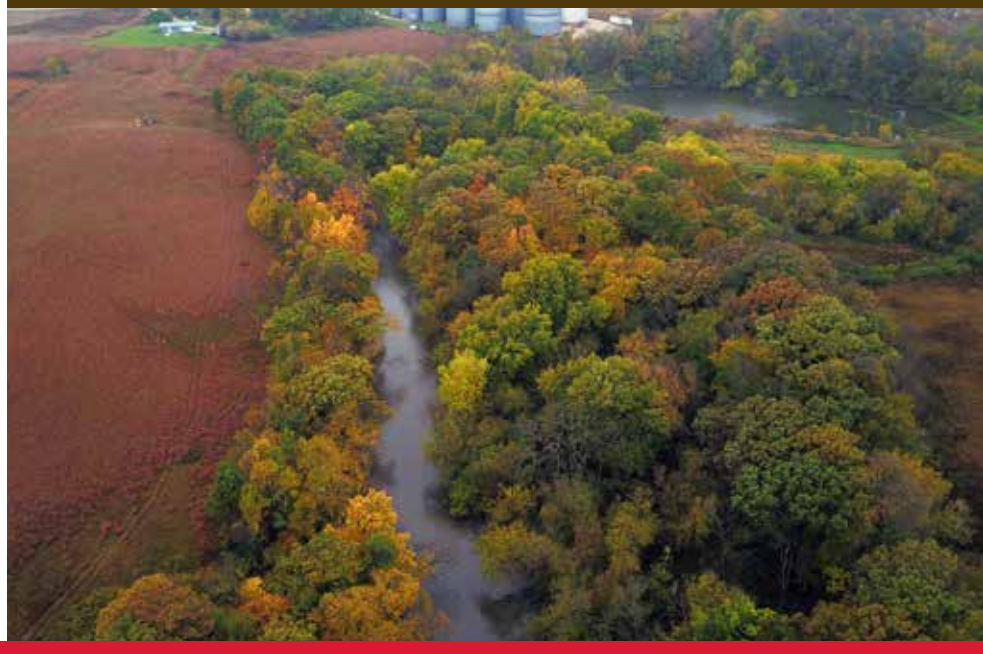
Soil & Water Conservation Club

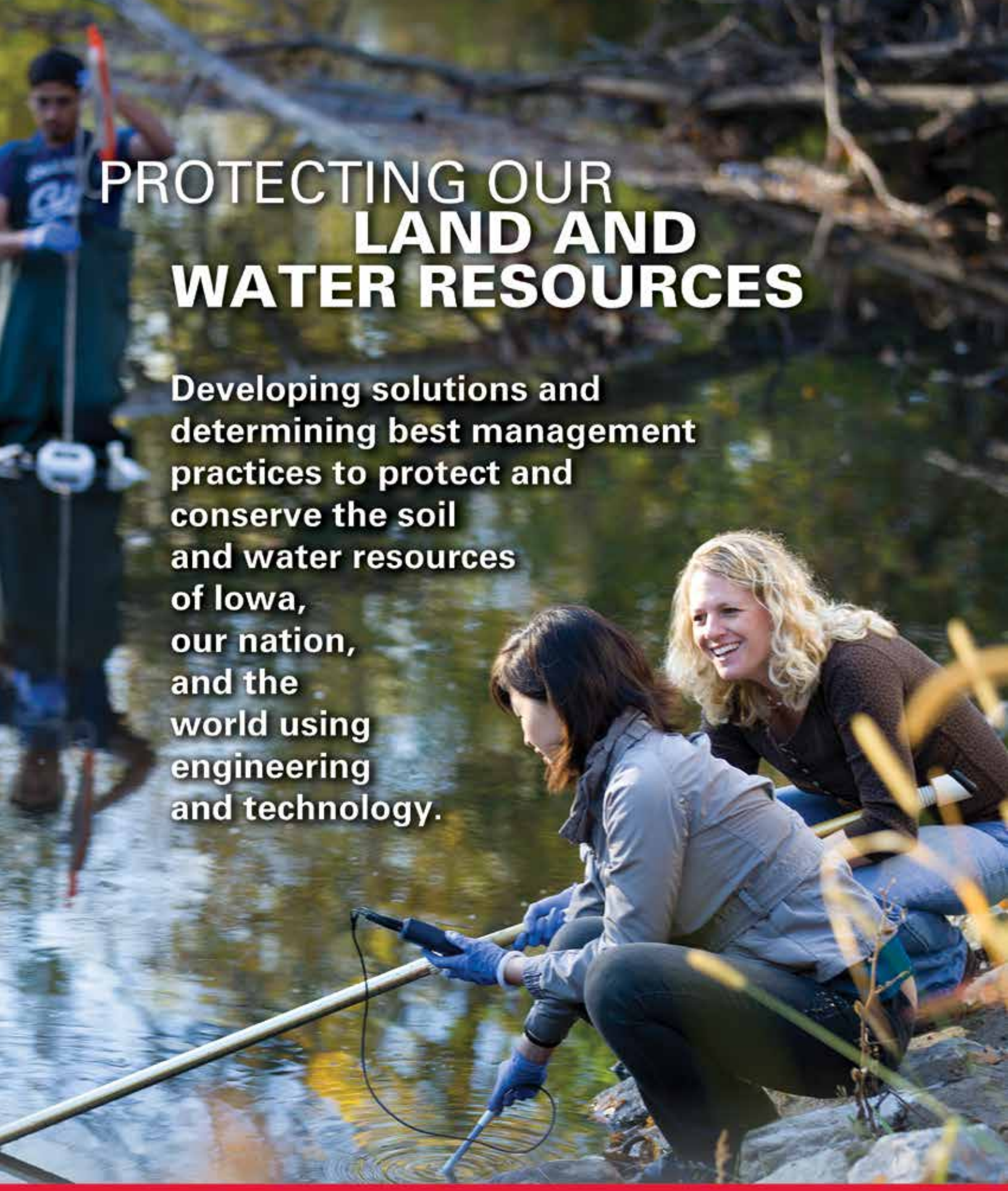
2020 Edition

Getting Into Soil & Water

A Publication of the Soil & Water Conservation Club



This year's cover features the winning photos from the Iowa Water Conference 2019 Photo Contest



IOWA STATE UNIVERSITY

Department of Agricultural and Biosystems Engineering

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COVER IMAGES:
Photos from the 2020 Spirit of the Water Essay Contest: Sunrise Spread (1st Place), Ross Evelsizer; Driftless Riffles (2nd Place), Hunter Slifka; For Whom Does the Water Flow (3rd Place), Emily Martin

Contents

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We Proudly Present GISW 2020

Jacob Wright, Shannon Breja and Justin Hunter
2020 Editors

In its eleventh year, *Getting into Soil and Water* remains dedicated to educating a broader audience on soil and water conservation and the preservation of environmental quality. Soil and water affect our lives in hidden and not-so-hidden ways, providing a medium for food production, delivering ecosystem services, and sequestering carbon dioxide to mitigate global climate change. As co-editors of the 2020 edition, we have had the special opportunity to explore these issues and trends in soil and water, and to create a publication to share others' insights and research findings with you. Our team of three co-editors is made up of Jacob Wright, Shannon Breja, and Justin Hunter. We wanted to share with you a little bit about ourselves and what soil and water conservation means to us.

Jacob Wright: I am a senior in agronomy and environmental studies and joined the Soil and Water Conservation Club in the spring of 2017. Growing up on a dairy farm in Virginia, I always saw numerous articles and heard discussion about nutrient contamination in the Chesapeake Bay. This peaked my interest for soil and water conservation, and being a part of this club and publication has allowed me to learn more about current research and issues in this field of study. I have learned a lot from co-editing through reading different research studies and seeing the diverse perspectives and ideas that came together to showcase the variety of opportunities in soil and water conservation.

Shannon Breja: I am a junior studying agronomy and seed science, and I became a member of the Soil and Water Conservation Club in the fall of 2017. Although I grew up surrounded by agriculture, I did not realize the urgency of conservation until coming to college. With the environmental impacts of agriculture becoming increasingly prevalent, the club has allowed me to learn about current conservation issues. The club has also allowed me to be co-editor of this publication to share some of these relevant issues and provide different perspectives about them. My hope for all of you is that *Getting into Soil and Water* will increase your knowledge of conservation and strengthen your interests in it.

> *"... we have had the special opportunity to explore these issues and trends in soil and water, and to create a publication to share others' insights and research findings with you."*

Justin Hunter: I am a senior in agronomy and joined the Soil and Water Conservation Club in the fall of 2017. My interest in conservation started my freshman year of college. Learning about the effects of soil erosion and water contamination motivated me to always try to be part of the solution rather than part of the problem. This club has allowed me to connect with people who share the same motivation as myself and to gain additional knowledge on agricultural conservation practices. Being a co-editor on this year's publication has brought great opportunities in networking with authors and learning more about the current conservation practices that are working today. I hope this publication gets the readers thinking about conservation and how these practices can improve both agriculture and the environment.

This publication would not be possible without the great help of our committee members. We would like to thank them for their dedication to making this publication unique and informative. We would also like to thank our advisors, Dr. Rick Cruse, Dr. Bradley Miller, Hanna Bates, and Heidi Ackerman for their knowledge and support throughout the publication process. They have been essential to this publication, and we are so thankful for them.

Finally, we need to send a huge thanks to you, our readers. Your support has given us the opportunity to create the eleventh edition of *Getting into Soil and Water*, and we are excited to continue these publications for years to come.

Field days are an excellent way to promote conservation through farmer-to-farmer learning. (Courtesy of Practical Farmers of Iowa)

Factors That Influence Farmer Adoption of Conservation Practices

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Although farming is essential for providing food and fiber for society, farming practices can often come with unintentional environmental costs. While farmers do not wish to deliberately contribute to the degradation of natural resources, the current dominant system of agricultural production in the Midwest has resulted in considerable soil erosion, substantially impaired water and air quality, and dramatically decreased wildlife and pollinator habitat. Fortunately, a large suite of conservation practices has been developed through years of cooperative research between universities and farmers to address these environmental concerns.

