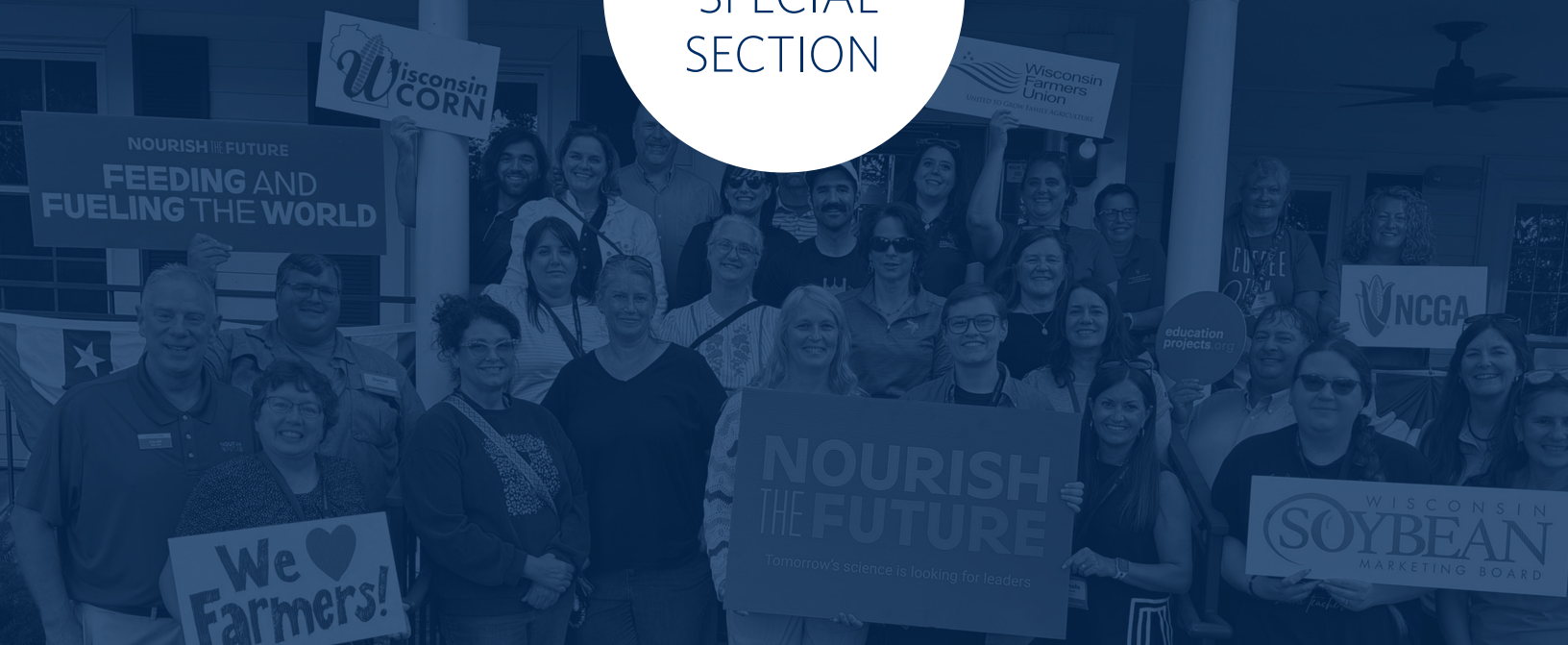




TEACHING THROUGH WATER

Educating the Educator: Using Agriculture to Build Science Literacy

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Introduction

How do we prepare students to make informed decisions about food, water, energy, biotechnology, and environmental sustainability, when many of their science teachers have had little or no formal training in agriculture? Nourish the Future addresses this challenge by starting with the educator.

Nourish the Future, or NTF, is a free national education initiative developed by science teachers for science teachers. Its goal is to increase agricultural literacy by helping educators connect the science they already teach to modern agriculture, food production, environmental sustainability, biotechnology, and agricultural careers (Nourish the Future, 2026a). The program is supported by agricultural commodity organizations and

agribusinesses, including the national Soy Checkoff program, Bayer Crop Science, and state commodity groups.

This funding provides professional learning, curriculum, classroom materials, and supplies to participating teachers at no cost.

The strategy is simple but powerful. Agriculture provides an authentic context for required science content. NTF equips educators through industry experiences, teacher-tested curriculum, and practical classroom materials. Teachers bring those experiences to students and other educators, multiplying the impact throughout their careers.

