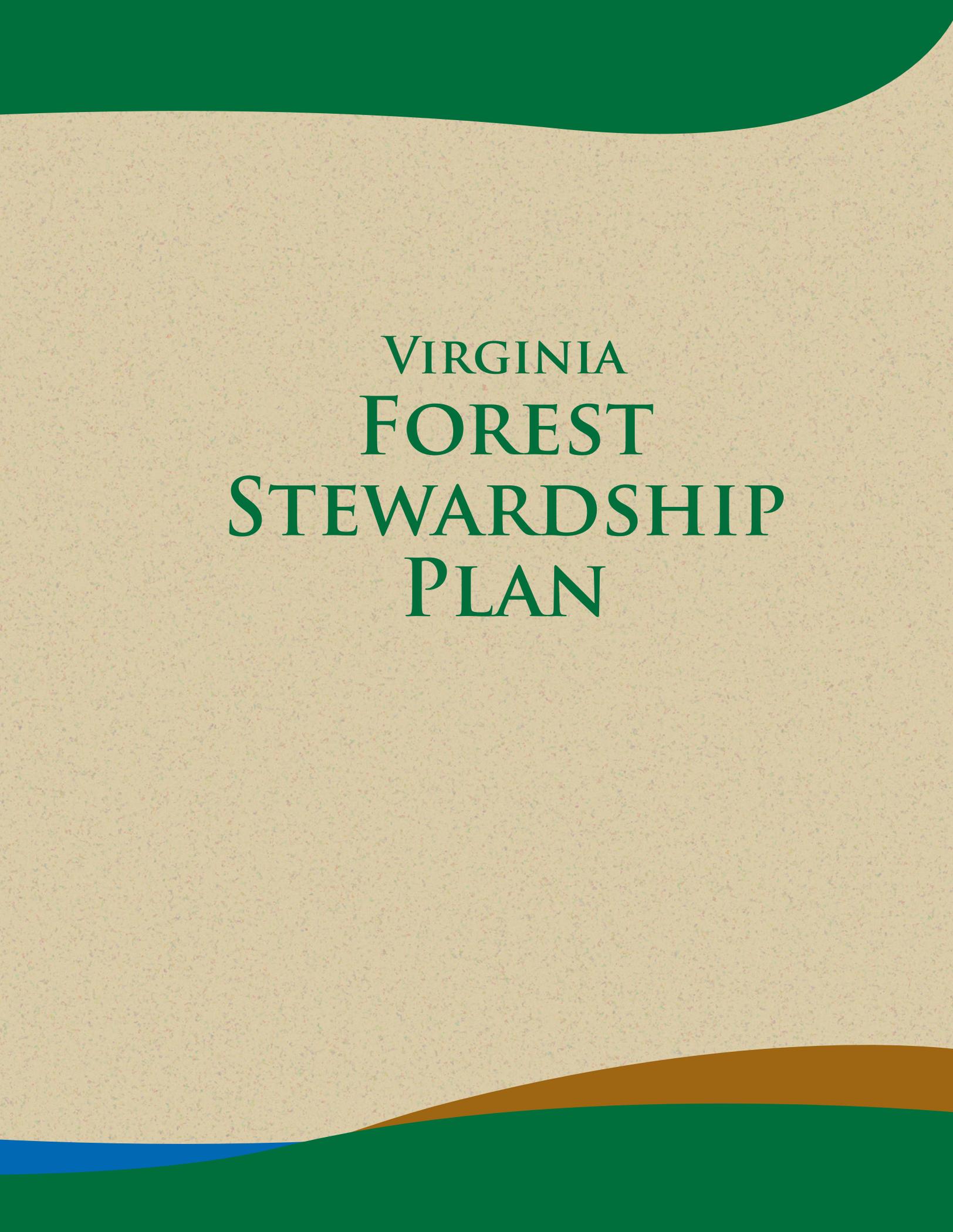




VIRGINIA FOREST STEWARDSHIP PLAN

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 and prepares a customized blueprint – a stewardship plan – for you to follow. By implementing the recommendations, you can achieve your goals. 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! 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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dof.virginia.gov

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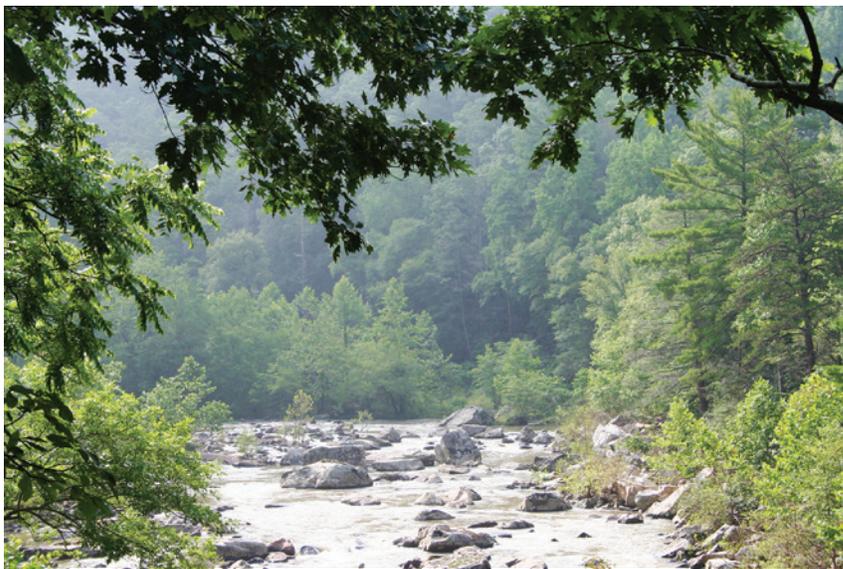
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Forward

Virginia’s Forestland is “Our Common Wealth”

Forested Land

As of 2021, more than 16 million acres – 62% of the Commonwealth – qualified as forestland. Of this forestland, 15.3 million acres were categorized as commercial timberland and 500,000 acres were categorized as reserved forestland (e.g., Shenandoah National Park, Virginia State Parks). Hardwood forests made up 79% and softwood forests made up 21% of all Virginia timberland.

Forest Ownership

Most of Virginia’s forestland is privately owned – individuals and families hold 59%; corporate 21%; federal, state, and local government 18%; and forest industry 2%. Approximately 95% of these private holdings average less than 100 acres in size, but the overall range is a few acres to thousands of acres.

The largest forest owner entity in Virginia is the USDA Forest Service National Forest System lands at 1.7 million acres. The Virginia Department of Forestry – through its 26 state forests – holds and manages 74,286 acres of forestland.

Economic Value

Virginia’s forests are healthy and diverse, yet they are changing because of population and socioeconomic pressures.

The forest resource of the Commonwealth:

- ◆ Contributes \$21.6 billion annually to Virginia’s economy.
- ◆ Contributes \$339 million back to Virginia landowners for selling their timber.
- ◆ Generates more than 108,000 jobs.
- ◆ Contributes an additional \$6.7 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, that Virginia’s forests are indeed our Common Wealth.



Virginia’s Stewards of the Forest

People Caring for Our Forest Resources

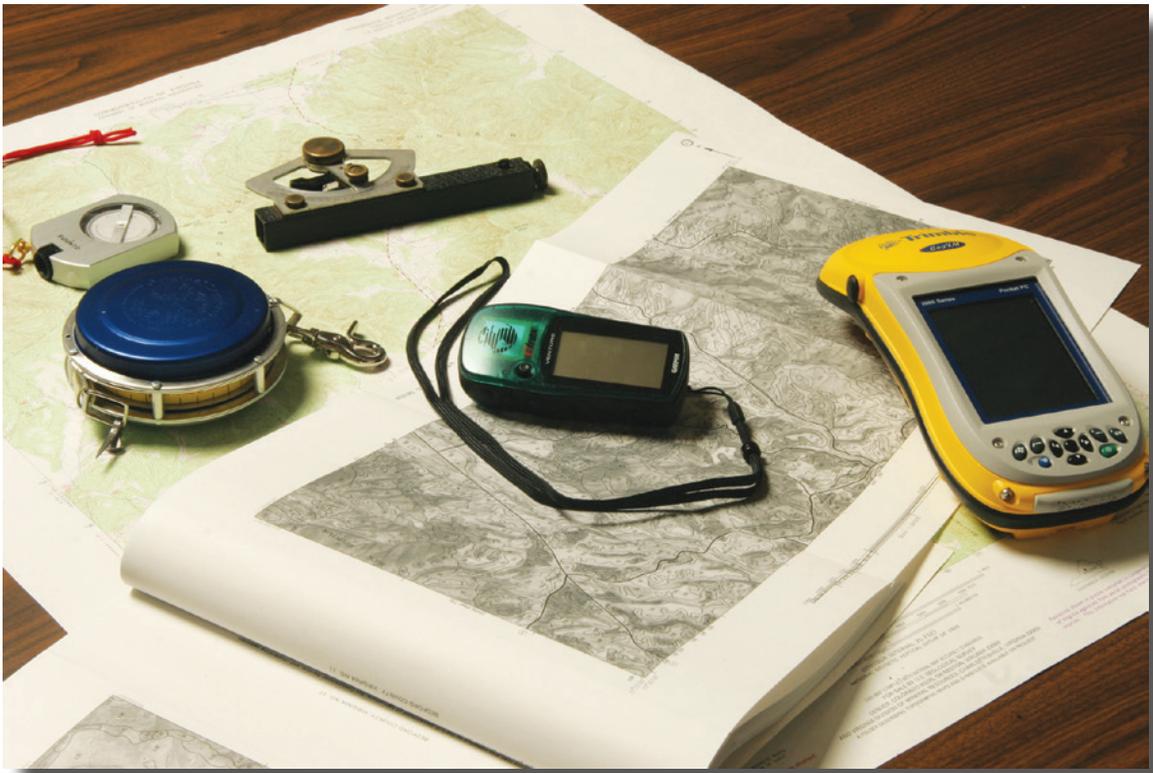
Stewardship starts with landowners who care about their forestland. Land ownership is one of the most valued rights for American citizens. However, ownership also carries the responsibility of good stewardship. Well-managed forests provide clean air and water; homes for wildlife; recreation; wood products, 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 was developed and is funded by the USDA Forest Service but is administered in Virginia by the Virginia Department of Forestry.

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 records 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



NRCS soil surveys

Table 1. Property Location and Boundary Resources

USGS Topographic Maps
<p>U.S. Geological Survey (USGS) https://www.usgs.gov/the-national-map-data-delivery/topographic-maps</p> <p>Virginia Energy – Geology and Mineral Resources https://energy.virginia.gov/geology/topindex.shtml</p> <p>ArcGIS USA Topo Maps https://www.arcgis.com/home/webmap/viewer.html?webmap</p>
Aerial Photographs
<p>U.S. Department of Agriculture – Geospatial Enterprise Operations (GEO) https://www.fpacbc.usda.gov/geo/index.html</p> <p>Virginia Department of Forestry Field Offices https://dof.virginia.gov/contact-us/</p> <p>Virginia Department of Transportation - Location and Design Division https://www.virginiadot.org/business/locdes/photogrammetry.asp</p> <p>Virginia Department of Forestry (InForest) http://inforest.frec.vt.edu/</p>
Soil Surveys
<p>Natural Resources Conservation Service https://www.nrcs.usda.gov/wps/portal/nrcs/main/va/soils/surveys/</p> <p>Web Soil Survey This is an excellent site for mapping your tract, getting soils information and management direction by using soil types. https://websoilsurvey.nrcs.usda.gov/app/</p>

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. Search for deeds and plats in Virginia by contacting the county Circuit Court Clerk in which the property is located. In addition to sellers' and buyers' names, useful information that may be found in deeds and plats includes:

- ◆ Legal description (needed to find property lines)
- ◆ Liens on the property
- ◆ Restrictions or covenants on the property
- ◆ Easements (e.g., 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 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, lay out a road, plan wildlife habitat improvement projects, and much more. Aerial photos are 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

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.



Property corner marking



Property boundary marking

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 years or so.

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 or purple 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 paint is less likely to be vandalized.



“Posted” sign



Aluminum vertical line meaning “Posted”

Easements and Rights-of-Way

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 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. These types of easements should not be confused with conservation easements, which specify activities that may occur on land but do not grant access rights.

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. 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, continuous, and adverse or hostile use of the land of another.



Powerline right-of-way

CHAPTER 2

FOREST MANAGEMENT



Forest Management

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

Clearcut Method

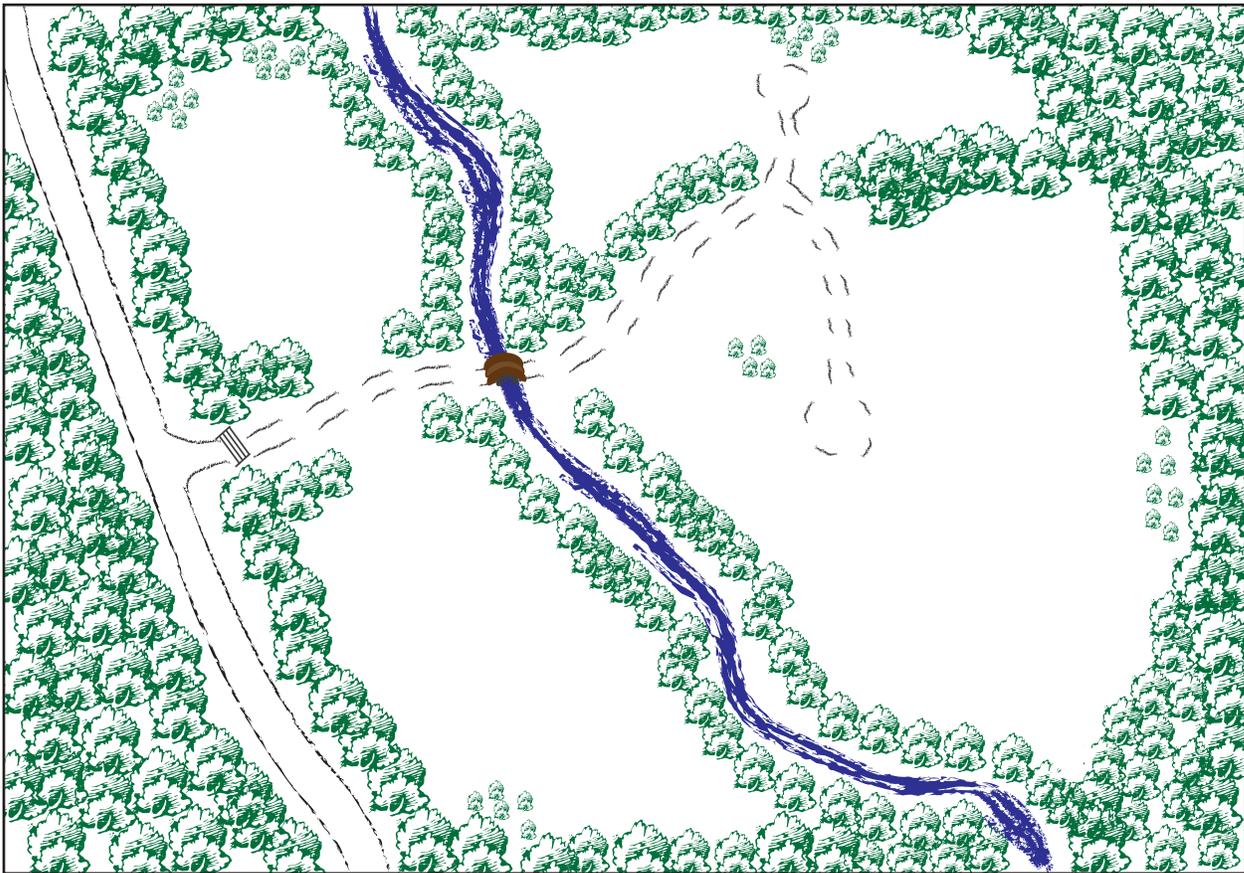
The main objective of clearcutting is to reproduce the forest with shade-intolerant species that require full sunlight and are best managed biologically and economically in even-aged stands. The method is used equally well with shade-intolerant early successional pines or with shade-intolerant hardwoods. It is the method used for establishing different species from those harvested, and 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 harvesting or otherwise felling all trees above 1½ inches in diameter or about 6 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 cutting 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 6 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

