AMERICA'S CONSERVATION AG MOVEMENT

WATER QUALITY STEWARDSHIP

A guide to protecting the lifeblood of your farm and community

Produced by Farm Journal in Partnership with USDA's Natural Resources Conservation Service

YOU GIVE WATER ITS WEIGHT. WHAT COMES NEXT?

Amy Skoczlas Cole
Executive Vice President,
Trust in Food, Farm Journal

Water intersects virtually every part of your operation. It determines whether you can get into the field to plant. It supports the well-being of livestock, and it connects your land to water bodies.

As a farmer or rancher, you care deeply about this precious asset: Nine out of 10 of you report protecting water on a daily basis, according to the U.S. Farmer Perspectives on Water report prepared by Trust In Food, a Farm Journal initiative.

Yet water can also be easy to overlook despite being ever-present, and that can create challenges for your farm, rural communities and urban neighbors. It can take years or even decades to degrade water quality, and a similar amount of time to clean it up.

Water quality faces numerous challenges, often attributed to agriculture, whether from soil erosion, nutrient runoff or saltwater leaching. In other areas, drought conditions or depleting groundwater reserves make farmers painfully aware of the importance of water availability.

Those issues might seem impossible to address. But the reality is you have an incredible opportunity to positively contribute to water quality, with ripple effects far beyond the borders of your fields. Small contributions to precisely target fertilizer or reduce sediment loss can make a big difference over time.

Use this guide to apply a water-quality lens to decisions you make on your farm. You'll explore some familiar themes, such as the water cycle, as well as hear from farmers and communities that have successfully taken steps to improve water quality. In each section, you'll find notebook pages – reflect on what you're doing, what you're learning and how you might apply these lessons.

You as a farmer are uniquely positioned to be a resource to protect and conserve our most vital natural resource. That's something worth celebrating.

Amy Skoczlas Cole

How do you define water stewardship on your operation?

PHOTO: JOHN HOFFMAN, DUCKS UNLIMITED

CONTENTS

THREE RESOURCE GUIDES, MANY CONSERVATION SOLUTIONS

Free series helps pinpoint your farm's next step

Resource Stewardship Planning Guide

Everything in the Resource Stewardship Planning Guide is focused on providing a path to address a problem or helping you make progress on a goal — whether that involves cropland, associated agricultural land, pasture or livestock facilities. This guide will help you gather your thoughts and information to advance your conservation efforts one step at a time.

Soil Health Stewardship Guide

Once you understand conservation fundamentals, the Soil Health Stewardship Guide is a great next step. You can see, touch and watch soil as it changes with the adoption of best practices. Have you ever taken a good look at the health of your soils — given each field a checkup? No matter where you stand in your journey, you can apply learnings from this guide to up your soil health game.

Water Quality Stewardship Guide

The Water Quality Stewardship Guide is designed to make a complex and controversial subject accessible. Learn more about using a water-quality lens to maintain productivity and the steps you can take to be a good neighbor and protect shared water resources. Farmers chime in to share how they own water quality as something that matters to their business and legacy.

KEEP RECORDS, TAKE ACTION

Here are a few tips for using these guides to show others how your farm is taking action on conservation:

- These digital guides are available as an editable PDF, including ample notebook pages for typing comments.
- Download your own copy and save it to your desktop or a cloud-based service, such as Dropbox.
- Keep a record of what you're thinking and learning. Refer to those notes as you try practices and programs.
- Consider printing a copy to use in meetings with crop consultants, NRCS agent, banker, etc.

To access these free resource guides, visit *AgWeb.com/ACAM*.

THE FUNDAMENTALS OF FRESH WATER

Farmers have long understood the importance of water. Growing the crops and raising the livestock that feed the world requires it. Our own bodies are about 60% water by volume, most livestock contain a similar percentage and crops can be as much as 95% water.

Understanding where your water comes from and how your operation fits within the overall flow of water in a watershed or groundwater recharge area helps farmers maintain water quality. It's especially important because of the water quality challenges many places face: Nearly half of U.S. rivers and streams have too many nutrients in them, primarily phosphorus and nitrogen, and less than a third are biologically healthy, according to EPA data. Similar challenges face one in five of the nation's lakes, Great Lakes and coasts. Some pollutants are attached to soils, some are dissolved in water, yet all are moved by water.

For most purposes, we tend to break up freshwater into two categories:

- **Surface water is what you can see looking around.** It's any body of still or flowing water, such as lakes, ponds, rivers, streams and wetlands, as well as any frozen surface water, such as glaciers or snow pack. Surface water can be connected to groundwater through wells, springs and unconfined aquifers.

- **Groundwater is water that completely fills the pores and fractures in sediments and rock below the ground.** The water table divides the saturated and unsaturated level below ground. Above the water table, sediment pores and rock fractures are only partially filled with water. This is the unsaturated zone. An aquifer is a sediment layer or rock layer that contains sufficient available groundwater for pumping. Precipitation, snow melt, and surface water seep, leach and percolate below the water table to recharge the groundwater supply.

Where on your farm do you have too much water? Where do you have too little?

_____

How important is surface water to your business and to your community? How important is groundwater?

_____

PHOTO: LINDSEY POUND

THE MANY WAYS SOCIETY USES WATER

Water is used for myriad of things — one of the most critical and obvious is drinking water. Drinking water can come from groundwater or surface water. When you tap into a well, you're tapping into groundwater. The majority of groundwater lies within a half mile of the surface. Farmers in general are acutely aware of where their water comes from. According to the U.S. Farmer Perspectives on Water report prepared by Trust in Food, a Farm Journal initiative, 93% of farmers know the source of their tap water, and it's most likely a well. Approximately 15 million U.S. households get their water from private well sources.

The United States Geological Survey (USGS) monitors and reports on water use for the public supply to drink, rural domestic and livestock production, irrigation, thermoelectric power generation, industrial, mining and aquaculture. According to USGS in 2015, the latest data available, the two activities that use the most water are thermoelectric power (used for cooling) and irrigation (agriculture as well as golf courses, parks, nurseries, cemeteries, etc.). Thermoelectric power use was responsible for 34% of freshwater withdrawals, and irrigation accounted for 42% of freshwater withdrawals that year.

But there are many more ways we use water that aren't necessarily accounted for, or measured.

Some of the Many Ways We Use Water

SALT WATER

- Reserves of surface salt water
- Reserves of subsurface chemicals, minerals, etc.

FRESH WATER

- Water table and aquifer reserves
- Snow pack reserves
- Surface water reserves
- Vegetation reserves

EARTH'S USE

- Fresh water cycle replenishment
- Habitat for marine biodiversity
- Climate control
- Dilution and distribution of heat and core minerals and chemicals
- Tectonic plate lubricant

HUMAN USE

- Recreation and tourism
- Regional and global transportation
- Sewage and trash disposal
- Wild food, fertilizer and mineral harvesting
- Medicine and materials harvesting
- Aquaculture to grow food products
- Drill and produce energy

EARTH'S USE

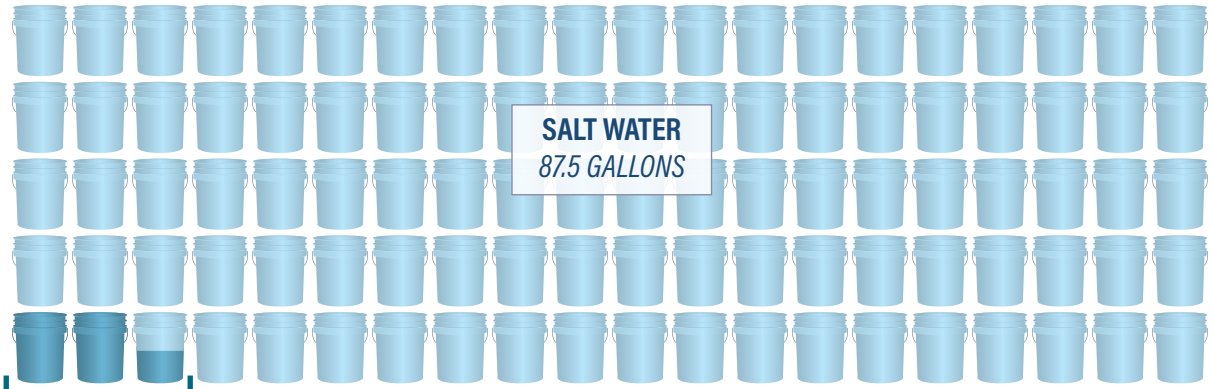
- Climate control
- Wildlife habitat
- Dilution, solution and distribution of natural chemicals
- Precipitation transports seeds and other organisms
- Address natural disasters, such as wildfires

HUMAN USE

- Agricultural water
- Drinking water
- Landscaping irrigation
- Bathing, cooking, sewer and cleaning
- Industrial water
- Local transportation
- Recreation

A Scarce Resource: Fresh Water for Farms and More

There are approximately 332.5 million cubic miles of water on Earth, according to USGS. If 100 five-gallon buckets represent that amount of water, only 2.5 buckets – or about 12.5 gallons – would be freshwater. With such a limited resource and a growing world population, it's no wonder the Council on Foreign Relations has cautioned water challenges could make "disputes more likely."



FRESH WATER
12.5 GALLONS

Of the 2.5 five-gallon buckets, we're going to fill some smaller containers so you can see how water is allocated out.

GLACIERS AND ICE CAPS
8.6 GALLONS

GROUNDWATER
3.75 GALLONS

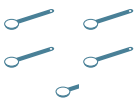
SURFACE WATER
19.2 OUNCES

If you take surface water, or that 19.2 oz of freshwater and break it down further:

GROUND ICE AND PERMAFROST
13.25 OUNCES

LAKES
3.84 OUNCES

SOIL MOISTURE
4.3 TEASPOONS



THE ATMOSPHERE
3.5 TEASPOONS

RIVERS, SWAMPS AND MARSHES
3.5 TEASPOONS

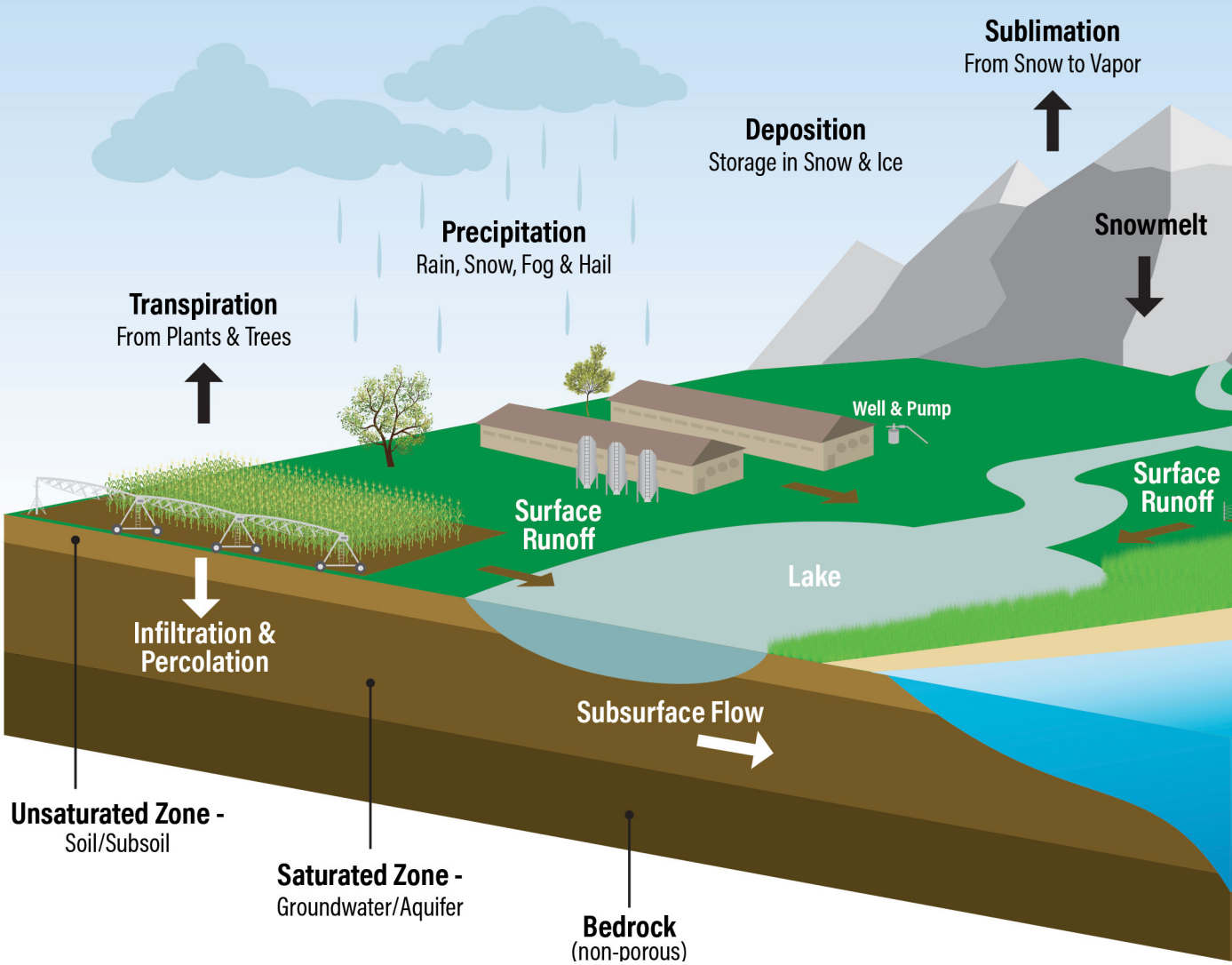
LIVING THINGS
1/3 TEASPOON

ILLUSTRATIONS: LINDSEY POUND AND ISTOCK

HOW WATER MOVES

All water is connected, and all life is connected to water. Water changes form and location but it's never really gone. Precipitation (or irrigation) falls and either ends up as surface water or runs through soil and rock to become soil moisture. Groundwater can flow to larger bodies of surface water, such as lakes or rivers via drainage or through the water table. Water evaporates back into the atmosphere from the land, plants or surface water to become precipitation.

To impact water quality (keeping water pure and uncontaminated with sediment, nutrients or chemicals) or to conserve water (to increase water quantity and availability), it's important to think through the four primary ways water intersects with farmland: in, through, on and off.



IN
(Soil Moisture)

This is the water located in the soil pore spaces and absorbed onto soil organic matter and clay particles, often known as soil moisture or water-holding capacity.

THROUGH
(Infiltration & Percolation)

When water moves through soil (infiltration) or rock (percolation/drainage) it forms the water table. The area below the water table is saturated. There can be pockets of underground water (known as aquifers). The area below the water table is known as groundwater. Groundwater discharges to streams, rivers, lakes and surface water can recharge groundwater. They are connected and contaminants can move between the two.

ON
(Surface Water)

Water located above ground is what's known as "surface water." This can be any body of water on your farm, such as a pond, lake, stream or river. These bodies of water can receive inflow, and conversely, surface water recharges groundwater through infiltration and percolation.

OFF
(Runoff & Evapotranspiration)

This is water that leaves the surface. Runoff occurs when soil is saturated and can't absorb water coming in contact with it (such as from a heavy rainfall). The excess water can run off the top of the land causing erosion and nutrient loss. Evapotranspiration occurs when water turns back into a gas form and returns to the atmosphere. It can do that by evaporation (from ground or standing water) or by transpiration ('exhaled' from plants during their metabolic processes).

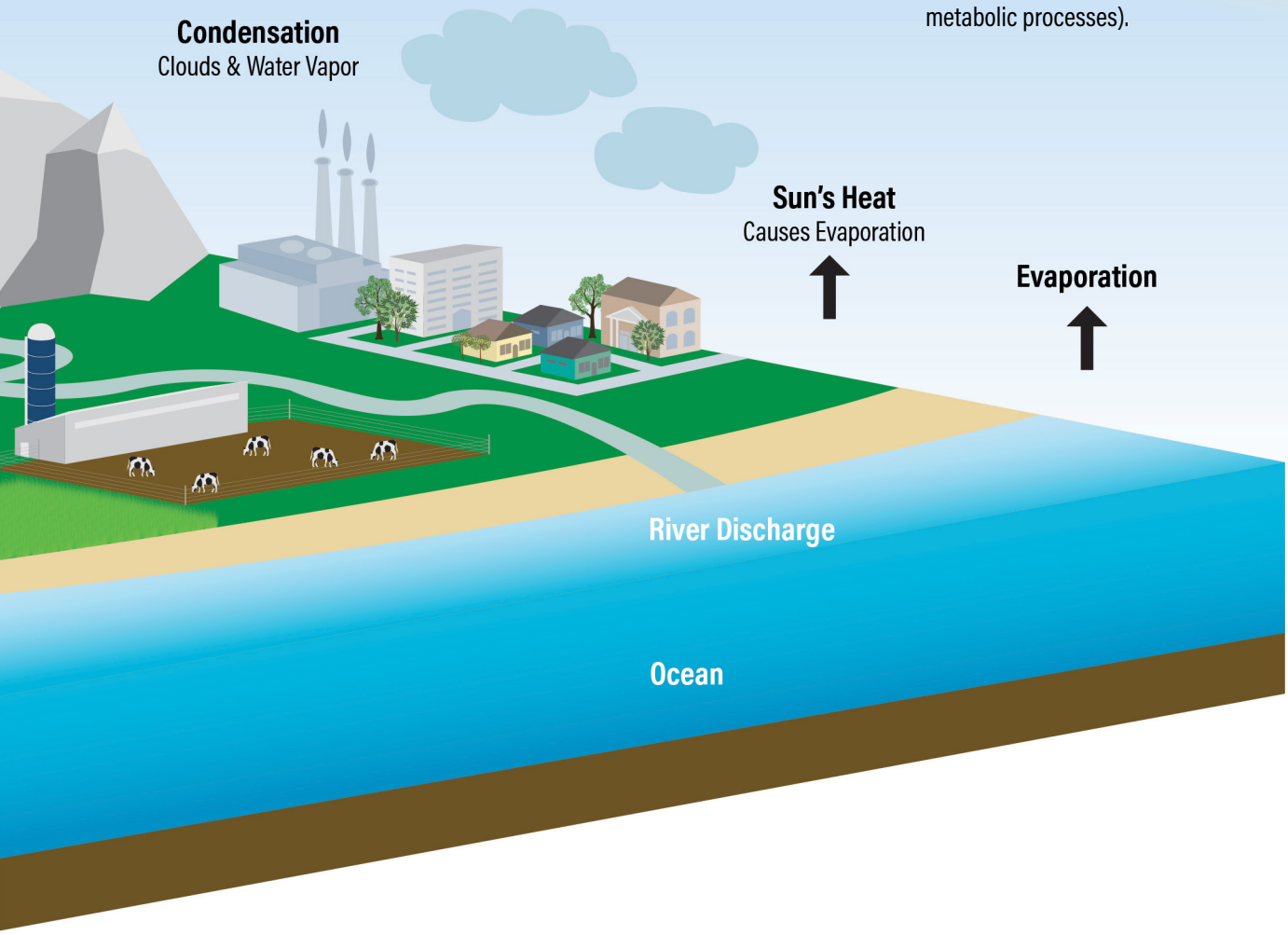


ILLUSTRATION: LINDSEY POUND

FARMER SPOTLIGHT: DAVID TRIMNER *Miltrim Farms, Marathon County, Wis.*

DRIVEN BY DESIRE AND FORESIGHT

In October 2019, Miltrim Farms was the first farm in America to receive the Alliance for Water Stewardship (AWS) core certification for water use practices through their Clean Water Farms Program. The partnership, comprised of David Trimner and his mom, Kathy; Tom and Lorene Mueller; and Andy Miller, farms 5,000 acres of corn, hay and small grains for a nearly 3,000-head dairy.

The AWS certification, along with joining the Eau Plaine Partnership for Integrated Conservation, has validated some of the ways Miltrim Farms has pushed to improve water quality and quantity. The AWS certification process involved a third-party audit, which gives Miltrim Farms additional credibility with their community, lenders, vendors and milk buyer.

Seven or eight years ago, the partners started looking into cover crops. Since their farm falls into the Eau Plaine and Black Creek watersheds they knew they needed to pay attention to water quality concerns. The county produces a lot of corn silage, which typically means more water and nutrients are used and there's less ground cover than other crops.

QUALITY AND QUANTITY

"Miltrim Farms is very practical in their stewardship plan. They farm in an area that has OK groundwater supplies" but not many aquifers, says Andy Johnson, who worked for the Marathon County Conservation office when Miltrim Farms expanded to 300 cows in the late 1980s and still serves as one of their consultants. "Miltrim has to be very conscious of not only water quality but also of water quantity stewardship — how to reduce water usage and better reclaim water. Their plan has them using less and less water per animal or per 100 lb. of milk production. They use cover crops not only for soil health but to maximize revenue from nutrient trading. All of these things were part

"By being stringent on our manure rates we keep runoff to a minimum or practically nothing."

~David Trimner

of their certification. Not every farm I deal with is at the Miltrim level of maturity where the farm is actively looking for opportunities that are driven not only by a desire for stewardship or driven by regulation, but they're looking for market opportunities driven by supply chain concepts."

Miltrim Farms has 18 robotic milkers that milk 1,100 cows with plans to add 12 more in the future. The technology has reduced water use for those 1,100 cows by 25%.

COVER CROPS AND CORN SILAGE

The farm has nearly half of its 5,000 crop acres in corn silage every year. Because of their northern location, they've gone to interseeding cover crops – a mix of clover, ryegrass, rapeseed, cowpeas and hairy vetch using a 60' airseeder shortly after corn emergence.

With interseeding, the cover crops take hold but soon go nearly dormant as the corn canopy covers the row and blocks out the majority of the sunlight.

In the fall, when the corn starts to dry down and more sunlight is available, the cover crops 'wake up' and start to grow again.

"We originally pursued cover crops to address water quality issues, but we heard they were a win-win to help clean up your water, help with nutrient runoff and reduce soil erosion," Trimner says. "Our first objective was the water quality issue because we have a phosphorus issue in our watershed, but as we continued to improve at using cover crops other benefits came to fruition for us.

"The big one was not having so many passes in the field. That saves a lot of money on some of the most expensive pieces of equipment. Pulling a chisel plow is not a cheap endeavor. It takes a lot of horsepower to run through the field and now we've almost completely eliminated that," he adds. "Obviously the other long-term benefits we hope to see are going to be a little tougher to track — yield increases because of soil health or potentially using less fertilizer because the soil is feeding the plant better."

With living roots growing in the soil at all times Trimner is seeing the land is holding onto and using water and nutrients better.