Such practices include things like cover crops, no-till farming, terraces, grassed waterways, prairie strips, diverse crop rotations, and stream buffers. While significant progress has been made over the past several decades, farmers on the whole have not yet voluntarily adopted these practices at a rate necessary to adequately balance agricultural production with natural resource sustainability throughout the Midwest. Understanding how and why farmers make decisions, including what factors influence the decision making process, is key for natural resource professionals to develop strategies for increasing the rate of farmer adoption of conservation practices.

Rural sociologists and other social scientists have been studying farmer behavior since the Dust Bowl era of the 1930s. One of the most important findings from this research has been that farmers are an incredibly diverse group of people with a wide array of beliefs, motivations, attitudes, values, and social norms that influence their behavior in very complex ways. This means that there is no singular strategy that natural resource professionals and policy makers are able to use to help encourage farmers to adopt conservation practices on their land. That being said, two recent projects led by researchers at Iowa State University and Purdue University analyzing decades of research studies have identified a number of factors that have most consistently been found to have an influence on adoption.

These meta-analysis research papers found that in general, farmers with larger farm sizes and income, farmers with higher levels of formal education, younger farmers, and those with farmland more vulnerable to erosion were more likely to adopt conservation practices. Additionally, farmers that identify with an environmental stewardship ethic, those who actively seek information about conservation practices,

Several conservation practices at a glance. (Courtesy of Iowa NRCS)

those who have previously adopted a practice, and those who have influential conservationist farmer leaders within their communities are more likely to adopt conservation practices.

Cost-share programs provided by state and federal agencies that help farmers pay for part of the cost of conservation practices have a positive influence on adoption. However, farmer awareness of these programs, as well as having positive attitudes about the programs themselves and the practices they pay for, are key to the amount of influence these programs have. Farmers who interact with natural resource professionals through conservation networks and programs are also more likely to adopt conservation practices. My own research has found a correlation between how often a farmer visits their local USDA office for conservation assistance and the likelihood that they will adopt certain conservation practices.

When considering the factors that influence farmers' decisions, it is crucial to understand that farming is an enterprise that involves very high risks, and farmers often operate on extremely thin profit margins. The ISU and Purdue research teams identified several common barriers associated with risk that have a negative influence on adoption of conservation practices. The financial cost of practices, perceived reduction in crop yields, practice compatibility with existing farming practices, market fluctuations in crop prices, distrust of community or government agencies, neighbors' lack of success with practices, complicated program application processes, and farmer uncertainty about potential practices can all decrease the likelihood that a farmer will adopt conservation practices.

Based on these findings, the authors of the two meta-studies also included several recommendations for natural resource professionals who work with farmers. Identifying and collaborating with farmer leaders in rural communities to facilitate conservation social norms through workshops and field days can be highly influential on other farmers. Increasing awareness by educating farmers about the benefits and potential risks, as well as how conservation practices can reduce risk, decreases uncertainty and can therefore increase adoption. Assisting farmers with cost-share programs helps offset financial risks, and accentuating other farmers' positive experiences with adoption can be especially effective. Finally, one of the most important factors that influences farmers to adopt conservation is facilitating the development of long-term relationships and opportunities for knowledge transfer between natural resource professionals and farmers and between farmers themselves!

"Rural sociologists and other social scientists have been studying farmer behavior since the Dust Bowl era of the 1930s."

Finished basement project at occupant's home where drainage dimple board, sump pump with battery back up and a humidistat vent fan were installed rendering this space usable for the first time in over a decade.

Bee Branch Healthy Homes Project

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The City of Dubuque's Bee Branch Watershed is the area hit hardest by flash flooding during significant rain events. Frequently, several feet of water inundate homes destroying water heaters, furnaces, washers, dryers, and personal belongings. Disinvestment in the flood prone area resulted in declining property values. Equally as important, were the residual effects on its residents including poor health, negative neighborhood perceptions, stress, and a general feeling of helplessness against Mother Nature.

"Nobody would put any money into their homes, and you couldn't blame them for the simple fact that the water would ruin everything," said Cletus Cashman, 90-year-old lifelong Dubuque resident and participant of the Bee Branch Healthy Homes (BBHH) Resiliency Program.

In 1999, the City hired a consultant to study the nature of the flash flooding. The study, called the Drainage Basin Master Plan, determined that approximately 1,150 homes and businesses were at risk of flood damage. It also recommended major infrastructure projects to eliminate risk from flood damage. In 2003, the city began working on a multi-phased, watershed-wide approach to protect its residents.

Since then, millions have been invested to slow the rate of stormwater, reduce the amount of stormwater runoff, and safely channel stormwater through the city's North End neighborhood. Several strategies have been used including retention basins, permeable pavement systems, storm sewer capacity improvements, and daylighting one-mile of the Bee Branch Creek and its associated floodplain.

Helping watershed residents living with residual issues from flooding was the city's top priority when applying for Community Development Block Grant - National Disaster Resilience Competition (CDBG-NDR) funds in 2014 and 2015. The grant team made the strategic move to incorporate repairs and renovations to homes in addition to public infrastructure improvements.

The application was successful, and in 2016 the State of Iowa was awarded $96 million to make flood improvements in nine watersheds as part of the Iowa Watershed Approach including Dubuque's Bee Branch Watershed. The City received $23 million for infrastructure improvements and $8.4 million for the Bee Branch Healthy Homes Resiliency Program.

Dubuque's approach includes right sizing public infrastructure, repairing and renovating homes to reduce water intrusion and address damage, and family advocacy support. This triangle represents a comprehensive plan to simultaneously improve neighborhood, structural, and social resilience. Knowing this innovative approach could serve as a replicable model for other communities, the city has captured data throughout the program.

To date, BBHH has helped 200 families address water intrusion and prepare for future rain events. On average, improvements range between $10,000 -

In September 2019 a 2-3" flash flood event inundated this BBHH project home in just a couple hours, forcing it's two families to leave the home in the middle of the night.

$28,000 depending on project scope and property type. The program is available to owner-occupied homes, single-unit rentals, and multi-family residential units that are located in the eligibility area and meet income requirements established by the U.S. Department of Housing and Urban Development.

Every participating household is required to visit with a BBHH advocate. They talk about any barriers or challenges the family is facing. These self-identified challenges are sorted into five categories: health, education, financial, social, and built environment. Classifying the challenges has helped evaluate gaps in services throughout the community. Disaggregating the data by subgroups such as race/ethnicity and tenant versus owner-occupied has been integral in understanding that subgroups experience different challenges and require different approaches in order to create positive outcomes.

There have been several lessons learned throughout the program. Property drainage is critical. This includes soil modifications and effective gutter and downspout systems. Keeping water away from the home is more important than any other modification. Once inside the home, raising furnaces and water heaters off the floor as little as six to eight inches can save them from flood damage. Dehumidification with permanent high-power vent fans, sump pumps, and tuck pointing have been equally common modifications to create a drier and healthier home.

What happens upstream effects downstream. This is equally as true in urban watersheds as it is for our rural neighbors. This can be applied at all levels – from stormwater management in our streets to a home gutter system dumping water directly on an adjacent property. Part of being a good neighbor is looking at how your home impacts others. It also means checking on your neighbors during flash flood events to make sure they are safe. Hearing that neighbors are talking to each other because of the program is the greatest compliment the city can receive. Relationships among neighbors and structural improvements to both public and private infrastructure is creating greater neighborhood resilience, and the city couldn't be more proud to tell that story.

Existing conditions found in the basement of a project after years of water intrusion. Poor Air quality and water wicking materials contributed to asthma triggers for the family living in the home.

Figure 2. A saturated riparian buffer in Iowa.

Saturated Riparian Buffers: Who Says You Can't Teach an Old Buffer New Tricks?

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The Perks of Buffers

Replacing farmland adjacent to streams with grasses or forests provides many benefits to agricultural ecosystems. Commonly referred to as riparian buffers, perennial vegetation planted along stream corridors improves wildlife habitat and reduces soil erosion and nutrient losses from overland water flow (Lee et al., 2000). Properly managed buffers have been shown to increase the quantity and diversity of bird species and pollinators, considered vital to agriculture sustainability (Bradbury et al., 2019). Buffered streambanks are also less susceptible to soil erosion, losing up to 80% less soil than row cropped or grazed stream banks (Schultz, 2004). Riparian buffers have also been shown to remove nitrogen from groundwater leaving agricultural fields. Microbes in the soil use the nitrogen as an energy source, converting nitrate to non-reactive nitrogen gas. The United States Department of Agriculture has acknowledged the multifunctional benefits of riparian buffers by promoting them as a part of the Conservation Reserve Program (CRP). Over 1.2 million acres of farmland are currently enrolled in filter strip or riparian buffer CRP contracts, and Iowa leads the country with over 200,000 acres enrolled (FSA, 2019). Traditional riparian buffers play a key role in improving water quality in Iowa by reducing soil and nutrient losses from water moving across the land surface, but they are ineffective at removing the bulk of nitrogen lost from Iowa farmland that is routed to streams in subsurface tile drains.

Tile drains are commonly installed on poorly drained soil, lowering the water table to improve crop yields. Drainage water often contains elevated concentrations of soluble nutrients, including nitrate. The 17.4 million acres of drained land in the Midwest act as the largest source of nitrogen to the Gulf of Mexico, contributing to an annual Hypoxic Zone. Hypoxia is caused in the Gulf of Mexico from excess nitrogen and phosphorus contributing to algal blooms and the subsequent depletion of oxygen from algal decomposition. Each state in the Mississippi River Basin has implemented a nutrient reduction strategy to reduce the size of the Hypoxic zone in the Gulf of Mexico. Iowa is one of the largest nutrient contributors to the Gulf and was the first state to implement a nutrient reduction strategy. Iowa's strategy uses both in-field and edge-of-field conservation practices to reduce nutrient losses from Iowa. One of these edge-of-field practices redesigns traditional riparian buffers to also remove nitrogen from tile drainage. Referred to as saturated riparian buffers (SRBs), nitrate is removed from tile water by rerouting the water back into the buffer before it reaches the stream.

