Chesapeake Forest Restoration Strategy

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Forest Service
Northeastern Area State and Private Forestry
Newtown Square, PA
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Contents

Acknowledgments

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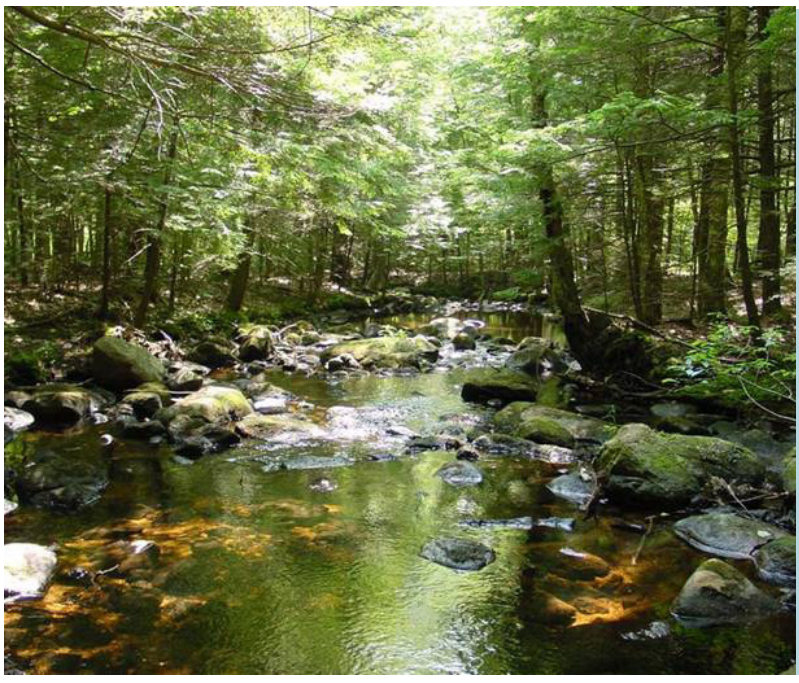
**Public comments on this draft Strategy are being accepted through August 6, 2012. Please direct any written comments or questions on the draft Strategy to Sally Claggett, sclaggett@fs.fed.us, (410) 267-5706.



Section 1
Introduction

Forest restoration may be the single most important activity to help bring back the Chesapeake ecosystem. Forests are a critical ecosystem component that supports major Chesapeake Bay goals—clean water, healthy watersheds, wildlife habitat, fisheries, land conservation, citizen stewardship, and climate change response. For these reasons, this document was developed as a key supporting action in the **2010 Executive Order (13508) Strategy for Protecting and Restoring the Chesapeake Bay Watershed**.

This document focuses on restoring forest cover in targeted areas of the landscape to improve ecosystem function and provide community benefits. The progress of restoring forests is measured in decades not months. This Strategy was developed with a clear understanding that the long-term success of restoration depends on equally robust efforts to conserve and manage existing forest land. A companion Working Lands Conservation Strategy is being developed in 2012, which will address forest and farmland conservation priorities.

"By 2012, USDA will work with Department of Interior and other entities to develop a Chesapeake Bay watershed strategy to maximize forest restoration in priority areas including: residential land currently managed as lawn; areas covered by community tree canopy expansion and green infrastructure programs; gaps in core wildlife habitat; deficient lands such as abandoned mine lands, brownfields, and lands with vulnerable soils; and agroforestry areas." (p. 54, 2010 Executive Order (13508) Strategy for Protecting and Restoring the Chesapeake Bay Watershed.)

Forests have been the dominant cover type in the Chesapeake region for thousands of years—once covering 95 percent of the watershed. Now forests cover only 55 percent of the watershed, and the earlier trend of increasing forest cover after 1900 has reversed (figure 1.1). In the 1990s and early 2000s, forests were lost to development at a rate of 100 acres per day in the Chesapeake Bay watershed. This latest forest loss is especially alarming because it is permanent.

Forests produce the cleanest water of any land use, so the effects of forest loss ripple downstream and into the Bay, where the greater nutrient loads and higher temperatures generate conditions that threaten the Bay's abundant life. Forest restoration can help mitigate the loss of forests and should be applied widely in concert with other sustainability goals for well-managed agriculture and well-designed communities.

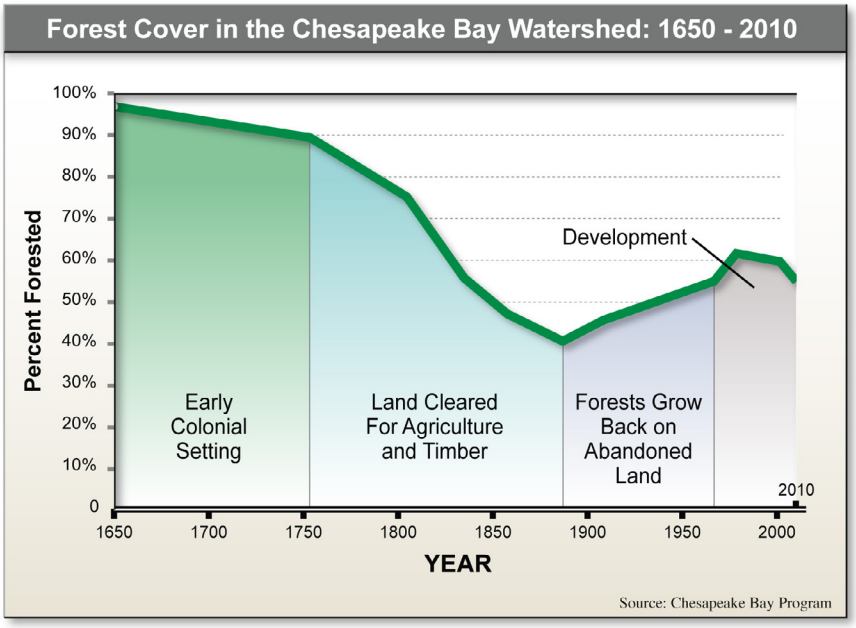
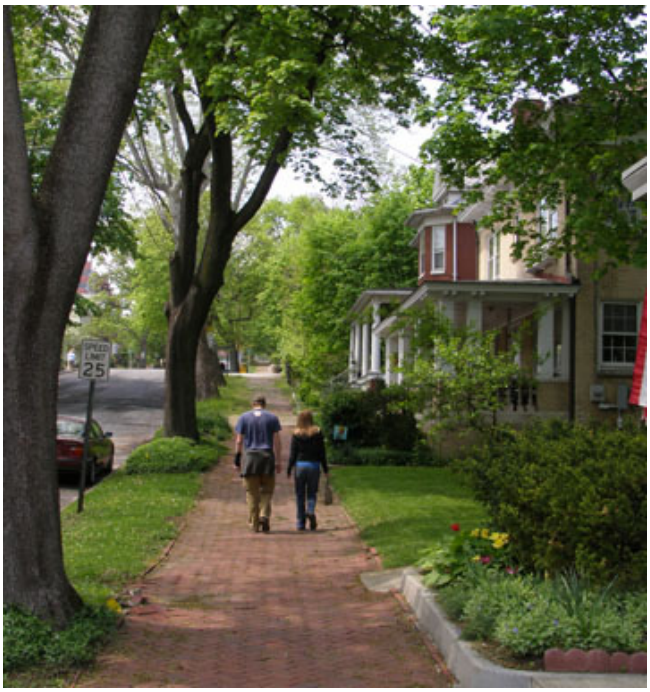


Figure 1.1. Forest cover in the Chesapeake Bay watershed from 1650 to 2010.

Trees are nature's multitasker, generating many benefits from the single investment of planting trees. The benefits of forests and even individual trees are numerous and far reaching:

- Water quality: Forested watersheds have the cleanest water.
- Air quality: Urban trees in the conterminous United States remove about 784,000 tons of air pollution each year. [1]
- Stormwater management: One tree can reduce stormwater runoff by 13,000 gallons per year. [2]
- Energy use: 100 million mature trees around buildings in the U.S. reduced the need for heating and cooling, which translated into annual energy savings of $2 billion.[3]
- Storing carbon: In the United States, urban trees store about 770 million tons of carbon[4]—over 150,000 pounds per acre in the Northeast Region—which helps mitigate climate change.
- Drinking water: For every 10 percent increase in forest cover in the source watershed, treatment and chemical costs decreased by approximately 20 percent.[5]
- Real estate: Landscaping with trees increases property values 7 to 25 percent.
- Reduce flooding: More trees in a watershed means less runoff and reduced potential for downstream flooding.
- Wildlife habitat: Trees and forests provide the structure and native food sources to sustain a wide variety of species.
- Stream and air temperatures: Trees over streams can decrease the water temperature 2 to 4 degrees, supporting diverse aquatic life. Trees help reduce the "urban heat island effect."
- Ultraviolet radiation: Trees can help diffuse harmful ultraviolet radiation.
- Income: Practicing good forest management can keep forests healthy, provide continued forest cover, and contribute to vibrant rural economies on a sustainable basis.
- Sustainability: Trees are an excellent investment considering the stacked benefits they provide. The cost of establishing a 1- to 2-year-old tree can range from $3 to $12; this investment will continue to provide benefits at no cost because on average, most native trees live for 100 to 200 years (some oak trees will live an average of 350 years!). Urban trees have a shorter average lifespan.

These are some of the reasons to plant trees that apply to most areas in the Bay watershed. More specific benefits are described for the priority areas in the Strategy sections that follow.



Building on Past Progress

Chesapeake Executive Council Directives in 1996, 2003, and 2007 set goals for forest cover, including riparian forest buffer restoration, forest conservation, and urban tree canopy expansion. This Strategy builds on the successes of these past and ongoing partnership efforts.

As of 2011, partners had restored over 7,400 miles of riparian forest buffers in the Chesapeake Bay watershed since 1996 (figure 1.2). The vast majority have been restored through the USDA Conservation Reserve Enhancement Program (CREP). In recent years, forest buffer restoration has not come close to the Bay-wide goal of restoring 900 miles per year that was established in 2003. However, partners are making renewed efforts as a result of the Executive Order Strategy.

Programs to expand urban tree canopy originated from a Chesapeake Bay watershed goal in 2003. They have since become grassroots efforts as local communities recognize that trees pay us back. Over 55 communities and 7 counties have completed urban tree canopy assessments, and many are developing goals and plans to increase tree canopy cover (see Urban and Community Forestry Section). This Strategy builds on these accomplishments with actions to help communities move from assessment to on-the-ground restoration.

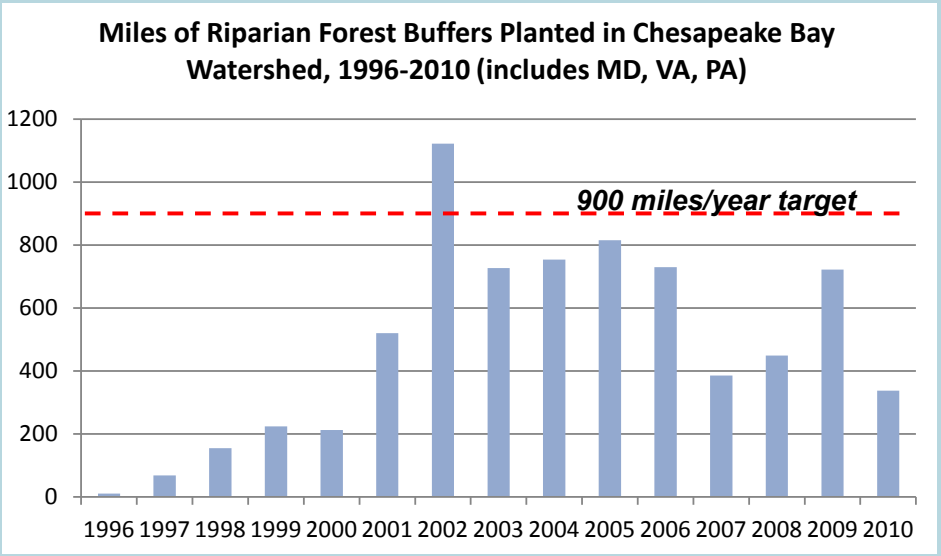


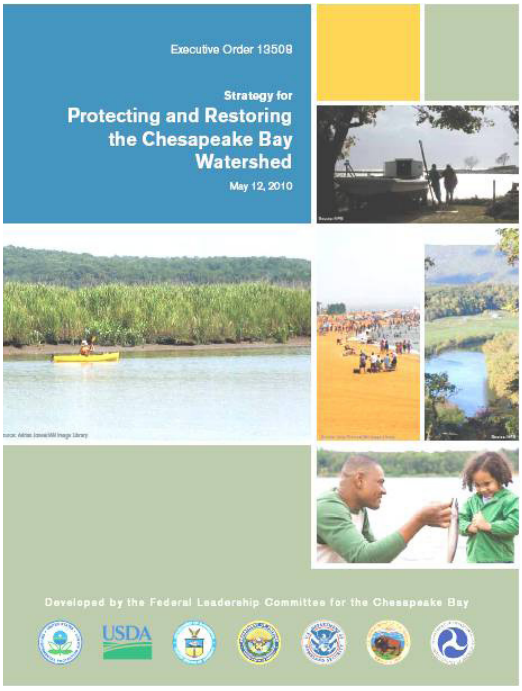
Figure 1.2. Miles of riparian forest buffer planted from 1996 to 2010. Source: Chesapeake Bay Program

Responding to New Drivers for Tree Planting

In 2010, the Environmental Protection Agency (EPA) established the **Chesapeake Bay Total Maximum Daily Load** (TMDL) with rigorous accountability measures to restore clean water in the Chesapeake Bay and the region's streams, creeks, and rivers. The TMDL is based in large part on Watershed Implementation Plans developed by the 6 States in the watershed and the District of Columbia. It limits the load of pollutants that can enter waterways. Riparian forest buffer plantings, and all tree plantings, are Best Management Practices (BMPs) that count toward the pollution reduction needed to meet TMDL requirements. For instance, one acre of riparian forest buffer can remove up to 65 pounds of total nitrogen, 2 pounds of phosphorus, and 2,500 pounds of sediment annually from an average agricultural row crop setting (Chesapeake Bay Watershed Model). Tree planting is an ideal practice for local governments and other organizations because trees have low overhead costs, trees produce multiple environmental benefits, and every dollar invested in growing a tree returns at least $2.50 in environmental services.