Teachers Teaching Teachers

The foundation of NTF is that it is for teachers, by teachers. Teacher Leaders do not simply present curriculum. They engage educators as learners. Teachers collect data, manipulate materials, analyze evidence, make mistakes, ask questions, and discuss results. By experiencing the investigation first as learners, teachers encounter the same questions, procedural challenges, data interpretation problems, and opportunities for scientific reasoning that their students will encounter. A biology teacher who has never tested soil nutrients performs the test. An environmental science teacher investigates how agricultural practices affect a watershed. A chemistry teacher can explore biofuels through concepts already present in the curriculum.

Agriculture is the context for teaching science, not an additional subject competing for instructional time.

NTF uses two complementary professional learning models. The **National Teacher Leader Cohort** develops educators who deepen their understanding of modern agriculture, inquiry-based instruction, leadership, and agricultural careers. These teachers become part of a national network that shares curriculum and supports other educators.

The second model brings professional learning directly to states through two-day **Nourish the Future Feeding and Fueling the World** (NTF FFTW) workshops. During 2026, NTF FFTW workshops were held

in North Carolina, Alabama, North Dakota, Missouri, Indiana, Kentucky, Wisconsin, Nebraska, Michigan, and Minnesota.

Removing Barriers to Implementation

NTF FFTW workshops immerse middle and high school educators in phenomena-based investigations that are aligned with Next Generation Science Standards and connect biology, chemistry, environmental science, biotechnology, and other STEM disciplines to food and fuel production.

Each participating teacher receives equipment and classroom supplies valued at up to \$300. Materials can include water quality and watershed equipment and La-Motte soil testing kits. Teachers therefore leave the workshop not simply knowing about an activity but prepared to implement it.

The impact can also extend beyond individual classroom lessons. Some participants teach high school research courses yet before NTF training had never considered directing students toward agricultural research. Exposure to agricultural biotechnology, soil science, water quality, plant science, biofuels, and food systems gives teachers new areas for student research, and introduces students to agricultural STEM disciplines and career pathways they may not previously have encountered.

IMAGE 1. NTF FFTW WI 2026 Teachers and Industry Leaders Including Secretary of The Wisconsin Department of Agriculture, Trade and Consumer Protection, Randy Romanski



Water as an Entry Point to Civic Science

The NTF water quality curriculum demonstrates how this strategy connects science learning with civic engagement. Water connects communities, and decisions involving agriculture, development, stormwater, recreation, and ecosystem protection have consequences beyond property lines.

The NTF middle school water quality curriculum creates a particularly effective progression. Students move from watershed processes to human impacts to nutrients to abiotic testing to biological indicators and finally to evidence-based remediation (Nourish the Future, 2026b).

IMAGE 2. NTF FFTW KY teachers investigate water quality with the Understanding Watershed Activity

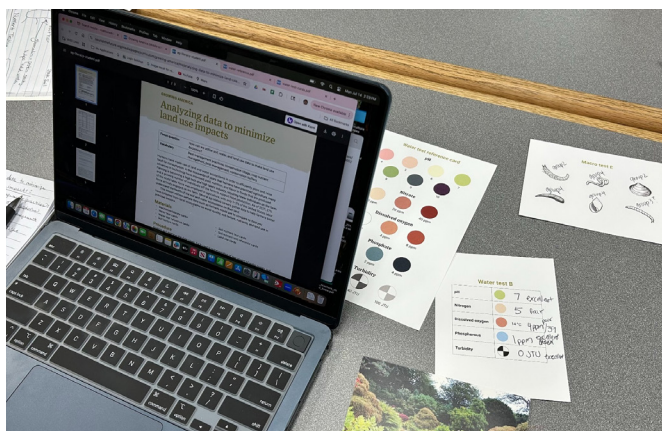


Students investigate watersheds, soil profiles, erosion, nutrient impacts, and relationships between land use and water quality. They can measure temperature, turbidity, pH, dissolved oxygen, nitrogen or nitrate, and phosphorus or phosphate. They investigate soil infiltration and erosion and examine macroinvertebrates as indicators of ecosystem health. Finally, students combine physical, chemical, and biological evidence to evaluate water health and develop remediation plans.

This final step is essential to civic engagement.

Students are not simply asked whether water is polluted. They must consider evidence, determine what may

IMAGE 3. Nourish the Future Resources for Students Investigating Land Use Impacts (including macroinvertebrates and water test cards)



be influencing the system, and propose actions that could improve it.

The progression mirrors the reasoning citizens need when confronting environmental issues in their communities. They observe a problem, gather evidence, evaluate explanations, understand human impacts, and consider solutions.

From Classroom Science to Community Science

Students can examine a local water system, identify surrounding land uses, and predict possible influences. Physical, chemical, and biological evidence can then be compared with maps, rainfall patterns, land use information, or publicly available environmental data.

