

LANDOWNER GUIDE TO **BUFFER** SUCCESS



Image courtesy of Chesapeake Bay Program

An aerial photograph of a river winding through a landscape. On the left bank, there is a dense, green forest. The opposite bank features a mix of green trees and brown, harvested agricultural fields. The sky is clear and blue.

LANDOWNER GUIDE TO BUFFER SUCCESS

Image courtesy of Chesapeake Bay Program

Steps for Success
Throughout the year



AN INTRODUCTION TO THE LANDOWNER

*Image courtesy of
Pennsylvania Association
of Conservation Districts*

Guide to Buffer Success

Dear Landowner,

Thank you for choosing to restore a forested riparian buffer that will provide benefits to you, wildlife, your stream, and those downstream. The purpose of this guide is to help you succeed in your goal of establishing and maintaining an effective buffer. This guide includes insight from dozens of conservation professionals with experience on hundreds of sites.

We hope you can learn from our mistakes and avoid your own. Probably the most important task is maintenance, which for many projects involves applying herbicide spots around tree shelters in the spring and late summer.

Herbicides boost survival and growth rates to advance your trees quickly past their most vulnerable stage. Completing key tasks efficiently in the first three years will offer major payoffs in the long run.

This guide was originally written by partners in the USDA's Conservation Reserve Enhancement Program (CREP), but the information is highly relevant for any forested riparian buffer restoration effort. This version of the guide was tailored for Virginia landowners but should be helpful for buffer projects throughout the Mid-Atlantic. We suggest pinning this guide on a wall where it can be a convenient reminder for the next few years.

We also hope the photos and guidance inspire and remind you of the end goal of this work. Many resources and many efforts, public and private, ours and yours, are going into buffer restoration efforts.

We suggest pinning this guide on a wall where it can be a convenient reminder for the next few years. We also hope the photos inspire and remind you of the end goal of this work.

We wish you great success and believe this guide can help.

Yours in Conservation,

USDA Farm Service Agency,
USDA Natural Resources
Conservation Service, PA
Department of Environmental
Protection, PA Game
Commission, Chesapeake Bay
Foundation, PA Association of
Conservation Districts, PA
Department of Conservation
and Natural Resources,
Pheasants Forever, Alliance for
the Chesapeake Bay, and
Stroud Water Research Center

In this guide you'll find:

- *Activities by season that are key to success*
- *Tips to save time and improve outcomes*
- *Blank areas for making notes for future use (how many ounces of product for your sprayer, etc.)*
- *Photos with informative captions*
- *A summary of how trees help streams*
- *A fuller text with complete details and additional references*

The following have contributed to this publication:

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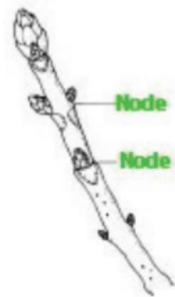
Image courtesy of Pennsylvania Department of Conservation and Natural Resources

February and March are the perfect months for supplementing your forested riparian buffer plantings with live stakes. Live staking is an easy way to propagate woody plants (trees and shrubs) from cuttings. Though live stakes can be purchased from some nurseries, they can also be harvested directly from existing trees and shrubs in your buffer. Live stakes are a cheap way to help stabilize streambanks or supplement streamside plantings, increasing the effectiveness and likelihood of your buffer's success.

Many wet-loving trees and shrubs that prefer growing along streambanks make excellent species for live staking because they sprout new roots in response to trauma to help the plant survive a perceived threat. Cutting a stem and driving it into the soil stimulates this survival rooting response. Some native species that may respond well to live staking include black willow, pussy willow, sandbar willow, buttonbush, common ninebark, red-osier dogwood, gray dogwood, silky dogwood, American sycamore, black elderberry, and arrowwood viburnum.

When harvesting live stakes, first be sure you can correctly identify the trees and shrubs from which you plan to take the cuttings to avoid accidentally establishing non-native invasive species. Because live stakes should only be harvested while dormant (in the winter before the buds break), it is helpful to identify and flag species while they have leaves and flowers or fruit. When you have a positive ID and are ready to harvest live stakes, cut branches that are roughly 1/2 to 1 & 1/2 inches in diameter in 2–3-foot lengths. Several stakes can be made from long branches but try to have 5-7 nodes per stake.

Nodes are small bumps on a stem or branch from which new leaves will grow in the spring. Hand-pruners, garden shears, or loppers all work well for cutting live stakes. To increase survivability, make sure to place the stakes in a bucket of water after harvesting to keep them from drying out. Usually, you can remove up to 30% of the branches from a tree or shrub without affecting it.



February–March Live Staking and Shelter Maintenance

Harvesting and Planting Live Stakes video

Watch Now:  YouTube

<https://youtu.be/VHXQW5IKQD8>

Credit: Pennsylvania Department of Conservation and Natural Resources

Steps for Success Late Winter

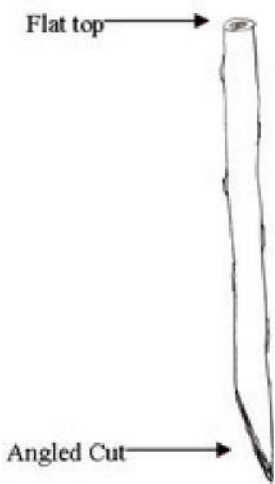


Image from Penn State Extension

Cut the bottom of the stake on an angle to form a point and make blunt/flat cuts across the top to keep the ends distinguishable. Trees grow better when planted right-side-up! The angled end will also help with inserting the stake into the soil. Side branches should be trimmed from the stakes so that you are left with a single stake.

Ideally, live stakes should be planted directly after cutting, but they can also be stored in a bucket of water or wrapped in wet cloth for several weeks. Be sure to keep these cuttings cold so they remain dormant until the planting occurs.

When planting your live stakes, place them one to four feet apart in rows or in triangular arrangements, and insert them at a 90-degree angle to the ground. Be sure they are close enough to the streambank or in an otherwise wet area to keep them moist to encourage root growth. Because of their lower survival, live stakes are typically planted more densely than bare root or containerized tree seedlings. With the angled end facing down, push the live stake into the soil until two-thirds of it is in the ground. If you have trouble pushing the live stake, you can use a rubber mallet to pound it (being careful not to split it) or you may need to move the stake to find a better location. If you're having trouble driving the live stakes into the soil, use rebar or another metal rod or drill to create "pilot holes" for live stakes. Pilot holes should be slightly smaller than the diameter of the live stakes.

Live stakes may not produce much growth above the soil in their first year, as they are busy developing strong roots. Usually, tree shelters are not used to protect live stakes, but this may be appropriate in some areas where deer browsing poses a serious threat.