Tree planting also supports a number of key outcomes and actions set forth in the **Chesapeake Bay Executive Order Strategy** released by Federal partner agencies in May 2010. Some examples include:

- Forest Buffer Outcome: The goal is to restore forest buffers along 63 percent of the total riparian miles (stream bank and shoreline) in the Bay by 2025. This translates into restoring 900 miles of forest buffers in the Bay watershed each year, a target all Bay States committed to in 2007. (p. 51)
- Brook Trout Outcome: As the only native trout species in the Chesapeake Bay, brook trout are an indicator of good water quality because they need cool water (<70 °F) and streams free of silt and sediment. One of the best actions to ensure habitat improvement for this species is to plant riparian forests. (p. 66)
- Green Streets–Green Jobs: This EPA initiative unites a town's vision for a sustainable future with the tools to accelerate local greening efforts, yielding positive results in watershed protection, community livability, and economic vitality. (p. 32)



Targeting Priority Areas for Forest Restoration

There are different ways to prioritize areas for tree planting. This Strategy takes a broad look at the watershed and areas that offer ripe opportunity for action.

Overview of the Strategy Sections

Fish and Wildlife Habitat – Most wildlife species in the watershed depend on a forested landscape. Restoration should focus on riparian areas and on expanding the "green infrastructure" network of large forest patches (hubs) and corridors connecting them.

Mine Lands – Following the lead of the Appalachian Regional Reforestation Initiative, coal-mined lands that have been reclaimed to non-native grasslands can be restored to high-value hardwood trees. This is done through collaboration with community groups, Federal and State agencies, industry, nongovernmental partners, and willing landowners.

Agroforestry – Trees can produce economic and environmental benefits on farms through strategic practices such as riparian forest buffers, windbreaks, alley cropping, silvopasture, and forest farming. Partnership actions focus on increasing awareness of these agroforestry practices and carrying them out.

Urban and Community Forestry – Increasing tree cover in towns and cities is a priority because of the numerous environmental and societal benefits that trees provide directly to people. Grassroots community involvement can spur tree planting initiatives in developed areas and unique partnerships that come together to plant trees for different, but mutually beneficial, reasons.

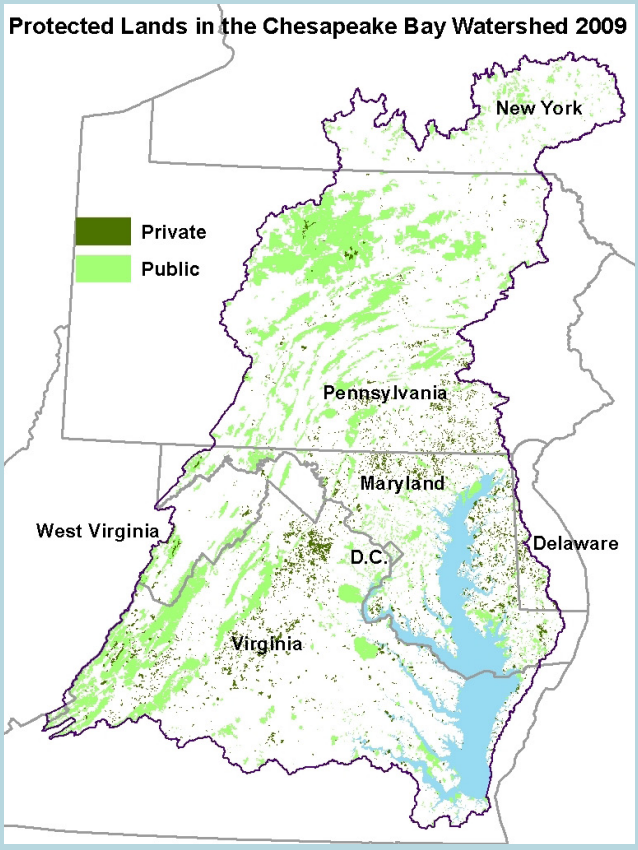
Contaminated Lands – Brownfields and other contaminated sites offer opportunities for intensive remediation and restoration using trees. Tree species can be specifically selected for their ability to take up and store and/or degrade site contaminants. Forests have been restored by building partnerships with interested local parties, but more technical guidance would be useful.

The Strategy's conclusion section emphasizes integrating forest restoration efforts across these priority areas and highlights some key tools and partnership actions that will support these efforts. Regional and local partnership initiatives can target areas that have overlapping priorities, which will leverage resources from multiple programs to achieve forest restoration goals.

Targeting Restoration Using Geospatial Data

Strategic forest conservation and restoration can be achieved using a **green infrastructure** planning approach. Green infrastructure refers to the network of natural areas (for example, forests, wetlands, and greenways) that provides multiple environmental benefits and supports sustainable communities. Geospatial information and analysis tools are used to prioritize areas of the landscape where conservation and/or restoration will achieve multiple, overlapping benefits.

One common-sense targeting approach is to focus restoration on conserved lands—those that are already protected from development through private conservation easements or public land management. These areas can be excellent candidates for forest restoration because landowners are already committed to stewardship and investments will be protected with the land.



Source: Chesapeake Bay Program

Restoring Chesapeake Forests through Partnerships

Accelerating forest restoration in the Chesapeake will require collaboration among partners in a broad network—Federal and State agencies, local governments, watershed and community organizations, and private partners. This Strategy lays out broad priorities and actions that will guide our forestry partnership efforts at the Chesapeake Bay Program in the years ahead. The process of collaboration started with the following teams that developed the Strategy sections over the past year, and will expand to encompass the many partners working to restore the Chesapeake Bay ecosystem and its vital forests:

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[1]Nowak, David J.; Stein, Susan M.; Randler, Paula B.; Greenfield, Eric J.; Comas, Sara J.; Carr, Mary A.; Alig, Ralph J. 2010. Sustaining America's urban trees and forests: a Forests on the Edge report. Gen. Tech. Rep. NRS-62. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 28 p. **www.fs.fed.us/openspace/fote/sustaining.html**. (26 April 2012).

[2]Plumb, Mike. 2008. Sustainable raindrops: cleaning New York Harbor by greening the urban landscape. Riverkeeper Report. 40 p. **http://www.riverkeeper.org/wp-content/uploads/2009/06/Sustainable-Raindrops-Report-1-8-08.pdf**. (26 April 2012).

[3]McAliney, Mike. 1993. Arguments for land conservation: documentation and information sources for land resources protection. Trust for Public Land, Sacramento, CA.

[4]Nowak, D.J.; Crane, D.E. 2002. Carbon storage and sequestration by urban trees in the USA. Environmental Pollution. 116(3): 381-389.

[5]Ernst, C.; Gullick, R.; Nixon, K. 2004. Protecting the source: conserving forests to protect water. Opflow. 30(5). 5 p. **http://efc.muskie.usm.maine.edu/conservation_finance/Documents/Drinking%20Water/Conserving%20Forests%20to%20Protect%20Drinking%20Water.pdf**. (26 April 2012).

Section 2
Fish and Wildlife Habitat

WHY

From its headwaters in the Appalachian Mountains to the Atlantic Ocean, the Chesapeake Bay watershed supports over 3,600 species of animals and plants. Historically, these "living resources" of the Bay thrived in a landscape that was around 95 percent forested. These forests sustained healthy streams and rivers and the most productive estuary in the world. With forest cover now at 55 percent and declining, habitat loss has taken a great toll on the many species that need forests for clean water, food, shelter, and breeding—in essence, for survival. As human population growth and development continue in the region, **forest habitat must be preserved and restored in priority areas** to minimize further losses in fish and wildlife populations.

Restoring riparian forest habitat remains the most essential task to support wildlife and fisheries across the Bay watershed. Riparian forests provide a host of well-documented benefits for wildlife, such as:

- Filtering nutrients, sediment, and other pollutants from waterways
- Maintaining consistent streamflows and moderating stormwater
- Shading streams to provide optimal temperature and oxygen levels
- Fueling the aquatic food chain with essential tree material (for example, leaf litter)
- Providing corridors for wildlife to travel safely and forage between habitat patches

Forest habitat is increasingly fragmented by road building, residential development, and other human activities such as Marcellus shale gas development. This fragmentation has the greatest impact on songbirds such as the cerulean warbler (figure 2.1) and other species that require large blocks or "hubs" of forest interior habitat. Only 40 percent of Chesapeake forests are currently capable of providing forest interior conditions. In our patchwork landscape of human disturbances, animals need forested corridors that connect larger "islands" of forest and wetland habitat. Forest restoration should be targeted to expand on the existing habitat network of forest hubs and corridors and fill in critical gaps.

Forest restoration in the Bay should support **diversity in age, structure, and species composition** of forests across the landscape to meet the unique needs of different wildlife species. Some key species in decline, such as the cerulean warbler and Delmarva fox squirrel, require mature forest habitat. Others, such as the American woodcock and golden winged warbler, rely on young or "early successional" forest habitat, which has declined due to fire suppression and other land use changes. In addition to restoring forest cover where it has been lost, it is important to **manage existing forest land to improve habitat** for a specific array of species.

Photos: Delmarva fox squirrel, golden-winged warbler (U.S. Fish and Wildlife Service); spotted salamander, cerulean warbler (Bill Hubick, www.billhubick.com)

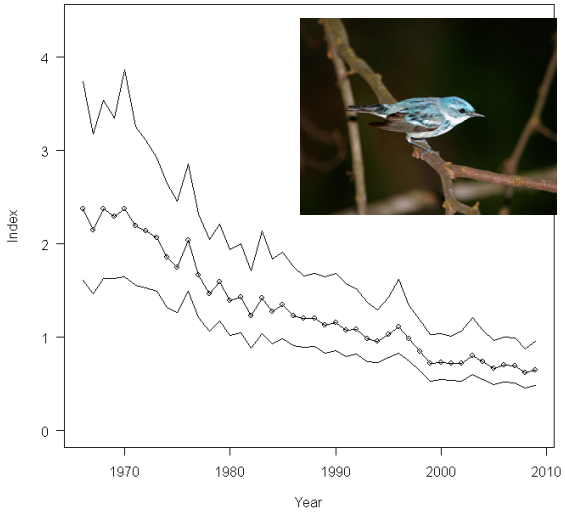


Figure 2.1. Breeding bird surveys have shown steep declines of forest interior dwelling birds such as the cerulean warbler (Appalachian Region). Sauer, J.R.; Hines, J.E.; Fallon, J.E.; Pardieck, K.L.; Ziolkowski, Jr., D.J.; Link, W.A. 2011. The North American Breeding Bird Survey, results and analysis 1966-2009. Version 3.23.2011. Laurel, MD: USGS Patuxent Wildlife Research Center. **http://www.pwrc.usgs.gov**.

Expand Forest Hubs and Corridors

WHERE

In recognition of the damaging effects of habitat fragmentation on wildlife, a number of States and localities have worked on "green infrastructure" assessments in the last decade. These GIS analyses use many data layers to identify and prioritize a critical network of forest hubs, corridors, and wetlands to be conserved. These assessments help identify areas where forest restoration can have the greatest benefit to fish and wildlife habitat (figure 2.2). Assessments have been completed in **Maryland**, **Virginia**, and Delaware. Pennsylvania and West Virginia are currently developing State assessments with support from EPA Region 3. In New York, the U.S. Fish & Wildlife Service and partners in the Upper Susquehanna Conservation Alliance are using ecological data to prioritize areas for conservation and restoration.

Forest restoration should be targeted to bolster the remaining habitat network being used by wildlife. Forest restoration can enhance forest hubs by filling in habitat gaps and expanding hub boundaries. Making hubs larger provides additional forest interior habitat for many bird species of concern, such as the wood thrush, Kentucky warbler, hooded warbler, and yellow-throated vireo. Forest corridors along waterways and ridgelines are critical habitat pathways for many wildlife species. In many cases, forested corridors between habitat patches are lacking, so restoration should be designed to fill in unforested gaps and widen existing forest corridors where feasible.

State Wildlife Action Plans, created in recent years by State wildlife agencies, are another key tool for identifying habitat priorities for many wildlife species of concern. As these plans are updated, additional GIS information will likely be available to aid restoration planning for critical habitats. **State Forest Action Plans,** developed by State forestry agencies in 2010, also provide good guidance on forestry priorities in each State.

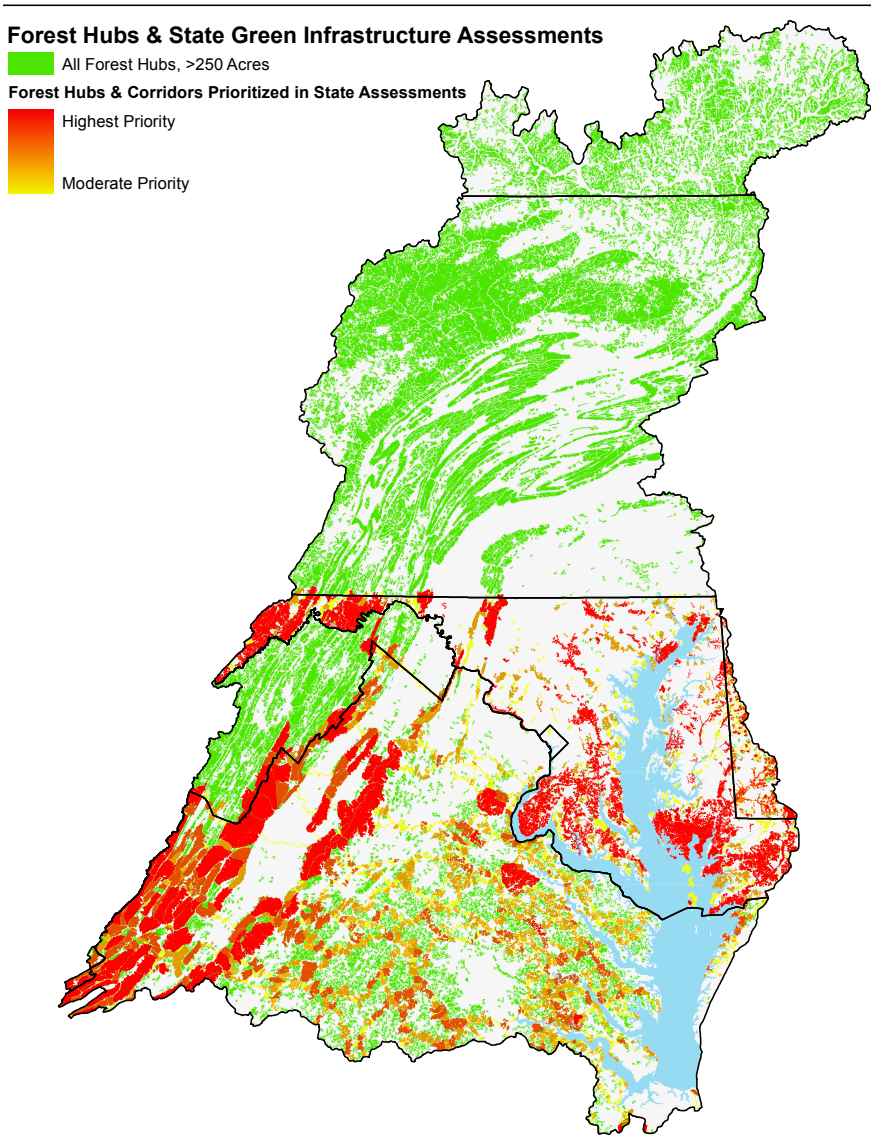


Figure 2.2. The distribution of forest hubs that provide at least 250 acres of forest interior habitat is shown in green. The areas highlighted in red-yellow are forest hubs and corridors that have already been prioritized in statewide green infrastructure assessments. Source: Map compiled by Tim Culbreth, Maryland Forest Service with forest hub data provided by EPA (Wickham dataset, 2001) and state green infrastructure data provided by Joe Weber (VA-DCR), George Edmonds (MD-DNR), and Mark Biddle (DE-DNRC).