The teacher's role changes from providing the correct explanation to helping students determine what claims the evidence supports.

This is where agricultural literacy and civic scientific literacy intersect. Agriculture should neither automatically be blamed for an environmental problem nor automatically be excluded as a possible contributor. Students should investigate evidence; they should examine agricultural practices intended to reduce nutrient and sediment loss, including vegetative buffers, nutrient management, reduced tillage, and practices that increase soil infiltration.

Students begin moving beyond statements such as "pollution associated with agriculture" or "farmers protect the environment" toward better questions. What does the evidence show? What practices are being used? What are the tradeoffs? What additional evidence is needed before making a recommendation?

That is science education serving civic engagement.

Extending Learning Through Research and Biotechnology

At the high school level, NTF water curriculum extends learning into biodiversity and biotechnology. Students can examine freshwater plankton biodiversity and use Simpson's Index of Diversity to investigate aquatic ecosystems. Water bioinformatics allows students to use

IMAGE 4. NTF FFTW NC 2026: Education And Outreach Coordinator, Sarah Dinger leads a tour of the NC State Vegetable Pathology Lab



DNA sequences and the National Center for Biotechnology Information database to identify organisms represented in water samples (Nourish the Future, 2026c). These experiences demonstrate that modern environmental monitoring combines field observations, chemistry, biology, mathematics, genetics, and computational tools.

NTF Teacher Leaders also include college educators. Dr. Brian Shmaefsky of Lone Star College, a former president of the Society for College Science Teachers, brings experience in environmental science, biology, faculty mentoring, and professional learning (Nourish the Future, n.d.). College faculty participation helps connect secondary science, undergraduate STEM learning, and agricultural career pathways. Agricultural science teachers provide specialized expertise and pathways, while general science teachers provide another avenue for expanding agricultural literacy through biology, chemistry, environmental science, earth science, and other STEM courses.

The Teacher Multiplier Effect

A student experiences a lesson once. An educator can teach that lesson repeatedly.

A science teacher reaching 130 students each year can reach 1,300 students over ten years. When that teacher shares an NTF investigation through district professional development, a state science teachers conference,

or a professional network, the original professional learning investment begins reaching students who were never taught by the original participant. This is especially important because most students will never enroll in an agriculture course. They do, however, take biology, environmental science, chemistry, earth science, and other science courses.

Educating the educator reaches not only today's students but future students throughout that educator's career.

Teacher leadership therefore scales agricultural and civic science literacy. Practicing educators understand classroom constraints and can tell colleagues, "I used this with my students, and this is how I made it work."

Preparing Students for Earth and Beyond

Agricultural literacy extends beyond traditional farming. Food, water, soil, energy, biotechnology, and sustainability are civic issues on Earth and will become survival issues as humans move beyond it. In future settlements on the Moon, Mars, or elsewhere, humans will again become pioneers, with everyone connected to food production and resource management. Students investigating these systems today are developing scientific knowledge needed to solve problems on Earth and eventually sustain communities beyond it.

Conclusion

The practical teaching strategy demonstrated by Nourish the Future is not simply providing teachers with more curriculum. It is building teacher capacity. Agriculture provides an authentic context for science, while NTF prepares teachers to use that context through firsthand investigations, classroom ready curriculum, equipment, and connections with scientists, agricultural professionals, college faculty, and other educators.

The National Teacher Leader Cohort and NTF FFTW workshops extend that impact as teachers reach new students each year and share their experiences with other educators. Water quality demonstrates the result. Students collect and interpret evidence, investigate

human interactions with natural systems, consider possible solutions, and use science to participate thoughtfully in civic decisions.

That is agricultural literacy. That is scientific literacy. And that is civic engagement.

About the Authors



Christine Girtain is the 2023 New Jersey State Teacher of the Year, a DoW STEM Ambassador, Director of the East Coast Space Settlement Design Competition, and a co-founder of the Jersey Shore STEM Eco-system. A longtime science educator and Nourish the Future Teacher Leader, she works to expand authentic research, agricultural literacy, and STEM career pathways for students and educators. Girtain is the corresponding author and can be contacted at NJSTOY2023@gmail.com.



Jane Hunt serves as Education Director for EducationProjects.org. Jane taught middle school science, biology, and AP environmental science for 30 years in central Ohio. She is trained in problem-based learning, as a trainer of Next Generation Science Standards, and she is an adjunct professor at Ashland University. She designs workshops and oversees educational products including career videos, e-learning courses, and curriculum.

Resources

- ♦ **Nourish the Future:** <https://nourishthefuture.org/>
- ♦ **Nourish the Future Water Quality Curriculum:** <https://nourishthefuture.org/curriculum/water-quality>

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