EPA
United States
Environmental Protection
Agency

Watershed Partnership Protects World-Class Trout Stream

Background

The brown trout population in Spring Creek was stressed because water quality was being degraded by both point and non-point sources of pollution.

Point Sources: Three municipal wastewater treatment plants and two fish hatcheries within the watershed were in violation of their National Pollutant Discharge Elimination System (NPDES) permits. Only one case was actually litigated: a municipality was fined $35,000 for the violations at its sewage treatment plant and the fine was placed in escrow to be used by the Spring Creek Chapter of Trout Unlimited for water quality improvements within the watershed.

Non-point Sources: A 1991 study by the Pennsylvania Cooperative Fish and Wildlife Research Unit showed that sediment from agricultural drainage basins was reducing the reproductive ability of brown trout in Spring Creek. Agricultural areas in the watershed were surveyed and it was determined that 4.1 miles (6.6 km) of streambanks were eroding, mainly due to unfenced pasture allowing cattle unlimited access to the streams (Figure 1). Sediment from this erosion was covering the trout's eggs and restricting the flow of water over the eggs. The lack of water bringing oxygen to and removing wastes from the eggs resulted in a decline in trout populations. Worst affected was an eight-mile (12.9 km) section where the Slab Cabin Run tributary drains into Spring Creek.

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. EPA delegates the administration of the NPDES program to most states, and has done so for Pennsylvania.

Spring Creek:

- Is located in the Ridge and Valley Ecoregion - The ridge slopes are steep, the soils are thin, and they are not ideal for either farming or development. The valleys are fairly flat, and the soil is deep and fertile.
- Drains into a tributary of the West Branch of the Susquehanna River and ultimately into the Chesapeake Bay.
- Is famous for its abundant population of wild brown trout and is one of the top trout streams in the state.
- Has about 1/3 of the land in its watershed devoted to dairy and crop farming and a majority of the properties along the streams in the watershed are privately owned; therefore, the landowners' participation was voluntary and they have no obligation to allow the public access to the streams.
- Has the Pennsylvania State University within its watershed.

The overall goal of this project was to improve the brown trout habitat in Spring Creek by reducing sediment loads (non-point source) coming from Slab Cabin Run and Cedar Run by 50%. To accomplish this, landowners needed to be convinced to install bank stabilization and fence the riparian areas along their streams.

Figure 1. An unfenced pasture along Slab Cabin Run allowed cattle unlimited access to the stream, producing erosion and pollution problems.

Solution

A partnership was formed among the Centre County Conservation District, the Pennsylvania Cooperative Fish and Wildlife Research Unit, and the Spring Creek Chapter of Trout Unlimited (TU) to reduce sediment loads in Spring Creek and document improvements in water quality.

In 1991, the only funding available to help landowners finance streambank fencing required them to pay at least 25% of the costs. Dr. Robert Carline, who headed the 1991 study for the Pennsylvania Cooperative Fish and Wildlife Research Unit, proposed that Trout Unlimited use the escrowed fines to fund the landowners' portion of the cost of stream fencing. It was hoped that landowners would allow fencing to be installed if there was no initial cost to them. Dr. Carline's proposal for use of the escrowed fine was approved based on expected improvements to conditions downstream from the reduction of sediment loads upstream.

The partnership was awarded a grant from the Pennsylvania Department of Environmental Protection (DEP) for planning and pretreatment assessment. Long-term monitoring stations were set up in the three basins (Spring Creek, with no riparian pastures; and Slab Cabin Run and Cedar Run, two basins adjacent to Spring Creek, each having long stretches of unfenced pasture). A variety of parameters − stream flow, stream temperature, sediment loads, substrate composition, benthic-macroinvertebrates, and fish − were investigated. Considerably more sediment was found in Cedar Run and Slab Cabin Run than in Spring Creek. The low sediment load in Spring Creek contributed to successful reproduction of brown trout, which had densities 5 to 23 times higher than its two tributaries.

All of the landowners along Slab Cabin Run, the tributary with the most miles of unfenced pastures and the highest levels of sediment, were contacted beginning in the spring of 1992. Landowners were given some basic information and encouraged to visit the demonstration project at Penn State.

The first landowner to participate, Mr. J. Meyer, was pivotal in getting other landowners involved. Slab Cabin Run bisects the Meyer pasture, which is located at the downstream boundary of the project. Much of the streambank in this pasture lacked vegetation and portions were subject to erosion. The Meyer farm is visible from the road, allowing other landowners to clearly see the improvements as they were being made and turning it into the real demonstration project. This helped encourage other landowners to participate.

