Section 319

NONPOINT SOURCE PROGRAM SUCCESS STORY

North Dakota

Implementing Best Management Practices and Targeting Technical Assistance Restores Lake

Waterbody Improved

Agricultural activities contributed excess nutrients and sediment to North Dakota's Lake LaMoure, resulting in a hypereutrophic (high nutrient concentrations and poor water clarity) state. As a result, North Dakota added the lake to its 2002 Clean Water Act (CWA) section 303(d) list of impaired waters as threatened for its recreation and aquatic life designated uses. Implementing agricultural best management practices (BMPs) reduced the amount of nonpoint source pollution entering the lake. As a result, lake clarity has increased and chlorophyll *a* levels have decreased, allowing Lake LaMoure to return to a mesotrophic (lower nutrient concentrations and greater water clarity) state. On the basis of those data, North Dakota removed Lake LaMoure from the CWA section 303(d) list in 2010.

Problem

Lake LaMoure is a 409-acre reservoir on Cottonwood Creek in southeastern North Dakota. The lake provides recreational opportunities such as swimming, boating and fishing (Figure 1). Agriculture (crop and livestock production) is the primary land use in the lake's 160,000-acre watershed.

In the 1990s, local residents became concerned as frequent algae blooms plagued the lake in mid- to late-summer, and the fish community became increasingly dominated by less desirable fish such as carp and bullheads. In response, in 1995 the LaMoure County Soil Conservation District (SCD) began evaluating the relationship between land management and degrading water quality in the Lake LaMoure/Cottonwood Creek watershed. The SCD measured water quality and quantity and inventoried the land use practices in the watershed. The 1995 assessment revealed that Lake LaMoure received approximately 72,712 pounds (lbs) of nitrogen and 11,987 lbs of phosphorus—roughly equal to a fertilization rate of 147 lbs/acre nitrogen and 24 lbs/acre phosphorus. Models also indicated that the lake generated an additional internal loading amount equal to a fertilization rate of 13.8 lbs/acre nitrogen and 11.4 lbs/acre phosphorus.

The SCD's assessment identified that recreational use impairments in Lake LaMoure were primarily caused by nonpoint source pollutants from agricultural lands, including nutrients (nitrogen and phosphorus) and suspended sediments. Potential nonpoint pollutant sources included excessively tilled croplands, overgrazed rangeland and livestock winter feeding areas. The assessment also identified the lake's carp population as possibly contributing to resuspension of sediments and nutrients through rooting and foraging activities on the lake bottom.

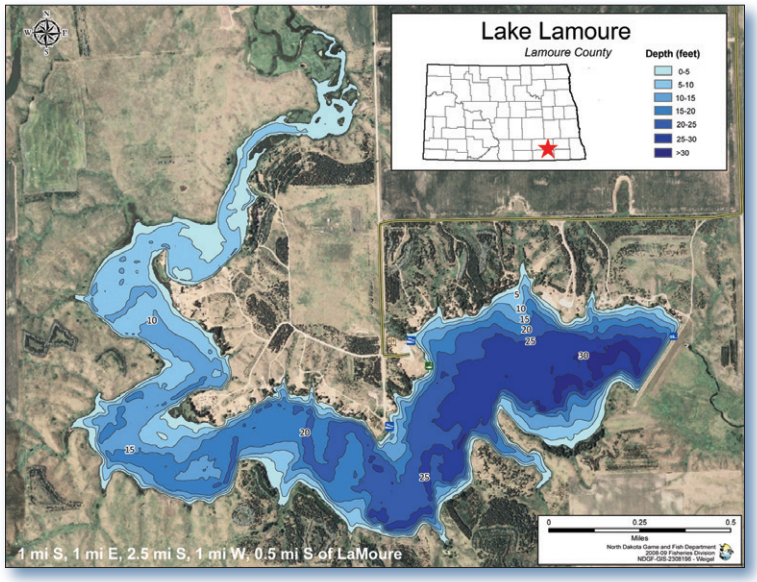

Figure 1. Lake LaMoure is in southeast North Dakota.

The SCD's assessment determined that in-lake phosphorus concentrations needed to be reduced to a mean annual concentration of 0.19 milligrams per liter (mg/L) to change the lake's trophic state from hypereutrophic to mesotrophic. Trophic State Index (TSI) values are calculated according to seasonal means of total phosphorus, chlorophyll *a* (the photosynthetic pigment that causes the green color in algae and plants), and Secchi disc transparency (indicating water clarity). TSI values are often grouped

into trophic state classifications: oligotrophy, or low productivity (values of 0–40); mesotrophy, or moderate productivity (values of 40–50); and eutrophy, or high productivity (values of 50 or more). TSI values can assess changes in a lake's productivity over time and compare the productivity of lakes in the same region.