"We've lowered our manure rates substantially. In the summer, we apply it to our hay fields," he says. "We use a dribble bar to apply the manure and get 6 or 7 million gallons of manure on a growing crop. It makes spring and fall less hectic and gets our manure to a crop as it's growing. By being stringent on our manure rates, we prevent runoff from the fields into sensitive areas like nearby waterways and ditches."

PHOTOS PROVIDED BY MILTRIM FARMS

IT ALL ADDS UP

Trimner says they're noticing changes on their farm. Some are small, some big, but he notes the significance of every one adds up. With their heavy clay soils, using cover crops is changing their soil structure.

"You basically get the benefits of three- to four-year hayground but all the time," he says, noting the soil is much firmer to drive on because the structure is so much better.

"The fact we have a lot of water quality issues in the state is what got us thinking; What are the things we can do to solve this problem?" Trimner says. "Although farms are a large part of the cause they can also be a large part of the solution."

TAKING THE NEXT STEP ON WATER STEWARDSHIP

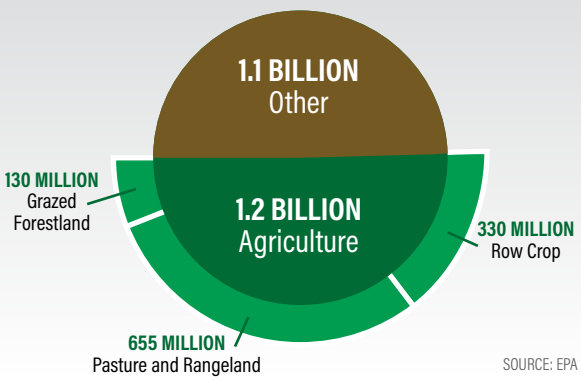
SOURCE: NRCS

It can take decades to make significant improvements in water quality. This is largely due to the nature of water and flow. According to studies led by Jim Tesoriero, a United States Geological Survey research hydrologist at the Oregon Water Science Center, up to 84% of annual flow in a stream can come from what is known as baseflow, which is streamflow that is attributed to groundwater discharge and other delayed sources, not runoff.

It's baseflow that keeps a stream flowing between precipitation events. Groundwater moves much more slowly than runoff. In fact, studies on the Chesapeake Bay have shown if groundwater is contaminated with nitrates, it can take nearly 100 years for all of that groundwater to completely move through the watershed. That means the most practical way to preserve future water quality is to apply management today that will have water quality benefits for decades. If we get it wrong it could take generations to make it right, but if we take a proactive and preventative approach to manage resources more carefully now our children and their children will enjoy the benefits.

"Our study provided direct evidence that, in some cases, nitrate can take decades to travel from the land surface to discharge in streams," Tesoriero says. "This is an important finding because long travel times will delay the observation of the full effect of nutrient management strategies on stream quality."

LAND USE IN THE U.S.



SOURCE: EPA

ROOT CAUSES

Building and maintaining good soil health is important to water quality because healthy soils are better able to hold nutrients and less susceptible to erosion. In fact, EPA has

recognized soil erosion, nutrient loss and runoff of pesticides and other contaminants from agriculture as the leading cause of water quality impairment. According to the 2014 EPA National Rivers and Streams Assessment, 46% of U.S. rivers and streams have excess nutrients and only 28% are classified as healthy. More than 50% of the land in the U.S. (1.2 billion acres) is devoted to agriculture, making the management of ag lands a key part of protecting water quality.

Farmers should adopt a conservation system that helps amplify each conservation practice applicable to their farm. Like medicine in health care, no practice is inherently good for everyone. Instead, every practice can be enhanced by the way it and other practices are applied. As a result, farmers benefit from improved soil health, and communities benefit from the reduction of offsite contaminate losses to protect water quality.

PRECISION PRACTICES

Jorge Delgado, USDA-ARS research soil scientist, recommends precision conservation, which is using precision agriculture and the 4Rs (right rate, source, time and place) plus technology with conservation practices to maximize the effectiveness of conservation practices. This has become known as 4R+.

"Using the right conservation practice for the right site (precision conservation) will help us adapt to a changing climate and extreme weather events," Delgado says. Examples include timing nutrient applications to avoid runoff events or incorporating nutrients to make them less available to runoff flows.

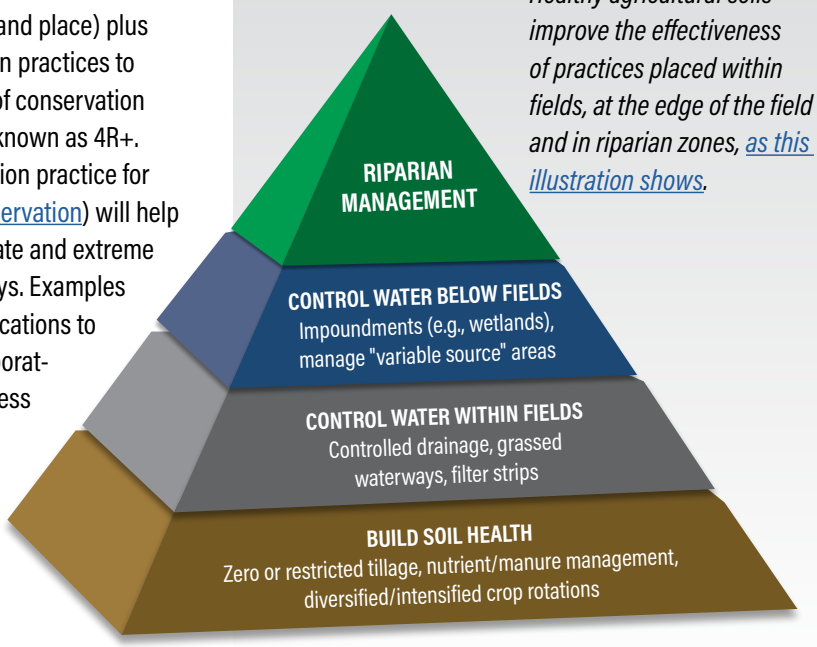
A targeted approach to the placement of structural conservation practices and spatially designing management practices can help maintain yields and provide efficient environmental benefits. These benefits come from optimizing production to reduce input losses and addressing variable site risk with management details that help protect site-specific water resources.

"To give farmers the greatest flexibility, think of conservation practices as a pyramid," says Mark Tomer, a research soil scientist with USDA–ARS at the National Laboratory for Agriculture and the Environment. "Building soil health is the base of that pyramid – restricting tillage, managing nutrients and increasing crop diversity support an entire suite of possibilities for water management and conservation to add to that work."

All producers will need to engage in water management – the control and movement of water resources to minimize damage to life and property while maximizing efficient beneficial use – amid a changing climate. And those decisions will impact water quality.

CONSERVATION PRACTICES IN A WATERSHED

Healthy agricultural soils improve the effectiveness of practices placed within fields, at the edge of the field and in riparian zones, as this illustration shows.



3 WAYS WATER CAN BE IMPAIRED

When EPA considers water "impaired" (not meeting one or more applicable water quality standards) it is often contaminated with one or more of the following:

Chemicals

The chemicals can be from industry or individual use, but in terms of agriculture it typically means a form of pesticide contamination. EPA regulates pesticide use – for more information, visit www.epa.gov/safepestcontrol/drinking-water-and-pesticides.

NRCS can evaluate the potential for site-specific pesticide loss in leaching and runoff and help producers mitigate the environmental risks of pest control activities.
To learn more, go to:
http://go.usa.gov/KoK
or contact your local NRCS agent.

Sediment

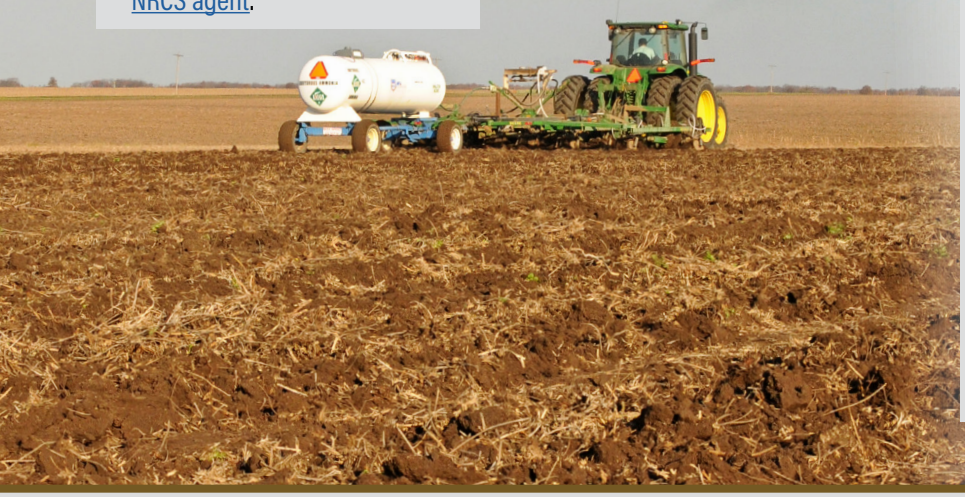
When soil erosion occurs by movement of water, soil particles can move with it. Water erosion can happen on ground that seems very flat, but, of course, its impact worsens with increased slope and rainfall. In fact, according to USGS, as much as half of the sediment for the year can happen in a single storm event. This is problematic because not only are surface soils more prone to erosion but also because they are more likely to contain nutrients.

Nutrients

Excessive amounts of nutrients are the predominant driver of water quality issues for many of the impaired bodies of water. Excess nutrients can get into surface water and groundwater. There are two main nutrients that can be problematic:

- **Nitrogen** (N) can be a source of contamination that primarily enters water in solution - the loss of nitrates as they dissolve and move with water over and through the soil profile. According to EPA, 43% of our nation's river and stream miles were rated poor due to nitrogen content and another 25% were rated fair.

- **Phosphorus** (P) can move both in solution (dissolved in water) and bound to soil particles moved along with sediment. According to EPA, 58% of our nation's river and stream miles were rated poor due to phosphorus content and another 24% were rated fair.



NITROGEN

Excess N in the water can be a health hazard and treating water that contains excessive amounts is expensive. Since N moves with water, the problem literally moves downstream.

"It all comes down to health," says Annette Sudbeck, manager of the Lewis and Clark Natural Resources District in Northeast Nebraska that includes a portion of the Bazile Groundwater Management Area. "Nitrate in drinking water is a risk to personal health. On a farm, on an acreage, in a community, or in a city, drinking water with high nitrate concentrations can impact health. It is known to cause blue baby syndrome and gastrointestinal issues and is suspected to be linked to some cancers.

"The consequence of nitrate contamination in groundwater is the need to treat it in order to maintain concentrations below the EPA maximum contaminant level of 10 parts per million nitrate.

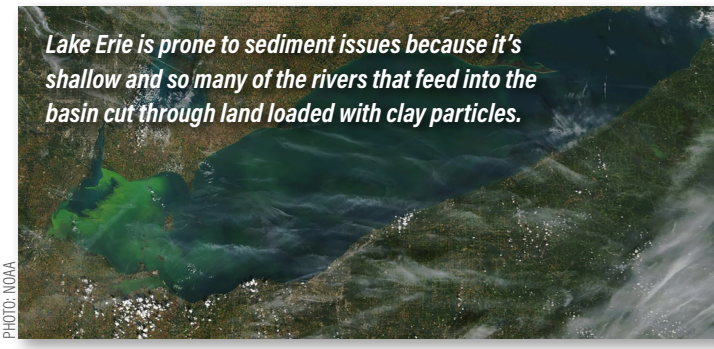
"Preventing nitrogen contamination in groundwater sources through proper fertilizer application rates applied at the proper time for plant uptake, modification of the crops grown to those requiring less inputs, and through the implementation of conservation practices that minimize the leaching of nitrates can have widespread, effective impacts. Reducing the amount of nitrogen entering the water system can reduce or eliminate the need to treat water to remove the nitrates. It's not a cheap endeavor to fix with water treatment. Preventing nitrates from getting into water in the first place is better for everyone."

