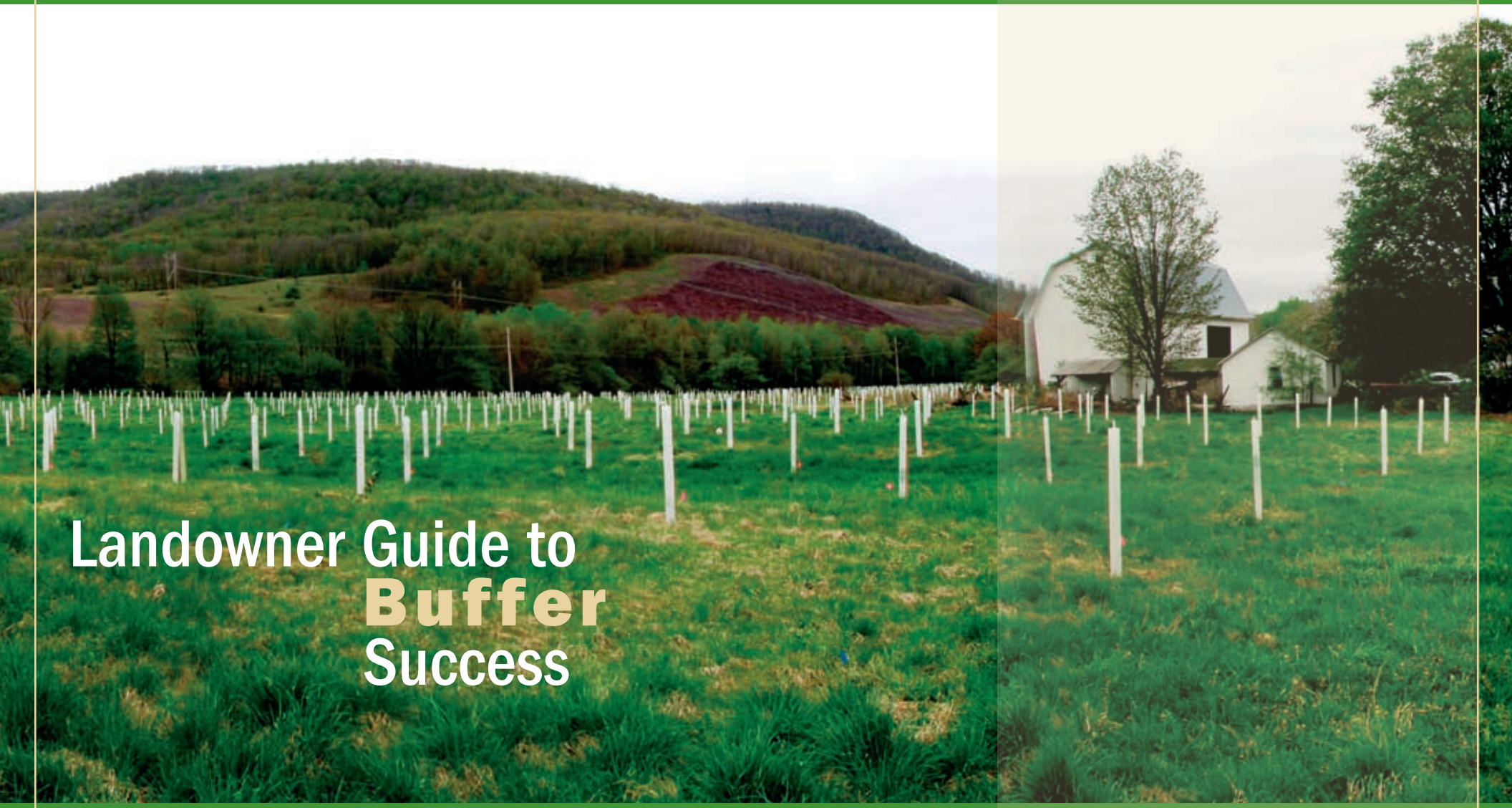
Landowner Guide to Buffer Success

PA CREP
Conservation Reserve Enhancement Program

Growing our Economy
Growing our Communities
Growing Greener

CHESAPEAKE BAY FOUNDATION
Saving a National Treasure



Landowner Guide to **Buffer** Success

Steps for Success

Through out the year

An Introduction to the Landowner Guide to Buffer Success

Dear Landowner,

You have decided to restore a forested buffer that will provide benefits to you, wildlife, your stream and in countless ways downstream. The purpose of this guide is to help you succeed in your goal. This guide includes insights from dozens of conservation professionals and experience on hundreds of sites. We hope you can learn from our mistakes, and avoid your own. Probably, the single most important task is to apply herbicide around tree shelters in spring and late summer. Herbicides boost the survival rate and growth rate to get your trees quickly past their most vulnerable stage. Good work at key tasks in the first three years will give major payoffs in the long run. This guide is written especially for participants in the USDA's Conservation Reserve Enhancement Program (CREP), but the insights are highly relevant to forested buffer restoration via many other 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 attractive photos 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 wish you much 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, Western Pennsylvania Conservancy, Center for Rural Pennsylvania, Ducks Unlimited, PA Association of Conservation Districts, PA Department of Agriculture, PA Department of Conservation and Natural Resources, PA Fish and Boat Commission, Partners for Fish and Wildlife, and the State Conservation Commission

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PA CREP Conservation Reserve Enhancement Program

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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.)*
- *Attractive photos with informative captions*
- *A summary of how trees help streams*
- *A fuller text with complete details and additional references*

This document was prepared by Chesapeake Bay Foundation's Pennsylvania Office in February, 2007 with help from many others. Chesapeake Bay Foundation wishes to thank the following for their insights and valued contributions including photos:

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Mike Pruss, PA Game Commission
PA CREP Technical Committee
CBF Communications Staff and Stream Buffer Specialists
Deborah Rudy, Alliance for the Chesapeake Bay
Cornell University
Nebraska Univsersity

February—March

Check Your Tree Shelters

Leaning shelters allow rodents easy entry and could allow herbicide to reach and harm trees. Downed shelters will kill trees. A few seconds can correct leaning or downed shelters.

