potomac conservancy

State of the Nation's River 2010

Farms & Forests: Rural Land Use in the Potomac Watershed

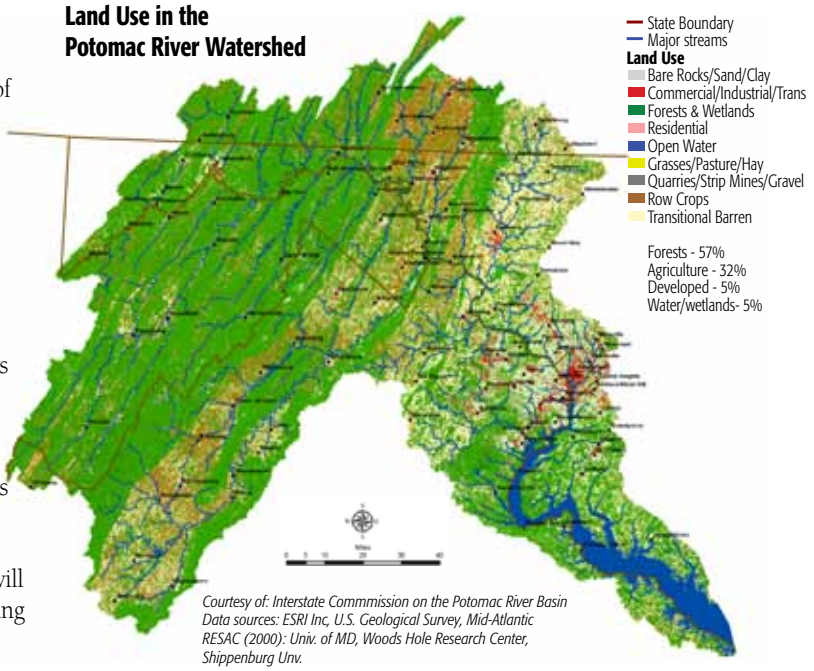
Development in the Potomac Region Fragments Forests & Consumes Farmland

Whether in the forks and branches and the main stem of the Potomac, or in major tributaries of the Shenandoah and the Monocacy, our watershed is a patchwork quilt of land uses, vegetation covers, soils, and other features. The interaction of these components ultimately determines water quality. The whole of the watershed—i.e., the land that drains into a common stream—must be taken into account when correlating stream health with land use.

In this report, Potomac Conservancy highlights the value of our natural and working landscapes, as well as the pressures facing both from man-made causes, primarily development. This report makes the case for placing a high value on forested lands, and also appropriately scaled and well-managed farms, by recognizing the value of such lands when compared to developed or built environments. We highlight the importance of rural lands in this developing watershed, and discuss the stressors that are currently affecting the health of lands and waters in the Potomac region.

The potential for significant pollution from agricultural lands does not diminish the cultural and economic importance of farming. Pollution from nutrients, disease-causing organisms such as *E. coli* and carcinogens and mutagens such as endocrine disrupting compounds from antibiotics, herbicides, and pesticides can be lessened with adherence to best management practices.

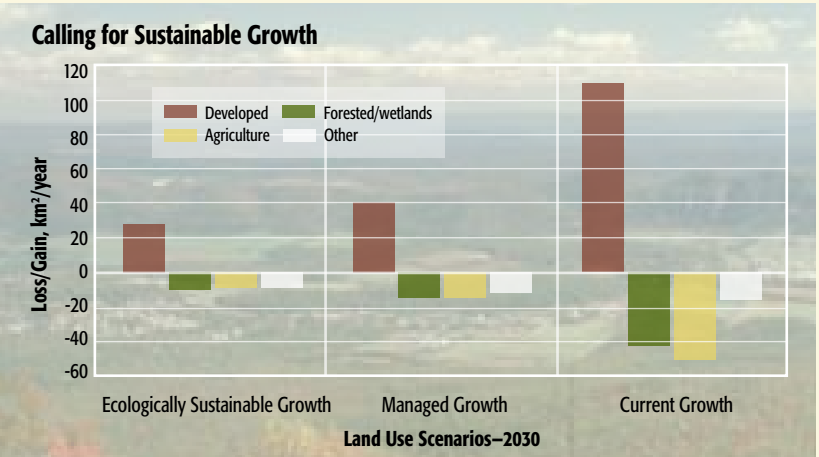
Thoughtful land use practices, such as strategic green infrastructure plans, will address many of the problems in the watershed. Collectively, county-level planning efforts can build to a network of forests, farms, and natural areas that will sustain the health and ecosystem functions of the Potomac River region as a whole.



