

Restoring Brook Trout Habitat in Headwater Streams Using Large Woody Debris

Dan McKinley, Fisheries Biologist, Green Mountain National Forest
Roger Monthey and Dave Welsch, U.S. Forest Service, Northeastern Area State and Private Forestry
(All photos by Chris Alexopoulos, U.S. Forest Service)

The presence of brook trout is a generally accepted indicator of an ecologically healthy stream. Good trout habitat includes downed trees and large woody debris, which alter flow to gouge deep pools for protection against predators. They also distribute gravel for spawning sites. Well-managed riparian areas are important in maintaining shade that moderates water temperature and in providing for future large woody debris. Leaf fall and litter provide food energy for fish and stream insects.



Each year since 1988, the Forest Service has worked to improve brook trout habitat in 1 to 3 miles of Green Mountain National Forest streams. They first installed simple log sill structures by hand to create plunge pools for adult brook trout. After a few years of hand labor, they transitioned into using machines in large streams to place large woody debris that was anchored to the bank or streambed (photo 1). Although heavy equipment is an important tool for placing woody debris, it is not always necessary, especially for smaller streams.



Photo 1. This stream has both installed logs and a natural accumulation of large woody debris on the Green Mountain National Forest.

Forest Service staffs on the Green Mountain, White Mountain, and Monongahela National Forests are currently restoring large woody debris in smaller streams using a technique called “Chop and Drop.” Chop and Drop involves selecting and directionally felling whole trees into the stream channel to create large woody debris structures (photos 2 and 3).

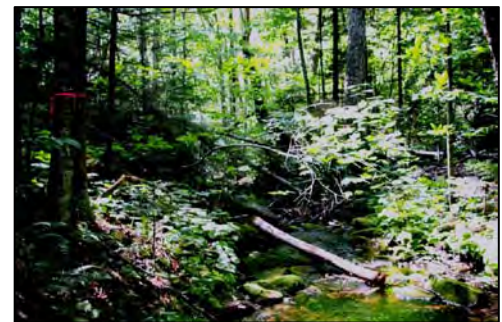


Photo 2. This is a stream channel before applying Chop and Drop.

The Green Mountain National Forest has been using Chop and Drop primarily on small streams where the trees being felled are considerably longer than the bank full width of the stream. The trees in these situations tend to anchor themselves without the need for large heavy equipment. Some of this wood, however, may subsequently be moved downstream by the high flows of springtime. Forest Service employees are monitoring the movement of large woody debris on a sample of these smaller, second-order streams to better understand where this debris moves to and its effectiveness in its new location.

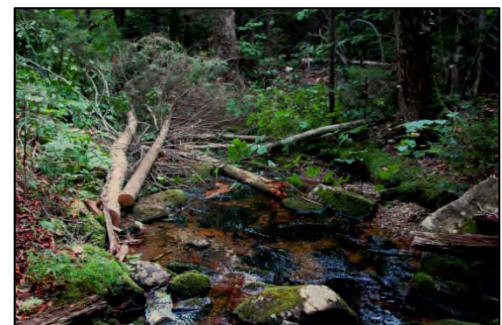


Photo 3. This is the same stream channel after applying Chop and Drop.

In 1988, the Forest Plan for the Green Mountain National Forest was amended to establish desired future conditions for stream habitat, including large woody debris – 52 pieces per mile. Though this was a conservative target compared to what was known about large woody debris in streams in the Western United States, it was a place to begin in a part of the country where wood in streams has had a negative connotation.

Over the next 10 years, 15 restoration projects were monitored to document the physical and biological effects of adding woody debris. Each restoration site had a paired untreated control section for comparison. The monitoring revealed a five-fold increase of large woody debris. This in turn resulted in significant improvements in habitat structure as shown in figure 1.¹ Pool area, pool quality, and pool frequency (spacing and distribution) increased two- to five-fold since the project started. As a result, brook trout and insect populations also increased (figures 2, 3, and 4).¹

¹Nislow, K.H. 2001. Assessing habitat quality for age-0 Atlantic salmon. PhD Dissertation. Department of Biological Sciences, Dartmouth College, Hanover, NH)