How Saturated Riparian Buffers Work

Saturated riparian buffers work by intercepting a tile drain as it leaves the field and crosses into a riparian buffer. Tile water is diverted into a distribution pipe where it then seeps through the buffer's soil to the stream. To construct a SRB, a two chambered water control structure is placed at the field outlet. See Figure 1. The chambers are separated by flashboards set to a depth that raises the water table in the buffer without pushing water back into the field. Tile water leaves the field and enters the first chamber where it flows into one of two distribution outlets located on each

side of the control structure. Distribution pipes are installed to a depth of around 2 feet and run parallel to the stream. The flashboards dividing the two chambers raises the water level in the control structure forcing water into the distribution pipes, where it then moves as shallow groundwater through the buffer. In cases of high flow from tile drains, the second chamber houses an overflow discharge pipe to prevent water backing up into the adjacent field. Once nitrate rich tile water becomes shallow groundwater in the riparian buffer, nitrate can be removed by microbes or plant uptake. Riparian buffers remove around 50% of the nitrate that leaves the field, or 134 lbs N per drained acre (Jaynes and Isenhart, 2018). Recent research has determined the majority of nitrate removed from SRBs is likely by microbes converting nitrate to non-reactive nitrogen gas in a process called denitrification (Groh et al., 2019). Saturated riparian buffers have shown early promise as a practice to remove nitrate from tile drainage and have been quickly integrated into the CRP program and the Iowa Nutrient Reduction Strategy. It will take a widespread implementation of SRBs alongside other conservation practices, including wetlands, cover crops, and woodchip bioreactors, to reach nutrient reduction strategy goals.

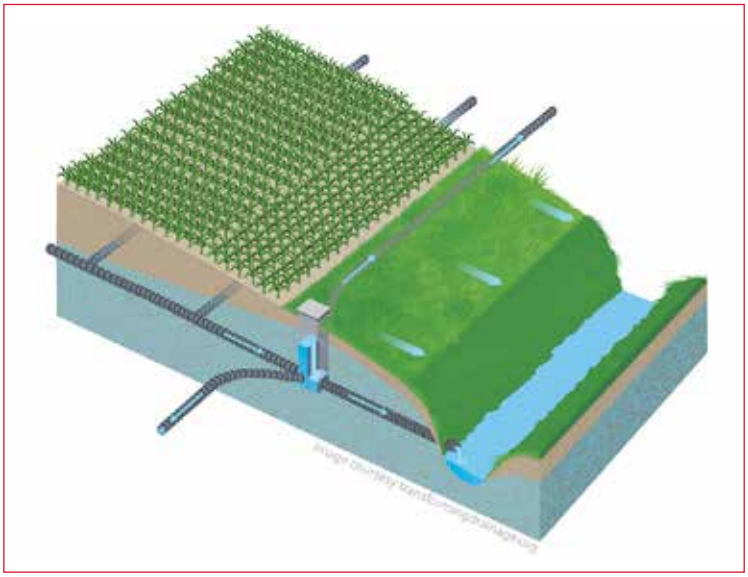

Figure 1. A diagram of a saturated riparian buffer equipped with a two chambered water control structure.

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Ada Hayden Heritage Park in Ames, Iowa. (Courtesy of Andrew Zalasky)

The Economics of Water Quality Policy

Hannah Huang
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Spirit of the Water
Essay Contest
Winner

When one thinks about what a professional in the field of water science looks like, they might envision a biologist, chemist, or other scientist working in the laboratory or in the field. However, there are many other types of professionals besides those studying our water and working to improve its quality. Dr. David Keiser, a professor of economics at Iowa State University, focuses on the economics of water quality policies, and analyzes the effectiveness of current policies and how to improve them.

When he was younger, Dr. Keiser wasn't initially sure of what his career path would be. He studied various topics as an undergraduate and decided to pursue a Master's in applied economics at the University of Georgia after seeing the kind of work an economist does. There, he became intrigued about environmental economics, specifically water resource economics. After completing his Ph.D. at Yale University, he found his calling in academia.

Currently, Dr. Keiser's research interests are in environmental and natural resource economics, mostly focusing on the economics of water quality policies. "These policies include legislation such as the Clean Water Act that governs surface waters – lakes, rivers, streams – and the Safe Drinking Water Act that governs drinking water quality," he says. Dr. Keiser cites his interest in nature and love for outdoor recreation - such as swimming, fishing, and boating - as well as his enjoyment of math-based problem solving and statistics, as the reasons behind his research interests. "Economics utilizes a lot of quantitative tools to help society figure out how best to allocate scarce resources, such as government funds. The combination of my interests in economics and the environment were a perfect fit," he says.

Dr. Keiser's work helps federal and state agencies understand the costs and benefits of certain actions directed toward improving water quality. For example, his work helps the U.S. Department of Agriculture understand where and how much money should be invested to have the greatest impact in helping reduce agricultural runoff. This, in turn, effects recreational and drinking waters, things that everyone experiences and relies on.

When asked about his research methodology, Dr. Keiser answered, "A lot of my work combines very large datasets

with advanced statistical methods to understand how effective water quality policies have been." Speaking about one of his papers on the Clean Water Act, he said his team "compiled nearly 50 million records on pollution to study how a large federal grants program impacted water quality and housing values." Why did they study housing values? "The reason we looked at housing values is that they are believed to reflect what people are willing to pay for changes in the environment. Environmental quality, like clean water, is not something that we can buy and sell in stores, so economists must use other ways to infer how much society values it. In the Clean Water Act paper, we assume that housing values reflect how much people valued local improvements due to the federal grants program. Their benefits can then be compared against their costs." However, he also points out that other factors may affect the end conclusion, such as "the fact that these local benefits exclude any benefits society places on improvements in water quality even if they might not use the resource. For example, even though we live here in Iowa, we might be willing to donate money to improve water quality in the Gulf of Mexico to know that it helps aquatic species there."

For those who are unfamiliar with the intersectionality of water quality and economics, Dr. Keiser explains that economics is crucial in examining the effectiveness of our country's policies and spending regarding our water resources, given that the United States has spent almost $5 trillion on water quality programs since the 1970s. Furthermore, economics is also utilized in other STEM fields, especially those related to energy, engineering, and the environment. So, even if someone is interested in contributing to the study of water quality but isn't keen on a STEM career, there are other ways to be involved in this field.

"...his work helps the U.S. Department of Agriculture understand where and how much money should be invested to have the greatest impact in helping reduce agricultural runoff."

The impact of Dr. Keiser's work is significant, affecting many levels of government and ultimately the communities within the United States. Water is vital to our everyday lives, and the work of economists such as Dr. Keiser is helping us understand how to best act to protect this important resource.

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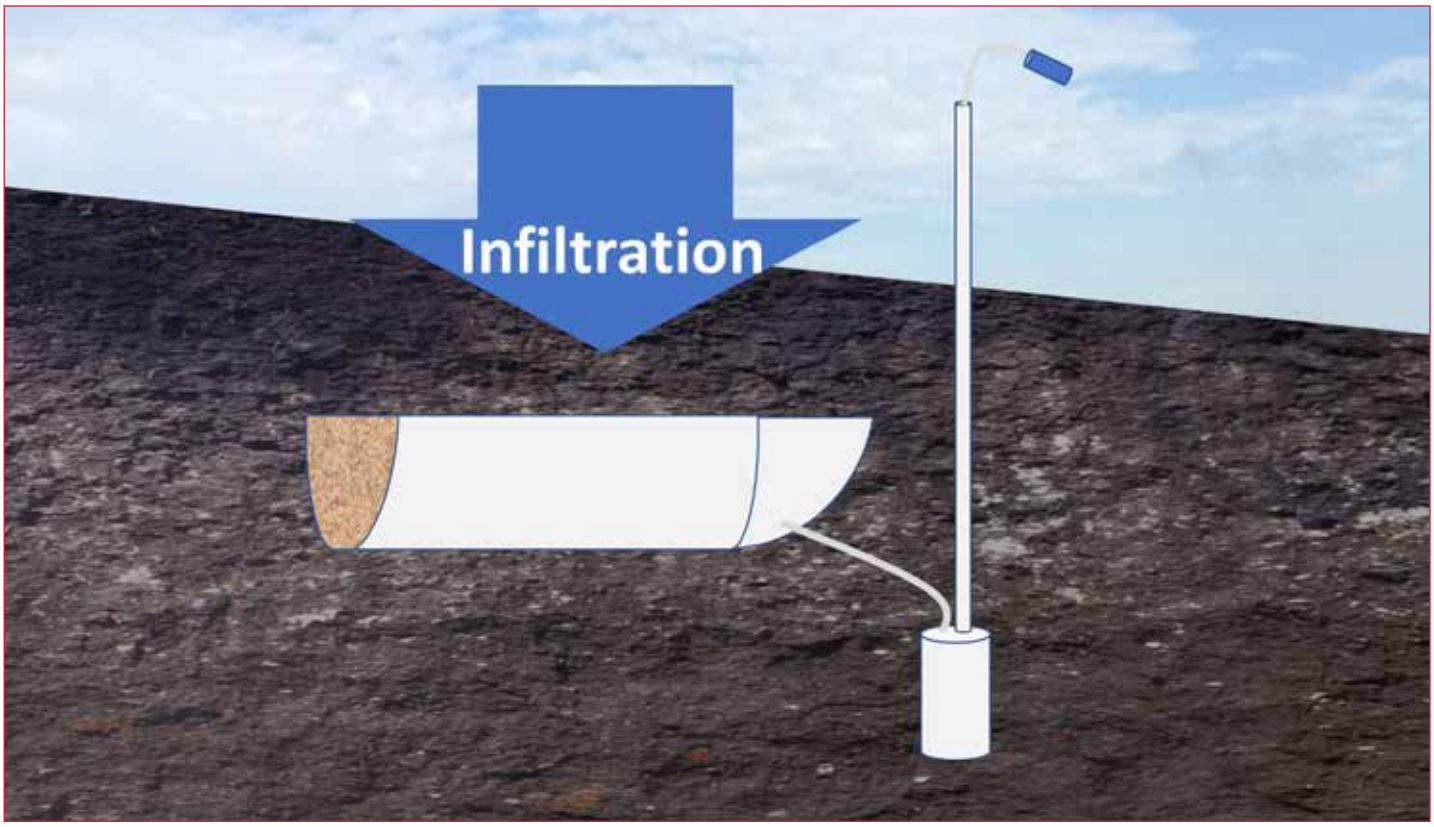

Figure 1. Cross section schematic of a lysimeter.

