PEGGY GREB (K11204-1)

# Saving Little Topashaw

## Eroded southern creek offers lessons on undoing years of harm to watersheds

Hydraulic engineer Doug Shields (left) and technician John Massey record the location (using GPS) and condition of a 4-year-old large woody debris structure in Little Topashaw Creek in Mississippi.

After a 2-hour drive from the ARS National Sedimentation Laboratory in Oxford, Mississippi, hydraulic engineer Doug Shields and agronomist Seth Dabney don hip waders and trudge through thick mud in a cottonfield, approaching the banks of Little Topashaw Creek.

Swollen and brown from heavy rains, the waterway cascades violently within its 20-foot canyon walls, rushing through a straightaway, over a headcut, and finally up against an S-curve. “It’s too rough for going down into the stream today,” says Shields. “But it’s a great day for data collection and observing.”

Shields, of the Oxford laboratory’s Water Quality and Ecological Processes Research Unit, leads the Little Topashaw Creek Stream Corridor Rehabilitation Project. This effort, which involves all the lab’s units, uses a 2-mile stretch of the creek for finding ways to make up for past abuses of watersheds. “Studies such as this can help us find cost-effective ways to help ecosystems recover,” Shields says between rain squalls.

He says that, like other watersheds throughout the lower Mississippi River valley, the 10-mile-long creek has suffered accelerated channel erosion caused by poor watershed management practices and channelization—the often-used practice of replacing a stream with a straight ditch.

Little Topashaw Creek is part of the Yalobusha Watershed, where ARS is conducting extensive research. (The work is included in the new Conservation Effects Assessment Project, which is featured in this month’s Forum, on page 2.) Shields, Dabney, ecologists Charles Cooper and Scott Knight, hydrologist Glenn Wilson, and geologist Andrew Simon have collected data on Little Topashaw’s water quality, fish, macroinvertebrates, vascular plants, geomorphology, and hydrology. But it’s the physical changes they have introduced—large woody debris structures, willow cuttings and grass hedges, and submersible pumps—that get the most attention.

"Traditional measures for controlling streambank erosion require costly stone or concrete structures," Shields says. "The measures being studied here may cut such costs considerably."

### Woody Debris and Willow Posts

In outfitting their segment of the creek with 72 debris structures, the team sought to replicate an essential component of stream aquatic habitat.

"Large woody debris provides shelter for fish and insects, stabilizes caving banks, and restores riparian habitats," says Shields. "But scientifically based guidelines for its use are scarce."

Unfortunately, many of the structures—consisting of uprooted trees stacked in crossing layers and anchored with steel cables to the streambed—have failed during the 3 years since they were built. "We pushed the envelope with our design," says Shields, "but we think the failures have led us to produce even better guidelines than if we had achieved 100 percent success."

The structures reduce sediment transport, triggering natural deposition to heal channels enlarged by years of erosion. Shields says they cost about $25 per foot of treated bank, or 20 to 50 percent of the cost of recent stone bank-stabilization projects in the region.

Meanwhile, Shields and University of Memphis wetland plant physiologist Reza Pezeshki are studying revegetating eroded riparian streambanks by planting dormant black willow *(Salix nigra)* cuttings, called posts.

Previous greenhouse studies by ARS and Pezeshki showed that soaking willow posts in water for 10 days before planting significantly increased their survival and growth. In the recent research, the team planted about 4,000 willow posts along the creek. For comparison, they also planted cuttings that were not soaked and ones that were soaked for 14 days.

"Soaking significantly enhanced plant survival during the first year," says Shields. "Soaked posts survived at a rate of 64 percent, but only 53 percent of unsoaked posts survived." Perhaps more importantly, soaked posts did much better under stress. "About 70 percent of soaked posts planted on drier, high banks survived," says Shields. "Only 40 percent of unsoaked posts survived there."

### Grass Hedges and Pumps

Oxford researchers see two other strategies at the creek—planting grass hedges within gullies and using submersible pumps—as complementary, low-cost methods of stabilizing streambanks.