February and March are also ideal times to conduct tree shelter maintenance! So, while you're out harvesting and planting live stakes, take a few moments to straighten any leaning tree shelters, replace damaged or missing stakes, and re-drive any loose stakes. Remove bird nets from trees that are approaching the top of their tubes (within 12 inches). While insects are inactive, remove any wasp nests, which can attract bears who will damage and knock down tubes.

Tree shelters significantly boost tree survival and growth by protecting trees from deer browse and rodent damage, while also allowing for easy application of herbicide to control competing vegetation. However, if left on too long, they can cause damage to the trees. Tube-type tree shelters can be removed completely when tree trunks are nearly the same size as the diameter of the shelter at the base of the tree. Fast-growing trees like tulip poplar and sycamore may need to have their shelters removed several years before slower-growing species like oaks. Alternatives to tube-type shelters, (such as wire cages) can be removed when the trees are approximately two inches in diameter at the top of the shelter.

Some tube-type shelters have perforations that would naturally allow the trees to split the shelters as they grow, but manual removal may still be necessary to avoid potential damage to the tree. Tight shelters can cause water and debris to become trapped, especially at the base of the shelter, causing rot. They can also girdle trees. Use a blade to carefully split the shelter along the perforation. Do not leave old tree shelters on the ground—dispose of them properly. Depending on where you live, you might even be able to recycle shelters.



Image courtesy of Penn State Extension

Images courtesy of Pennsylvania Association of Conservation Districts

April–May
Apply Herbicide!

3' diameter herbicide spots are a common and effective approach. On most sites, two applications per year are highly effective in promoting robust growth of trees and protecting them from rodents like voles.

Image courtesy of Stroud Water Research Center

Steps for Success
Spring

KEYS TO SUCCESS IN APRIL–MAY

Stone mulch can be an effective alternative to herbicide spots. “2A Modified” stone (mixed sizes) applied 2” deep x 12” diameter is one option. Ask your project advisor for details.



Image courtesy of Stroud Water Research Center

Herbicide Application Around Tree Shelters

Apply broad-spectrum herbicide (such as Roundup ProTM) around sheltered seedlings to protect them from rodents and to reduce competing vegetation. **Regular herbicide use is probably the single most critical step for overall success.** If certified professionals are doing the work, adding a pre-emergence herbicide can extend the benefits.

- 1. Spraying 3-4’ diameter spots around sheltered trees in April or May is a common and highly effective approach to protecting trees.
- 2. Always follow label instructions. Most herbicides are highly toxic to desirable trees, shrubs, and stream life.
- 3. In general, apply herbicide in April in Virginia. If unsure, consult your buffer project advisor.
- 4. For more information, see “Details for Spring Activities” later in the guide.

Tips: In spring, spray while grass is short but active, then mow later. In summer, mow before spraying to provide easy access. Remove bird nets as needed. Watch for and stay ahead of invasive species.

Work Records:

Years Spray is Needed:*	Date Done:	Products, Rates, and Amounts Used and Other Notes for Future Reference:
1		
2		
3		
4		
5		

**Spray is critical in years 1-3. Applications in years 4-5 will be valuable if feasible.*

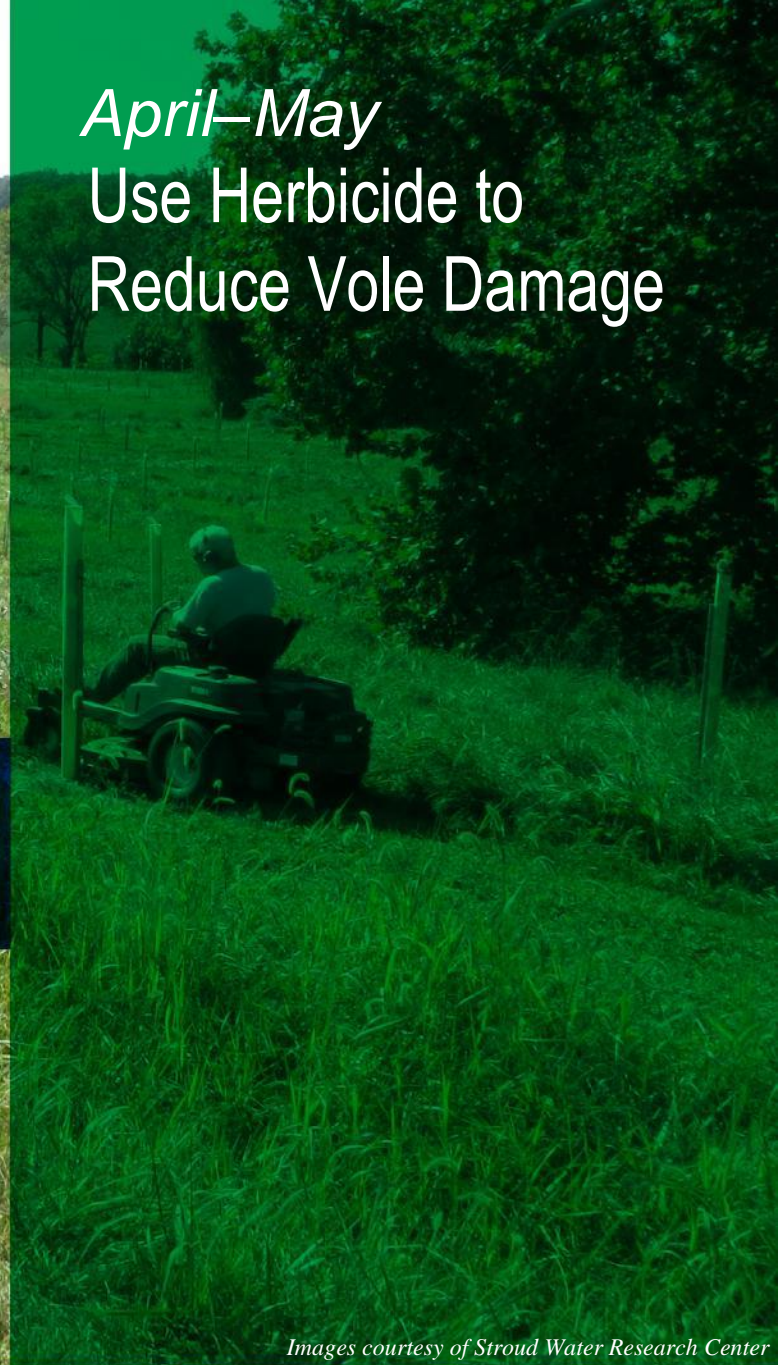
Nurseries and orchards rely on clearing competing vegetation with herbicides to control vole damage by eliminating their food and cover. Voles are a lead cause of reforestation project failures.



Voles can damage and kill trees until they reach 4-5" diameter. Herbicide use is key to getting trees quickly past this vulnerable stage.