Avoid damage from nets. Fast growing trees can add 12-18" or more in spring. Remove nets on any tree likely to reach nets this season. Clip off any twisted trees below the twist to reduce long-term damage.

Steps for Success

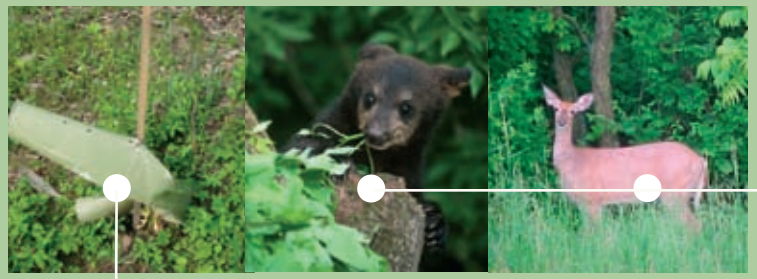
Late Winter

Keys to Success in February & March

Check tree shelters and stakes

1. Fix any downed, damaged or leaning shelters
2. Re-drive any loose stakes, replace any broken or rotten stakes
3. Remove nets from trees that will reach nets this season
4. Remove any wasp nests
5. Mark any missing or obviously dead trees. Repeat when appropriate.
6. At the proper time, remove shelter if needed (see the following pages)

Tips: Do tree shelter checks after the year's frost heaving is ended, but before the spring rush of other work, and before the wasps get active. Carry some extra shelter ties or wire, a few stakes and a hammer to re-drive loose or replacement stakes.



Wasp nests can plug shelters, preventing tree emergence. Nests also attract bears and other hungry mammals, leading to tube damage like this.

Wasps, bears, voles, birds, deer and other wildlife are a natural part of a healthy environment. For just a few years, protecting young trees is critical for successful reforestation to provide its benefits for wildlife for many years to come.

Work Records for tree shelter checks:

Years Checks are needed	Date Done:	Notes:
1		
2		
3		
4*		
5*		

** There may still be a few trees in shelters in years four, five or later, particularly slower growering species like oaks.*

Shelters are a huge boost to survival and growth by allowing easy application of herbicide to keep voles from damaging trees, but most types will need to be removed manually.

Tubex ™ shelters installed on CREP sites through 2006 were either green or white. Both colors have the vertical perforated line that should allow most of these shelters to come off by themselves. Numerous contractors used green Tubex ™. Williams Forestry used white Tubex™ on many sites. All other types of shelters will need to be removed manually. Don't confuse white Tubex™ shelters(which can be left on trees) with other white shelters that lack perforated lines and will need to be removed.

Some types of shelters need to be removed. Details on the left.

Damage from a shelter left on too long. Serious disease and death can occur even before trees fill and touch shelters.

Shelters help deter voles and buck rub. If you must remove the tube, balance the overall risks.

February—March

Check Your Tree Shelters

Brief Summary On Tree Shelter Removal:

If your tree shelters have a vertical perforated line (designed to split as the tree grows), they can be left in place unless specifically causing damage. On sites planted through 2006, only Tubex™ brand shelters had this feature. If your shelters lack a vertical perforated line, remove shelters from trees that are 1.5 to 2 inches in diameter at top of shelter. On sites with real worries about voles and buck rub, perhaps wait longer, but monitor closely to avoid damage/disease caused by shelters.

If removing shelters, leave any wooden stakes in place to deter buck rub and to mark tree locations. Remove all non-biodegradable stakes before entrapped by trunk for tree health and human safety.

Steps for Success

Late Winter

Tight shelters can cause water and debris to become trapped. Disease and rot can follow.

Details on Tree Shelter Removal:

Q: Why must most types of tree shelters be removed at 1.5 to 2 inches tree diameter?

A: As trees grow, shelters can injure or kill trees. Even before trees reach shelter diameter, trapped water and debris can cause disease and rot. Actual girdling of trunks can also occur. The trunk's wide flare at ground level is the first likely point of damage. Despite many claims by manufacturers, most types of tubes do not degrade or split adequately to prevent this damage.

Q: What else should I consider?

A: Consider the risks of removing shelters for your specific site (from voles, buck rub, herbicide, mowers). Balance this with the risk of leaving the shelters in place a bit longer. For example, if your site has lots of voles (common), the benefit of being able to easily spray herbicide around trees may outweigh the risk of leaving tubes in place a bit longer. Regular checks will give you key information to help make decisions. Some persons are testing the idea of cutting the shelter's full length, but leaving it in place a bit longer. Results are not clear at present.

Q: Where can I get more information?

A: The detailed text at the end of this document (p24) has more information. You can also ask the conservation professional that assisted you with project design.

Buffers and Livestock:

Before
Buffers that also get cows out of creeks are doubly beneficial. Shown here are conditions before and after a buffer project in a pasture. Fences limit cattle access to just a few locations to drink or cross.

After

April

Apply herbicide!

Competing vegetation is a serious threat. Competition for water can outright kill trees. Competition for light and nutrients will stunt trees. Here, the tree shelter (top) is barely visible. Herbicide controls competition to allow highest possible growth rates.

Consistent herbicide use is key to success. Probably no other step is so vital to project success. Spraying continuous strips is best.

While spraying continuous strips is best, spot spraying can be effective. These rings should be larger to prevent unsprayed plants from overtaking the area later in the season.

Consistent herbicide use is key to success.

