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PROTECTING AGRICULTURAL WATERSHEDS

ARS promotes stewardship of water resources to support agricultural production while protecting environmental, human, and animal health. Agricultural watersheds cover more than 70 percent of the continental United States. Operating a national network of experimental watersheds and long-term agroecosystem research sites, ARS is uniquely situated to develop integrated watershed management strategies for agriculture across broad regions of the continental United States. The following accomplishments highlight ARS advances in watershed protection research in FY 2019.



New bank stability assessment technology protects rivers and streams. Current bank erosion prediction technology does not account for spatial and temporal variability, making it difficult to accurately predict bank erosion. ARS researchers in Oxford, Mississippi, developed a new way of predicting bank erosion by incorporating new parameters into ARS's widely used Bank Stability and Toe Erosion Model (BSTEM). The Sacramento District of the U.S. Army Corps of Engineers is using the new technology to prevent levee failure around the city of Sacramento, California.

Mulch and gypsum reduce nutrient export into rivers. ARS researchers in Oxford, Mississippi, found that adding inexpensive organic sources such as hardwood mulch to ditches or other edge-of-field systems can reduce the impact of nitrogen pollution on surrounding waterways. Mulch and mulch-gypsum amendments removed 65 to 69 percent of the load in the system, and including gypsum significantly decreased phosphorus runoff.

Design and demonstration of the construction of a phosphorus removal structure. ARS scientists in West Lafayette, Indiana, designed an underground tile drain phosphorus filter on a large swine farm near Holland, Michigan, using 60 tons of slag—the largest tile drain filter ever constructed using tanks. An American Society of Agronomy journalist filmed and documented the process for future use in training modules. Increased adoption of phosphorus removal structures will reduce dissolved phosphorus runoff and protect bodies of water.



Oilseed cover crops reduce unwanted soil nitrogen loss. Contamination of water from the leaching and runoff of soil nitrogen and phosphorus from corn-soybean cropping systems is a major concern. Winter annual cover crops can use leftover nitrogen and phosphorus from the previous crop and reduce runoff. ARS researchers from Morris, Minnesota, in collaboration with University of Minnesota scientists, demonstrated that winter camelina and pennycress grown as cover crops can reduce nitrogen losses by 84 percent and 91 percent compared to typical no-till and conventional till systems, respectively.

Cover crops reduce nitrate leaching. ARS scientists in Beltsville, Maryland, conducted a meta-analysis of literature to understand how well cover crops reduce nitrate leaching from agroecosystems. Compared to no cover crop controls, cover crops reduced nitrate leaching by 56 percent. Soil type, planting and termination dates, shoot biomass, and climate each influenced the extent to which cover crops reduced nitrate leaching. These findings indicate that cover crops are an effective way to reduce nitrate leaching and should be integrated into existing cropping systems for water quality benefits.