Nitrogen Pollution of Air and Water in Iowa

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Nitrogen is an essential nutrient for all life. Iowa farmers help ensure their crops have enough nitrogen by growing nitrogen-fixing plants, like soybeans, or by applying fertilizer and manure. Ideally, nitrogen is taken up by the crops and removed with harvest. Unfortunately, nitrogen is also lost to the environment, primarily to the air and water (Libra, Wolter, & Langel, 2004). When water moves through the soil it can take nitrogen with it, particularly in the form of nitrate (Jones, Nielsen, Schilling, & Weber, 2018). This process is called leaching, and it carries nitrate from soils to surface and ground waters. Excess nitrate in drinking water is unsafe for human consumption. In lakes, streams, and the Gulf of Mexico, too much nitrate contributes to algal blooms, which can suffocate fish and other animals when the algae decays. Nitrogen is also lost to the air through denitrification, where microbes respire nitrate instead of oxygen when oxygen is unavailable, such as periods when soils are saturated with water. Denitrification converts nitrate to three gases: nitric oxide, nitrous oxide, and dinitrogen gas. Iowa soils have been shown to produce little nitric oxide, so we will focus on nitrous oxide and dinitrogen gas (Hall, Reyes, Huang, & Homyak, 2018). Dinitrogen gas is harmless and makes up approximately 80% of the atmosphere. Nitrous oxide, on the other hand, is a powerful greenhouse gas that contributes to global warming and the destruction of the ozone layer. Regardless of the gas produced, denitrification in soils removes nitrogen that could have been utilized by crops.

At Iowa State University, our lab researches how to reduce nitrate leaching and denitrification to nitrous oxide gas. We are particularly interested in how topography plays a role in both processes. In north-central Iowa, the topography of the Des Moines Lobe is dominated by former depressional wetlands, commonly referred to as potholes. Despite extensive attempts to drain potholes to prevent their flooding and allow crops to be cultivated, the potholes still flood in wet years and generally have higher soil moisture than the surrounding uplands (Logsdon, 2015). As water is required for leaching and is expected to promote denitrification by limiting oxygen availability, we wanted to investigate if potholes had higher rates of both.

To answer these questions, we installed lysimeters in a line from the center of a pothole to the surrounding uplands (Figure 2). Each lysimeter diverted soil water as it flowed through the soil to a collection container (Figure 1). After each precipitation event, we measured the volume of water and the concentration of nitrate and other forms of nitrogen in the diverted water to quantify how much nitrogen was leached. Our results suggest higher rates of leaching in potholes than in the surrounding uplands (N. Lawrence, unpublished). Thanks to a grant from

the Iowa Water Center, we were also able to quantify total denitrification across the pothole through a cutting-edge isotopic technique. Our results indicate that the potholes support only slightly higher rates of denitrification than the surrounding uplands. Collectively, these results suggest that potholes are a source of nitrate leaching to downstream ecosystems and are poorly effective at removing nitrogen through denitrification.

Future research will focus on strategies to reduce leaching and denitrification to nitrous oxide. Potholes could be targeted for alternative management to help achieve these goals. Perennial plants such as bioenergy crops may be able to reduce leaching by more effectively taking up nitrogen and water (McIsaac, David, & Mitchell, 2010). These crops could also reduce denitrification to nitrous oxide by similarly reducing the nitrate required for denitrification. We are currently investigating whether planting a perennial bioenergy crop will reduce leaching and denitrification to nitrous oxide.

Figure 2. Installing lysimeters.

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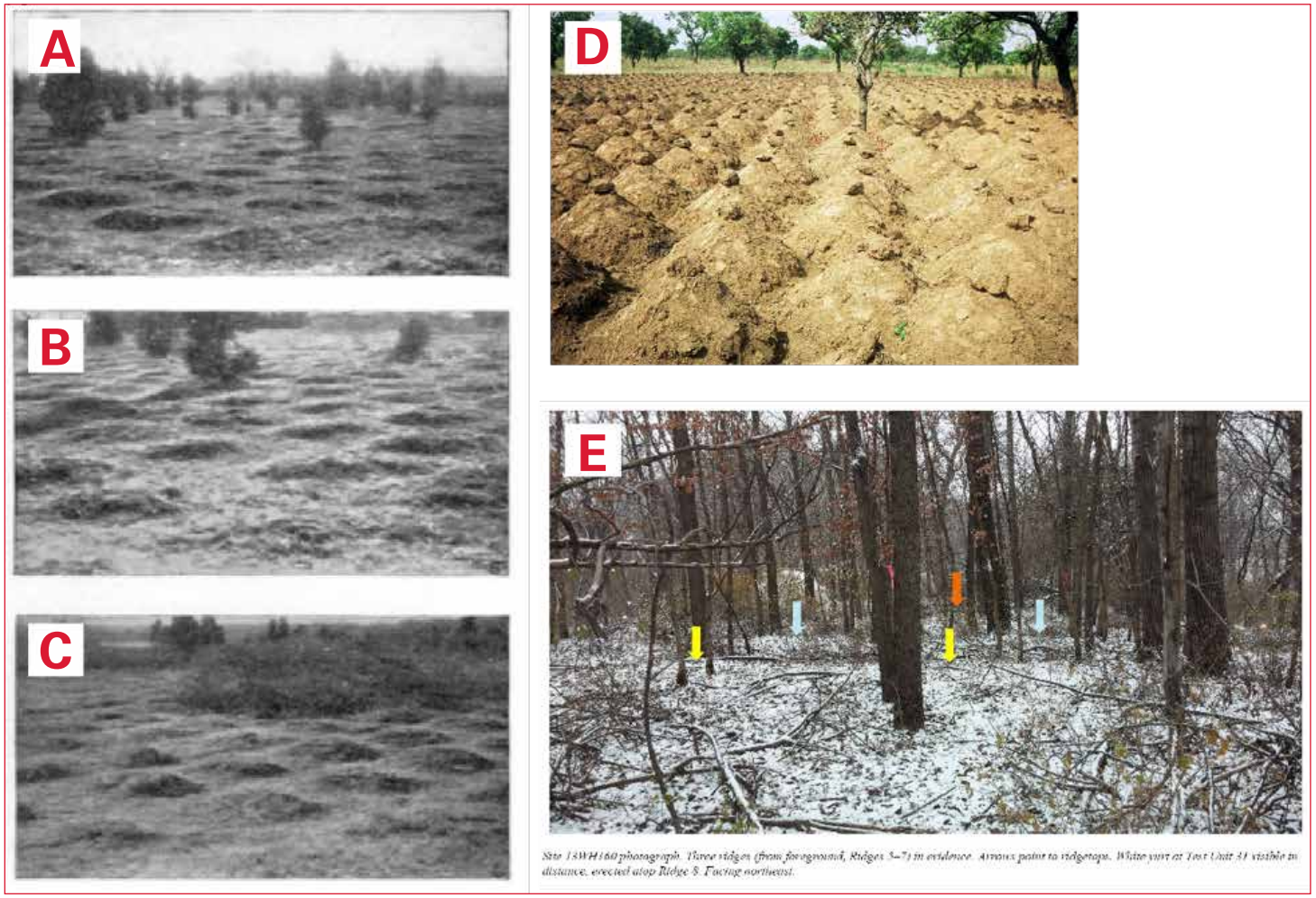

Figure 1. Some examples of Native American agricultural practices – past (a-c) and present (e) – and modern practices in Wunturu, Ghana (Mapio, 1985), d). a)-c) Corn hills in Taunton, Massachusetts during the early 1920s c). d) Similar structure as corn hills shown in more recent day Wunturu, Ghana (Mapio, 1985). e) Relic ridge structures in a modern overgrown forest near Ft. Atkinson, Iowa (Peterson, 2019). Ridges are running left-to-right and indicated with similar colored arrows as you move from foreground to background.

Can Traditional Ecological Knowledge Be Integrated Into Modern Cropping Systems to Enhance Soil and Water Conservation?

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All agricultural cultures, including those of Indigenous peoples, depend on their relationship with soils to sustain their way of life. Soils are not only the foundation of human agriculture, but most Indigenous farming communities developed intimate knowledge of the relationships between plants, soils, and people based on generations of experience growing in a particular landscape. Even though many cultures grew crops on soil, they did not all have the same management practices. First, we will briefly explore traditional ecological knowledge of Indigenous peoples of North Americans with regards to soils. Second, we will explore how their traditional ecological knowledge might inform modern, mainstream agriculture.

Native American gardens were (and still are) interwoven deeply throughout the culture of each Native nation; stories and songs describe the crops being grown. The traditional ecological knowledge (see Box for definition) that Indigenous people developed through careful thought and observation of the natural world guided the way that each person utilized resources on the landscape when hunting, gathering, and farming (McGregor, 2004, Berkes et al., 2000). This knowledge is based through each generation, teaching young Native American gardeners to recognize the differences in cropping systems and which systems were most appropriate for a particular landscape.

Traditional ecological knowledge - a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment (Berkes and Usher, 2000).

Two common planting methods used by Native American gardeners, noted throughout archeological literature of the early twentieth century, include garden ridges and corn hills (Delabarre and Wilder, 1920; Figure 1). Corn hills are small rounded humps of soil that typically measured around eight inches high and up to 4 feet across. Depending on the community that was using them, early archeologists state that they might either be oriented in an organized fashion or haphazardly (Delabarre and Wilder, 1920). Garden ridges are tubular shaped, often found beside one another, creating a field of ridges. Sometimes these ridged fields were broken up by corn hills interspaced within them (Sasso, 2003). Some of these ancient ridged field sites spanned over 100 acres (Fowler, 1969).