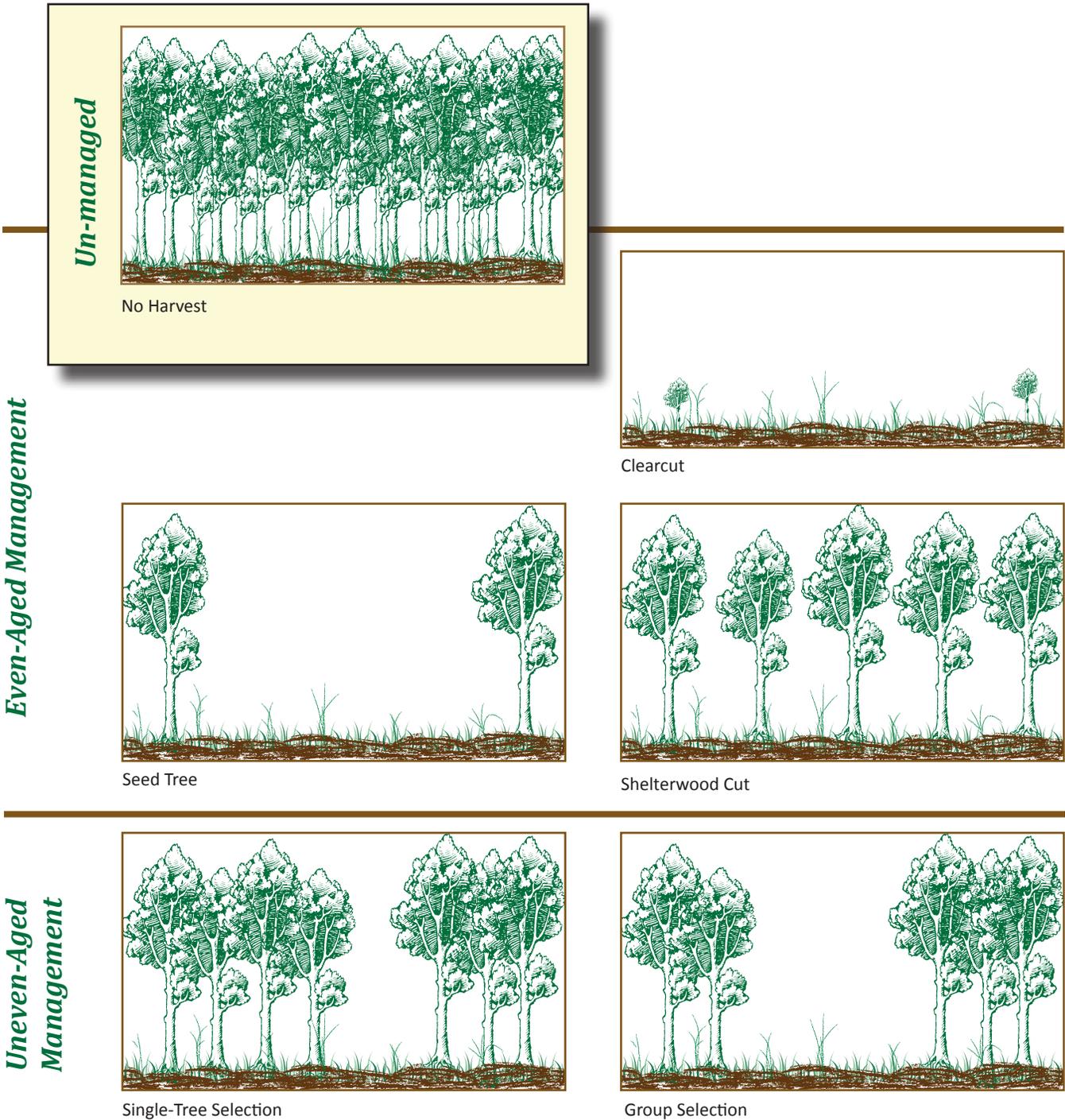
Many factors can play a major role in the regeneration of a particular site. Some, such as man-made boundary patterns, soil conditions, topographic position, and seasonal/climatic factors, can affect tree reproduction. Each factor will show influence on the species composition, age-class distribution, 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. Topsoils 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 other features. 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 of seedlings 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 they are 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 (1 to 5 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, or desirable for wildlife values or 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 those of the crop trees. Also, cut or kill climbing vines on or near the crop trees. 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 (ideally 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 and resistance to insects and diseases of the trees left.
- ◆ Enhance wildlife habitat.
- ◆ Obtain early financial returns to offset establishment and operational costs.
- ◆ Concentrate growth on the 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.



After timber harvest

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 Forest Management Practices: 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

Pine harvests on many sites are subject to Virginia's Seed Tree Law, enacted by the State Legislature in 1951 to ensure steady pine resource. The law states that on tracts of 10 or more acres, where loblolly or white pine make up at least

25% of the trees, eight cone-bearing trees at least 14 inches in diameter must be left standing to reseed the site. There are exemptions to this law, including land use changes to agriculture or development. In addition, an Alternative Management Plan approved by the state forester can allow for complete harvest followed by replanting pine or converting to hardwood. Contact your local VDOF forester before harvest for assistance in understanding the details of the Seed Tree Law and complying with its provisions.

Code of Virginia Seed Tree Law

<https://law.lis.virginia.gov/vacodefull/title10.1/chapter11/article9/>

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, 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 on-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 Forest Management Practices: 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 or 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 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 as well. 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, thus reducing 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. 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, each with numerous variations: hand planting and machine planting. On open fields or large, well-prepared cutover tracts, machine planting may be the most effective and economical. 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 Forest Management Practices: Tree Regeneration}](#)

Hand Planting

Simple equipment is used 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, with 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 cannot 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

Planting machine use on harvested forestland is not recommended due to the rough conditions of these sites. These machines are best used in open land planting and are available for rent from the Virginia Department of Forestry or through private contractors.

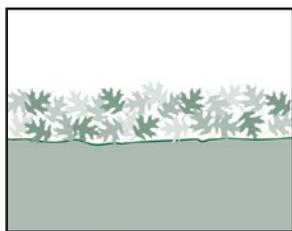
As with hand planting, protecting seedlings from drying out during machine work is very important. Seedlings must remain covered and the roots kept moist.

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

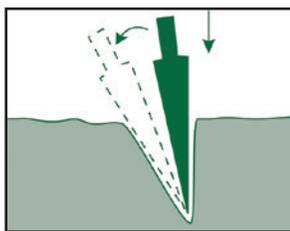


Machine planting

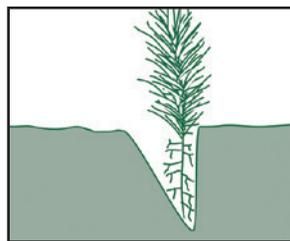
Figure 3. Hand Planting Bare-root Pine Seedlings



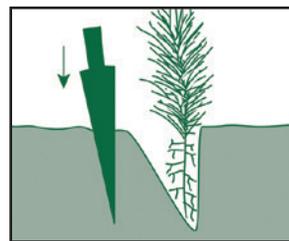
1. Brush aside loose organic material, such as leaves, grass, etc., from the planting spot to expose mineral soil. If organic matter gets into the planting hole, it can decompose and leave air spaces. Roots will dry out when they grow into these spaces.



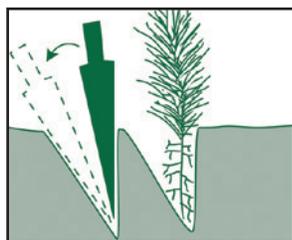
2. Insert bar straight down and pull backward to open hole, making sure the hole is deep enough for the roots to be fully extended. If the roots are curled or bunched up, the tree will often weaken or die, or may blow down later due to poor root structure.



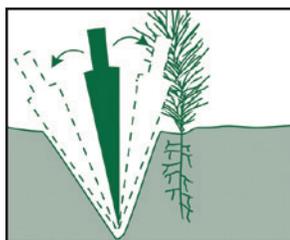
3. Remove bar and place seedling upright at correct depth with roots straight. Hold the seedling in place in the hole, making sure the roots are straight and fully extended, and the seedling is at the proper planting depth.



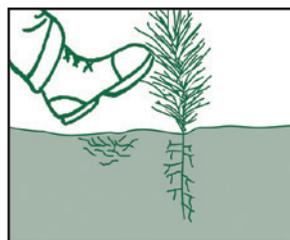
4. Insert bar straight down behind last hole.



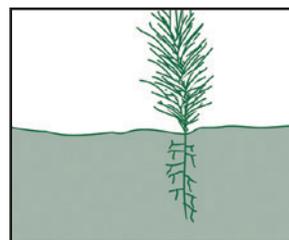
5. To hold seedling, pull bar handle back toward the planter to close hole at the bottom of the roots.



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 interferes 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 Forest Management Practices: 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.



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. Commercial thinning should be performed whenever the stand grows to an overcrowded condition. [{See Forest Management Practices: 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 Forest Management Practices: Final Harvest}](#)

Hardwood-Specific Management



The hardwood forests of Virginia are very diverse, complex systems providing homes for nearly innumerable trees, shrubs, forbs, and grasses, not to mention wildlife. Hardwood forests vary considerably across the state, from the bottomland hardwood swamps of the Coastal Plain to the red clays of the Piedmont to the fertile valleys between the mountains to the dry and rocky mountain ridges. Temperature, soil type, and soil moisture greatly influence the species found in a local hardwood forest. Species change as one travels across the state, and, in fact, they often change just going around a mountain. Trees like sweetgum are common in the east, but non-existent in the west. Conversely, Northern red oak is more common in the west. Past land use and harvesting practices also have a huge impact in determining what tree species are present and their quality. Because of this variability, there is no one-size-fits-all management for hardwoods. Each stand must be assessed and considered individually.

Just like growing agricultural crops and pine, hardwood forests are grown and harvested on a rotation. Hardwood rotations are often much longer than pine: 50 years for fast-growing yellow-poplar and 80 to 120 years for oaks. Harvesting in hardwood forests can be done many ways, and every entry to harvest trees is important. It can be done well, and it can be done poorly. Either way, it will have a considerable impact on the forest for many decades. Regular consultation with

a professional forester for guidance is necessary to ensure harvests are undertaken at the right time and in the right way, so desirable regeneration is developed in the understory, released at the right time, and then managed. This way, the best trees make it to the final canopy for a future crop and seed source.

All of this process can be guided by your management plan prepared by your forester.

In this management plan, the forester balances timber production with other goals, such as aesthetics, wildlife, and recreation, to make the most of landowner objectives. Following the forester's recommendations will speed development of the forest so it provides increased benefits sooner.

Natural Regeneration

Starting a new hardwood forest is done using natural regeneration. Natural regeneration mostly grows from seed produced by trees on the site, seed blown in from surrounding forest, or from wildlife that bury seed for later and never retrieve it. Different tree species regenerate from seed under different light conditions. The process of providing the right amount of light to regenerate the desired species requires the skills of a forester, and often some time.

Stump sprouting (called coppice regeneration) and root sprouting also contribute to natural regeneration. The degree to which existing trees stump and root sprout depends on the species, age, and time of year they are cut. Stump sprouts can produce trees of inferior quality, if the stump is already decaying due to heart rot disease. The risk of this can be minimized by management of the sprouts as they grow.

Activities can be undertaken to improve regeneration of the desired species. These may include prescribed burning, herbicide treatment, cutting of the existing understory, or thinning. Some species like yellow-poplar are relatively easy and fast to regenerate. Others like white oak, northern red oak, and southern red oak take years of work and nurturing to ensure they develop well.

The planning and preparation for regeneration

needs to take place years before trees in the canopy are harvested.

Final Harvest

Once sufficient and desirable regeneration is established, then the crop trees in the canopy can be harvested. This is the sawtimber harvest that landowners look forward to. There are several ways this harvest can be carried out to further nurture regeneration. Having sufficient regeneration in place allows the landowner time to market and sell the sawtimber when prices are high. Once regeneration is well established, the canopy needs to be removed to release the new saplings to grow and develop into the next forest. [{See Forest Products Marketing: Selling Timber}](#)

Harvesting Methods

The harvesting methods discussed previously in the Forest Management Practices section cover the options for hardwood. Harvesting equipment used is often dictated by site restrictions and what is available from local harvesters. Regardless of the equipment that is used, great care should be taken to prevent damage to the trees that will be remaining in the stand to continue growing. These will be harvested in the future, and their value is reduced if damaged during previous harvests. Harvesting in hardwoods and regeneration of the forest are closely linked. Sometimes several harvests are used in succession to establish and aid regeneration before the final harvest. [{See Forest Management Practices: Harvesting Methods}](#)



Shelterwood hardwood harvest

Intermediate Treatments

After a forest is regenerated and the canopy harvested, intermediate treatments can be done to guide development of a stand to maturity. There are many types, but all are some sort of thinning that reduces the number of trees and leaves the best species and stems of good form in a position to grow as fast as possible. In general, the sooner this can be started, the better. Early treatments are non-merchantable and are an expense; they include cleaning, weeding, and crop tree release. They are often necessary treatments for stand health and productivity, despite their cost. Early in the life of the stand, there is the opportunity to shape the forest and set it on its course for the next hundred years! Later intermediate treatments can be commercial thinnings to sell pulpwood, fuelwood, and small sawtimber, depending on local markets. [{See Forest Management Practices: Intermediate Practices}](#)

Once trees have grown to merchantability, the process of establishing natural regeneration should be started as described previously. Final harvest of crop trees should be undertaken only after sufficient regeneration is in place.

Hardwood Restoration

Many hardwood stands need restoration. They are dominated by low quality trees as a result of poor past management. The all-too-common practice of “high-grading” (removing only the best, most valuable trees and leaving the rest) has created these stands. In most cases, they have been high-graded two or three times over the last 60 years. These stands are characterized by having a relatively large number of trees with poor quality stems, trees with damage from past harvest, trees of non-merchantable species, and late succession trees growing into the overstory. They also frequently have trees of multiple ages, but not always well distributed throughout the stand.

Restoring these stands to a productive, merchantable status takes time and guidance by professional foresters. Sometimes additional harvesting is recommended to remove low-value trees and let existing regeneration grow.

Sometimes clearcutting to regenerate early succession trees is best. Depending on markets, sometimes conversion to pine for one rotation is recommended. A hardwood understory will develop under the pine, and then when the pine reaches maturity and is harvested, the hardwood understory is released to make the next forest. There are several methods to restore degraded hardwood stands. If your forest is in this situation, your forester will recommend the best option for you.

Planting Hardwoods

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, protecting from deer and rodents, 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 are available to perform needed work. Some success has been reported on direct seeding of hardwoods, particularly oaks.

Hardwood seedlings account for about 1% 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 include:

- ◆ Best sites are rich bottomlands, stream terraces, coves, lower-slopes, and north- and east-facing slopes.
- ◆ Hardwood species are very site specific. Matching the best tree to the particular site will improve the chances for a successful planting.

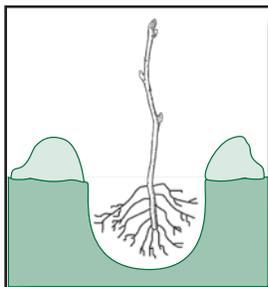
- ◆ Choose the right seedlings for the site.
 - ✧ **Wet sites:** willow oak, cypress, pin oak, swamp chestnut oak, water oak, alder, black gum, and other wet-tolerant species.
 - ✧ **Dry sites:** black oak, chestnut oak, southern red oak, hickory, persimmon, apple, and other species for dry sites.
- ◆ 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 planting 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.
- ◆ Prepare the site by removing heavy fescue or other plants that harbor mice and voles.



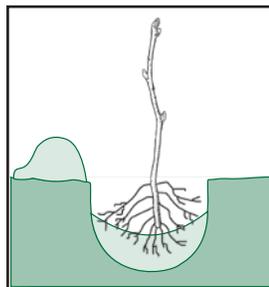
Riparian hardwood planting

- ◆ 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.
- ◆ Plant seedlings on a spacing that will permit mechanized cultivation or mowing.
- ◆ Control grasses and herbaceous vegetation until tree seedlings have outgrown the weeds. Registered herbicides can be effective, when following the label instructions.
- ◆ When planting, take care of the roots! Keep bundles closed or in plastic bags to keep them from drying out.

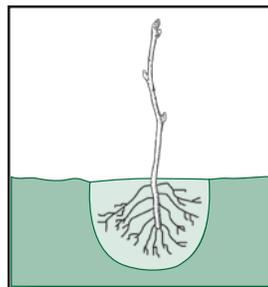
Figure 4. Hand Planting Bare-root Hardwood Seedlings



Dig hole large enough to spread out roots.

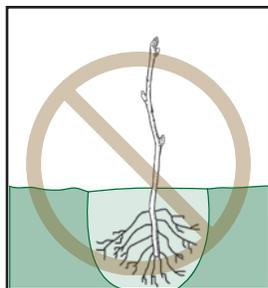


Set seedling with the root collar at ground level.

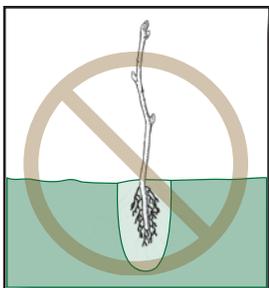


Fill hole, firm soil so there are no air pockets.

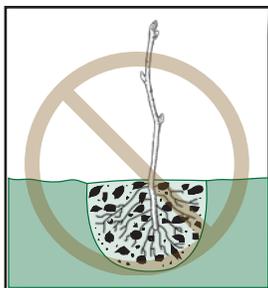
Avoid the following situations:



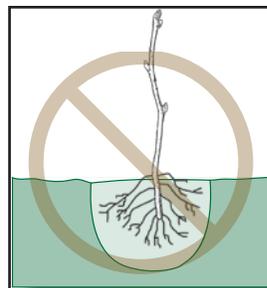
Hole too deep, root collar below ground level.



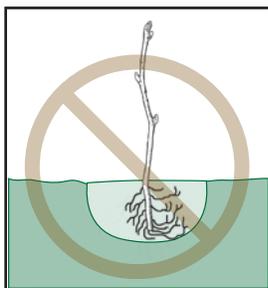
Compacted roots, hole too narrow.



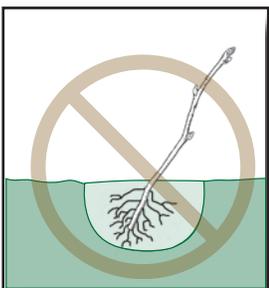
Air pockets and debris in hole.



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.
- ◆ Killing the grass competition with herbicides prior to planting the hardwood seedlings is very important. Continue to use herbicide to control the vegetation around your planted tree for two to three years after planting.

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 planted 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 Forest Management Practices: 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 Forest Management Practices: 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 reestablish the chestnut with a resistant variety.



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. 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 a different strategy 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. They generally fall into three categories: Virginia Department of Forestry foresters, private consulting foresters, and foresters employed by forest industry. All of 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.
- ◆ Mark timber. (The Department of Forestry, by policy, does not provide timber inventory, appraisal, or marketing services.)
- ◆ 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.

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.

- ◆ 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.)