Steps for Success
Spring

Unconventional approach: strips were moved pre-planting, then herbicide spots applied. Better approach: apply herbicide in strips, mow area between rows if allowed and appropriate.

Keys to Success in April

Herbicide Application Around Tree Shelters

Apply broad-spectrum herbicide (such as Roundup Pro™) 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.** Adding a pre-emergent herbicide is advisable during this spring application.

1. Ideally, spray 3' strips centered on shelters (particularly if mowing is part of plan) but 3-4' spots are OK.

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 southern Pennsylvania, and in MAy in northern Pennsylvania. If unsure, consult your CREP staffer.

4. For more information, see detailed text on page 25. Check the next pages for more spring buffer success activities.

Tips: Adding a pre-emergent herbicide to your spray mix will extend the benefits of your spraying by suppressing regrowth. See page 25 for details. While out, in the buffer, also remove any nets as needed. Watch for any invasive or noxious plants. Early detection and treatment is key.

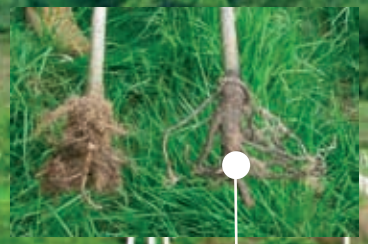
Work Records:

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. In years 4 and 5, there may still be a few trees in shelters that would benefit.*

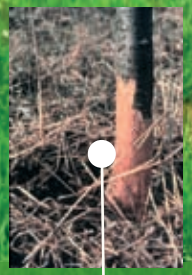
April-May

Use Herbicide to Reduce Vole Damage.

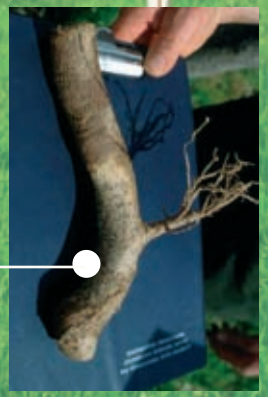


Nurseries and orchards rely on "clean culture" via herbicides to control vole damage by eliminating their food and cover. To date, voles are a lead cause of reforestation project failures.

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



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



Voles can tunnel beneath tree shelters, even those installed to depths of 3" or more. Gnawing on roots and stems is often fatal, and always stunts growth. Here, over 90% of roots have been eaten by voles.

Sever vole problems may require use of a rodenticide containing zinc phosphide which is economical and effective. Consult your project advisor. Measures in fall are even more important. See pages 17, 25 and 27 for more information. The above landscape view shows a site with the barest minimum protection. Herbicide kill spots should be bigger. Continuous strip application would be better.

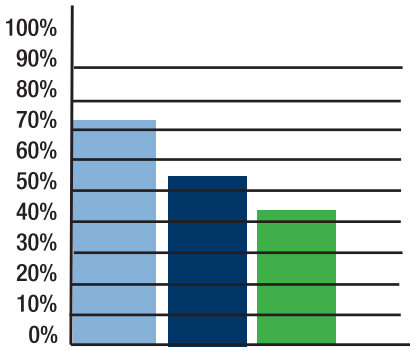
Steps for Success

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 size. Declines in height in the second graph were due largely to voles killing the main leader, folloed 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



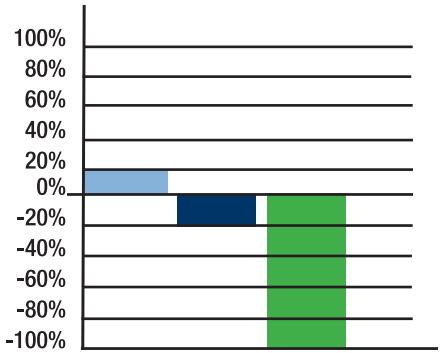
Percent Survival after Two Years
(Source: CBF research at Hopeland Farm)