Riparian Forest Buffers

Federal and State partners have committed to restoring riparian forest cover along 68 percent of the Chesapeake Bay watershed's stream miles by 2025, with an ambitious target of restoring 900 miles each year. In addition to their well-recognized role in improving water quality, riparian forests fulfill important habitat needs for a host of aquatic and terrestrial species. For example, forests along streams and rivers provide critical migration pathways, especially for slow-moving species like amphibians and reptiles that cannot easily cross open fields and forest gaps. Forest buffers around isolated depressional wetlands and vernal pools offer essential habitat for the adult life phase of many amphibians that live in forests and breed in nearby wetlands. Forests surrounding isolated wetlands are important throughout the watershed and occur in a high concentration on the Delmarva Peninsula. While forest buffers will bring benefits anywhere they are restored, certain areas are a higher priority for key wildlife species of concern.

Example: Targeting buffers for Eastern brook trout

Loss of forest cover, particularly in the riparian zone, is one of the major causes of decline for sensitive aquatic species such as the Eastern brook trout. Brook trout, the only native trout species in the Chesapeake Bay basin, require high water quality, water temperatures less than 70° F, and streambeds free of sediment for spawning. Because brook trout are an important indicator of watershed health and an umbrella species for protecting other headwaters species of concern, their restoration was included as a key outcome in the Executive Order Strategy for the Bay. Brook trout historically inhabited a broad expanse of the Chesapeake Bay basin, thriving in mountain headwater streams and spring creeks and rivers across the Piedmont region. However, brook trout have disappeared or are predicted to have vanished from more than half of the subwatersheds they originally inhabited. A GIS analysis conducted by the group Eastern Brook Trout Joint Venture found that riparian forest cover (greater than 70 percent in a subwatershed) was the strongest predictor of brook trout survival. Figure 2.3 shows a subset of Chesapeake Bay catchments that have intact brook trout populations (blue) where riparian forest cover is less than 70 percent and can be improved through targeted forest restoration. The red areas are downstream catchments where brook trout are currently absent but could be successfully reintroduced following forest restoration and other habitat enhancements.

Because brook trout are valued for their beauty, sport fishing qualities, and association with pristine water quality, their restoration can be a strong motivator for landowners to plant riparian forest buffers and improve stream habitat.

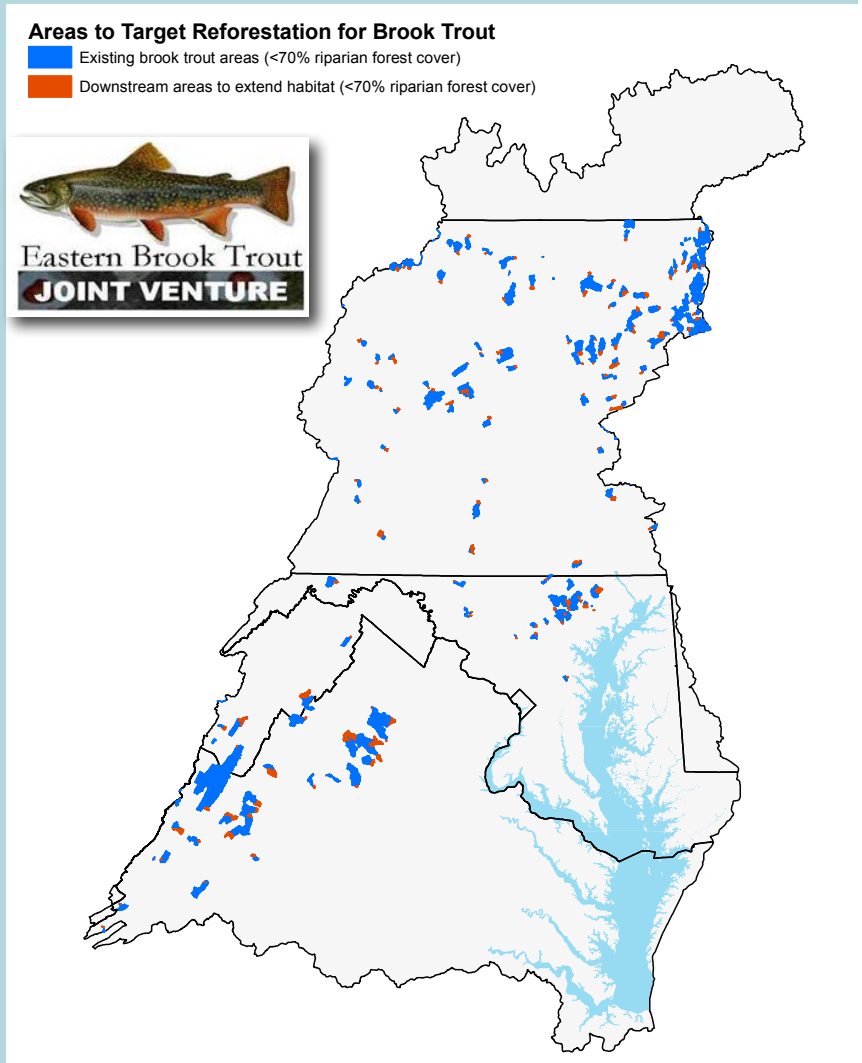


Figure 2.3. Analysis of areas to target reforestation for brook trout. Data for New York will be incorporated in 2013. Source: Mark Hudy (U.S. Forest Service), Eastern Brook Trout Joint Venture.

Financial and Technical Assistance

HOW There are a number of USDA programs that provide financial and technical assistance for forest buffer and tree planting projects on agricultural lands, including:

- Conservation Reserve Enhancement Program (CREP)
- Conservation Reserve Program (CRP)
- Environmental Quality Incentives Program (EQIP)
- Wildlife Habitat Incentive Program (WHIP)
- Wetlands Reserve Program (WRP) (covers conservation easements and restoration)

Each program has different requirements and opportunities, so contacting the local Soil Conservation District Office is the best place to start.

Landowners can learn about other financial and technical assistance options by contacting the local State forestry office, State natural resources office, or U.S. Fish and Wildlife Service office. Nongovernmental organizations, such as the Chesapeake Bay Foundation and Trout Unlimited, offer assistance in some areas. Some local jurisdictions offer specific incentives for tree planting, which may be ongoing or short term for several years. Many private companies can also plan reforestation projects. It is best to talk to several natural resource experts in the area to learn about local opportunities.

Some additional programs and habitat initiatives that could be used for forest restoration efforts include:

- U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program
- **National Fish & Wildlife Foundation Grants**
- Joint Venture Partnerships - **Eastern Brook Trout**, **Appalachian Mountain**, **Atlantic Coast**
- State and local green infrastructure plans
- State restoration programs, including funding to implement Total Maximum Daily Load/Watershed Implementation Plans

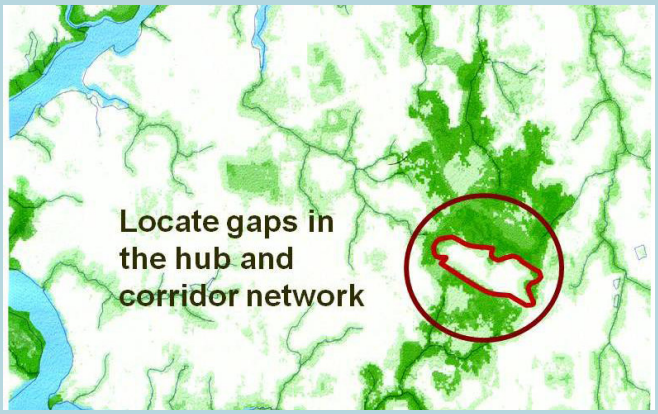
Important pollinator species in decline, such as the Eastern tiger swallowtail, need forest habitat to keep providing benefits to adjacent farmland and fields. Source: U.S. Fish and Wildlife Service

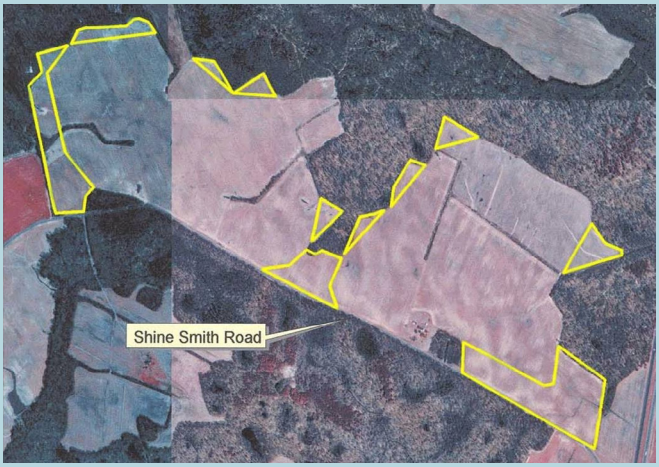
Chino Farms Case Study:

Targeting Gaps in Green Infrastructure

Chino Farms, a 5,200-acre property on Maryland's Eastern Shore, exemplifies strategic habitat restoration to benefit wildlife. The Eastern Shore Tributary Team selected the farm as a forest restoration demonstration site based on its key location in the State's Green Infrastructure assessment. The site plan targeted the margins of the productive agricultural fields to expand forest interior habitat and connect two large forest tracts in the area. The project **leveraged Federal, State, and local funding sources to plant 36,000 trees to restore 65 acres** of priority forest habitat.

Landowner Dr. Henry Sears has modeled other stewardship practices including organic farming, restoring grassland and wetland habitat, and protecting the land in perpetuity through the Maryland Rural Legacy Program.





Areas in yellow were reforested at the edges of farm fields to expand and connect the forest hub-corridor network. Source: Images provided by Bill Jenkins, EPA Region 3. Read full case study in **A Sustainable Chesapeake: Better Models for Conservation**. *Burke, D.G. and J. E. Dunn, eds. 2010. The Conservation Fund. P. 107-114.*

Restoration in Action

Since 2005, Trout Unlimited has been working with partners to restore brook trout habitat throughout the Potomac River watershed in West Virginia where streams with unrestricted cattle access—a top threat to brook trout throughout the Bay watershed—now have impaired water quality and fish habitat. This partnership helps landowners restore stream habitat by installing livestock fencing and riparian buffers and by removing barriers to fish passage.

The partnership observed two bottlenecks to delivering conservation services in the upper Potomac: affordable installation of Best Management Practices (BMPs) and the technical capacity to design stream restoration projects. To tackle these issues, Trout Unlimited and the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program established a "conservation crew" that installs over 20 miles of fencing and related riparian corridor enhancements each year. With the support of the Natural Resources Conservation Service (NRCS), Trout Unlimited hired a biologist in January 2011 to expand the partnership's ability to design, permit, and manage stream restoration projects.

Key ingredients to Trout Unlimited's success in the Potomac headwaters include:

- The ability to use brook trout as a marketing tool to engage landowners in adopting conservation practices.
- Close relationships with agencies and partner groups, such as the NRCS, Farm Service Agency, and the West Virginia Department of Natural Resources.
- Mission-driven outreach to landowners, backed by technical, financial, and operational know-how.

Riparian tree planting by Trout Unlimited and partners in the Potomac headwaters. Source: Kevin Anderson

Actions

Collaborate with USDA, forestry and wildlife agencies, and nongovernmental partners to **restore 900 miles of riparian forest buffer each year**; sustain and leverage funding available through CREP and other programs.

Focus forest restoration efforts in priority areas to meet brook trout restoration goals; transfer successful models, such as Trout Unlimited's Potomac initiative, to other priority areas.

Continue to **develop State and local green infrastructure (forest hub-corridor) plans** to help target forest conservation and restoration (for example, in Pennsylvania, West Virginia, and New York).

Work with the Chesapeake Bay Habitat Goal Implementation Team, State fish and wildlife agencies, the National Fish and Wildlife Foundation (NFWF), and other nongovernmental organizations to further **identify restoration priority areas and actions for key forest-dependent species**.

Promote forest restoration as a central BMP to meet Total Maximum Daily Load/Watershed Implementation Plan targets ***and*** simultaneously achieve habitat goals.

Pursue innovative funding incentives and outreach strategies to reach landowners in targeted areas through NFWF and other grants.

Conduct **Designing Sustainable Landscapes pilot project in the Nanticoke and Pocomoke watersheds** with a focus on forest-dependent species and habitat classes (U.S. Fish & Wildlife Service/North Atlantic Landscape Conservation Cooperative).

Section 3
Mine Lands

WHY Significant opportunities exist to restore forest habitat on lands formerly mined for coal in the Chesapeake Bay watershed. With the passage of the Surface Mining Control and Reclamation Act (SMCRA) of 1977, native forests cleared for surface mining were replaced with non-native grasses and shrubs in most cases. Machinery used during this reclamation heavily compacted the soils. This soil compaction, combined with competition from aggressive non-native vegetation, has inhibited the natural regeneration of native forests on many of these sites, leaving them in a state of "arrested natural succession" for decades, if not longer.

