land and forestry practices.

### Determine Your Basis

The basis of your forestland is the original amount you invested to purchase your property. This amount is the cost of land including roads, buildings, timber, fees for surveyors, realtors, foresters, attorneys and other costs associated with the acquisition. As with purchases of land, the value of property acquired by gift or inheritance is allocated proportionally among the categories listed above. Basis is used to determine

gain or loss on sales and exchanges, and for calculating amortization, cost recovery, depletion and casualty loss deductions.

Major tax advantages are available for forest landowners who harvest timber and reforest harvested land or previously non-forested land and include:

- ◆ Treatment of timber sale income as a long-term capital gain.
- ◆ Deduction of forest management expenses. Note that the recovery (deduction) of capital expenditures as depletion depends on how long the investment has been held.

An excellent reference for timber income tax questions is the USDA Forest Services Handbook No. 718, Forest Owner's Guide to the Federal Income Tax, available from the Government Printing Office, phone: 202/512-1800, [www.fs.fed.us/spf/coop/library](http://www.fs.fed.us/spf/coop/library).

### Estate Planning

Estate planning includes both saving for retirement and the transfer of any remaining property to the heirs at death. Good planning avoids unnecessary and unexpected estate taxes and administration costs. Potential estate tax and administration expenses should be recognized. There could be a transition period of two to four years when settling an estate and sometimes longer when there are problems involved.

Publications and professional assistance are available from: IRS offices, Lawyer Referral Service, Certified Life Underwriters (CLUs), bank trust departments or the National Timber Tax web site [www.timbertax.org](http://www.timbertax.org).

### Tax Considerations

Special tax laws apply to timber management. Tax treatment should be considered in reference to: cost-share payments, management expenses, reforestation, passive loss rules, capital gains and casualty losses. Your local VDOF Forester will be able to direct you to the most current tax information.

### ***Land-Use Taxation***

Almost three-fourths of Virginia's localities allow land to be assessed according to its land-use instead of fair market value. Contact your Local VDOF Forester to find out if forestry land-use taxation is available in your county.

Under use-value taxation, properties are taxed based on the productive value of the land rather than at the current fair market value of the land. Use-value taxation speaks to the heart of landbase conservation because, under this program, the landowner is recognized for and taxed based on the current rural use of the land rather than the development potential of the land.

Use-value taxation is a relatively temporary conservation tool because it requires only a one-year commitment from the landowner. However, the reduced taxes paid by the landowner represent an incentive to maintain his or her land in forest.

### ***Agricultural and Forestal Districts***

A minimum of 200 acres (with one or more landowners) is required to form a District, and only landowners can initiate the formation of Agricultural and Forestal Districts. Landowners petition their county administrator or planning commission to establish the district. This process varies slightly from county to county, but usually the planning commission and the Board of Supervisors hold public hearings before deciding to establish a district. Once established, any property within a mile of the district can be added to the district.

Landowners sign voluntary agreements with the locality, and the properties receive use-value taxation and some protection of rural use. In exchange, the landowners agree not to develop the properties for a period ranging from four to 10 years. These agreements can be renewed on an ongoing basis.

This program allows for more focused conservation than the county-wide land-use tax. Ag/Forestal districts place greater restriction on what properties can be enrolled and place a greater burden on the landowners to establish the district and to renew it. Because fewer landowners can take advantage of these districts, they may place less of a burden on the localities.

### ***Riparian Buffer Tax Credit***

The Riparian Buffer Tax Credit is a state tax credit that reimburses landowners for a portion of the value of timber left standing in riparian buffers after timber harvesting. The buffer area must be left in unharvested forest use for a period of 15 years. This tax credit focuses conservation on some of the most sensitive lands and reimburses landowners for practicing sustainable forest management. If you are planning a timber harvest, ask your VDOF Forester if you may be eligible for a Riparian Forest Buffer Tax Credit.



# CHAPTER 12

## FOREST STEWARDSHIP PROGRAM AND CERTIFICATION



# Forest Stewardship Program National Standards and Guidelines

Source: USDA Forest Service, *State & Private Forestry, Cooperative Forestry, Revised, February 2009*



## Program Purpose

The purpose of the Forest Stewardship Program is to encourage the long-term stewardship of nonindustrial private forestlands, by assisting the owners of such lands to more actively manage their forest and related resources.

The Forest Stewardship Program provides assistance to owners of forestland and other lands where good stewardship, including agroforestry applications, will enhance and sustain the long-term productivity of multiple forest resources. Special attention is given to landowners in important forest resource areas and those new to, or in the early stages of, managing their land in a way that embodies multi-resource stewardship principles. The program provides landowners with the professional planning and technical assistance they need to keep their land in a productive and healthy condition. The planning assistance offered through the Forest Stewardship Program may also provide landowners with enhanced access to other USDA conservation programs and/or forest certification programs.

The Forest Stewardship Program is authorized by the Cooperative Forestry Assistance Act of 1978, as amended, 16 U.S.C. 2103A. These standards and guidelines are intended to assist State and Territorial partners with the implementation of this authority and to provide supplemental guidance, as appropriate, to achieve intended program outcomes.

## State Forest Stewardship Coordinating Committees

Each State Forester or equivalent State official establishes a State Forest Stewardship Coordinating Committee, administered by the State Forester. The Committee shall include, to the extent practicable, individuals representing the following:

- ◆ The Forest Service, Natural Resources Conservation Service (NRCS), Farm Service Agency (FSA), and the Cooperative Extension Service
- ◆ NRCS State Technical Committee
- ◆ Local Government
- ◆ Soil and water conservation districts
- ◆ Consulting foresters
- ◆ Environmental organizations
- ◆ Forest products industry
- ◆ Forest landowners
- ◆ Land-trust organizations
- ◆ Conservation organizations
- ◆ State fish and wildlife agency
- ◆ Tribal representatives
- ◆ Other relevant interests as deemed appropriate

Existing State committees may serve as the State Forest Stewardship Coordinating Committee if their membership includes the interests specified above.

The Committee must be ongoing to address stewardship planning and implementation concerns and overall program coordination, and not convened on a temporary basis. The Committee's primary functions are:

- ◆ To provide advice and recommendations to the State Forester concerning implementation of the Forest Stewardship Program, and other associated landowner assistance and cost-share programs.
- ◆ To provide assistance and recommendations concerning the development, implementation and updating of the statewide assessment and resource strategy.

State Foresters are encouraged to actively pursue partnerships with Committee and non-committee agencies, organizations and institutions interested in forest resource management and conservation.

## Landowner Eligibility and Requirements

For purposes of this program, non-industrial private forest (NIPF) acreage includes lands owned by any private individual, group, association, corporation, Indian tribe or other private legal entity. Further, it includes rural lands with existing tree cover or suitable for growing trees.

Private non-industrial forestlands that are managed under existing Federal, State or private sector financial and technical assistance programs are eligible for assistance under the Forest Stewardship Program. Forest resource management activities on such forestlands must meet, or be expanded or enhanced to meet the requirements of the Forest Stewardship Program.

**Participation in the Forest Stewardship Program is voluntary.** To enter the program, landowners agree to manage their property according to an approved Forest Stewardship Management Plan. Landowners also understand that they may be asked to participate in future management outcome monitoring activities.

The Forest Stewardship Program and associated outreach efforts must adhere to the USDA non-discrimination policy: The USDA prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status.

## Forest Stewardship Management Plan Standards

A Forest Stewardship Management Plan is a plan that addresses individual landowner objectives while adhering to National and State Forest Stewardship Management Plan guidelines. State guidelines must consider the National Association of State Foresters (NASF) Principles and Guides for a Well-Managed Forest. A general outline for plans, actions and progress, as relating to these principles, can be found in NASF's *A Stewardship Handbook*.

### Plan Criteria

All Forest Stewardship Management Plans must:

- ◆ Be prepared or verified as meeting the minimum standards of a Forest Stewardship Management Plan by a professional resource manager, and be approved by the State Forester or a representative of the State Forester.
- ◆ Document authorship.
- ◆ Clearly state landowner objectives.
- ◆ Describe current forest condition or condition class.
- ◆ Describe desired forest condition or condition class.
- ◆ Include practices and activities aimed at reaching the desired forest condition or condition class.
- ◆ Document a feasible strategy and timeline for practice and activity implementation.
- ◆ Describe any suggested monitoring activities to be done by the forester or landowner.
- ◆ Be developed for a specified management period that adequately allows for progress with the landowner's long-term stewardship objectives.

- ◆ Be reviewed and renewed, revised or rewritten at the end of the specified management period, or sooner as needed, to be considered current.

Landowners must be involved in plan development by setting clear objectives; timetables and targets, and clearly understanding the plan's details and implications.

## Resource Elements

The plan preparer will consider, describe and evaluate resource elements present and their importance to the ownership. Resource elements to be considered include:

- ◆ Soil and Water
- ◆ Biological diversity
- ◆ Aesthetic quality
- ◆ Recreation
- ◆ Timber
- ◆ Fish and wildlife
- ◆ Threatened and endangered species
- ◆ Forest health
- ◆ Archeological, cultural and historic sites
- ◆ Wetlands
- ◆ Fire
- ◆ Carbon cycle

Management recommendations and alternative strategies, consistent with landowner objectives, will be provided to protect or enhance all resource elements that are present. Prescriptions or treatments must be stand or site specific. An ownership map drawn to scale, or photo, that accurately depicts vegetation cover types, hydrology and other significant forest-related resources with a legend, is required.

The professional resource manager will discuss the Forest Stewardship Management Plan with the landowner, following completion, and periodically, to assure understanding and encourage plan implementation.

## Additional Information

The landowner's understanding may be improved by including additional information appendices. Appendices might include:

- ◆ Descriptions of assistance available and incentive programs
- ◆ Educational materials
- ◆ A glossary of terms
- ◆ An explanation of applicable Federal, state and/or county regulatory programs, especially as they apply to:
  - ✧ Archeological, cultural and historical sites
  - ✧ Wetlands
  - ✧ Threatened and endangered species

## Forest Stewardship Plans and USDA Conservation Programs

The Farm Bill expands eligibility for many USDA conservation programs to include non-industrial private forest landowners. The Farm Bill also recognizes that Forest Stewardship Management Plans (FSMP) and other forest management plans may address conservation program planning requirements for certain programs, where forestland is concerned, thus eliminating the need for a separate conservation plan.

The Forest Service will work with State Foresters and USDA agencies to facilitate participation in USDA conservation programs by providing relevant training and information to foresters and landowners. All who are providing technical and planning assistance should make landowners aware of programs for which they may be eligible. Plan preparers can also help to prepare landowners for participation in these programs during and after the planning process. State Foresters are encouraged to consult with their State Conservationist to mutually agree to any additional information needed by NRCS for landowners to participate in the Environmental Quality Incentives Program (EQIP) and other USDA conservation programs. Through these programs,



eligible landowners may be able to receive assistance to implement their Forest Stewardship Management Plan.