- ◆ Harvest planning 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 [<https://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 [<https://dof.virginia.gov/forest-management-health/landowner-assistance/find-a-forester/private-forestry-consultant-directory/>]. This forestry service providers list includes consulting foresters, logging contractors, and other service providers. A consulting forester on the list must have a B.S. degree or higher in forestry 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 check references. The consultant may work on a per hour, per job, or 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 vary by the company and could include planning, inventory, timber sales assistance, obtaining harvesting or planting contractors, or obtaining 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 communicating 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.

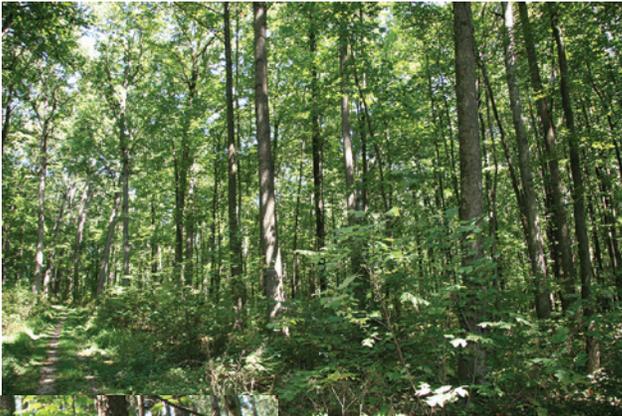
Virginia Tech and Virginia State Universities

The Virginia Tech College of Natural Resources and the Environment [<https://cnre.vt.edu/>] and Virginia State College of Agriculture [<https://www.ext.vsu.edu/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 [<https://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.



Planting contractors

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. Some 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. From a walk in the urban forest to a hunt 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, as well as 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 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 [<https://www.hardwoodinfo.com/>]
- Southern Forest Products Association [<https://www.southernpine.com/>]
- American Forest and Paper Association [<https://www.afandpa.org/>]



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 it is 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 who are familiar with selling and harvesting timber can help landowners get the best value from their forestland (much like a realtor selling a house). 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.

Find your local VDOF forester

<https://dof.virginia.gov/forest-management-health/landowner-assistance/find-a-forester/find-a-vdof-forester/>

Find a private consulting foresters

<https://dof.virginia.gov/forest-management-health/landowner-assistance/find-a-forester/private-forestry-consultant-directory/>

Professional Assistance

Virginia Department of Forestry foresters can provide:

- ◆ Forest Management Plans (fee may apply)
- ◆ 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
- ◆ Landowner agent services
- ◆ 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, landowners should keep in mind their goals and what they want from their 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 these 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 volume estimates 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% 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 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 National Timber Tax website [<https://www.timbertax.org/>].

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 the 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 the logger before harvesting starts.

The seller should require notification from the buyer several days before any work begins. Virginia law requires that Virginia Department of Forestry be notified of the harvest as well *{See Water Quality: Logging Notification}*. The seller or 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 undesignated trees, cutting across the property line, damaging streamside areas, and damaging residual trees and young growth.

Resolving Disputes

The seller and buyer or their designees, who are qualified to act as their representatives 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 buyer 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. *{See Forest Management: Pine-Specific Management}*

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.

Find your local VDOF forester

<https://dof.virginia.gov/forest-management-health/landowner-assistance/find-a-forester/find-a-vdof-forester/>

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 product or market, processing needs, perishability, and/or types of customers. They also include income-producing activities, such as recreation and hunting leases.

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

National Agroforestry Center

<https://www.fs.usda.gov/nac/>

Association of Temperate Agroforestry

<https://www.aftaweb.org/>

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.

University of Kentucky Non-Timber Forest Products Publications

<http://forestry.ca.uky.edu/ntfp-pubs>

North Carolina State University Cultivating Native Woodland Botanicals

<https://newcropsorganics.ces.ncsu.edu/herb/cultivating-native-woodland-botanicals/>

Virginia Cooperative Extension Herb Culture and Use

https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/426/426-420/426-420.pdf

Mushrooms

Virginia's forests 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



Shiitake mushroom logs

woods, and hedgehog. The most common cultivated forest mushrooms are the oyster and shiitake. Although 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.

Virginia Cooperative Extension Forest Farming

<https://ext.vt.edu/natural-resources/forest-farming.html>

University of Kentucky Non-Timber Forest Products Publications

<http://forestry.ca.uky.edu/ntfp-pubs>

Natural Lump Charcoal

Charcoal 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



Natural lump charcoal

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, as 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 customers through venues like farmer markets.

Virginia Tech Producing and Marketing Natural Wood “Lump” Charcoal

<https://ext.vt.edu/natural-resources/charcoal.html>

<https://www.web3.cnre.vt.edu/frec/charcoal/outreachprograms.html>



Natural lump charcoal is an economic opportunity

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 are 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 degradation 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.

USDA Forest Service Chapter 6 - Cooking Wood, Smoke Wood, and Flavor Wood

<https://www.fpl.fs.fed.us/documnts/usda/agib666/aib66606.pdf>



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

Specialty Wood

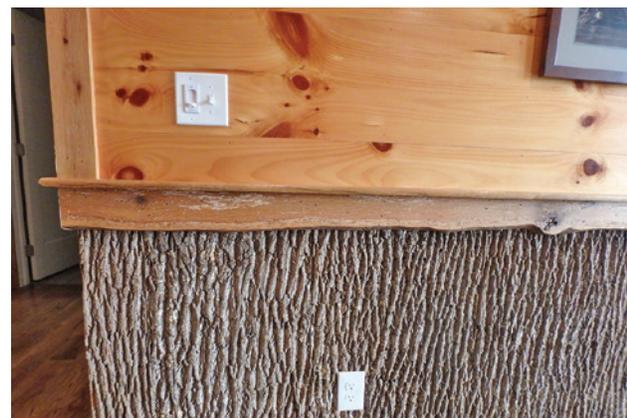
Specialty woods are unique forest products that are usually ignored during traditional harvests because they do not make the standards needed for lumber or veneer. They are selected more for their character, unique look, or properties that can be used in custom or one-of-a-kind items. Burls; highly-figured 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.

USDA Forest Service Chapter 16 - Specialty Wood Products

<https://www.fpl.fs.fed.us/documnts/usda/agib666/aib66616.pdf>



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



Yellow-poplar bark used as home paneling

Christmas Trees

The Virginia Christmas tree industry is made up of thousands of growers. Most Christmas tree growers come from varied backgrounds and do not rely on these sales as their sole source of income. 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 more than 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, annual maintenance 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.

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. The 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.

Virginia Christmas Tree Grower’s Association

<https://virginiachristmastrees.org/>

Virginia Cooperative Extension Introduction to Growing Christmas Trees in Virginia

<https://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 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.

University of Maryland Greenery

<https://extension.umd.edu/resources/natural-resources/alternative-forest-enterprises/greenery>



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	

Forest Product Laboratory

<https://www.fpl.fs.fed.us/>

USDA Forestry

<https://www.usda.gov/topics/forestry>

Emerging Forest Markets

As demands for products and services change and increase, new markets are created that may provide economic benefits to forest landowners.

Ecosystem or Environmental Services

Approximately 62% 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 as free public goods, with little consideration of their market value to the landowner.

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, approximately 16,000 acres of forestland are lost annually through conversion to other land uses. Developing



processes and markets to begin transferring some of this ecosystem service value to private forestland owners can help slow this trend of forestland conversion.

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

Carbon Sequestration

Levels of carbon dioxide (CO²) in the atmosphere are now capturing considerable interest. CO² is one of the major greenhouse gases 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% 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.

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

Sectors of the economy that contribute to CO² 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.



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 “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 the impairment.

The preceding factors all 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



Protecting water quality

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.

USDA Forest Service Ecosystem Services
<https://www.fs.fed.us/ecosystemservices/>

InForest
<http://inforest.frec.vt.edu/>

Virginia Cooperative Extension Virginia Citizen's Guide to Environmental Credit Trading Programs: An Overview
<https://vtechworks.lib.vt.edu/handle/10919/75526>

Ecosystem Marketplace
<https://www.ecosystemmarketplace.com/>

Dovetail Partners Land Use
<https://dovetailinc.org/>



Protecting wetlands

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.

USDA Forest Service
<https://www.fs.usda.gov/research/search?content=bioenergy>



Small pine trees harvested to improve the forest and for bioenergy

Biochar

Biochar is a pure carbon product made from organic material that is generally produced through a process called pyrolysis. Pyrolysis is the decomposition of organic matter at elevated temperatures in an environment with limited oxygen. Biochar can be produced using woody biomass such as wood chips, sawdust, shavings, or bark that is generated from timber harvesting or as a by-product of wood products manufacturing.

Biochar Production and Opportunities for Wood Business

Biochar production systems can be classified as either pyrolysis or gasification systems. The pyrolysis of biomass results in three main products: a solid (biochar), a liquid (bio-oil), and a gas (syngas). Furthermore, pyrolysis becomes self-sustaining as syngas is produced, which combusts, generating additional heat for the production process. Gasification produces smaller quantities of biochar in a directly heated reaction vessel with introduced air. Although pyrolysis systems result in higher concentrations of biochar, both production systems can be developed as mobile or stationary units, depending on the need and availability of the feedstock.

Historically, there has been a steady demand for the use of wood residues in paper and engineered wood products and in the landscaping industry. However, biomass energy markets, another major outlet for wood residues, have been depressed in recent years largely due to low fossil fuel prices and relatively mild winter temperatures across the northern United States. As a result, alternative markets for low-value, underutilized wood products generated from mill processes and forest management activities are a growing interest. An emerging biochar industry shows some promise as a solution for utilizing these woody biomass materials.

Market Opportunities and Emerging Uses

Biochar can be used as a soil amendment in agricultural applications, as media for stormwater and wastewater filtration, and for environmental remediation efforts. Beyond these applications, other areas of interest include the use of biochar as a livestock feed supplement and as an animal litter additive. In Europe, biochar as a feed ingredient is believed to improve herd health while also reducing overall methane production and manure odor. It should be noted, however, that research has yet to fully investigate the potential benefits of biochar as a feed supplement.

Past and current research demonstrates that markets for biochar are experiencing growth and will likely continue to grow with additional research and marketing of potential uses and benefits. This expected market growth will have a positive impact on the forest products sector because it can expand the use of underutilized woody biomass generated by wood manufacturing and forest management activities. Furthermore, biochar can be a value-added product for existing forest businesses, or it can be a stand-alone venture in locations with an available supply of woody biomass.

Survey and Analysis of the U.S. Biochar Industry
https://www.dovetailinc.org/report_pdfs/2018/DovetailBiochar118.pdf

USBI Biochar Introduction
<https://biochar-us.org/biochar-introduction>



Biomass

Destination-Based Markets

Forest landowners may gain economically from people’s desire for fun, adventure, and knowledge. There is growing demand for destination-based activities, where people pay to experience specific activities, or for 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.

Virginia Cooperative Extension

https://www.pubs.ext.vt.edu/tags.resource.html/pubs_ext_vt_edu:agritourism



Natural wonders found in nature



Maple syrup industry generates tourism as well as marketable products



Historical displays and tours



Nature-based tourism activities like hiking



Honey industry and pollinator habitat improvement

Forest Certification

In addition to Stewardship Certification under the Forest Stewardship Program, there are several nationally- and internationally-recognized forest certification programs that may 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 may 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.

The Role of Logging Business Owners in Forest Certification

https://www.pubs.ext.vt.edu/content/pubs_ext_vt_edu/en/ANR/ANR-51/ANR-51.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 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 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.

<https://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 coordinates SFI certification activities. SFI also supports private forest landowners through a mutual agreement with the ATFS. SFI is also endorsed by PEFC.

<https://forests.org/>

Forest Stewardship Council

Under FSC, Virginia landowners may be certified individually or under the Southern Forests Network’s group certificate. FSC is not a part of PEFC but is also internationally recognized.

<https://us.fsc.org/en-us/certification/forest-management-certification/family-forests>

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.

<https://pefc.org/>

<https://dovetailinc.org/>

*Chain of Custody
From Certified Forest to Finished Products*



Figure 5. Sustainable Forestry Programs



Buy Local Effort

Virginia Grown Forest Products Program

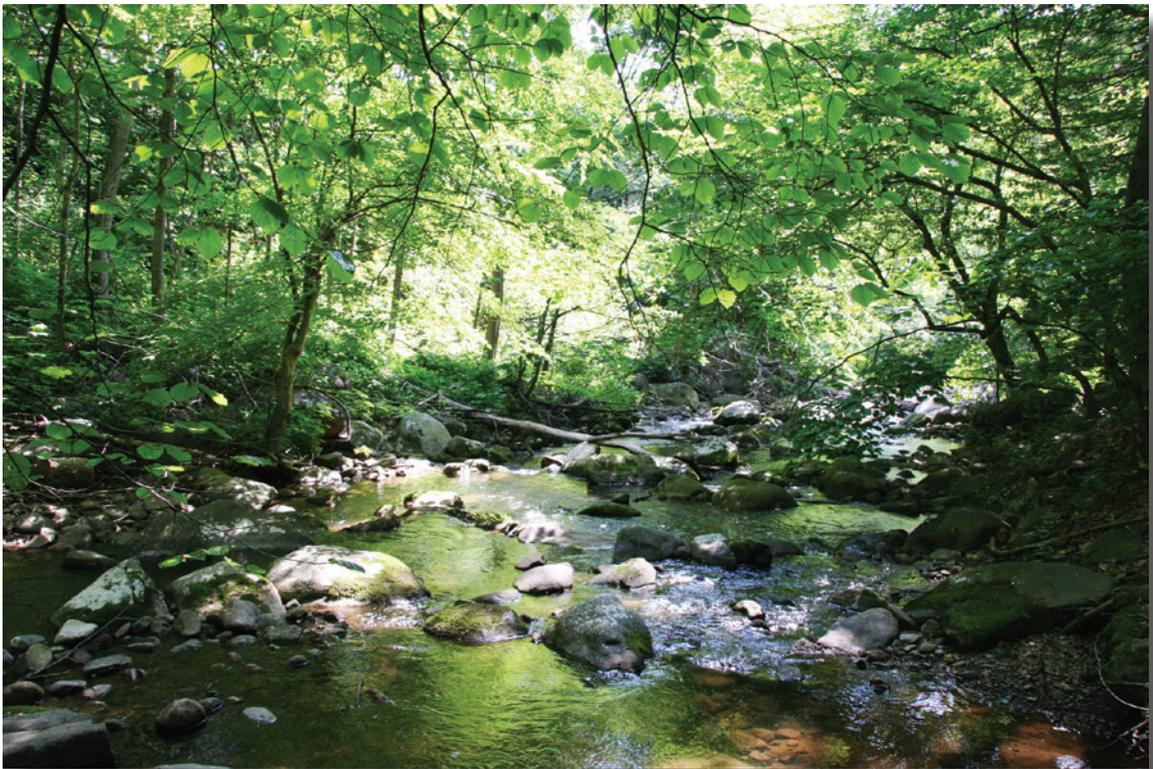
The Virginia Grown Forest Products program was developed in partnership with the Virginia Department of Agriculture and Consumer Services to make citizens aware of the value of purchasing and using wood products made from trees grown in the Commonwealth. Launched in 2012, the program aspires to better 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 108,000 Virginia jobs, contributes \$21 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



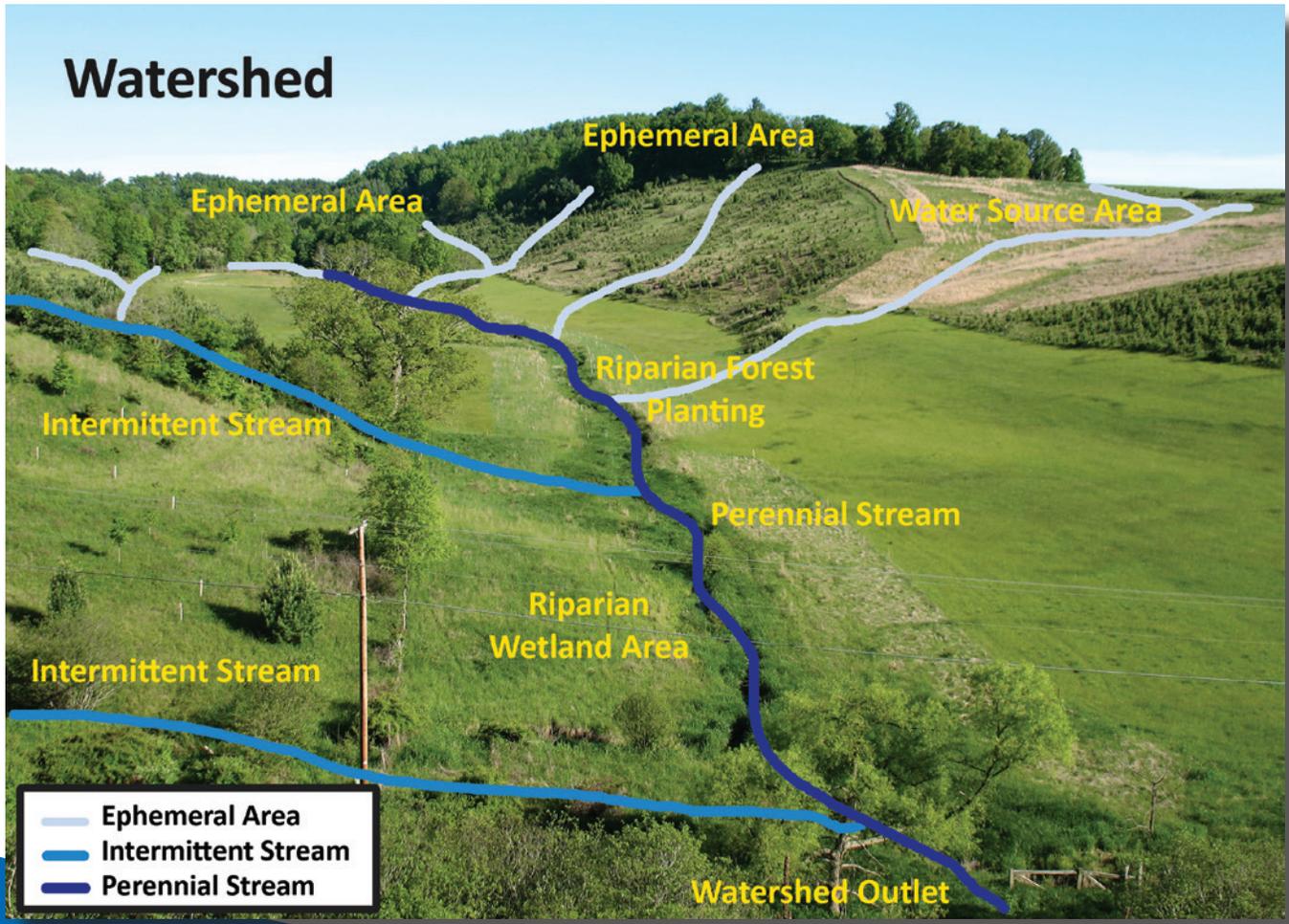
Forests and Water Quality

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 slowing 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, twigs, 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

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 best management practices (BMPs) on roads and trails can create pollution problems.