The Chesapeake Bay watershed contains significant areas of abandoned mine lands that were mined before SMCRA regulations were in place. This mining left deep scars on the land and persistent toxic impacts on streams, wildlife, and human health in some areas. Abandoned mine land areas that have acid mine drainage require site-specific reclamation practices that address contaminants. Tree planting should be incorporated into abandoned mine land restoration projects wherever appropriate based on site characteristics and toxicity concerns.

Re-establishing forest cover on mine lands will improve water quality in the headwaters of the Chesapeake and enhance stream habitat for Eastern brook trout, imperiled mussels, and other aquatic species. In the short term, mine land reforestation benefits early successional songbird species such as the golden-winged warbler, which requires young forest habitat. In the longer term, it benefits species such as the cerulean warbler, which requires large blocks of mature forest, by expanding forest cores and reducing overall forest fragmentation.

This Strategy recognizes that mine land reforestation will not be appropriate everywhere. Some landowners are using former mine lands for agricultural production. Other reclaimed mine lands have become hotspots for grassland birds, so this habitat should be kept intact for those species. Areas that are not suitable for large-scale reforestation could still benefit from the planting of forest buffers along streams to reduce soil erosion and improve aquatic habitat for many species.

Typical reclaimed mine land within the Chesapeake Bay watershed. This site in Centre County, PA, features compacted soils and non-native vegetation. Grassland now covers what was forested prior to mining. Source: Scott Eggerud

WHERE Figure 3.1 shows the distribution of mine sites that have been documented in State GIS databases. Abandoned mine lands that were mined before SMCRA regulations were in effect are shown in red. It is estimated, however, that there are many more that have not been mapped in a GIS. Note that Maryland did not have GIS data for Abandoned Mine Lands available at the writing of this Strategy. The permitted (post-SMCRA) surface mine sites are blue; these are most likely to have been reclaimed in larger patches of grass and shrubs with limited forest regeneration.

Data layers from the 2006 National Land Cover Database were overlaid to estimate the acreage of nonforested mine land in each Bay watershed county. Table 3.1 shows the Bay counties with the greatest acreage of nonforested mine land as well as statewide totals. Note that these estimates may underestimate forest cover somewhat because the resolution used does not detect the youngest regenerating forests. **These counties can serve as a good starting point for accelerating forest restoration where there are interested partners.**

Figure 3.2 shows the close overlap of mine lands in the Bay and priority habitat of two key songbird species of concern—the cerulean warbler (colored blue), which requires mature forest, and the golden-winged warbler (colored yellow), which favors young forest. Mined lands in the Bay also contain areas of key grassland bird habitat that are not suited for reforestation. Priority habitat of other key species of concern, like Eastern Brook Trout and threatened/endangered species, should also be incorporated when targeting reforestation efforts. State wildlife agencies and bird conservation organizations need to collaborate to determine the location of the highest priority areas for focusing reforestation efforts.

Table 3.1. Statewide totals of nonforested mine land (above) and Bay counties with the greatest acreage of nonforested mine land (below).

	Mine Land Acres	Non-Forested Acres	% Non-Forested
MD	12,910	6,811	53%
PA	43,273	10,900	25%
WV	13,943	7,374	53%
Total	70,126	25,084	36%

Counties with highest non-forested mine land acres		Mine Land Acres	Non-Forested Acres	% Non-Forested
Garrett	MD	7,539	4,302	57%
Clearfield	PA	15,326	3,995	26%
Grant	WV	8,240	3,954	48%
Allegany	MD	5,372	2,509	47%
Jefferson	WV	2,316	1,874	81%
Schulkyill	PA	7,572	1,516	20%
Luzerne	PA	2,283	915	40%
Mineral	WV	2,119	910	43%
Dauphin	PA	992	853	86%

Source: Analysis by Tim Culbreth (MD-DNR).

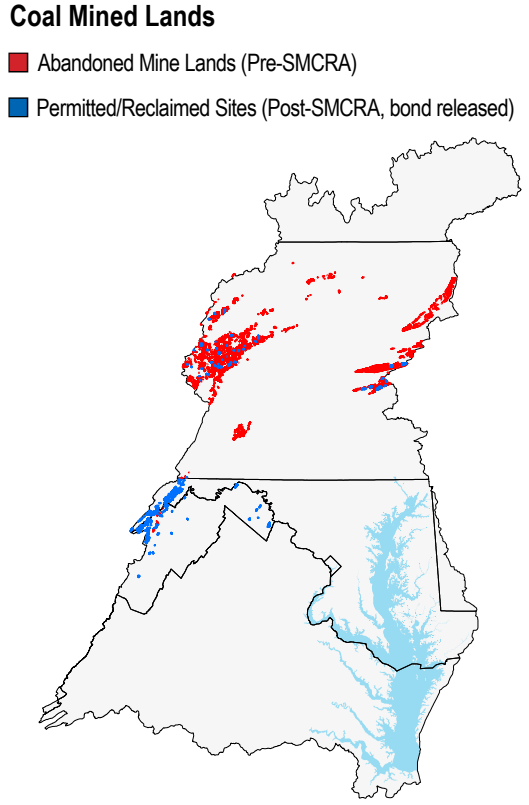


Figure 3.1. Known locations of coal mined lands in the Chesapeake Bay watershed. Source: Map compiled by Tim Culbreth (MD-DNR) from State sources.

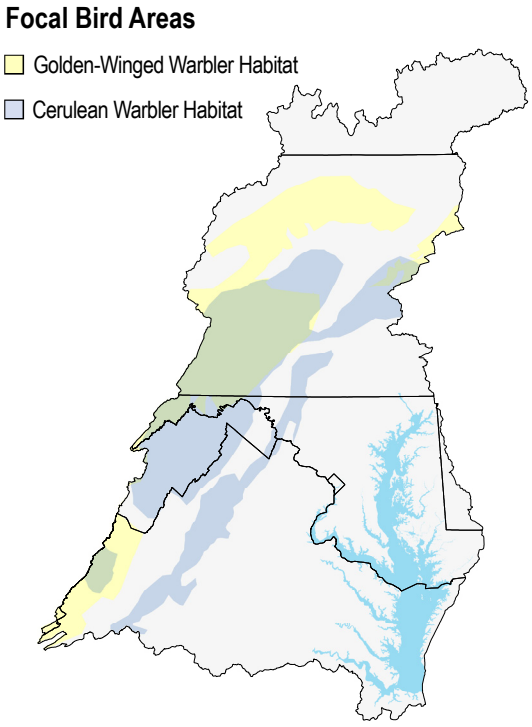


Figure 3.2. Priority habitat for key warbler species in decline overlaps considerably with mine lands. Source: Appalachian Mountain Joint Venture

HOW The **Appalachian Regional Reforestation Initiative** (ARRI) provides an excellent model and partnership approach to accelerating mine land reforestation in the Chesapeake Bay watershed. ARRI, which was established in 2004, is a coalition of the Office of Surface Mining Reclamation and Enforcement (OSMRE), State coal regulatory authorities, other Federal and State natural resource agencies, academia, industry, and nongovernmental organizations that promotes the reforestation of mined lands throughout the seven-state region that covers Central Appalachia. ARRI has drawn from decades of research to develop the Forestry Reclamation Approach, a set of Best Management Practices for quickly and effectively restoring high-value forest habitat on reclaimed mine lands.

The Forestry Reclamation Approach is certainly not the only option for reforesting mine sites, but it is particularly effective at addressing the primary reclamation problems of soil compaction and competing vegetation. It has been successfully applied in cooperation with active mine site operators who have been willing to restore the area to forest rather than grass. This approach has also been used in partnership with watershed organizations and other community groups to reforest sites that were already restored to grassland. As of 2011, partners in the Appalachian Region reported that 70 million trees were planted on 103,000 acres through reforestation efforts on active and former mine land sites.

5 Basic Steps of the Forestry Reclamation Approach developed by the Appalachian Regional Reforestation Initiative

1) Create a suitable rooting medium for good tree growth that is no less than 4 feet deep and comprised of topsoil, weathered sandstone, and/or the best available material.

2) Loosely grade the topsoil or topsoil substitutes established in Step 1 to create a noncompacted growth medium.

3) Use ground covers that are compatible with growing trees.

4) Plant two types of trees—early successional species for wildlife and soil stability, and commercially valuable crop trees.

5) Use proper tree planting techniques.

Nine-year-old trees planted on reclaimed land by ARRI partners in Kentucky using the Forestry Reclamation Approach. Source: Michael Hiscar

Mine land reforestation has been successful where there are strong watershed associations, local conservation organizations, academic institutions, or other community groups to champion the effort. These local organizations are critical in helping to identify potential sites, willing landowners, funding sources, and volunteers to make the tree planting happen. One highly successful approach has been the Office of Surface Mining-VISTA Appalachian Coal Country Team (ACCT). Through this program, VISTA volunteers currently serve in local watershed and community improvement groups throughout Appalachian coal country. Some of their local projects have included tree plantings and other restoration activities on former mine lands. There are currently no ACCT volunteers stationed within the Chesapeake Bay watershed, but these innovative community partnerships should be pursued.

Some of the funding sources that have either been effectively used in the past to reforest mine lands or could be pursued in the future include these:

- Federal programs administered by States – Office of Surface Mining Reclamation and Enforcement Abandoned Mine Lands; EPA Brownfields, Nonpoint Source (319)
- USDA cost-share programs (EQIP, WHIP, CREP)
- State forestry and restoration programs
- Mining industry – Work to reclaim active mine sites with forestry
- Private – Grants from foundations; utility companies seeking carbon credits

Tree planters from the Indiana University of Pennsylvania, Pennsylvania Bureau of Forestry, The Nature Conservancy, Office of Surface Mining Reclamation and Enforcement, and many other partners pose after a 160-acre planting in Centre County, PA. Early successional forest habitat for the golden-winged warbler was a primary goal of the project. Source: Jeffrey Larkin

The success of the Appalachian Regional Reforestation Initiative has been recognized nationally:

- First Presidential Migratory Bird Stewardship Award presented by the Department of the Interior in 2011
- 2011 National Award from the Arbor Day Foundation

Reforestation in Action

For more than a decade, **The American Chestnut Foundation** (TACF) has been working with universities, the Appalachian Regional Reforestation Initiative, and others to find ways to restore American chestnuts on reclaimed surface mines across Appalachia. American chestnut was a dominant forest tree—and very valuable to wildlife—that was essentially eliminated from the region in the mid-20th century by a blight. The native range of American chestnut overlaps considerably with the Appalachian coalfields. In 2008, in cooperation with the Office of Surface Mining, TACF planted approximately 4,500 blight-resistant chestnut trees on mine lands across 6 States, including some sites within the Chesapeake Bay watershed.

Based upon these successes, TACF recently received a Conservation Innovation Grant through the Natural Resources Conservation Service's Environmental Quality Incentives Program. From 2012 to 2014, the grant will fund the establishment of 12 30-acre plantings of a mixed hardwood-chestnut forest on reclaimed mines in Pennsylvania, Virginia, West Virginia, Ohio, and Kentucky. The project will examine the level of blight resistance in TACF's latest generation of backcross chestnuts and how they compete against other commonly used reclamation species. More than 245,000 seedlings, including 15,000 chestnuts, will be planted in this study, yielding valuable data that will allow land managers to make informed decisions when carrying out chestnut reforestation projects on reclaimed mines.

Blight-resistant American chestnuts were planted on mine land in the Georges Creek watershed of the Potomac River in 2010. Compacted soils were deep tilled or "ripped" to provide optimal growing conditions, and seedlings were protected with tree tubes and weed mats. Source: Scott Eggerud

Actions

Work with agency and nongovernmental partners to **identify priority areas and sites for targeted mine land reforestation**; incorporate habitat priorities for key bird species, brook trout, and other species of concern.

Convene a **regional workshop for watershed groups and agency partners** to promote forest restoration on mine lands in the Chesapeake Bay watershed.

Host local workshops in targeted areas to **engage landowners and community partners** in mine land reforestation opportunities.

Pursue the formation of OSMRE-VISTA **Appalachian Coal Country Teams**, or other community-based mine land reforestation initiatives, in the Bay watershed.

Work with Bay State mining agencies and abandoned mine lands programs to promote reforestation on reclaimed sites as much as possible.

Support the Appalachian Regional Reforestation Initiative's outreach and **collaboration efforts with active mining operations** to encourage forestry reclamation in the Bay watershed.

Section 4
Agroforestry

WHY

Farms and forests play a vital role in the economic, social, and ecological landscape of the Chesapeake Bay watershed. Approximately 22 percent of the watershed—9 million acres—is in agricultural land use (figure 4.1). An additional 4.2 million acres of woodlots exist on farm land in the Bay watershed. The future viability of these working lands is threatened by high rates of land conversion and development. Retaining sustainable rural landscapes and economies must be at the heart of watershed protection and restoration efforts. The positive environmental stewardship practices of farmers will be critical in reducing runoff of nutrients and sediment to local waterways. This Strategy section focuses on **using trees in strategic and innovative ways** to benefit farms and the Bay.