Courtesy of: Interstate Commmission on the Potomac River Basin
Data sources: ESRI Inc, U.S. Geological Survey, Mid-Atlantic RESAC (2000): Univ. of MD, Woods Hole Research Center, Shippenburg Unv.

Impact of Land Use

In a cycle that has repeated itself from the first human settlements, forests were cut, wood used or sold, and the land converted to agricultural use. Homesteads cropped up in our valleys, cattle grazed grass fields. Trees crowned mountaintops and streams traversed the valleys. Recently, this rural vision has too often been transmuted into scenes of large factory farms with animals packed into stalls. Manure piles are often unregulated, free to wash into local streams with every rain. Often, the fields and pastures are subdivided to accommodate housing needs of our growing population.



In 2002, the Regional Earth Science Applications Center (RESAC) at the University of Maryland modeled the amount of growth that would take place in the greater Washington, DC, metro area (about 5 million acres) by 2030. The "Current Growth" trend shows patterns of forest destruction and development will ultimately lead to the degradation of waterways. The Ecologically Sustainable and Managed Growth scenarios, which involve ecological planning and conservation, will limit the impacts of future development by conserving open space and forestlands.

Data Source: Regional Earth Science Applications Center, University of Maryland, 2002, reported in Jantz et al., 2003.

According to *The State of Chesapeake Forests*, the bay region has lost forestland at a rate of 100 acres per day since the mid-1980s. ***Sprawl has claimed more than three quarters of a million acres in the last 30 years.*** Models show that the agricultural and forested lands in the upper reaches and headwaters of the Potomac are vulnerable to development. The need for conservation and preservation of forest and farms in these areas is high.

West Virginia, home to the headwaters of the Potomac, loses more than 100,000 acres of productive farmland every year to development. Several fast-growing counties in the Potomac River watershed—Berkeley, Jefferson, and Morgan—are cited by Natural Resources Conservation Service as "… rapidly being transformed into a bedroom community of the Washington-Baltimore Metropolitan area." Just 3% of the population works on farms—mostly dairy, and apple and peach orchards. Many of these areas are now being developed, at the expense of forest and farmland.

The Shenandoah Valley, in Virginia, is renowned for its scenery and recreational opportunities. Due to rapid development and agricultural use, the Shenandoah River was named one of *America's Most Endangered Rivers* in 2006 by American Rivers. The Shenandoah is the Potomac's largest tributary, and is important to both local and downstream residents in the Washington, DC region because it is a source of drinking water.

The Monocacy River region in Frederick County, Maryland, is under development pressure. About 9,300 acres of agricultural/resource lands were developed from 1973 to 2002. Maryland's 1997 Smart Growth Areas Act targeted state infrastructure funds to growth areas, referred to as Priority Funding Areas, including existing municipalities, areas inside the Washington and Baltimore beltways, heritage areas, enterprise zones, and neighborhood revitalization areas.

Valuing Our Lands and Our Rural Legacy

Broken Connections

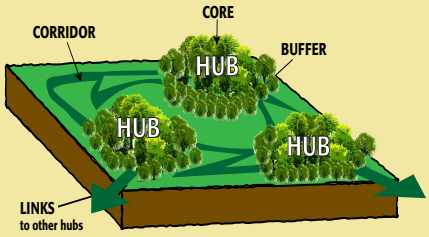
Fragmentation: Most of the forested lands within the Potomac basin are fragmented or exist in unconnected patches alongside other land covers. Fragmentation levels are high in Cabin John Creek, Accotink Creek, Monocacy River, the Potomac (Opequan-Shenandoah), and the Lower Shenandoah, due to agricultural lands and intruding urban development. In Maryland's Monocacy watershed, more than 87,000 acres are at risk from DC-area sprawl.

Parts of West Virginia and Virginia are also in danger. The South Fork of the Shenandoah watershed in Virginia suffers fragmentation/forest loss, due to the advancing sprawl from the east. The Cacapon watershed is also threatened and has already seen high fragmentation.

Parcelization: In 2006, Maryland's *Governor's Commission for Protecting the Chesapeake Bay through Sustainable Forestry* placed "parcelization" first on their list of primary threats to sustainable forestry. Parcelization occurs when large, contiguously owned tracts are broken up into smaller lots.