Farmers can be solutions providers.

"Soil health is a huge part of it," says Austin Baldwin, resource conservationist at NRCS in Nebraska. "If a farm doesn't have good, healthy soil acting as biologically active filtering material, it's unrealistic to think that we can improve water quality."

PHOSPHORUS

Excess P in the water is problematic because it can speed up a process known as eutrophication (excessive richness of nutrients in a body of water, which causes a dense growth of plant life and a reduction in available oxygen). This increase in nutrients can cause toxic algal blooms. As the bloom dies and decomposes it uses up available oxygen in the water and can create dead zones where aquatic life cannot survive. Additionally, the algae can be toxic to humans and pets.



Lake Erie is prone to sediment issues because it's shallow and so many of the rivers that feed into the basin cut through land loaded with clay particles.

PHOTO: NOAA

Lake Erie is one of the most troubled spots in the U.S. with P concentrations. Since 75% of the land feeding into the basin is farmland, there is much that can be done to mitigate excess P, such as subsurface application.

"We're leaking a little bit of phosphorus from a lot of fields," says Laura T. Johnson, director of the National Center for Water Quality Research at Heidelberg University in Ohio. "Farmers have to consider if they need additional phosphorus. The simplest fix for excessive dissolved phosphorus is applying at the right rate."

Of course timing and method of application is important, especially if you're applying manure. "Phosphorus is sticky, but you can get loss after application when applied before rain events or on frozen ground," Johnson says. "We encourage less tillage and higher residue, but there are tradeoffs."

FARMER SPOTLIGHT: LES AND JERRY SEILER, *Lake Erie Basin, Ohio*

WIN-WIN SOLUTIONS FOR SOIL AND SOCIETY

PHOTO: COURTESY OF LES AND JERRY SEILER

Les and Jerry Seiler farm near Lake Erie, which hosts more than half of the fish population for the Great Lakes and is the source for drinking water for millions of people.

When you farm 30 miles from Lake Erie, a source of water EPA has declared impaired, you hear a lot about water quality. Brothers Les and Jerry Seiler farm 1,650 acres in the Western Lake Erie Basin in northwestern Ohio.

In 2014, residents of Toledo were told not to drink, nor even touch their water for three days in August. By day two, the National Guard was distributing water to residents.

"Everybody deserves a good source of water," Les says. "A farmer should never cause problems and not be accountable for them. We're all connected, everything is a whole system. I'm part of the Maumee River Basin, which is the leading contributor to phosphorus in Lake Erie."

The Seilers have spent decades trying to be good stewards of the land and the water. They have some land with up to 12 degree slopes. In the 1980s, they started putting in waterways to address gully erosion. They also started strip-tilling and banding fertilizer. Eventually, they went to no-till and started soil testing by zone. Now they have added cover crops and diversified crops as the next evolution in their quest to keep the soil and nutrients in place.

NO NEED TO APPLY PHOSPHORUS

Knowing agriculture was a leading cause of so much of Lake Erie's issues, Seiler was determined to get involved and be part of the solution. He credits being active and partnering with many organizations to accomplish his goals of staying profitable but on the leading edge of water quality.

"Back when we started mitigating soil erosion, no one knew what soil health was," Seiler says. "But now we understand this is a system and it's changed how we farm. What you do affects water quality. This will be the fifth or sixth year I haven't used phosphorus to plant a corn crop. Our phosphorus levels are good.

We've been zone testing our soil every other year since 2003 and that's given me the confidence that I don't need to add phosphorus. We've been rebuilding our system and Mother Nature has been fixing the soil."

Seiler has participated in the seven-county Conservation Action Program (CAP), an organization that exists to help foster adoption of water quality practices in northwest Ohio. He is a Cover Crop Champion in conjunction with CAP and the National Wildlife Federation (NWF) as well as participating in the Farmer Advocate Program with The Nature Conservancy (TNC). Those programs exist to connect farmers with folks such as Seiler who can answer technical questions about growing cover crops.

COST-SHARE HELP

Being involved in partnerships has benefited Seiler in unexpected ways and helped him adopt and adapt to technology more quickly. In 2000, one of the partnerships had a cost-share program to invest in yield monitors. That one program gave him real data that Seiler says "snowballed into a lot of other decisions."

He's also had partnerships help take the sting out of trying new practices, such as cover crops, by providing cost-share dollars. And in some cases, like his involvement with TNC, change the worst eye-sore on his farm to a point of pride.

"We had a gnarly ditch that wound around one area of our farm. Before, the county would give us concrete to line the banks with because they kept eroding away. I was embarrassed to take people on that farm," Seiler says. "It's now a show farm. The Nature Conservancy helped pay for a lot of installing a two-stage ditch on that area of our farm. I don't know that we could have done it ourselves. Our mindset was, this is too much water, get it off our farm.

"Only 2% to 5% of people farm the way we farm – continuous no-till and cover crops on every acre."

—Les Seiler

But they showed us if we slowed the water down it takes the damage out of it. We hauled all that concrete away."

THE BENEFITS OF A NETWORK

The biggest improvement in the farm is how connected Seiler says he's become to other farmers who think like he does.

"Only 2% to 5% of people farm the way we farm – continuous no-till and cover crops on every acre. Cover crops for us have been the missing link. The resiliency you build in your soils is like having the banker on your side. It's certainly made us more profitable," Seiler says.

"But finding out you're not alone in what you're doing? It's cool. It's really powerful to have that network for yourself and then be able to turn around and do it for others through programs like the Cover Crop Champions," he adds. "That's the most rewarding part of this whole thing – the network you become a part of. It's a two-way street and we all strive to learn from one another."

Tips to Find Partnerships

- Get involved with local farm organizations.
- Check with your local water conservation district.
- Reach out to local water advocacy groups about how farmers such as you can help.
- Connect with your NRCS agent, conservation district professional or Extension agent.
- Attend a conservation, no-till, water quality or cover crop conference.

10 WAYS TO PRIORITIZE WATER QUALITY

Farmers commonly focus their attention on conservation planning by thinking through planning issues that deal with nutrient management, soil health or a particular problem spot on their farm. Water quality considerations naturally dovetail with many of these planning activities. Here's how to make them more top-of-mind.

1. Know your watershed and its issues. Farmers feed the world, but that doesn't gain many points in a culture increasingly removed from where their food comes from. Learn what problems exist in your watershed so you are in touch with your community's concerns and can know how your operation might contribute to or mitigate those issues.

2. Follow the water. Know where your water comes from and where it goes. Look at every aspect of your farm and trace the water on, off, in and through. (See page 8 for How Water Moves.) Think of your farm as a system, which exists within the watershed, which is also a system.

3. Take credit and continue to implement. Chances are many of the practices you do to mitigate soil erosion or improve soil health have a positive effect on water quality. Take credit for past conservation wins, but don't stop there. Analyze where tweaks in production practices might positively impact water quality without much additional effort.

4. Get help and be open to overhaul. If you've got an area on your farm that just isn't working be open to turning your production system on it's head – at least in small doses. Try something outside your comfort zone that experts or others have said

work for them, and give it a solid try, even on a few acres. Recognize some practices will take more than one year to show results. However, if you're outside your comfort zone, find one (or several) trusted adviser(s). For tips on how to choose a trusted adviser, see page 43-44 of the Resource Stewardship Planning guide.

5. Get involved and be open to partnership. According to the National Water Quality Inventory, 70% of lakes, reservoirs and ponds; 78% of bays and estuaries; and 55% of rivers and streams assessed in the U.S. are impaired by pollution and do not meet minimum water quality standards. There's a high likelihood yours could be one of them. You live there and it's your water too, so find out what is being done locally to protect water sources and get involved. It's a good idea to have a voice in the process, and as a bonus, you'll be more likely to hear about partnerships and projects that could have cost-share dollars available to help make production changes.

6. Know your data and test for water quality. Test your farm well, your tile drainage outlets and any surface water (ponds, streams, lakes and rivers) on or adjacent to your farm. Visit EPA to find out more information about proper testing procedures and to find a water-testing lab in your state.

"If you understand context you can make decisions with confidence," says Andy Johnson, consultant for Miltrim Farms. "To do that you have to know your numbers. If you don't know what they are and how they change over time or after a major event, you can't move forward with any real ability to be effective. Too many farmers are afraid if their numbers are known they might be used against them. But if you don't know your numbers you also can't defend yourself and you'll be painted with the same brush as everyone in your watershed."

7. Recognize tradeoffs. When balancing the needs of your operation, sometimes water quality is sacrificed for greater efficiency, better soil health or profitability. All are necessary, but recognizing where decisions might be impacting water quality can help you be more nimble in navigating concerns. (See page 24 to learn more about these tradeoffs.)

8. Plan for extreme weather. Volatile weather patterns have become more pronounced in the past decade. Think through which strategies you'll use when water is scarce and when it is abundant. How can extreme weather not only affect your operation but the water that enters and exits it?

9. Use technology. Advances in technology have brought down the cost of variable-rate technology, climate stations, water efficiency controllers, water sensors and drip irrigation. Some items that used to cost thousands of dollars now cost hundreds or even less. Often the costs can be recouped within a few years by efficiencies gained and sometimes there might be cost-share dollars available for early adopters. If it's been a few years since you've investigated what technology is available to monitor precipitation, reduce water use or apply nutrients more precisely, it's probably worth a talk with your local dealers to see what technology might benefit your operation.

10. Use a nutrient management plan. Nutrients, specifically phosphorus (P) and nitrogen (N) are the leading cause of impaired bodies of water in the U.S. While they're necessary elements for crop production, walking through the particulars of a nutrient management plan is a worthwhile endeavor to tackle with a professional. (See page 15 for more on N and P in watersheds.)

ADDRESS BARRIERS, FOCUS ON BIG PICTURE

A mix of factors motivates farmers and landowners to improve conservation efforts, and their willingness to take on practices that might improve soil or water quality is as complex as their operations.

"Social science research in recent years has identified a number of important barriers to and facilitators of farmers' conservation practice adoption. It's imperative to both help farmers address barriers, like perceived risks to yields, and focus on factors that help facilitate adoption, like stewardship ethics," explains J. Arbuckle, Extension sociologist, Iowa State University.

In a review of multiple studies about various conservation practice adoption Arbuckle and colleagues found farmers had common threads that moved them to implement conservation practices or reject them. He says some stewardship barriers are structural, such as lack of markets and infrastructure for small grains and forages that can be used in extended rotations. Rented land and time constraints are barriers to adoption along with the convergence of increasing farm size and climate change, which causes weather volatility and smaller planting and harvest windows.

"The concept of soil health is resonating with a lot of farmers, and seems to be helping them to think more holistically about how different practices can increase soil health, and how that leads to yield and resilience benefits over time. Importantly, the practices that increase soil health also tend to address off-farm issues like water quality, so it's a win-win," Arbuckle says.