A different tactic was used to get landowners in the Cedar Run basin (Cedar Run and Mackey Run) involved. They were invited to a public meeting so that the objectives of the project could be explained to all of them at once. Unfortunately, turnout was relatively low due to a snowstorm. The five landowners who attended, agreed to participate in the project. The landowners who did not attend were contacted by telephone, with follow-up visits to those who appeared interested. During the visits, they were provided with a description of the project, a copy of the agreement for participating landowners, a copy of the Penn State Extension Bulletin on Streambank Fencing, and information about how restricting stream access could reduce the risk of their livestock's infection from water-borne diseases.

The majority of the landowners felt that something upstream was responsible for the sediment. The few landowners who did recognize that their cattle contributed to the problem of eroding streambanks placed rocks along the banks (Figure 2). The newly added rock reduced erosion where it was placed, but caused livestock to enter the stream in adjacent areas and the new access points began to erode.

Figure 2. Some landowners put stones that they found on their fields on sections of the streambanks that were becoming eroded.

Landowners not initially interested had common concerns such as:

- Unwanted woody vegetation would grow between the fence and the stream;
- Weeds would grow up behind the fence and colonize the pasture;
- Riparian buffers would reduce their amount of pasture;
- Maintenance would increase due to the new fence.

Reluctant landowners were repeatedly visited by Dr. Carline or other project personnel and taken to visit the demonstration project. They became more likely to participate once Dr. Carline developed a relationship with them and convinced them he was serious about helping them, as well as the environment, and they saw the results on a participating property.

Rehabilitation decisions were negotiated between the landowner and the coalition. The Natural Resources Conservation Service (NRCS) provided technical assistance along Slab Cabin Run by designing repairs for severely eroded areas and assisted landowners with obtaining funding from the Agricultural Stabilization and Conservation Service (now the Farm Service Agency), U.S. Department of Agriculture (USDA). Suggestions were made to the landowners about what should be done and they provided input as to what they needed − animal crossings, access, etc. High tensile wire fencing was used on most of the properties (Figure 3). On properties with horses, wood fencing was used (Figure 4) because horses can injure themselves on wire fencing. Only a small amount of streambank needed to be fenced on horse farms, so the higher cost did not greatly increase the overall cost of the project.

Once landowners decided to participate in the program, they were required to sign an agreement stating that they agreed to the construction plan; would allow access to the property for construction, routine inspection and data collection; and would maintain the improvements for 10 years.

Figure 3. High tensile fencing was installed 3 m on either side of the stream to prevent livestock from trampling down the stream banks and to allow for natural revegetation along the stream.

Figure 4. Different fencing was used on horse farms, because horses can injure themselves on wire fencing.

Figure 5. Crossings were installed to allow livestock limited access to the stream.

Construction of streamside fences, installation of rock-lined animal crossings (Figure 5), and stabilization of banks were largely done by private contractors. The U.S. Fish and Wildlife Service (USFWS) installed fencing and stream-access on two projects. The Pennsylvania Fish and Boat Commission and Penn State University also provided heavy equipment for several projects.

In addition to restoration of Slab Cabin Run and Cedar Run, eroding streambanks at other properties in the watershed were also stabilized. Most were on state owned properties along Spring Creek, downstream of where Slab Cabin Run and Cedar Run enter it. One of the largest of these projects was on a cattle and sheep farm.

Maintenance of the improvements became the responsibility of the landowners and includes routine maintenance of the fence − replacement of posts, repair of wire, removal of trash and debris, or even replacement of sections of fence after a storm − and control of the weeds. In January 1996, fences on two of the properties were significantly damaged due to serious flooding. The landowners were contacted to see if they needed help repairing their fencing. One of the landowners said that he would repair it himself, but the other landowner accepted the offer of help. About 30 volunteers from TU and USFWS spent a Saturday morning repairing the fence and clearing the debris.

Monitoring/Results

More than 90% of the riparian pastures in the Slab Cabin Run and Cedar Run basins were treated by 1998. On Slab Cabin Run, 18,045 ft (5,500 m) of fence were erected, more than 1,673 ft (510 m) of banks were stabilized and 24 accesses and crossings were installed. On Cedar Run, 13,190 ft (4,020 m) of fence were constructed, 804 ft (245 m) of bank were stabilized and 14 accesses and crossings were installed. On Spring Creek, 6,375 ft (1,943 m) of fence were put up, 3640 ft (1,110 m) of banks were stabilized and 16 crossings and accesses were installed.

