



CREP Fact Sheet

Streamside Magicians: How Trees Help Streams

Written by Chesapeake Bay Foundation April 20, 2006

For many, Pennsylvania's wooded streams are figuratively places of magic. If so, the real magicians are the streamside trees. This fact sheet explores some of the key ways trees are critical for healthy streams. As we work to improve our streams, mimicking healthy streams is sensible and restoring streamside trees is a critical step.



Clean Streams - The Legacy of Penn's Woods

The forests of Pennsylvania provide residents an enormously important resource – clean streams. Less attractive than the streams, but doing the real work are microbes and microscopic plants and animals. With roughly 75% of PA streams small enough to jump across, these busy organisms are adapted to life beneath the canopy of Penn's Woods and do their best work under these conditions.

Inside the Magician's Hat – How Trees Help Streams

Some ways trees help streams are obvious such as the cool, clear, shady conditions. And it makes sense that the life of the stream is adapted to these conditions. Other ways are less obvious but equally important.



Trout grow on trees. With very few green plants growing in the stream, the beginning of the food chain isn't as apparent as the trees on the banks, but in fact, streamside trees are a big source of food. Leaves, twigs, pollen, etc. all become food for a variety of stream organisms. Some are adapted for shredding leaves, others for scraping the layer of

food-rich microbes and fungi from surfaces of decomposing leaves. Still others scrape the dark, slippery layer of algae from the rocks. This hazard to stream walkers is actually the main aquatic plant community in most woodland streams – microscopic algae of many types and shapes called diatoms. Each organism is tightly adapted to its way of feeding on specific forest products. Given other foods, such as grasses or the stringy green algae of meadow streams, many stream organisms can't adjust and starve. Leaves of native trees are a key food source.

However, the main source of the energy that powers a healthy woodland stream is a barely noticeable mix of carbohydrates and other organic materials referred to as “watershed tea.” Well over half of all the energy available to stream life comes from rainwater dissolving edible materials out of the fallen leaves on the forest floor. Microbes living in a thin film of life on the surfaces of sand, gravel, rocks and roots feed on this watershed tea, removing other materials (such as excess nutrients) from the water as they feed. In turn, they are fed upon by microscopic animals and the food chain continues through visible stream insects, etc. right up through the fish. While not obvious, it is quite true that trout grow on trees.

Trees Multiply Stream Habitat. Another less than obvious way that trees enhance the life of streams is their impact on the amount and quality of stream bottom habitat. The life of streams tied to the bottom, literally. Most organisms cling to the rocks, roots and gravel to avoid being swept away. Trees vastly increase the amount of available bottom habitat. Compared to a bare soil bank in a meadow stream, a bank with fine tree roots can have a hundred or thousand times more surface area for stream life. By keeping fine soil out of streams, streamside forests promote gravelly bottoms that can also provide thousands of times the usable habitat compared to silty, muddy bottoms - more habitat and better habitat. Finally, forested streams segments are typically two to three times wider than the same streams in sunlit meadows. With full sun, grasses encroach on the stream and channels narrow dramatically. This is often visible where a narrow meadow stream runs into a woodlot, and immediately doubles or triples in width - more area, more habitat, more life.

Of Cows and Streams



Photo courtesy of USDA NRCS

Dairy farmers know how to maximize milk production. Cows need lots of high quality feed. Larger farms can support more cows. Cows given ideal, healthy conditions produce more milk. Streams can be likened to dairy farms, producing clean water instead of milk. To do its best work, stream life requires lots of its favorite foods. More stream bottom area can support a larger “herd” of clean water producers. Streams with ideal conditions (cool and shady) will produce more clean water. Trees provide all of these needs, enabling streams to do the maximum possible work cleaning water. Details follow.

Researchers Document the Benefits of Streamside Forests

In a 2004 research paper, Stroud Water Research Center (with a staff of 30+ stream researchers located in Chester County, PA) documented how forested conditions increase a stream's ability to cleanse itself. They studied 16 streams in eastern PA, comparing forested sections to grass buffered sections as the streams ran from woodlots to meadows (no livestock) and back again. For a four-page summary contact CBF at 717-234-5550. For the full technical journal article see www.pnas.org/cgi/content/abstract/101/39/14132.

Forested vs. Grass Buffered Streams Summary of Research by Stroud Water Research Center			
Study Variable:	Forest Buffer	Grass Buffer	Comments:
water temperature	+	-	forested areas cooler in summer, warmer in winter, both beneficial
streambed habitat quality	+	-	more usable streambed habitat, both amount and quality
removal of nitrogen pollution	+	-	forested areas removed 200% to 800% more nitrogen pollution
removal of phosphorus pollution	+/-	+/-	no significant difference
removal of pesticide pollution	+/-	+/-	no significant difference
stream velocity	+	-	lower in forested areas, providing more contact time for clean up
stream width	+	-	forested streams 2-3x wider, providing 200-300% more habitat
large woody objects for habitat	+	-	large woody objects provide key habitat and benefits
+ means significantly better results vs. other buffer option - means significantly less helpful vs. other buffer option +/- means no significant difference for forested vs. grass buffer			



Chesapeake Bay Foundation is privileged to work with Stroud Water Research Center on joint efforts to study PA streams and advocate for state policies and programs to restore and protect them. CBF and Stroud are collaborating on a long-term study

documenting the impacts of stream bank fencing (to exclude livestock) and forested buffers on south-central Pennsylvania streams. CBF and Stroud are committed to improving the health of Pennsylvania streams, river and the Chesapeake Bay through sound science and effective public policy.

Added Benefits from Streamside Forests

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

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



In a study performed by the Pennsylvania State University, nesting density by birds was two times greater along fenced stream areas than unfenced stream areas grazed by livestock (Hafner and Brittingham 1993). Many bird species, including Mallard ducks, depend on the habitat created by riparian buffers for nesting and reproduction. (Photo courtesy of USDA NRCS)

Spread the Magic - Plant Streamside Trees



Trees provide critical benefits to streams, enabling them to “do their magic” for both water quality and for quality of life generally. Restoring streamside trees can provide a major boost to efforts to improve Pennsylvania’s streams.



CREP is partnership of federal, state and private groups including:

USDA Farm Service Agency, USDA Natural Resources Conservation Service, PA Dept. of Environmental Protection, and PA Game Commission, along with Center for Rural PA, Chesapeake Bay Foundation, Ducks Unlimited, PA Association of Conservation Districts, PA Dept. of Agriculture, PA Dept. of Conservation of Natural Resources, PA Fish and Boat Commission, Partners for Wildlife, Pheasants Forever, State Conservation Commission, and Western PA Conservancy.



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This fact sheet was prepared by Chesapeake Bay Foundation, a non-profit group with PA headquarters in Harrisburg. CBF provides field staff to assist landowners with CREP project work and other forested buffer restoration programs. Since 1997, CBF has invested more than \$7 million in voluntary conservation measures in PA, and helped over 700 landowners install more than 1600 miles of forested buffers. CBF’s mission is to protect and restore the Chesapeake Bay and its watershed to maintain a high quality of life for the region’s residents.