FACILITATORS OF ADOPTION

- **Perceived benefits of practices.** Farmers who recognized potential benefits of practices were more likely to adopt a practice than those who were focused on the risks.

- **Supportive landlords.** A supportive landlord goes a long way to a farmer's ability and willingness to adopt conservation practices. Being able to extend a lease to facilitate conservation adoption helped increase willingness as well. For best practices on how to present adopting conservation practices on rented land – even make the case for removing unproductive acres from your lease, see pages 38 to 41 of the Resource Stewardship Planning guide.

- **Systems thinking, compatibility with current farming system and use of complementary practices.** Research has shown farmers who think about their operation as a system are more likely to adopt conservation practices such as cover crops. If that practice is compatible with complementary practices, for example, no-till, then adoption is more likely. Systems thinking can have other benefits, too. For example, proactive attention to in-field conservation can help reduce the need for grassed waterways or edge-of-field filter strips. In site-specific cases where structures are needed, they can be targeted to prevent hazardous sediment and agrichemical loss, reducing farm costs and saving time on maintenance.

- **Self-identifying as a good steward or conservationist versus identifying as a "productivist" is a strong predictor of conservation adoption.** This was the case for not only adopting individual practices but adopting multiple practices.

- **Trusted information.** Having and being able to access trusted sources of conservation information either helped motivate adoption or hindered conservation adoption when it wasn't available.

- **Awareness and concern for soil and water issues including soil health and resiliency were key factors in driving practice adoption.**

Out of the above list, what factors are most motivating to you as you manage your soil and water resources?

_____

_____

Do you identify yourself as a good steward or productivist?

_____

_____

WATER ISSUES MATTER TO LANDLORDS TOO

Living downstream from your own farmland makes you pay more attention to water quality, says Chris Henning, who owns land in the Raccoon River Watershed in Greene County, Iowa. Of her 320 acres, 160 are in production.

In 1993, a flood filled the basement of her former home to the floorboards of the first floor and, 60 miles away at her new farmstead, caused tractor-sized gullies in her fields. That got her involved in water quality issues.

Henning's farm has four creeks that run through it and is 1.5 miles from the Raccoon River. That river is source water for the Des Moines Water Works, which provides half a million people with drinking water. As chair of the Raccoon River Watershed Association, Henning is an outspoken advocate for water quality in her community.

After the flood of '93, Henning started making changes. Eventually, she added buffer strips, incorporated cover crops on all her cropland and restored 60 acres to wetlands.

A WIN-WIN

"I have fields with wetlands that don't look like they should have wetlands, but if you know the history of the field, you understand why. That area would drown out five out of every six years, and the sixth year would have poor yields," Henning says. "I put it in a wetland and get $275 to $300 an acre. Not only did I get to take land that never produced anyway out of production, but it's helped me in other ways. It made my average yield for the field go up, so when I buy crop insurance or calculate ROI on the farm, it's a no-brainer.

"The wetland helps filter the water that goes into the county tile and ultimately ends up in the river. Most years, there are ducks, and there's always wildlife."

Henning credits cover crops for adding to her organic matter on areas of the field she described as "cement gray." She's increased organic matter by 1.5 percentage points in the worst areas.

On her rented acres, Henning insists on a crop-share arrangement. "With crop share, we're both involved in the outcomes. I want to be able to walk out on my land and know the decisions the farmer and I make, and how we farm, make a difference."

Cover crops and Conservation Reserve Program (CRP) buffers on erodible land help landowner Chris Henning.

RANCHER SPOTLIGHT: KIM BRACKETT *Brackett Ranches, Idaho-Nevada border*

RANCH BUILT AROUND LOCAL WATER CONTEXT

Kim Brackett and her husband, Ira, run a cow-calf ranch in southern Idaho. The intersection of water quality and availability is pronounced because the region only receives 10" to 12" of precipitation annually. In Idaho, ranchers permitted to graze public lands may also file for water rights.

Seventy miles of pipeline buried 6" to 8" underground transport water from the Nevada mountains, where the family's cattle graze in summer, across the desert. Kim estimates her husband spends up to 40% of his time per year maintaining the "absolutely crucial" infrastructure. Leaks are visible aboveground as wet spots, while airlocks are harder to diagnose and require opening and closing of valves to release built up air.

A DEEP APPRECIATION FOR WATER

Protecting water quality also is a priority because it ensures grass resources remain for cattle, Brackett shares. The family fences off a handful of riparian areas next to meadows, which are flood irrigated to grow and harvest hay for stocker cattle, to prevent the animals from pushing soil and grass into waterways. They place salts and protein in different locations to avoid stream banks and creeks.

Managing grass effectively extends to the family's grazing plan for its Bureau of Land Management land. In partnership with a range conservationist, they analyze each allotment of land to identify the right number of cattle to keep grass in check. Regular grazing ensures less fuel for wildfires.

On privately held acres, the Bracketts practice more adaptive grazing, adjusting cattle numbers in fields to strike the right balance and keep noxious weeds in check. "One of the things I've learned is try to match your irrigation system, your water system, to your environment," Brackett says.

PHOTO: BRIAN BAXTER

Water is so scarce on Kim Brackett's family cow/calf ranch, they develop an annual drought contingency plan to be proactive.

She is hopeful future ecosystems markets that pay farmers not only include carbon sequestration but also water conservation and wildlife habitat growth.

HOW TO BALANCE TRADEOFFS

PHOTO: ISTOCK

A farm operation constantly weighs and evaluates tradeoffs — juggling timing, resources and personnel. Sometimes the decisions are made so fast there's little thought put into how they make those decisions or what they're prioritizing. Experts caution you to consider your decision-making and ask the question: "How am I making that original decision?" Challenge yourself to make it in as balanced a way as possible.

One tradeoff that has been made in the past is prioritizing nitrogen (N) amounts over phosphorus (P). The result can be rather devastating for water quality if P builds up in the soil.

As a farm kid turned farmer, Carrie Vollmer-Sanders learned early the devastation of not managing manure properly.

"We had a creek in the back of our house growing up. My dad had put the farmland near it in CRP. My sister and I would play in that creek and even as a kid we observed the algae that grew from the tile lines," Vollmer-Sanders says. "When I pointed it out to my dad, he showed me where the tile came from a catch basin from the other end of a field that was our neighbor's. They didn't have a manure management plan for their farm and my dad told me: 'this is what happens when you don't take care of your manure and it gets into your water.' I never forgot that lesson."

In addition to serving as the director of North America ag engagement strategy for The Nature Conservancy (TNC), Vollmer-Sanders farms in northwest Ohio and northeast Indiana with her husband who also works for a major ag company. Being in the Lake Erie Basin and those early lessons from her dad have led her to prioritize P as the limiting application factor.

"If you're applying manure at a rate that

Test for Phosphorus Stratification

To test for stratification of phosphorus (P), Johnson recommends doing a soil test. But when pulling soil cores to test for stratification of P, you'll want to separate the top 2" of the soil core into a separate sample. If the top 2" is 20 ppm higher than your average soil P test, you have P stratification.

is good for phosphorus then your nitrogen is fairly low," Vollmer-Sanders says, noting manure can be very beneficial. "It has great micronutrients and is a valuable resource, but one we have to manage properly because water is also an incredibly valuable resource."

Timing is the most common tradeoff farmers make, particularly when it comes to nutrient management. Farmers in the Chesapeake Bay watershed, for example, are prohibited from applying nutrients in the fall to protect the Bay and the industries it supports. The external pressure and regulations have shifted applications to the spring or to be spoon-fed throughout the season.

Vollmer-Sanders says being aware of water quality issues might alter your decision-making. For example, buying variable-rate equipment to apply nutrients in the spring will cost money up front, but being able to apply less product and better manage inputs might save money or even things out in the long run.

UNEXPECTED CONSEQUENCES

Some tradeoffs don't turn out exactly the way we envision them. Cover crops, for example, are generally beneficial for reducing losses of P dissolved in runoff water and attached to soil. They are also good for capturing leftover nitrogen after crop harvest to reduce N leaching and runoff potential. Yet some cover crop roots (especially deep rooted species) and associated microbial activity can help make more P available at times when we don't want it to be, or at least we don't want it to be mobile.

"Cover crops build up organic matter and that stimulates microbes in the soil that can pull up phosphorus that wasn't available before and bring it up to the surface," explains Laura T. Johnson, director of the National Center for Water Quality Research at Heidelberg University in Ohio. "At the surface is where runoff occurs so it's at a higher risk for loss. It doesn't mean cover crops aren't a good idea, but we are still learning. We see more stratification of phosphorus, especially with no-till. When that happens, it's even more important to manage for phosphorus availability."

Beneficial cover crops needed for a no-till system to function can contribute to a stratification of accumulated P near the soil surface if nutrients are surface applied.

Manure has great micronutrients and may be "an incredibly valuable resource but one we have to manage properly because water is also an incredibly valuable resource."

—Carrie Vollmer-Sanders, The Nature Conservancy

This means there might be a case for injecting or incorporating nutrients or occasionally disturbing the soil with light tillage if nutrients are surface applied, Johnson notes. This is under research.

Tile drainage can be a tradeoff. Drainage can provide an incremental increase in productivity, but more nutrients can leave the field. To help protect water quality, edge of field trap practices like saturated buffers may be needed in some locations to treat nutrient losses.

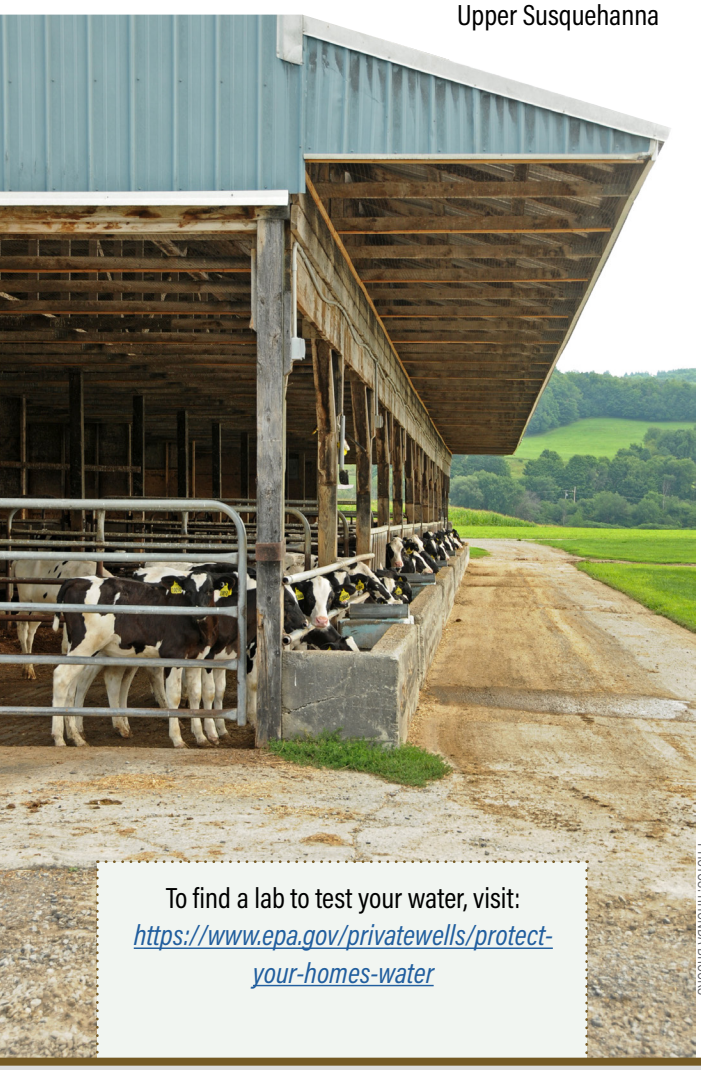
"You can vary or change nitrogen rates, change timing or add a cover crop," says Dan Jaynes, scientist with the USDA-ARS National Laboratory for Agriculture and the Environment on the Iowa State University campus. "There's a lot we can do to reduce losses of nitrogen."