Preliminary results of streambank restorations were published in 1998. It was found that between 1991 and 1998 sediment in Slab Cabin Run decreased by 56.5% and sediment in Cedar Run decreased by 49.6%. Fine substrates were also found to have declined between 1992 and 1997. These preliminary results also suggest that there has been a slight, but statistically significant, decrease in the nitrate concentration in Cedar Run.

Post-treatment monitoring began in 2001, more than two years after all of the construction was completed, and will continue into 2003. An assessment of the changes in the sediment load, substrate composition, channel morphology, nutrient load, and macroinvertebrate and fish communities since pre-treatment is currently being conducted by a Penn State graduate student. Though the results have not been published, the data from Spring Creek and Cedar Run show that there has been a significant decrease in the amount of sediment between 1992 and 2001 (Figure 6). Additionally, on a 7.9-mile (12.72 km) section of Spring Creek downstream from Slab Cabin and Cedar Runs, the average number of trout redds (nests) rose from 102

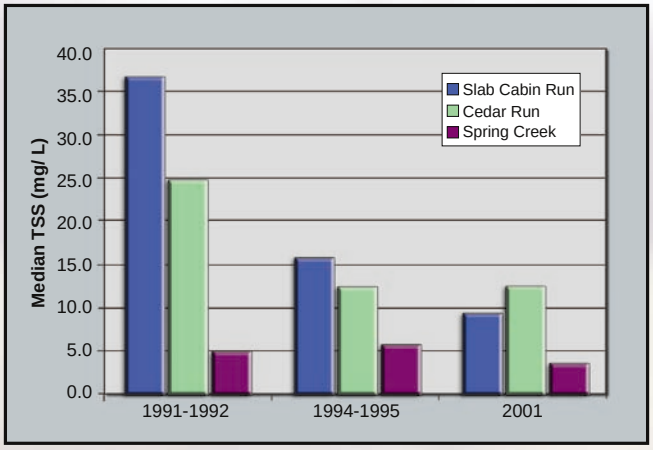

Figure 6. Median range of Total Suspended Solids (TSS) data from 1991-92 (pre-fencing), 1994-95 (partially fenced on Cedar Run; fenced on Slab Cabin Run) and 2001 (post-fencing).

in 1987-88 to 562 in 1997-2000 and 2002. Besides a reduction in sediment load from the improved sub-basins, it is possible that there were concurrent reductions in non-point source pollution from urbanized areas; hence these improvements in trout redds cannot be attributed solely to riparian restoration.

This project was clearly successful, as it met its goal of reducing sediment loads from Slab Cabin Run and Cedar Run by 50%. However, the future of the improvements may be in jeopardy, as the 10-year maintenance agreements for many of the properties are about to expire. Many landowners are happy with the program and will probably continue to maintain the fencing, but some are less enthusiastic and have already stopped maintaining their fences. One landowner, who has problems with multiflora rose, is threatening to tear down the fence.

Resources

The costs of construction varied depending on the extent of rehabilitation needed. The main costs include fence (about $0.71/ft), and crossings ($500/crossing). The cost of stabilizing banks with rip-rap depended on the source of the rock. Some of the stone for the bank stabilizations came from landowners' rock piles. The Bellefonte Lime Company donated more than 1,700 tons of limestone and the Pennsylvania Fish and Boat Commission (PFBC) donated trucking, loaders, and supplies. The total cost of construction was $149,090. Initial funding from the Pollution Mitigation Program (PMP) was used for construction along Slab Cabin Run, with additional funding for Slab Cabin Run coming from the Agricultural Stabilization and Conservation Service (ASCS), the Pennsylvania Game Commission (PGC), and TU.