April–May
Use Herbicide to
Reduce Vole Damage



Images courtesy of Stroud Water Research Center

Voles are small, mouse-like mammals that have been known to give birth to over 70 young in a year. Population surges are common.

Severe vole problems may require use of a rodenticide containing zinc phosphide, which is cheap and effective. Consult your project advisor if voles are a concern for your buffer project.

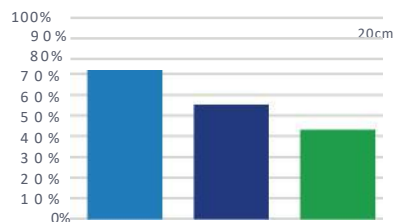
Steps for Success
Spring

KEYS TO SUCCESS IN APRIL–MAY

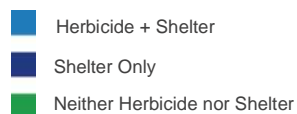
Herbicide Application Around Shelters

The graphs below show the key benefits of herbicide use around sheltered plants. Note that mere survival is not the goal—the goal is reforestation. In the second graph, only those plants protected by both shelters and herbicide were gaining in size. Declines in height in the second graph were due largely to voles killing the main leader, followed by resprouting of shorter side leaders. Robust growth is the goal, and routine herbicide use is probably the single most cost-effective step to aid this.

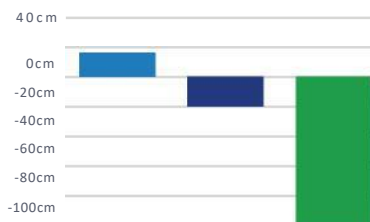
Tree SURVIVAL after two years:
Herbicide Helps



Percent Survival after Two Years
(Source: CBF research at Hopeland Farm)



Tree GROWTH after two years:
Herbicide Is Key to Growth



Growth (centimeters) after Two Years
(negatives mean loss of height)
(Source: CBF research at Hopeland Farm)

Stakes: *Regardless of the type of tree shelter, any non-biodegradable stakes must be removed before tree growth entraps them. This is for the health of trees and safety of future users of the site, such as for potential timber products.*

If shelters are removed, wooden stakes can be left in place and provide some benefits. If trees become droopy or floppy (typically happens only after leaf-out), fasten tree to stake with twine that will rot. Stakes may also deter buck rub. If located upstream of tree, stakes can even help in the event of flood. While they provide limited protection from large debris, they can reduce the amount of grassy debris collecting around the tree (which could lead to rot).



Image courtesy of Chesapeake Bay Foundation

June–July Managing Vegetation

Proper control of invasive species has allowed for native trees and shrubs to colonize this site over time.



Images courtesy of Chesapeake Bay Foundation

Invasive plants in riparian areas like this tree-of-heaven have been intentionally or accidentally introduced by human activity into a region in which they did not evolve, and they cause harm to natural resources, economic activity, or humans. Mid-to-late summer, when the tree is sending sugars down to the roots, is the best time to control tree-of-heaven using systemic herbicides.

Early detection and treatment of noxious and invasive plants can avoid major infestations and decrease treatment costs.

Steps for Success *Summer*

Image courtesy of Chesapeake Bay Foundation

Managing Vegetation that was Not Sprayed in Spring with Broad Spectrum Spray

Early detection and treatment of noxious and invasive plants can avoid major infestations and treatment costs. Best control strategies vary by species. Consult “Details for Summer Activities” at the end of this guide for references or more information. You can also consult your buffer project advisor.

Mowing should be used in buffers during the establishment period (first 2-3 years). Mowing is useful for discouraging weeds and voles but delays natural tree regeneration for those years. Discuss appropriateness of mowing with your buffer project advisor. Widespread mowing after year three is not recommended.

Bonus Tip: Plan a late-fall mowing to reduce vole habitat over winter but focus on the vegetation near the trees, not the middle of the row. Mowing only the middle of the row leaves high vegetation near the trees, which attracts voles in the winter. Lower vegetation near trees encourages rodents to find shelter and food elsewhere.

When spot spraying for noxious or invasive weeds, consider a selective herbicide such as 2,4-D that kills broadleaf plants, but not grasses. Using a broad-spectrum herbicide such as glyphosate will kill broadleaf plants and grasses. This leaves bare soil where weeds can flourish, since there is no grass to suppress them.

Date:

Notes on activities, products, rate, etc.

HIGHLY INVASIVE PLANTS

Listed by Virginia Department of Conservation and Recreation

Weeds like bull thistle should be controlled both before and after buffer installation.

Visit <https://www.dcr.virginia.gov/natural-heritage/invspdflist> to see more Virginia invasive plants

- *Ailanthus altissima*, Tree-of-heaven
- *Alliaria petiolata*, Garlic Mustard
- *Alternanthera philoxeroides*, Alligator-weed
- *Ampelopsis brevipedunculata*, Porcelain-berry
- *Carex kobomugi*, Japanese Sand Sedge
- *Celastrus orbiculatus*, Oriental Bittersweet
- *Centaurea stoebe* ssp. *Micranthos*, Spotted Knapweed
- *Cirsium arvense*, Canada Thistle
- *Dioscorea polystachya*, Cinnamon Vine
- *Elaeagnus umbellata*, Autumn Olive
- *Euonymus alatus*, Winged Euonymus
- *Ficaria verna*, Lesser Celandine
- *Hydrilla verticillata*, Hydrilla
- *Iris pseudacorus*, Yellow Flag
- *Lespedeza cuneata*, Chinese Lespedeza
- *Ligustrum sinense*, Chinese Privet
- *Lonicera japonica*, Japanese Honeysuckle
- *Lonicera maackii*, Amur Honeysuckle
- *Lonicera morrowii*, Morrow's Honeysuckle
- *Lythrum salicaria*, Purple Loosestrife
- *Microstegium vimineum*, Japanese Stiltgrass
- *Murdannia keisak*, Marsh Dewflower
- *Myriophyllum aquaticum*, Parrot Feather
- *Myriophyllum spicatum*, Eurasian Water-milfoil
- *Persicaria perfoliata*, Mile-a-minute
- *Phragmites australis* ssp. *Australis*, Common Reed
- *Pueraria montana* var. *lobata*, Kudzu
- *Reynoutria japonica*, Japanese Knotweed
- *Rosa multiflora*, Multiflora Rose
- *Rubus phoenicolasius*, Wineberry
- *Sorghum halepense*, Johnson Grass
- *Urtica dioica*, European Stinging Nettle



With invasive plants, early control is key. This autumn olive should be treated ASAP to prevent its spread in the buffer.



Don't leave vegetation high near trees.