Annual soil amendments to the garden ridges and corn hills were used to enhance soil fertility; this is important as these cropping areas were used multiple years in a row (Delabarre and Wilder, 1920). Native farmers used various soil amendments to build soil health, including river muck (Hurt, 1987), the use of fallow periods (Caduto, 1996), mulches (Wilken, 1972), and dead fish (Delabarre and Wilder, 1920). Native farmers' use of biodiverse cropping systems, such as growing corn, squash, and beans (colloquially known as the three sisters) in the same space at the same time, also allowed for a highly productive agronomic system (Monaghan et al., 2014; Mt. Pleasant, 2011)

What Can We Learn?

Currently, in the Midwestern United States, corn (Zea mays) is king. However, this large grain crop has had an intimate relationship with humans for over 6,000 years (Piperno and Flannery, 2001). By harnessing its productive capacity, and that of soybean (Glycine max.), through crop breeding (new genetics) and management practices, we have made much progress with increasing yields. However, this progress has come with major problems with soil and water quality.

We now face soil erosion rates that are ten times or greater what would 'naturally' occur (Montgomery, 2007), soil organic matter levels that are on average 50% less than before cultivation (Gebhart et al., 1994; Guo and Gifford, 2002), and severely impaired local and downstream water quality (Rabalais et al., 2001; Sharpley et al., 1994; Turner and Rabalais, 2003). Where did we go wrong? Traditional ecological knowledge is emerging as a new concept that crosscuts across multiple disciplines – like anthropology and agronomy. Recent studies on TEK have shown its importance to informing modern, mainstream science. Some of these studies highlight the hubris of modern, mainstream science by showing that modern scientists sometimes "discover" something that has been known for centuries (Nicholas, 2018). But TEK shows potential for informing modern ecological or agricultural knowledge (Bonta et al., 2017; Bowman et al., 2015; Mantyka-Pringle et al., 2017).

A pertinent example of this ability of TEK to inform modern agriculture, and perhaps help alleviate some of the environmental issues it has created, is the Native American practice of Three Sisters Intercropping. Three Sisters intercropping combines corn, common beans (Phaseolus vulgaris), squash (Cucurbita moschata), and sometimes sunflowers (Helianthus annuus) - colloquially called the three sisters (or four sisters including sunflowers). These were typically planted on corn hills (Figure 1).

Currently, lack of crop diversity is one of the underlying factors for the soil and water quality issues in Midwestern US – which is dominated by corn and soybean (Glycine max.) production. Here is where TEK of Three Sisters Intercropping might inform modern agriculture. Crop Diversity is one of the NRCS's 'Principles of Soil Health', and many farmers are reviving relay and intercropping across the Midwestern US. There is already evidence that Three Sisters polyculture increased crop yield (Zhang et al., 2014). It is likely that the ecological interactions among corn, beans, and squash could help to advance modern intercropping – not only for enhanced yields – but also making for a more regenerative and sustainable agricultural future.

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Courtesy Grace Wilkinson.

HABs Increasing in Frequency Worldwide

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Iowa Water Center
Associate Director

Have you ever gone to the lake and been greeted by unwelcome, smelly scum? Algae are terrestrial and aquatic organisms that produce energy through photosynthesis. They are a primary food source for other organisms and produce oxygen during their photosynthetic process. Rapid growth of algae, called algal blooms, occurs naturally across aquatic landscapes. However, there is a group of bacteria called cyanobacteria that has similar photosynthetic characteristics and functions in aquatic systems. Cyanobacterial blooms, called harmful algal blooms (HABs), are capable of producing dangerous toxins.

HABs are increasing in frequency worldwide. Here in the Midwest, changing climate conditions and increased nutrient loss (particularly phosphorus and nitrogen from agricultural systems or municipal sewage wastes) feed these algal blooms, creating negative impacts for aquatic life, public health, recreation, and drinking water quality management.

The pressing threat of HABs has led to increased research activity across many governmental and non-governmental programs, including the United States Geological Survey's (USGS) Water Resources Mission Area. The Water Resources Research Act of 1964 created a national network of Water Resources Research Institutes (WRRI), administered by USGS. In 2017, nine WRRIs in the Upper Mississippi River Basin aligned their research focus on HABs with the intent to gain, share, and synthesize knowledge on HABs in order to develop a regional product.

In 2018, with the support from the North Central Region Water Network (NCRWN), this regional coordination initiative led to the formation of a twelve-state team partnering WRRIs and Cooperative Extension to assess current HABs outreach and education efforts and establish uniform recommendations for the North Central Region. Cooperative Extension, also a part of the Land-Grant University System, is often on the front lines of communication research-based information to stakeholders. Using HABs as the focal issue, this team sought to inventory current WRRI-sponsored HABs research, inventory and identify gaps in Extension HABs publications and outreach efforts, and bring Extension and WRRIs together to assess programming needs.

After completing these inventories, the partnership identified five key topic areas in which to develop messaging for outreach materials:

- **General HABs Knowledge.** There is a need across the region to provide basic information on HABs. The products developed with this messaging are a "one-stop shop" for high-level HABs information. For states that are lacking in resources or public demand to provide more in-depth HABs information on specific topics, these products provide a base-level introduction to HABs.

- **Identifying, Monitoring, and Treating HABs.** Identifying, monitoring, and treating HABs are the logical next step for those in regions experiencing HABs. Those that see algal blooms will wonder if they are harmful algae or nuisance algae; water professionals and citizen groups like watershed coalitions and lake associations will be interested to know how they can control them. There are many resources that exist outside of Extension for identifying, monitoring, and treating HABs, particularly those offered by the Environmental Protection Agency and state agencies (who typically house a monitoring program for HABs or beach closures). Extension products can provide information specific to identifying, monitoring, and treating HABs that then refer people to these additional resources.

- **Human Health and HABs.** Both humans and domestic animals can come into contact with HABs, either through drinking contaminated water, eating fish, or recreating in lakes and rivers. Ingesting toxins produced by some HABs can lead to neurological problems, including respiratory distress and convulsions (neurotoxins), and gastrointestinal illnesses, liver, and kidney diseases (hepatotoxins). Contact with the skin (dermatoxins) can cause rashes and skin irritation. In addition to these acute effects, the effects of chronic exposure to cyanotoxins are difficult to study and not well understood. Human health concerns may be a key entry point for raising concern among many populations and policymakers.

- **Animal Health and HABs**. In some states, like North Dakota and Missouri, the primary public concern regarding HABs resulted from pet and livestock deaths from drinking or coming into contact with algal toxins. While humans might attribute their symptoms to other common illnesses, animals that ingest toxins may suffer sudden death from acute toxicity, placing more importance on preventing animals from coming into contact with blooms.

- **Landscape Nutrient Management Practices and HABs.** Human-derived sources of nutrients are a primary contributor to the development of HABs in aquatic ecosystems. Agricultural, or non-point source systems, are inherently leaky systems, and their impacts on aquatic systems are increased by climate change. Forecasting how nutrients leave the landscape is a challenge because of the unpredictability of weather conditions. However, the use of nutrient management practices can minimize nutrient loss from agricultural systems and benefit farmers and those downstream. Nutrient management practices that address both nitrogen and phosphorus losses are a primary prevention strategy for HABs.

Partnership members self-selected into sub-groups to develop key messaging for each of three audiences: the general public (any person who might encounter HABs); the engaged citizen (individuals interested in taking action with HABs knowledge learned); and water professionals (those actively working in professions that may deal with the prevention, identification, treatment, or monitoring of HABs). Additionally, the team made recommendations for products to develop for use in Extension and outreach programming. For this list, as well as the comprehensive package of key messaging, please refer to the white paper available at https://northcentralwater.org/files/2019/11/HAB-11-22-2019.pdf.

Courtesy Eugene Braig.

This comprehensive and partnered approach to tackling one of the region's most pressing water issues is a good start to building a culture of collaboration among the major players in water research and education. It is important to engage with the diverse breadth of interested parties: soil and water conservation district staff, agricultural and environmental engineers, local watershed groups, county conservation boards, municipal and county staff, farmers and ranchers, neighborhood associations, and citizen scientists, to name a few. Partnering to solve water resource issues in our states is the best path forward.

Celebrating the Conservation Profession While Shaping its Future

Clare Lindahl
CEO
Soil and Water Conservation Society

When the clock struck midnight on January 1st, 2020, the Soil and Water Conservation Society began the celebration of its 75th Anniversary. Seventy five years of being the premier organization for professionals who practice and advance the science and art of natural resource conservation throughout this nation and beyond. Seventy five years of cultivating, through local and national leadership, a community of informed dynamic individuals whose contribution, has created and continues to create, a bright future for agriculture, the environment and society.

Coming up on this incredible achievement moves one to reflect thoughtfully on the past and, as the ninth CEO of the Society, I am compelled to set a course for the future. With the world around us changing at an unprecedented pace, it is hard to predict what the Society and the conservation profession will look like in the next 75 years but I know it will include the Soil and Water Conservation Society as an inclusive and dexterous organization ready to respond to the needs of our members and our natural resources.

Towards this goal of inclusion, the Society started as, and remains today, one of very few interdisciplinary professional associations. As Hugh Hammond Bennett, founder of the Society and the USDA Natural Resources Conservation Service, wrote seventy five years ago in the first edition of our Journal of Soil and Water Conservation, "For efficient forward movement of the national program of soil and water conservation…there will always be a need for well-trained specialists. There will always be a need for agronomists, geologists, engineers, foresters, botanists, hydrologists, and others…teachers, industrialists, students, doctors, union members, ministers, bankers, editors and farmers – people in every walk of life."

The Society recognized early on the strength in having many diverse voices at the table and found a role for itself in convening those with divergent interests towards a common goal. As conservation grows, the professions involved that can benefit from the Society grows as well and we will expand our reach to support the individuals and organizations across many fields. We will make the Society more accessible by seeking out different perspectives and through opportunities like our office wide memberships and community and corporate partnerships. As the first woman CEO of the Society, I take this charge particularly seriously, understanding personally not only the absolute necessity but the benefit of bringing those to the table that have not been invited before.

