

# FISH Need Leaves

Streamside forests are important links to healthy waterways and the fish that live there.

by Robert Whitescarver

**T**he sun set half an hour ago. The air thickens with moisture as fog slowly moves in over the river on its unceasing journey. The water riffing over the rocks is all I can hear. It takes me a few minutes to focus on the insects. There must be a hundred of them spinning up and down over the water. These are male mayflies swarming to mate with a female as she flies through their midst. When mayflies are present, it's a good sign there will be fish. Fish, especially trout, like to eat mayflies.

Anglers know well the importance of mayflies, caddisflies, stoneflies, crane flies, and other insects that spend most of their life in the water. Grouped together, these are called aquatic macroinvertebrates, which means that—like other invertebrates—they lack backbones, but are large enough to be seen by the naked eye. These insects are good indicators of clean water, which is necessary for many fish, including Virginia's native brook trout, or brookie.

The larval stages of these aquatic insects represent a primary food source for many species of fish. Macroinvertebrates spend the majority of their lives in the water. From the time the egg hatches through pupation, many of these insects spend most of their time eating leaves that have fallen into the stream. Scientists call these leaf eaters "shredders" because of their ability to shred and consume fallen leaves; they are the leaf digesters of the streams. When they have grown to full size they will undergo metamorphosis to the winged stage. At this point they move to the surface of the water and take flight, a phenomenon fondly awaited by anglers called a "hatch."

Fly fishermen take great pride "tying flies" that mimic the insects they think the fish are eating. For example, Quill Gordon and March Brown flies mimic the mayflies in the *Heptageniidae* family. These mayflies are known as "clingers" because of their ability to hang onto rocks in fast-moving water.

Scientists at the Stroud Water Research Center in Avondale, Pennsylvania have been studying freshwater ecosystems since the 1960s. Dr. Bernard Sweeney is the director and senior research scientist at Stroud. He believes, "A streamside forest along headwater streams is the single most important component for a healthy aquatic ecosystem."

Leaves from streamside forests serve as the main food source for macroinvertebrates. It's the bottom of the food chain for trout and other fish. Put another way, it's the corn silage of the fish farm: no leaves, no insects, no fish. Not only do trees supply food for the insects,

they also provide shade, which keeps water temperatures cool and prevents intense sunlight from directly reaching the stream. Thus, Sweeney contends, the three most important factors in a healthy aquatic ecosystem are food, temperature, and light.

## Food

"Even within a group of aquatic insects such as the mayflies and crane flies, species who eat leaves do so preferentially, clearly eating one species of leaf over another when given a choice, perhaps in recognition of the fact that each leaf species has different nutrient values," explains Sweeney.

Researchers with the Stroud Water Research Center have constructed both indoor and outdoor flumes to test which species of leaves each species of aquatic insect prefers.



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Macroinvertebrates prefer different species of native leaves, like this sugar maple, on the left, and hickory leaf (R).



Anglers attempt to mimic insects that trout are eating, such as this "Quill Gordon" dry fly made to float on the water.

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Above, a mayfly nymph. Left, adult mayfly.

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As depicted in this graph, giant crane fly larvae grew about two and a half times faster on hickory and maple leaves than on red oak leaves.

Sweeney stresses that since each aquatic insect prefers certain species of leaves over others and grows and survives differently on them as well, it is imperative to have a diversity of native trees along streams. A healthy mix of native trees along a stream bank supplies an abundance of food options for aquatic insects, which will attract and nurture fish.

### Temperature

“Each macroinvertebrate species has an optimum temperature regime. One species of mayfly we studied flourished at 68° Fahrenheit but perished at 70°. Keeping water temperatures cool is absolutely critical for these insects. They live on the edge because just a few degrees warmer may be lethal,” the scientist insists.