IDENTIFICATION OF COMMON

Invasive Plants in Riparian Areas



Canada Thistle



Japanese Knotweed



Mile-a-Minute



Multiflora Rose



Chinese Privet



Japanese Honeysuckle



Tree-of-Heaven



Common Reed



Autumn Olive



Invasive plants are often found in the company of other invasives, like this oriental bittersweet and autumn olive.

For help in identifying and controlling invasive plants, you can refer to Virginia Department of Forestry's page on invasive plants:
<https://dof.virginia.gov/forest-management-health/forest-health/invasive-plants-in-virginia/>

Photo Credits
Chesapeake Bay Foundation
McKean County Conservation District
Jefferson County Conservation District
Cameron County Conservation District
PA Department of Conservation and Natural Resources

Forested Buffers: A Stream's Best Friend

Regular use of herbicides around shelters is key for highest possible survival and growth rates and faster canopy closure. Shade is a great deterrent to many invasive plants since they prefer high light conditions.

August–October Another Herbicide Application Around Tree Shelters



Spot spraying requires large spots to be effective—roughly 3-5-ft in diameter. Spraying continuous strips is even better. Combined with mowing, continuous strips provide fuller control of competing vegetation and voles but eliminate any natural tree regrowth for a few years.



Steps for Success Summer

Images courtesy of Chesapeake Bay Foundation

KEYS TO SUCCESS IN AUGUST–OCTOBER

Another Application of Herbicide Around Tree Shelters

Apply a broad-spectrum herbicide (like Roundup Pro™ or other glyphosate product) around sheltered seedlings. This application is like the one completed in the spring, but the pre-emergent can be omitted. Spraying can be done from mid-August through early October, depending on your region and site-specific conditions. This application will control competing vegetation and create bare soil conditions around tree seedlings. This spraying is a key defense against voles during winter when a lack of other food often leads to tree damage.

Autumn is also the right time to consider additional steps to avoid vole damage over winter. A late fall mowing removes cover for voles and increases predation. If not needed for vole control, omitting mowing may increase natural tree regeneration. Extreme vole problems may justify the use of an economical rodenticide containing zinc phosphide, applied by a professional. Consult your buffer project advisor to discuss mowing or rodenticides. More information is available at the right of this page.

Tips: This spray is especially critical on sites where substantial regrowth in treated areas has occurred since spring. Competing vegetation can be an issue in late summer/early fall.

Addressing regrowth of any grass is key since voles prefer grass over broadleaf plants for food and cover. While working, pay attention to tree health, whether there are invasives regrowing, and other details. Also mark any dead trees for replacement later.

Pine voles, and occasionally meadow voles, tunnel below ground and feed on roots of trees and shrubs.



Left: A monarch chrysalis waits to hatch on a milkweed plant.

Below: Pollinators gather nectar from a Joe Pye weed plant.



Additional information on voles:

Virginia Cooperative Extension:

<https://ext.vt.edu/lawn-garden/turfandgardentips/tips/mole-vole.html>

Cornell University:

<https://tinyurl.com/2nk7ynss>

Vole damage to young tree roots



Images courtesy of Chesapeake Bay Foundation

Follow all herbicide label instructions. The surfactant in Roundup Original™ is highly toxic to aquatic life! Formulations like Rodeo™ can reduce this risk.

As Needed

Following floods: Within one week of any flood, any time of year, check tree shelters. Downed shelters will kill trees. Leaning tubes invite rodent damage. Also check for damage to any fences, crossings, etc.

If replanting where voles are a concern, consider using black walnut, tulip (yellow) poplar, and shagbark hickory, which are not preferred by voles.



Images courtesy of Chesapeake Bay Foundation

Work Done:

Date Done:

Notes:

LANDOWNER GUIDE TO BUFFER SUCCESS

Benefits of Buffers

Establishing a riparian forest is one of the single most significant improvements you can make to your property. Streamside forests are critical for the health of the stream and its inhabitants, and for the delicate terrestrial ecosystem (called “the riparian zone”) that surrounds the stream. Luckily, these wet woods are also infinitely enjoyable for the landowner and managing the riparian area as a forest is a great way to save time, money, and energy in taking care of your land.

Before Europeans began to settle Virginia, all our whopping 49,000 miles of creeks, streams, and rivers ran through forests. Because the natural state of our streams is to flow through woods, a stream without trees is unlikely to be healthy. The trees and shrubs found along creeks armor the banks, preventing runaway erosion. They also provide the conditions necessary for aquatic life, from trout to the bugs that they eat. The shade from the tree canopy keeps water cool enough for these organisms to survive, and the leaves and branches that fall into the stream are a primary food source for the bugs (called benthic macroinvertebrates by biologists), which form the base of the creek’s food web. Those tiny bugs are also mightily important for water quality because many are filter-feeders that clean the water for us while going about their lives on the creek bottom. In our modern landscape, where only 62% of the Commonwealth is forested, having a forested riparian buffer around the stream also functions to filter runoff from upland communities and farms, so that the water is cleaner by the time it reaches the stream itself. In short, to have a clean stream, you almost certainly need a forested buffer!



Brook trout, Virginia's state fish, is a blast to catch. You'll only find it in forested streams because it is quite sensitive to temperature and pollutant fluctuations.