We will learn from the past and embrace the future. We will continue to include the voice of the next generation of conservationists. The work we have done to recruit and build the next generation of conservationists has been one of the most exciting aspects of my couple years as CEO because it makes the Society sustainable and ensures a bright future for soil and water conservation. We have unveiled a career center that offers job opportunities and other services to members including resume reviews. We created career profiles of our members, so that the younger generations can see the diversity of conservation professionals. We have developed an online student and early career professional development guide and enhanced the conference experience of our student attendees through various activities, including pairing them up with mentors in their desired future fields. We started a robust intern program. Our work will be intergenerational.

> *"The Society recognized early on the strength in having many diverse voices at the table and found a role for itself in convening those with divergent interests to work toward a common goal."*

We will support our members and chapters. The Society's foundation is built on our chapter model, which extends across the U.S. and into Canada. Including out impactful student chapters, like the Iowa State University Soil and Water Conservation Club, which creates and delivers the publication you hold in your hands. Through our new conservation professional service offerings we will support and amplify the shared missions of our chapters and partners in the nonprofit, academic, and private sectors who can depend on us to plan their next conservation event, facilitate a group of conservation professionals to generate solutions around challenges, or share their conservation story.

Join us virtually for the Soil and Water Conservation Society's 75th Annual Conference, July 27 – 29, 2020. Great content, on an easy to use, familiar platform, available to you live at your home or office desk. Visit www.swcs.org/ac for more information.

Studying Nature in Nature

Alex Braidwood
Associate Professor, Graphic Design
Director, Iowa Lakeside Lab Artist-in-Residence Program
Iowa State University

For the past four summers, Iowa State University's College of Design Associate Professor Alex Braidwood has been teaching a field study class at Iowa Lakeside Lab Regents Resource Center called Acoustic Ecology. Lakeside Lab is a biological field research station in the northwest corner of Iowa founded in 1909 with the stated goal of providing a place for "the study of nature in nature." This mission continues to this day. As part of this mission, the Acoustic Ecology course that Braidwood has developed brings together undergraduate and graduate students from the sciences and the arts each summer to investigate the soundscape of Lakeside Lab and the surrounding areas. The region is dotted with prairie, wetland, and even woodland preserves where Braidwood both collects audio for his own work and exposes students to the process of nature sound recording during the two-week, two credit course.

The Acoustic Ecology class is a dynamic field study experience that involves a great deal of work in the field to put into practice the things that are discussed and demonstrated in the classroom. The course also involves a series of listening exercises to get everyone familiar and comfortable with the idea of active listening, a skill anyone can spend more time working on. The group moves through various exercises, some stationary and some mobile, to regain a level of focus on their ears and on listening - not just hearing, but listening. Hearing is the mechanical action performed by the ear and its subsequent parts. Listening, however, is much different. Listening involves the mind and has a level of intention to it that is not necessarily present in hearing. Listening is also a skill that can be improved upon.

These types of experiences provide an introduction into the lessons that will follow over the two-week class and are reinforced throughout the coursework. The class is part seminar, part field study, part technical demonstration, and part studio/lab. Students are shown early in the course a variety of audio recording techniques as well as taught how to use different sound recording devices and microphone configurations. The benefits of different recording systems and tactics are discussed, and students are given time to practice in the field as the class takes exploratory trips to various locations. The goal of the trips is also to determine sites and specific locations for capturing early morning recordings that begin pre-dawn and continue after sunset. This time of wildlife vocalization is referred to as the "dawn chorus" and is one of the more dynamic times for capturing an acoustic signature of a given place. After bringing the various field recordings back to the lab, the sounds are analyzed, processed, marked up, and observed. Students make observations about species diversity, uniqueness of the environment, impact of human sound, and anything else they find relevant for discussion.

In addition to recording techniques and equipment, the course covers a variety of professional audio editing and mastering techniques for the creation of audio pieces to be shared online. The end result is project-based and completed in the form of narrative audio pieces edited together to tell the story of what has been collected and observed. These audio pieces are in an audio format similar to popular edited podcasts such as RadioLab, 99 Percent Invisible, and This American Life.

To learn more about the class, check out this segment that Iowa Public Television produced as part of its series Iowa Outdoors: http://www.iptv.org/iowaoutdoors/story/31117/acoustic-ecology

If interested, registration will be open in early 2020 on the Iowa Lakeside Lab website. For summer 2020, the course has been renamed "Interacting with Nature Sound" to better communicate the goals and outcomes of this field study course at the intersection of art, science, and nature.

This intersection of art, science, and nature also describes the other work Alex Braidwood is involved with at Iowa Lakeside Lab as Director of their Artist-in-Residence (AIR) program. Since 2016, Braidwood has been in this position and has grown the program into a residency that brings artists working in any medium to Lakeside Lab from all over the country, and now, the world. The program welcomed its first international artist, a Dutch composer, in 2019. The residency has a competitive application process and focuses on artists who work at the intersection of art, science, and nature. SciArt, as it is sometimes referred, is an exploding area of contemporary art, and individuals working in this space find a great deal of value embedding in a place like Iowa Lakeside Lab. Artists are invited to visit classes, participate in field study outings, and share their work with the Lab community as well as the public in the Great Lakes Region of Iowa through bi-weekly public open studio events.

Braidwood has positioned the residency program within the lab on the ideas exemplified in his tagline for the program which is, "Artists and scientists are both asking questions about the world, they're just doing it in different ways." This really does summarize how artists engage with the Lab as they explore the different possible relationships available to them in this unique environment in the northwest corner of Iowa.

You can learn more about Lakeside Lab Artist-in-Residence program on the website where artists share their experiences and document their work during their time in residence: http://lakesidelabair.org/

You can also follow them on Instagram @LakesideLabAIR

Managing Phosphorus for Water Quality in Iowa Lakes

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Nutrient pollution in surface waters – or eutrophication – is a grave social and economic concern for communities across Iowa. Over 90 percent of Iowa lakes and reservoirs are characterized as eutrophic due to very high nutrient levels (IDNR, AQuIA Database, Carlson, 1977). This means that our lakes are vulnerable to algal blooms during the summer months (Figure 1). Algal blooms are one of the most visible and dangerous symptoms of eutrophication as these blooms are linked to concerns such as fish kills and the release of toxins (Smith, 2009).

During the summer of 2018, researchers with the Ambient Lake Monitoring Program found the toxin microcystin in 72 percent of their 128 study lakes across Iowa (IDNR, AQuIA Database). Microcystin is a liver toxin that may be produced during algal blooms by some types of cyanobacteria, commonly called blue-green algae. Exposure to this toxin can cause skin irritation, gastrointestinal distress, and liver damage (Carmichael, 2001). Toxic algal blooms are an obvious public health concern, and they jeopardize the recreational economies of Iowa's water bodies – an industry valued at around $1 billion statewide, annually (Jeon et al., 2016). As such, there is a pressing need to manage algal blooms in order to protect public health and recreational economies across our state.

Figure 1. Harmful algal bloom in Silver Lake, Dickinson County, Iowa.

Managing Inputs

Preventing algal blooms requires that we reduce nutrient inputs to Iowa surface waters. For lakes and reservoirs, it is especially important to manage phosphorus inputs. Phosphorus is an essential nutrient for all organisms. However, high phosphorus levels in lakes can be "too much of a good thing," and fuel algal blooms dominated by cyanobacteria (Schindler et al., 2016). Lake phosphorus management typically focuses on reducing watershed phosphorus losses with practices such as cover crops and buffer strips. These efforts are critical for eutrophication management; however, it is also important to consider how phosphorus can be recycled within water bodies. Specifically, phosphorus stored in the sediments at the bottom of a lake can be released into the overlying water if the sediments are disturbed or if chemical conditions change (Søndergaard et al.

2003). This process is referred to as internal phosphorus loading and can maintain high, in-lake phosphorus concentrations even if watershed nutrient inputs are reduced, perpetuating poor water quality (Jeppesen et al., 2005).

Unfortunately, the mechanisms that control internal phosphorus loading are poorly described for the shallow lakes and reservoirs that we have in Iowa. This knowledge gap makes the management of internal phosphorus inputs extremely difficult. How can you prevent something if you don't know when, where, or why it's happening? The goal of my graduate research with the Wilkinson Limnology Lab at Iowa State University is to start answering the "when, where, and why" of internal phosphorus loading in shallow lakes. With funding support from the Iowa Water Center, we constructed a sediment core incubation system to measure internal phosphorus loads in Iowa lakes and test the underlying mechanisms (Figure 2). Over the course of last summer, our research team visited several study lakes in western Iowa and collected cores of lakebed sediments and the overlying water. We took these cores back to the laboratory and incubated them under different conditions that lakebed sediments might experience naturally, such as low versus high oxygen levels. Every day the cores were incubated, we collected samples of the overlying water and tested the phosphorus concentration. This measurement allowed us to determine if the sediments were releasing phosphorus over time and if so, how much.

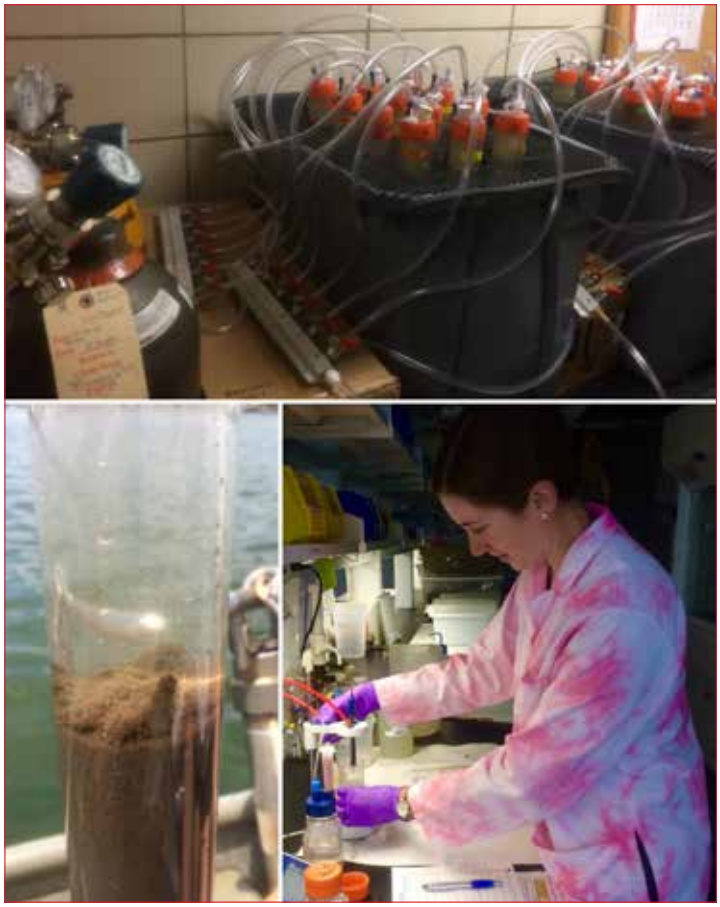

Figure 2. Sediment core incubation system (top), cores collected from study lakes (bottom left), and analyzing water samples for phosphorus (bottom right).