## Continuing Education for Stewardship

The State Forester in consultation with the State Forest Stewardship Coordinating Committee will develop a continuing education program to provide landowners, state service foresters and other natural resource professionals with relevant and timely forest resource management and planning information. The State Forester and the Committee should actively seek partners, including the Forest Service, Cooperative Extension, Conservation Districts, relevant non-governmental organizations and others to achieve continuing education program objectives. The continuing education program could include:

- ◆ Tours and demonstrations
- ◆ Informational brochures and pamphlets
- ◆ Extension bulletins/newsletters
- ◆ Information regarding woodland owner associations and landowner cooperatives
- ◆ Natural resource publications
- ◆ Technical workshops, seminars, etc.
- ◆ Web-based information

## Forest Stewardship Recognition

States are encouraged, but not required, to adopt a program to recognize participating landowners. The nationally established mechanisms for recognition of stewardship participants are a Forest Stewardship sign and a Forest Stewardship certificate. State Foresters in consultation with their State Forest Stewardship Coordinating Committees may choose to develop additional recognition activities for exemplary landowner forest stewards. Recognition activities may also be developed at the regional and national level. These options could include the following approaches:

- ◆ Forest Stewardship award or recognition programs for individual forest landowners, groups, organizations, etc.

- ◆ Selection and recognition of a “Stewardship Forest” of the year, or Forest Stewardship Landowner/Manager of the year.
- ◆ Regional recognition by the Northeastern Area Association of State Foresters, Southern Group of State Foresters, and/or Council of Western State Foresters.
- ◆ Selection and recognition of a national Forest Stewardship Landowner by NASF or other national group or organization.

## Monitoring Forest Stewardship Management Plan Implementation

Successful **implementation** of landowner Forest Stewardship Management Plans, and thus sustainable forestry in practice, provides the best indication that the program is achieving its primary purpose of encouraging the long-term stewardship of non-industrial private forestlands.

The regional forester, area or institute director will develop a program for periodically monitoring the implementation of a representative sample of current Forest Stewardship Management Plans in important forest resource areas and other areas as appropriate. Guidelines for an acceptable random, representative sampling methodology will be developed and maintained by the USDA Forest Service Regional Forester, Area or Institute Director and periodically reviewed by the Washington Office. Acceptable sample size will vary by Region, Area or Institute, State or Territory depending on the number, acreage and distribution of current Forest Stewardship Management Plans.

Selected properties will be visited and assessed by State, Forest Service or other qualified resource management professionals to verify that current forest conditions are consistent with landowner stewardship objectives and the result of sustainable management, as defined in the landowner’s approved Forest Stewardship Management Plan.

A visit to a property will indicate whether or not that property is being managed sustainably as defined by the Forest Stewardship Management Plan. Visits to selected properties will yield a percentage of total acres visited, that are being managed sustainably as defined by approved Forest Stewardship Management Plans. This percentage will be used as an indication of overall accomplishment in terms of acres managed.

Visits to selected properties may be conducted by the plan preparer or another natural resource professional. Management plan implementation monitoring programs may be conducted in partnership with other landowner assistance and/or land management agencies and organizations.

Additional, more-detailed guidance for plan monitoring is provided in other program-related documents.



## Stewardship Certification

Private landowners who are participating in the Forest Stewardship Program and who have made significant progress in implementing the conservation practices recommended in their Forest Stewardship Management Plans, may be recognized as Forest Stewards. This award distinguishes their woodlands as a Certified Stewardship Forest. To be considered for approval for Forest Steward designation, a landowner must have demonstrated sound conservation management of his/her natural resources in accordance with established minimum standards and guidelines. The Forest Steward designation is not a competition, but rather an award honoring landowners for implementing their management plans in the true spirit of stewardship.

To receive Forest Stewards certification, the landowner is first nominated by the forester who is assisting them in carrying out the recommendations in his or her Forest Stewardship Management Plan. A Certification Inspection Record (Form 129) is completed and approved by the Virginia Department of Forestry, deputy regional forester or designee and other resource specialists who have knowledge of the landowner's accomplishments. The deputy regional forester acknowledges that certification criteria have been met and forwards the form to the Department of Forestry State Headquarters for final approval by the State Forester or designee.

In recognition of certification as a Forest Steward, the landowner receives a letter of acknowledgement and congratulations for his/her achievement from the State Forester. The nominating forester schedules an appropriate recognition event for presentation of a special laser-engraved walnut Stewardship plaque, Stewardship lapel pin and a "Stewardship Forest" sign and post for placement on the forest property.

This certification program is ongoing and includes periodic revisits by professional foresters and other natural resource specialists to keep in touch with the landowner's progress and to be available for future stewardship management activities.



The designation as a Forest Steward shows the landowner is dedicated to true conservation of his/her natural resources, including both environmental and economic benefit shared by all Virginians.



### ***Certification Criteria***

Property being considered for Stewardship Forest certification must meet all the following:

- 1) Property contains no less than 10 forested acres.
- 2) A written Stewardship Management Plan addressing multiple-use management based on the landowner's objectives has been developed for all the property owned in the county.
- 3) Salvage damaged timber as soon as possible where not in conflict with the landowner's other management objectives.
- 4) Regeneration, whether by artificial or natural means, planned before final harvest, unless there is a land-use change.
- 5) Primary and secondary resource objectives managed in a way least damaging to other resource values.
- 6) Follow current Best Management Practices (BMPs) when establishing roads and trails for timber management activities, recreational uses or fire protection to protect soil and water quality.
- 7) Unique plant communities, critical wildlife habitat and endangered species habitat protected.
- 8) Scenic areas and unique geological or archaeological features identified, protected and maintained.

### ***Primary Objectives***

Property being considered for Stewardship Forest certification must meet the criteria outlined for their primary objectives and a compatible blend of criteria for the other resources listed.

#### **Forest Products**

- 1) Protect forest from wildfire.
- 2) Maintain a healthy and vigorous forest of best species for each site and protect it from insect and disease.
- 3) Planned regeneration executed within three years of final harvest.
- 4) Carefully-planned, well-supervised and properly-executed timber harvests before trees reach biological maturity. Size and shape of harvested areas compatible with the landowner's other management objectives.
- 5) Thinning of stands as needed to maintain a vigorous forest of proper stocking levels. Suppressed, diseased, crooked or trees of poor form and quality should be removed.
- 6) Stands managed toward achieving full stocking.
- 7) Livestock grazing limited or carefully managed.
- 8) Silvicultural practices and related activities associated with managing, harvesting and regenerating all forested lands to be carried out following the current Best Management Practices (BMPs).

**Wildlife**

- 1) Wildlife species must be identified and written management recommendations implemented over the entire property to enhance the desired species within multiple-use guidelines.
- 2) Enough suitable habitats deliberately created, maintained and improved to support healthy populations of desired species.
- 3) Wildlife populations kept from becoming so dense that they are damaging their own habitat, or the habitats of other species.
- 4) Maintain habitat diversity by maximizing different forest types.
- 5) Protect and maintain all wetlands.
- 6) A primary streamside management zone (SMZ) on each side of streams to be maintained in trees.

**Soil and Water**

- 1) Conduct all land management activities on both forestland and agricultural lands in accordance with Best Management Practices (BMPs) or field office technical guide from NRCS.
- 2) Implement needed forestland management practices to minimize soil erosion and enhance water quality. Examples:
  - a) Completing projects suitable for BMP demonstrations.
  - b) Rehabilitating critical areas and stabilizing old roads.
  - c) Maintaining streamside management zones and filter strips.
  - d) Manage wetlands so as to maintain or improve their function.
- a) Maintaining cover on highly erodible lands.

**Recreation and Environmental**

- 1) Develop management plan to protect, enhance, utilize or restore identified natural heritage and historical resources, such as unique plant communities, critical wildlife habitat, endangered species habitat, archaeological and historical resources.
- 2) Recreational use specified and management plan followed.
- 3) Enhancements made to property to facilitate recreational use (i.e. picnic areas, campsites, riding trails, walking trails, nature study, etc.).
- 4) Litter controlled and trash dumps cleaned up.
- 5) Recreational facilities actively maintained.
- 6) Adverse environmental impact of recreational use minimized.
- 7) Areas with hunting as recreational use must show evidence of developing hunting opportunities.
- 8) Enhance and maintain areas visible to the public in as attractive a manner as possible. Examples include the following:
  - a) Retaining trees with good fall colors;
  - b) Planting or maintaining flowering trees, shrubs and wildflowers;
  - c) Identifying and maintaining scenic overlooks, unique geological features and waterfalls, and
  - d) Improving access to scenic areas.



# CHAPTER 13

## GLOSSARY



## Glossary

### Abbreviations

- BMP** - Best Management Practice
- C/S** - Cost-Share
- DBH** - Diameter Breast High
- DGIF** - Department of Game and Inland Fisheries
- VDOF** - Department of Forestry
- FSA** - Farm Service Agency (formerly ASCS)
- LAT** - Latitude
- LONG** - Longitude
- MBF** - Thousand Board Feet
- NIPF** - Non-industrial Private Forestland
- NRCS** - Natural Resources Conservation Service
- RT** - Reforestation of Timberlands
- SMZ** - Streamside Management Zone
- T&E** - Threatened and Endangered
- TSI** - Timber Stand Improvement
- USDA** - United States Department of Agriculture

### Dictionary

**ABIOTIC.** The non-living components of the environment, such as air, rocks, soil, water coal, peat, plant litter, etc.

**ACID SOIL.** A soil having a preponderance of hydrogen ions over hydroxyl ions in the soil solution; thus a soil giving an acid reaction (precisely below pH 7.0; practically, below pH 6.6).

**ACRE.** An area of land containing 43,560 square feet, roughly the size of a football field, or a square that is 208 feet on a side.

**ADVENTITIOUS BUD.** A bud which develops at the base of a needle cluster, or on woody tissue on a branch or leader, when the end of the branch or leader is injured or cut off.

**AFFORESTATION.** Establishing a forest on an area which has not previously had trees growing on it.

**AGRICULTURAL BEST MANAGEMENT PRACTICES PROGRAM (AgBMP).** A state cost-share program for private landowners, administered by the Virginia Department of Conservation and Recreation, to address environmental resource concerns on their property. Funding comes from Virginia's General Fund and assists landowners in the management of agriculture, livestock and forestry.

**ALGAE.** Simple rootless plants that grow in bodies of water in relative proportion to the amount of nutrients available. Algal blooms, or sudden growth spurts, can affect water quality adversely.

**ALKALINE SOIL.** Any soil that is alkaline in reaction (precisely, above pH 7.0; practically, above pH 7.3).

**ALL-AGE FOREST.** A forest stand in which trees of all ages and usually all sizes are present. This is in contrast to an "even-aged" forest.

**ALTIMETER.** An instrument used to determine the height of a tree.

**ANNUAL RING.** The growth layer of one year, as viewed on the cross section of a stem, branch or root.

**ANNUALS.** Plants that live less than 12 months.

**ANTHRACNOSE.** A disease usually characterized by ulcer-like leaf or fruit spots and caused by fungi that produce asexual spores in the type of fruiting body called an acervulus.

**AQUIFER.** A sand, gravel or rock formation capable of storing or conveying water below the surface of the land.

**ASPECT.** The compass direction towards which a slope faces.



**ASSOCIATION.** An assemblage of plants having ecologically similar requirements and including one or more dominant species from which it derives a definite character.