Your NRCS agent can help identify and weigh any tradeoffs between addressing different natural resource concerns and productivity goals and then recommend the best practices for your operation.

FARMER SPOTLIGHT: MIKE AND PETE MCMAHON *EZ Acres, Upstate NY*

ACCOUNTABILITY IN ACTION

A near perfect convergence of sensitive watersheds and a building project led Mike McMahon, a partner in EZ Acres farm, and his brother Pete to seek out additional help. EZ Acres is a 950-cow dairy with 750 head of young stock and 2,700 acres. The farmstead and around 70% of the land is located in the Upper Susquehanna River Watershed, which ultimately drains into the Chesapeake Bay. The remaining acres are part of the Skaneateles Lake Watershed, which provides unfiltered drinking water to six municipalities, including Syracuse.



PHOTOS: RHONDA BROOKS

To find a lab to test your water, visit: *https://www.epa.gov/privatewells/protect-your-homes-water*

The brothers are the 5th generation to milk cows in Cortland County, NY. In 1985, they took the business over from their father, and in 1995 they consolidated their herd from four locations into one new freestall and milking parlor.

"When we emptied the old facilities and brought the animals to our new location, we heard grumbling," McMahon says. "All of a sudden people think about you differently when you have a new building going up. We'd always known we were part of the aquifer but hearing people's concerns knocked us upside the head. It was a wakeup call for us."

A CASE STUDY IN THE MAKING

At the same time they were planning their new facility, the Cornell University's College of Agriculture and Life Sciences (CALS) was looking for a case study farm. EZ Acres is situated in two sensitive watersheds, bordered by two trout streams to the north and the south, and located over a sole-source aquifer. Topographically, there is an 800' difference in elevation from the top of the hills to the valley flats on their operation. That all made it the perfect place for a case study farm.

"With all of these things going on we knew if we didn't take some responsibility for the water running through our farm, we could

make life miserable for a lot of people who depend on that water," McMahon says.

EZ Acres partnered with folks at CALS and set about making changes.

They started by soil sampling every one of EZ Acres' 160 fields, looking at current nutrient loading and manure handling practices. Next, they overhauled their cropping system — from raising alfalfa and corn on high ground to intensively managing native grasses.

"We were worried we wouldn't be able to grow enough forage, but to our surprise the switch to reed canary grass has averaged almost 19 tons to the acre on the hills making more forage than ever," McMahon says. "It stays down for 10 to 12 years, is a voracious sink for manure and keeps the hills from eroding. We now have over 400 acres."

Through the years, they've worked with the Cornell Net Carbohydrate and Protein System and Cornell Nutrient Management Spear Program to change their feed rations and reduce the amount of nutrients brought on to the farm.

"Our grain-to-forage ratio was upside down, 60% grain/40% forage. In about 10 years time, we've flip-flopped that. Today we're at about 70% forage," McMahon says. "We also challenged the common thinking in the 1990s that you need a lot of phosphorus in the diet to have a successful breeding program. In a modern dairy, 85% of the phosphorus that comes on the farm comes in the form of feed, not fertilizer. Right out of the gate they dropped our phosphorus in feed by over 30% and we saw no detrimental effect."

CHANGE FOR THE BETTER

All the changes on their farm are with an eye to water quality, but also to profitability.

In 1995, their milk production was 68 lb. per cow. In the past 25 years, it has increased to 92 lb. per cow, which McMahon credits to high-quality forages.

With water quality top of mind, Mike and Pete McMahon have implemented numerous changes on their farm in the past 25-plus years.

All these changes have made their herd healthier and farm more profitable, but how have they impacted water quality?

Comparing 2003 to 2005 versus 2017 to 2019, their per-acre nutrient applications have decreased from:

- 200 lb. nitrogen per acre to 105 lb.
- 25 lb. phosphorus per acre to 4 lb.
- 41 lb. of potassium per acre to 17 lb.

When they moved the herd to one location, they did not till up their existing pastures. Those areas serve as natural buffers that have grown up with native grasses and trees to protect the trout streams. Since there were still a couple of sensitive areas that would flood at times, in 2019 they removed some tillable acres from production and planted 370 evergreen and deciduous trees to a 600' area on each side of the stream to create an additional 1,200' of buffer.

Over the past 15 years, they have planted thousands of willow shrubs on both streams to stabilize the stream bank and shade the

water, making a healthier environment for the trout. The most significant impact to prove their commitment to water quality has been the smallest expenditure. Since 1997, they have been pulling samples from five wells and two streams the first of the month every quarter. For $70 per quarter, they monitor phosphorus and nitrate levels.

The samples from the surface water/streams have never come back higher than 1 ppm nitrate-N unless pulled after a heavy rain.

"The wells are a different story. The municipal well has the whole valley's worth of agronomic practices flowing into it and there are a whole lot of people drinking out of that well," McMahon says. "In 1997, we had a batch of samples come back at 16 ppm nitrate-N — 44 ppm nitrate-N is cautionary and 100 ppm nitrate-N is do not drink. Through our agronomic practices it's decreased from 16 ppm nitrate-N to 9 ppm nitrate-N."

Their focus involves nutrient mass balance. EZ Acres weighs every input and every export from the farm and Quirine Ketterings, a professor at Cornell University, department of animal science, breaks it down into its nitrogen, phosphorus and potassium balance.

The study is morphing to include carbon because yogurt company Chobani is being asked by food retailers about the carbon footprint of dairies. The farm weighs all of its forages and everything that comes on to the farm so the numbers can be calculated.

"Surface streams, seasonal streams, groundwater — think about where that water goes. Think about your community," McMahon says.

Which bodies of water might impact your farm? List as many as you can.

_____

_____

What downstream people, businesses or communities use water that flows through your farm?

_____

_____

Who uses the water upstream from you before it reaches your farm?

_____

_____

Where can you test water for nitrate and phosphorus (tile outlets, wells, etc.)?

_____

_____

What will your test schedule be? (Quarterly? Spring and fall?) Add the dates to your calendar and order testing kits.

_____

_____

LISTEN, REFLECT AND COMMUNICATE

In order to effectively interact with your community about water quality issues you need to know your watershed and how your farm fits into the big picture — and you need to do a good job of listening and reflecting, says Andy Johnson, water quality consultant.

"You have to go through a reflective stage," Johnson says. "In our local case it was getting a TMDL that caused this moment of reflection where farmers thought they were doing all this good stuff, but they had to look at what people were saying and understand why this other group of landowners, business owners and river lovers were pissed off."

Knowing the hot buttons and your own data might allow you to look at the numbers with an unbiased eye to see what your contribution is to the issue. For example, Mike McMahon (see page 26) considers his monthly water tests a cost of being a farmer. He tests multiple locations, most of them not even on his own farm, so he has the data to help understand what is happening in his sensitive watershed, which is used by multiple communities for drinking water.

"If you can have someone show your farm is predicted to contribute 3.5 lb. of phosphorus per acre to the watershed that frees you up to start asking yourself, 'What should it be? What could it be?' When you find out you're never going to get it to zero, but at 1 lb. per acre nature can assimilate it then you can turn your attention to how to get from 3.5 down to 1," Johnson says. "Then you look at converting unproductive cropland to wetland, adding cover crops and maybe changing your manure management plan."

PHOTO: RHONDA BROOKS

For Mike McMahon, it's important to be able to articulate the specifics of his farm and show they're making gains to be good stewards.

Find Your Watershed and Know Its Issues

There are map resources available to visualize the watershed or watersheds you live and operate within. (See the Resources Section on page 46.) First you'll want to find your Hydrological Unit Code or HUC. A HUC is akin to your watershed's address and is often followed by an even number from 2 through 12. Think of it as specificity in directions. The six levels of HUC classification are: 2-digit (region), 4-digit (subregion), 6-digit (accounting unit), 8-digit (cataloguing unit), 10-digit (watershed) and 12-digit (subwatershed).

FARMER SPOTLIGHT: RON SNYDER, *Pemberville, Ohio*

BETTER SOIL STRUCTURE LEADS TO CLEAN WATER

When Ron Snyder bought his 200-acre farm south of Toledo, Ohio, nearly 30 years ago, it was in poor shape. For years he worked to get water to infiltrate the soil with little to show for his efforts of chisel plowing and subsoiling.

After attending a no-till conference a decade ago, he started to think differently. He gradually shifted to no-till and added cover crops. Since 2011, he hasn't applied any phosphorus and his soil organic matter is on the rise based on soil tests. The best improvement, he says, is soil structure.

"Right before I went to that no-till conference I used a spade to dig down in my soil and pop out a clod. The pore space in concrete was greater than what I had in my soil at that time," Snyder says. "I started with annual ryegrass and now my soil structure is totally different, more mellow and forgiving.

Ron Snyder's solution is simple: If you fix the soil, you go a long way to fixing the water, too.

PHOTO PROVIDED BY RON SNYDER

THE DIFFERENCE IS TANGIBLE

"A neighbor who just rented a field near mine had an agronomist out to try to figure out what was happening with the soil in his new field. They decided to compare it to mine. The agronomist told me 'we both took one step on your side of the line, took a step back and then another step forward. We couldn't believe it. It was like walking on a cushion,'" he explains. "That's the difference paying attention to the soil has had on my farm."

The improvement in aggregate soil structure and the use of living cover has helped reduce erosion as well as create pore spaces for water to infiltrate soil. To Snyder this is important for the health of Lake Erie because of the high phosphorus content in the fine soil particles.

"In 2018, I noticed a neighbor using his vertical tillage tool and dust was blowing. I wondered what nutrients were in the dust," Snyder says. After spending time assessing the tile drains in his own field, he collected dust that had settled on his equipment and sent it to the lab. "My agronomist wanted to know where the heck that soil had come from since it tested so high. That's where all the nutrients are — in that really fine soil."

As Snyder describes: Healthy soil filters water properly and improves water quality.

FARMER SPOTLIGHT: KEITH JAMES, *Milford, Utah*

FARM WITH A WATER CONSERVATION LENS

From the perspective of Keith James, a Utah farmer growing alfalfa for horses, dairies and export markets on about 1,000 acres in a desert environment, soil health underpins water conservation. Keith and his son, Ben, operate in the Escalante Valley Basin, which sits on top of an aquifer that — while rechargeable and deep at 1,200' below the earth's surface — only is as plentiful as the annual snowpack.

"We feel the best thing we can do to improve water quality is have a good, rich biological environment in our soil," Keith explains. "That allows the water to be retained in the top foot of the soil so we don't have any leaching down into the aquifer."

PUT TO GOOD USE

Water conservation is an important driver for their farm, which only gets about 7" of rainfall annually. Their alfalfa is pivot irrigated, and when the family noticed they were losing too much water from inefficient disbursing plates spraying water out the side of the pivot, they began using an aftermarket solution to avoid losing water to frequent windy conditions.