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.

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.

Roads

To soften the visual impacts of forest roads:

- ◆ Avoid tracking mud onto paved highways.
- ◆ Avoid steep grades entering the site.
- ◆ Avoid rutting.
- ◆ Avoid runoff reaching paved roads.
- ◆ Construct entrances at an angle to the paved road to increase the line of sight when entering the paved road.
- ◆ Maintain roads at all times during the operation.

- ◆ Close out roads once the operation is complete, using grass, gravel, or other means.
- ◆ Gate all roads to limit access to stabilized roads.

Harvests

Harvest planning significantly improves the visual impact of timber harvesting. 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.
- ◆ Consider a visual tree buffer between the harvest and residential areas.

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 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 3% to 5% are desirable; however, sustained grades of 6% to 8% are acceptable when following best management practices. An occasional short pitch of up to 10% 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



Logging road following seeding

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.

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%.
- ◆ Place roads on slopes less than 10%.
- ◆ 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 should 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 wildlife food plants; periodically mowed or disked, and replanted for maintenance. Any constructed fire lines may be kept open by mowing every other year. If mowed, 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%) 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 slowly. 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 on the VDOF website [https://dof.virginia.gov/wp-content/uploads/VAs-Forestry-BMP-Field-Guide_pub.pdf].

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 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. Each day for which any violation continues without removal of such obstruction, on and after the 10th day following service of process on the violator, shall constitute a separate offense punishable as a misdemeanor under §18.2-12.



Protecting Virginia’s streams

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.



Protecting Virginia’s wetlands

Logging Notification

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

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, the operator must obtain a notification identification number from VDOF. This is simply an assigned number used to identify a company when it notifies VDOF of timber harvests.

Loggers are asked for a 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. Loggers will receive a confirmation number when they notify and should retain this confirmation number as proof of notification.

This information will also 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 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 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, reducing oxygen 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.



Wetlands play an essential role in protecting water quality

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.

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.

Riparian forests also provide shade and moderate stream temperature, which is important for most aquatic species.

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% for phosphorus and 89% 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 phosphorus 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% of the original crown cover is left.

Riparian Forest Buffer Establishment

Riparian forest buffer establishment means creating a new forested buffer on open, non-forested land near a water feature. Establishment requires the change of land use from open, non-forest to forest. Establishment can be accomplished through surrounding trees naturally seeding in the buffer area or trees being planted and protected in the buffer area. The width of the buffer is generally measured from the top of the bank to the last tree planted or naturally regenerated in the field.

Forest establishment is an art and a science. A forester will make a site specific, silviculturally-based recommendation for forest establishment to meet resource objectives in concert with landowner objectives. Buffer configuration, size, and width will depend upon objectives.

General criteria for riparian forest buffers is “wider is better” for water quality protections and watershed improvement purposes. Wider buffers offer more functional benefits help to mitigate increasing intensity of land use in the watershed. The general width guidelines recommended for Chesapeake Bay reporting is 100 feet wide, with a 35 feet minimum width required.

Buffer expansion into open, non-forest land, is encouraged and desirable in keeping with “wider is better” to meet water quality, watershed, and landowner objectives.



Riparian buffer by planting



Riparian buffer by natural seeding

The Importance of Soils

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.

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.

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, using BMPs to prevent soil damage and loss.



Stabilization of soils

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. 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.

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.



Tornado damage



Dead locust

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 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 *Biscogniauxia* 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 knock down 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 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, as 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.



Seek professional advice when assessing tree damage.

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 proceed without specific and detailed knowledge about causal agents. The following guidelines should help you evaluate what is practical to do in most cases.

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, but avoid piling it against the trunk. 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 using proper pruning cuts to promote healing. Sanitize pruning instruments between cuts if transmission of microorganisms is likely. Use of registered pesticides should be considered only after you are 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, 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 heterobasidion.



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

There are several species of pine bark beetles in the genus *Ips*, along with the black turpentine beetle



Black turpentine beetle pitch tubes

(*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% 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

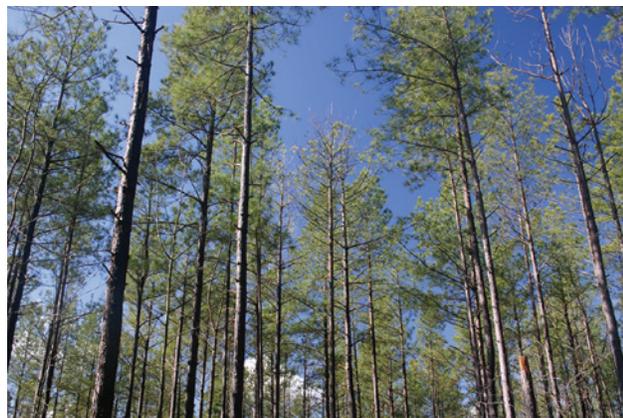
It is worth mentioning that southern pine beetle, Ips, and turpentine beetles can be present in a stand all at the same time. Quite often, if southern pine beetle is present, Ips or turpentine beetle will follow soon after, but it is the southern pine beetle that is driving the system. Other than the 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.

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.



Pine stand decline

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% 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 leads 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 left very large pine stumps over many acres, 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, with 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. VDOF routinely treats all pine seedlings in the nursery to protect them from fusiform rust. Historically, Virginia has not had many problems with fusiform rust compared with more southern states. However, reports of rust infection have surfaced in southeastern Virginia, most commonly 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% 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

Heterobasidion Root Disease

Heterobasidion irregulare 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.



Heterobasidion root disease

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. 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.



Littleleaf disease

Forest Health Issues in Hardwood Forests

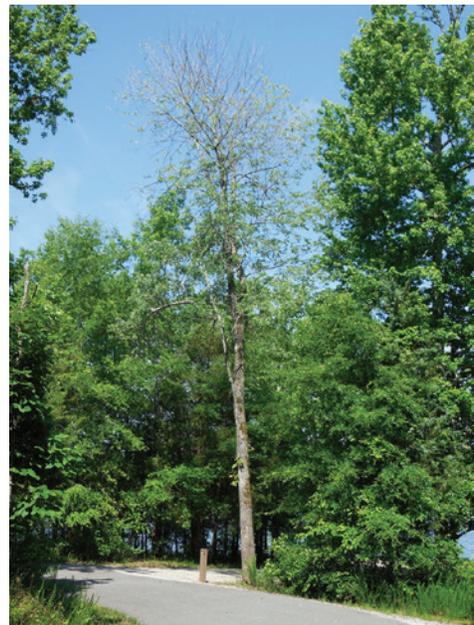
Due to the inherent diversity of most hardwood forests and associated silvicultural practices, forest pest problems are too numerous and varied to discuss individually in this manual. Pest problems also tend to be less distinct than with pines, and fall more within the realm of multi-agent causal factors, which contribute to decline. Avoiding forest health problems in hardwood forests generally requires that some basic guidelines are followed as 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 *Lymantria dispar*) 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 species, such as loblolly pine and yellow-poplar, are increasing dramatically in volume. Six oak species were ranked in the top 20 by volume in the latest survey, most showing an increase 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. The top four species in terms of number of stems include red maple, loblolly pine, yellow-poplar, and sweet gum.

White oak and chestnut oak are ranked 8th and 10th, respectively. No other oaks are in the top 20 – northern red oak is 21st, scarlet oak is 22nd, southern red oak is 23rd, and black oak is 26th. 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 *Biscogniauxia* 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.

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% 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:

Biscogniauxia Canker

The fungus, *Biscogniauxia punctulatum*, is 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 what it was.

Biscogniauxia 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



Biscogniauxia canker

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, 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, Biscogniauxia canker is rarely detected while the affected tree is still alive.

The prevalence of *Biscogniauxia* 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, reflecting 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 *Biscogniauxia* 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 problematic or aggressive 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 *Lymantria dispar* that is somewhat less lethal can fit in nicely as an inciting factor within the decline concept.

Spongy Moth (formerly Gypsy Moth)

Periodic buildups of spongy moth (*Lymantria dispar*) populations have resulted in significant defoliation in Virginia since 1984. The spongy 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 spongy 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 the moths; 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 nonetheless 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 spongy moth outbreaks generally begin in high-elevation habitats, they are fully capable of spreading well into mid-slope and lowland areas and can 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 spongy 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 spongy moth operating as a significant and recurring “inciting factor,” it is greatly speeding up the process of oak decline.

Resilience of forests to spongy moth can be bolstered by selectively harvesting oaks and promoting resistant species like yellow-poplar before 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, particularly when aggressive invasive plants are suddenly released by a loss of overstory.



Spongy moth larva



Spongy moth oak mortality

Spotted Lanternfly

The spotted lanternfly (*Lycorma delicatula*) is an invasive, sapsucking insect that was first detected in Virginia in January 2018. It is a serious concern due to its long host list and its potential to be a significant agriculture and nuisance pest. Long-term impacts to forestry are still unknown. It prefers to feed on tree-of-heaven, but also many native tree species, such as black walnut, maples, cherries, and many more. Although long-term impacts to host trees are still being researched, spotted lanternfly feeding is known to cause yellowing of foliage, branch dieback, and reduction in tree vigor, which makes trees more susceptible to secondary pests and pathogens.

Spotted lanternfly has a one-year life cycle in Virginia, with eggs hatching in late April. There are four nymphal instars – the first three instars are black with white spots, and the fourth instar develops red coloration. The adults hold their wings in a tent-like position while resting, but expose a bright red underwing when flying. Spotted lanternfly adult females lay egg masses on flat surfaces (tree trunks/branches, rocks, outdoor furniture, etc.), allowing the egg masses to be accidentally moved by humans transporting firewood, camping trailers, logging equipment, or anything that has been sitting outside for an extended period of time. All landowners and forestry professionals should be aware of the spotted lanternfly and learn how to identify this pest.



Spotted lanternfly adults and egg masses

Emerald Ash Borer (EAB)

Emerald ash borer (*Agrilus planipennis*) is a relatively new insect pest that has reached a density allowing it to spread rapidly throughout the state. All species of ash native to North America are susceptible to the emerald ash borer, and once infested, a tree usually dies within three to five years. Ash trees of all sizes are at risk, even smaller saplings; emerald ash borer has been found to infest ash trees as small as ½ inch in diameter. Signs and symptoms of emerald ash borer include D-shaped exit holes on the outer bark, S-shaped galleries under the bark, branch dieback and thinning canopies, and bark stripping by woodpeckers.

Insecticide treatments are the only way to increase the likelihood that an ash will survive. Preventative treatments with appropriate products have a higher chance of success before signs of decline are apparent. It is important to note that re-treatment is necessary every one to three years (depending on the product) while emerald ash borer populations are high. The decision to treat is a long-term investment but may be more cost-effective than tree removal.

If forestland has a large component of commercially-valuable ash, forest management options should be discussed with a professional forester. Since emerald ash borer only impacts the outer layer of wood, infested ash trees may still have wood product potential as long as they are harvested within a year of dying. If the ash tree is not a safety hazard (i.e., it is deep in the forest with no walking trails, buildings, or high-value assets nearby), it is acceptable to leave the ash tree on the property knowing that it will likely die.



Emerald ash borer mortality



Emerald ash borer galleries



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:

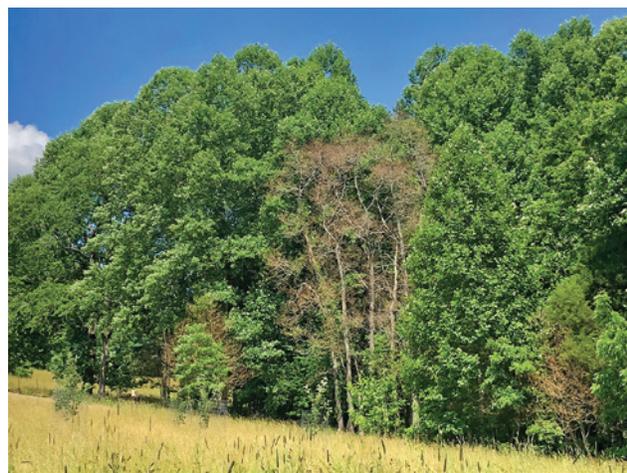
- ◆ Flowering dogwood due to dogwood anthracnose (Note: resistant dogwood varieties exist)
- ◆ Butternut (becoming rare) due to butternut canker
- ◆ American elm due to European elm bark beetle, which transmits the fungus that causes Dutch elm disease (Note: resistant varieties of American elm exist)
- ◆ 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 bark disease and beech leaf disease
- ◆ Maples due to the Asian long-horned beetle
- ◆ Sassafras and redbay due to laurel wilt disease



Black walnut decline associated with thousand cankers disease



Beech leaf disease



Dead sassafras from laurel wilt 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 wavyleaf 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 in the landscape, alone or in combination, means there is no one-size-fits-all approach. Increasingly, a careful blend of chemical and silvicultural strategies are necessary to reach the intended management objectives.



Wavyleaf 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 (*Elaeagnus 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 spongy moth defoliation leads to mortality of overstory oaks, aggressive NNI plants that are lingering in the understory can 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.



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

Vegetation succession is the natural process by which one type of vegetation is replaced by another. 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 wildlife species dependent on these communities, necessitates fire management as a means of setting back the process of succession.

Many of the ecosystems found across Virginia’s diverse landscape were shaped by the frequent presence of fire over thousands of years. Lightning was the primary source of ignition prior to the arrival of Native Americans, after which, they began to alter the landscape through the earliest form of what we now call prescribed burning. The Native Americans used fire to clear dense vegetation for agriculture, establish villages, attract game, and promote specific plants they would use for food, basket-making, and other products.

By the late 19th century, the logging industry was established throughout the South. Excessive logging, followed by wildfires fueled by logging debris, led to a lack of forest regeneration in many areas. Because of this, we began extinguishing all wildfires and halted the use of prescribed fire.

After nearly a century of suppressing fires on the landscape, natural resource professionals realized the negative impacts of fire exclusion. Virginia’s forests and grasslands are well-adapted to fire, with plant species that have survival or regeneration strategies that not only tolerate fire, but, for some, may require it (fire-dependent). Some wildlife species depend upon these plants as well. As fire disappeared from the landscape, these fire-adapted plants and animals also declined.

In an effort to reverse these trends, agencies have reintroduced fire to portions of public lands. While this is certainly

a step in the right direction, much greater potential for habitat restoration exists on private land, as the majority of Virginia is privately owned.

Many private landowners are coming to recognize the benefits of fire, and are using fire as one of the important management tools in the stewardship of their properties.

Fire-dependent plants are those that require fire to complete part of their life cycle. Longleaf pine is a fire-dependent tree species – fire helps the plant grow beyond the “grass stage” and limits competition for sunlight and nutrients.

Fire-adapted plants are those that have adaptations that can withstand occasional fires without harming the plant. The large taproot of oak seedlings is an adaptation allowing them to easily re-sprout following a fire.



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

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. For example, 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.



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

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, or longleaf 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 is 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 may be draped with dead needles and leaves that 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

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% 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.



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

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 high. 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. Hikers and other users also benefit from easier travel and increased visibility. Hunters are more likely to get a clear shot. 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. However, care should be taken to limit the amount of fire char on the trunks of the trees, because some sawmills and paper mills may not accept logs that contain fire char anywhere on the log or bark. The landowner should contact the VDOF forester or their local mills to determine if fire char or scars will make the logs un-merchantable, BEFORE a prescribed burning operation is conducted.

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.

Technical Assistance

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.

Because they are the authority on prescribed fire in the Commonwealth, we encourage anyone who has questions about prescribed burning on their land to first contact the Virginia Department of Forestry (VDOF). Additional information, expertise, and input can be obtained from the Virginia Department of Wildlife Resources (VDWR).