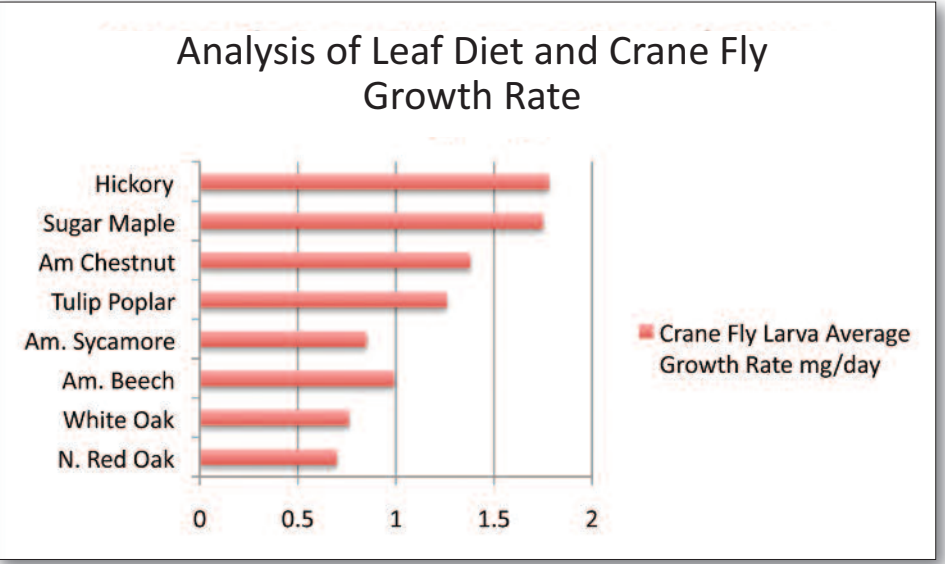
Trout need cool temperatures as well. Brook trout thrive when water temperatures are in the 60s. They struggle and often perish when water temperatures climb to the 70s or higher.

Trees along streams help keep water temperatures cooler by providing shade during the warmer months. According to Sweeney, on average, forested sections of streams receive 17 percent less radiation than non-forested segments.

### Light

Sweeney and other scientists at Stroud confirmed that light intensity affects the types of algae that grow in a stream. He states in one research paper, “algal photosynthesis is a linear function of light intensity.” In other words, the more light, the more algae. He further suggests that for trout and macroinvertebrates, long filamentous algae (multiple celled), which favor intense light, do not make good habitat. Having plenty of trees along the stream will prevent intense light from reaching the water, thus favoring single celled algae such as diatoms—the algae preferred by macroinvertebrates found in cleaner streams.

Graph courtesy of the Stroud Water Research Center



Left, indoor research flumes at the Stroud Water Research Center are used to find out what species of leaves different macroinvertebrates prefer to consume. Right, Dr. Bernard Sweeney, director of the research center, stands next to outdoor research flumes. Below, Dr. Tom Benzing of Trout Unlimited has been a champion for research and conservation efforts to bring back native brook trout.



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This young “brookie” is the only trout native to Virginia and requires clean water to thrive.

### Water Quality

Dr. Tom Benzing is a Professor of Integrated Science and Technology at James Madison University and Vice President for Conservation on the Virginia State Council of Trout Unlimited. He says, “To bring back native brook trout we must improve water quality and restore habitat. Eliminating sediment sources in the water and planting native trees along streams will help trout and the entire aquatic ecosystem.”

Sediment congregates when soil is not protected from the forces of erosion. Exposed soil easily erodes from bare ground, construction sites, denuded ditches, and poorly managed farms. Livestock on those farms, especially cattle, devastate fish habitat when they are allowed unlimited access to streams. They not only pollute the water with manure and urine, they trample stream banks, cause further soil erosion, and prevent trees from growing along the banks.

Paul Bugas, who serves as aquatics manager for the Department’s (DGIF) north-central region, stresses this point. “Soil particles clog the gills of fish and smother

populations of macroinvertebrates and fish eggs. Suspended soil particles create cloudy conditions, resulting in ecological damage. Unlimited access of cattle in streams absolutely destroys aquatic habitat,” he concurs.

Brook trout need very clean water, as do mayflies. “You bring back the mayflies, you will bring back native trout,” says Benzing.

To achieve this, we must plant native trees along the banks of our streams, prevent soil from washing off the land, and keep livestock out of our waterways. Virginia has a plan to bring back the mayflies and the trout: It’s called the Watershed Improvement Plan, and it calls for planting 103,552 acres of new streamside forests by 2025.

Virginia and the U.S. Department of Agriculture have programs to help land-owners install streamside forests, reduce soil erosion, and fence livestock out of streams. These programs reimburse landowners for the financial costs of planting trees, planting cover crops, healing eroded areas, and installing fences and livestock watering systems at rates ranging from 75 to 140 percent. One example, the Conservation

Reserve Program, also pays rent on the land that is excluded from livestock—sometimes as much as \$100 per acre per year. Help us achieve this goal by planting native trees along the streams on your property and encourage others to help as well. By working together we can bring back healthy waterways and Virginia’s coveted native trout, the spectacular brookie. 🌲

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### RESOURCES

To find out how you can help plant more streamside forests, protect soil from eroding, and excluding livestock from streams contact:

- Your local Soil and Water Conservation District: [www.vaswcd.org](http://www.vaswcd.org)
- U.S. Department of Agriculture: [www.usda.gov/](http://www.usda.gov/)
- Virginia Department of Forestry: [www.dof.virginia.gov](http://www.dof.virginia.gov)