Image courtesy of Alliance for the Chesapeake Bay

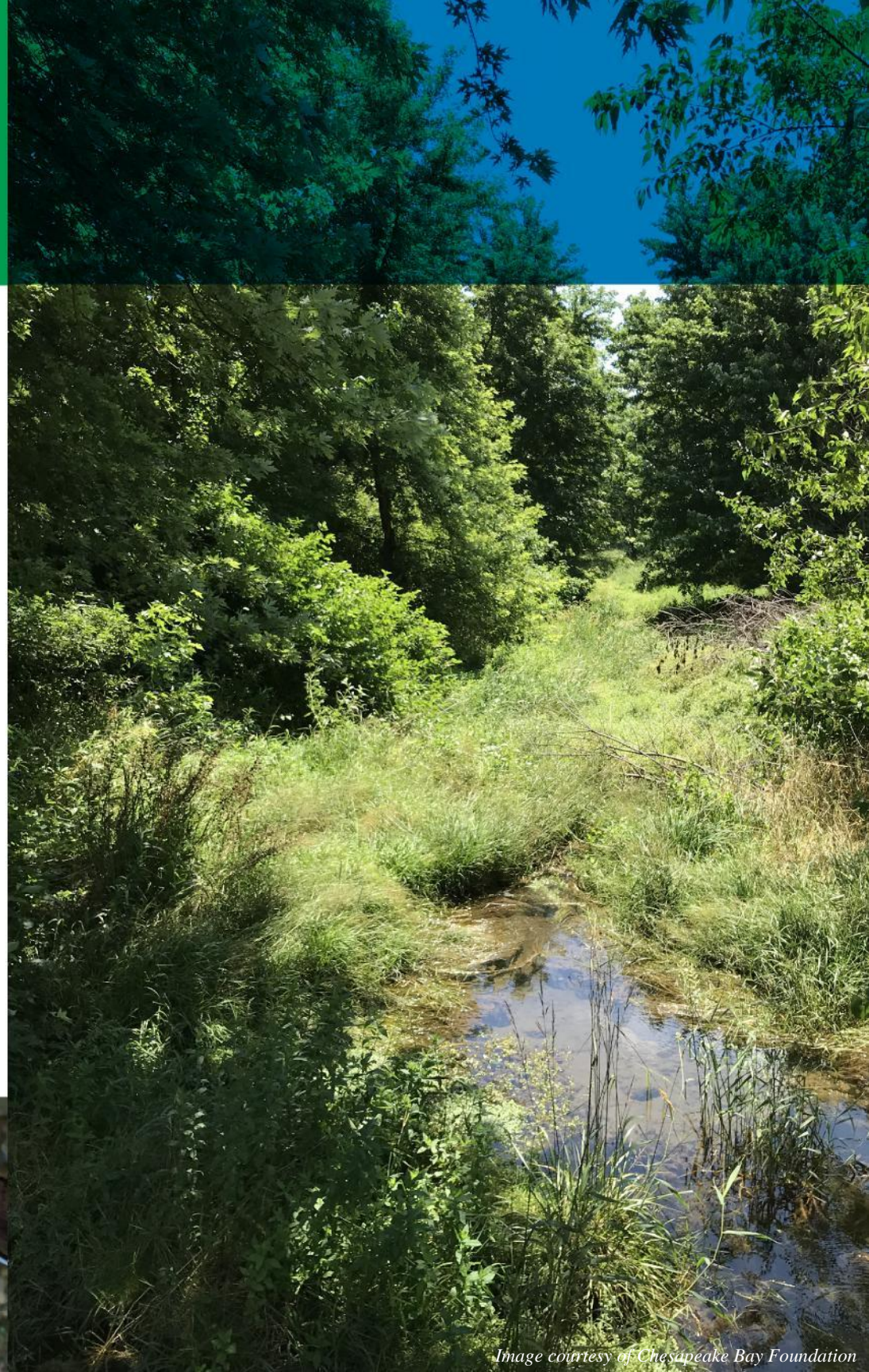


Image courtesy of Chesapeake Bay Foundation



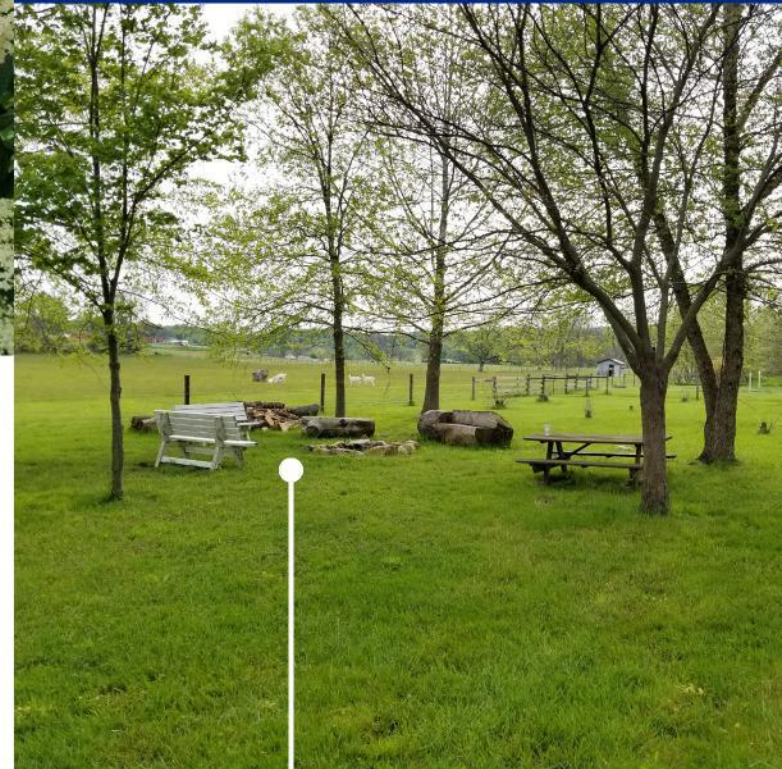
Riparian species like this elderberry in a planted buffer provide a feast for pollinators. The more diverse a planting is, with species that bloom at different times, the better a buffer will be for these invaluable insects.

Images courtesy of Alliance for the Chesapeake Bay

Riparian forests are also incredibly important for wildlife. There are many species that are only found along forested streams, like mink or the Louisiana Waterthrush, and hundreds more that are not restricted to riparian forests but are often found there because of ideal habitat. A basic principle of ecology is that the more plant diversity there is, the more animal diversity there will be. And healthy riparian forests are immensely diverse places. Ample light reaches the understory thanks to the break in canopy from the stream channel and frequent disturbance from floods, ice scour, and herbivores (historically beavers). This gives more space for dense brush and unique plants along the forest floor, providing more habitat for more species. This disturbance, and the difficulty that wet soils can pose to humans trying to remove old trees, result in high numbers of dead standing trees, called “snags” by biologists, which are invaluable resources for wildlife. Snags are homes to birds like woodpeckers and chickadees, mammals

from bats to bears, and countless reptile and invertebrate species. Keeping snags and planting riparian forests are two of the best ways to provide habitat for bats on a property, which is more important than ever because an introduced fungus (called White-Nose Syndrome) has resulted in the loss of over 90% of our bats, which are vital to us for pest insect control.

Songbirds use riparian forests as travel corridors because the dense vegetation provides cover and food through otherwise open landscapes. Planting a forested riparian buffer is also a fantastic way to provide pollinator habitat. Common riparian tree and shrub species, like willows, basswood, black gum, elderberry, and silky dogwood, are incredibly important sources of nectar and pollen to native pollinators that need something blooming to forage on over the entire growing season.



This landowner mows a small part of his buffer to maintain as a picnic spot. Who wouldn't want to have a campfire next to a babbling stream on your very own property?