Investigating Mechanisms

Preliminary results from the past summer indicate moderate to high internal phosphorus loading rates in our study lakes. The influence of oxygen levels on sediment phosphorus release varied across different study lakes and between shallow versus deep sites within each lake. Next year, we will continue to investigate the chemical mechanisms responsible for the observed patterns. Testing the mechanisms that control sediment phosphorus release can inform targeted management approaches to reduce internal loading. It is important to note that efforts to reduce internal phosphorus loading will only be effective if watershed inputs are also controlled. Addressing eutrophication in Iowa water bodies requires bold management of both external and internal phosphorus loading.

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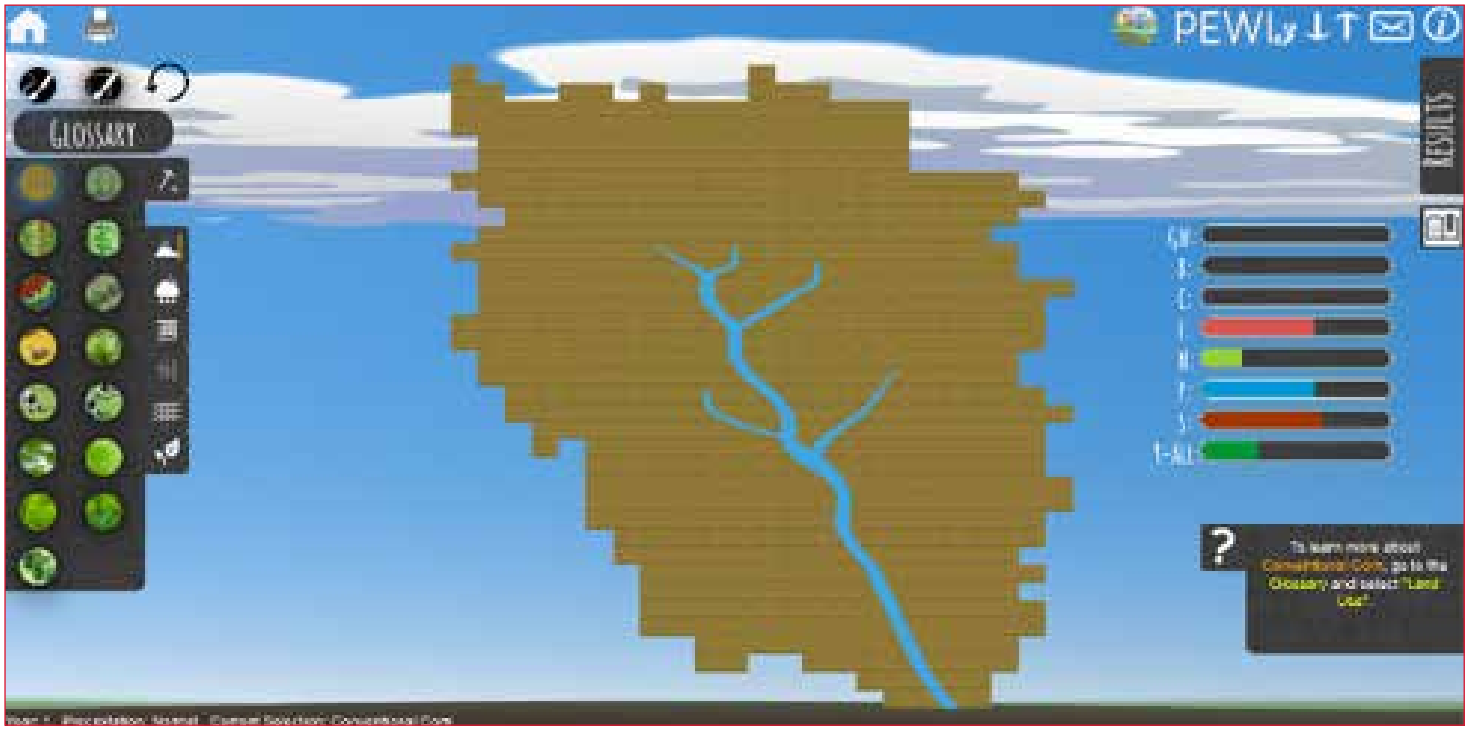

Figure 1. PEWI watershed with river running north to south. Glossary tab and land use selections (left), ecosystem service indicators (right hand bars), results tab (upper right), and other function tabs.

Teaching About Land Use and Watersheds With PEWI

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What educational strategies encourage students to learn about soil and water?

- "Telling" is adequate.
- "Showing" is helpful.
- But "making it happen" can be the most powerful.

PEWI is a digital game-based learning (DGBL) tool created by Iowa State University that relies on simulation, one of the most powerful and reliable ways to make phenomenon happen for students in the classroom. Simulation is one of the ways to "make it happen." Simulation fits the theory of experiential learning and other inquiry-based approaches to education. Lessons that rely on simulation show students the results of their inquiries, and involve them in making sense of the world by systematically asking good questions.

PEWI is an online game that teaches about agricultural land uses, watersheds, water quality, biodiversity, ecosystem services, and the scientific tools that land managers rely upon, such as topographic, soil, and drainage maps (Figure 1). PEWI stands for People in Ecosystems Watershed Integration (Chennault et al., 2016; Schulte et al., 2010) and has been used by teachers in middle school through university. PEWI even has a "drone" mode.

PEWI can be played at no cost at: https://www.nrem.iastate.edu/pewi/

Okay – so computer games in schools aren't new. They have been used in classrooms by nearly 80% of middle and high school teachers (An et al., 2016), but a widespread complaint of teachers is the lack of correlation with educational subject matter (Bourgonjon, 2013). There are very few games that fit soil and water like PEWI. We've demonstrated PEWI to high school and community college agriculture and science teachers, and they really get it.

PEWI Land and Water

PEWI consists of a visual representation of 5,888 acres (2,382 hectare) with geophysical features combined from two Iowa landforms, the Des Moines Lobe and the Southern Iowa Drift Plain (Prior, 1991). Fifteen land uses can be applied or removed, including: corn (2 planting systems), soybeans (2 planting systems), mixed fruits and vegetables, alfalfa, grass hay, cattle (2 pasture systems), wetlands, prairie, forest, and woody bioenergy. PEWI

provides maps for students to access to explain differential movement of water, nutrients, and sediment; comparative growth of vegetation; and maps to show historical flood frequency, sub-watershed boundaries, soil drainage class, soil type, topography, and crop yields. Instructors may set precipitation at seven levels from dry (24.58 in or 62.43 cm) to wet (45.10 in or 114.55 cm) or permit random assignment.

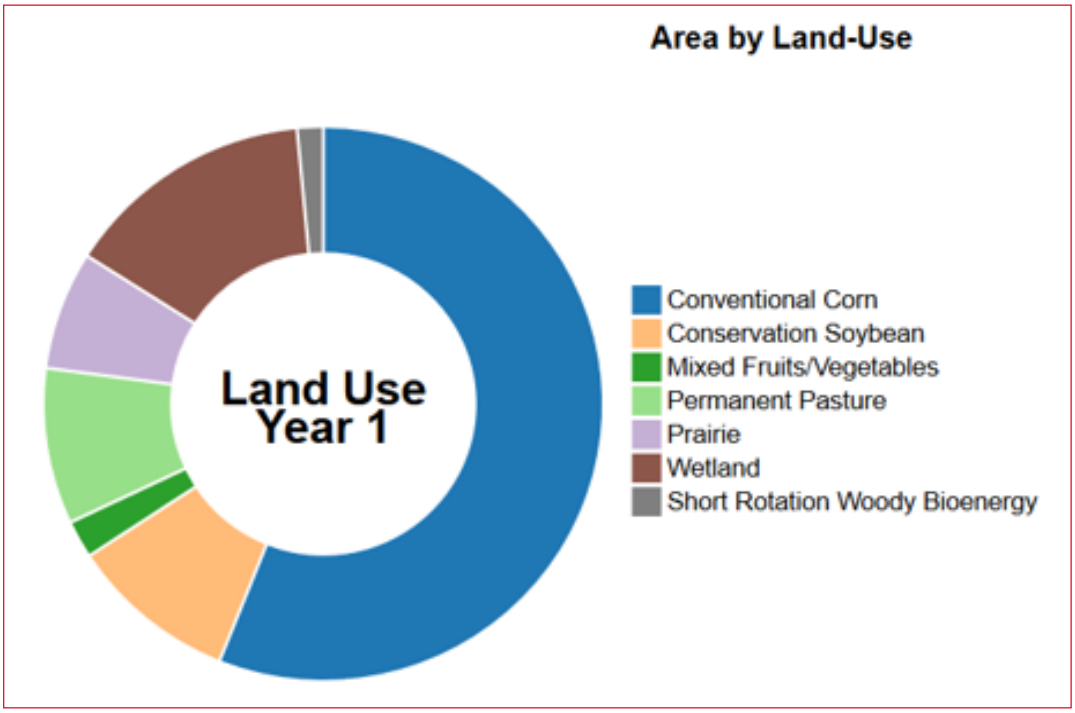

Figure 2. Sample graphic from results data visualization section. Land use areas for year one for student input into watershed. Shows visually the proportion of land uses. The numerical data is provided in tabular from using a toggle feature. Only land uses that the student used are listed.