Parcelization has wide ranging implications for water quality and wildlife conservation in the Potomac River watershed. For example, there are more than 156,000 owners of forested land in Maryland, of which about 132,000 (or more than 84%) own less than 10 acres. The future sustainability of Maryland's forests depends on these landowners, who own 51% of Maryland's forest land.

The increasing number of landowners and decreasing lot sizes can create a vicious cycle. New roads, sewers, and other infrastructure are needed, and the surrounding forest becomes vulnerable to development. The varying objectives of multiple owners in a parcelized forest is difficult to manage for natural resources, including timber and habitat.



Green Infrastructure Connects Lands

Much like the gray infrastructure that supports our cities–roads, bridges, sewers, etc.–green infrastructure is equally essential to sustaining our communities. Green infrastructure protects wildlife, water quality, working lands, and quality of life while contributing much needed dollars to local economies, providing food and fiber and enhancing real estate values. Like our roads and bridges, this valuable green network is a necessity, not an amenity, that only functions effectively when developed as a system rather than a series of isolated parts.

Benefits of Forests

- Clean air
- Filter water
- Regulate climate
- Store nutrients
- Conserve soil
- Provide habitat
- Protect against storm damage

FORESTS: An Endangered Landscape

Slightly more than half of the land in the Potomac River basin is forested. Although that sounds like a lot, it is not enough to ensure high water quality. In a 2007 study, researchers found that a watershed in our region should have upward of 65% tree cover/6% paved surfaces near streams for excellent health; approximately 60% tree/10% pavement earns a 'good' health rating. Tree cover and streamside forests (as well as the amount of paved or hardened surfaces) are all important determinants of water quality.

Forested and other natural areas have the capacity to protect the quality and biodiversity of streams and rivers. The forest canopy and floor act as a sponge for rainfall and produces very little, if any, storm water runoff. ***Forest monitoring has shown that less than 5% of rainfall falling on a forest is converted into runoff.***

Forests better protect streams from an influx of nutrients, compared with other land use practices. The difference is even more significant when forest cover is compared with paved (or impervious) surfaces—more than 25 times more nitrogen and phosphorus run off impervious cover. The ecological benefits of maintaining or increasing forest cover can be impressive at the watershed scale.

When compared to the forests of the past, today's forests are generally less abundant and diverse, more heavily fragmented and structurally homogenous. There are indications that overall forest health in the region is declining, possibly because of factors such as multiple invasive species and a heavy deer population. As the rural farmlands in the Potomac region are built up, developers will turn to forestlands. It is predicted that, in the Potomac River basin, future net loss of forest will increase, particularly in the Shenandoah Valley and the Appalachian Plateau.

Down by the River: The Importance of Streamside Vegetation

Without forests to absorb pollutants, trap sediments, and protect the stability and integrity of the stream environment, water and habitat quality deteriorates rapidly. Degraded streamside forests often lead to increased stream 'flashiness," where a stream has significantly increased flows immediately after a rainstorm. This phenomena is a major contributor to the destruction of habitat in smaller streams. Streamside ecosystems are especially important on smaller, more ecologically sensitive streams, which account for more than three quarters of the total stream length in the United States. Forest distribution, therefore, can enhance or detract from the landscape's ability to filter nutrients and sediment and provide quality habitat. In a perfect world, natural areas would be connected to provide corridors for wildlife; in the Potomac region, habitat connectivity has largely been lost.

Valuation of Forests

Many studies have sought to answer the question: "what is a forest worth?" Values can be economic, ecological, and/or moral and depend on the perspective of the user. Forest ecosystems have objective values that relate to the function or purpose that is being sought—the economic value of a forest for timber, for example—and values that are subjective, intrinsic, and inherent, such as the enjoyment value of the forest. These subjective values are more difficult to quantify, but must be considered.