Called a Wobbler, the product contains fewer than 10 grooves — versus the 12 to 20 grooves found in a traditional distributor plate.

"It puts out a quite large water droplet," Keith explains. "We have noticed on a windy day, we see far less fog or mist because much larger water droplets hit the ground and much less water is being evaporated."

In addition to the economic benefits of losing less water to evaporation, maintaining access to water is another consideration.

The aquifer's declining," Keith says. "The state overallocated water rights in the earlier years of irrigation, and they are now wanting to cut those back to a renewable level. That means cutting farmers back. We did what the state required us to do — we put the water to beneficial use. We're not about cutting it back, we're about becoming more conservative."

He encourages any producer looking to take a first step to begin thinking about their operation through a water conservation lens.

"There's just a lot of things that can be done if people are willing to do them," Keith says. "It's an economic benefit as well."

KNOW HOW NUTRIENTS MOVE AND THEN ADJUST

Nutrient Mass Balance (NMB) is a concept that has gained traction in recent years, particularly for livestock operations, although it can be assessed for crop-only operations. The NMB at Cornell's Nutrient Management Spear Program (NMSP) calculates the balance of nutrients remaining on farm after exports such as animals, manure, crops and milk are subtracted from inputs brought on to the farm such as feed, animals, bedding and fertilizer. Every component is broken down into its balances of nitrogen (N), phosphorus (P) and potassium (K) per acre and for dairies, per hundredweight of milk shipped.

PHOTO: RHONDA BROOKS

Mike McMahon of E-Z Acres Farm in Courtland County, NY, was surprised to learn 85% of P that comes onto a farm comes from feed, not fertilizer.

The reasoning is simple: Fewer nutrients will be lost to the environment if you bring less of them on farm in the first place. The key is understanding movements of nutrients to be able to make adjustments so the farm and its environment are on a sustainable path.

Based on the data accumulated by more than 600 dairy farms, Dr. Quirine Ketterings who leads the NMSP has been able to ascertain what they call an "optimum operational zone," also referred to as "the green box." Farms that have balances within feasible ranges per acre and per hundredweight of milk produced are said to meet the feasible balances (are "in the green box").

"Because more than 600 farm balances were completed over the past decade, we have been able to document that New York dairy farms have greatly improved their soil phosphorus balance over time and that allows us to maintain good soil test P levels to support crop production without excessive soil P accumulation. This also means less phosphorus is available for runoff," Ketterings says. "That's a huge accomplishment, and a 'good news story' for the New York dairy industry."

The process of converting every farm import and export into their N, P and K values means assessing the farm on a macro level instead of focusing on individual components one at a time. The power in the data is looking at the nutrient numbers and connecting that to on-farm practices. It brings new perspective and a sense of clarity to decision-making, according to participating farmers.

NUTRIENT REMOVAL RATES

(pounds per 10 bushels)

	Nitrogen	Phosphorus	Potassium
Corn	9	3.7	2.7
Soybeans	38	8	14
Wheat	12	6.3	3.7

SOURCE: MICHIGAN STATE UNIVERSITY EXTENSION.

Mike McMahon of E-Z Acres Farm in Courtland County, N.Y., was surprised to learn 85% of P that comes onto a farm comes from feed, not fertilizer. Those, and other realizations led his farm to participate in NMSP and have led to reductions in the P values in their feed and shifts in their cow's rations. McMahon credits his wife with excellent record keeping that allows them to make NMB decisions on a farm-wide basis.

Even on a crop-only farm looking at the NMB can be enlightening. Most farmers don't realize the vast amounts of nutrients contained in the grain leaving their farm or the residue that remains on it. For example, a 110-car trainload of soybeans contains 1 million pounds of nitrogen, a quarter of a million pounds of phosphate and a half-million pounds of potash. Looking at the nutrient values of all exports and imports from a farm is looking at the farm in a whole different way. At the macro level, new insights might emerge that you just can't see when looking at individual processes.

Resources for Nutrient Mass Balance:

- Cornell University Nutrient Management Spear Program
- To calculate your own NMB, use this series of forms, which take an estimated four to 10 hours to complete. If you do not have livestock, skip all questions related to livestock.

110-CAR TRAINLOAD
OF SOYBEANS CONTAINS:

1
MILLION POUNDS
OF NITROGEN

1/2
MILLION POUNDS
OF POTASH

1/4
MILLION POUNDS
OF PHOSPHATE

PHOTOS: LINDSEY POUND & NUTRIEN

ADVANCE EFFORTS WITH EMERGING TECH

In addition to advances with variable-rate technology, water sensors, irrigation scheduling and yield mapping, there are also high-tech solutions to see how your farm fits into your local watershed and beyond.

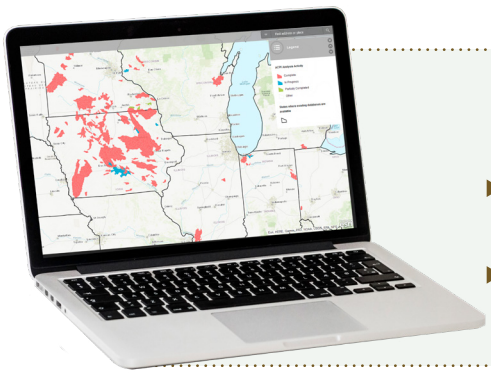
One example is the Agricultural Conservation Planning Framework (ACPF), which uses high-resolution elevation data, Esri's ArcGIS (Geographic Information Systems) custom toolbox and crowdsourcing to make the tool better. It maps HUC 12 level watersheds, which are generally 15,000 to 35,000 acres in size, to identify local terrain, field and soil information and suggest which areas are at highest risk based on factors such as slope and drainage.

"You can choose different precision conservation techniques based on the farmer's preference of which conservation techniques work best on his land and they can immediately see on the maps the areas different practices can treat," explains Mark Tomer, research soil scientist, USDA–ARS, National Laboratory for Agriculture and the Environment.

The tools have been crafted with the Midwest's subsurface drainage, runoff controls, riparian buffers, regional landscapes and agricultural systems in mind.

ACPF isn't available everywhere yet, and with the expense and learning curve of ArcGIS, it's likely to only be available through a planner in your area who uses the software on a daily basis. Yet farmers are likely to see more of these types of highly visual precision watershed mapping techniques show up in the near future. It allows you to see how your farm fits into a wider context starting with the local watershed, Tomer says. The opportunities to improve water quality are unique in each landscape and in each watershed. The framework gives conservationists a flexible way to help producers meet local needs.

"Farmers use maps for their work in individual fields and understand precision ag. This is just precision conservation. Farmers know technology and mapping are beneficial to their operations. They've been using yield maps for the last 20 years," Tomer says. "The fact is a good conservation system should take away some of the constraints farmers face right now if the framework is used properly. It's an opportunity to show them on a map what they're already seeing in the field and show them how it can change by applying conservation. That's technology used well."



More Details About the Agricultural Conservation Planning Framework

- Watch this prerecorded webinar to see how the ACPF mapping tool can help with local conservation efforts.
- Visit the ACPF website to explore ways the tool can help producers and their local communities improve water quality.

SITE RISK ASSESSMENT

Site risk assessments for water quality are a series of judgment calls about an individual farm's risk of erosion as well as nitrogen and phosphorus loss. The assessments help NRCS and consultants determine which areas are most at risk for water quality concerns that additional conservation practices might mitigate. While the assessment can be carried out by a farmer it is a bit like doing your taxes, you might have better results and less frustration if you call in a professional.

Site risk assessments cover a lot of different areas of production. The following worksheets will help you gather information useful for working with a professional to do that assessment.

1. Have you completed any prior conservation plans, either because of participating in a government conservation program or any other written conservation plan? *(Please list them below and locate copies.)*

_____

_____

_____

2. Do any of those written plans include *(check all that apply):*

- ☐ Practices to reduce soil erosion
- ☐ A nutrient management plan
- ☐ Pest management plan practices
- ☐ Irrigation water management plan practices
- ☐ Wildlife habitat enhancement practices
- ☐ Manure management and handling practices
- ☐ Agricultural water management plan
- ☐ Grazing management plan

3. Did you receive any federal, state or local cost-share dollars or incentives for developing any of the conservation plans, or implementing any practice associated with a plan? *(Describe including amount, acres, practices and agencies involved.)*

_____

_____

_____

4. You'll need to complete the Revised Universal Soil Loss Equation, Version 2 (RUSLE2) for this field. There is software available, but the equation does a lot of math to account for topography, such a slope, vegetation cover, etc., to account for long-term soil erosion by water. It will also help as you assess gullies. *To learn more about RULES2 and other appropriate tools and assessments, visit: https://www.ars.usda.gov/southeast-area/oxford-ms/national-sedimentation-laboratory/watershed-physical-processes-research/research/rusle2/revised-universal-soil-loss-equation-2-overview-of-rusle2/*

5. Crop History. On a per-field basis, describe:

Number of acres planted:_____

Crop rotation (planting dates, seeding rates, row width, yield goal, harvest dates and actual yield):

_____

_____

Tillage practices:

_____

_____

Grazing (type of animal, number of head and number of days grazed):

_____

_____

Irrigation (method used to schedule, amount of water applied and number of times irrigated):

_____

_____

Cover crop (type of crops, seeding rates, planting date, seeding method, termination method and timing of termination, any double cropping, strip cropping, interseeding, etc.):

_____

_____

Is the cover crop grazed? If so, describe type of animal, number of head and number of days grazed:

_____

_____

Is forage left behind for wildlife use? If so, describe:

_____

_____

Are any acres abandoned/not harvested? If so, describe:

_____

_____

6. Production and technology considerations: *(Check any box that applies to this field)*

- ☐ Variable-rate technology (VRT) for seeding
- ☐ Yield monitor at harvest
- ☐ Yield map
- ☐ Adjacent to a water body, intermittent stream or wetland
- ☐ Contour farming
- ☐ Strip cropping
- ☐ Gully erosion present
- ☐ GPS

7. Conservation considerations *(Check any that apply to this field and list the number of acres applicable)*

☐ Grassland terraces: _____ ☐ Cropped terraces: _____

☐ Grassed waterways: _____ ☐ Vegetative barriers: _____

☐ Hedgerow plantings: _____ ☐ Stream side forest buffer: _____

☐ Stream side herbaceous buffer (describe width, maintenance activities and purpose of buffer):

_____

_____

☐ Windbreak or herbaceous wind barrier: _____

☐ In-field contour buffers: _____

☐ Field Borders (describe width, maintenance activities and purpose):

_____

_____

☐ Filter Strips (describe width, maintenance activities and purpose):

_____

_____

☐ Critical area planting: _____ ☐ Grade stabilization structure: _____

☐ Contour farming: _____ ☐ Strip cropping: _____

☐ Fence for managing livestock (describe purpose(s)):

_____

☐ Prescribed grazing: _____ ☐ Irrigation tailwater recovery system: _____

☐ Drainage water management: _____

Are water tables (include above and below ground water levels) managed for (check all that apply):

- ☐ Reduction of nutrient, pathogen pesticide and other contaminant losses from the field
- ☐ Season wildlife habitat
- ☐ Weed control
- ☐ Managing crop residue
- ☐ Conserving soil organic matter
- ☐ Reducing wind erosion and particulate emissions
- ☐ Other purpose? (Specify) _____
- ☐ Other (describe) _____

8. Is this field adjacent (within 100' up slope) to a water body? *(stream, intermittent stream, drainage ditch or irrigation canal/ditch)*

9. Do livestock have access to the water body? *(such as controlled or unrestricted)*

10. Does this field have subsurface tile drainage or surface drainage structures? *(Describe including pattern of drainage if there is one, spacing, surface inlets, pipes, connections)*

11. Have soil tests been performed on this field within the past five years to determine nutrient needs? *(Describe methods used, year(s) performed and results for N, P and K values, EC values and Sodium Absorption Ration (SAR), and frequency of testing)*

12. Were commercial fertilizers used on this field? *(Describe amount applied per acre per year for the past 3 years for N, P, K and S, number of acres applied, primary crop the nutrients were intended for, if nitrification inhibitors were used, if VRT was used, dates of application, method of application and type of commercial fertilizers)*

13. Was manure applied to this field? *(Describe primary crop for which nutrients were intended, quantity of manure applied per acre over the past 3 years, source of manure, form of manure handling, dates applied and method applied. If nutrient testing was performed, list test values for N, P and K in manure. If manure was composted, list the composting method and number of acres treated)*

14. Describe frequency of plans to apply manure in future years:

15. Describe how manure was stored or treated before application and any amendments added before application to enhance nutrient efficiency or reduce environmental impacts.