Herbicide + Shelter

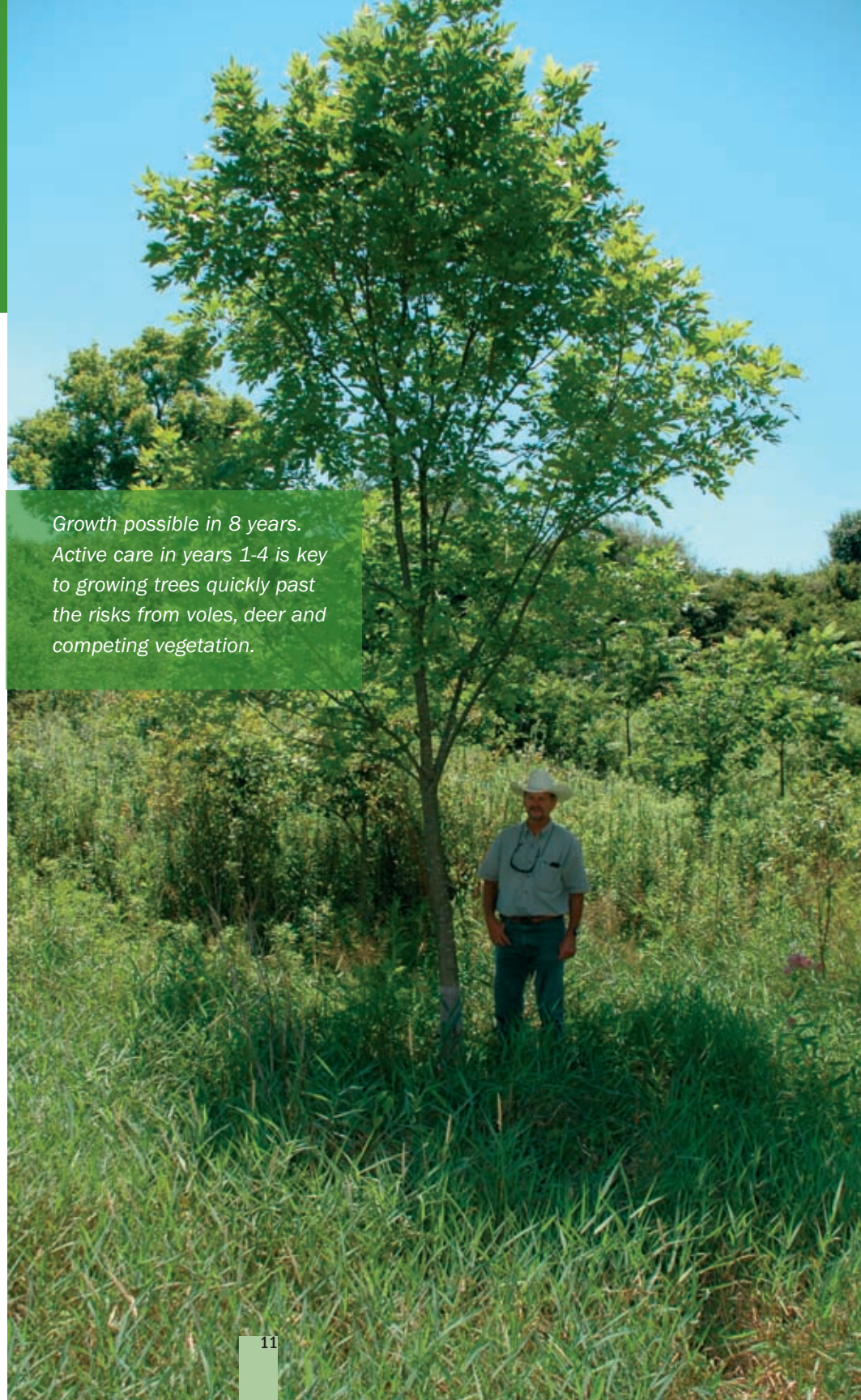
Shelter Only

Neither Herbicide nor Shelter

Tree GROWTH after two years: Herbicide Is Key To Growth

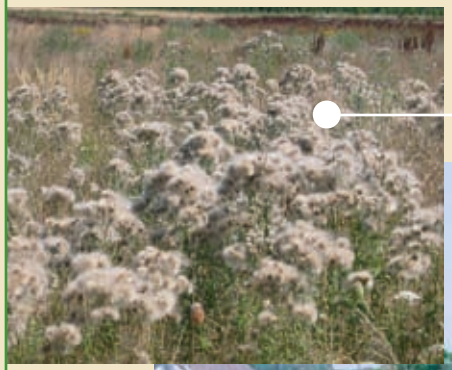


Growth (cm) after Two Years (negatives mean loss of height)
(Source: CBF research at Hopeland Farm)

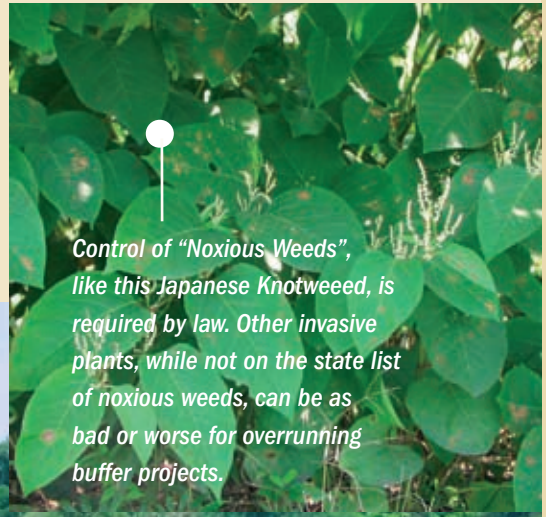


Growth possible in 8 years. Active care in years 1-4 is key to growing trees quickly past the risks from voles, deer and competing vegetation.

June-April
Managing Vegetation.



Control problem weeds before they set seed.



Control of "Noxious Weeds", like this Japanese Knotweeed, is required by law. Other invasive plants, while not on the state list of noxious weeds, can be as bad or worse for overrunning buffer projects.

A young buffer well on its way due to good management of competing vegetation

Combining continuous herbicide strips with mowing can provide complete control of a site's vegetation. On sites with known problems with noxious or invasive plants, this may be practical.

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

Steps for Success
Summer

Keys to Success in June-August

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

1. Early detection and treatment of noxious and invasive plants can avoid major infestations and treatment costs. Best control strategies vary by species. Consult detailed text, p.26) references and/or professional for more information

2. Mowing can be a useful tool vs. voles and weeds during establishment period (first 2-3 years), but also prevents natural tree regeneration. Discuss appropriateness of mowing with agency staff providing advise on your project and follow that plan. Wide spread mowing after year three is not permitted.

Tip: 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 (like Roundup™) will broadleaf plants and grasses. This leaves bare soil where weeds will flourish in the future since there is no grass to suppress them.

tree

Tips: If mowing will be a part of your management, spray 3' wide continuous herbicide strips in spring (instead of spots) centered on shelters. This will allow mowing of all live vegetation without bumping shelters and breaking stakes. Mow unwanted plants before they set seed. A late season mowing will reduce vole cover going into winter.

Work Records:

Date:	Notes on activities, products, rate, etc.