Virginia Department of Forestry Prescribed Burnin:

<https://dof.virginia.gov/wildland-prescribed-fire/prescribed-burning/>

Virginia Department of Wildlife Resources:

<https://dwr.virginia.gov/wildlife/habitat/good-fire/>

Virginia Certified Prescribed Burn Managers Program

<https://dof.virginia.gov/wildland-prescribed-fire/prescribed-burning/certified-burn-managers-program/>

Virginia Prescribed Fire Council

<https://www.vafirecouncil.com/>

Additional prescribed fire sites

<https://southernforests.org/fire/prescribed-fire-in-the-south/>

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 -***



Consult a professional before considering prescribed burning

Legal Considerations for Prescribed Burning

The Virginia Department of Forestry (VDOF) is the legal authority for prescribed fire and wildfire in Virginia. Specific laws regarding fire under authority of VDOF can be found in Title 10.1 of the Code of Virginia [<https://law.lis.virginia.gov/vacode/title10.1/chapter11/section10.1-1142/>]. Additional information on penalties for negligence, fires set with malicious intent, and more can be found in Title 18.2 [<https://law.lis.virginia.gov/vacode/title18.2/>].

Prescribed Burn Elements

Prescribed burning shall be performed in the following manner:

- ◆ A prescription for the prescribed burn shall be prepared by a certified prescribed burn manager prior to the burn.
- ◆ Prescribed burning shall be conducted under the direct supervision of a certified prescribed burn manager, who shall ensure that the prescribed burning is in accordance with the prescription.
- ◆ The nearest regional office of the Virginia Department of Forestry shall be notified prior to the burn.

What Happens if My Fire Gets Away?

If any person carelessly, negligently, or intentionally sets any woods or marshes on fire, or sets fire to any stubble, brush, straw, or any other substance capable of spreading fire on land, whereby the property of another is damaged or jeopardized, he shall be guilty of a Class 4 misdemeanor, and shall be liable for the full amount of all expenses incurred in fighting the fire.

Local Ordinances and Other Considerations

Some local ordinances may supersede state laws and regulations, so be sure to check with your local government(s) to ensure you are in compliance. Some counties may require a burn permit (which is different from a burn plan or Prescribed Burn Manager certification) prior to conducting a prescribed burn. Also be aware of local weather conditions and “red flag” days. Absolutely no burning shall occur on red flag days, when the danger of wildfire activity is extremely high.



Consult a professional before considering prescribed burning

Prescribed Burning in Summary

It is legal to conduct a prescribed burn on your own property in Virginia; however, if your burn area is within 1,000 feet of an occupied building that is not on your property, you need permission from those occupants prior to burning.

You do not have to be a Certified Prescribed Burn Manager to conduct a prescribed burn; however, it is highly recommended that you become certified. Becoming certified not only provides you with information and training through the certification course, it also provides you with some protections in case a fire gets away. If you are a Certified Prescribed Burn Manager, are conducting a burn within prescription, are attending and monitoring the fire at all times, and the fire gets away due to circumstances not within your control, you may not be charged for a Class 4 Misdemeanor, nor possibly be held liable for the costs of extinguishing the fire.

If a fire gets away and burns another property, you may be liable for the costs of damages incurred regardless of whether you are a Certified Prescribed Burn Manager or not. It is recommended that you check your insurance policy regarding escaped fires prior to burning or consider purchasing prescribed fire insurance.



Prescribed fire is serious business

You may not conduct a prescribed burn before 4 p.m. from February 15 through April 30 unless you are a Certified Prescribed Burn Manager **AND** have applied and been approved for an exemption. Only Certified Prescribed Burn Managers may apply for an exemption to burn during the 4 PM Burning Law period, and you need to have a valid reason why the burn can only be conducted during this period.

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.

by using common sense, following fire safety rules and obeying fire laws.

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 and November. Fire causes and the general 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 together 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



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

- ◆ There is 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 flammable material.
- ◆ You may apply for an exemption to burn during the 4 PM Burning Law period, but only if you are a Certified Prescribed Burn Manager and have a valid reason for burning within that time period.
- ◆ An exemption may be approved for prescribed burning between February 15 and April 30 if the fire is conducted in accordance with a prescription; if managed by a certified prescribed burn manager, and all law requirements in §10.1-1142-C are met.
- ◆ Fires shall not be left unattended if within 150 feet of woodland or dry fuel.
- ◆ No new fires may be set or fuel added after midnight.
- ◆ The 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.



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 a 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 [<https://dof.virginia.gov/>].

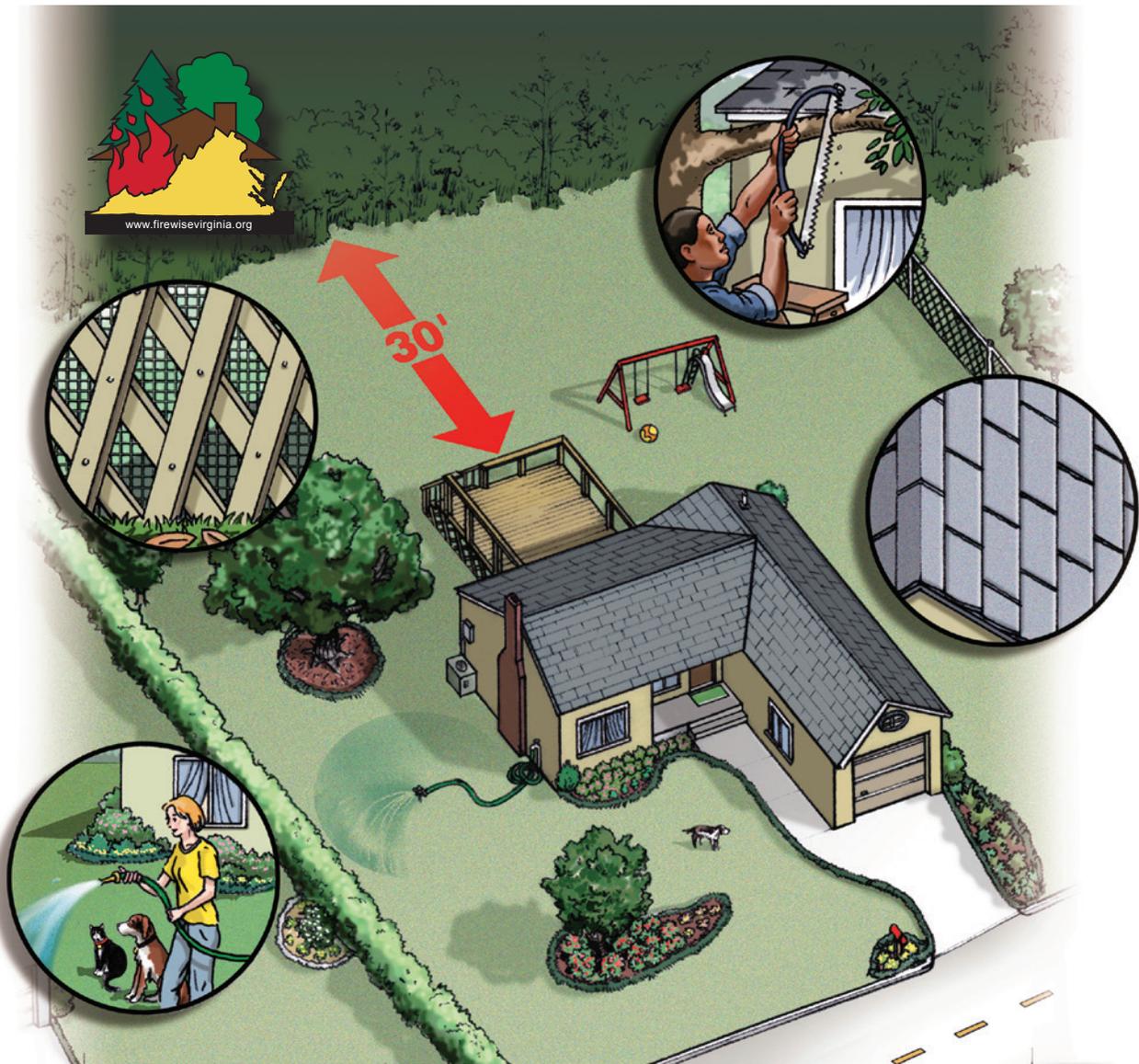


Maintain sufficient clearances around your home.



Firewise practices can save your home.

Figure 6. Make Your Home Firewise



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. It is important to remember that habitat management is not all about “game” species. Many people are more interested in non-game species (e.g., bird watching, wildlife viewing).

The early stages of a regenerated forest 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 in early-successional cover along the edges of the forest, in weedy forest openings, or in native bunch grasses growing under an open forest, while squirrel, turkey and bear favor older timber stands, with some brushy, young forest habitat and small herbaceous clearings.

Wildlife species need a diversity of habitat types to meet their year-round survival needs of food, escape cover, shelter and water. These vary according to the particular animal being managed. For example, squirrels need almost 100% mature hardwood forest with cavity trees, while deer require a mix of nearly 50% brushy cover (cutover timberland), 25% mature hardwood forest and 25% open field habitat. Turkeys require habitat somewhere in between – more mature hardwoods and some large pines preferred, but with a need for brushy cover for nesting and escape cover, and open fields or forest clearings for insect foraging and brooding. Therefore, habitat management for wildlife needs to take into consideration the particular habitat needs of the species being managed.

When planning for a timber harvest, some den or cavity trees and perch trees should be left standing, along with mast-producing trees. The best species for mast include oak, hickory, beech, and walnut. It is best to leave these in clumps rather than as singles. Dogwood, huckleberry, blackberry, wild grape and other shrubs – wildlife food-producing species – can be encouraged by cutting trees that



shade them out. Small areas of such habitat can be enhanced by firewood cutting where commercial timber harvesting isn't feasible. Old home sites and cemeteries often contain an abundance of plants that benefit wildlife, but be

mindful that some of these are invasive and should be removed. These sites deserve protection for wildlife habitat along with preservation of our ancestral heritage, so it is recommended that they be left undisturbed in their natural state. Small open areas can also be planted in shrubs for habitat improvement. Gray and silky dogwoods, indigobush, 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.

Another beneficial technique to enhance wildlife habitat is to create cut-back borders or edges around fields and forest clearings. This involves cutting the trees and shrubs around the clearing for 20 to 50 feet back from

the edge to create dense, shrubby habitat adjacent to both the mature forest and the opening. Firewood harvesting can be a good way to create this habitat.

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. In addition, springs and seeps are inviting to wildlife and should be protected during logging operations. Grazing livestock in woodlands can be very destructive to wildlife habitat and should be avoided.



Cut-back borders along seeded haul roads.



Cut-back borders and dense, shrubby habitat.

Photo by Va. Dept. of Game and Inland Fisheries

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. As the forest regenerates, the dense, young forest habitat created, along with the herbaceous plants, provides excellent food and cover for many game and non-game wildlife species that depend on brushy habitat. Clearcuts should be kept fairly small: 10 acres 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, both woody and herbaceous, and release overtopped young trees. Trees selected to be removed should be over mature, poor mast-producers, or have no value as cavity/den trees. 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. When doing selection harvests with wildlife in mind, strive to leave a variety of hard and soft mast species (e.g., oaks, black gum, cherry, and beech) in the residual stand to provide for a more consistent annual mast crop. 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. Also favor other species of mast producers, including hickory, blackgum, viburnum, dogwood, holly, redcedar and serviceberry.

Pine Conversion

Habitat diversity develops wildlife diversity, so include some evergreen areas in wildlife management plans. Forested areas that have poor soil fertility can be planted to white, loblolly, or shortleaf 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. Extensive tracts of pines do not produce optimal habitat conditions for wildlife. Pine conversions should be developed on sites too poor to grow quality hardwood.

Pine Management

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. A maximum density of 544 trees/acre (10 ft. x 8 ft.) down to a minimum of 396 trees/acre (10 ft. x 11 ft.) would cover the range of economically-viable planting rates, while still providing some wildlife benefits. The wider the spacing, the greater the value to wildlife, as more sunlight will stimulate growth of herbaceous plants.

It is important to thin as soon as possible, not only for the benefits to the stand but also for the significant improvement to wildlife habitat quality. Residual stands should not exceed 65 square feet of basal area per acre, although 50 square feet per 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 personnel, preferably a Virginia Certified Prescribed Burn Manager.

Virginia Certified Burn Managers Program
<https://dof.virginia.gov/wildland-prescribed-fire/prescribed-burning/certified-burn-managers-program/>

Habitat for Wildlife
<https://dwr.virginia.gov/wildlife/habitat/>

Managing Pines for Profit and Wildlife
<https://dwr.virginia.gov/wp-content/uploads/managing-pines-smaller.pdf>

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



Rotten logs are home to many species of wildlife.

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 areas. 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 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. Ideal construction of a brush pile would include: placement of three to four small logs or tree limbs (six to 10 inches in diameter) and six to eight feet long on the ground with eight to 12 inches between logs. Then crisscross similar sized logs or limbs over these to create a base over which branches and cut limbs can then be placed.

Decks/Skid Trails

Decks and skid trails should be seeded with a mixture of native grasses and 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. Certain grasses, such as fescue, orchardgrass, and perennial ryegrass, should be avoided. Clovers do best when planted without grasses.

Maintaining Soft Mast

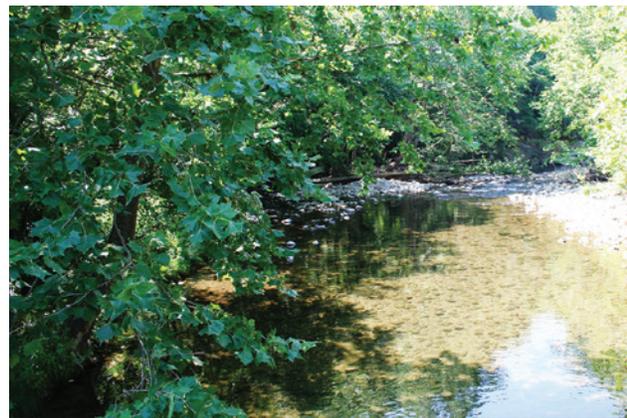
Soft mast-producing trees, shrubs, and vines are very important food sources for many forest wildlife species. Often these soft mast plant species have a growth structure/form that develops dense thickets, which provide excellent cover for wildlife. Species like dogwood, wild grape vines, persimmons, black cherry, greenbriers, black haw, crabapple, hawthorn and sassafras should be retained whenever possible. Favor these species when thinning or daylighting along roads, field edges, and openings. Maintaining plenty of good soft mast producers within any timber stand is essential for ruffed grouse, turkeys, and a variety of other game and non-game wildlife species, especially songbirds.

Stream, Creek and Drainage Management

Riparian zones are lands adjacent to streams, rivers, lakes, and wetlands (e.g., marshes, spring seeps, water holes, and vernal ponds.) They are highly-productive ecosystems because they receive nutrients, water, and energy from the adjacent uplands.

Riparian zones are important habitats for wildlife because the vegetation is unique and diverse. These 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 insect habitat. 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% 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.



Overhanging vegetation provides cover, and the shade prevents extreme temperature fluctuations harmful to aquatic organisms.

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 native grass and legume mixture; a good wildflower mixture for pollinating insects and maintained as permanent openings; or simply allowed to revert to forest. Consult a biologist for more details on planting mixtures. To maintain permanent openings, disk, mow, burn, hand cut, or use herbicides every few years to prevent woody plant invasion. Cutting back the edges of woodland openings (20 to 50 feet) will enhance their value as wildlife habitat by creating additional cover and food.

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 DWR fisheries biologists for ideas and technical guidance on building ponds and water impoundments.



Woodland openings benefit many species of wildlife.

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.

On woodlots with fewer than six to eight cavity trees per acre, supplement with artificial nest boxes [<https://dwr.virginia.gov/wp-content/uploads/make-a-bird-house.pdf>].

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"> ◆ Encourages vigorous growth of understory vegetation necessary for food production, brood cover and escape cover. ◆ Results in new forest of desirable mast-producing trees (oaks, cherry, ash, walnut and yellow-poplar) and woody shrubs or herbaceous vegetation (blackberry, dogwood, grape, greenbrier and pokeweed). ◆ Provides habitat for a wide range of wildlife species.
	Seed Tree and Shelterwood	<ul style="list-style-type: none"> ◆ Encourages vigorous growth of understory vegetation necessary for wood production, brood cover and escape cover. ◆ Results in new forest of desirable fruit and seed mast-producing trees (oaks, cherry, ash, walnut and yellow-poplar) and woody shrubs or herbaceous vegetation (blackberry, dogwood, grape, greenbrier and pokeweed). ◆ Provides habitat for a wide range of wildlife species.
Uneven-Aged Management	Single-Tree Selection	<ul style="list-style-type: none"> ◆ Provides habitat for species desiring continuous forested environment. ◆ Provides specific den trees, snags and fruit-producing trees. Tops of harvested trees provide ground cover. ◆ Provides habitat for a wide range of wildlife species.
	Group Selection	<ul style="list-style-type: none"> ◆ Provides needed browse, nesting cover, food and escape cover in heavily forested areas. ◆ Tops of harvested trees provide cover. ◆ Provides habitat for a wide range of wildlife species.
Option	Oak/Hardwood Savanna	<ul style="list-style-type: none"> ◆ Provides historical habitat type and is aesthetically pleasing and desirable by some wildlife species like turkeys, deer, quail and grassland birds. ◆ Could help regenerate oaks.

Habitat Management Practices for Agricultural Areas

A major problem facing early successional wildlife species, including many songbirds and pollinating insects, is the lack of suitable reproductive and winter cover. The use of heavy, sod-producing grasses, such as Kentucky 31 tall fescue, has almost eliminated this type of cover. Good management for upland wildlife species (deer, turkey, quail, grassland songbirds, and pollinating insects) 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 these species are described below.

Fallow Fielding and Crop Rotation

One way to create early successional habitat for upland wildlife 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, 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. Or, one can just sow a cover crop, such as oats, and then leave the field idle, or just simply leave the field idle and manage the resulting native cover in a rotational fashion, disking, burning, or mowing about one third each year.