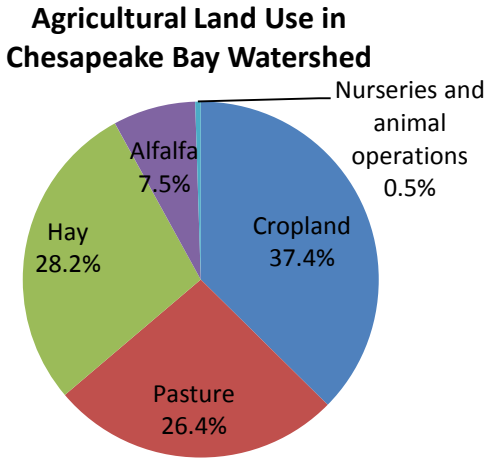


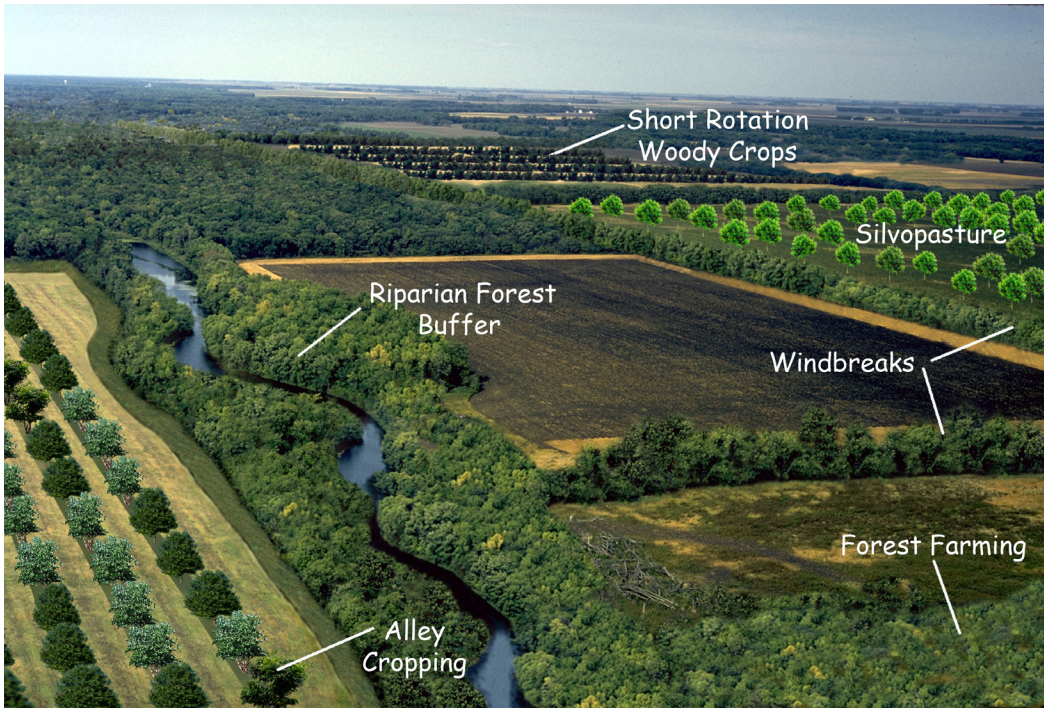
Figure 4.1. Agricultural land use in the Chesapeake Bay watershed. Source: Chesapeake Bay Program

Agroforestry is the intentional mixing of trees and shrubs into crop and animal production systems to create environmental, economic, and social benefits. – USDA Agroforestry Strategic Framework

Agroforestry practices bring together the **ecological** advantages of trees and other woody plants and the **economic** benefits associated with their products. By incorporating trees into agricultural landscapes, farmers can bolster the economic and environmental sustainability of their farming enterprise. By adopting agroforestry practices in wooded areas, landowners can receive an additional income stream that supports keeping the land in forest cover.

The USDA Agroforestry Strategic Framework (FY2011-2016) cites these benefits of agroforestry practices:

- Provide protection for valuable topsoil, livestock, crops, and wildlife
- Increase productivity of agricultural and horticultural crops
- Reduce inputs of energy and chemicals
- Improve water quality
- Diversify local economies



*The **USDA National Agroforestry Center** provides a wealth of information about how agroforestry practices can be incorporated into working lands. Source: National Agroforestry Center*

What is Agroforestry?

1) Riparian Forest Buffers
Definition: Trees and shrubs along streams and around wetlands that reduce the negative impacts of adjoining land use practices on aquatic resources.

Benefits: Improved wildlife, pollinator, and aquatic habitat. Potential economic benefits include multiple marketable products that can be grown in the buffer such as fruits, nuts, and timber. Riparian forest buffers are already a well-recognized practice within the Bay, but many streams need buffer restoration and enhancement.

2) Windbreaks/Shelterbelts
Definition: Trees and/or shrubs that mitigate the negative impacts of wind or snow.

Benefits: Protection of wind-sensitive crops and livestock, reduced snowplow costs, and shelter for homes (reduced heating costs and snow drifting, among others). Emerging benefits include capture of pesticide spray drift, reduced emissions and odor from intensive livestock production systems, carbon sequestration, and marketable wood products such as timber and biofuels.

3) Alley Cropping
Definition: Rows of trees or shrubs with one or more agricultural crops that shelter crops, increase or sustain site productivity, and diversify production.

Benefits: Nitrogen-fixing woody species can reduce the need for nitrogen; energy needs can be reduced through woody biofuel production; economic contributions from woody plants may include seed, fruit, nut, and fiber products. A common example of alley cropping in the Bay region is the integration of annual crops, such as pumpkins or sweet corn, with orchard tree crops.

4) Silvopasture
Definition: Integration of trees and livestock production on the same acre at the same time. Silvopastures are managed to enhance the growth and productivity of both the overstory trees and the understory forage vegetation while also providing shelter for livestock.

Benefits: Establishing silvopasture on steep, marginally productive, and highly erodible pasture and cropland can enhance both water quality and farm profitability. Silvopasture may also increase biodiversity and provide shelter, cover, and food for wildlife species.

5) Forest Farming/Multistory Cropping
Definition: Cultivation of edible, floral, medicinal, and craft crops underneath a forest canopy. Common understory crops include ginseng, golden seal, and other valuable medicinals as well as edible ramps and mushrooms.

Benefits: Increased economic viability of forest land by providing annual or short-term income as timber matures. Provides an incentive for forest landowners to address issues such as forest health, overstocked stands, invasives, lack of forest regeneration, and excessive deer browse.

Special Applications – Short Rotation Woody Crops
Definition: Fast-growing tree species, such as poplars and willows, that are grown for biofuels using agronomic techniques in open fields.

Benefits: Numerous environmental and economic benefits, including energy independence and local job creation. The Bay watershed has thousands of acres of idle or marginal land that could support these woody crops.

Windbreak (top), alley cropping (upper middle), silvopasture (lower middle). Source: NRCS. Forest farming/ginseng (bottom). Source: Bill Slagle

Where

Agroforestry practices can be applied throughout the watershed to provide benefits to landowners and the Bay.

Landowner outreach, technical assistance, and incentives for agroforestry should be focused in areas that have the greatest need and present the greatest opportunity. The Natural Resources Conservation Service has selected priority watersheds for supplemental cost-share funding of voluntary conservation practices through the Chesapeake Bay Watershed Initiative (figure 4.2). These priority watersheds represent areas that have the highest runoff of nutrients and sediment into the Bay. Riparian forest buffers and other agroforestry practices should be focused in these areas to accelerate Bay restoration efforts.

State forestry agencies in Maryland and Virginia have been working with partners to target riparian forest buffers at the county level using GIS tools. These analytical tools identify areas where forest buffers are most needed and would yield the greatest water quality benefits. Analysis results help guide outreach and technical assistance to landowners who are interested in incentive programs.

Carrying out other agroforestry practices such as windbreaks, silvopasture, alley cropping, and forest farming will depend largely on farm characteristics and landowner goals. Counties with a high concentration of pasture land (figure 4.3) provide a good starting place for silvopasture education and pilot initiatives. Areas with high poultry production are a good place to promote windbreaks, or "vegetative environmental buffers," to manage air emissions and odors.

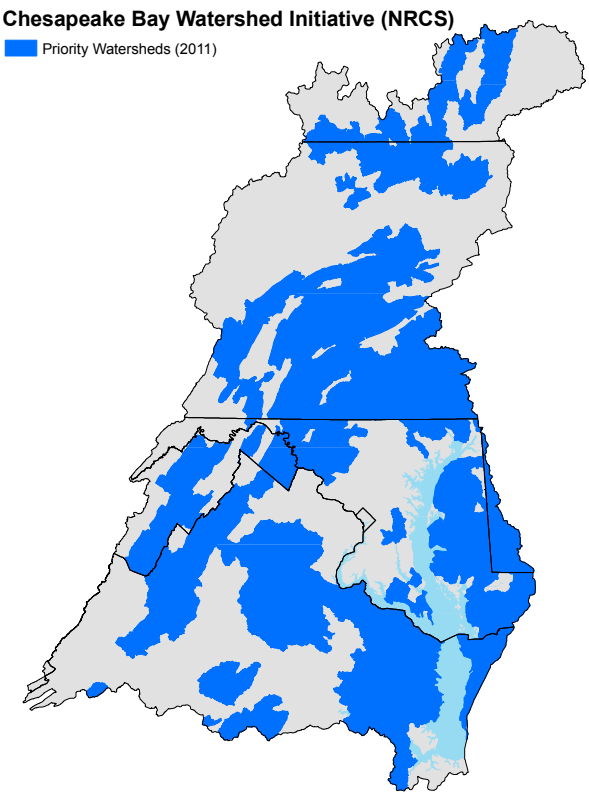


Figure 4.2. Priority watersheds for Chesapeake Bay Watershed Initiative agricultural cost-share funding (FY2011). Source: NRCS

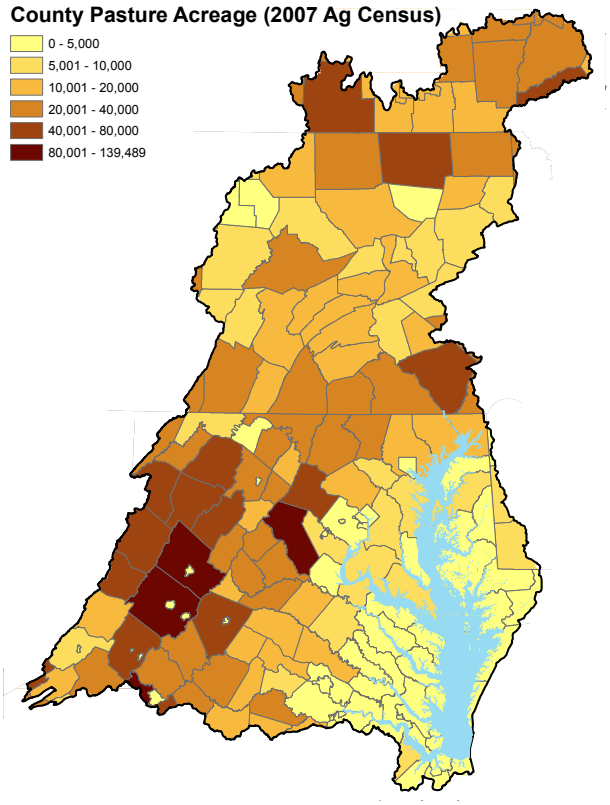


Figure 4.3. Acreage of pasture by county within the Chesapeake Bay watershed using 2007 USDA Census of Agriculture data. Source: Chesapeake Bay Program

HOW The USDA Natural Resources Conservation Service (NRCS) provides financial assistance to establish agroforestry practices through Farm Bill programs such as the Environmental Quality Incentives Program, Wildlife Habitat Incentive Program, and the Conservation Stewardship Program. Cost-share and rental payments to establish riparian forest buffers are available through the Conservation Reserve Enhancement Program and Conservation Reserve Program, both of which are administered by the USDA Farm Service Agency. Additionally, State and local programs also exist in some areas to promote these practices. Because incentives vary by State, information can be found online and at local USDA Service Centers. **Technical assistance** for installing agroforestry practices is available from NRCS, State forestry agencies and consulting foresters, and local Soil and Water Conservation Districts.

Although cost-share assistance for forest buffers and tree/shrub establishment has long been available, the term "agroforestry" and some of its practices are still relatively new to many agricultural producers and professionals in the region. To address this gap, agency partners in Pennsylvania have been proactively raising awareness about agroforestry and promoting its many benefits:

- **Agroforestry Workshops** were held in 2011-2012 to target producers, landowners, and natural resource professionals and focus on silvopasture, forest farming, buffers, and windbreaks. The Pennsylvania Department of Conservation and Natural Resources (PA-DCNR) Bureau of Forestry sponsored the workshops in cooperation with the NRCS, Penn State University, Cornell University, Shaver's Creek Environmental Center, and the Pennsylvania Association for Sustainable Agriculture.
- An **agroforestry demonstration site** is being developed at Dickinson College Farm through a PA-DCNR Bureau of Forestry grant from the U.S. Forest Service.
- The NRCS in Pennsylvania **updated its technical guidance** to include agroforestry practices. Its guidance includes standard criteria for the five main agroforestry practices, financial program payment scenarios for windbreaks and riparian forest buffers, a Tech Note for establishing windbreaks around poultry production facilities, and Conservation Stewardship Program guidance about planting trees and shrubs that provide edible products.
- The NRCS in Pennsylvania also added Forestry and Agroforestry categories to its **Conservation Innovation Grants program** that solicit demonstrations of alley cropping, multistory cropping, adding short-rotation woody biomass to annual crop rotations, direct tree seeding methods, and establishing pollinator habitat in forest edges.
- The PA-DCNR Bureau of State Parks obtained a grant to conduct a **pilot "goats in the woods" project to remove invasive vegetation** at King's Gap Environmental Education in Cumberland County.

These partnership initiatives provide a great model and foundation for promoting agroforestry practices more broadly across the Bay watershed in the years ahead.

An innovative example of silvopasture in Maryland is the use of "eco-goats" to remove damaging invasive plants from woodlands and fields. The goats shown here are munching on oriental bittersweet at the forest edge. Source: Brian Knox, **Eco-Goats**

Agroforestry in Action

The Catawba Sustainability Center (CSC) is a 377-acre tract of farm and forest land nestled in the Catawba Valley in the Upper James River Basin in southwestern Virginia. The CSC is an Outreach and International Affairs initiative of **Virginia Tech University**. At the CSC, community members, students, and other stakeholders collaboratively learn about agroforestry in a setting focused on both economic growth and environmental stewardship. It is a key Chesapeake Bay headwaters property that has over 2 miles of the Catawba Creek flowing across its landscape.

In 2008, **Catawba Landcare**, a local landowner group working at the CSC, expressed interest in agroforestry and a partnership with the USDA National Agroforestry Center. To date, the partners have established fruit, nut, and floral riparian buffer demonstrations; native medicinal forest farming trials; windbreaks; and edible roadside landscapes. They have also offered accompanying workshops and training events, which have contributed to more than 3 miles of private riparian forest buffer plantings, a small demonstration windbreak, a forest farming demonstration, and installation of protective fencing. Future plans call for development of a silvopasture demonstration.

Students and community members plant woody florals at the Catawba Sustainability Center to demonstrate crops that can be used in agroforestry riparian plantings. Source: James Chamberlain

Actions

Work with NRCS State Technical Committees in Bay States to **promote agroforestry practices through Farm Bill programs**.