FORESTED vs. GRASS



Buffers

Summary of Research by Stroud Water Research Center (located in Chester Co., PA)

Study Variable:	Forest Buffer	Grass Buffer	Comments:
Water Temperature	+	-	forested areas cooler in summer, warmer in winter, both beneficial
Streambed Habitat Quality	+	-	more usable streambed habitat, both amount and quality
Removal of Nitrogen Pollution	+	-	forested areas removed 200% to 800% more nitrogen pollution
Removal of Phosphorus Pollution	+/-	+/-	forested area tended to remove more phosphorus, but further study is needed
Removal of Pesticides	+/-	+/-	equal removal in forested areas was a surprise since sunlight is key
Stream Velocity	+	-	lower in forested areas, providing more contact time for clean up
Stream Width	+	-	forested streams 2-3x wider, providing 200-300% more habitat
Large Woody Objects for Habitat	+	-	large woody objects provide key habitat and benefits

⊕ means significantly better results than the other buffer option

⊖ means significantly less helpful than the other buffer option

+/- means no significant difference

Trees help streams clean themselves

In a recent study, Stroud Water Research Center (with a staff of 30+ stream researchers) showed that forested conditions increase a stream's ability to cleanse itself. They studied 16 streams in eastern PA, comparing forested sections to grass buffered sections as the same streams flowed from woodlots to healthy meadows with no livestock and back again. Forested streams can remove 200% to 800% more nitrogen pollution than non-forested streams. The full results appear in the table on the left.

Added Benefits from Streamside Forests:

Beyond providing clean water, streamside trees also provide a long list of other benefits, including:

- Allowing rainfall to soak into the soil, turning floodwater into well water.
- Reducing flooding and flood damage, guarding roads, bridges, houses, and land.
- Providing quality recreation and related income to local communities.
- Providing key habitat for both aquatic and terrestrial wildlife.
- Providing air quality benefits, especially when near animal production facilities.

DOING GOOD THINGS BY PLANTING BUFFERS

Complete Details: A Seasonal Summary of Activities



Image courtesy Chesapeake Bay Program



Many landowners view
buffers as a valued boost
to fisheries.



Images courtesy of Chesapeake Bay Program

Trees provide critical benefits to streams, providing benefits for both water quality and for quality of life. Restoring streamside forests provides a big boost to efforts to improve Virginia's streams.

There are several voluntary conservation programs and grants available to offset landowner out-of-pocket expenses partially or completely for forested riparian buffers.

Farm Service Agency (FSA)

The U.S. Department of Agriculture Farm Service Agency provides landowners with financial incentives to implement conservation practices that help protect water and soil through the Conservation Reserve Enhancement Program (CREP). Contracts are voluntary and generally last between 10 to 15 years with the option to re-enroll. Landowners are paid an annual rental rate each year that they are under contract. Find your local FSA office at www.fsa.usda.gov.

Natural Resource Conservation Service (NRCS)

The U.S. Department of Agriculture Natural Resources Conservation Service offers a voluntary program called the Environmental Quality Incentives Program (EQIP) that helps landowners plan and implement conservation practices by providing financial and technical assistance. It offers flexible contracts for a maximum of 10 years. There are a wide variety of conservation practices in this program that address concerns such as water quality, soil erosion, nutrient management, and wildlife habitat. To find a local contact visit www.nrcs.usda.gov.

James River Buffer Program

The JRBP partnership works to provide the James River watershed with resilient streamside forests that improve water quality while ensuring that landowners' visions are understood. For qualifying landowners, the program provides the following:

- design and management plan
- preparation of site as needed
- materials and installation
- maintenance for three years

The JRBP is a partnership between The James River Association, the Virginia Department of Forestry, and the Chesapeake Bay Foundation. To learn more or apply, visit <https://www.jamesriverbuffers.org/>

Virginia Agricultural Cost-share Program (VACS)

The objectives of the VACS Program, administered by the Soil and Water Conservation Districts, are to encourage voluntary installation of agricultural best management practices (BMPs), address Virginia's nonpoint source pollution water quality objectives, and to improve water quality in the state's streams, rivers, and the Chesapeake Bay. Find your local Soil and Water Conservation District office at vaswcd.org/map-of-districts

Virginia Conservation Assistance Program (VCAP)

The Virginia Conservation Assistance Program is an urban cost-share program that provides financial incentives and technical and educational assistance to property owners installing eligible Best Management Practices (BMPs) in Virginia's participating Soil and Water Conservation Districts. These practices can be installed in areas of your yard where problems like erosion, poor drainage, or poor vegetation occur. Find your local SWCD office at vaswcd.org/map-of-districts

Upper James Home Rivers Initiative

This program targets headwater properties in Highland and Bath Counties to assist landowners with conservation projects such as restoring streams, stabilizing streambanks, restoring riparian buffers, implementing conservation plans for local farmers, and installing livestock exclusion fencing. Trout Unlimited modeled the Initiative after a highly successful program in West Virginia. Learn more at <https://www.tu.org/project/upper-james-river-home-rivers-initiative/>

More Programs

Learn about other programs for riparian restoration here: <https://jamesriverconsortium.org/landowner-resources/funding-programs/>

DETAILS FOR LATE WINTER ACTIVITIES

Complete Details: A Seasonal Summary of Activities

(February–March): Checking tree shelters and stakes

Timing: Best done when site is easily traveled, after most frost-heaving is finished, before spring flush of tree growth occurs, and while wasps are less active. Most landowners will want to do this in February or March before the busy spring season.

Leaning or downed tree shelters: This happens mostly from either broken ties or broken, rotted, or frost-heaved stakes. Frost action in the soil (especially in wetter soils) commonly lifts many stakes. A few taps from a 2-pound hammer can prevent toppling, pinning, and killing trees. Rodents enter downed shelters and quickly damage any tree inside. Frost-heaved shelters (with a gap between soil and shelter) also allow rodents to enter easily (much less a worry if routine herbicide applications are done). You can place a small board on top of the tube, avoiding tree as needed, and give it a few taps to drive the tube back into the soil. Loosen the ties while hammering, so they don't bind on the stake and break. In wetter soils, stakes can rot off before the trees are able to support the weight of the shelter. Rotten or otherwise damaged stakes must be replaced.



Nets: Nets help prevent bird entrapment in tubes but can ruin many trees. Rotting birds typically kill trees, so keeping them out keeps both birds and trees healthy. Nets should be removed from trees that will reach the nets that year. For fast growing trees, this can be done when trees are closer than 18" from the tops of the shelters. If not removed in time, nets typically cause growth deformities in tree tips. These deformities will reduce growth rate and may reduce future timber value. If a tree grows through a net before removal, clip off any deformed tips below the deformity. Later removal of one shoot may be desirable if a double leader results.



This bird net should be removed immediately. If the leader is tangled in the net, you may need to clip the net with scissors or pruners to avoid damaging the tree.

Tip: Leaving a quarter-sized hole in the net during installation should allow the leader to push through without getting tangled or deformed.



Wasps: Large wasp nests can prevent trees from emerging past the nest or may lead to rotting conditions. Damage to tubes by mammals may be related to wasp nests, which bears and other animals eat. At the very least, it is recommended to remove large wasp nests. Doing so in spring before wasps are active will reduce risk of stings.