Strip Disking or Plowing

In less intensive agricultural situations, such as an old field pasture or abandoned area, soil disturbance must be created specifically to maintain early-successional habitat for upland wildlife species. Strip disking or plowing, where the ground is simply plowed or disked and left alone for a period of time, 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, 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 over-seeding a legume, such as partridge pea, beggarweeds (*Desmodiums*), 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. A technique some prefer is called “rotational food-plotting.” Instead of leaving the strips idle to come up in native cover, they can be planted into an annual food plot mixture. In following years, leave last year’s planted strip fallow and seed the newly disked strip. By doing this on a rotational basis, you will essentially be setting up a rotational cropping system. A mixture containing milo, millet, buckwheat, and sunflower works well in many cases. Care should be used not to plant it too heavily, as having many annual native “weeds” like ragweed invade the plantings is good for wildlife. The goal of food-plotting should not be having a pure, thick stand of planted crop.

Mowing Hayland

Many game bird and songbird 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 (with March being best for all things considered). 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 to keep 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 even 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. 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, sumac, 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. Spot herbicide can always be used in addition to mowing to keep the field from being taken over by tall trees or invasive plants. When possible, never mow all of a field each year. Always mow in a rotational fashion.

Fire and Controlled Burning

Done correctly, prescribed 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. Hire a professional certified prescribed burner.**

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.

Note: While slow winter burns make good first time burns, once landowners are experienced with burning, occasional use of growing season burns is also good for creating wildlife habitat. 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 wildlife biologist.

Virginia Prescribed Fire Council

<https://www.vafirecouncil.com/>

Fencerow/Hedgerow and Travel Corridors

The easiest way to provide escape cover and travel corridors for wildlife is the creation of shrubby travel lanes. 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, escape cover, and resting areas for wildlife. 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 mowing equipment. Selective herbicides can also be used to control encroachment by woody vegetation and undesirable tree species. 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 planted in a fencerow, clumpy growth species like sumac, wild plum, gray and silky dogwoods, crab apples, hawthorns, chokecherry, indigobush, and sassafras should be used. They should be planted in dense clumps. To provide good winter food and year-round 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 3- to 5-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 or into forest. Natural succession can be advanced by planting dogwoods, hawthorns, sumac, crab apples, wild plums, or chokecherry shrubs.

Hard edge, where open land or agricultural fields meet older forest stands, can be softened to enhance habitat for wildlife by cutting back the trees (20 to 50 feet into the woods) around the field. This may be done along with another timber harvest elsewhere on the property, or by

landowners cutting firewood. To extend the habitat value of these cut-back edges, the brush could be cut back over time (100 feet of clearing every 2 to 3 years) instead of all at once.

Another technique to develop brushy soft edge habitat is to plant fruiting shrubs out from a timber stand into a field or clearing.

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, from both the harvested grain and native plants. With mechanized harvesting, as much as 5% to 10% of the crop may be left in the field. Any waste grains that would be available for wildlife are lost if they are incorporated into the soil by plowing. 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 again before planting, increasing time, labor and fuel costs for the farmer.

Wildlife, the farmer, and the environment in general greatly benefit if fall plowing is 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 done in late February to March, or delayed until late 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 light mixture of big bluestem, little bluestem, Indiangrass, and switchgrass. To further enhance these borders, a good mixture of native wildflower seed should be added to provide more plant diversity.

Development of Nesting Cover

Often, nesting cover is a limiting factor for wildlife. Nesting cover should be developed next to woods 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 than is a 20- by 2,000-foot long, narrow strip.

A variety of mixtures can be planted for nesting cover. Many times, nesting cover can be established by simply managing native plant succession. After disking and prescribed burning, nesting cover usually develops on its own two to three years after disturbance. If good nesting cover does not develop on its own, planting a mixture of little bluestem, big bluestem, and a few native wildflowers can help it along. If you plan on grazing or mowing the stand after the birds have raised their brood, a mixture of switchgrass, big bluestem, and Indiangrass will provide good cover.



Photo by Va. Dept. of Wildlife Resources



Weedy wildlife field edge next to crops and woods.



Mixed native grasses and forbs make good wildlife nesting and brood-rearing cover



Bobwhite Quail Habitat Management

Good quail habitat contains distinct components and characteristics. 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 often 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 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. To keep things simple, think of the "third rule" developed by Tall Timbers Research Station, near Tallahassee, Florida. About one third of quail cover should be in a very young, annual-plant dominated, mixed weedy cover, which doubles as brood-rearing cover and winter feeding cover; another one third should be in a stage that is a bit older, with slightly more native grass cover for nesting and night roosting; and the last one third should be in thicket cover of some type, which serves as the escape cover critical for evading predators.

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. A good example of this type of habitat structure is an area dominated by ragweed and partridge pea.

Periodic plowing, disking, or burning – every three years as 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, 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.



Bobwhite quail

Photo by Va. Dept. of Wildlife Resources

An essential element of bobwhite habitat is the presence of dense, woody or shrubby 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 grape or greenbrier. 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.

Note that good bobwhite quail habitat can also be created and maintained under thinned stands of timber – producing pine species like loblolly, shortleaf and longleaf. The same “third rule” used above applies under a canopy of trees. Sunlight is the key ingredient needed to create quail cover under pines. Generally speaking, a stand of pines should be thinned down to no more than 60 square feet of basal area. Thinning down to 40 square feet is better. A good rule would be to go down to 60 to 70 square feet on a first thinning, then on the second thinning, several years later, take the stand down

to 40 to 50 square feet of basal area. To further enhance thinned pine stands for quail, prescribed burning is recommended. The first burn should be conducted during the winter months to help reduce fuel loads, remove needles and duff, and scarify beneficial native seeds. Subsequent burns should be a mix of winter burns and growing season (March to April, or August to September) burns. Burn units should be 50 to 60 acres in size, ideally, and should not exceed 150 acres for best results. About one third to one half the acres should be burned in rotational fashion every year.

Similar techniques can be used under thinned hardwood stands. However, more care must be used to conduct burns during a time when damage to residual hardwoods will be minimized. Hardwoods should not be thinned down too heavily, too quickly, as letting in too much sun too quickly can cause stress to the residual trees. A goal should be to provide at least 50% open canopy in a hardwood stand. Consult a forester and wildlife biologist in each case for on-site evaluation and advice.

Eastern Wild Turkey Habitat Management

The wild turkey is an omnivore, with its annual diet consisting of 90% plant and 10% 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 species 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 or chicks.

A mixture of forested and open land provides the best turkey habitat. Open land should comprise 10% to 50% of the area and should favor a system of well-dispersed, smaller clearings or linear strips (such as seeded log roads). Turkeys typically do not use the center of clearings larger than 20 acres. Turkeys prefer mature woodlands comprised

of a mixture of tree species and open understories of 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 while feeding on



Wild turkey

Photo by Va. Dept. of Wildlife Resources

insects. Brood range can be created in forested stands by thinning to a basal area of 40 to 60 square feet 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, especially where longer lived white oaks predominate. At least 60% 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 across the landscape. One example would be a rotation age of 120 years with 8% 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. Other soft mast-producing trees and shrubs, including dogwood, black gum, serviceberry, crabapple, and others, beneficial to wild turkey should be retained. 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. Managing pine stands as described in the bobwhite quail section previously will also produce excellent turkey habitat.

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 limits 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 the roadbed planted with a grass/forb/legume mixture. Prohibit vehicle access when possible 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.



Photo by Va. Dept. of Wildlife Resources

Turkey poult

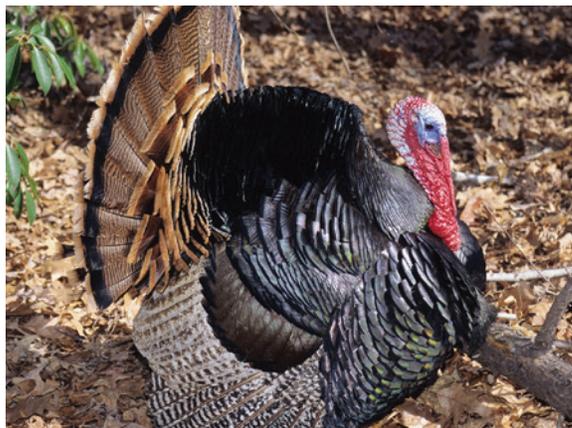


Photo by Va. Dept. of Wildlife Resources

Wild turkey

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. In many parts of Virginia, deer herds exceed the cultural carrying capacity tolerated by people. Overabundant deer can also inhibit forest establishment and impact other native plants. With proper management of both habitat and population, our deer herd will continue to thrive without impacting the overall environment.

While white-tails are adaptable to a wide variety of conditions, good quality food, water and cover are essential. Ideal deer habitat includes a mix of nearly 50% brushy cover (harvested timberland or brushy field edges), 25% mature hardwood forest and 25% open field habitat. While forested lands usually provide good habitat, timber harvests can improve habitat quality for deer, if used to create a mixture of brushland, woodland, and herbaceous openings.

Deer have a varied diet and will eat practically anything green when necessary, but they display preferences that seem to be based on nutritional quality. Forests should be managed to maintain good quantities of grasses, herbaceous soft-stemmed plants, fruits, mushrooms and acorn-producing oaks. Generally, 50% 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% of the forest floor at noon. Leave a variety of hard and soft mast-bearing species in the residual stand to ensure some yearly mast production in the event one species of oak has a mast failure in a particular year. 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. These

herbaceous habitats also provide important cover for songbird nesting, rabbit nesting and feeding, deer fawning, and insect foraging areas for turkey, grouse, and songbirds in summer. Natural openings in forests should be maintained by annual mowing, disking, or prescribed burning. Openings of one to three acres in size should be located throughout a forest stand 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. Note that good quail management equals good deer management.

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) [<https://dwr.virginia.gov/wildlife/deer/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 DWR wildlife biologist.



White-tailed deer

Non-Game Species Habitat Management

The designation “non-game” is for those species that are not hunted, trapped, or fished. It also includes threatened and endangered species, such as the peregrine falcon, northern flying squirrel and many species of birds.

Overall habitat improvement will benefit both game and non-game species. Diversity in habitat types and ages will support a variety of species. By providing mixed habitats that support a variety of different habitat structures in relation to nesting, roosting, cover, and foraging preferences over the course of a year, it is possible to support many species in one 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 (brush 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: year-round residents, winter visitors, and summer visitors. All songbirds, regardless of whether they are seed or fruit eaters at other times of year, will consume primarily invertebrates during the breeding season to meet the protein needs of rapidly developing nestlings. Also, insect-eaters may switch to eating fruits on their Central and South American wintering grounds. However, the food requirements are only part of the equation. There are other requirements that are being met by different habitat types, such as nesting areas, roosting structure, and escape cover.



Pileated woodpecker

Year-round Residents

These are often the birds that we are most familiar with: cardinals, blue jays, chickadees, Carolina wrens and bluebirds, just to name a few. They are the residents of small farm woodlots as well as city parks and yards. 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.

Many 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 concealment and escape cover from hawks, particularly in the winter, so holly, mountain laurel, sweetbay, or similar evergreens make for a valuable mid-story component in woodlots or around yards.



White-breasted nuthatch

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,

brushy hedgerows and forest/field edges. A plan of mixed forests and idle fields with hedgerows accommodates the needs of most winter visitors. Managing habitat as described previously for bobwhite quail will benefit many of these species also.



Dark-eyed junco

Summer Visitors

Summer brings 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, 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. The goal is 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 (diameter limit cuts) when a selective harvest 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, structure, and food. 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 brood parasites, laying their eggs in the nests 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, including along logging roads leading into the forest interior. 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 before 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 may improve pine stands for wildlife and improve tree growth. Ideal areas for many summer songbirds are habitats that can 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 or wintering areas to the south.

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, and even small woodlots are used.

Increasing the width of forested buffers along streams, even to the point of doubling recommended buffer widths 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 nesting habitats for shrubland birds and 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 DWR website.

Department of Wildlife Resources

<https://dwr.virginia.gov/wildlife/>

Managing Land in the Piedmont of Virginia for the Benefit of Birds and Other Wildlife

https://dwr.virginia.gov/wp-content/uploads/Managing_Land_Guide_2016_large.pdf



Field sparrow eggs

Photo by Va. Dept. of Wildlife Resources



Brushy habitat for traveling birds



Tree-lined fence rows



Grassy habitat for traveling birds

Threatened and Endangered (T&E) Species

Being “stewards of the forest,” many landowners are very concerned about the myriad of threatened and endangered (T&E) species that reside in Virginia. Most private forest landowners probably purchased 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 as an opportunity to conserve biodiversity, other landowners may shudder to think of having such a species on their land, fearing restrictions on their management opportunities. Landowners are required, by the federal Endangered Species Act (ESA) and Virginia’s endangered species laws, to avoid 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: landowners are exempt from T&E plant restrictions for activities on their 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).

In the preparation of the Forest Stewardship Plan, foresters have the ability to determine if there are any rare, threatened, or endangered species near a property by using the DWR’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 three-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.



Smooth purple coneflower
(*Echinacea laevigata*).

Photo by Karan A. Rawlins, University of Georgia, Bugwood.org

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 them meet management goals, even if T&E species are present. The key is to assess what, if any, species are present on a 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 management of forestland. The key is to determine what T&E species are present before starting a project.

Additional content is available from Virginia Tech and other agencies.

Virginia Tech Threatened and Endangered Species

<https://forestupdate.frec.vt.edu/resources/endangered.html>

Virginia Tech Guide to Threatened and Endangered Species on Private Lands in Virginia

https://www.pubs.ext.vt.edu/content/pubs_ext_vt_edu/en/420/420-039/420-039.html

DWR Threatened and Endangered Species

<https://dwr.virginia.gov/wp-content/uploads/media/virginia-threatened-endangered-species.pdf>

CHAPTER 8

FOREST RECREATION



Recreational Benefits of Forests

Owning forestland affords you many uses of the forest. Some of those uses are 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 what types of recreational activities to have on your forestland. You should consider:

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

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. You may be simply observing nature, enjoying the sunshine, playing outdoor games with friends, or brushing up on your photography skills. This type of passive recreation is compatible with almost any other management activity.



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-sleeved top and pants are recommended even in warm weather, to help protect from bugs, scrapes, thorny plants, poison ivy, and sun exposure.
- ◆ 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 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. Access roads or trails offer a good place for enjoying the forest while getting exercise. Mountain bikes can be used in some areas that are more rugged and harder to navigate. If you are constructing a bike trail, use the guidelines outlined in the trail section. The maximum grade should be 10% to 30% 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 a tread width of 12 to 24 inches.



Horseback Riding

Horseback riding is a popular pastime for many people, and there are clubs 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, use the guidelines outlined in the trail section. The maximum grade should be 15% to 30% for 200 to 500 feet. Clearings should be six to eight feet wide, eight to 10 feet tall, with a tread width of 24 to 36 inches. Care should be taken with stream crossings on horse trails to ensure that sediment will not enter the stream.



Camping

A forested tract offers a good opportunity for camping, especially for 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 can 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 a 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 (ATVs) by landowners and the general public. ATV trails on your timberland should be treated as if they are small roads. 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 DWR website.

When you are determining management options for your timberland, you will need to determine for which wildlife species 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, and field edges are some of the items that can be used to enhance the hunting experience.

<https://dwr.virginia.gov/hunting/>



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 DWR website.

If your tract has a pond or stream, you may have 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 to provide some control over fish species composition and predator-prey balance. 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.

<https://dwr.virginia.gov/fishing/>

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.

<https://dwr.virginia.gov/boating/>



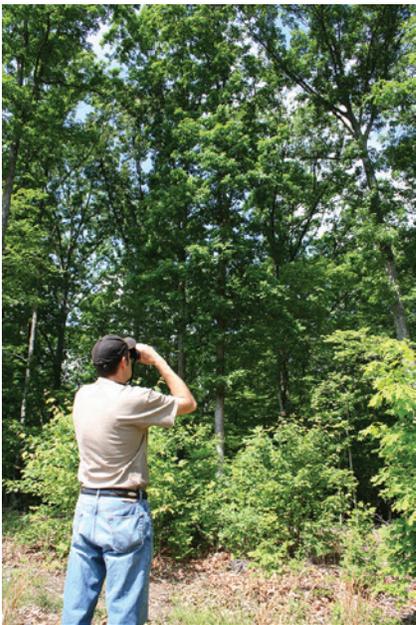
Wildlife Watching

Wildlife watching is something you can do alone or with the whole family. 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. Follow these tips from experienced behavior watchers to witness wildlife without startling them or sapping their energy.

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 into the woods 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

- ◆ 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 to get a better look at small animals and insects.

“Catch” a Fish View

- ◆ Crouch when you approach a stream or lake bank to avoid being seen by 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 edge, or 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 many species.
- ◆ Consider the weather. After a rain, for instance, many animals emerge to feed.



Wildlife Are Watching

- ◆ 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.

A Texas Guide to Wildlife Watching

https://tpwd.texas.gov/exptexas/view/wildlife_watching/



Trail Location and Guidelines

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.

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.

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 ideal alignment will fit the trail to the ground and afford the user the best views from the trail.

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 sites, 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 and skid trails having few travelers may be used to avoid the soil disturbance associated with new trail construction.
- 7) Provide vistas, 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 slides and tree falls, unless hazards can be removed.
- 11) Take advantage of vegetation and terrain to maintain a natural atmosphere where possible.
- 12) As a general rule, the trail should have a grade of 1% to 7%. Do not locate on zero grades. Some grade is necessary for drainage.

Detailed trail construction plans can be found on the USDA Forest Service website [<https://www.fs.usda.gov/managing-land/trails/trail-management-tools/trailplans>].



Trail specifications should match intended use.