**AZIMUTH.** Direction from a point, measured in degrees clockwise from true north.

**BACKFILL.** Excavated material used to build up a road higher than the original level.

**BACKFIRE.** 1) Fire set along the inner edge of a fire control line to stop a spreading wildfire by reducing the fuel or changing the direction of force of the fire's convection column. The term applies best where skill techniques are required for successful execution. Using such fire to consume unburned fuel inside the fireline to speed up line holding and mop up is usually distinguished as "burning out" or "clean burning." 2) A prescribed fire set to burn against the wind. Also called back-burn. 3) To set a backfire.

**BARE ROOT-SEEDLING.** Stock shipped without their roots being in soil.

**BASAL AREA.** 1) Of a tree – the cross-sectional area (in square feet) of the trunk at breast height (4½ feet above ground). For example, the basal area of a tree 14 inches DBH is approximately 1 square foot. 2) Of an acre of forest – the sum of basal areas of the individual trees on the acre. For example, a well-stocked northern hardwood stand might contain 80-100 square feet of basal area.

**BEDROCK.** Unbroken solid rock, overlain in most places by soil or rock fragments.

**BERM.** A low earth fill constructed in the path of flowing water to divert its direction, or constructed to act as a counter-weight beside the road fill to reduce the risk of foundation failure.

**BEST MANAGEMENT PRACTICES (BMPs).** Implies a practice or combination of practices, that is determined by a state or designated area-wide planning agency to be the most effective means of preventing or reducing the amount of pollution.

**BIENNIALS.** Plants that live for two growing seasons.

**BILTMORE STICK.** A tool resembling a yardstick, calibrated to measure the diameter of a tree at breast height. Sticks are calibrated with different scales depending upon the reach (arm length) of the person using it.

**BIOLOGICAL CONTROL.** The use of organisms or viruses to control parasites, weeds or other pests.

**BLAZE.** To mark a tree, usually by painting and/or cutting the bark. Boundaries of forest properties frequently are delineated by blazing trees along the boundary line.

**BLOWDOWN.** A tree pushed over by the wind, also called windthrow.

**BOARD FOOT.** A unit measuring wood volumes equaling 144 cubic inches that is commonly used to measure and express the amount of wood in a tree, saw log, veneer log or individual piece of lumber. For example, a piece of wood 1 foot x 1 foot x 1 inch or one measuring 1 foot x 3 inches x 4 inches both contain 1 board foot of wood.

**BOLE.** The main trunk of a tree.

**BOLT.** A short log or a square timber cut from a log, commonly 8 feet long.

**BORROWPIT.** That area from which soil is removed to build up the road bed, sometimes directly adjacent and parallel to a road.

**BREAST HEIGHT.** The standard height, 4½ feet above average ground level, at which the diameter of a standing tree is measured. Abbr. D.B.H.

**BROAD-BASED DIP.** This is a surface drainage structure specifically designed to tip water out of a dirt road while vehicles maintain normal haul speeds.

**BROADCAST BURNING.** Burning over a considerable area and permitting fire to spread freely with or without the use of firebreaks.

**BROOD-REARING HABITAT.** Commonly referred to as "bugging areas," this habitat provides an abundance of insects for young turkeys and quail as well as many non-game species of birds.

**BROWSE.** Portions of woody plants including twigs, shoots and leaves used as food by such animals as deer.

**BROWSELINE.** The uppermost limit on trees and tall shrubs to which livestock and big game animals browse. Syn. Grazing line.

**BUCK.** To cut trees into shorter lengths, such as logs or cordwood.

**BURN.** An area over which fire recently has run.

**BUTT LOG.** This is the first log above the stump and is generally the most valuable log in a tree.

**CACHE, FIRE-TOOL.** A supply of fire tools and equipment assembled in planned quantities or standard units at a strategic point for exclusive use in fire suppression.

**CALIPER (or calipers), TREE.** An instrument to measure diameters of trees or logs.

**CAMBIUM.** The layer of cells between the inner bark and wood of a tree. This is where growth takes place.

**CANDLE.** The new, bright green and tender growth of all conifers that grow in the spring.

**CANOPY.** The upper level of a forest, consisting of branches and leaves of taller trees.

**CARNIVORE.** A flesh-eating animal.

**CARRYING CAPACITY.** The maximum number of animals possible in an area without inducing damage to vegetation or related resources; may vary from year to year because of fluctuating forage production.

**CELL.** The basic structural unit of all living organisms. An organism may be composed of a single cell (e.g. bacteria) or many cells (all “higher” organisms, including human).

**CHAIN.** A distance of 66 feet. Five chains make a tally.

**CHLOROPHYLL.** The green photosynthetic substance in plants which allows them to capture solar energy.

**CHOKER.** A length of wire rope or chain with a loop or noose at one end used to secure trees or sections of trees for skidding.

**CLEARCUT.** A harvesting technique which removes all the trees (regardless of size) on an area in one operation. Clearcutting is most often used with species that require full sunlight to reproduce and grow well. Produces an even-aged forest stand.

**CLINOMETER.** An instrument used to determine the height of a tree.

**CLONE.** A plant group derived from a single individual through vegetative reproduction. Example: A clone of many aspen trees may sprout from the roots of a single aspen tree, after it is cut.

**CO-DOMINANT.** A tree receiving full light from above, but comparatively little from the sides. Such trees usually have medium-sized crowns.

**COMMERCIAL FORESTLAND.** Any forested area capable of producing 20 cubic feet of timber per acre per year which has not been withdrawn from such use by law or statute.

**COMMERCIAL TREATMENTS.** Forestry operations, such as thinning or other TSI work, which generate income from sale of the trees that are removed.

**COMMUNITY.** A collection of living organisms functioning together in an organized system through which energy, nutrients and water cycle.

**CONIFER.** A tree belonging to the order coniferales that is usually evergreen, cone-bearing and with needle, awl or scale-like leaves, such as pine, spruce, fir and cedar; often referred to as a “softwood.”

**CONSERVATION.** The protection, improvement and use of natural resources according to principles that will assure their highest economic and social service.

**CONSERVATION RESERVE ENHANCEMENT PROGRAM (CREP).** A federal cost-share program for private landowners, administered by the USDA Farm Service Agency, to stabilize highly erodible land on the landowner's farm. Funding comes from Farm Bill appropriations and the Virginia Department of Conservation and Recreation to assist landowners with the stabilization of open crop and pasture land.

**CONSERVATION RESERVE PROGRAM (CRP).** A federal cost-share program for private landowners, administered by the USDA Farm Service Agency, to stabilize highly erodible land on the landowner's farm. Funding comes from Farm Bill appropriations and assists landowners with the stabilization of open crop and pasture land.

**CONSULTING FORESTER.** A self-employed professional forester.

**CONSUMER.** The company or individual who purchases rough wood products with the intent of remanufacturing or reprocessing them into a usable form.

**CONSUMER SCALE.** Wood is hauled off the land and is measured at the mill (where the logger sells his/her wood). The logger reports this mill scale to the landowner. Payment to the landowner is based on this scale at the mill.

**CONTACT HERBICIDE.** An herbicide that kills primarily by contact with plant tissue rather than as a result of translocation; only the portions of the plant that actually come in contact with the chemical are affected.

**CONTROLLED BURNING.** The planned application of fire with intent to confine it to a predetermined area.

**COOL-SEASON FORAGE.** Plants that mainly provide a winter or early spring food source for wildlife (examples: clover, winter wheat, rye, ryegrass).

**COOPERAGE.** Containers consisting of two round heads and a body composed of stave held together with hoops.

**COPPICE FOREST.** A forest consisting wholly or mainly of sprouts.

**CORD.** A pile of wood four feet high, four feet wide and 8 feet long, measuring 128 cubic feet. Actual volume of solid wood in a cord will vary from 60 to 100 cubic feet, depending on size of individual pieces and orderliness of stacking. In the Lake States, pulpwood cords are usually 4 ft. x 4 ft. x 100 in. and contain 133 cubic feet.

**CORDWOOD.** Small diameter and/or low-quality wood suitable for firewood, pulp, or chips, but not for saw logs.

**COVER.** Physical habitat structure that allows resting places or protection for wildlife.

**COVER TYPE.** Classification of lands according to predominating vegetative cover.

**CROOK.** A defect of a tree characterized by a sharp bend in the main stem.

**CROP TREE.** A tree identified to be grown to maturity and which is not removed from the forest before the final harvest cut. Usually selected on the basis of its location with respect to other trees and its quality.

**CROWN.** The branches and foliage of a tree; the upper portion of a tree.

**CROWN CLASSIFICATION.** Individual trees in a stand may be classified according to the relative size and height of their crowns compared to other trees in the stand. In descending order of crown height and size, the classes are: dominant, co-dominant, intermediate and suppressed.

**CROWN COVER.** The canopy of green leaves and branches formed by the crowns of all trees in a forest. Syn. Leaf Canopy.

**CROWN FIRE.** A fire which runs through the tops of living trees, brush or chaparral.

**CROWN RATIO or LIVE-CROWN RATIO.** The ratio of the portion of a tree height with leaves to the total tree height.

**CRUISE.** A survey of forestland to locate timber and estimate its quantity by species, products, size, quality or other characteristics. Also refers to an estimate derived from such a survey.

**CRUISER.** One who cruises timber. Syn. Estimator; Land looker; Valuer.

**CUBIC FOOT.** A wood volume measurement containing 1,728 cubic inches, such as a piece of wood measuring 1 foot on a side. A cubic foot of wood contains approximately 6 to 10 usable board feet of wood.

**CULL.** 1) A tree or log of merchantable size rendered unmerchantable because of poor form, limbiness, rot or other defect. 2) The deduction from gross volume made to adjust for defect. 3) To cut a small portion of a stand by selecting one or a few of the best trees. 4) To reject a tree, log or board in scaling or grading. 5) Any item of production that does not meet specifications.

**CULVERT.** A conduit through which surface water can flow under roads.

**CUNIT.** A unit of measure in cube scaling equal to 100 cubic feet of wood.

**CUT-AND-FILL.** Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or fill areas.

**CUTTING CYCLE.** The planned time interval between major harvesting operations in the same stand. The term is usually applied to uneven-aged stands. For example, a cutting cycle of 10 years means that every 10 years a harvest would be carried out in the stand.

**DAMPING-OFF.** The killing of young seedlings by certain fungi that cause decay of the stem or roots.

**DIAMETER, BREAST HIGH (DBH).** The diameter of a tree at 4.5 feet above average ground level, except that in National Forest practice it is measured from the highest ground level.

**DEBARK.** The action of removing bark from trees or sections of trees. Debark generally denotes mechanical means as opposed to manual peeling. Syn. Bark; Barking.

**DECIDUOUS TREE.** A tree which loses all of its leaves during the winter season.

**DEFECT.** Any irregularity or imperfection in a tree, log, piece product or lumber that reduces the volume of sound wood or lowers its durability, strength or utility value. Defects in lumber may result from such factors as insect or fungus attack, growth conditions and abnormalities, manufacturing or seasonal practices, etc.