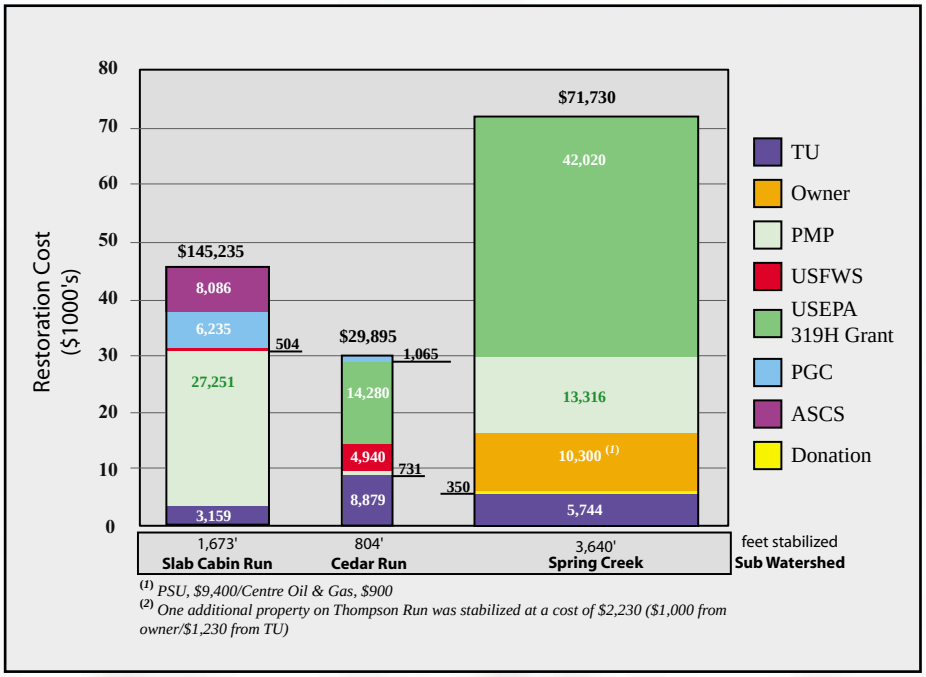

Figure 7. Cost of rehabilitation by sub watershed and funding sources.

A grant for $56,300 from the Pennsylvania DEP (EPA resources given to the states for non-point source management under Section 319H of the Clean Water Act) was used to continue construction.

The budget for post-treatment monitoring is $60,000/yr for three years, which is being funded by a grant from the EPA, through the Chesapeake Bay Program, and includes personnel, analysis and some equipment.

Keys to Success

- The **partnership** formed between the organizations within the watershed was instrumental in securing the necessary funding and expertise to carry out this project. Dr. Robert Carline played a key role in pulling all of the organizations together and getting landowners to agree to participate in the program.
- The **desires of the landowners** were taken into consideration in order to make their participation as agreeable as possible.
- **Landowners were not required to pay** for any of the construction on their properties.
- **Landowner satisfaction** was ensured by including them in the planning process and accommodating their needs, e.g., location of crossings and accesses, type of fencing used, etc.
- By making the riparian areas narrow (only 10 ft (3 m) on either side of the stream), **farmers were required to give up very little pasture**.
- By not requiring planting along the stream, the **cost of maintenance** to the fence (due to branches falling on it, etc.) was **reduced**.

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Partnerships and Coordination

This project is an excellent example of how one person can make a difference. Dr. Robert F. Carline coordinated this effort and brought several organizations together to solve a problem. The following organizations worked together and contributed the resources listed:

USGS Pennsylvania Cooperative Fish and Wildlife Research Unit:
Dr. Robert Carline got landowners to participate in the program; wrote grants; and performed monitoring with the help of PSU graduate students.

Trout Unlimited, Spring Creek Chapter:
Provided $41,298 from the Pollution Mitigation Program and $19,012 from national and chapter funds and volunteers to help with construction and survey work of flood repair damage.

Centre County Conservation District:
Provided local project officer for the EPA grant from the PA DEP and submitted quarterly reports about the project.

USDA, Natural Resources Conservation Service:
Helped landowners obtain funding from USDA; provided technical assistance; assisted with landowner relationships; and obtained general permits for animal crossings and ramps.

Pennsylvania Game Commission:
Provided fencing through a Chesapeake Bay Program grant.

U.S. Fish and Wildlife Service:
Installed fencing through their Partners in Wildlife Program.

Pennsylvania Fish and Boat Commission:
Provided personnel or equipment for projects on state property.

U.S. EPA, Chesapeake Bay Program:
Provided $60,000/year for three years of monitoring.

MAIA Best Management Practices Case Studies Course

Organizations throughout the Mid-Atlantic region have developed and implemented unique approaches to respond to environmental problems and concerns. The Mid-Atlantic Integrated Assessment (MAIA) has also conducted considerable research in the region, much of which has been used by environmental managers to meet their responsibilities.

MAIA and UMBC initiated a graduate-level research seminar where students document these success stories so that other managers and organizations can also use these approaches and research.

All photographs were provided courtesy of R. Carline.

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