Article 43

Technical Note #14 from Watershed Protection Techniques. 1(1): 29

Impact of Riparian Forest Cover on Mid-Atlantic Stream Ecosystems

What is the value of a forest buffer along small streams? Strong evidence about the critical role of riparian forests play in stream ecosystems has emerged in a recent research study by Sweeney (1993). He compared the physical and ecological characteristics of headwater streams that had two different types of riparian cover: second growth forest and grassy meadows. The first and second order streams used in the study were located in the White Clay Creek watershed in the Piedmont of Pennsylvania.

Sweeney noted that the channels of headwater streams with forest cover were about 2.5 times wider than those with only grass cover. The "stream narrowing" associated with headwater streams without riparian forest cover was attributed to the formation and slumping of grass sod from the banks that gradually encroached into the channel. Thus, the channel gradually narrowed in width and became deeper.

Stream narrowing associated with the lack of riparian forests can have several serious ecological consequences. For example, 54 percent less surface area was present on the stream bottom to support the benthic habitat needed for aquatic organisms. In addition, forested streams had 7.5 times as much woody debris and 27 times as much total snag volume in their channels compared to streams without forest cover.

Woody debris and snags are extremely valuable habitat areas for many aquatic insects and help the stream retain more of its organic matter inputs. Sweeney found, for example, that 38 times more leaf litter and fine woody debris were present in forested streams, as compared to those with only grass or meadow cover. The greater retention of organic matter in forested streams is of critical significance because leaf litter serves as an important energy source in the aquatic food web.

The wider and shallower channels of forested streams had nearly 17 times more wetted rock area than the deeper and narrower meadow streams. While wetted rock area seems like a particularly obscure stream variable, it has a lot of meaning for aquatic insects. Submerged cobbles and rock surfaces are where they cling to avoid high water velocity. Exposed rocks, on the other hand, are sites where aquatic insects emerge to begin the aerial phase of their life cycle. Thus, the reduced wetted rock area in the narrower and deeper meadow streams results in poorer habitat for aquatic insects.

Forest cover also shades the stream. For example, on sunny days, solar radiation inputs to the forested stream were reduced by 17% (summer) and 42% (winter), compared to meadow streams. Consequently, water temperatures in the forested streams were typically much cooler than meadow streams (an average of four degrees C).

Aquatic ecosystem in headwater streams without forested cover have reduced diversity and productivity. Sweeney notes major differences in the composition of the aquatic insect community between the two stream types. Notably, forested streams have "shredder" and "collector" feeding guilds while grassy meadow streams have "grazer" guilds. The major changes in stream habitat and temperature also affect individual species, each of which has its own tolerance limits for reproduction, emergence, larval development, and feeding environment.

Although Sweeney's study was conducted in a rural watershed, it has many implications for urban streams as well. Clearly, riparian forest cover is a key factor in maintaining the integrity of any headwater stream ecosystem. This finding suggests that efforts to preserve or reestablish riparian cover along urban streambanks should be a consistent element of a local stream protection approach. As a note, urban streams may well be widening and narrowing at the same time (due to the increased channel erosion from increased stormwater flows, and the encroachment by grass sod) Perhaps further research can shed light on the channel dynamics of urban headwater streams.

—TRS

Reference

Sweeney, B.W. 1993. *Effects of Streamside Vegetation on Macroinvertebrate Communities of White Clay Creek in Eastern North America.* Proceedings of Academy of Natural Sciences of Philadelphia (144)-291-340.