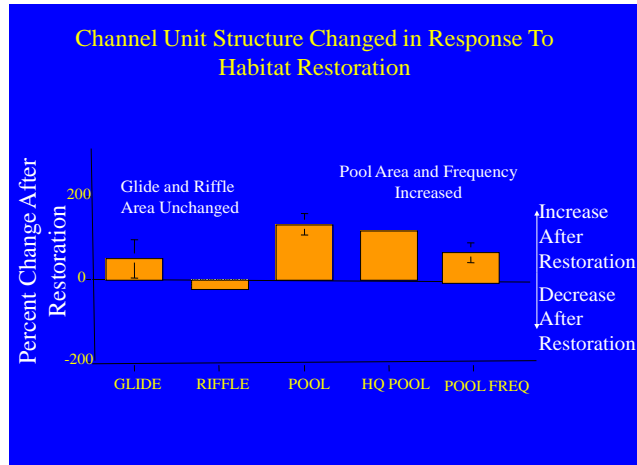


Figure 1

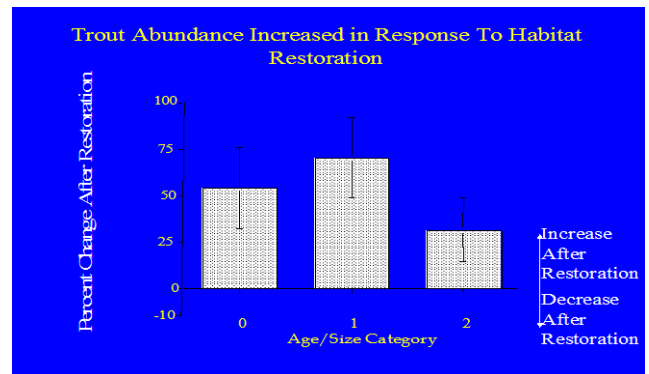


Figure 2

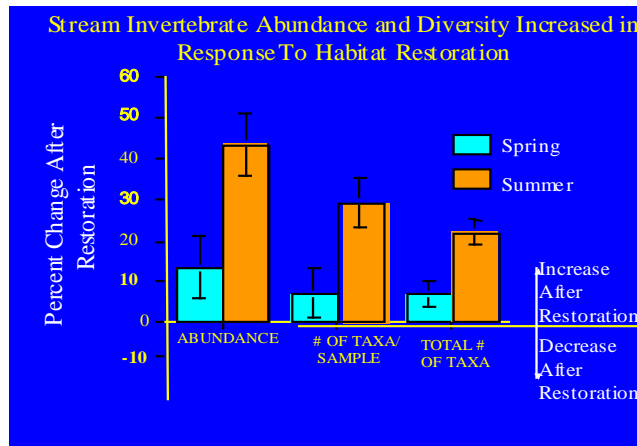


Figure 3

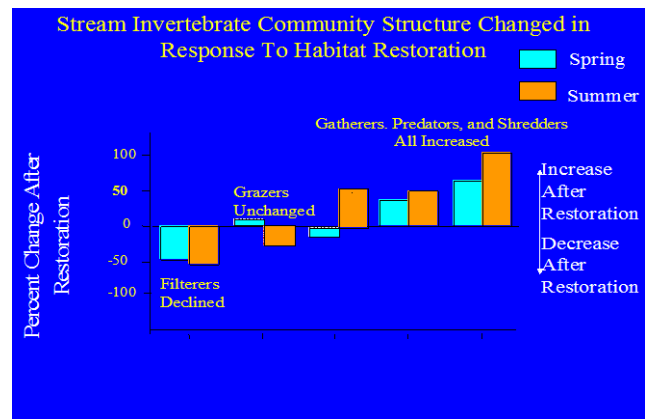


Figure 4

Although habitat changes were significant, adding large woody debris to streams did not create the desired conditions for pool area and distribution called for in the 1986 Forest Plan. By the time the plan was revised in 2006, research and modeling of northeastern riparian forests had shown that having 175 to 225 pieces of large woody debris per mile more accurately approaches natural conditions.

Forest staffs are continuing to collect physical and biological data to evaluate habitat management for brook trout on headwater streams. Habitat monitoring of more intensive treatments where the amount of large woody debris met Forest Plan objectives shows that pool area and quality are very close to, or exceed, desired future conditions in these streams (table 1).

Table 1. Pool habitat response 5 years after adding large woody debris (LWD).

	Pool Area ¹ (DFC >29%)		Pool Quality ² (DFC >32%)		Pool Spacing ³ (< 3x-5x channel width)	
	Pre LWD	Post LWD	Pre LWD	Post LWD	Pre LWD	Post LWD
Puskenkill Brook	19%	27%	20%	43%	3	2
Mad Tom Brook	32%	45%	0%	38%	5	2
Steam Mill Brook	22%	29%	25%	80%	3	3

¹ The 2006 Forest Plan establishes the Desired Future Condition (DFC) for Pool Area as >29% of the reach area.

² The 2006 Forest Plan establishes the Desired Future Condition (DFC) for Pool Quality as >32% of pools meeting pool quality criteria defined in the plan.

³ The 2006 Forest Plan does not specify a DFC for pool spacing. However, pool spacing of 3 to 5 bankfull channel widths is typical of a step-pool headwater stream with natural large woody debris loadings.

Maine Forest Service Brook Trout Project

The Maine Forest Service is currently working on a project to protect and enhance brook trout habitat through forest management. This project is funded by the U.S. Forest Service, Northeastern Area State and Private Forestry through a 2009 Redesign grant to the Maine Forest Service.

Other project partners include Maine’s Sustainable Forestry Initiative (SFI), Maine Department of Inland Fisheries and Wildlife (DIF&W), Maine Department of Marine Resources (DMR), and Orion Timberland LLC. Maine SFI has been one of the primary partners in protecting existing trout habitat. SFI has hosted and organized skidder bridge construction workshops and has placed bridges at host mill sites where they are available for loan to loggers to promote their use in protecting trout habitat at stream crossings.

The Maine DIF&W, another of the primary partners, is locating candidate sites for adding large woody material and providing the technical expertise to monitor fish responses to the treatments. The Maine DMR has also located a potential Chop and Drop site that is not only valuable to brook trout but also a highly productive site for Atlantic salmon.

The Maine DMR will also help with permitting and provide significant input into the riparian management section of a cold-water fisheries manual. Orion Timberlands has agreed to host a woody material enhancement site on its property on Mule Brook.

The project is expected to produce demonstrations of “trout friendly” forest management and habitat enhancement practices at four locations in Maine; four or more workshops for foresters, loggers, and landowners on how to protect and enhance trout habitat; a manual on protecting and enhancing cold-water fisheries for foresters and loggers; and the production or purchase of 10 hemlock skidder bridges and 10 plastic arch culverts to expand Maine’s temporary skidder bridge loaner program into brook trout watersheds.

The habitat enhancement work is currently being planned. The Maine DIF&W has completed GIS analysis using trout survey data to identify a list of streams that are candidates for habitat enhancement work. These streams are not supporting the trout populations and habitat features possible for their location in the State. For further information, please contact Keith Kanoti of the Maine Forest Service at Keith.Kanoti@maine.gov.