Ties: Shelters are fastened to stakes with ties. Over time they can become brittle and break. Replacing as needed with UV resistant ties (or suitable wire) will keep shelters upright and functioning. To reduce the risk of frost-heave lifting shelters, leave a little slack in the ties so that a rising stake is less likely to pull the shelter up by the tie.

Note: Streamside forests provide valuable habitat for many types of wildlife. Bears, birds, voles, wasps, and deer are all valuable parts of a healthy environment. For a brief time in the early years, efforts to limit their use and damage of young trees is key. Otherwise, the intended wildlife benefits of a successful reforestation will not occur.

DETAILS FOR LATE WINTER ACTIVITIES

Complete Details: A Seasonal Summary of Activities

(February–March):

Balancing risks in removing or leaving shelters on trees

As trees grow, shelters can become a problem. The most serious is when the broad flare at the base of the tree approaches tube diameter. If your tree shelters lack a vertical perforated line (designed to allow the shelter to split as the tree grows), it is necessary to remove shelters by cutting them top to bottom (use care to avoid damaging the tree) and pulling them off. It is best to remove them when trees reach 1 1/2 to 2 inches in diameter at top of tube. If your tree shelters have a vertical perforated line, they can be left in place unless specifically causing damage.

Even after a tube has split on its own, leaving them in place for additional time can protect seedlings from buck rub, herbicide, and mowers. Deer and voles will damage trees up to 4-5" in diameter. If trying this method, be sure to cut the full length of the tube, including the portion in the soil which is least degraded by UV light and the first-place constriction will occur.

Another issue to watch out for with shelters is the collection of and debris and moisture, which could lead to

disease. Periodic monitoring can help avoid damage due to shelters of any type.

Timing: If removal is needed, it can be done as part of an early spring check of tree shelters or as a separate step later in spring, using the shelters to protect trees for an additional herbicide application before removal. Shelters delay hardening-off of tree tissue. If removed in fall, tender tissue may be harmed by winter temperatures. Also, buck rub and vole damage may be reduced for another year by removal in spring rather than fall.

Size: Remove or split all shelters that lack a vertical line of perforations when trees are 1 1/2 to 2 inches in diameter at the top of the shelter. Trees will reach 1 1/2 to 2 inches in diameter at varying rates, depending on species and site conditions.

Stakes: Regardless of the type of tree shelter, any non-biodegradable stakes must be removed before tree growth entraps them. This is for the health of trees and safety of future users of the site (such as those harvesting trees

for timber products). If shelters are removed, wooden stakes can be left in place and provide some benefits. If trees become droopy (which typically happens only after leaf-out), fasten the tree to stake with twine that will rot. Stakes may also deter buck rub. If located upstream of tree, stakes may also help in the event of flood. They provide limited protection from large debris but will help reduce the grassy debris collecting on the tree (which could lead to rot).

Periodic monitoring can help avoid damage caused by tubes.



Image courtesy of Chesapeake Bay Foundation



Image courtesy of Chesapeake Bay Program

DETAILS FOR SPRING ACTIVITIES

Complete Details: A Seasonal Summary of Activities

(April–May): Applying herbicide around sheltered plants

Routine herbicide use is probably the single most important step for a successful project. Do not apply herbicides directly to the trees. Tree shelters are a big help when spraying herbicide by preventing accidental application to the trees. A broad-spectrum herbicide such as a glyphosate product (for example Roundup Pro™) provides excellent control of grass and broadleaf vegetation and has no soil residual activity that could harm trees. Eliminating vegetation near trees is highly effective in preventing rodents (mainly voles) from damaging trees. This method is standard practice in orchards, nurseries, and tree farms. Voles are a serious threat and have damaged plantings on hundreds of sites to date. For more information on voles, see references on page 17.

When using any herbicide, follow all label instructions. The surfactant (sticking agent) in Roundup Original™ and many generic products is highly toxic to aquatic life. To reduce risk, use Roundup Pro™ or a similar product and avoid overspray or drift onto open water. Rodeo™ and equivalents can be even safer if the surfactant (which must be added) chosen by the landowner is safe for aquatic systems. Knowledgeable sales staff can assist with choosing a surfactant. If you apply glyphosate only, you will need to apply it repeatedly (normally 2x) during the growing season to maintain a weed-free (and vole-free) area. If certified professionals are doing

the herbicide applications, adding a pre-emergence herbicide can extend the benefits. Pre-emergence herbicides prevent seeds from becoming weeds, thus extending the time between spray applications while boosting survival and growth rates.

Use of pre-emergence herbicides increases the complexity of applications. If you plan to use pre-emergence products, you will need to calibrate your sprayer to assure a proper dosage or hire a professional to do the application. Your buffer project advisor can direct you to any number of such professionals. **There are many publications to show you how to calibrate a sprayer, such as “calibrating a backpack sprayer” at <https://tinyurl.com/v7d8aiuu>.** Be prepared to do math if you want the benefits of using pre-emergence herbicides.

The following list of options begins with simpler, lower risk methods and moves to methods with more risk to trees (if misapplied), but increased control of unwanted vegetation. In each case, trade names are only examples of the active ingredient. Several of the products below have equivalents.

Level 1: Roundup Pro at 2 to 4 quarts/acre (or equivalent)

Level 2: Roundup Pro at 2 qt/ac + Surflan at 2 qt/ac (or equivalent)

Level 2: Roundup Pro at 2 qt/ac + Pendulum AquaCap at 3.2 qt/ac (or equivalent)

Level 3: Roundup Pro at 2 qt/ac + Surflan at 2 qt/ac + SureGuard at 8 oz/ac (note: SureGuard is a dry product)

Level 3: Roundup Pro at 2 qt/ac + Surflan at 2 qt/ac + Goal 2XL at 1.5 qt/ac

Comments:

Level 1: No pre-emergence control. Will require repeat applications for full control. **Level 2:** Extends control, especially for grasses (which are vole habitat). **Level 3:** Extends control to delay regrowth of both grasses and broadleaf plants (including most noxious and invasive weeds). SureGuard and Goal can injure trees if they contact swollen buds or leaves.

Don't be overwhelmed by the options.

Choose a plan that works for you and follow it. Twice a year application of glyphosate alone (spring and late summer) should provide protection from voles on many sites, particularly when combined with 2-3 mowings per year. If a pre-emergence herbicide is desired, it is probably advisable to hire a professional to assure a calibrated application that does not kill trees. Whatever option you chose, the key is to follow the plan and get the herbicide applied to assure survival and growth. You can easily apply herbicides with a backpack sprayer with a spray wand that has a single, off-center, flat fan spray tip. With properly maintained shelters to keep spray off the

trees, you can spray each row of trees with a single pass. You can minimize the unsprayed “shadow” behind each shelter by doing a quick wiggle of the spray wand as you pass each shelter.