Trail Design

Trails should be designed in keeping with their proposed use. In general, the trail should incorporate features that reduce adverse impacts upon the environment, ensure safety and enjoyment of users, result in a trail of high quality and permanence, and provide 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, a width of 4 to 6 feet and a height of 8 to 10 feet should be cleared around the trail. Horse trails should be cleared to accommodate a horse and rider without any hazards: 8 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, trees cut near the trail should be flush with the ground and the stumps covered with soil. Avoid unnecessarily cutting trees with a dbh (diameter at breast height) greater than 4 inches. Cut any snags, leaners, or hazard trees that appear likely to drop across the trail. Cut limbs at the branch collar or back to the next limb outside the clearance limits to encourage healing and promote a more natural-looking appearance.

Leave ferns, grasses, and other low vegetation to present a more attractive trail environment. Spread logs, branches, and other debris away from the trail in a way that will appear natural to the trail user and prevent a potential fire hazard.

Drainage

Drainage control on a trail involves two primary types of water control: **surface water** and **subsurface water**.

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. 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.

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.

Another method of diverting water is the use of water bars. Water bars are generally made with an 8- to 10-inch diameter log laid at a 20- 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.

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.

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.

Table 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 more than 16 million acres, or two thirds of Virginia, and these forestlands make significant contributions to the natural and economic health of the Commonwealth. Since 1977, the Commonwealth has lost more than 300,000 acres of forestland. Although as a whole, the state has gained forestland since 2007, rapid loss of forestland is still occurring in parts of the state, including around metropolitan areas, in coastal regions, and along major transportation corridors. This conversion most often occurs soon after forestland is passed from one generation of landowners to the next. 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.
- ◆ Mitigate the effects of sea level rise and prevent flooding.
- ◆ Maintain healthy temperatures in urban communities.
- ◆ Provide wildlife habitat.
- ◆ Offer recreation opportunities and promote mental and physical wellbeing.
- ◆ Provide revenue and jobs.
- ◆ Sustain scenic beauty for tourism.
- ◆ Represent valuable historic and cultural resources for a diverse set of communities, families, and peoples.

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.



Conserving Your Land

There are many options available to landowners to help them keep their woodlands intact, in family, and in forest. Each of the conservation tools and strategies below falls somewhere on the spectrum from strong to weak protection. Ideally, all forest landowners will find a conservation tool, or a suite of tools, appropriate for their situation. Hopefully, landowners who are interested in forest conservation will progress toward stronger protection measures over time.

Forestland conservation tools may range from those that permanently protect land from development to less restrictive tools that help current owners plan and prepare future generations for forest ownership. In this chapter and in Chapter 11, which presents some tax incentives for conservation-minded landowners, various tools are introduced for landowners to consider. No tool fits all, but different tools may work better for particular landowners and contexts.

While most landowners desire to see their land stay intact and in forest, most end up doing little toward accomplishing this goal. In Virginia, we have a multitude of tools and support programs in place to enable landowners with a conservation ethic to protect their lands from development.

Conservation Easements

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

When landowners enter property into a conservation easement, they surrender some of their rights to develop their property as well as the right to most industrial uses of the property. Landowners retain all the other rights of private ownership, such as the right to sell the property or leave it to their 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.

Conservation easements can financially benefit landowners. A gift of a conservation easement to a state agency or other qualified easement holder can qualify the landowner for a federal income tax deduction, a state income tax credit, local property tax reductions, and federal estate tax exemptions. In addition, several programs exist that will directly pay landowners for all or a portion of the monetary value of their conservation easement or particular development rights. These include the Forest Legacy Program, the Virginia Land Conservation Foundation, and Purchase of Development Rights programs that are usually administered by localities. [{See Key Funding Programs}](#)

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.

To learn more about conservation easements and organizations that are qualified easement holders, visit these websites.

VDOF Conservation Easements

<https://dof.virginia.gov/forest-management-health/forestland-conservation/conservation-easements/>

DCR Who Can Help Me Protect My Land

<https://www.dcr.virginia.gov/land-conservation/help-protect>

Land Trust Alliance Find a Land Trust

<https://www.findalandtrust.org/land-trusts>



Key Funding 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.

<https://www.fs.usda.gov/managing-land/private-land/forest-legacy>

Virginia Land Conservation Foundation (VLCF)

The Virginia Land Conservation Foundation (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.

<https://www.dcr.virginia.gov/land-conservation/vlcf>

Enviva Forest Conservation Fund

The Enviva Forest Conservation Fund, a \$5 million, 10-year program sponsored by Enviva and administered by the U.S. Endowment for Forestry and Communities, is designed to protect tens of thousands of acres of sensitive bottomland forests in the Virginia-North Carolina coastal plain. The Enviva Forest Conservation Fund will award matching-fund grants to nonprofit organizations to permanently protect ecologically sensitive areas and preserve working forests.

<https://envivaforestfund.org/>

Donating Land to the 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, 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 guarantees that the land will be dedicated to forestry forever. State ownership can provide public recreation and hunting opportunities that may not be available under private ownership. State ownership can 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.

It is worth noting that, as with conservation easements, other organizations in Virginia accept donations of land and will conserve them as forests, including land trusts, other non-profit conservation organizations, and other state agencies, such as the Department of Wildlife Resources and Department of Conservation and Recreation. The decision about which organization a landowner chooses to donate to should be based on donor priorities for how the land is to be used and managed in the future and the receiving organization’s capacity for ensuring that those priorities are implemented. For example: Will public access and outdoor education be well supported? Will biodiversity or historic resources be well protected? Will sustainable forest management be encouraged?



Estate and Legacy Planning

Most people are familiar with the concept of estate planning – a process, using financial and legal planning tools, that individuals or families go through to distribute their assets to their heirs, including their lands, house, bank accounts, personal property, life insurance, stocks and bonds, etc. Estate planning is an important exercise for all landowners who want to do right by their heirs and their land.

While an estate plan is an essential piece of the puzzle, it may not be enough to ensure that the landowner’s values, land ethic, and land management goals are adopted by future generations.

Legacy planning is a more comprehensive process for planning how a landowner’s property, values, and management goals are passed to future generations. It is an ongoing process for landowners to share with their heirs all that they value about their land and to include heirs in land management and planning.

This multi-step process involves:

- ◆ Setting financial and land-management goals;
- ◆ Identifying all the landowner’s assets;
- ◆ Consulting a team of experts, including foresters, lawyers, and CPAs; and
- ◆ Meeting with family members to visit the land, share experiences, and discuss the family’s dreams for the land.

Legacy planning draws on financial and legal tools, like durable powers of attorney, life insurance, and ownership structures, such as LLCs and trusts, to ensure that assets are protected, and that financial needs of heirs are met. However, it also draws on land conservation tools, like forest management plans, conservation easements, conservation tax-incentives, and cost-share programs, to ensure that a landowner’s woodlands stay intact, in forest, and in the family.

Generation NEXT Program

The Generation NEXT Program is a joint effort of the VDOF and Virginia Cooperative Extension to combat the loss of forests and other rural lands in Virginia. The goal of the program is to keep Virginia’s family-owned forests intact, in forest, and in family ownership by encouraging and equipping forest landowners and their families to plan the intergenerational transfer and long-term future of their forests. Through training materials and workshops co-facilitated by natural resource professionals, attorneys, and financial planners, the program educates landowners and their families about the conservation, legal, and financial tools that are available to them, and helps them start the difficult yet rewarding process to complete a Legacy Plan.



Take steps to ensure your land will remain intact, in forest, and in the family:

- 1) Begin the process and commit to keep moving forward
- 2) Determine your family assets
- 3) Write down long-term goals for your land
- 4) Hold a family meeting
- 5) Gather or create essential documents
- 6) Establish your legacy planning team
- 7) Determine the legal, financial, and conservation tools available to help you meet your goals
- 8) Provide opportunities for your family to learn about and enjoy your woodlands
- 9) Revisit your plan on a regular basis and adapt as your land, assets, and family change

More information on Legacy Planning and the Generation NEXT Program is available online [<https://ext.vt.edu/natural-resources/legacy-planning.html>].

For more information on tax incentives and related programs that incentivize forest conservation, see Chapter 11. {*See Chapter 11 Taxes and Financial Assistance*}



Conservation Agencies

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

<https://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).

<https://www.dcr.virginia.gov/>

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

<https://www.vdacs.virginia.gov/>

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

<https://www.dhr.virginia.gov/>

Virginia Department of Wildlife Resources (DWR) – Conservation of wetlands and wildlife habitat, as well as wildlife management areas.

<https://dwr.virginia.gov/>

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

<https://www.vof.org/>

For additional information, contact your local VDOF office.

<https://dof.virginia.gov/contact-us/>

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

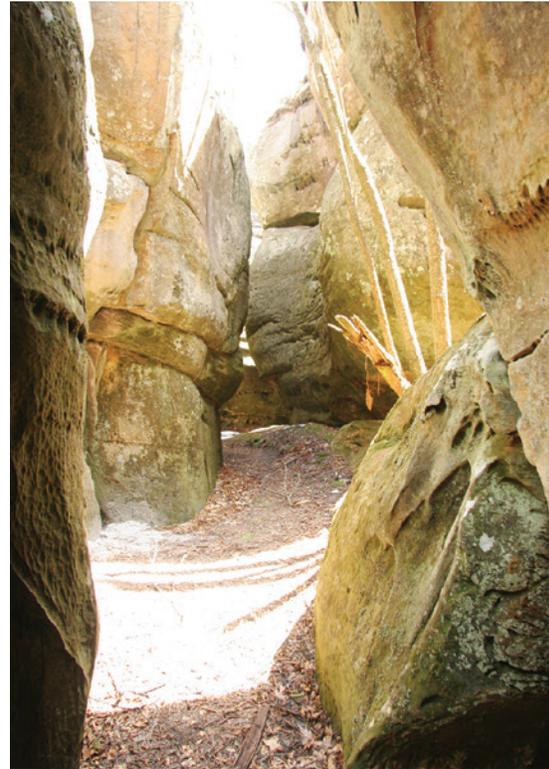
Virginia has been called an “ecological crossroads” for its vast range of distinctive natural communities, physiographic regions, and natural features. Here, southern and northern ecosystems are found in proximity. From the Cumberland Plateau to the Eastern Shore, the Commonwealth encompasses a tremendous 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 an expanding 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.

DCR's Natural Heritage

<https://www.dcr.virginia.gov/natural-heritage/>



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 this kind is 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, 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 [<https://www.dcr.virginia.gov/natural-heritage/>].



Historic Resources

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 \$22 billion tourist industry.

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.



The Charles Irving Thornton tombstone on Cumberland State Forest, with an inscription written by Charles Dickens, is on the National Register of Historic 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 [<https://www.dhr.virginia.gov/historic-registers/>], 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 [<https://www.dhr.virginia.gov/>].

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 the trees grow, while remaining 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.

VDOF Financial Assistance Programs

<https://dof.virginia.gov/financial-assistance-programs/>

However, for the most current information regarding cost-share programs, contact your local VDOF forester [<https://dof.virginia.gov/forest-management-health/landowner-assistance/find-a-forester/find-a-vdof-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 both 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 those practices. However, it is very important that the landowner's management plan, not the cost-share incentive program, directs the activity or practice. 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)
<https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index>
- ◆ Conservation Reserve Enhancement Program (CREP)
<https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index>



USDA Natural Resources Conservation Service (NRCS)

- ◆ Environmental Quality Incentive Program (EQIP)
<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/va/programs/financial/eqip/?cid=nrcseprd1308394>
- ◆ Conservation Stewardship Program (CSP)
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/va/programs/financial/csp/>



Virginia Department of Forestry (VDOF)

- ◆ Reforestation of Timberlands Program
<https://dof.virginia.gov/forest-management-health/landowner-assistance/financial-assistance-programs/reforestation-of-timberlands-program/>
- ◆ Hardwood Habitat Incentive Program (HHIP)
<https://dof.virginia.gov/forest-management-health/landowner-assistance/financial-assistance-programs/>



Virginia Department of Conservation and Recreation (DCR)

- ◆ Virginia Agricultural Cost-Share Program (VACS)
<https://www.dcr.virginia.gov/soil-and-water/costshar2>

Contact your local VDOF 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 [<https://www.timbertax.org/>] and “Tax Tips for Forest Landowners for the Current Tax Year.”

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. They 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.

Excellent references for landowner timber income tax questions can be found at the USDA Southern Research Station website – see Agricultural Handbook No. 718 and No. 731, Forest Landowner’s Guide to the Federal Income Tax [<https://www.srs.fs.usda.gov/pubs/42921>].

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 website [<https://www.timbertax.org/>]. *{See Forest Conservation: Estate and Legacy Planning}*

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 or visit Virginia’s Land Use-Value Assessment Program website [<https://luva.aaec.vt.edu/>].

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 [<https://dof.virginia.gov/water-quality-protection/water-quality-protection-landowner-assistance/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, October 2015*



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 Cooperative Extension
- ◆ NRCS State Technical Committee
- ◆ Local Government
- ◆ Soil and water conservation districts
- ◆ Consulting foresters
- ◆ 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 state Forest Action Plan.
- ◆ To provide assistance and recommendations concerning priority issues and geographies for focused program delivery and to encourage Landscape Stewardship; and
- ◆ To provide advice and recommendations concerning the Forest Legacy Program.

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.
- ◆ Include landowner information.
- ◆ Include location and plan maps.
- ◆ Clearly state landowner objectives.
- ◆ Describe current forest condition.
- ◆ Describe desired forest condition.
- ◆ 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 by clearly understanding the plan’s details and desired outcomes.

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
- ◆ Agroforestry
- ◆ Aesthetic quality and desired timber species
- ◆ Recreation
- ◆ Wood and fiber production
- ◆ Fish and wildlife
- ◆ Threatened and endangered species
- ◆ Forest health and invasive plants
- ◆ Conservation-based estate planning/legacy planning information
- ◆ Archeological, cultural, and historic sites
- ◆ Wetlands
- ◆ Fire
- ◆ Carbon sequestration and climate resiliency
- ◆ Forest of recognized importance

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 a 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. When Forest Stewardship Management Plans are desired to align with American Tree Farm standards, forests of recognized importance (FORI) must be considered.

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.

Monitoring is an important component of successful Forest Stewardship Management Plan implementation; therefore, the state forestry agency must annually monitor a portion of all Management Plans. States use the Stewardship Mapping and Reporting Tool (SMART) to generate a plan monitoring sample each year and record monitoring results.

Selected properties will be visited and assessed by state, USDA 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.

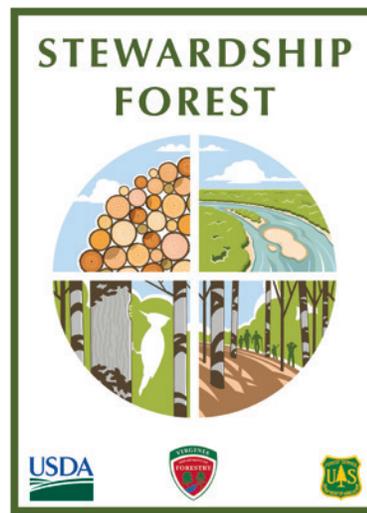
Stewardship Certification

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 Steward certification, the landowner is first nominated by the forester who is assisting him or her in carrying out the recommendations in his or her Forest Stewardship Management Plan. A Forest Stewardship Program Certification Inspection Record (Form 7.11) 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 natural resources, including both environmental and economic benefit shared by all Virginians.



Stewardship Forest Certification Criteria

Landowners who make substantial accomplishments toward implementing their management recommendations and reaching their goals will be publicly recognized, if possible, as a Certified Forest Steward for their accomplishments. All landowners enrolled in the Forest Stewardship Program will become recipients of various mailings on topics of interest and should remain in close contact with resource professionals so that their accomplishments can be maintained.

Eligibility

To be eligible for certification as a Certified Forest Steward, properties must be actively managed with a truly multiple-use forest management approach based upon the landowner's priorities and objectives. This involves performing management activities that enhance the following resource areas:

- ◆ Timber Growth
- ◆ Aesthetics
- ◆ Soil and Water Conservation
- ◆ Wildlife Habitat
- ◆ Recreation
- ◆ Historic and Cultural Resources

Woodland livestock grazing may also be included as one of a landowner's management objectives if a portion of the property is used for that purpose.

It is important to note that multiple-use benefits do not have to be obtained on every acre. Some areas may provide only one benefit, while other areas may provide many uses. When the property is considered as a whole, however, the landowner must demonstrate active management for at least two of the above-mentioned resources.

In addition to active management, passive management within forested wetlands and streamside management zones (SMZ) will be viewed as good overall management and worth recognizing during the certification process.

Stewardship certification is a subjective decision recommended by the local VDOF forester, forestry consultant or other forestry professional, and made by the regional stewardship coordinator or state stewardship coordinator. As a rule of thumb, landowners who have practiced no previous active management before entering the program may need one to three years to bring their properties up to program standards. However, landowners should not have to wait for certification until they have performed all practices described in their Forest Stewardship Management Plans.

Inspection Procedure

Agency representatives, landowners, or consultants may request a certification inspection for a participating property by contacting the local VDOF forester or regional stewardship coordinator. The certification inspection team will consist of the regional coordinator, VDOF forester, and any other resource professional that had input into the plan. The landowner can also be present, if possible.

Nomination

Any consulting, industrial, or VDOF forester, or other natural resource professional that is assisting the landowner in carrying out the recommendations in his or her Forest Stewardship Management Plan may nominate the landowner using the Form 7.11 Forest Stewardship Program Certification Inspection Record.

Award

In recognition of certification as a forest steward, the landowner receives a letter of acknowledgment and congratulations for his achievement from the State Forester. The nominating forester schedules an appropriate recognition event for presentation of a special stewardship plaque and a “Stewardship Forest” sign for placement on the forest property. This special landowner recognition is publicized as deemed appropriate through local and statewide media, and agency/organization information newsletters.