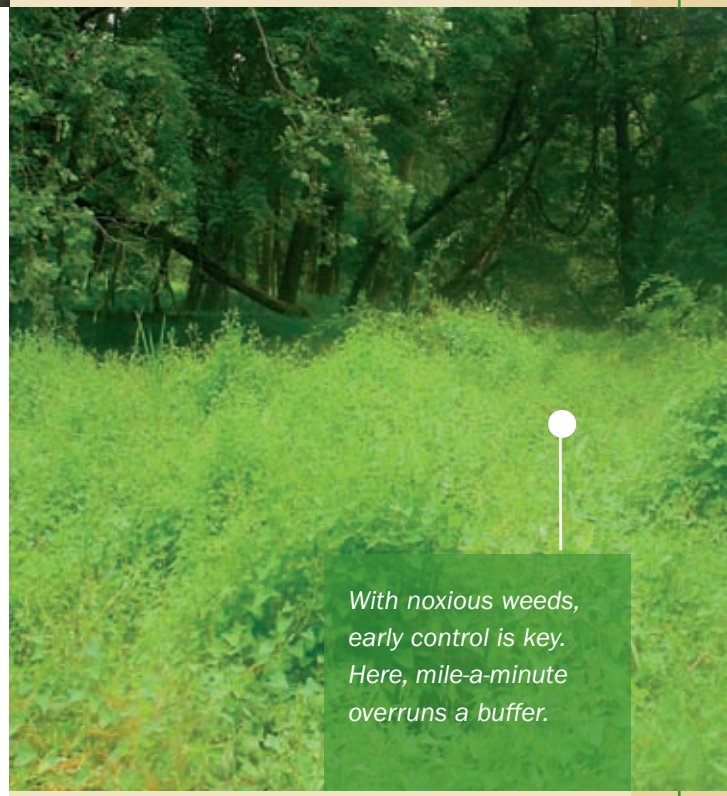
State-listed noxious weeds such as this Canada thistle must be controlled under state law.

State-listed Noxious Weeds – control required by law

- *Canada thistle (Cirsium arvense)*
- *Multiflora rose (Rosa multiflora)*
- *Johnson grass (Sorghum halepense)*
- *Mile-a-minute (Polygonum perfoliatum)*
- *Kudzu-vine (Pueraria lobata)*
- *Bull or Spear Thistle (Cirsium vulgare)*
- *Musk or Nodding Thistle (Carduus nutans)*
- *Shattercane (Sorghum bicolor)*
- *Jimsonweed (Datura stramonium)*
- *Purple Loosestrife, including all cultivars (Lythrum salicaria)*
- *Giant Hogweed (Heracleum mantegazzianum)*
- *Goatsrue (Galega officinalis)*
- Marijuana (Cannabis sativa)

Other Invasive Plants – control highly recommended

- *Common Reed (Phragmites australis)*
- *Japanese Knotweed (Polygonum cuspidatum)*
- *Reed Canary Grass (Phalaris arundinacea)*
- *Japanese Honeysuckle (Lonicera japonica)*
- *Japanese Hops (Humulus japonicus)*
- *Oriental Bittersweet (Celastrus orbiculatus)*
- *Tree-of-Heaven (Ailanthus altissima)*



With noxious weeds, early control is key. Here, mile-a-minute overruns a buffer.

Best control strategies vary by species.

Mowing can be a useful tool in controling weeds

Japanese Knotweed, an invasive plant, is common along waterways.

