Reshaping the Course of a River's History

August 2000: After five years and countless floods, this riverbank (right side of photo) still holds the line against major erosion that was threatening a nearby county road. Photo courtesy of Rich Axvig, NRCS.

When torrential storms hit Grand Forks County, North Dakota, in June 2000, they did more than touch off destructive flooding.

The storms waged a war of nature versus nature. Two worthy opponents—a raging, rain-swollen river and a vegetation-laden riverbank—battled one another head on.

When that war was over, the riverbank had won a surprising, yet important, victory for the county and for the practice of bioengineering—a technique that combines structural and vegetative elements to stop riverbank erosion.

"The riverbank held up just great," said Richard Axvig, district conservationist with the Natural Resources Conservation Service (NRCS) in Grand Forks. "There was an awful lot of water flowing pretty hard and fast at that riverbend. We weren't sure how it would hold up."

But thanks to a lush growth of willows and straw grass, first planted in 1995 to thwart erosion along a meandering section of the Turtle River, the riverbank survived the assault.

River Eating its Way

The summer storm wasn't the first time that flooding caused problems along that section of the river. Since the 1980s, the river had been slowly eating its way toward a major east-west county

highway every time rain and snowmelt increased the water level. In 10 years, the riverbank had moved 40 feet, putting the water's edge about 150 feet from the center of the two-lane road.

The county water resources board, highway department and the NRCS needed a solution. So they turned to Linda Kingery, environmental coordinator with the Red River Regional Council, a non-profit agency that manages grants for governments in four northeastern North Dakota counties.

Kingery had been looking for a problem area in North Dakota that was suitable to use bio-engineering techniques rather than the more traditional—and expensive—method of stabilizing a riverbank by lining it with mesh and tons of rock.

Kingery thought a 330-foot section along the Turtle River could be a good test site. So she brought in three NRCS bioengineers from Michigan to conduct a riparian workshop that combined classroom instruction on how to restore natural vegetation with a hands-on application. The restoration design for the site was developed by Roger Thompson, a project engineer for the NRCS in Grand Forks County.

The 67 participants represented a number of agencies, including the NRCS, the North Dakota Forest Service, the North Dakota Game and Fish Department, the State Water Commission, the North Dakota Department of Health, the University of North Dakota and the Minnesota Department of Natural Resources.

September 1995: A backhoe, sitting on the newly reshaped riverbank, places large rock along the toe of the Turtle River to provide some protection from the river's ebb and flow. Afterwards, the bank was planted with willows and straw grass to begin restoring natural vegetation. Photo courtesy of Rich Axvig, NRCS.

Reshaping the Riverbank

Prior to the hands-on phase, the riverbank first had to be moved back from the road and reshaped because erosion had carved out a sheer, 12-foot-high cliff. So heavy machinery was brought in to cut down the cliff and re-create a sloping bank that would increase the distance between the river and the road.

Next, rock was laid along the bank both 2 feet above and below the water level to protect the soil from the river's constant wave action.

Workshop participants dug a trench behind the rock above the water level. They made bundles of willows and laid them into the trench to begin rooting. A second trench was dug farther up the bank where additional bundles were placed.

Brush mattresses, fashioned from more willows, were laid on the riverbank and switch grass was planted—both to help form a natural cover that would protect the soil. Willows and switch grass, indigenous to the area, were used because they are hardy, especially around water, and have good, fast-growing root systems.

At the top of the bank, three rows of trees were planted to provide an additional buffer and to shade the river, which helps lower the water temperature and improve the oxygen supply for fish.

Kingery estimated that about 800 volunteer hours were put in to complete the project. About $15,000, part of a larger project grant from the state health department, covered the contractor cost of the reshaping and rock placement. Had the traditional rock layer method been used, the project cost would have been substantially higher and the benefits to plant and fish life would not have been realized, she added.

The project has clearly provided the expected environmental benefits in the past five years, Kingery said. And, it also has provided some important lessons.

Learning Lessons the Hard Way

In the spring of 1996, less than six months after the initial work was done, ice chunks slammed into the bend of the riverbank, tearing the brush mattress. Americorps volunteers helped to replace the section with new willows.

There were several damaging events in 1997, again causing erosion at that bend. High water events in 1998 and 1999 shaved off a little more soil. Every year, Kingery and other natural resource managers went back to the site and made repairs, trying a different technique each time to fix the nagging problem.

May 2000: High-water events beginning in 1996 scoured out a curve on the riverbank because the radius curvature was too tight for the river to easily navigate.

"One of the lessons we learned there was that we had squeezed the radius too tight for that river," Kingery said, when the riverbank was brought back away from the road. When high-flow events occur, the river cuts into the bank because it can't navigate the shortened bend.

"We didn't have room to spread the riverbank out," Kingery said. "That would have meant a lot more excavation that we didn't have the time or money to do. We were going to deal with what was there. At that point, we didn't think a lot about the radius of that curvature."

Now, she said, they do. And though some would view the repetitive damage as a setback, Kingery doesn't see it that way. The erosion has been minor—only about 2 feet in five years compared with 40 feet in 10 years.

"It would have been neat to get it right the first time," Kingery said. "But that's the nature of working with a natural system. Sometimes it all works out great but a lot of times it doesn't. And it's the times that it doesn't work out perfectly that you have to pay attention. If we don't do that, we really haven't learned anything.

"If that erosion hadn't happened, we probably wouldn't pay so much attention to radius curvature and we wouldn't pay so much attention to how those things progress," she added. "Watching things over five years, because it didn't work perfectly, gave me a lot better understanding of what's going on there."

Kingery said she, too, is pleased with how well the riverbank fared in the June flood which she termed as "way off the charts" in magnitude.

"When we addressed that site, what we really wanted to do was stop the erosion," Kingery said. "This performed marvelously under a big test. We didn't see any new erosion. There were quite a few people who were involved in building that thing who were really amazed that it didn't really show any negative effects."

New Solution to an Old Problem

Even more encouraging is the fact that a new technique put in about two months prior to the flood may solve the long-standing erosion problem.

About 100 willows tied to small wooden stakes were planted within the erosion area to spur new growth, Kingery said. Wire cages were placed over stakes in six sections of the area to protect the young plants from resident beavers—long suspected of stunting the growth of the willows closest to the water.

When floodwaters hit the riverbank, the cages were crushed. The willows, on the other hand, survived.

"By August of 2000, there were only three stakes that hadn't grown," Kingery said. "Virtually all of them had new growth. They'll continue to branch out and probably hide that erosion in a year or so. In time, it will fill in by itself."

September 1995: A dozer moves dirt to begin reshaping the riverbank that had been eroded into a sheer cliff about 12 feet high. In 10 years, the riverbank had eroded 40 feet. Photo courtesy of Rich Axvig, NRCS.

Since the Turtle River site was done, interest in and requests for riparian projects (restoring natural vegetation) has skyrocketed, Kingery said. And though not all erosion is a suitable candidate for bioengineering techniques, Kingery hopes to meet the goal of completing 100 river miles of riparian projects by the end of 2002.

So far, about 30 miles already have been done in eastern North Dakota within the Red River basin. About 40 miles are planned for completion in 2001.

And along the way, no doubt, more lessons will be learned.

More information on the North Dakota riparian sites and projects is available on the following website: www.health.state.nd.us/rrbrp.