UMD CONSERVE Center leading effort to advance water and food security

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A CONSERVE Center member sampling freshwater. Credit: CONSERVE Center of Excellence

We're running out of water to grow food. Climate change, population growth and increasing demands on freshwater systems are straining agricultural water supplies.

The CONSERVE Center of Excellence, based in the University of Maryland School of Public Health, is leading the effort to develop and adopt safe, alternative irrigation strategies that will sustain food production. These include the use of non-traditional water sources like advanced treated wastewater (reclaimed water), brackish water, and return flows.

In a special issue of the journal *Environmental Research*, team members from the Center, led by Dr. Amy R. Sapkota at the University of Maryland School of Public Health, present 15 research articles that address how we can achieve water and food security and protect public health in a changing climate.

Here are some highlights:

We're running out of groundwater so we need to find alternative sources.

Groundwater levels in the Mid-Atlantic region, which is typically viewed as water rich, have declined significantly over the last 15 years according to a study led by Rachel Rosenberg Goldstein and colleagues at the University of Maryland. Their findings call for the exploration of non-traditional irrigation water sources and highlight the need to understand the impact of agricultural water demands, climatic trends and non-agricultural withdrawals on groundwater levels.

Negative perceptions and lack of knowledge are the biggest barriers to the acceptance of non-traditional irrigation water sources.

Although non-traditional irrigation water sources have been widely used in agriculture for centuries and many studies have demonstrated their safety, Channah Rock of the University of Arizona and Rachel Rosenberg Goldstein of the University of Maryland and colleagues found that there are remaining concerns related to the quality and safety of these water sources.

A study led by Kent Messer of the University of Delaware and colleagues found that consumers prefer harvested rainwater over other non-traditional irrigation water sources. Another study from this group showed that consumers who have never heard of reclaimed water are less willing to pay for produce irrigated with it, but positively framing and branding reclaimed water may improve consumer willingness to purchase products grown with this water source.

Similarly, according to a study of US farmers from CONSERVE team members at the University of Maryland, farmers' willingness to use non-traditional irrigation water increased when they were knowledgeable about non-traditional water sources, and when they learned that the quality of non-traditional irrigation water was as good as or better than farmers' current water sources.

Non-traditional irrigation water is promising but we need to clean it first.

Non-traditional irrigation water sources, like reclaimed water and return flows, hold promise for expanded use in agriculture, but additional treatments may be necessary to reduce microbial and chemical

contaminants.

A study led by Shirley Micallef of the University of Maryland and colleagues found Salmonella enterica bacteria, including strains known to cause human illness and multidrug-resistant strains, in untreated river water of the Delmarva Peninsula. Another study from Sadhana Ravishankar of the University of Arizona and colleagues found that in Arizona, reclaimed waters tested positive for fecal indicator bacteria and return flow waters tested positive for Salmonella enterica and shiga-toxigenic E. coli O145.

Non-traditional irrigation water sources like untreated pond water, reclaimed water, and produce processing plant water also can contain chemical contaminants, including herbicides, antibiotics and stimulants, that vary seasonally according to a study led by Amir Sapkota of the University of Maryland School of Public Health and colleagues.

We're getting better at sampling and treating non-traditional water.

A study led by Manan Sharma of the USDA Agricultural Research Service and colleagues from the University of Maryland Eastern Shore, the University of Delaware and the University of Maryland describes a newly developed flotation device that allows the collection of surface water samples at a consistent depth while protecting sample cartridges from sediment. Another study led by Amy Sapkota of the University of Maryland School of Public Health explains how the addition of a chlorine quenching agent, sodium thiosulfate, to reclaimed water samples during sample collection allows for an accurate culture-based bacterial count without negatively impacting bacterial profiles generated by next-generation sequencing methods.

Kalmia Kniel of the University of Delaware and colleagues evaluated zero-valent iron (ZVI) sand filtration and found that ZVI is a promising and inexpensive on-farm technology that can treat reclaimed water such that it meets the recommended federal guidelines for agricultural irrigation. Manan Sharma of the USDA Agricultural Research Service and Amy Sapkota of the University of Maryland School of Public Health and colleagues also found that ZVI-sand filtration significantly reduced mixtures of several classes of antimicrobials present in treated reclaimed water to concentrations close to those detected in potable quality tap water.

A study led by Sadhana Ravishankar of the University of Arizona also showed that ozone, in combination with plant-based antimicrobials, can effectively remove bacteria from contaminated water and could be an alternative to conventional sanitizers currently used for washing and processing of produce.

We need to implement the right criteria for water quality testing.

State regulations for recycled water are typically more stringent than federal regulations for agricultural water according to a study led by Channah Rock of the University of Arizona and colleagues. The findings, showing that the risk of illness from lettuce grown with recycled irrigation water that meets state-level standards is lower than the risk for lettuce grown with water that meets federal standards, highlight the need to reevaluate current federal guidelines to reflect real-world practices.

Beyond this compilation of research papers, the CONSERVE team is actively engaged in outreach and education, partnering with farmers and communities to facilitate safe water reuse and seeking ways to apply new

research findings to support vulnerable communities in Maryland and across the globe.

Among their initiatives is a collaboration led by Hood College and the Religious Coalition for Emergency Human Needs in Maryland. The collaboration is helping to provide vulnerable families with healthy food from a community garden irrigated with rooftop-harvested rainwater. CONSERVE team members are also working with colleagues at the Arava Institute for Environmental Studies in Ketura, Israel, and farmers in the West Bank to facilitate the safe reuse of household greywater for agricultural irrigation. Additionally, the team is collaborating with scientists at the Hebrew University of Jerusalem, building relationships with communities in food insecure countries like Ethiopia and Nepal to implement successful methods for growing more food with less water.

Provided by University of Maryland

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