Ecological Values

The State of Chesapeake Forests (2007) states that "Forests are the largest portion of the Chesapeake Bay watershed's green infrastructure—the natural life support system that sustains the environment and contributes to public health and quality of life." Forests provide ecological benefits including carbon sequestration, water filtration, nutrient storage, soil conservation, and climate regulation. ...***Natural areas that are relatively free from disturbance can produce 100 times the benefits that could be derived from converting the same landscape to another use.***"

Ecosystem Services Provided by Forest Cover

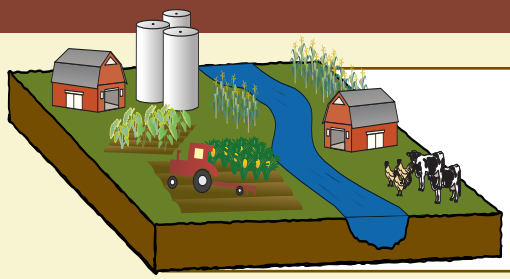
Ecological Service	Location	Annual Value Per Acre of tree Cover
Air Pollutant Removal	Washington DC Area Harrisburg, PA Washington DC	$261 $405 $174
Biodiversity	Maryland	$305
Carbon Sequestration	Chesapeake Bay Watershed	$5-$57
Recreation	Chesapeake Bay Watershed	$131
Energy Savings	Washington DC	$231
Stormwater Control (one-time savings)	Washington DC Area Harrisburg, PA	$25,031 $3,527

Data from The State of Chesapeake Forests *evaluates and assigns economic value to forests in the region. Other economic values include timber use for building or fuel, and recreation (such as hunting or fishing).*

Economic Values

One concept in economic valuation of forests is the "willingness to pay" concept, which is based on the measurement of users' preferences and motivations, from self-interest to altruism.

Total economic value is the value that is lost if a forest area is eliminated or seriously degraded. Total economic value can be estimated by individual use values (direct use, such as timber extraction or indirect use, such as stormwater control) and non-use values (conservation, enjoyment, future generations).



Benefits of Farmland

- Food production
- Groundwater recharge
- Rural economic benefits
- Tourism
- Wildlife Habitat
- Heritage and character
- Barrier to development

FARMS: An Endangered Lifestyle

Agricultural land—land used primarily for the production of food and fiber—covers approximately one third of the Potomac River region. The US Department of Agriculture's latest 5-year census (2002-2007) shows several significant agricultural trends for the Potomac River basin, including a slight increase in the number of farms. However, the USDA census shows a decrease in total acreage, likely from farm abandonment and development. The portion of agriculture in the Potomac region used for organic farming increased, but is still very small.

Of the three types of crops covered by the census—corn, soybean and grains—only corn grew in acreage, while the number of corn farms decreased. This suggests a consolidation of smaller farms into larger acreage farms. An increase in corn acreage may be attributable to increased need for feed sources for livestock or for the production of corn-based products such as ethanol. While the number of cattle farms decreased, hog and chicken farms increased significantly. Cattle head count decreased, pig livestock increased, and poultry remained about the same.

Although the number of farms using chemical methods to combat insects and weeds stayed relatively constant, the total acreage of chemicals applied (both insecticides and herbicides) grew. ***In particular, chemicals to control weeds were applied to almost 30% more acres in 2007.*** The number of farms using commercial fertilizers decreased slightly, however, the number of acres using commercial fertilizers rose.

Stressors: Curbing Farm Runoff Is Critical

US Geological Survey researchers documenting the effect of changes in land use show that concentrations of nutrients (nitrogen and phosphorus) in streams were lowest in woodlands, wetlands, and grasslands, and highest in agricultural and urbanized areas. ***While farmers have made progress in reducing the amount of soil and fertilizer washing off their fields into the bay and its rivers, more pollution controls are needed on about 81% of all the croplands, according to the US Department of Agriculture.*** Both livestock grazing or feeding operations and row crops are common sources of nutrient pollution for the region's rivers.

The Potomac River contains high levels of pesticides because of the developed and agricultural nature of the watershed. The USGS lists 28 herbicides and 14 insecticides found in ground and surface waters of the Potomac. Most pollutants enter the water via runoff from treated agricultural land and disposal of pesticides.

Pesticide contamination from chemicals such as atrazine, metolachlor, simazine, cyanacine in the Potomac have reached or exceeded levels that are harmful to drinking water; several of the pesticides lack EPA standards. In addition to their toxic qualities, many pesticides and herbicides are known to disrupt or mimic the workings of endocrine system, particularly atrazine. There are many other endocrine disrupting compounds that enter our waterways via agricultural operations, including antibiotics and steroids.

Valuation of Agricultural Lands

Many farmers find the trend toward larger operations with only a few products to be unsustainable because of limited capital or the lack of suitable farmland, and have become interested in finding new or alternative ways to either supplement or replace traditional grain and dairy operations.