Agroforestry is a relatively new concept. **Train-the-trainer workshops** that target resource professionals in the watershed are a first step toward reaching watershed landowners. Subsequent workshops can introduce agroforestry practices to landowners.

Establish **agroforestry demonstration areas** by finding early adopters with working farms and forests so that others can see the conservation and economic benefits of agroforestry practices. Pursue **USDA Conservation Innovation Grants** and other funding sources to establish these sites.

Work with the NRCS Ecological Sciences staffs in the Bay States to **get the five main agroforestry practices included in the Field Office Technical Guide and Farm Bill programs.**

Explore a **Bay Branding campaign** for agroforestry products similar to Edible Chesapeake but focused specifically on foods and products developed from businesses committed to sustaining working forests within the Bay area.

Design and implement **agroforestry research projects** to ensure stakeholders have access to cutting-edge and regionally relevant science.

Expand application of agroforestry practices and innovations to **small-scale landscapes, including urban settings**.

Section 5
Urban and Community Forestry

Students planted a native river birch in a schoolyard. Source: Chesapeake NEMO

WHY

Considering the many benefits trees provide to people, it is important that they grow where people are—in our towns and cities. Increasing tree cover in communities is one of the most sustainable and cost-effective practices to improve both society well-being and the environment. These benefits include, but are not limited to, the following:

- **Public Health:** By lowering city temperatures and removing pollutants from the air, trees can reduce the risk of residents developing a number of health problems, including heart and lung disease and asthma. Based on studies of the costs of pollution to society, such as health care, the existing tree cover in Washington, DC, saves that city nearly $51 million annually.[1]
- **Air Quality:** Trees save Baltimore City over $2 million each year by mitigating ozone, particulate matter, and other pollutants.[2] This figure does not include the many other public health benefits that trees provide.
- **Water Quality:** Trees can protect drinking water, reduce stormwater, and, with proper watershed planning, reduce flooding.
- **Wildlife Habitat:** Our urban forests provide habitat for the wildlife we enjoy.
- **Energy Savings:** Trees can save an average household 30 percent of air conditioning costs.[3]
- **Community Reinvestment:** Studies show that urban trees increase property values, encourage more shopping, and contribute to overall satisfaction within a neighborhood. Green job corps and the Green Streets program (see Introduction) also provide jobs for planting and maintaining trees.

In recognition of these benefits, in 2007 the **Chesapeake Bay Executive Council committed to having 120 communities develop urban tree canopy expansion goals by 2020**. This goal will likely be exceeded as communities realize that trees are a good investment and develop grassroots programs. Local programs to preserve and expand tree canopy are the most cost-effective way to achieve the following multiple community objectives:

Water Quality Goals

Planting trees in urban or suburban settings reduces the volume of nutrients and sediment that enters local waterways, helping to meet Chesapeake Bay Total Maximum Daily Load requirements. Urban tree planting gets credit as a Best Management Practice that reduces nitrogen loading from an estimated 13 pounds/acre to 4 pounds/acre on average in the watershed.[4]

Stormwater Management

Tree planting is an important, low-cost strategy to reduce runoff and meet stormwater management requirements. Some larger cities have language to expedite tree planting in their MS4 (Municipal Separate Storm Sewer Systems) permits; Washington, DC is the first jurisdiction in the Bay watershed to include a specific annual tree planting target in its permit.

Air Quality Attainment

Air quality has been a concern in some areas of the Chesapeake Bay watershed (figure 5.1). Tree planting can be a cost-effective, easily tracked way to meet regional air quality goals and is increasingly included in air quality improvement plans. For instance, trees in Prince William County, Virginia, removed 227 tons of nitrogen dioxide (NO2) each year, and the same trees provided a total estimated air quality benefit of nearly $37 million.[5] EPA guidelines currently consider tree cover to be a voluntary measure in air quality improvement plans.

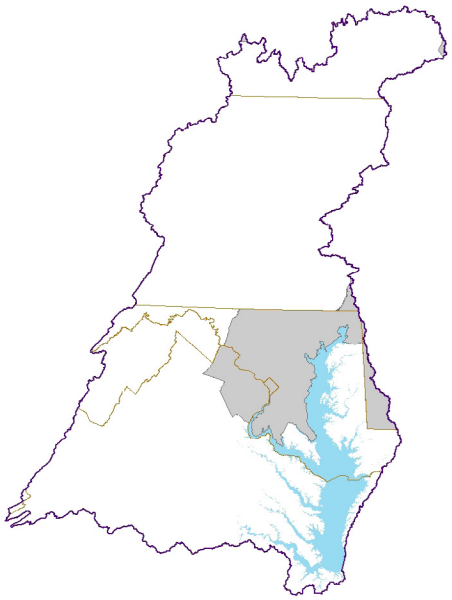


Figure 5.1. Air Quality Non-Attainment Areas (shaded gray), 1997 8-Hour Ozone Standard. Source: EPA. Note that these areas are currently being redefined by EPA and States based on 2008 standard.

WHERE EVERY community can benefit from efforts to increase urban tree canopy. Figure 5.2 shows areas where work has begun to assess tree canopy and set goals. These localities are good targets for strategic investments to support tree canopy expansion. Where communities have not completed tree canopy assessments, investments should be targeted in more populated areas and areas affected by storm damage.

Lawns surrounding private homes and offices within the Bay watershed take up more land than corn or soybeans (figure 5.3). There is ample opportunity to plant trees on large lawns, and landowner programs show that there is willingness to stop mowing and start reforesting this space.

Matching the growth characteristics of trees to the conditions at the planting site is a very important strategy. For example, it's important to plant smaller trees in utility rights-of-way in developed areas, especially if there are overhead or buried lines and older sewer lines. Trees need sufficient space to grow and thrive over many years. For example, sidewalk damage to trees is a common reason why street and park trees are removed. Where these spaces can't be increased, other solutions include meandering sidewalks around trees, suspending sidewalks above tree roots, and replacing concrete sidewalks with recycled rubber sidewalks, among other modifications.

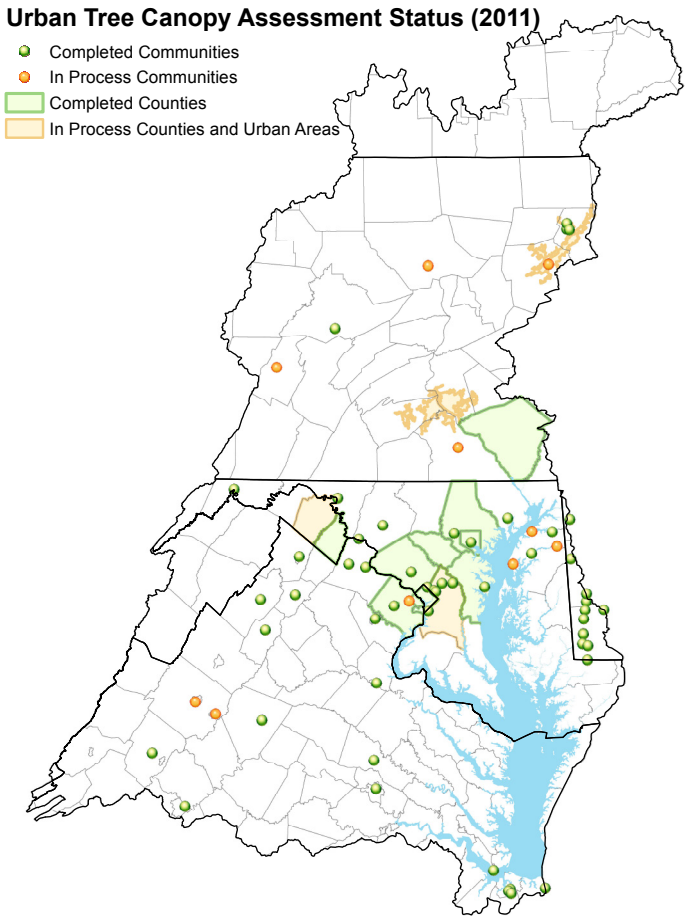


Figure 5.2. Urban tree canopy assessment status in the Chesapeake Bay watershed as of 2011.
Source: Chesapeake Bay Program, compiled from State forestry agencies. Note that although tree canopy assessments have not been com pleted yet in the Bay portion of New York, the State forestry agency and a number of local governments support tree planting initiatives.

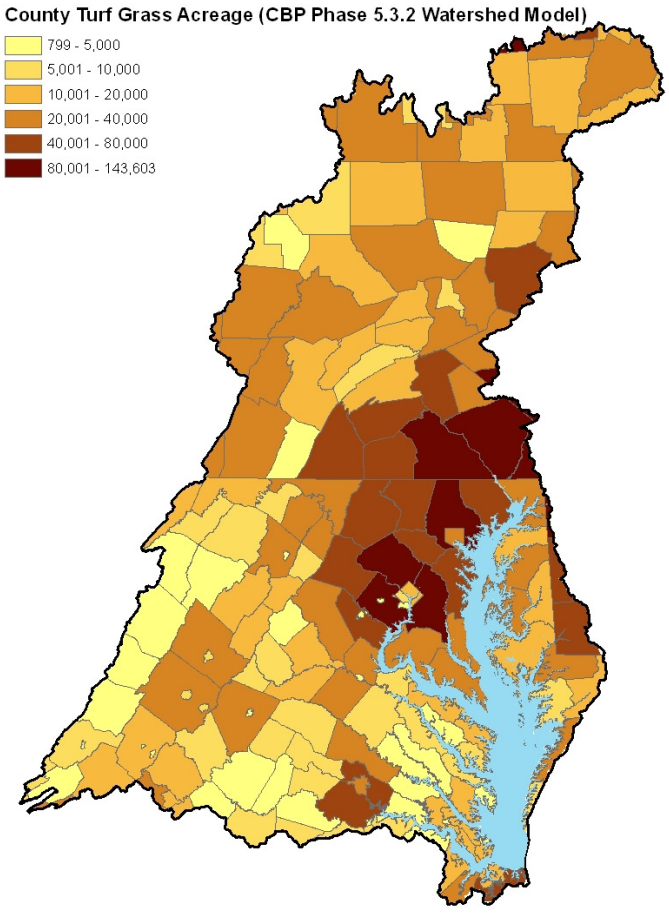


Figure 5.3. The acreage of turf grass by county in 2006 in the Chesapeake Bay watershed. Source: Chesapeake Bay Program, 2006 data

Assessing Tree Canopy

HOW Tools and resources are constantly being developed and improved to help communities assess existing tree canopy and strategically plant urban trees. Two examples include these:

Urban Tree Canopy Assessment

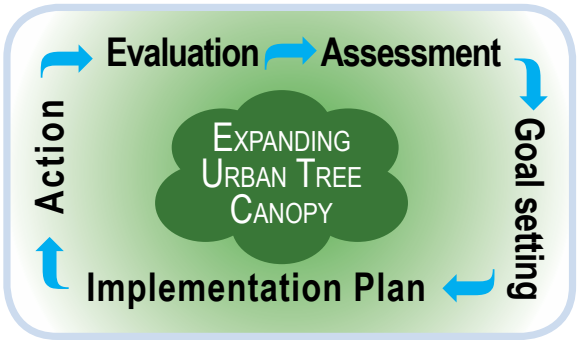
An **urban tree canopy assessment** gives decisionmakers detailed information about existing and potential tree canopy using high-resolution aerial imagery. This data helps them understand the urban forest in its current form and plan feasible approaches to increasing tree canopy.

i-Tree Tools

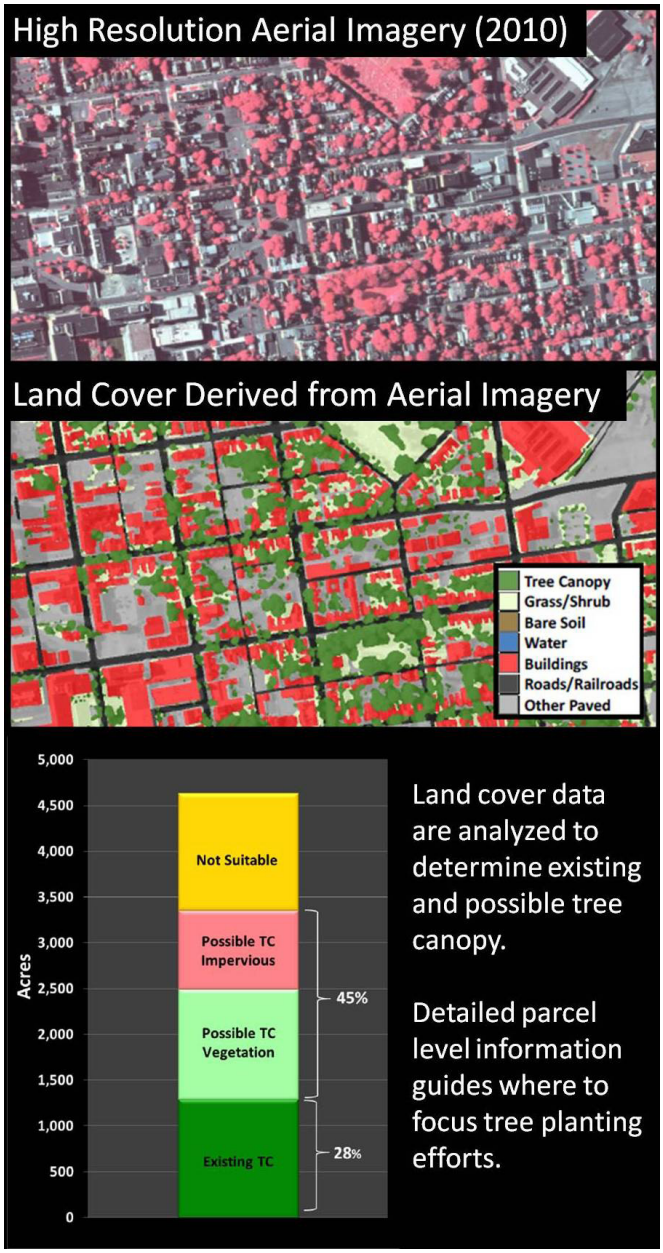
The **i-Tree suite of tools** can be used to collect data during on-the-ground tree surveys. These tools quantify the structure and function of community trees and the environmental services they provide. Communities of all sizes can use this information to strengthen their urban forest management and tree planting efforts.

