Pecatonica River:

Targeting conservation practices in a watershed to improve water quality

Partners discuss new stream crossing on the Judd farm. © TNC

One of the challenges facing landowners and managers in Wisconsin and nationwide is keeping sediment and phosphorus on the land and out of streams. Too much phosphorus leads to excessive algae growth, which blocks sunlight from underwater plants and consumes oxygen in the water.

Since 2009, farmers and conservation groups in Wisconsin have worked together to test whether it is possible to target efforts to improve water quality to have the greatest impact at the lowest possible cost. The idea was to use science to target conservation efforts on those fields and pastures with the greatest potential for contributing nutrients to streams.

The group tested this approach in the Pecatonica River watershed in southwest Wisconsin, and the results are in. With three years of water quality data (2013 to 2015) following a three-year implementation period, we found a 55 percent decrease in phosphorus loading during storm events in the test watershed, and we can say with 95 percent confidence that the change is due to targeted conservation practices.

We focused on storm and snow melt runoff events because that is when the majority of the sediment and phosphorus is transported from the watershed via the stream. U.S. Geological Survey stations on both watersheds (test and control) reported that as much as 20 percent of the annual phosphorus and sediment loading took place in a single day's heavy rains.

Launching a Pilot Project in Driftless Area

Bypassed by the glaciers, the Driftless Area in southwest Wisconsin is characterized by steep-sided ridges and miles of rivers and smaller tributary streams that eventually drain into the Mississippi River.

The pilot project was located on two sub-watersheds to the Pecatonica River: Pleasant Valley Branch (test watershed) and Ridgeway Branch (control). These watersheds were chosen because statewide computer models showed a strong likelihood that implementing conservation practices would reduce nutrient levels and improve water quality in the streams.

The partners identified a small number of farms in the Pleasant Valley watershed that were contributing comparatively large amounts of phosphorus and sediment to the stream. We used a field-scale tool that estimated average annual phosphorus delivery to streams (the Wisconsin P index) combined with one that estimated erosion (RUSLE2) to identify fields contributing the most phosphorus and sediment.

During the implementation phase, from 2010-2012, conservation staff worked with farmers to identify alternative management practices, including different types of tillage, crop rotations and manure handling that would reduce sediment and nutrient runoff. In this watershed, reducing tillage provided the biggest estimated cuts in soil and phosphorus losses, improving water quality and increasing farm profitability.

Because changing management practices can have financial implications, we helped some of the farmers identify conservation practices that were compatible with the farm's current cropping and livestock system. The partners secured funding from the Natural Resources Conservation Service to help farmers implement the needed changes.

Changing crop rotations to increase cover on fields in winter gives the Kellers another source of feed for some of their herd. © Mark Godfrey/TNC

The Baumgartners no-till most of their corn and soybean land. One result is large reductions in phosphorus and sediment runoff. © TNC

Farmers and county conservation staff worked together to implement conservation practices that reduced soil and nutrient loss. © Mark Godfrey/TNC

Science and Targeted Changes Are Keys to Success

USGS set up monitoring gauges and gathered data on water quality in test and control watersheds. © Mark Godfrey/TNC

Mottled sculpin, a cold-water fish that indicates a good quality coldwater stream. © John Lyons/WDNR

USGS staff gathered data on bank erosion and sediment deposition. Stream bank stabilization was an important conservation practice. © Mark Godfrey/TNC

We gathered baseline data on stream flow, water quality, stream channel sediment, phosphorus transport and storage, and fish and invertebrate populations to compare differences between the Pleasant Valley watershed where management practices were being changed and the control watershed, where no action was taken.

Using a paired watershed test allowed us to attribute reductions in sediment and phosphorus to project implementation. Without the control watershed comparison, these reductions would have been masked by normal weather-induced fluctuations in sediment and phosphorus loads and by changes due to regional land use trends. One such trend was conversion from Conservation Reserve Program (CRP) grasslands to row crops, which occurred in both watersheds during the project period.

Because we identified the highest-contributing areas in the watershed and were able to address most of them, we saw significant water quality improvements in the first three years after the 2010-2012 implementation period. Working in a relatively small watershed helped to reduce the expected lag time between applying targeted land conservation practices and actually seeing improvements in downstream water quality.

Farmers working with the project cut their estimated average phosphorus runoff and erosion almost in half, keeping an estimated average 4,400 pounds of phosphorus and 1,300 tons of sediment out of the water each year.

The improved water quality in this watershed has a substantial cumulative effect to downstream areas. For example, on just one warm spring day with steady rainfall, this watershed now exports about 225 pounds of phosphorus, 275 pounds less than it would have if the conservation practices had not been put in place. That extra 275 pounds of phosphorus is no longer over-fertilizing the river and potentially producing 137,500 pounds of algae in downstream waters.

Other lessons learned in the project:

- Farm fields and stream channels were both important sources of phosphorus and sediment. Approximately 70 percent of the sediment exported out of the watershed in the stream is from farm fields and 30 percent from stream banks.

- Upland soils are annually eroding about 13 times more sediment than stream banks. Much of this sediment is deposited on adjacent fields, pastures and along the stream banks. Some of the eroded sediment is exported from the watershed, but a portion settles along gentle reaches and is stored in channels. Due to a lag effect, it would likely take about 8 years to export sediment already stored in Pleasant Valley channels.

- The project applied conservation practices to cropland, pastureland, farmsteads and stream banks. Stream habitat improvements included sloping back high, eroding banks and replacing invasive box elder trees with grasses and native wildflowers, which helped reduce phosphorus and sediment runoff. They also played an important role in improving the health of the fishery.

- After stream bank restoration, silt and muck on stream bottoms was reduced, uncovering cobble and stone bottoms. The Wisconsin Department of Natural Resources will propose removing Pleasant Valley Branch from the EPA list of sediment-impaired streams.

- State biological assessments showed improved conditions for fish as well as insects and other macro-invertebrates. More sensitive fish species that are less tolerant of pollution and disturbed habitat, such as brook and brown trout and mottled sculpin, are present.

Anglers have seen a quick response in fish species and abundance of trout in the Pleasant Valley watershed. © Mark Godfrey/TNC

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