"Vegetative barriers are widely used to control runoff and reduce soil erosion in cropland," says Dabney. "But they have not been used to control deep gullies in noncropped areas." Such gullies

**Technicians Calvin Vick (left) and John Massey measure switchgrass stem density and geometry at the upstream end of a riparian gully at Little Topashaw Creek.**

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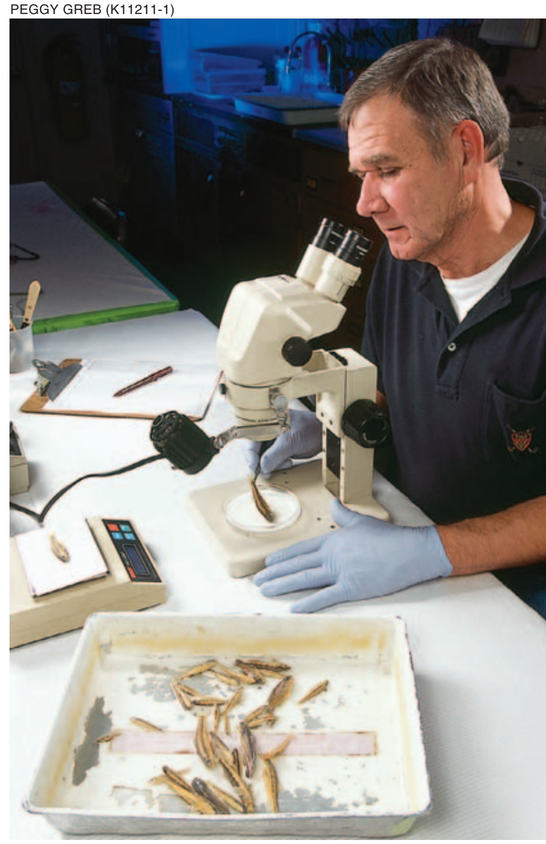

**Biologist Duane Shaw uses several unique morphological characteristics to identify one of the over 200 species of freshwater fish found in Mississippi.**

**Once restored, Mississippi streams damaged by erosion and channel incision are capable of supporting a rich and diverse fish fauna.**

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PEGGY GREB (K11198-1)

**Biologist Richard Lizotte removes water quality samples from an automated water sampler on Little Topashaw Creek.**

commonly result from floodplain farming next to incised channels. "Edge-of-field gullies are normally controlled with drop-pipe structures composed of a small earthen dam drained by a metal culvert," says Dabney. "These are quite effective, but they require capital investment and eventually corrode."

Well-established grass hedges can remain erect against waterflow that ponds to depths of up to 1.5 feet, he says. Dabney has planted switchgrass *(Panicum virgatum)* in gullies along Little Topashaw because "it's robust, it's tolerant of cold weather, and it's a native grass."

Meanwhile, solar-powered pumps and gravity-driven drains are being used to dewater and stabilize upper portions of steep streambanks subject to rapid erosion. Bank dewatering cuts the chances of sudden bank collapse by stabilizing weak, saturated soils and keeping water that seeps through high banks from carrying sediment with it and creating large cavities.

"Pumps offer the alternative of actively lowering the water table, and they're suitable in critical locations where rapid bank stabilization or deep drainage is needed," says Simon. "Also, bank stabilization with submerged pumps costs about $12 per foot, while stabilizing similar banks with quarried stone costs about $90 per foot."

"Low-cost, environmentally friendly methods to stabilize incised channels are badly needed because current techniques, though effective, are costly," says Shields. "Also, stabilizing incising channels and their stream corridors can have major positive ecological effects, particularly when the methods are designed to help restore habitat for fish and wildlife."

More information about Little Topashaw is available at msa.ars.usda.gov/ms/oxford/nsl/wqe_unit/topashaw.html.—By **Luis Pons,** ARS.

*This research is part of Water Quality and Management, an ARS National Program (#201) described on the World Wide Web at www.nps.ars.usda.gov.*

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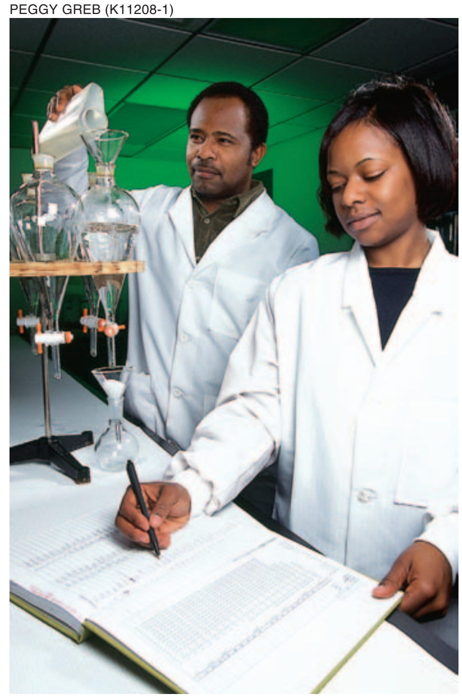

**Chemist James Hill (left) and technician Jennifer Swint process water samples collected from field sites for pesticide analysis.**