Identification of Common Noxious and Invasive Plants in Riparian Areas

Canada Thistle

Japanese Knotweed

Mile-A-Minute

Tree-of-Heaven

Multiflora Rose

Reed Canary Grass

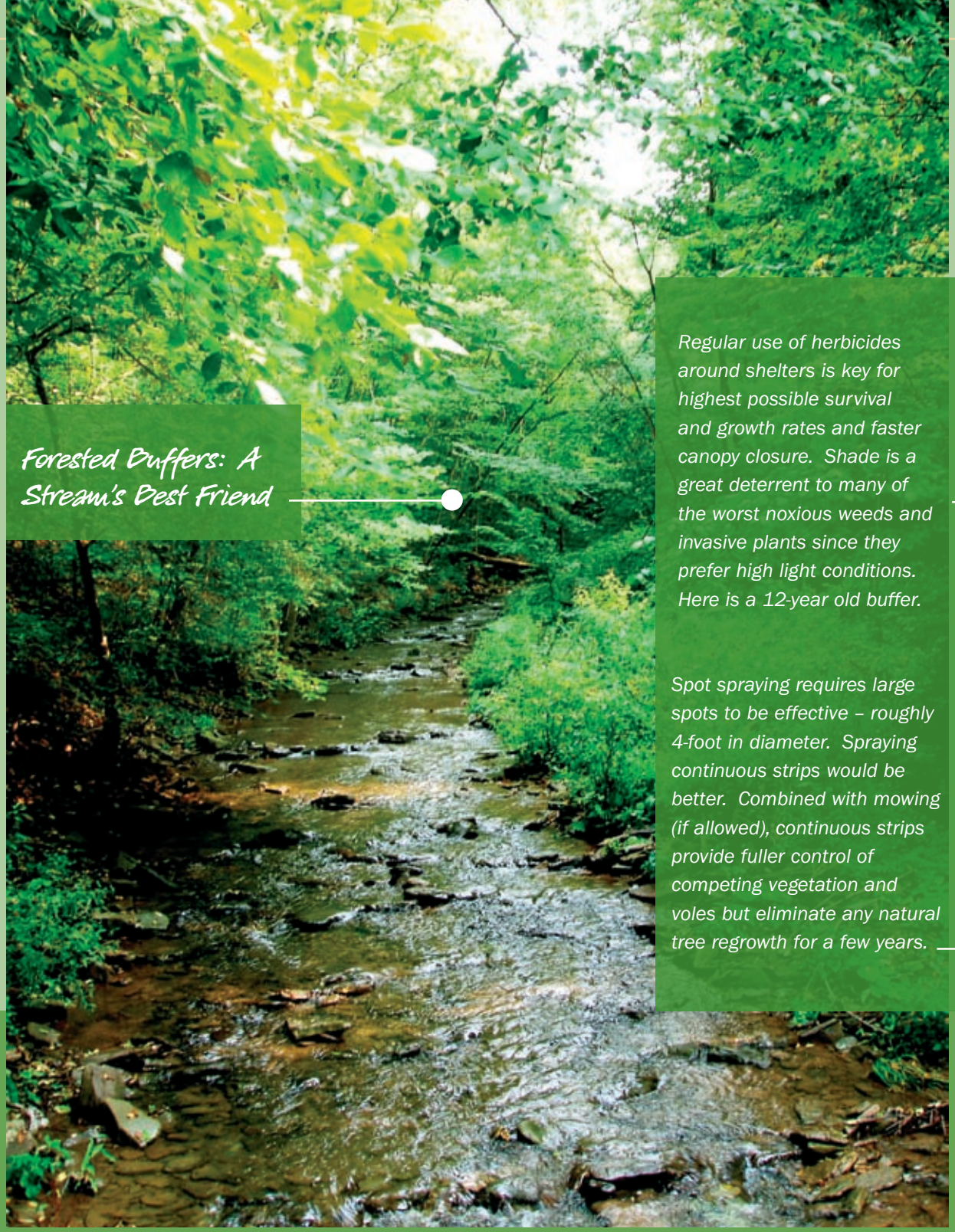
Japanese Hops

Common Reed

Oriental Bittersweet

For further help in identifying and controlling inoxious and nvasive plants, you can refer to Alliance for the Chesapeake Bay's **Pennsylvania Field Guide: Common Invasive Plants in Riparian Areas**, on line at **http://www.acb-online.org/pubs/projects/deliverables-145-1-2004.pdf** or purchase by calling **717-737-8622**.

Photos provided by Deborah Rudy, Alliance for the Chesapeake Bay



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 of the worst noxious weeds and invasive plants since they prefer high light conditions. Here is a 12-year old buffer.

Spot spraying requires large spots to be effective – roughly 4-foot in diameter. Spraying continuous strips would be better. Combined with mowing (if allowed), continuous strips provide fuller control of competing vegetation and voles but eliminate any natural tree regrowth for a few years.

August-October

Another Herbicide Application Around Tree Shelters

Steps for Success

Fall

Left: Spring peepers spend early livies in water as tadpoles.

Below: Mayflies spend most of their lives as nymphs in streams.

Keys to Success in August-October

Another Application of Herbicide Around Shelters

Apply a broad-spectrum herbicide (like Roundup Pro™ or other glyphosate product) around sheltered seedlings. This application is like the one done in 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 will 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 damage on trees.

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

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. Mowing is allowed in CREP projects during the establishment period (the first 2-3 years). If not needed for vole control, omitting mowing may increase natural tree regeneration – particularly in northern PA where that potential is higher. Extreme vole problems may justify the use of an economical rodenticide containing zinc phosphide, applied by a professional. Consult your CREP project staff to discuss mowing or rodenticides. More information is available at right.

Tips: This spray is especially critical on sites where substantial regrowth in treated areas has occurred since spring. Competing with 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 late.

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

Additional information on voles:

Penn State University site (good overview, no photos): http://pubs.cas.psu.edu/freepubs/pdfs/uh094.pdf

Cornell University site (good overview and photos): http://nysipm.cornell.edu/factsheets/treefruit/pests/vole/vole.asp

University of Maryland site (also tells how to assess vole levels) http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=146&cat=8

Right: Voles tunnel through snow and may gnaw on trees up to the height that snow accumulates.

Tasks To Be Completed 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 is needed: Replanting should only be done after addressing the cause of the initial failure (most commonly voles and/or competition from plants). Replanting can be done in fall using containerized seedlings or in spring using either containerized seedlings or bare root stock. Either should be successful if other recommendations are followed.Consult with CREP staff about cost share prior to replanting.

Floods can easily knock down tubes but trees are typically still alive. Prompt action can avoid tree losses that would otherwise occur over time.

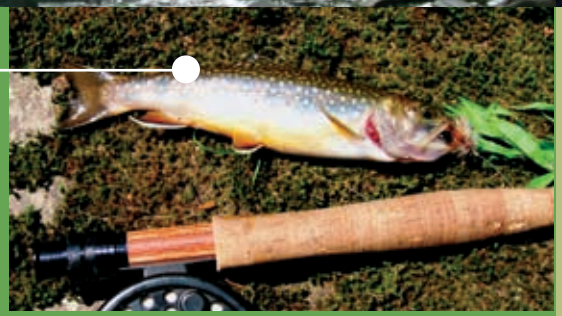
Work Records:

Work Done:	*Date Done:*	*Notes:*

Forested buffers are a stream's best friend.

Trees multiply stream habitat. The life of streams is tied to the bottom, literally. Most small organisms cling to rocks, roots and gravel to avoid being swept away. Trees vastly increase the amount and quality of bottom habitat. Compared to a bare soil bank in a meadow stream, a bank with fine tree roots can have a hundred or thousand times more surfaces where living things can cling. Forested streams also have more bottom area. They are typically two to three times wider than a meadow stream of equal flow. With full sun, grasses encroach on the stream and channels narrow dramatically. Trees give streams more area, more habitat, more life.

Trout grow on trees. Trout eat stream insects that specialize in eating leaves of native trees that fall into streams. In very real ways trout grow on trees.



Forested buffers:

Read on to learn how forests do their magic for Streams.

Trees Help Streams

Some ways that trees help streams are obvious: they shade streams and hold the banks in place. Other ways are less obvious but even more important.

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 sudy is needed
removal of pesticides	+/-	+/-	equal removal in forested area was a surprise since sun light 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 (3X) other buffer option

- means significantly less helpful than the other buffer option

+/- means no significant difference for forested thean the grass buffer

Trees help streams clean themselves

In a recent study, Stroud Water Research Center (with a staff of 30+ stream researchers showed how 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.