Setting Goals and Planning for Tree Canopy Expansion

These are the recommended steps for conserving and expanding community tree canopies, which includes community participation throughout the process:



Ask these questions during the initial *assessment and mapping phase*: "What is present? What is possible? And what is preferable?" After determining the current tree canopy status, engage stakeholders throughout the community to discuss increasing canopy cover. Many sociopolitical issues will influence how individual communities decide to increase tree canopy cover and *set a tree canopy goal* for the future. Once a goal is agreed upon, making the goal official using an ordinance or other binding documents can help move a goal into the *implementation phase*. A good example of how to encourage *action* towards reaching a goal is to engage a variety of partners whose separate missions (for example, addressing crime and stormwater or reducing asthma rates) all lead to increasing tree cover.



Land cover and **tree canopy assessment** *for Lancaster, PA. Source: Jarlath O'Neil-Dunne, University of Vermont Spatial Analysis Lab*

Programs to Support Urban and Community Trees

The U.S. Forest Service provides funding for **urban and community forestry programs** carried out by State forestry agencies. Communities can use these funds, as well as other competitive grant opportunities, to preserve and expand their tree canopies. State programs and initiatives play a key role in community tree planting efforts. Some examples include these:

Delaware
Tree canopy assessments have been completed for all communities in the State, and the **Delaware Forest Service** is targeting funds to those that have adopted tree canopy goals. Contact: **Kyle Hoyd**, 302-698-4578.

Maryland
The Chesapeake Bay Trust's **Community Greening grant program** provides support for developing tree canopy assessments, plans, and goals as well as for carrying out the work. The **Marylanders Plant Trees** Initiative encourages landowners to plant trees (and register the trees online) by offering a $25 discount on native trees. Contact: **Marian Honeczy**, 410-260-8511.

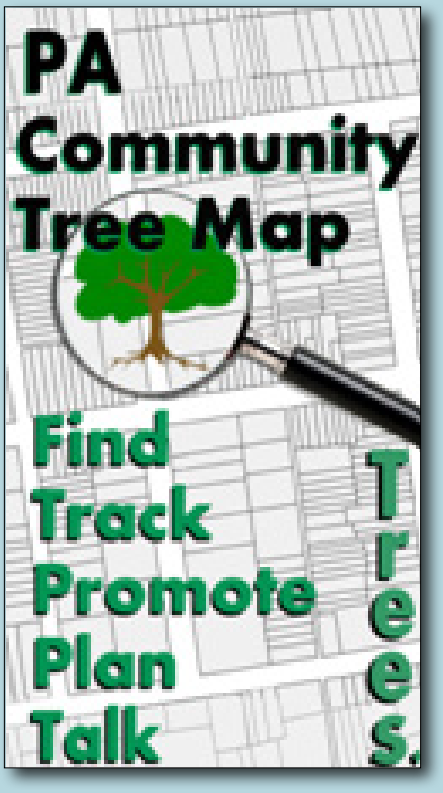
New York
The **NY Urban and Community Forestry program** offers grants for community tree inventories, management plans, tree planting, maintenance, and invasive pest detection studies. They also coordinate regional Releaf committees. Contact: **Mary Kramarchyk**, 518-402-9425.

Pennsylvania
The Pennsylvania DCNR Bureau of Forestry's **TreeVitalize program** offers funding for tree planting and trains volunteer Tree Tenders to help install and care for urban trees. Contact: **Ellen Roane**, 717-705- 2825.

Virginia
Virginia is developing an interactive map viewer to allow citizens to view the urban tree canopy for the communities where assessments have been completed (**27 communities and counting**). Contact: **Paul Revell**, 434-977-6555.

West Virginia
The **CommuniTree** partnership promotes tree planting and public education through volunteerism. Contact: **Bob Hannah**, 304-825-6983.

District of Columbia
An average of 8,600 new trees is needed annually to meet Clean Water Act requirements. DC programs that encourage tree planting include **RiverSmart Homes** and a **Tree Rebate**. Like other States, the **Urban Forestry Administration** will soon have an interactive urban forest map. Contact: **Monica Lear**, 202-671-5133.



The PA Department of Conservation and Natural Resources Bureau of Forestry is completing Interactive Community Tree Canopy Mapping: A Tool for Urban and Rural Landowners and Planners. This Web mapping interface guides tree planning efforts, helps users set goals, and encourages communities to increase tree planting and care. All available tree canopy data in Pennsylvania will be displayed online, allowing communities to easily review information; transfer data; calculate the benefits of their tree plantings and increase in canopy cover (for example, stormwater reduction, energy savings, and air pollution reduction); locate areas at risk; and record community tree planting events.

Community Forestry in Action

In 2005, Baltimore County saw an opportunity to turn excess turf in low-density residential neighborhoods into forests to improve water quality and for other environmental benefits. As a result, the Rural Residential Reforestation program began one of the first "turf to trees" programs in the region. Baltimore County obtained grants to pay for labor, tree seedlings, and associated planting supplies such as tree shelters, stakes, root dip, and rodenticide.

Labor and planting equipment for the projects were provided by the county's full-time, year-round, four-person crew that plants, monitors, and maintains trees for reforestation projects using Forest Conservation Act mitigation payments from developers.

An important part of the turf to trees conservation strategy focused on reducing barriers, such as cost, to landowner participation in watershed restoration projects. The educational, technical, and financial incentives provided to landowners helped them to mow less and become better stewards of their land.

Summary: Planted 7,989 trees on 48.5 acres

Water quality benefit: An estimated 515 pounds of nitrogen, 44 pounds of phosphorus, and 17 tons of sediment are reduced annually because of this project.

A full case study of this program is referenced below: Burke, D.G.; Dunn, J.E., eds. 2010. **A sustainable Chesapeake: better models for conservation**. The Conservation Fund: 99-106.

Actions

Continue to support communities in using urban tree canopy assessment and i-Tree tools.

Provide **training and technical assistance** to help communities move from assessments to action with supportive **local policies and programs to meet tree canopy goals**.

Develop **educational and marketing campaigns**, targeted to distinct audiences, to promote how trees meet multiple community goals.

Focus Urban and Community Forestry program funding and partnership efforts to support work toward meeting local tree canopy goals.

Promote and track tree planting as a cost-effective, core strategy for meeting local Total Maximum Daily Load targets, MS4 stormwater requirements, and air quality goals.

Transfer successful **turf-to-trees program** models and lessons learned to more localities that have high turf grass cover.

Work with nontraditional partners to increase tree plantings in all jurisdictions.

Develop and expand **tree planting initiatives on Federal lands**.

Turf to trees programs greatly reduce the time and energy spent on mowing excess lawn while providing many benefits to wildlife, water, and air. Source: Don Outen

[1]October 2011. Unpublished results of i-Tree analysis of 2007 county data. Syracuse, NY: U.S. Department of Agriculture, Forest Service, Northern Research Station.

[2]Data released by the Center for Chesapeake Communities and Pinchot Institute for Conservation, 11/18/2011

[3]Center for Urban Forest Research. Davis, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

[4]Information provided by the Chesapeake Bay Program Modeling Group

[5]Data released by the Center for Chesapeake Communities and Pinchot Institute for Conservation, 11/18/2011

Section 6
Contaminated Lands

WHY

Contaminated lands include brownfields, Superfund (Comprehensive Environmental Response, Compensation, and Liability Act) remedial and removal sites, Resource Conservation and Recovery Act Corrective Action sites, and State Superfund sites. These contaminated and formerly contaminated properties have been cleaned up and reused for many purposes—residential, commercial, and industrial developments as well as recreational areas and restored natural habitats. Whether these properties are fully redeveloped or, more commonly, under or unutilized, they provide excellent and extensive tree planting sites when plans call for redeveloping or ecologically revitalizing an area.

Targeting contaminated sites for forest restoration in the Chesapeake Bay watershed provides many benefits: remediating or reducing the impacts of site contaminants on the environment, improving water quality because of the strategic locations of these properties near water sources, improving the environment for nearby population centers, and enhancing the aesthetic and intrinsic values of these properties.

Trees can help clean up contaminated sites using a process known as phytoremediation. Gray alder, black locust, and other species can store metals such as cadmium, copper, and zinc from soils and keep them from migrating to surface waters or any other plant or animal. Trees can also influence groundwater flow to optimize treatment strategies and even actively remove contaminants from groundwater. For example, fast growing poplars have been used to remove water-soluble contaminants such as BTEX (gasoline constituents) and tetrachloroethylene (a drycleaning solvent).

A project that integrated remediation and restoration located at the Naval Amphibious Base Little Creek in Virginia removed contaminated materials, restored tidal wetlands and coastal forest land, and incorporated walking trails and wildlife viewing areas. Source: Bruce Pluta

Every site can benefit from reforestation efforts ranging from enhanced landscaping strategies to total reforestation of large and small parcels. Reforestation and other ecological restoration activities are cost-effective components of remedial projects because they have lower long-term maintenance and associated costs. Forested areas and other ecological habitats can be restored either as part of the development of the property or as the targeted end use of that development. Trees and shrubs can be integrated into redevelopment plans for recreational, residential, commercial, and even industrial facilities. At Naval Station Norfolk, for example, a landfill adjacent to the Bay was capped as part of the site closure. Much needed parking areas were integrated into the design of the cap. To address negative impacts potentially associated with runoff from the site and the new parking areas, the design incorporated vegetated bioswales with native trees and shrubs to capture and passively treat and cool parking lot runoff and reduce the heat island effects associated with the parking area.

WHERE

Contaminated lands have known locations that can be targeted for reforestation (figure 6.1). An extremely high percentage of contaminated lands are either adjacent to or very close to wetlands, creeks, streams, or rivers. Planting trees on all or even parts of these properties can directly and positively influence the quantity and quality of water runoff that leaves the property and enters the waters of the Bay. Floodplain reforestation offers even greater benefits because of the enhanced flood protection. Contaminated lands also provide opportunities to strategically expand green infrastructure and better connect natural areas for habitat.

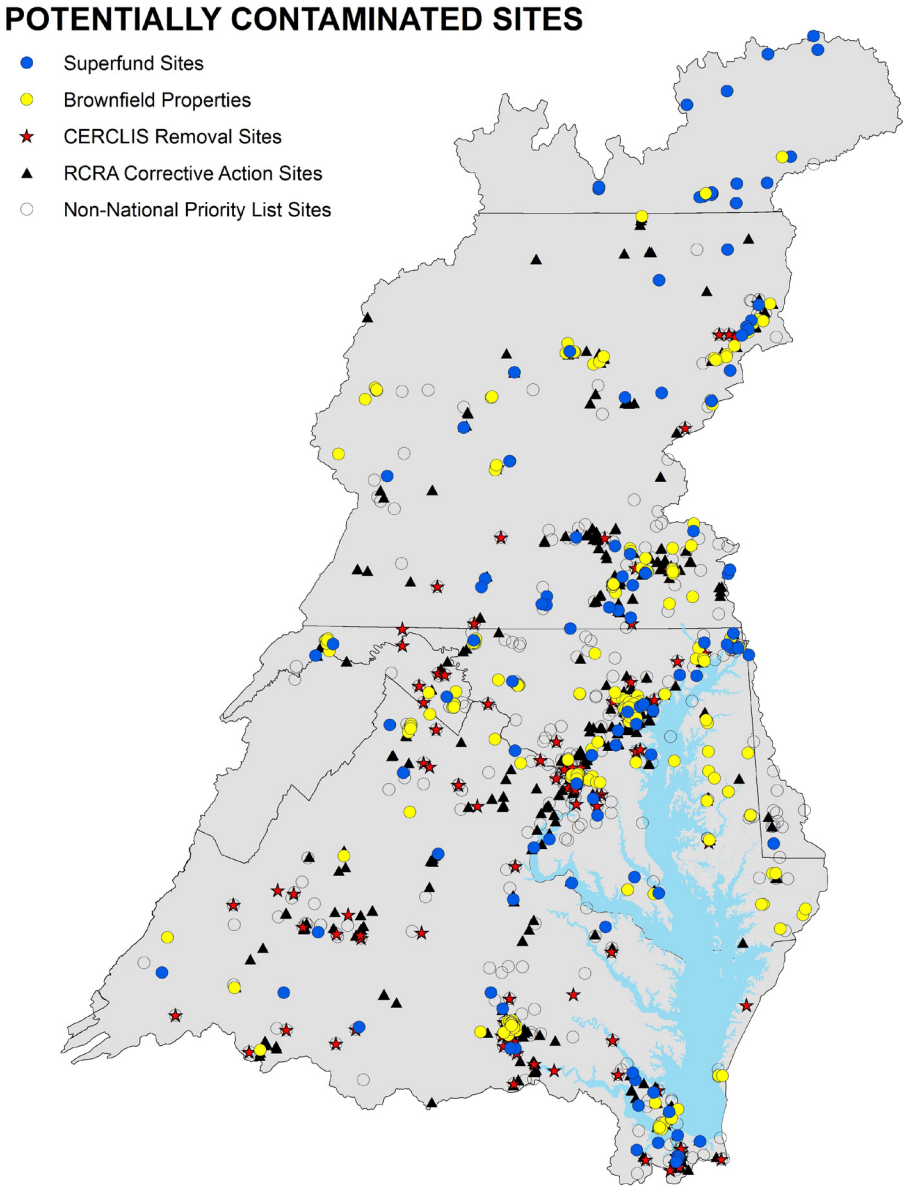


Figure 6.1. Potentially contaminated sites in the Chesapeake Bay watershed. Source: EPA. Note that in this draft map, data for New York only includes Superfund and Brownfields sites, not RCRA, CERCLIS and Non-National Priority List sites. This map portrays Federal program data and does not include sites identified through State programs for contaminated lands.

EXAMPLE: Potential for Targeting Forest Restoration on Contaminated Sites

Figure 6.2 illustrates the cumulative impact that reforesting contaminated lands could have on both local watersheds and on the Bay. These lands may be important to target because of their size, some unique attribute they possess, or their strategic position in the landscape as a key link between other forested or sensitive areas. This map shows the overlap of contaminated sites in the Anacostia River watershed with State and local green infrastructure (forest hubs and corridors). There are a number of sites adjacent to waterways and existing forest that present excellent opportunities for ecological restoration.