Follow-Up Reinspection

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. After a minimum of 10 years, the forester will revisit the tract where a Forest Stewardship Management Plan was completed and reevaluate the plan, the tract, and the landowner’s progress to ensure that the landowner is continuing to practice good resource management.

Minimum Standards and Basic Guidelines for Certification

These minimum standards and basic guidelines are designed to help the natural resource manager or specialist with his involvement in the Forest Stewardship Program. The natural resource professional should use these criteria as a measure of the landowner’s progress and accomplishments towards forest stewardship certification.

To use the criteria, the natural resource professional must know the landowner’s resource management objectives. To qualify for stewardship forest certification, a landowner must manage one of his resources intensively as his primary management objective and also designate at least one secondary resource management objective. With the landowner’s objectives known, the natural resource professional can refer to the appropriate minimum standards and basic guidelines in determining whether the property and landowner should be certified.

Though a landowner may do much more than the criteria listed, these are minimum standards he/she must do to qualify. In addition, a special category of Preliminary Standard Accomplishments is listed. Regardless of a landowner’s resource management objectives, he/she must meet all of these criteria to qualify for certification.

Preliminary Standard Accomplishments

- ◆ Protection from wildfire, insects, and disease
- ◆ Salvage of damaged timber, unless it interferes with primary and secondary resource management objectives
- ◆ Definite plans to regenerate all lands before final harvest, unless there is a land-use change
- ◆ Primary and secondary resources managed in a way least damaging to other resource values
- ◆ Water quality maintained and erosion minimized by following BMPs
- ◆ Protection of natural heritage resources including unique plant communities, important wildlife habitat, endangered species habitat, archaeological, and historical resources

Timber Production

Primary Objective Criteria

- ◆ Active protection of stand from wildfire, insects, and disease by:
 - ✧ Reducing wildfire hazard
 - ✧ Salvaging all damaged timber in a timely manner
 - ✧ Managing stands in a manner that reduces insect or disease hazard
- ◆ Planned regeneration occurring soon after final harvest
- ◆ Timber harvested before biological maturity of the stand
- ◆ Stands thinned as needed to maintain vigor
- ◆ Size and shape of harvested areas compatible with other objectives
- ◆ Tree species favored and managed that are best adapted to specific sites
- ◆ Non-merchantable trees controlled as compatible with other objectives
- ◆ Stands managed toward achieving full stocking
- ◆ Livestock grazing limited to levels compatible with the resource plan
- ◆ Forestry BMPS implemented where appropriate

Secondary Objective Criteria

- ◆ Salvage of damaged timber, unless it interferes with primary objective
- ◆ Planned regeneration occurring in a timely manner after final harvest
- ◆ Stands thinned as needed to maintain vigor

- ◆ Trees which may reach biological maturity, but harvested before decline, becomes evident in the stand
- ◆ Tree species favored and managed that are best adapted to specific sites, unless it interferes with other objectives
- ◆ Non-merchantable trees managed, unless it interferes with other objectives
- ◆ Adequate stocking maintained in stands compatible with other objectives and past history
- ◆ Size and shape of harvested areas compatible with other objectives
- ◆ Forestry BMPS implemented where appropriate

Wildlife

Primary Objective Criteria

- ◆ Feature species identified and wildlife management plan followed
- ◆ Enough suitable habitat deliberately created, maintained, and improved to support fairly dense populations of desired species
- ◆ Wildlife populations kept from becoming so dense they are damaging their own habitat or the habitats of other species
- ◆ Other resources managed to enhance the habitat of featured wildlife species

Secondary Objective Criteria

- ◆ Desired species identified and wildlife management plan followed
- ◆ Some habitat created, maintained, and retained for desired species consistent with primary objective
- ◆ Wildlife populations kept from becoming so dense they are damaging their own habitat or the habitats of other species

- ◆ Other resources managed in ways that supply some habitat needs of desired wildlife species, considering the property as a whole

Environmental and Recreation

Primary Objective Criteria

- ◆ Develop management plan to protect, enhance, utilize or restore identified natural heritage historic resources
- ◆ Recreational use specified and management plan followed
- ◆ Recreational opportunities such as picnic areas, campsites, riding or walking trails, or boat docks, etc., must be actively maintained, retained and created
- ◆ Litter controlled
- ◆ Actual recreational use of property
- ◆ Environmental impact of recreational activities minimized
- ◆ Area with hunting as recreational use must show evidence of developing hunting opportunities beyond wildlife management
- ◆ Significant accomplishments toward maintaining or enhancing aesthetics must be shown

Secondary Objective Criteria

- ◆ Development management plan to protect, enhance, utilize or restore identified natural heritage and historic resources
- ◆ Recreational use specified and management plan followed
- ◆ Recreational opportunities maintained, retained, and created as compatible with primary objective
- ◆ Litter controlled in recreational activities
- ◆ Environmental impact of recreational activities minimized
- ◆ Areas with hunting as recreation use must show evidence of developing hunting opportunities beyond

wildlife such as hunting blinds, camping areas, etc.

- ◆ Some accomplishments toward maintaining or enhancing aesthetics must be shown. Examples include the following:
 - ✧ Retaining trees with good fall colors
 - ✧ Planting or maintaining flowering trees, shrubs, and wildflowers
 - ✧ Identifying and maintaining scenic overlooks, unique geological features
 - ✧ Improving access to scenic areas

Soil and Water

Primary Objective Criteria

- ◆ Conduct all land management activities on both forest and agricultural lands in accordance with BMPs or field office technical guide (SCS)
- ◆ Significant accomplishments towards conserving soil and enhancing water quality must be shown. Additional examples include the following:
 - ◆ Completing projects suitable for BMP demonstration areas
 - ◆ Rehabilitating critical areas and stabilizing old roads
 - ◆ Maintaining streamside management zones and filter strips
 - ◆ Manage wetlands so as to maintain or improve their functions

Secondary Objective Criteria

- ◆ Accomplishment must be shown toward conserving soil and enhancing water quality. Examples include the following:
 - ✧ Maintaining cover on highly erodible lands
 - ✧ Use of BMPs on forestry and other land management practices

CHAPTER 13

GLOSSARY



Glossary

Abbreviations

- BMP** - Best Management Practice
- C/S** - Cost-Share
- DBH** - Diameter Breast High
- DCR** - Department of Conservation and Recreation
- DWR** - Department of Wildlife Resources
- VDOF** - Department of Forestry
- FSA** - Farm Service Agency
- 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, and water.
- ACID SOIL.** A soil having more hydrogen ions than hydroxyl ions, thus 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.
- 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 basic 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.
- 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. 2) A prescribed fire set to burn against the wind. Also called back-burn. 3) To set a backfire.

BARE ROOT-SEEDLING. Young tree shipped without its 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). Combination of practices that is determined by a designated authority 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 volume 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. 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 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. The first log above the stump, 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 diameter 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.

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).

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 establish riparian forest buffers. Funding comes from Farm Bill appropriations and the Virginia Department of Conservation and Recreation.

CONSERVATION RESERVE PROGRAM (CRP). A federal cost-share program for private landowners, administered by the USDA Farm Service Agency, to stabilize highly erodible land. 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 the wood). The logger reports this mill scale to the landowner. Payment to a landowner is based on these measurements taken at the mill where the wood is sold.

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.

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, 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.

CROP TREE RELEASE. A practice that shortens the harvest rotation of desirable crop trees by selectively cutting or killing less desirable competing trees in younger, overstocked forests. The competing vegetation should be killed or removed on three to four sides of the crop tree.

CROWN. The branches and foliage of a tree; the upper portion of a tree.

CROWN CLASSIFICATION. A way of classifying individual trees in a stand 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.

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.

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. 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.

DBH. *{See Diameter, Breast Height}.*

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. The linear distance across a tree trunk, technically passing through the center. Tree diameter is usually measured 4½ feet above ground level
{See Diameter, Breast Height}.

DIAMETER, BREAST HEIGHT (DBH). The diameter of a tree at 4½ feet above average ground level (except in National Forest practice, it is measured from the highest ground level).

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. Wood cut to standard sizes for use in construction and manufacture of furniture or other products. Softwood dimension lumber consists of boards more than 2 inches thick but less than 5 inches thick (i.e., 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 in an area.

DOMINANT TREES. The tallest, fastest-growing trees in a plantation or natural stand, which 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. A forest is an example of an ecosystem.

ECOSYSTEM SERVICES. The environmental benefits and services that forests provide, such as improving air quality; filtering sediment and runoff from reaching streams and lakes; promoting 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.

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 deals 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.

EPHEMERAL STREAM. A stream that flows only briefly during and following a period of rainfall in the immediate locality.

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 (e.g., 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 work in the woods. It is 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 absent or insufficient *{See Afforestation}, {See 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 leaf litter and unincorporated humus.

FORESTS OF RECOGNIZED IMPORTANCE (FORI). Land in or adjacent to National and State wildlife areas, significant archaeological and cultural sites, and riparian zones along significant navigable waterways. Significant sites can be anything from cemeteries, to battlegrounds, to old homesteads, to a spot of family significance.

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, practices, and business techniques 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.

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.

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.

GRADE. The slope of a surface such as a roadway. Also, the elevation of a real or planned surface or structure {See *Slope*}.

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. May be 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 for several months at a time.

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. 2) B-Horizon – The horizon of deposition to which materials have been added by percolating waters. 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, which may be incorporated or unincorporated in the mineral soil.

HYSOMETER. Any of several tools or instruments designed to measure the height of trees (e.g., altimeter).

IMPRINTING. A short-term, rapid learning process early in life of an animal 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 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. Included are cleaning, liberation, weeding, release, thinning, improvement, salvage and sanitation cuttings. An intermediate cut may generate income (commercial cutting) or, in some cases, may actually cost the forest landowner (a non-commercial cutting).

INTERMITTENT STREAM. A stream or body of water appearing and disappearing seasonally, sometimes dry.

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, SHADE. The characteristic of certain tree species that does not permit them to survive in the shade of other trees (e.g., 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 (also called yard).

LAYERING. Process of regenerating a plant by covering a lower branch with soil, after which the branch develops roots and can stand alone as a new plant.

LEACHING. Downward movement of a pesticide or other soluble material through the soil as a result of water movement.

LEADER, TERMINAL. The uppermost branch or vertical tip of the tree, which 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. A place where logs or tree-length material is assembled for loading and transporting (also called log landing, log yard, brow, or bunching area).

LOGGER. An individual whose profession is cutting timber.

LOGGING DEBRIS (SLASH). 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 {*See Board Foot*}.

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. Acorns or nuts (hard mast) or berries and fruits (soft mast). 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 pickax. It has a long handle and a stout head, which combines an ax 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 sold 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% 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 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 downed 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-abundance 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 have 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.

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 of animals 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.

PERENNIAL STREAM. A stream or body of water present throughout the year.

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.

PICKAROON. A device with a head similar to an ax 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 driven into the ground to support other structures.

PLANTATION. An artificially reforested area established by planting or direct seeding.

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 4 inches or more in diameter at breast height. The maximum size of poles is usually some diameter between 8 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 high mobility in the first day or two (e.g., young waterfowl).

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, to 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. Generally trees 5 to 9 inches DBH are used for pulp.

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 planted and 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 after harvest.

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, by means of seeding or planting, or natural, from natural seeding or sprouting.

RESIDUAL STAND. Trees remaining uncut, usually intentionally 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 diversity of wildlife and protect water quality.

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 4½ feet tall and up to 4 inches in 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 topsoil 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 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. A term of measurement in percent representing the increase in height over a distance measure. An increase of 1 foot over a distance of 5feet is expressed as a 20% slope *{See Grade}*.

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 (e.g., 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 several horizons, or layers: 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% mineral, 25% air, 25% water and 5% 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. Sale in which wood is sold "on the stump" and the sale price is based on the appraised, estimated volume determined by the forester.

SALTING. Any form of wood coloration caused by fungi. Although primarily found in dead trees, salting can also occur under stressed tree conditions or even in living trees. Although salting 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, not of seed 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% or more of the trees present are of the same species, and "mixed" otherwise.

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}*, *{See Crown Cover}*, *{See Stocking}*.

STEM. The portion of a tree that supports the branches; also called the bole or trunk.

STICK, BILTMORE. A rule graduated in such a way that the diameter of a 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. Some scale sticks may also measure tree height.

STOCKING. An indication of the number of trees in a stand as compared to the desirable number for best growth and management; terms are well-stocked, overstocked, or 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 game birds 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 Crown Class}*.

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, SHADE. 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 mature height of at least 15 feet and a trunk diameter of at least 3 inches.

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 American Tree Farm Program, an organization sponsored by the American Forest Foundation.

TREE INJECTOR. Equipment specially designed to inject chemicals into the trunk of a tree.

TREE RULE. A tree rule expresses the volume of standing trees (a log rule expresses the volume of cut logs).

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.

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 ¼ inch 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.

VIRGINIA AGRICULTURAL COST-SHARE PROGRAM (VACS). 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.

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, 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 a 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 (e.g., 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 (e.g., 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 bark.

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.



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)

For forest management planning and technical services, cost assistance, conservation easements, forest harvest monitoring, forest health, and wildfire prevention and protection, contact:

900 Natural Resources Drive, Suite 800
Charlottesville, Virginia 22903-0667
(434) 977-6555 | Fax: (434) 296-2369

<https://dof.virginia.gov/>

Virginia Department of Wildlife Resources (DWR)

For information and assistance on wildlife and habitat protection; wetland conservation, or wildlife management areas, contact:

7870 Villa Park Drive, Suite 400; PO Box 90778
Henrico, Virginia 23228-0778
(804) 367-1000

<https://dwr.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:

600 East Main Street, 24th Floor
Richmond, Virginia 23219
(804) 786-7951 | Fax: (804) 371-2674

<https://www.dcr.virginia.gov/natural-heritage/>

Virginia Department of Environmental Quality (DEQ)

For programs related to air, water, and land protection, including regulations, contact:

1105 East Main Street, Suite 1400
P.O. Box 1105
Richmond, VA 23218
(804) 698-4000 | (800) 592-5482

<https://www.deq.virginia.gov/>

Virginia Energy – 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

<https://energy.virginia.gov/geology/geologymineralresources.shtml>

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) 482-6446 | Fax: (804) 367-2391

<https://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

<https://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:

39 Garrett Street, Suite 200
Warrenton, VA 20186
Mailing Address: PO Box 85073, PMB 38979
Richmond, VA 23285-5073
(844) 863-9800

<https://www.vof.org/>

Virginia State University – College of Agriculture and Natural Resources

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) 524-5960

<https://www.vsu.edu/agriculture/>

<https://www.ext.vsu.edu/forestry>

Virginia Tech – College of Natural Resources and Environment

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 Cooperative Extension.

Cheatham Hall, RM 138, Virginia Tech
310 West Campus Drive
Blacksburg, VA 24061
(540) 231-5482

<https://cnre.vt.edu/>

Cooperative Extension Service

101 Hutcheson Hall (0402)
250 Drillfield Drive
Blacksburg, VA 24061
(540) 231-9347

<https://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

jgagnon@vt.edu

<https://forestupdate.frec.vt.edu/>

<https://www.facebook.com/VFLEP>

Federal Resources

USDA Natural Resources Conservation Service (NRCS)(Virginia)

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 | Fax: (855) 627-9827

<https://www.nrcs.usda.gov/wps/portal/nrcs/site/va/home/>

USDA Farm Service Agency (FSA) (Virginia)

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 | Fax: (855) 621-5866

<https://www.fsa.usda.gov/state-offices/Virginia/>

USDA Forest Service (USFS)

George Washington-Jefferson National Forest
Supervisor's Office

5162 Valleypointe Parkway
Roanoke, Virginia 24019
(888) 265-0019 | (540) 265-5100

<https://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.

Norfolk District
803 Front St.
Norfolk, VA 23510
(757) 201-7606

<https://www.usace.army.mil/>

Associations and Other Cooperators

American Forests

1220 L. Street, NW, Suite 750
Washington, DC 20005
(202) 737-1944 | Fax: (202) 737-2457

<https://www.americanforests.org/>

Association of Consulting Foresters (ACF)

A consulting forester is defined as “a professional forester who devotes not less than 75% 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.

376 McLaws Circle, Suite 1A
Williamsburg, VA 23185
(703) 548 0990

<https://www.acf-foresters.org/>

For a listing of consulting foresters serving Virginia landowners (including those who are members of ACF), visit:

<https://dof.virginia.gov/forest-management-health/landowner-assistance/find-a-forester/private-forestry-consultant-directory/>

Forest Landowners Association (FLA)

FLA is an organization founded in 1941 in the South to advocate for the interests of timberland owners.

406 Bradley Street
Carrollton, GA 30117
(404) 325-2954

<https://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
(334) 427-1029

<https://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
(703) 255-2700 | Fax: (703) 281-9200

<https://nationalwoodlands.com/>

The American Chestnut Foundation

The American Chestnut Foundation is working to restore the American chestnut to eastern woodlands.

TACF National Office
50 North Merrimon Avenue, Suite 115
Asheville, NC 28804
(828) 281-0047

<https://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 | (804) 559-0325

<https://vaswcd.org/>

Virginia Christmas Tree Growers Association

Virginia Christmas Tree Growers Association (VCTGA) is an association of professional Christmas tree growers interested in the growing and marketing of quality trees.

PO Box 315
Woolwine, VA 24185-0315
(540) 382-7310

<https://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

staff@vfpa.net

<https://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 | Fax: (804) 278-8774

<https://www.vaforestry.org/>

CHAPTER 15

ADDITIONAL RESOURCES

*Additional information and publications available at
dof.virginia.gov*