**DEFOLIATION.** The loss of leaves or foliage on a plant or tree.

**DENDROCHRONOLOGY.** The science dealing with the study of the annual rings of trees in determining the dates and chronological order of past events.

**DENDROLOGY.** The study of the identification, habits and distribution of trees.

**DEN TREE.** A hollow tree used as a home by a mammal.

**DIAMETER.** Tree diameter is usually measured 4½ feet above ground level (see DBH).

**DIAMETER-LIMIT SALE.** A timber sale in which all trees over a specified dbh may be cut. Diameter-limit sales often result in high grading.

**DIAMETER TAPE.** A tape measure, calibrated to determine the diameter of a tree by measuring its circumference.

**DIB (d.i.b.).** Diameter inside bark, usually measured at the small end of a log.

**DIEBACK.** The progressive dying, from the tip downward, of twigs, branches or tops.

**DIMENSION LUMBER.** Hardwood dimension lumber processed so it can be used virtually in the sizes provided, in the manufacture of furniture or other products. Softwood dimension lumber consists of boards more than 2 inches thick but less than 5 inches thick. Such wood is used in construction and is sold by units such as 2x4s, 4x8s, or 2x10s.

**DISKING.** A site preparation system where a heavy harrow with large disks is pulled over a site to eliminate competing vegetation.

**DIURNAL.** Active during the day.

**DIVERSION DITCH.** A channel with a supporting ridge on the lower side constructed across a slope for the purpose of intercepting surface runoff.

**DIVERSITY.** The variety of plants and animals on an area.

**DOMINANT.** The tallest, fastest-growing trees in a plantation or natural stand.

**DOMINANT TREES.** Those trees within a forest stand that extend their crowns above surrounding trees and capture sunlight from above and around the crown.

**DORMANT SEEDLINGS.** Seedlings that have temporarily ceased visible growth (sometimes called a resting stage) because of high or low temperature, moisture or other external causes.

**DOYLE RULE.** One of several log rules designed to estimate the board-foot volume of lumber that can be sawn from logs of a given length and diameter. See log rule.

**DUFF.** Forest litter and other organic debris in various stages of decomposition, on top of the mineral soil, typical of conifer forests in cool climates where rate of decomposition is slow and where litter accumulation exceeds decay.

**ECOLOGICAL NICHE.** The role a particular organism plays in the environment.

**ECOLOGY.** The study of interactions between living organisms and their environment.

**ECOSYSTEM.** An interacting system of living organisms (plants and/or animals), soil and climatic factors. Foresters consider a forest an ecosystem.

**ECOSYSTEM SERVICES.** Ecosystem Services are the environmental benefits and services that forests provide, such as improving our air quality; filtering sediment and runoff from reaching our streams and lakes; insect pollination, and providing outdoor recreation opportunities.

**ECOTONE.** A transition between two distinct communities.

**EDGE.** The boundary between open land and woodland or two other ecological communities. This transition area between environments provides valuable wildlife habitat. Consideration of edge can reduce visual impact of a timber harvest.

**EDGE EFFECT.** The increased richness of plants and animals resulting from the mixing of two communities where they join.

**ENDANGERED SPECIES.** A species designated as being in danger of becoming extinct.

**ENDEMIC.** Native or confined to a certain area.

**ENTOMOLOGY, FOREST.** The science that deal with insects in their relation to forests and forest products.

**ENVIRONMENT.** The prevailing conditions that reflect the combined influence of climate, soil, topography and biology (other plants and animals) factors present in an area.

**ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP).** A federal cost-share program for private landowners, administered by the USDA Natural Resources Conservation Service, to address environmental resource concerns on their property. Funding comes from the Farm Bill appropriations and assists in management of agriculture, livestock and forestry concerns.

**EPICORMIC BRANCHING.** Branches that grow out of the main stem of a tree, arising from buds under the bark. Severe epicormic branching increases knottiness, thereby reducing the quality of lumber sawn.

**EPIDEMIC.** A temporary widespread outbreak of disease.

**EROSION.** The process by which soil particles are detached and transported by water, wind and gravity to some downslope or downstream point.

**EUTROPHICATION.** The natural or artificial process of nutrient enrichment whereby a water body becomes filled with aquatic plants and low in oxygen content.

**EUTROPHIC LAKE.** A lake that has a high level of plant nutrients, a high level of biological productivity and low oxygen content.

**EVEN-AGED FOREST.** A forest in which all of the trees present are essentially the same age (within 10 to 20 years).

**EVERGREEN.** Trees that retain green foliage throughout the year. Not all conifers are evergreens. An example is tamarack.

**EXTINCT.** Being no longer found anywhere in the world—e.g.; passenger pigeon.

**FACE CORD.** Stove length wood with a “face” of 32 square feet (a stack four feet high and eight feet wide). The volume of a face cord depends on its length.

**FAUNA.** Animals.

**FELL.** The process of severing a tree from the stump so that it drops to the ground.

**FINAL CUT.** In even-aged management, the amount or volume of material removed in harvesting the main crop at the end of the rotation.

**FIREBREAK.** A natural or constructed barrier utilized to stop or check fires that may occur or to provide a control line from which to work. Sometimes called a fire lane.

**FIRE PLOW.** A heavy duty, usually specialized machine; either of the share or disk type, designed solely for abusive work in the woods and used with either horses or tractors to construct firebreaks and fire lines.

**FLORA.** Plants.

**FOAMING AGENT.** A material, designed to reduce drift, which causes a pesticide mixture to form a thick foam.

**FOLIAGE.** Growth of leaves on a tree or other plant.

**FOOD CHAIN.** A group of plants, animals and/or microorganisms linked together as sources and consumers of food.

**FOREST.** A plant community in which the dominant vegetation is trees and other woody plants.

**FORESTATION.** The establishment of forest naturally or artificially upon areas where it is at present absent or insufficient. See Afforestation; Reforestation.

**FORESTED WETLAND.** An area characterized by woody vegetation more than 20 feet tall where soil is at least periodically saturated with or covered by water.

**FOREST FIRE.** Any fire on forestland which is not being used as a tool in forest protection or management in accordance with an authorized plan *{See Wildfire}*.

**FOREST FLOOR.** All dead vegetative matter on the mineral soil surface in the forest, including litter and unincorporated humus.

**FOREST MANAGEMENT.** Giving the forest the proper care so that it remains healthy and vigorous and provides the products and amenities the landowner desires. (Technical Definition: The application of technical forestry principles and practices and business techniques, such as accounting, benefit-cost analysis, etc., to the management of a forest.)

**FORESTRY.** The scientific management of forests for the continuous production of goods and services.

**FOREST SANITATION.** The destruction, removal or treatment of infected or infested material for the purpose of reducing disease and insect incidence in the forest. See also Cutting, methods of.

**FOREST SURVEY.** An inventory of forestland to determine area, condition, timber volume and species for specific purposes, such as timber purchase, forest management or as a basis for forest policies and programs.

**FOREST TYPE.** A group of tree species which, because of their environmental requirements and tolerance for shade and moisture, are repeatedly found growing together. Examples are the jack pine type and the aspen-paper birch type.

**FORK.** A defect characterized by division of the main stem or bole of a tree into two or more stems.

**FRILLING.** A method of killing trees by inflicting a series of cuts around the bole (stem) and applying an herbicide to the wounds. Frilling or girdling of trees may be used to reduce the density of a stand or to kill individual undesirable trees.

**FROST CRACK.** A vertical split in the wood of a tree, generally near the base of the bole, from internal stresses and low temperatures.

**FULLY-STOCKED STAND.** A forest stand in which all growing space is effectively occupied but having ample room for development of the crop trees. Syn. Normal stand.

**GALL.** A pronounced swelling or outgrowth on a plant.

**GIRDLE.** To encircle the stem of a living tree with cuts that completely sever bark and cambium and often are carried well into the outer sapwood, for the purpose of killing the tree by preventing passage of nutrients or by introducing toxic materials. Besides girdling proper, or removal of bark and cambium in a band of appreciable width girdling may take several forms, viz: 1) Hacking or frilling--A single line of overlapping downward axe cuts, leaving a frill into which toxic materials may be poured. 2) Double hacking--Girdling by means of a double frill cut around the tree and the removal of the chips between them. 3) Notching--Ringing the tree with notches cut well into the sapwood. 4) Stripping--Peeling off a band of bark completely around the tree.

**GRADE.** (see slope) The slope of a surface such as a roadway. Also, the elevation of a real or planned surface or structure.

**GRADING.** Evaluating and sorting trees or logs according to quality.

**GREENTREE RESERVOIR.** A forested, wetland area inundated during the dormant period of tree growth to temporarily provide aquatic habitat, usually for waterfowl, without damaging tree survival.

**GROUND WATER.** The subsurface water supply in the saturated zone below the level of the water table.

**GROUP SELECTION.** A process of harvesting patches of selected trees to create openings in the forest canopy and to encourage reproduction of uneven-aged stands.

**GROWTH RATE.** With reference to wood, the rate at which the wood substance has been added to the tree at any particular point; usually expressed in terms of number of rings per inch. Growth rate bears an inverse relationship to number of rings per inch. Also applies to volume, value or other types of increase in trees or stands.

**GROWTH RINGS.** The layers of wood laid down each growing season, also called annual rings. These rings frequently are visible when a tree is cut and may be used to estimate the age of the tree, as well as to determine the rate of its growth.

**GULLY.** A channel resulting from erosion and caused by the concentrated flow of water during or immediately following heavy rains. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage. (A rill is of less depth and can be smoothed by ordinary tillage.)

**GUYLINE.** A line used to stay or support spar trees, booms, etc.

**HABITAT.** The local environment in which a plant or animal lives.

**HARD MAST.** Fruits of oaks, hickories, pines and beech trees that are important foods of many species of wildlife in the fall and winter.

**HARDWOOD.** A term used to describe broadleaf, usually deciduous, trees such as oaks, maples, ashes, elms, etc. It does not necessarily refer to the hardness of the wood.

**HARVEST.** A general term for the removal of trees.

**HEARTWOOD.** The inner core of a woody stem, wholly composed of nonliving cells and usually differentiated from the outer enveloping layer (sapwood) by its darker color.

**HEEL-IN.** To store young trees prior to planting by placing them in a trench and covering the roots or rooting portions with soil.

**HEIGHT, MERCHANTABLE.** The height of a tree (or length of its trunk) up to which a particular product may be obtained. For example, if the minimum usable diameter of pulpwood sticks is 4 inches, the merchantable height of a straight pine tree would be its height up to a trunk diameter of 4 inches. Note, one must know the product being cut to estimate merchantable height.

**HEIGHT, TOTAL.** The height of a tree from the ground level to the top of its crown.

**HERBACEOUS VEGETATION.** The low-growing, non-woody plants in a forest understory, including wildflowers and ferns.

**HERBICIDE.** A chemical that kills herbaceous (non-woody) plants. In common usage, however, often used interchangeably with the words phytocide (plant killer) and silvicide (tree killer).

**HERBIVORE.** A plant-eating animal.

**HIBERNATION.** A condition where an animal's metabolism is purposely slowed to endure prolonged periods of adverse environmental conditions, normally several months at a time.