Project Highlights

The SCD developed a watershed project implementation plan that identified beneficial use improvement and nonpoint source pollutant-reduction goals, specific activities for accomplishing the goals and a method for evaluating progress. The SCD began targeting conservation planning assistance along with voluntary implementation of BMPs in 1997.

With help from the SCD and other federal, state and local partners, landowners applied BMPs to 56,950 acres, including implementing conservation tillage (22,010 acres) and no-till (1,816 acres), converting cropland to hayland (1,149 acres), establishing riparian easements (41 acres), stabilizing streambanks (1,915 linear feet), and installing exclusion fencing (2,610 linear feet). In addition, landowners adopted prescribed grazing management on 319 acres, strategies for better managing livestock waste nutrients (on 17,472 acres), and improved crop residue management (on 2,246 acres). The SCD worked with landowners to implement 10 manure management systems and install fencing to exclude livestock from riparian areas. After the watershed project had ended, one additional system was installed with funding from Natural Resources Conservation Service's Environmental Quality Incentive Program.

Results

Implementing BMPs reduced water pollution and improved the lake's water quality. Analysis of chlorophyll *a* data and Secchi disk transparency yields TSI scores that show that Lake LaMoure has improved from a hypereutrophic to a mesotrophic state (Figure 2). When analyzed for trends using a Seasonal Kendall Test, the chlorophyll *a* data showed a significant decline (slope of -0.810, $p < 0.1$). The Secchi disk transparency readings showed a significant increase (slope of 0.124, $p < 0.05$). Water quality improved, and recreation and aquatic life designated uses have been restored. On the basis of those data, North Dakota removed Lake LaMoure from the state's CWA section 303(d) list of impaired waters in 2010.

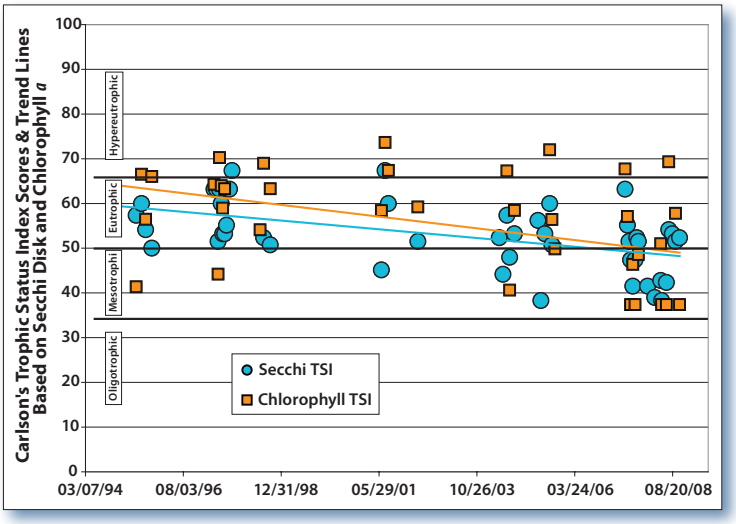

Figure 2. TSI scores for Lake LaMoure from 1994 through 2008.

Partners and Funding

The LaMoure County SCD led the watershed assessment and development of the Lake LaMoure/Cottonwood Creek Watershed Project. The SCD hired staff to work with watershed landowners to develop contracts and deliver technical assistance for implementing BMPs. SCD project staff worked closely with federal, state and local partners, including the North Dakota Wetlands Trust (renamed the Natural Resources Trust), Natural Resource Conservation Service, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and the Nonpoint Source BMP Team—a CWA section 319-funded engineering program through the Sheyenne James Resource Conservation and Development program.

In addition, the North Dakota Department of Health provided oversight for project management, developed the quality assurance project plan, conducted training for proper water quality sample collection, and helped to develop and implement outreach and education activities. The North Dakota Game and Fish Department provided financial assistance for establishing riparian easements and restoration practices. Partners have encouraged and maintained public involvement by holding workshops, distributing newsletters and offering presentations to community groups.

The project received $1,753,668 in CWA section 319 funding that was matched by $1,169,112 in local funds (cash and in-kind services) from landowners.

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