Simulation

Simulations are preferred by teachers because they allow students to "safely and cost-effectively acquire skills and attitudes which are hard to get by rote learning" (Bellotti et al., 2013, p. 2). Simulations can be paired with instructional approaches such as collaborative and team-based learning, as well as lecture, laboratory, and field trips. Annetta (2008) showed that collaboration in simulation game playing can enhance learning.

PEWI is not a "farm simulation" where students step into the role of producer and grow crops. Instead, students in lesson plans are given watershed-level challenges like this: The current nitrate level in ppm in the PEWI River exceeds desired levels. Select the type, acreage amount, and location of land uses on the PEWI Watershed to lower the level of nitrate to an acceptable level.

Without a simulation like PEWI, consider how difficult it would be for scientists, state and local government, and community members to generate enough evidence to add or remove a land use, such as substituting prairie for row crops; or row crops for prairie, in a particular location. The evidence, pro or con, would take years to accumulate. Monitoring is expensive and someone has to staff the equipment. Someone owns the land, which brings up economic and ethical questions. A simulation like PEWI makes the query-response process fast, easy (Figure 2), and poses fewer ethical dilemmas than for the real situation.

National Educational Standards

A simulation also fits with national standards for science, the Next Generation Science Standards (NGSS) (National Research Council [NRC], 2012). Simulation fits an NGSS practice definition of "trying things again and again but without real materials" (NRC, 2012). The standards for agricultural education, the National Agriculture, Food, and Natural Resources Standards (AFNR; National Council for Agricultural Education, 2015), also features learning by students about cycles and feedback, which are satisfied by simulation software that require students to articulate a goal and interact with PEWI to achieve it. The PEWI team has analyzed the tool for alignment to both standards. PEWI aligned with nine high school level NGSS student Performance Expectations categories. For AFNR, the PEWI evaluation provided evidence for alignment of 10 standards and 17 indicators from the areas of Environmental Service Systems, Natural Resource Systems, and Plant Systems. Release of an online Teachers Guide for PEWI is planned for the future.

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Art and Conservation: The Interdisciplinary Vision of Felix Summers

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Artists are not usually the first people who spring to mind when thinking about soil conservation in the United States. In the 1950s and 60s however, Felix Summers' artwork introduced the Soil Conservation Service (now the Natural Resources Conservation Service) and big ideas about conservation farming to thousands of Americans. Even if they did not know his name, rural communities knew Felix Summers' vivid, one-panel cartoons pointing out the dangers of soil erosion and the value of conservation farming.

In the mid-20th century, the Soil Conservation Service (SCS) used a team of technical illustrators in the Information Office to bring SCS ideas and publications to life. Professional artists illustrated complex scientific and engineering concepts not easily conveyed in text or photography. The tremendous number of informational bulletins, pamphlets, and other materials that flowed from the SCS in the mid-20th century often featured the work of these in-house illustrators. While most of their work illustrated specific manuals, guides, and public-facing pamphlets, the Information Division also provided a constantly expanding catalog of conservation cartoons to field offices. Field office staff across the country published the cartoons that best addressed local issues in local newspapers. These cartoons were many Americans' first introduction to the SCS and conservation agriculture. Most of the over 400 cartoons in the artwork catalog were the work of one illustrator, Felix Summers.

Making His Way to the SCS

Felix Summers came to the SCS by way of two very different places: the New York City art scene of the 1930s and the Mills County Iowa SCS office. He began his art career at the University of Nebraska and went on to do post-graduate work at Yale, where he studied with muralist Eugene Savage. Summers' style reflected the contemporary influence of the Regionalist school made famous by other Midwestern artists such as Thomas Hart Benton, John Steuart Curry and Grant Wood. Iowan farmers since before

"The work of illustrators like Summers helped the SCS reach a wide audience not already familiar with the work of the SCS or the conservation movement. Cartoons provided a shorthand that quickly and succinctly conveyed why the work of the SCS mattered."

the Civil War, Summers' family was steeped in agriculture. His rural upbringing outside of Strahan, Iowa informed his artistic focus on scenes of agrarian and rural life. Despite his rural roots, Summers spent five years painting murals in decidedly non-rural Manhattan department stores and nightclubs, including the storied Cotton Club and the El Morocco. World War II deferred Summers' early artistic career as a muralist when the Army drafted him to serve with the combat engineers. After the war, the art world's tastes moved away from Summers' agrarian Regionalism - rejecting the familiar, rural scenes that were his specialty.

Showcasing His Skills

Looking for work after the war, Summers returned home to Iowa and took an entry-level job as a conservation aid at the Mills County office of the SCS. His skill at the drafting table lent itself well to conservation planning. Combining a growing belief in the mission of the SCS with his desire for artistic expression, Summers spent his evenings and weekends drawing cartoons designed to spread the gospel of soil conservation. His work drew the attention of SCS leadership, and he was soon promoted to the regional office in Milwaukee as a full-time illustrator. Beginning in 1948, the SCS began distributing Summers' cartoons nationally. An agency reorganization moved Summers to Lincoln, Nebraska where he worked as an illustrator in the

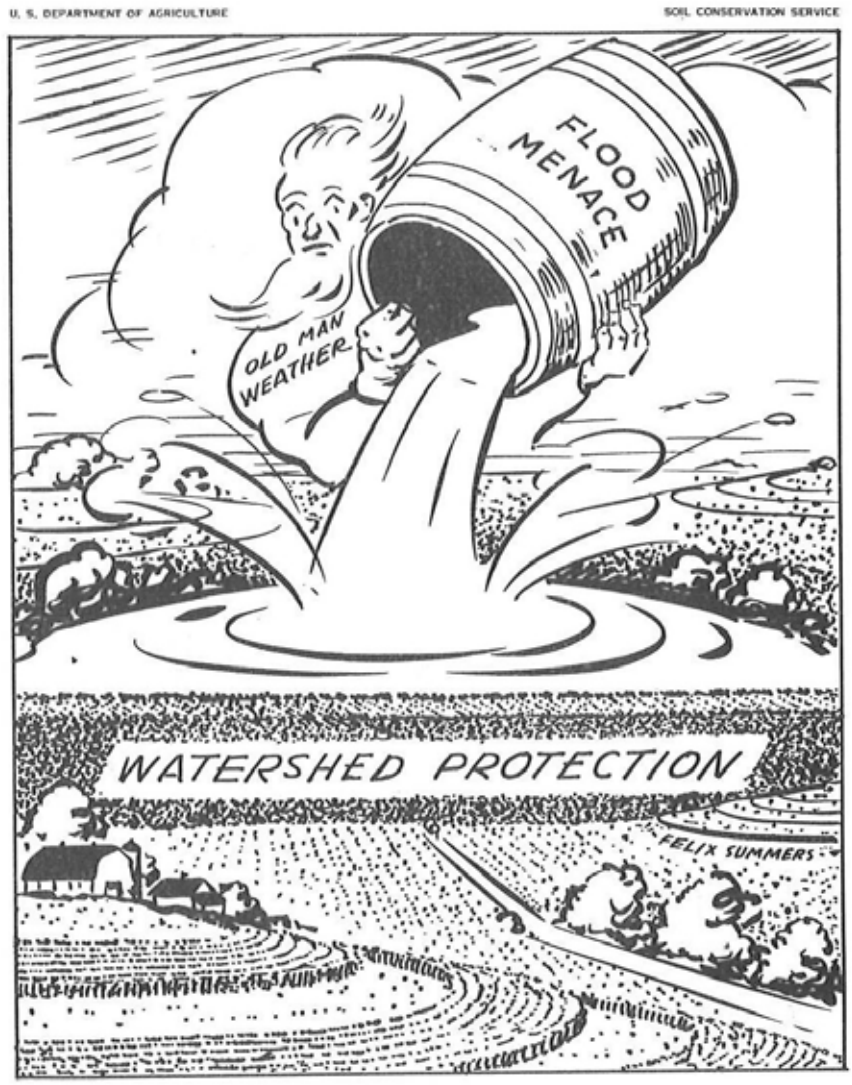
"Summers provided an extremely efficient message that reassured those farmers and ranchers already practicing conservation and challenged those who were not."

Midwest Regional Technical Service Center until his retirement in 1972. Upon his retirement, Summers received the USDA's Superior Service Award for his illustrative work in service of conservation. Felix Summers died in 1987 at the age of 77.

Reaching a Wider Audience

The work of illustrators like Summers helped the SCS reach a wide audience not already familiar with the work of the SCS or the conservation movement. Cartoons provided a shorthand that quickly and succinctly conveyed why the work of the SCS mattered. Photographs provided examples, but art conveyed big ideas quickly and succinctly. Armed with something to say about conservation, the same artist who was out of style in post-war Manhattan nightclubs was right at home in midwestern newspapers. Summers' cartoons drew in people who would ordinarily scan past what might have seemed like dry and technical articles about federal conservation efforts. Moreover, he conveyed SCS messages in a visual shorthand that spread the word to even the casual reader. When interviewed in 1952, Summers summed up his artistic approach: "to speak the language of farmers on their own terms, but do it pictorially. I wanted to interpret for other people all the sweat, strain, and worry that goes into farming."

By summing up the importance of conservation agriculture in one panel cartoons, Summers provided an extremely efficient message that reassured those farmers and ranchers already practicing conservation and challenged those who were not. A New York muralist might seem an unlikely champion for conservation, but Summers widely distributed work remains a testament to the importance of a truly interdisciplinary approach to conservation.



STOPPING A BARREL OF TROUBLE

AW-200

All images are from a copy of the mid-century SCS artwork catalog preserved in the Douglas Helms Collection in the Special Collections Division of the USDA's National Agricultural Library in Beltsville, Maryland.

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I'M AN
AGRONOMIST

SUSTAINABILITY MASTERMIND

ImAnAgronomist.net

By the time I got to Iowa State, I knew I wanted to make a difference in the world, but I wasn't sure how. Until I learned about implementing sustainable food systems in our world. That's why I'm studying soil, plant, and social sciences and the interactions that support sustainable plant growth. So I can become an agronomist. So I can leave our world better than I found it.