**HIGH CONSERVATION VALUE FORESTS.** Forests of outstanding and critical importance due to their environmental, social, biodiversity or landscape values.

**HIGH GRADING.** Removing the mature, high-quality trees from a stand and leaving inferior species and defective trees. "Take the best and leave the rest." Generally regarded as a poor forestry practice.

**HOME RANGE.** The area that an animal uses during its normal activities, not to be confused with territory.

**HORIZON, SOIL.** A layer of soil approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil building processes. 1) A-horizon--The upper horizon of the mineral soil, from which material has been removed by percolating waters. The horizon of eluviation. Commonly divided into a dark colored A1 horizon containing a relatively high content of organic matter and light-colored A2 horizon of maximum leaching. 2) B-Horizon--The horizon of deposition, to which materials have been added by percolating waters, the horizon of illuviation. 3) C-Horizon--The weathered parent material.

**HUMUS LAYER.** The top portion of the soil which owes its characteristic features to its content of humus. The humus may be incorporated or unincorporated in the mineral soil.

**HYSOMETER.** Any of several tools or instruments designed to measure the height of trees. The altimeter is such a tool.

**IMPRINTING.** A short-term, rapid learning process early in life that is generally irreversible. More prevalent in precocial young.

**IMPROVEMENT CUT.** A cutting made in a stand past the sapling stage for the purpose of improving its composition and character, by removing trees of less desirable species, form and condition in the main crown canopy.

**INCREMENT BORER.** An auger-like instrument with a hollow bit, used to extract cores from trees for growth and age determination.

**INDUSTRY FORESTER.** A professional forester working for a wood-consuming industry.

**INFILTRATION.** The downward entry of water into the soil. This is distinct from percolation, which is movement of water through soil layers or material.

**INSECTICIDE.** Any chemical used to destroy insects and other small invertebrates.

**INSECTIVORE.** An animal that eats insects.



**INSTAR.** A stage in the development of an insect between two successive molts.

**INTEGRATED PEST MANAGEMENT (IPM).** An ecological approach to pest management in which all available necessary techniques are consolidated into a unified program so that pest populations can be managed in such a manner that economic damage is avoided and adverse side effects are minimized.

**INTENSIVE FORESTRY.** The practice of forestry with the objective of obtaining the maximum in volume and quality of products per unit of area through the application of the best techniques of silviculture and management.

**INTERMEDIATE CROWN CLASS.** Trees with crowns extending into the canopy with dominant and co-dominant trees. These trees receive little direct sunlight from above and none from the sides. Crowns generally are small and crowded on all sides.

**INTERMEDIATE CUT.** The removal of immature trees from the forest sometime between establishment and major harvest with the primary objective of improving the quality of the remaining forest stand. Contrast with harvest cut. An intermediate cut may generate income (commercial cutting) or, in some cases, may actually cost the forest landowner (a non-commercial cutting).

**INTERMEDIATE CUTTINGS.** Cuttings made in a stand between the time of its formation and its major harvest. Included are cleaning, liberation, weeding, release, thinning, improvement, salvage and sanitation cuttings.

**INTERNATIONAL RULE.** One of several log rules designed to estimate the volume of lumber that may be sawn from a given log. See log rule.

**INTERPLANT.** To set young trees among existing forest growth of similar age and/or size, planted or natural, to bring the stand to a fully stocked condition.

**INTERSPERSION.** The irregular occurrence or intermixing of plant species, communities and habitat types that provide cover for animals within a limited area.

**INTOLERANCE.** The characteristic of certain tree species that does not permit them to survive in the shade of other trees. Example: Oak and loblolly pine are intolerant; sugar maple and balsam fir are tolerant.

**INVASIVE SPECIES.** Non-native plant or animal species whose introduction does or is likely to cause economic or environmental harm.

**J-ROOT.** Seedling roots planted in a manner that forms a J-shaped configuration in the planting slit. Such seedlings may grow poorly or die.

**KG BLADE.** A sharp blade on a bulldozer blade to shear off brush and trees.

**L-ROOT.** Seedling roots planted with roots forming an L-shaped configuration. Such seedlings may grow poorly or die.

**LANDING.** An area where wood is concentrated in a harvest operation prior to hauling to the mill. Yard is synonymous.

**LAYERING.** Process of regenerating a tree by covering a lower branch with soil after which the branch develops roots and can stand alone as a new tree.

**LEACHING.** Downward movement of a pesticide or other soluble material through the soil as a result of water movement.

**LEADER.** A terminal leader is the uppermost branch or vertical tip of the tree. It eventually becomes the tree stem or trunk.

**LITTER.** The uppermost layer of the organic debris, composed of freshly fallen or slightly decomposed organic materials.

**LODGED TREE.** A tree that has not fallen to the ground after being partly or wholly separated from its slump or otherwise displaced from its natural position.

**LOG.** A piece of the woody stem of a tree. The trunk portion of a tree used for saw logs.

**LOG DECK.** Also called log landing, log yard, brow or bunching area. A place where logs or tree-length material is assembled for loading and transporting.

**LOGGER.** An individual whose profession is cutting timber.

**LOGGING DEBRIS (SLASH).** That unwanted, unutilized and generally unmarketable accumulation of woody material in the forest, such as limbs, tops, cull logs and stumps, that remain as forest residue after timber harvesting.

**LOG RULE.** A device, usually presented in tabular form, which expresses log volume content based on log diameter (inside bark of the small end) and length. A log rule expresses the volume of cut logs. A tree rule expresses the volume of standing trees.

**LOP.** 1) To chop branches, tops, or small trees after felling so that the slash will lie close to the ground. 2) To cut the limbs from a felled tree. Syn. Toplop; Limb.

**LUMP-SUM SALE.** A timber sale in which payment is based on the APPRAISED value of the tract, distinguished from a sale in which payment is based on the volume HARVESTED and SCALED.

**MBF.** Thousand board feet – unit for measuring wood volume. One board foot is 1 foot x 1 foot x 1 inch or .144 cubic inches.

**MACHINE, PLANTING.** Mechanical equipment that opens a hole or furrow and closes it again and firms the soil about a tree seedling that is usually inserted by hand.

**MAIN STEM.** The portion of a tree between ground level and the division into major branches, usually referred to as the bole.

**MANAGEMENT PLAN.** A written plan for the operation of a forest property using forestry principles. It usually records data and prescribes measures designed to provide for optimum use of all forest resources.

**MARKING TIMBER.** The process of indicating what trees are to be cut or otherwise treated. Prior to timber sales, it is advisable to mark with paint each tree to be harvested. One spot of paint at eye level and one on the stump portion will help determine whether unmarked trees have been cut.

**MAST.** Nut-like fruits of trees, such as acorns, beech and chestnuts. Mast is valuable as a source of food for many wildlife species.

**MATTOCK.** A versatile hand tool, used for digging and chopping, similar to the pickaxe. It has a long handle and a stout head, which combines an axe blade and an adze (cutter mattock) or a pick and an adze (pick mattock).

**MATURE TREE.** A tree that has reached the desired size or age for its intended use. Size or age will vary considerably depending on the species and intended use.

**MENSURATION, FOREST.** A science dealing with the measurement of volume, growth and development of individual trees and stands and the determination of various products obtainable from them.

**MERCHANTABLE HEIGHT.** The point on a tree stem at which diameter limit requirements for a certain product are not met. Limits are: the point at which a saw log tree is less than 8 inches in diameter, measured inside the bark (dib); a pulpwood tree less than 4 inches dib, or the point on any tree at which a defect is found that cannot be processed out.

**MERCHANTABLE TIMBER.** A tree or stand of trees that may be disposed of at a profit through conversion to salable products.

**MILACRE.** A sample plot of 1/1000 acre (usually 1/10 chain square) used in reproduction or vegetation surveys.

**MIXED STAND.** A stand in which less than 80 percent of the trees in the main crown canopy are of a single species.

**MOLT.** To shed the hair, outer skin or feathers at certain intervals, to be soon replaced by a new growth.

**MORTALITY.** Death or destruction of forest trees as a result of competition, disease, insect damage, drought, wind, fire and other factors.

**MULCHING.** Providing any loose covering for exposed forest soil using organic residues, such as grass, straw or wood fibers, to protect exposed soil and help control erosion.

**MULTIPLE USE.** Using and managing a forested area to provide more than one benefit simultaneously. Common uses may include, wildlife, timber, recreation and water.

**NATURAL REGENERATION.** Regenerating a stand of trees using seed from trees either on-site or nearby, or sprout growth for some species of hardwoods.

**NON-COMMERCIAL CUTTING.** A cutting that does not yield a net income, usually because the trees cut are too small, poor quality or not marketable.

**NONINDUSTRIAL PRIVATE FORESTLAND (NIPF).** Forestland owned by a private individual, group or corporation not involved in wood processing.

**NONPOINT SOURCE POLLUTION.** Pollution arising from all ill-defined and diffuse source, such as runoff from cultivated fields, grazing land or urban areas.

**NONSELECTIVE HERBICIDE.** An herbicide that will kill or harm all or most plant species.

**NO TILL; ZERO TILL.** Planting a crop without prior seedbed preparation into sod, crop residue or an existing cover crop and eliminating subsequent tillage operations.

**NOXIOUS WEED.** A plant defined by law as being especially undesirable, troublesome and difficult to control.

**OLD-GROWTH FOREST.** A forest dominated by long-lived species that has escaped catastrophic disturbance for at least 120 years. It usually has large, old, dying trees, large snags and down logs.

**OMNIVORE.** An animal that eats both plants and animals.

**ORNITHOLOGY.** The study of birds.

**OVERBROWSING.** Excessive use of browse usually found where there is an over-population of game. Similar to overgrazing, except that overgrazing refers to grasses and forbs, while overbrowsing refers to shrubs and trees.

**OVERMATURE FOREST.** A forest in which, as the result of age, growth has almost entirely ceased and decay and deterioration has accelerated.

**OVERSTOCKED.** The situation in which trees are so closely spaced that they are competing for resources, resulting in less than full-growth potential for individual trees.

**OVERSTORY.** The canopy in a stand of trees. In contrast to the understory, which is low-growing woody or herbaceous vegetation forming a layer beneath the overstory.

**OVERTOPPED CROWN CLASS.** Trees with crowns entirely below the general level of the crown cover receiving no direct light either from above or from the sides. Syn. Suppressed.

**PAIR BOND.** The attachment that either of the mated pair has for the other.

**PARCEL.** A specific area of land that generally has the same site and vegetative characteristics.

**PARTIAL CUT.** A cutting by which only a part of the stand is removed. It usually implies a series of such cuttings.

**PATHOGEN.** A living organism capable of causing disease in a particular species or range of species.

**PATHOLOGY, FOREST.** The science that deals with diseases of forest trees or stands and to the deterioration of forest products by organisms.

**PEELER.** A log from which veneer stock will be cut.

**PERCOLATION.** Movement of water through soil layers of material.

**PERENNIALS.** Plants that form annual, above-ground vegetation, and seed structures from underground roots that persist for many years.

