



Environmental Stewardship

PHOTO: USDA

Conserving and Protecting Water Resources

Clean water is essential for drinking, agriculture, energy, recreation, aquatic habitats and other uses, but America's water resources face complex issues such as climate change, pollution and increasing demand. Researchers and Extension educators at land-grant universities across the United States are helping farmers and communities conserve water and implement tools and strategies that improve water quality.

Here are a few examples of that work:

- Researchers in multiple states are working together to find ways to efficiently and fairly allocate water. New data and models have enabled water users, managers and policymakers to objectively and accurately weigh the costs and benefits of complex water supply decisions. Researchers also advanced the theory of water trading and provided workshops on water banking, which can help balance economic and environmental benefits. Water-use projections guided policy in **Georgia**, and in **Washington** a cost-benefit analysis influenced decisions on a major water management plan in the Yakima Basin. Washington State University also developed tools and negotiation strategies that reduce the time and legal resources needed to make water agreements and increase the likelihood that agreements are amenable to all parties. This research helps develop policies and program that alleviate water conflicts, protect ecosystem services and ensure enough water for all uses now and in the future.
- Understanding how and why farmers make decisions that conserve water or protect water quality has helped make water policies and program more cost-effective and easier to implement. For example, **Kansas** State University showed that farmers' decisions to adopt tools and practices are largely influenced by nearby peers and that reducing contract stringency could improve water quality program participation and cost-effectiveness. In **Ohio**, the governor's office used findings from a study of farmers' conservation behaviors to design strategies to reduce runoff into Lake Erie.
- Estimates of the evapotranspiration — the amount of water lost through soil evaporation plus the amount lost through plant transpiration — indicate when crops actually need more water. Hundreds of **California** growers, agricultural land managers and crop advisors use the University of California's

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weekly evapotranspiration reports to inform how long to irrigate and how frequently to irrigate. Scheduling irrigation based on evapotranspiration estimates can improve plant health and yields, save water and cut irrigation costs.

- The University of **Nebraska** released AquaCrop-OS, an open-source version of an important model that is used worldwide to fine-tune irrigation so that less water is wasted.
- **New Mexico** researchers developed a user-friendly, inexpensive, accurate soil moisture sensor that will help prevent overwatering.
- By adopting water-saving practices recommended by Extension educators, **Texas** homeowners save an estimated 201.9 million gallons of water annually — that's almost 130 gallons per household per day. In addition to conserving fresh water for future use, these efforts result in estimated water-cost savings of \$734,700 per year for participants.
- **Michigan** State University showed that pretreating fast food restaurant wastewater can reduce the impacts of fat, oil and grease on septic systems, prevent premature system failure and delay costly repairs.
- **Tennessee** scientists identified oxidizers like chlorine and ultraviolet light that can remove hormones, antibiotics and other pharmaceutical compounds from domestic wastewater so that it can be safely used to irrigate fruit and vegetable crops. Reusing water is critical to stretching our water supply for future uses.
- Nutrients provided by fertilizer, manure, compost and other means are essential to crop production, but must be managed properly so they don't pollute water. A team of scientists from 15 land-grant universities updated the nutrient needs for various crops, identified best practices for applying fertilizers and educated government agencies, farmers, crop advisors and others about nutrient management. For example, a **New Mexico** State University video series is used in K-12 schools, college courses, and professional trainings and has over 30,000 views. Nutrient management is key to maintaining or increasing plant productivity, protecting water quality, and using farmers' time and money efficiently.

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Multistate research helps protect water sources from agrochemicals

Pesticides, herbicides, fertilizers and other agrochemicals are used on farms to protect crop yield and quality and in urban and residential settings to control pests and weeds. Despite important uses, agrochemicals can leach into soil and groundwater or flow into surface waters, where the chemicals can adversely affect human and environmental health. A team of researchers from 20-plus land-grant universities has improved our understanding of agrochemicals, their adverse impacts, and ways to mitigate them. For example:

- Researchers in **Oregon** used a new model to better estimate how different cropping practices or mitigation strategies would affect pesticide loads in Zollner Creek, which contains critical habitat for two endangered or threatened salmon species. These estimates can be used to guide farming practices and policies that protect the ecosystem from pesticides.
- Studies by **Louisiana** State University showed that the shallowness and salinity of water can affect the fate and toxicity of agrochemicals. These findings could lead to more accurate estimates of exposure to agrochemicals and could inform regulations on pesticide use, especially in coastal states like Louisiana.
- **Nebraska** scientists studied the fate and potential toxicity of heavy metals like arsenic and uranium that are present in irrigation water. Their findings will help guide policy and practices that protect human and animal health.

This information and technology will help regulatory agencies, agrochemical manufacturers, farmers and others make decisions about pesticide use, management, and policy that protect water quality and human and environmental health.