Ecological Values

Although the ecological value of agriculture cannot match the benefits that forests provide, farms do provide a variety of intrinsic and real values to the Potomac River watershed that would be lost if these lands were converted to more urbanized land uses. Agricultural land provides food, cover, and breeding grounds for wildlife species and its well-maintained soils filter and provide groundwater replenishment.

Economic Values

The income from sales of farm products may be spent locally, creating local jobs. Fresh food grown locally is in higher demand. The loss of farmland and concentration of production in more distant areas increases costs and reduces food quality.

Farmlands have high value in the Potomac watershed. The 2007 USDA agricultural census shows high values of farmland in Frederick and Washington Counties, in Maryland, likely elevated by the proximity to urban areas. Rockingham County in Virginia is the highest revenue producer at $534 million.

Scenic farm landscapes and rural character attract tourists to the region. The Potomac River basin has seen large growth in agritourism as farms add activities such as corn mazes, orchards, and petting farms.

Farms connect us to our rural heritage. Farmlands help balance sprawl and maintain a "buffer" against urbanization. Conservation easements and open space ordinances reduce the negative effects of development.

Farmland preservation is essential for all of the reasons listed above. However, the nature of the farm and the land management practices that are used significantly affects the overall value. Best management practices are critical to sustain the intrinsic and economic value of the land.

Size Matters: Family and Factory Farms

The USDA census shows a trend toward consolidation into larger farms known as CAFOs (for confined, or concentrated, animal feeding operations).

The Economic Research Service of the USDA defines a family farm "as any farm organized as a sole proprietorship, partnership, or family corporation. Family farms exclude farms organized as nonfamily corporations or cooperatives, as well as farms with hired managers. Family farms are closely held (legally controlled) by their operator and the operator's household."

While the differences between CAFOs and family farms sometimes fall into gray areas, on average, CAFOs tend to be larger and owned by corporations and tend to be more polluting than family farms.

In the Potomac region, medium-sized CAFOs are most common. There are between 235 and 280 large CAFOs in the region, primarily in Virginia and West Virginia. The counties in the headwaters of the Potomac have the highest frequency of CAFOs.

Air and water quality issues have been long associated with CAFOs, and more than a dozen scientific studies have directly linked air and water pollutants from animal waste to specific health or environmental impacts. Pollutants include nutrients such as nitrogen and phosphorus; organic matter, such as manure; sediment; pathogens, such as *E. coli*; heavy metals such as arsenic; endocrine disrupting compounds such as hormones and antibiotics.

There is a high correlation between impaired watersheds and the number of CAFOs. The Union of Concerned Scientists estimates the following cost of CAFOs: $26 billion in reduced property values from odors/water contamination, $1.5-3 billion in drug-resistant illnesses attributed to overuse of antibiotics, and $4.1 billion in soil and groundwater contamination.

Climate change

The Mid-Atlantic region is already showing numerous indications of climate change, including shifts in precipitation amount and frequency, sea level rise, temperature variability, and increased frequency of extreme events (such as droughts and hurricanes). Increased temperatures and flashy runoff are likely to further degrade the Potomac and its tributaries. Rainfall events are projected to intensify, and an increasing amount of warmer surfaces (such as road and roofs) will result in further increases in stream temperatures and higher runoff peaks that degrade stream beds and transport more pollutants to water bodies.

Forests: Twenty-first century climate changes will very likely result in the northward shift in the range of trees and forest types; as much as 350 miles. In general, late-century Maryland forests may look like eastern Virginia and North Carolina today, with pines replacing hardwoods. Biodiversity may be reduced through forest productivity/composition changes, and disturbance by heat stress, drought, severe storms, fire, disease, and pest outbreaks. Forest productivity may increase a bit due to elevated carbon dioxide, increased precipitation, and a longer growing season.

Agriculture: Climate change will affect agriculture in the Potomac River watershed. According to the 2008 study, *Comprehensive Assessment of Climate Change Impacts in Maryland*, "Mid-latitude regions (such as the Mid-Atlantic) may experience moderate warming benefits in the form of crop and pasture yields under moderate increases in temperature (2–5°F) and increases in atmospheric carbon dioxide and rainfall. However, increased risks of drought in summer and early fall and unknown changes in weed and pest damages will generate uncertainty among farmers and animal producers regarding adaptation to climate change."