**PERSISTENCE TIME.** The time required for a pesticide to become inert. Arbitrarily assumed to equal four half-lives when measured persistence time is not available.

**PESTICIDES.** Chemical compounds or biological agents used for the control of undesirable plants, animals, insects or diseases.

**PHLOEM.** The tissue in higher plants that transports organic nutrients manufactured in the leaves to other portions of the plant.

**PHYTOTOXICITY.** Injury to plants due to exposure to a chemical.

**PICKAROO.** A device with a head similar to an axe but with a point rather than a blade mounted on the end of a handle, which is used to assist in the lifting and placement of bolts of wood.

**PILING.** Round timbers to be driven into the ground to support other structures.

**PLANTATION.** An artificially reforested area established by planting or direct seeding. Contrast with a natural forest stand that is established naturally.

**PLANTING BAR.** A hand tool used in making a slit-hole in which trees are planted.

**PLANT PATHOLOGY.** The science that deals with the nature and causes of plant disease.

**PLOT.** An area of land usually less than one acre on which trees and sometimes other vegetation are measured during a cruise (or inventory).

**POINT SOURCE POLLUTION.** Pollution arising from a well-defined origin, such as a discharge from an industrial plant.

**POLE.** A young tree four inches or more in diameter breast height. The maximum size of poles is usually, though not invariably, taken to be some diameter breast height between eight and 12 inches.

**POST.** A short timber up to 16 feet in length used in an upright position to support other structures for fencing.

**PRECOCIAL.** Young born with eyes open, down or fur covered and are quite mobile in the first day or two, e.g. ruffed grouse young.

**PRE-COMMERCIAL OPERATIONS.** Cutting conducted in forest stands that removes wood of a size too small to be marketed. Such operations usually are designed to improve species composition and increase quality, growth and vigor of the remaining trees.

**PREDATOR.** Any animal that kills and feeds on other animals.

**PRESCRIBED BURNING.** Skillful application of fire to natural fuels that will allow confinement of the fire to a predetermined area and at the same time will produce certain planned benefits.

**PRESUPPRESSION, FIRE.** Activities in advance of fire occurrence to ensure effective suppression action. Includes recruiting and training, planning the organization, maintaining fire equipment and fire control improvements and procuring equipment and supplies.

**PREVENTION, FIRE.** Activities directed at reducing the number of fires that start, including public education, law enforcement, personal contact and reduction of fuel hazards.

**PRUNING.** The removal of live or dead branches from standing trees. With forest trees, pruning is generally done along the trunk to remove the side branches (which cause knots in the wood) to produce a higher quality wood (knot-free).

**PULPWOOD.** Wood cut or prepared primarily for manufacture into wood pulp, for subsequent manufacture into paper, fiber board or other products, depending largely on the species cut and the pulping process. Generally trees 5" to 9" DBH.

**RANGE.** The geographic area in which a tree species grows. Natural range is the entire geographic area where a species is known to occur under natural conditions; commercial range is the geographic area in which a species is harvested for commercial purposes.

**RAPTOR.** The birds of prey--including falcons, hawks, owls, eagles and ospreys.

**RARE SPECIES.** A plant, animal or community that is vulnerable to extinction or elimination.

**REFORESTATION.** The natural or artificial restocking of an area with forest trees; most commonly used in reference to the latter.

**REFORESTATION OF TIMBERLANDS PROGRAM (RT).** A state cost-share program for private landowners, administered by the Virginia Department of Forestry, to reforest harvested timberlands to pine trees. Funding for the program comes from a forest products tax collected for every tree harvested in Virginia and matched by funding from Virginia's General Fund.

**REGENERATION.** The act of replacing a forest stand that has been harvested, either naturally or artificially.

**REGENERATION CUT.** A timber harvest designed to promote and enhance natural establishment of trees. Even-aged stands are perpetuated by seed tree, shelterwood and clearcuts. Uneven-aged stands are perpetuated by selection of individual or small groups of trees.

**RELEASE.** To free trees from competition by cutting or otherwise removing or killing nearby vegetation and branches. Usually applied to young stands.

**REPRODUCTION.** The process by which the forest is replaced or renewed. This may be: Artificial Reproduction, by means of seeding or planting. Natural Reproduction, from natural seeding or sprouting.

**RESIDUAL STAND.** Trees remaining uncut following any cutting operation.

**RESTRICTED-USE PESTICIDE.** A pesticide that is designated as such by the Environmental Protection Agency because it is felt that it may generally cause, without additional regulatory restrictions, unreasonable adverse effects on the environment, including injury to the applicator. A "restricted-use" pesticide may be used only by, or under the direct supervision of, a certified applicator.

**RICK.** One-third of a standard cord. 37 cubic feet unsplit, 40 cubic feet split.

**RIPRAP.** A layer of boulders or shot rock fragments placed over a soil to protect it from the erosive forces of flowing water.

**RIPARIAN FOREST.** Wooded buffer zones along streams, rivers and the Bay that support a greater diversity of wildlife than nearly all non-aquatic areas or upland forests.

**ROLLING DRUM CHOPPER.** A large cylinder with blades around it, pulled by a large bulldozer, used to chop and press down brush and slash.

**ROOT COLLAR.** The stem of a seedling at the ground line at the time of removal from the nursery.

**ROOTS.** The portion of the tree that is generally underground and which functions in nutrient absorption, anchorage and storage of food and waste products.

**ROT.** A defect characterized by decay of wood in a standing tree or log.

**ROTATION.** The planned time interval between regeneration cuts in a forest stand.

**ROTATION AGE.** The age at which the stand is considered ready for harvesting under the adopted plan of management.

**RUNOFF.** That portion of precipitation or irrigation water that flows off a field and enters surface stream or water bodies. The water that flows off the surface of the land without sinking into the soil is called surface runoff.

**SALVAGE CUT.** A harvest made to remove trees killed or damaged by fire, insects, fungi or other harmful agents, to utilize available wood fiber before further deterioration occurs.

**SANITATION CUT.** A cutting made to remove trees killed or injured by fire, insects, fungi or other harmful agents (and sometimes trees susceptible to such injuries), for the purpose of preventing the spread of insects or disease.

**SAP.** The moisture in unseasoned wood and all that it holds in solution.

**SAPLING.** A tree at least 4.5 feet tall and up to 4 inches diameter.

**SAWLOG.** A log large enough to produce lumber or other products that can be sawed. Its size and quality vary with the utilization practices of the region.

**SAWMILL.** A plant at which logs are sawed into salable products. It includes all the machinery and buildings necessary for the operation of the plant.

**SAWTIMBER.** Trees that yield logs suitable in size and quality for the production of lumber.

**SCALING.** Process of measuring wood products, usually pulpwood and saw logs, after the trees are felled.

**SCALE STICK.** A flat stick, similar to a yardstick, which is calibrated so log volumes can be read directly when the stick is placed on the small end of the log of known length.

**SCALPING.** Removing a patch or strip of sod in preparation for planting trees.

**SCARIFY.** 1) To break up the forest floor and top soil in preparation for natural regeneration or direct seeding. 2) As applied to seed, to wear down by abrasion or by acid treatment an outer, more-or-less impervious seed coat to facilitate or hasten germination.

**SEALED BID SALE.** Sale of timber where several timber buyers are invited to submit a secret bid stating what each would pay for the timber offered.

**SECOND GROWTH.** Forests that originate naturally after removal of a previous stand as by cutting, fire or other cause. A loosely used term for young stands.

**SEDIMENT.** Solid material that is in suspension, is being transported, or has been moved from its original location by air, water, gravity or ice.

**SEEDBED.** 1) In natural regeneration, the soil or forest floor on which seed falls. 2) In nursery practice, a prepared area in which seed is sown.

**SEEDING.** A method of establishing a forest artificially by sowing seed. In broadcast seeding, seed is sown over the entire area. Partial seeding may be done in strips, furrows or trenches, plots or spots.

**SEED TREE.** Any tree which bears seed; specifically, a tree left to provide the seed for natural reproduction. Syn. Mother tree.

**SEEPAGE.** Percolation of water through the soil from unlined canals, ditches, laterals, watercourses or water storage facilities.

**SELECTION CUT.** A regeneration cut designed to create and perpetuate an uneven-aged stand. Trees may be removed singly or in small groups. A well-designed selection cut removes trees of lesser quality and trees in all diameter classes along with merchantable and mature, high-quality saw log trees.

**SELECTIVE HERBICIDE.** An herbicide that is effective against only certain species and is able to control unwanted plants without serious injury to desirable species.

**SHADE TOLERANCE.** Relative ability of a tree species to reproduce and grow under shade. Tree species are usually classified in descending order of shade tolerance as: very tolerant, tolerant, intermediate, intolerant and very intolerant.

**SHEARING.** The operation of cutting off trees and brush at ground level by pushing a bulldozer blade along the surface. The stems and trunks are sheared off at ground level.

**SHEET EROSION.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**SHELTERBELT.** A wind barrier of living trees and shrubs maintained for the purpose of protecting farm fields. As applied to individual farmsteads, termed "Windbreak." Syn. Belt.

**SHELTERWOOD HARVEST CUTTING.** A harvest cutting in which trees on the harvest area are removed in a series of two or more cuttings to allow the establishment and early growth of new seedlings under partial shade and protection of older trees. Produces an even-aged forest.

**SHRUB.** A low-growing perennial plant with a persistent woody stem and low branching habit.

**SILVICULTURE.** The art of producing and tending a forest; the application of the knowledge of silvics in the treatment of a forest; the theory and practice of controlling forest establishment, composition and growth.

**SINKHOLE.** A depression in the landscape where limestone has been dissolved.

**SITE.** An area evaluated as to its capacity to produce a particular forest or other vegetation based on the combination of biological, climatic and soil factors present.

**SITE INDEX.** An expression of forest site quality based on the expected height of dominant trees at a specified age (usually 50 years in the eastern United States).

**SITE PREPARATION.** Treatment of a site with mechanical clearing, burning or herbicides to prepare a site for planting.

**SKIDDING.** The act of moving trees from the site of felling to a loading area or landing. Skidding may be accomplished by tractors, horses or specialized logging equipment. The method of skidding can greatly affect the impact of logging on soil and the residual stand.

**SKID ROAD.** A road or trail leading from the stump to the skidway or landing.

**SLAB.** The exterior portion of a log removed during the sawing process.

**SLASH.** Debris left after logging, pruning, thinning or brush cutting; also, large accumulation of debris after wind or fire. It includes logs, chunks, bark, branches, stumps and broken understory trees or brush.

**SLASH DISPOSAL.** Treatment of slash to reduce the fire hazard or for other purposes.

**SLOPE.** (See grade). A term of measurement in percent and means the increase in height over the distance measure. An increase of one foot over a distance of five feet is expressed as a 20 percent slope.

**SNAG.** A standing dead tree used by many species of birds and mammals for feeding and nesting.

**SOFT MAST.** Soft fleshy fruits eaten by wildlife (examples: persimmon, wild grapes, blackberries, blueberries, huckleberries, mulberries, plums and crabapples).

**SOFTWOOD.** Generally, one of the botanical groups of trees that in most cases have needle or scale-like leaves; the conifers; also, the wood produced by such trees.