The aerial photo (figure 6.3) shows a landfill adjacent to the Anacostia River in the District of Columbia where tree planting would provide multiple benefits to water quality and help achieve the city's tree canopy goal of 40 percent. Collaborative initiatives, such as the Urban Waters Partnership pilot projects in the Anacostia and Patapsco watersheds, provide a good vehicle for greening contaminated sites.

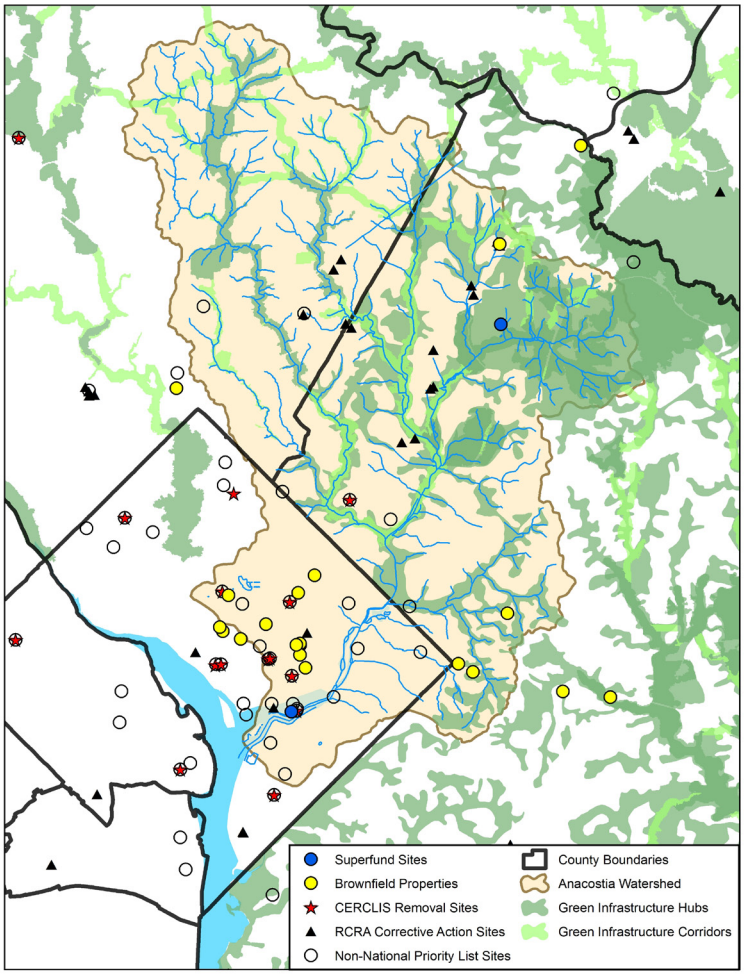


Figure 6.2. Contaminated sites in the Anacostia River watershed are overlaid with State and local forest hubs and corridors. Source: Anacostia images provided by Matt Nicholson, EPA Region 3

Figure 6.3. This landfill site along the Anacostia River could be targeted for tree planting.

HOW

The EPA and its State and local partners, including the regulated community, are beginning to recognize the importance of integrating ecological restoration activities, such as reforestation, into site remediation projects. Some initiatives within the cleanup programs, most notably EPA's Greener Cleanup, further encourage ecological restoration for the habitat, recreational, and carbon storage benefits that reforested land provides. Research is ongoing to improve understanding of how to use phytoremediation to store or destroy environmental contaminants while re-establishing a healthy ecosystem. Other researchers are looking at ways to control or influence the flow of groundwater using trees. Tree plantings and their plant and microbial associates are being studied for their "treatment" of contaminated groundwater. All of these activities are critical to understanding how to return contaminated lands to productive use.

The Federal and State agencies designated as natural resource Trustees for contaminated sites work to ensure that natural processes are restored after chemical contamination. Trustee actions often focus on integrating habitat restoration activities with EPA or State-supported remediation efforts. Where consistent with the resources lost at a contaminated site, Trustee actions can actively focus on integrating reforestation alternatives. The Comprehensive Environmental Response, Compensation, and Liability Act provides a mechanism for Federal and State Trustees' efforts to remediate sites and remove contaminants. State programs vary, but many also provide similar mechanisms under their cleanup programs as well.

There are other programs that can be integrated with cleanup programs. For example, using reforestation to reduce stormwater runoff from contaminated lands can help achieve Total Maximum Daily Load reductions. Programs that increase tree cover in urban areas, such as Pennsylvania's TreeVitalize program, could be harnessed to support the greening of brownfields sites.

Cleaning up sites presents opportunities to reuse them, and the success of these efforts depends on building partnerships among interested parties. Such a partnership was established at the Palmerton Zinc Superfund Site in Pennsylvania. A primary component of remedial activities at this site is the ultimate reforestation of over 3,000 acres on Blue Mountain. The vegetation on the mountain was killed by air and soil contamination resulting from past smelting operations. The site's responsible parties and Federal and State response and Trustee agencies are working with The American Chestnut Foundation to re-establish blight-resistant American chestnuts as part of the overall reforestation effort.

Reforestation in Action

The Jacks Creek/Sitkin Smelting Superfund Site in central Pennsylvania included 5 acres of floodplain with a narrow riparian band of trees and phragmites-dominated wetland. The soils were contaminated with metals. Once remediated, small depressions were created to replicate forested floodplain vernal pools that are present upstream of the site. The entire area was seeded with a native wet meadow mix to provide immediate soil stabilization. Native trees and shrubs were planted throughout the entire vernal pool area and along the banks of Jacks Creek and an adjacent unnamed tributary (figure 6.4). The ultimate objective is to restore a functional wooded floodplain with the capacity to buffer stormwater surges and provide habitat for both terrestrial species that use the riparian corridors and for aquatic species that rely on vernal pools for breeding.

ACTIONS

Identify and fund research needs. Identify key knowledge gaps and research needs. Target available funds for applied research in partnership with industry.

Develop and deliver technical guidance on how to effectively utilize trees and shrubs when remediating and restoring sites.

Utilize an **information and technology transfer** vehicle, such as EPA's CLU-IN, to make technical guidance readily available. Write factsheets for targeted audiences and deliver Web-based training as well as other effective outreach activities.

Facilitate cooperation and coordination among partnerships. Establish agreements between agencies to facilitate reforestation efforts on contaminated lands through cooperative research efforts, technical data exchange, and locating/identifying appropriate plant material for contaminated sites.

Review State and Federal regulations and guidance documents to identify impediments to reforestation and recommend revisions. **Identify cross-program incentives** that facilitate reforestation (for example, stormwater controls, tax incentives, smart growth strategies, easements, and site-level planning incentives, among others).

Identify priority areas and sites. Use geospatial tools to identify and target sites for investment based on potential "keystone" locations or connectivity. Establish partnerships and/or working relationships with professional, nonprofit, and watershed organizations to help with advocacy and educational outreach.

Figure 6.4. Jacks Creek/Sitkin Smelting Superfund Site in central Pennsylvania. Source: Bruce Pluta

Section 7
Conclusion

Restoring forest cover on the landscape is one of the best investments that can be made for the Chesapeake Bay watershed and the 17 million people who call it home. Chesapeake forests provide essential clean water, clean air, wildlife habitat, and a host of community benefits, yet they are being lost to development at a rate of 100 acres per day. The ambitious restoration goals set forth in the Chesapeake Bay Total Maximum Daily Load (TMDL) and Executive Order Strategy will only be met through robust efforts to both preserve and restore forest cover. Fortunately, planting trees is one of the simplest, most cost-effective actions that can be taken locally to meet water quality and habitat goals while also creating vibrant, sustainable communities.

This Strategy addresses opportunities to accelerate forest restoration in priority areas of the landscape that are particularly suitable for collaboration. While the Strategy's sections focus on distinct opportunities related to fish and wildlife habitat, mine lands, agroforestry, urban forestry, and contaminated lands, there are many potential areas of overlap among them. Indeed, to maximize the positive impact of tree planting, it makes sense to target places that fulfill multiple priorities, leveraging resources from a variety of partners. For example, reforestation on mine lands can be focused around forest hubs and corridors that are most valuable for key wildlife species. Restoring riparian forest buffers can be targeted to brook trout streams and other priority habitat, meeting the interests of farmers and conservation organizations while also helping to achieve TMDL goals. Communities working to expand urban tree canopy can find new planting ground and partnership resources by "greening" brownfields and other contaminated sites.

A number of tools can be used to facilitate these overlapping opportunities:

- The U.S. Geological Survey has developed the Chesapeake Bay Forested Land Management mapper, an interactive mapping tool that allows public users to rank land characteristics to create restoration and preservation priority maps (figure 7.1). Users can also overlay relevant restoration and preservation map layers shown in this Strategy and zoom into specific areas of local interest. The tool will be available online with the release of the next version in 2013.

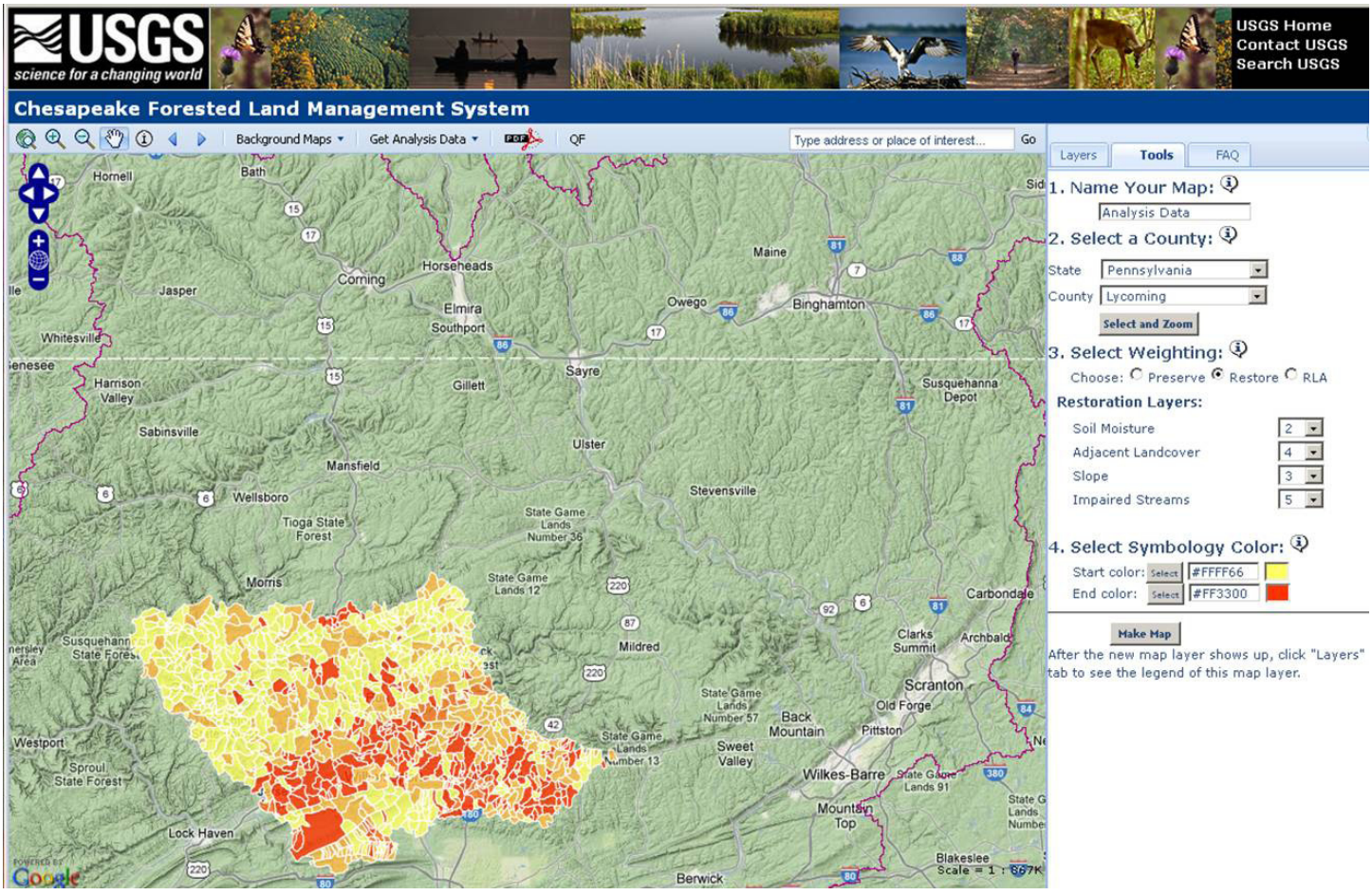


Figure 7.1. Chesapeake Bay Forested Land Management mapper, an interactive mapping tool that allows public users to rank land characteristics to create restoration and preservation priority maps.

- The **i-Tree** suite of tools, available online through a U.S. Forest Service partnership, provides user-friendly software programs to help communities assess and manage urban trees and quantify their environmental and economic benefits.
- The **LandServer** tool, developed by the Pinchot Institute, allows landowners to look up the unique conservation and restoration values of their property and learn about incentive programs for which they might be eligible. LandServer is also linked to the Bay Bank, an online marketplace linking landowners to emerging environmental market/credit opportunities.
- The **Forestry for the Bay** program provides a comprehensive clearinghouse of information and resources for landowners and other groups to learn about forest management and restoration opportunities.

LandServer
Online Conservation Assessment Tool

FORESTRY FOR THE BAY
A Healthy Woodlands Partnership

Forest restoration is a long-term endeavor that begins with planting and caring for trees—a fundamentally local, grassroots action. It is carried out in private yards and public parks and along city streets and farmland streams by the many hands that recognize the innumerable gifts that trees return to us. Community-based efforts are bolstered by strong local, State, and Federal programs that promote the planting and maintenance of trees. These important programs, highlighted throughout the Strategy sections, should be prioritized in agency budgets and expanded in years to come as a central, cost-effective strategy to meet restoration goals in the Chesapeake Bay TMDL and Executive Order Strategy.

This Strategy was developed with significant collaboration from interested partners across the watershed and sets forth broad actions to guide forestry partnership efforts at the Chesapeake Bay program in the years ahead. The U.S. Forest Service and U.S. Fish & Wildlife Service will continue this collaboration with a broader network of partners, crafting more specific action plans each year based on evolving needs and opportunities. We look forward to hearing your ideas and working together on innovative solutions to plant the Chesapeake's future forests.

Volunteers help restore the Chesapeake Bay "one tree at a time." Credit: Chesapeake NEMO