Success Stories: Best Management Practices

There are many agricultural practices that alleviate or diminish the negative effects of farming and livestock operation on local water quality. Popular practices include nutrient management plans, litter and manure storage structures, relocation of livestock feeding areas, distribution and marketing of manure, and planting of streamside forests as buffers. Below are some examples of how these best management practices work in the Potomac region.

- In the headwaters of the Potomac in West Virginia, approximately $14 million in water quality improvement practices were implemented by state, local, and federal government agencies on more than 300 agricultural operations in Pendleton, Grant, Hardy, Hampshire, and Mineral counties. There was a significant reduction of in-stream measured fecal bacteria and nitrates. As a result, impaired streams were delisted under the Clean Water Act. A 90% cost-share rate from the Conservation Reserve Enhancement Program made it very attractive for Hampshire County farmers to implement streamside buffers. The farmers reduced nutrient runoff by planting more than 1,000 acres of trees along streambanks, and installing ponds and watering facilities that kept their cattle away from streams.
- Approximately 85% of farmers in the North Fork of the Potomac in West Virginia watershed worked together to construct animal waste storage facilities, establish riparian buffers, and implement a range of other practices. The river now meets its designated use and is no longer impaired by fecal coliform bacteria.
- Development in the Upper Monocacy watershed in Maryland has been slowed and kept somewhat in check by the Priority Funding Area regulations. Between 1973 and 2002, a study of land use change within the Monocacy River watershed showed that growth and development (residential, industrial, and commercial) has occurred in existing communities. From 1997 to 2002, the growth primarily occurred in Priority Funding Areas and Rural Villages.

Next Steps: Halting the Degradation of Natural Lands

The current rate of forest loss and development of farmland will continue to degrade the quality of our waterways. To combat man-made stressors, more funding is required for land protection, specifically easements and acquisitions for Potomac forests and farmland. There must be strong support for our working landscapes via federal and state funding, but that funding should be contingent on the adherence to all clean water regulations and the use of best management practices. Potomac Conservancy supports the following initiatives as critical to preserving the health and heritage of the Potomac River region:

Preserve Forests – There should be no net loss of forests and strong protections for existing woodlands, particularly those buffering streams. Riparian buffers in working (i.e., harvested) forests should be maintained.

Permanently Protect Land – Placing land in conservation easement is a useful tool to protect land from sprawl, keeping it available as intact ecosystem or well-managed working land. Easements along stream corridors are especially effective at protecting waterways.

Expand Conservation Farming – All agricultural land would benefit from "conservation plans" designed to determine which practices best fit each farm. Another universal practice—keeping livestock out of streams—is critical to improving water quality.

Reduce Runoff – Reduce pollution from nutrients, sediment, pesticides, or excess salinity to a level that streams can absorb, and reduce contamination from agricultural sources.

Improve CAFO Compliance – The Environmental Protection Agency and the Chesapeake Bay states must vastly improve the inspection and compliance programs for CAFOs. The states should hold regulated facilities accountable to the conditions of their Clean Water permits and EPA must demonstrate the importance of a well-managed facility to the protection of our waterways. Inspections should be more frequent; violators must be fined at meaningful levels and be responsible for cleanup. Also, EPA must complete its work on its new data system for CAFOs, to better determine agricultural trends.

Fund the Farm Bill – Conservation elements of the Farm Bill (e.g., conservation practices, easement programs) should continue to be fully funded. As more is expected of farmers, they should receive commensurate support from federal and state governments. Renew and fully fund the conservation programs under the 2012 federal Farm Bill and fund the conservation programs authorized in the 2008 bill.

Research Chemicals – We need to know the effects on human health of pesticides, insecticides, and antibiotics from runoff from agricultural land.

Provide Small Lot Incentives – State and federal incentives and technical assistance should encourage small lot (1-10 acre) forest landowners to increase and enhance forest coverage. Many currently do not qualify for existing state and federal incentive programs.

Promote Wise Land Management – It is essential that we promote green infrastructure in all 40 counties of the Potomac watershed. Green infrastructure plans provide valuable guidance on the most essential lands to protect and those most appropriate for development at the local level. The plans reduce conflict between conservation and development interests by providing predictability and certainty in project planning and mitigation while protecting the public and private investments in land conservation that protect our health, our wildlife, and our natural environment.

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Since 1993, Potomac Conservancy has protected the health, beauty, and enjoyment of the Potomac and its tributaries.

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