**SOIL.** The top layer of the earth's surface, composed of finely divided disintegrated rock containing more or less organic material, which is penetrated by the roots of plants. It includes the surface soil (horizon A), the subsoil (horizon B) and the upper portion of the substratum (horizon C) to the extent that it is penetrated by plant and tree roots. The average soil is composed of 45 percent mineral, 25 percent air, 25 percent water and 5 percent vegetation.

**SOIL REACTION.** The degree of acidity or alkalinity of the soil mass expressed in pH values or in words as follows: extremely acid, below 4.5; very strongly acid, 4.5-5.0; strongly acid, 5.1-5.5; medium acid, 5.6-6.0; slightly acid, 6.1-6.5; neutral, 6.6-7.3 (strictly 7.0); mildly alkaline, 7.4-8.0; strongly alkaline, 8.1-9.0; very strongly alkaline, more than 9.1.

**SOIL TEXTURE.** The feel or composition of a soil based on the proportion of sand, silt and clay in the soil.

**SOLD AS APPRAISED SALES.** Wood is sold "on the stump" and the sale price is based on the appraised volume determined by the forester. This volume is only an estimate.

**SPALTING.** Any form of wood coloration caused by fungi. Although primarily found in dead trees, spalting can also occur under stressed tree conditions or even in living trees. Although spalting can cause weight loss and strength loss in the wood, the unique coloration and patterns of spalted wood are sought after by woodworkers.

**SPECIAL SITES.** Those areas offering unique historical, archaeological, cultural, geological or ecological value.

**SPECIES COMPOSITION.** The mix of tree species occurring together in the same stand.

**SPOT FIRE.** Fire set outside the perimeter of the main fire by flying sparks or embers.

**SPROUT.** A tree that grows from the stump or sucker root of a parent tree; it is not of seed origin. Basswood is frequently of sprout origin.

**STAND.** A group of trees occupying a given area and sufficiently uniform in species composition, age and condition so as to be distinguishable from the forest on adjoining areas. A forest stand is said to be “pure” if 80 percent or more of the trees present are of the same species. If less than 80 percent of all trees present are of the same species, the stand is said to be “mixed.”

**STAND DENSITY.** The quantity of trees per unit area. Density usually is evaluated in terms of basal area or percent-crown cover. See basal area, crown cover, stocking.

**STEM.** The portion of a tree that supports the branches; also called the bole.

**STICK, BILTMORE.** A rule graduated in such a way that the diameter of standing tree may be estimated when the stick is held tangent to the surface at right angles to the main axis of the tree and at a distance from the eye for which the stick is graduated.

**STICK, SCALE.** A graduated stick for measuring the diameters and contents of logs; both measures are stamped on the stick.

**STOCKING.** An indication of the number of trees in a stand as compared to the desirable number for best growth and management, such as well-stocked, overstocked, partially stocked.

**STOMATA.** Minute openings on the surfaces of leaves and stems through which gases (e.g. oxygen, carbon dioxide, water vapor) and some dissolved materials pass into and out of plants.

**STRATIFIED SEED.** Seed that has been stored in a cool, moist condition before use. This storage practice hastens the germination of some species.

**STREAMSIDE MANAGEMENT ZONE (SMZ).** An area of natural timber or vegetation protected and maintained on each side of a stream or drainage to provide habitat diversity, wildlife travel corridors and protect water quality.

**STUMPAGE.** Uncut trees standing in the forest. Sometimes used to mean the commercial value of standing trees.

**STUMPAGE PRICE.** The price a logger is willing to pay for wood as it is in the woodland or “on the stump.”

**SUCCESSION.** The progression of vegetation types after site disturbance that begins with herbaceous plants and ultimately reaches a mature forest. The gradual replacement of one plant community by another.

**SUCKER.** Synonymous with sprout.

**SUGAR BUSH.** A stand mostly of sugar maple that is used for gathering sap for the production of maple syrup.

**SUMMER ANNUAL GRASSES.** Grasses that must be replanted each spring. These plantings provide summer feeding areas for many kinds of wildlife, especially young turkeys and quail that utilize green forage and insects. Plants that mature and produce seed in late summer-early fall, such as millets and sorghums, are also used by seed-eating birds.



**SUMMER PERENNIAL GRASSES.** Grasses that do not need to be replanted each spring. These plantings also provide green forage, seeds and produce insects for many kinds of wildlife.

**SUPPRESSED.** The condition of a tree characterized by low-growth rate and low vigor due to competition with overtopping trees. See overtopped.

**SUPPRESSION, FIRE.** All the work of extinguishing or confining a fire beginning with its discovery.

**SUSTAINED YIELD.** An ideal forest management objective at which point the volume of wood removed is equal to growth within the total forest.

**SWEEP.** Tree defect resulting from a gradual curve in the main stem of the tree.

**TALLY.** A system of recording trees counted during a timber cruise.

**TRACT.** A specified or limited area of land that is owned by one entity and may contain numerous parcels.

**TAPROOT.** The main root of a tree that strikes downward with or without heavy branching until it either reaches an impenetrable layer or one so lacking in oxygen or moisture that further downward growth is impossible.

**TERRITORY.** The area that an animal defends, usually during breeding season, against intruders of its own species. Territories are smaller and are normally located within the animal's home range.

**THINNING.** Removal of trees in an overstocked stand to give the remaining trees adequate room for growth.

**THREATENED SPECIES.** Species that could become endangered in the foreseeable future.

**TIMBER.** Standing trees, usually of commercial size.

**TIMBER INVENTORY.** A collection of information about a timber stand made by measuring tree and stand characteristics, such as tree volume and grade and stand density.

**TSI (TIMBER STAND IMPROVEMENT).** A practice in which the quality of a residual forest stand is improved by removing less-desirable trees, vines and, occasionally, large shrubs to achieve the desired stocking of the best-quality trees.

**TOLERANCE.** The capacity of a tree to develop and grow in the shade of and in competition with other trees. Trees able grow in full or partial shade are considered "tolerant." Trees requiring full sunlight for survival are considered "intolerant."

**TRANSPLANT.** A tree that has been removed from its original seedbed and replanted one or more times in a nursery.

**TREE.** A woody plant having a well-defined stem, more or less definitely formed crown and usually attaining a height of at least 10 feet.

**TREE CAVITIES.** Hollow cavities in trees that provide resting or nesting places for wildlife.

**TREE FARM.** A privately owned forest (woodland) dedicated to the production of timber crops. Additionally, it may be recognized as a "Tree Farm" by the Tree Farm Program, an organization sponsored by the American Forest Foundation.

**TREE INJECTOR.** Equipment specially designed to inject chemicals, usually phytocides, into the trunk of a tree.

**TREE SHELTER.** A plastic tube that can be wrapped around the stem of hardwood seedlings to increase survival and growth.

**TRIM ALLOWANCE.** Excess length of a log to allow for square trimming the lumber to an exact length.

**TRUNK.** Main stem or bole of a tree.

**TURNOUT.** A widened space in a road to allow vehicles to pass one another and that slopes away (downhill) from the road. Also, a drainage ditch which drains water away from roads.

**UNDERCUT.** 1) In logging, the notch cut in a tree to govern the direction in which the tree is to fall and to prevent splitting. 2) In forest management, the harvesting of a quantity of timber less than the budgeted cut.

**UNDERPLANT.** To set out young trees or sow seed under an existing stand.

**UNDERSTOCKED.** A stand of trees so widely spaced that, even with full growth potential realized, crown closure will not occur. Understocking indicates a waste of resources, as the site is not fully occupied.

**UNDERSTORY.** The lesser vegetation (shrubs, seedlings, saplings, small trees) within a forest stand that forms a layer between the overstory and the herbaceous plants of the forest floor.

**UNEVEN-AGED STAND.** A group of trees of a variety of ages and sizes growing together on a uniform site.

**VENEER.** Thin sheets of wood (usually less than 1/4" thick) produced by slicing or peeling a log.

**VENEER LOG.** A log of high quality and desirable species suitable for conversion to veneer. Logs must be large, straight, of minimum taper and free from defects.

**VIRGIN FOREST.** A wooded area with old-growth trees that never has been harvested or altered by humans.

**VISUAL QUALITY MEASURES.** Modifications of forestry practices in consideration of public view, including timber sale layout; road and log landing locations; intersections with public roadways; distributing logging residue; tree retention; timing of operations, and other factors relevant to the scale and location of the project.

**VOLUME.** The amount of wood in a tree or stand according to some unit of measurement, (board feet, cubic feet, etc.) or some standard of use (pulpwood, sawtimber, etc.)

**VOLUME TABLE.** A table of figures used to estimate the volume of wood contained in a standing tree, based on dbh and merchantable height.

**WATER BAR.** A diversion ditch and/or hump across a trail or road tied into the uphill side for the purpose of carrying water runoff into the vegetation, duff, ditch or dispersion area so that it does not gain the volume and velocity that causes soil movement and erosion.

**WATERSHED.** The surrounding land area that drains into a lake, river or river system.

**WATER TABLE.** The highest point in a soil profile where water saturates the soil on a seasonal or permanent basis.

**WEED.** An unwanted plant.

**WELL STOCKED.** The situation in which a forest stand contains trees spaced widely enough to prevent competition yet closely enough to utilize the entire site.

**WETLANDS.** Lands sometimes or always covered by shallow water or that have saturated soils where plants adapted for life in wet conditions usually grow.

**WHORL.** Two to 10 or more branches growing in a ring at a node, surrounding the central leader or stem.

**WILDFIRE.** 1) An unplanned fire requiring suppression action, as contrasted with a prescribed fire burning within prepared lines enclosing a designated area, under prescribed conditions. 2) A free-burning fire unaffected by fire suppression measures.

**WILDLIFE HABITAT.** The native environment of an animal, ideally providing all elements required for life and growth: food, water, cover and space.

**WILDLIFE PLANTINGS.** Agricultural crops specifically planted for wildlife in fields or small forest openings and are sometimes referred to as food plots.

**WILDLIFE TRAVEL CORRIDOR.** Forested areas or other established vegetation used as travel lanes or buffer zones to connect larger stands of suitable wildlife habitat or prevent isolation of important foraging and nesting areas.

**WINDBREAK.** A wind barrier of living trees and shrubs maintained for the purpose of protecting the farm home, other buildings, garden, orchard or feedlots.

**WINDROW.** Slash, residue and debris raked together into piles or rows.

**WINDTHROW.** A tree pushed over by wind. Windthrows (blowdowns) are more common among shallow-rooted species and in areas where cutting has reduced the density of a stand so that individual trees remain unprotected from the force of the wind.

**WINTER ANNUAL GRASSES.** Grasses that must be replanted each fall or winter. These plantings mainly provide winter forage for deer, turkeys, rabbits and geese while they are growing but can provide seeds for birds when they mature (examples: wheat, rye).

**WINTER PERENNIAL GRASSES.** Grasses that do not need to be replanted each fall or winter. These plantings also provide winter forage for wildlife (examples: perennial ryegrass and orchard grass).

**WOLF TREE.** A tree that occupies more space in the forest than its value justifies. Usually a tree that is older, larger or more branchy than other trees in the stand.