- Allowing rainfall to soak into the soil, turning floodwater into well water
- Reducing flooding and flood damage, guarding roads, bridges, houses, 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 Activites

Many landowners view buffers as a valued boost to fisheries.

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 Pennsylvania's streams.

Details for Late Winter 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 lb 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 over the tube, avoiding tree as needed, and give it a few taps to drive the tube back into soil. Be careful not to snap the ties while hammering, which can 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 18" or more 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 you miss a net, clip off any deformed tips below the deformity. Later removal of one shoot may be desirable if a double leader results.

Wasps: On some sites, wasps build nests in many shelters. While they don't seem to directly harm the plants, large nests can prevent trees from emerging past the nest or may lead to rot conditions. Damage to tubes by bears and other mammals may be related to wasp nests, which bears and other animals eat. It is advisable to remove at least the 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, deer all are valuable parts of a healthy environment. For a brief time in the early years, effort to limit their use and damage of young trees is key. Otherwise, the intended wildlife benefits of a successful reforestation will not occur.

Replanting: Mark dead or missing trees for replanting. Be sure to fix the cause of losses before replanting. Consult your CREP staff regarding potential cost-share before replanting.

A successful buffer after 12 years of growth

Details for Late Winter Activities (February-March):

Balancing risks in removing or leaving shelters on trees:

If your tree shelters lack a vertical perforated line (designed to allow shelter to split as tree grows) it is necessary to remove shelters by cutting them top to bottom (use care avoid damaging the tree) and pulling them off. Remove when trees reach 1 ½ to 2 inches in diameter at top of tube.

If your tree shelters have a vertical perforated line (through 2006, only Tubex™ shelters had this feature) they can be left in place unless specifically causing damage.

A few people are trying a different approach to shelters that must be removed. They are splitting the shelters with a knife, and leaving them in place for additional time. If trying this unproven method, be sure to cut the full length including the portion in the soil which is least degraded by UV light and the first place constriction will occur.

Explanation: As trees grow, shelters can become a problem for trees. The worst problem occurs when the broad flare at the base of the tree approaches tube diameter. Moisture and debris can collect in the tube, leading to disease and damage. Forestry professionals in the mid-Atlantic suggest that shelters with a vertical perforated line can be left on trees indefinitely unless they are causing specific problems. This is not conclusive for other types of shelters, and thus removal, or at least splitting, is required. However, removing shelters exposes trees to increased risk from voles, buck rub, herbicide and mowers. Deer and voles will damage trees up to about 4-5” diameter. Herbicide and mowers can damage even larger trees. For sites with tubes lacking perforated vertical lines, there may be helpful middle ground - splitting the tubes with a knife and leaving them in place for additional time. Be sure to split the bottom-most portion that will first constrict the tree. Periodic monitoring can help avoid damage due to shelters of any type.

Timing: If removal is needed, it can be done as part of early spring check of tree shelters or as 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. 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 ½ to 2 inches in diameter at the top of the shelter. Trees will reach 1 ½” to 2” diameter at varying rates, depending on species and site conditions.

Stakes: **Regardless of type of tree shelter, any non-biodegradable stakes must be removed before tree growth entraps them. This is for health of trees and safety of future users of the site such as its potential timber products.** If shelters are removed, wooden stakes can be left in place and provide some benefits. If trees become droopy (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 may also help in the event of flood. Stakes give limited protection from large debris, but will help reduce the amount of grassy debris collecting on the tree (which could lead to rot).

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

Details for Spring Activities (April-May):

Applying herbicide around sheltered plants:

Routine herbicide use is probably the single most important step for a successful planting. **Do not apply herbicides directly to the planted trees.** Tree helters are a big help when spraying herbicide by preventing accidental application to the trees. The herbicide glyphosate (the active ingredient in Roundup Pro™ and Rodeo™) provides excellent control of grass and broadleaf vegetation, and does not have 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 and nurseries. Voles are a serious threat, having impacted plantings on hundreds of sites to date.

Additional information on voles:

Penn State University site (good overview, no photos): http://pubs.cas.psu.edu/freepubs/pdfs/uh094.pdf

Cornell University site (good overview and photos): http://nysipm.cornell.edu/factsheets/treefruit/pests/vole/vole.asp

University of Maryland site (also tells how to assess vole levels) http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=146&cat=8

When using any herbicide, follow all label instructions. The surfactant (sticking agent) in the original Roundup™ (called Roundup original™) and many generic products is highly toxic to aquatic life. To reduce risk, use RoundupPro™ (or similar product) and avoid overspray or drift onto open water. Even better, use Rodeo™ (or the equivalent), and add your own less toxic surfactant. There are many glyphosate products that are labeled for use in or near water that do not contain the surfactant found in Roundup original™. Your local farm chemical distributor can guide you in selecting the glyphosate product you need.

If you apply glyphosate only, you will need to apply it nearly every month during the growing season to maintain a weed-free (and vole-free!) area around your trees. To increase the effectiveness of your treatment and reduce the number of applications, add a pre-emergent (Pre-emergent) herbicide to your glyphosate treatment. PRE herbicides kill weed seedlings as they germinate or soon after. Common active ingredients are simazine (example: Princep, better against broadleaves) or pendimethalin (example: Pendulum, better against grasses). Either (or both) can be mixed with glyphosate to eliminate winter annuals and biennials, and prevent germination of annual weeds for many weeks.

Example Mixtures (trade names used as example, not recommendation):

- Glypro (3 pints/ac) + Princep 4L (2 quarts/ac) - annual grasses will break through first.
- Glypro (3 pints/ac) + Pendulum AquaCap (2 quarts/ac) - annual broadleaf plants will break through first.
- Glypro (3 pints/ac) + Princep 4L (2 quarts/ac) + Pendulum AquaCap (2 quarts/ac) - extended control of grass and broadleaf plants.

