



IMPROVING WATER QUALITY THROUGH SOIL HEALTH

INTRODUCTION

According to EPA, more than 70% of the United States' rivers and streams are in fair or poor biological condition. Recurring events, such as harmful algal blooms in Western Lake Erie and the "hypoxic zone" in the Gulf of Mexico, have drawn public attention to nutrient runoff from agriculture as a contributing source of water quality degradation. In 2014, the City of Toledo, Ohio warned citizens not to drink the water due to high microcystin levels associated with algal blooms. In 2015, the Des Moines Water Works in Iowa announced litigation against neighboring agricultural counties for high nitrate levels in the public water supply. Such events increase the likelihood of more on-farm regulations, which some contend would lead to fewer farms and a greater reliance on other countries for our food supply. Several of the same soil health-promoting practices that increase productivity for farmers and ranchers are also proven to reduce nutrient runoff and leaching, thereby protecting and improving water quality.

OPPORTUNITIES

There is a significant opportunity for landowners to capitalize on the economic and production benefits of soil health, while simultaneously improving surface and groundwater quality. Given the fact that 70% of land in the United States is privately owned, landowners have the greatest opportunity to impact food production in an environmentally responsible manner. For example, no-till and cover crops are primary practices farmers use to enhance soil health. Research in Maryland showed that these same practices also reduced loss of nitrate by 88% and phosphorus by 92%. Adding cover crops to no-till soybeans in Missouri reduced loss of soil by as much as 94%, nitrate by 77% and phosphorus by 63%. An analysis of 69 separate research studies from across the U.S. showed that cover crops reduced nitrate loss by an average of 70%.

Additional soil health practices, such as crop rotation and nutrient management, also play key roles for protecting and enhancing water quality through soil health. In fact, reduction in nitrate loss to groundwater is generally due to

plant uptake of that nitrate by the cover crop. Consequently, in order to ensure benefits to water quality, fertilizer recommendations for the following crop must account for nitrogen that will become available from the decomposing cover crop. As many practices used to enhance soil health influence nutrient availability, nutrient management is inherently a key soil health practice, and an entire systems perspective is required to optimize benefits and minimize nutrient losses. This recognition has given rise to the "4R" nutrient stewardship concept advocated by the fertilizer industry and followed by many natural resource professionals and farmers, where nutrients are to be added from the Right source, at the Right rate and Right time, and in the Right place.

RESEARCH AND ENGAGEMENT NEEDS

Significant research needs still exist to achieve soil health management systems to protect and enhance both groundwater and surface water quality. A concerted research effort would enable us to:

- Assess the potential water quality improvements and associated temporal dynamics for major watersheds

given different levels of soil health management system adoption in order to prioritize key sub-watersheds and associated land management practices.

- Quantify the current status of soil health and the current adoption level of soil health management systems across the U.S. in order to assess the current state and establish a baseline for measuring future progress.
- Quantify the impacts of soil health-promoting practices and systems on profitability and economic risk across a range of soils, cropping systems and climates. This is needed for practices already proven to enhance soil health, as well as for new technologies and practices.
- Quantify potential increases in soil organic carbon and available water holding capacity across a range of soils to develop a Decision Support System for farmers to guide them in increasing drought resilience through soil health. This will serve as an additional driver to farmer adoption of practices that also improve water quality.
- Determine optimal cover crop species mixes, seeding rates and seeding methods (e.g., inter-seeding, inter-cropping, frost-seeding) to enhance cover crop establishment and survival, increase soil organic carbon, and protect and enhance water quality.

Ultimately, farmers and ranchers are business owners. Accordingly, the Soil Health Institute will prioritize the development and transfer of materials and tools that focus on the profitability and economic risk of proven soil health practices and technologies.

ROLES OF THE SOIL HEALTH INSTITUTE

To protect and enhance water quality, the Soil Health Institute will:

- Build research/implementation strategic plans and corresponding networks/synergies to carry out those plans;
- Seek and obtain funding to address the gaps identified;
- Administer an accountable, transparent and technically

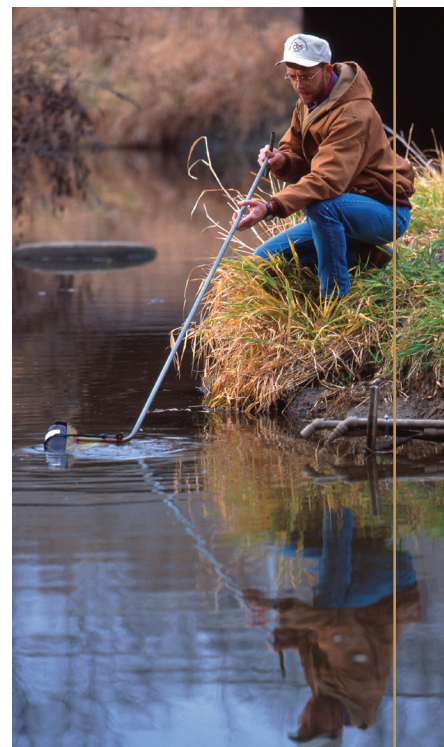
proficient grants program that develops and capitalizes on synergies among projects;

- Continually work alongside grantees to assess and ensure impact of the investments made and provide that information back to funders and the public;
- Incorporate research results into educational materials and programs for farmers, ranchers and other audiences; and
- Build and enhance partnerships for education, technology transfer and adoption.

SUMMARY

Research has clearly shown that many of the same soil health practices of interest to farmers for enhancing productivity are also beneficial for water quality. Consequently, conducting the additional research and education needed to expand adoption of soil health management systems by farmers will afford the simultaneous benefits of protecting and improving water quality. Assessments of current land management practices and potential water quality improvements will allow identification of priority sub-watersheds and practice adoption needs. Quantifying the current status of soil health and adoption of soil health-promoting practices will provide a baseline for measuring future progress and impact.

Enhancing soil health will significantly improve water quality while addressing farmers' production goals.



SOIL HEALTH
INSTITUTE