**WOODY PLANTS.** Plants that live longer than two years and have a thick, tough stem or trunk covered with a layer of cork.

**WOODY PULP.** Mechanically ground or chemically digested wood (composed primarily of wood fiber) that is used in the manufacture of paper, fiberboard, etc.

**XYLEM.** The tissue in higher plants that transports water, dissolved salts and other materials (e.g. pesticides) from the roots to aerial portions of the plant.

**ZOOLOGY.** The study and classification of animals and animal life.



# NOTES

Horizontal lines for note-taking.

# CHAPTER 14

## CONTACTS



## Stewardship Cooperators and Resources

The following are cooperating in the Forest Stewardship Program to provide technical assistance to private landowners in managing their natural resources:

### Virginia State Resources

#### *Virginia Department of Forestry (VDOF)*

VDOF provides forest management planning and technical services, cost assistance, forest harvest monitoring, forest health and forest fire prevention and protection.

900 Natural Resources Drive, Suite 800  
Charlottesville, Virginia 22903-0667  
(434) 977-6555 | Fax: (434) 296-2369  
[www.dof.virginia.gov](http://www.dof.virginia.gov)

#### *Virginia Department of Game and Inland Fisheries (DGIF)*

For information and assistance on wildlife and habitat protection; wetland conservation, or wildlife management areas, contact:

4010 West Broad Street  
PO Box 11104  
Richmond, Virginia 23230-1104  
(804) 367-1000 | Fax: (804) 367-9147  
[www.dgif.virginia.gov](http://www.dgif.virginia.gov)

#### *Virginia Department of Conservation and Recreation (DCR) – Division of Natural Heritage*

For information and assistance on conservation of open space for recreation, scenic areas, trails and natural heritage sites; Virginia's conservation goals; the Virginia Land Conservation Fund (VLCF), or rare, threatened or endangered species, contact:

217 Governor Street  
Richmond, Virginia 23219  
(804) 786-7951 | Fax: (804) 371-2674  
[www.dcr.virginia.gov/dnh](http://www.dcr.virginia.gov/dnh)

#### *Virginia Department of Environmental Quality (DEQ)*

DEQ coordinates programs related to air, water and land protection, including regulations.

629 East Main St.  
P.O. Box 1105  
Richmond, VA 23218  
(804) 698-4000 | Fax: (804) 698-4500  
[www.deq.state.va.us](http://www.deq.state.va.us)

#### *Virginia Department of Mines, Minerals and Energy (DMME) – Division of Geology and Mineral Resources*

For acquisition of topographic maps for pre-harvest planning, contact the map sales office of DMME.

900 Natural Resources Drive, Suite 500  
Charlottesville, Virginia 22903-0667  
(434) 951-6340 | Fax: (434) 951-6366  
[www.dmme.virginia.gov](http://www.dmme.virginia.gov)

#### *Virginia Department of Historic Resources (DHR)*

For information about the conservation of historic buildings and sites; battlefields, and cultural and archaeological sites, contact:

Virginia Department of Historic Resources  
2801 Kensington Avenue  
Richmond, Virginia 23221  
(804) 367-2323 | Fax: (804) 367-2391  
[www.dhr.virginia.gov](http://www.dhr.virginia.gov)

### ***Virginia Department of Agriculture and Consumer Services (VDACS)***

For information about the conservation of working farms, certification and funding for local Purchase of Development Rights programs, contact:

102 Governor Street  
Richmond, Virginia 23219  
(804) 786-3501  
[www.vdacs.virginia.gov](http://www.vdacs.virginia.gov)

### ***Virginia Outdoors Foundation (VOF)***

VOF is a public organization, created by the Virginia General Assembly in 1966 under Virginia Code § 10.1-1800. VOF is the primary holder of conservation easements in Virginia – for more information, contact:

Capital Place Building,  
1108 East Main Street, Suite 700  
Richmond, VA 23219  
[www.virginiaoutdoorsfoundation.org](http://www.virginiaoutdoorsfoundation.org)

### ***Virginia State University – College of Agriculture – Forestry Program***

Virginia State University is developing a course of study in forestry and conducts forestry research. The Cooperative Extension branch provides education and information to landowners.

Virginia Cooperative Extension  
Virginia State University  
L. Douglas Wilder Building  
P.O. Box 9081  
Petersburg, VA 23806  
(804) 524-6967  
[www.agriculture.vsu.edu](http://www.agriculture.vsu.edu)  
[www.agriculture.vsu.edu/special-programs/cooperative-extension/forestry/index.php](http://www.agriculture.vsu.edu/special-programs/cooperative-extension/forestry/index.php)

### ***Virginia Tech – College of Forestry and Natural Resources***

Virginia Tech offers degrees in forestry and related natural resource fields; conducts extensive forestry research, and provides information, publications and education to landowners and citizens through the Cooperative Extension Service.

Cheatham Hall, RM 138, Virginia Tech  
310 West Campus Drive  
Blacksburg, VA 24061  
(540) 231-5482  
cnre@vt.edu  
[www.cnre.vt.edu](http://www.cnre.vt.edu)

### ***Cooperative Extension Service*** [www.ext.vt.edu](http://www.ext.vt.edu)

### ***Virginia Forest Landowner Education Program (VFLEP)***

VFLEP offers landowners science-based education programs on woodland management; programs include short courses, on-line trainings, field days, weekend retreats and both web-based and print materials.

228 Cheatham Hall 0328  
310 West Campus Drive  
Blacksburg, VA 24061  
(540) 231-6391  
forester@vt.edu  
[www.forestupdate.frec.vt.edu](http://www.forestupdate.frec.vt.edu)  
[www.facebook.com/VFLEP](https://www.facebook.com/VFLEP)

## Federal Resources

### *USDA Natural Resources Conservation Service (NRCS)*

NRCS assists farmers and forest landowners with conservation planning, technical and financial assistance for conservation and forestry practices.

1606 Santa Rosa Road, Suite 209  
 Richmond, Virginia 23229-5014  
 (804) 287-1691  
[www.va.nrcs.usda.gov](http://www.va.nrcs.usda.gov)

### *USDA Farm Service Agency (FSA)*

FSA provides financial assistance to farmers and landowners for conservation and forestry practices.

1606 Santa Rosa Road, Suite 138  
 Richmond, VA 23229-5014  
 (804) 287-1500  
[www.fsa.usda.gov](http://www.fsa.usda.gov)

### *USDA Forest Service (USFS)*

George Washington-Jefferson National Forest  
 Supervisor's Office  
 5162 Valleypointe Parkway  
 Roanoke, Virginia 24019  
 (888) 265-0019 | (540) 265-5100  
[www.fs.usda.gov/main/gwj/home](http://www.fs.usda.gov/main/gwj/home)

### *U.S. Army Corps of Engineers*

For information and assistance on wetlands and to determine if a permit is required, contact the regional office of the U.S. Army Corps of Engineers.

[www.usace.army.mil](http://www.usace.army.mil)  
 Norfolk District  
 803 Front St.  
 Norfolk, VA 23510  
 (757) 201-7606  
[www.nao.usace.army.mil](http://www.nao.usace.army.mil)

## Associations and Other Cooperators

### *American Forests*

734 15th Street NW, Suite 800  
 Washington, DC 20005  
 (202) 737-1944  
[www.americanforests.org](http://www.americanforests.org)

### *Association of Consulting Foresters (ACF)*

A consulting forester is defined as “a professional forester who devotes not less than 75 percent of his/her working time each year to performing...technical forestry work... on a fee or contract basis” whose services are offered “to the public rather than to a single, full-time employer. ACF is the national professional association for consulting foresters.

312 Montgomery Street, Suite 208  
 Alexandria, VA 22314  
 (703) 548 0990  
[www.acf-foresters.org](http://www.acf-foresters.org)

For a listing of consulting foresters serving Virginia landowners (including those who are members of ACF), visit:

[www.dof.virginia.gov](http://www.dof.virginia.gov)

### *Forest Landowners Association (FLA)*

FLA is an organization founded in 1941 in the South to advocate for the interests of timberland owners.

900 Circle 75 Parkway, Suite 205  
 Atlanta, GA 30339  
 (404) 325-2954  
[www.forestlandowners.com](http://www.forestlandowners.com)

### *Longleaf Alliance*

The mission of The Longleaf Alliance is to ensure a sustainable future for the longleaf pine ecosystem through partnerships, landowner assistance and science-based education and outreach.

12130 Dixon Center Road  
 Andalusia, Alabama 36420  
[www.longleafalliance.org](http://www.longleafalliance.org)



### ***National Woodland Owners Association (NWOA)***

NWOA is a nationwide organization founded in 1983 by nonindustrial private woodland owners to promote forestry and the best interests of woodland owners. NWOA is independent of the forest products industry and forestry agencies and has affiliate landowner associations in counties and states throughout the United States.

374 Maple Avenue East, Suite 310  
Vienna, VA 22180  
(800) 476-8733

[www.woodlandowners.org](http://www.woodlandowners.org)

### ***The American Chestnut Foundation***

The American Chestnut Foundation is working to restoring the American Chestnut to the eastern woodlands.

TACF National Office  
160 Zillicoa Street, Suite D  
Asheville, NC 28801

[www.acf.org](http://www.acf.org)

### ***Virginia Association of Soil and Water Conservation Districts (VASWCD)***

The Virginia Association of Soil and Water Conservation Districts (VASWCD) is a private nonprofit association of 47 soil and water conservation districts in Virginia that provides leadership in the conservation of natural resources through stewardship and education programs. It coordinates conservation efforts statewide to focus effectively on issues identified by local member districts.

7308 Hanover Green Drive, Suite 100  
Mechanicsville, Virginia 23111  
(804) 559-0324

[www.vaswcd.org](http://www.vaswcd.org)

### ***Virginia Christmas Tree Growers Association***

Virginia Christmas Tree Growers Association (VCTGA) is an association of professional Christmas tree growers interested in the expansion of our farming industry by growing and marketing quality trees.

[www.virginiachristmastrees.org](http://www.virginiachristmastrees.org)

### ***Virginia Forest Products Association***

The Virginia Forest Products Association is a non-profit, non-governmental, privately supported association of individuals, firms and corporations having an interest in the Commonwealth's lumber and wood products industry.

220 East Williamsburg Road  
PO Box 160  
Sandston, VA 23150-0160  
(804) 737-5625

[info@vfpa.net](mailto:info@vfpa.net)

[www.vfpa.net](http://www.vfpa.net)

### ***Virginia Forestry Association (VFA)***

VFA is a private, non-profit organization dedicated to sustaining, developing, protecting and promoting the forests and related resources of Virginia. Members include individuals, forest landowners, foresters, loggers, consultants and forest products businesses and industries. Founded in 1943, VFA brings together a diverse membership that advocates both a healthy natural environment and strong business environment for the benefit of all Virginians.

3308 Augusta Avenue  
Richmond, VA 23230  
(804) 278-8733

[www.veforestry.org](http://www.veforestry.org)



# CHAPTER 15

## ADDITIONAL RESOURCES

*Additional information and publications available at  
[dof.virginia.gov](http://dof.virginia.gov)*