You can easily apply these mixtures with a backpack sprayer equipped with a spray wand with a single, off-center, flat fan spray tip. As long as you have done your tree shelter maintenance, you can spray each row of trees with a single pass. The shelter will keep the spray mixture off the trees, and the 'spray shadow' caused by the shelter blocking the spray should be minor. You can minimize the shadow by simply doing a quick 'wiggle' of the spray wand as you approach and pass each shelter to get the fan pattern to cover the area directly behind the shelter. It will only take a few minutes for you to develop the required technique.

If applying a pre-emergent herbicide , it is essential to calibrate your application so that you are applying the intended dosage of herbicide. If you are unsure of the procedure, there are many Cooperative Extension publications available on the internet that will be helpful **(for example, http://www.bae.ncsu.edu/programs/extension/agmachine/turf/Callibrating_a_Backpack_Sprayer.pdf).**

Best results come from applying a calibrated spray to a continuous strip 3' wide, centered on the row of shelters. This is especially the case if mowing will be done. 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 reach easily. Spraying can be done from vehicle or on foot. Mowing remaining areas provides complete vegetation management on the site. If you only use glyphosate, good results come from 3-4' diameter spots sprayed around each shelter. **Avoid applying herbicides to any part of desired plants – glyphosate will kill trees.**

Details for Summer Activities (June- August):

Managing vegetation that was not sprayed in spring with broad-spectrum herbicide:

This means the vegetation in areas other than right around tree shelters. There are two common tools for this work—herbicide treatment or mowing.

Use of herbicides to control targeted species:

There are many different noxious and invasive weeds. The best control methods often vary by species. Help in identifying problems weeds can be found at **http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/streamreleaf/Docs/Invasive%20Plants.pdf** or your local CREP staffcan 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 and/or the following reference. The Maryland Department of Natural Resources Forest Service *Riparian Forest Buffer Design and Maintenance (52 pages)* is the most comprehensive and recent (2005) publication 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 **http://www.dnr.state.md.us/forests/download/rfb_design&maintenance.pdf Or call 1-410-260-8509 to request a hard copy.**

Mowing:

Mowing helps control competing vegetation, invasive plants and rodent damage to trees. Unfortunately, mowing also prevents 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. CREP program guidance on mowing varies by region. Be sure to discuss whether you are expected or allowed to mow with your local CREP staff. If your site is not enrolled in CREP, discuss the role of mowing role in your project with the conservation professional who provides advice on the work and consults the specifics of your project agreement. If used, mowing should not be viewed as an alternative to broad-spectrum herbicide use around shelters, but as an effective companion. Mowing, if permitted, is especially helpful in the first two or three years. It should be done at least twice in the growing season, more often if needed to control competition or avoid seed formation by noxious invasive species. Mowing 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 Canada thistle. Mowing extensive areas of CREP buffers is not allowed beyond year three, unless approved by Farm Service Agency's county committee for specific reasons such as noxious weed control.

Details for Fall Activities (For Fall and as Needed in Any Season):

Details for Fall:

The above section (June-August) has information that applies to late summer and fall as well. One change should be noted: 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.

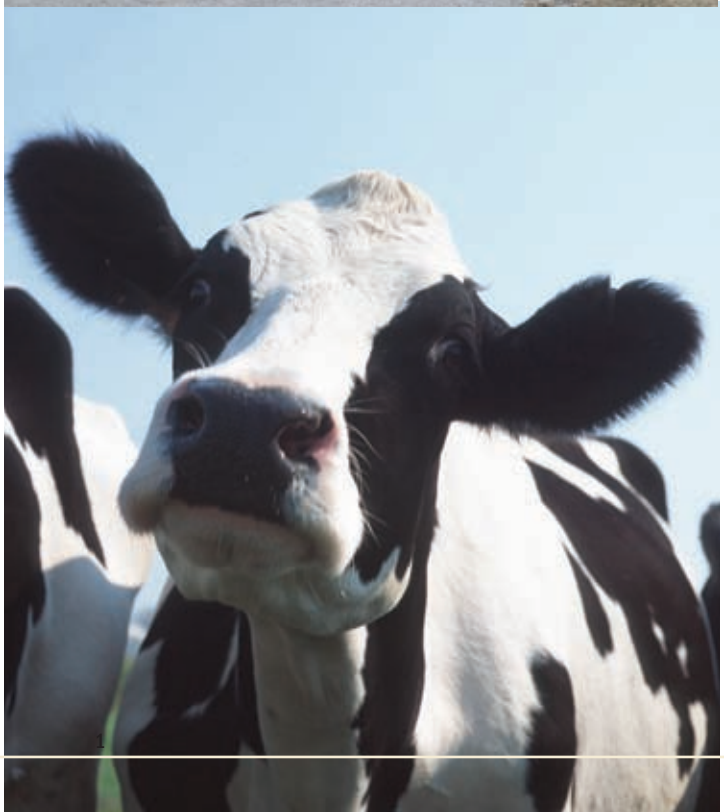
Details for as Needed Activities:

Following Floods:

Trees trapped in shelters knocked down by floods will generally die even without rodent damage, which also increases in down tubes. It is unclear how long trees survive if pinned down, but getting tubes and trees upright sooner vs. later will help. 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 local CREP staffer 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. 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 CREP staffer about possible cost share. Also, before any replanting, 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. Rodenticides containing zinc phosphide may also be practical and economical in dealing with **extreme** cases of rodent damage where conscientious herbicide use around tree shelters has not kept voles from damaging plantings. Check label restrictions and always follow label directions.



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CHESAPEAKE BAY WATERSHED

The Chesapeake Bay's 64,000-square-mile watershed covers parts of six states and is home to more than 17 million people.