Some landowners prefer applying herbicide as a continuous strip 3' wide, centered on the row of shelters. Strips of herbicide make mowing easier. Bumping shelters and stakes with mowing equipment will lead to broken stakes, loose shelters, and tree losses. The continuous sprayed strip eliminates the vegetation where the mower cannot easily reach. Mowing remaining areas provides complete vegetation management on the site. Good results also come from 3-4' diameter spots sprayed around each shelter.

Avoid applying herbicides to any part of desired plants—most herbicides will kill trees. Follow all label directions.

Landowners preferring to avoid use of herbicides may consider using stone mulch around tree shelters. While initially labor intensive, this approach should be long-lasting and avoid need for spray. A circle of “2A Modified” stone that is 2” deep and 12” in diameter is effective on many sites. Your project advisor can provide more details, and you can learn more about stone mulch here: <https://youtu.be/h348BVzgg8E>

DETAILS FOR SUMMER ACTIVITIES

(June–August):

Manage vegetation that was not sprayed in spring with broad-spectrum herbicide, mowing, and hand-removal of weeds from tubes



Images courtesy of Chesapeake Bay Foundation

This multiflora rose was growing in a tube along with the seedling.



Use of herbicides to control targeted species:

There are many different invasive weeds. The best control methods often vary by species. Help in identifying invasive plants and distinguishing them from native look-alikes in the mid-Atlantic can be found at https://www.nybg.org/files/scientists/rnaczi/Mistaken_Identity_Final.pdf, or your local buffer project advisor can direct you to resources. In general, avoid using broad spectrum sprays that also kill grasses and thus require repeat applications over time. (An exception is for the areas immediately next to trees as described above where repeated applications are planned.) Weeds prosper on bare soil. Grasses help suppress noxious and invasive weeds.

Consult a conservation professional or check out the Maryland Department of Natural Resources Forest Service's Riparian Forest Buffer Design and Maintenance publication (52 pages) on forest buffer maintenance for the mid-Atlantic region. It has specific herbicide recommendations for controlling noxious and invasive plants in appendices c and d. Access it at https://www.chesapeakebay.net/what/publications/riparian_forest_buffer_design_and_maintenance

Hand-pulling:

Hand-pulling weeds from tubes is often necessary, even when herbicide and mowing are a part of your overall buffer management strategy. Weeds growing in or directly adjacent to tubes compete for light, water, and nutrients, which either kill or stunt the growth of the tree. Sometimes you can pull a weed by reaching down into the tube, but most often you will need to loosen the zip ties and lift the tube to remove the roots entirely.

Complete Details: A Seasonal Summary of Activities

This Canada thistle grew through the bird net and needed to be removed to save the seedling.



Image courtesy of Chesapeake Bay Foundation

If the weeds have thorns or can't be pulled for some reason, use hand pruners or loppers to cut them back.

Mowing:

During the first 2-3 years, mowing helps control competing vegetation, invasive plants, and rodent damage to trees. Unfortunately, mowing also delays natural tree regeneration. Regeneration varies by region and by site, with little potential on grassy sites that lack strong seed sources within a hundred yards. If mowing is not needed to control voles, omitting mowing may increase natural tree regeneration. Mowing should not be viewed as an alternative to broad-spectrum herbicide use around shelters, but as an effective companion and can be especially helpful in the first two or three years. Mow at least twice in the growing season, and more often if needed to control competition or avoid seed formation by invasive species.

Mowing also helps trees by exposing rodents to increased predation. A late season mowing will provide added control of rodents by reducing cover during the winter. Mowing may not be effective against all weeds.



Image courtesy of Pennsylvania Association of Conservation Districts

DETAILS FOR FALL ACTIVITIES

Complete Details: A Seasonal Summary of Activities

(For Fall and “As Needed” in Any Season):

Details for Fall:

The above sections (April-May and June-August) have information that applies to late summer and fall as well. Please note that spring herbicide application around shelters would benefit from including a pre-emergent to prevent weed regrowth after spraying. In late summer or fall applications, the pre-emergent is less useful and can be omitted. It would provide control for winter annual weeds, but these are not typically a problem.

Fall is also the right time to consider additional steps to avoid vole damage over winter. A late fall mowing removes cover for voles and increases predation. Mowing is especially helpful in buffer projects during the first 2-3 years. Additional mowing up to year five may be advantageous if vole problems are severe. If not needed for vole control, omitting mowing may increase natural tree regeneration. Extreme vole problems may justify the use of a rodenticide containing zinc phosphide, which may also be practical and cost-effective in dealing with extreme cases of rodent damage where conscientious herbicide use around tree shelters has not kept voles from damaging plantings. As with any pesticide, **please check label restrictions and always follow label directions.**

Details for “As Needed” Activities:

Following Floods:

Trees trapped in shelters knocked down by floods typically will die even without rodent damage, which also increases in downed tubes. It is unclear how long trees survive if pinned down but getting tubes and trees upright sooner vs. later reduces the risk of death. Within a week of any flood, check that shelters and stakes are upright and sound. Also check for damage to any fences, crossings, etc. as applies to your project.

Survival check and possible replanting:

Late summer or fall is a good time to check plantings for overall health and success. Noting problems early will allow time to remedy them vs. expensive replanting. Your buffer project advisor can help troubleshoot or you can consult the MD DNR maintenance guide noted above (page 34 of the MD DNR guide offers help on identifying and solving problems). Shelters on apparently dead trees should be left in place for one additional growing season, as some trees that appear dead may resprout from the root. You may also want to drop a few seeds of native trees in the tube with some weed-free soil such as potting mix, or you may simply replant. Before replanting, consult with your buffer project advisor about possible cost share and be sure to fix the problem that caused the mortality the first time. Often, this is voles. Regular use of herbicides and mowing are key control methods.

Consult your buffer project advisor for questions related to rodenticide use. Lastly, if time allows, it is helpful to remove weeds and bird nets (if needed) in any season. A helpful video with a good overview buffer maintenance can be found here: <https://www.youtube.com/watch?v=cwSQipUQEE4>

Tip: Ask your buffer project advisor about programs that can pay for all or part of the cost for high quality fencing, stabilized stream crossings, and watering systems (alternatives to the creek) as part of buffer projects.



Image Courtesy of Chesapeake Bay Foundation



Image courtesy of Chesapeake Bay Foundation

For more information about riparian forest buffers, please visit
<https://www.fs.usda.gov/nac/practices/riparian-forest-buffers.php>

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This guide was modified by the Chesapeake Bay Foundation in 2022 to aid with any buffer project, particularly for those in the Commonwealth of Virginia.