_____

_____

16. Nutrient management values are being applied based on:

☐ Nitrogen removal rates

☐ Phosphorus removal rates

☐ Other (describe) _____

17. Any other soil amendments? *(Describe)*

_____

_____

18. Check any of the following that were performed and list results:

☐ Pre-plant or pre-sidedress nitrate-nitrogen test _____

☐ Deep soil profile nitrogen-nitrate test (greater than 1' deep) _____

☐ Leaf petiole or leaf tissue tests _____

☐ Post-harvest stalk test_____

☐ Chlorophyll analysis (leaf color charts, chlorophyll meters, optical sensors, remote aerial sensing, etc.)_____

19. Was GPS used to georeference and produce a map of the soil properties of this field in the past 3 years? *(Describe how the map was based – i.e. grid sampling, random sampling, soil conductivity, etc.)*

_____

_____

20. Describe your pest control practices for the past 3 years, including primary crop the control agent was intended for, products used, liquid or dry form used, if a part of a tank mix, method of application, rate applied per acre per application, number of applications, total amount applied and number of acres treated. *Include all the following types of products: herbicides, insecticides, fungicides, defoliants, growth regulators, microbial agents, miticides, nematicides, rodenticides, soil fumigants and seed treatments.*

_____

_____

Check any of the following that apply:

- ☐ I used a pesticide product for improving plant health.
- ☐ I altered applications or timing to protect honey bees.
- ☐ I rotated mechanisms of action for the PRIMARY PURPOSE of avoiding pests becoming resistant to pesticides.
- ☐ I planted crop seeds that have been commercially treated with fungicides and/or insecticides.
- ☐ I planted crop cultivars with genetically engineered tolerances to herbicides (such as glyphosate or glufosinate).

21. Describe your scouting procedures for insects, weeds and plant diseases:

Check all that apply:

Scouting was done for: ☐ weeds ☐ insects ☐ mites ☐ diseases

☐ other: _____

- ☐ Scouting was done on a pre-determined calendar.
- ☐ Scouting was done using a development model (degree days, max/min temps, wetness, etc.).
- ☐ Scouting was done because of a pest advisory warning.
- ☐ Scouting was done before treatment.
- ☐ Scouting was done post-treatment to evaluate degree of control.
- ☐ Records were kept (written or electronic for the following:)
  - ☐ Numbers of weeds ☐ Numbers of insects ☐ Numbers of diseases
- ☐ Scouting data were compared to published infestation thresholds to determine when to take measures to manage pests.
- ☐ Field mapping data were used for making weed management decisions.
- ☐ A diagnostic lab was used for pest identification or soil or plant tissue pest analysis for this field.
- ☐ Weather data was used to determine need or timing of application for pest management practices.
- ☐ I have attended training sessions on pest identification and management other than pesticide applicator training in the past 3 years.
- ☐ I used floral lures, attractants, repellants, pheromone traps or other biological controls in this field.
- ☐ Describe any activities undertaken SPECIFICALLY for managing pests or reducing their spread other than products applied. (Such as management of residue; change in tillage or any mechanical or physical barriers; change in rotation, plant density, plant spacing, crop variety; release of beneficial organisms; Adjustments in planting or harvesting dates or adjusting animal grazing rotations, timing or duration). _____

22. Irrigation. Describe your irrigation system for this field, including primary and secondary irrigation, source of irrigation water (be specific), amount of water applied per application, application dates, total water applied to the field, any limits to annual application amount, test results for nitrogen content or salinity if done, if evaluation/improvement was done on uniformity of water application:

_____

_____

a. Describe how you decide when to irrigate.

_____

b. Describe any soil moisture monitoring devices you use in this field.

_____

c. Describe any water management software or services you use on this field.

_____

d. Describe how you decide how long or how much water to run on each set.

_____

e. How do you determine how much water has been applied?

_____

f. Do you know how much water the crop(s) remove from the soil? How?

_____

g. In addition to replacing water used by the crop, which of the following are reasons you irrigate (check all that apply):

☐ Pre-planting irrigation to refill rootzone ☐ Apply moisture for seed germination and emergence

☐ Freeze protection or crop cooling ☐ To apply fertilizer or other chemicals

☐ Groundwater recharge ☐ Other: _____

h. Describe any other practices used to improve water applications:

_____

i. Do you manage irrigation to address salinity problems in this field?

_____

23. Field operations. Describe your field operations for the past 3 years in chronological order (land forming, tillage, preparing for irrigation before seeding, planting, harvesting, pruning and hedging). List crop year, equipment used, timing (date), depth of tillage/planting, etc.:

_____

JOT NOTES, TAKE ACTION

Have you filled out the Resource Stewardship Planning guide? If not, consider downloading it and starting there. As you fill it out, ask the question: "How does this impact water quality?" If you have already filled it out, review your different conservation management plans for your farm operation. You should also get the Soil Health Stewardship guide, which is great foundational step to effectively managing the movement of water in and on the edge of fields. Jot down notes here about areas you might need to investigate further or address:

How does this impact water quality?

Thinking through your farm operation, are there any areas that might have a water issue? If so, what are they?

My watershed is called? *(use resources section)*

My HUC 8: *(use resources section)*

Impairments listed in my watershed:

What bodies of water exist on my farm? *(List each)*

Have you ever tested these bodies of water? What were the results?

What are the closest adjacent bodies of water downstream from my farm?

Have you ever tested these bodies of water? What were the results?

Have you tested your well within the past year? What were the results?

You'll want to repeat the form below for each area of your farm. You are encouraged to fill this out on a field or zone basis for cropland and/or for every livestock site, pasture or paddock for managed grazing areas. Don't forget about non-cropped areas such as associated agriculture lands.

Refer back to your answers on page 28 about where water comes onto your farm and where it leaves your farm. Think through those locations and where water is going on, off, in and through. Are there more you didn't previously identify?

Use the following as prompts for each area:

On:

Off:

In:

Through:

Water damage to crops, conservation practices, life and property is often increased because of the speed of water. Are there any opportunities to slow down water as it comes in contact with your operation? *(Edge of field practices, more residue, installing buffer zones, trees, etc.)*

Do you have plans to deal with extreme weather, floods and droughts?

Drought plan – What can you change to retain more water, or what is your backup plan when water is scarce?

Excessive water plan – What can you do to mitigate excessive water or prevent flooding?

Go back to your answers about where water leaves your farm (page 28). Which of those can be tested for water quality? Results? *(i.e. subsurface such as tile discharge, or runoff such as into surface water area)*

How often can you commit to testing each one of these? (Monthly, quarterly, spring and fall?) Mark it on your calendar and order testing supplies.

Have you ever tested water after a major rainfall event to compare the difference?

What conservation practices are you employing for soil health?

Which of those practices are positive for water quality?

How do you know?

Which ones might be negative for water quality?

Are there any adjustments you can make to these practices to make them less so?

Go back to your resource planning for the various areas of your farm. Are there any tradeoffs you could make in practices or in timing that would show positive impacts in water quality?

What are the tradeoffs?

What would have to happen to make that possible?

Have you ever completed a nutrient management plan?

- If yes, attach.
- If no, gather information on every field or zone, such as: complete multi-year crop rotation, nutrients applied per year and timing info, soil test information, test value of manure applied, application timing, etc.

WATER QUALITY RESOURCES FOR YOUR FARM

PHOTO: NRCS, LYNN BETTS

ACCESS NRCS PROGRAMS FOR WATER STEWARDSHIP

Contact your NRCS field office to learn more about these and other applicable programs.

Conservation Stewardship Program (CSP)

- CSP is the largest U.S. conservation program helping producers voluntarily adopt conservation on working lands. Consider this program for conservation practices that can help reduce soil loss, manage water, reduce greenhouse gas emissions, improve wildlife habitat or enhance energy efficiency on-farm.

Environmental Quality Incentives Program (EQIP)

- EQIP provides financial and technical assistance to address natural resource concerns and deliver environmental benefits. You might use this program for practices that improve water and air quality, conserve ground and surface water, reduced soil erosion and sedimentation, and improve or create wildlife habitat.

Targeted Efforts

- NRCS targets technical and financial assistance provided through the farm bill, and the agency responds to local, state and national priorities for water quality. Wetlands Reserve Easements (WRE), part of the Agricultural Conservation Easement Program, help producers restore and enhance enrolled wetlands. USDA-Farm Service Agency's (FSA)'s Conservation Reserve Program, for which NRCS delivers the technical assistance, can also be used.

EDUCATE YOURSELF ON WATER AND FARMING

River-Runner tool

- Use the free River-Runner tool based on USGS data to place a drop of water anywhere in the U.S. and see where it ends up.

National Map tool

- Want a map of your watershed? Use the National Map tool at USGS to layer on and visualize water features for your area.

LEARN ABOUT WATER QUALITY AND QUANTITY ISSUES NEAR YOU

"How's My Waterway?" tool

- Use this EPA resource to learn about issues affecting drinking water, recreation and aquatic life.

National Water Quality Monitoring Council

- Download water testing data.

Crop-CASMA

- See how much (or little) moisture is in the soil in your area.

JOIN A LOCAL WATER PARTNERSHIP

"Who Protects Water?" map

- Check out the River Network's "Who Protects Water?" map to locate organizations in your area that are engaged and working on water quality issues.

Engage your conservation district

- Ask your local NRCS agent for more information or search for your conservation district online.

AMERICA'S CONSERVATION AG MOVEMENT

Farmers leading the way on conservation: past, present and future

America's Conservation Ag Movement connects with more than 1 million farmers across our country's most essential value chain. Together with these partners, the Movement helps producers accelerate the on-farm adoption of stewardship practices that ensure more food, fuel, and fiber for Americans today, and healthy soil and clean water and air for future generations. Because conservation agriculture is just good business.

USDA United States Department of Agriculture
Natural Resources Conservation Service

www.farmers.gov
www.nrcs.usda.gov

USDA's Natural Resources Conservation Service provides America's farmers and ranchers with financial and technical assistance to voluntarily put conservation on the ground, not only helping the environment, but agricultural operations, too.

AEM Association of Equipment Manufacturers

The Association of Equipment Manufacturers and our member companies are committed to supporting a sustainable world by serving as a catalyst for conversation and innovation. We are working to spark ideas for setting sustainability priorities for the equipment manufacturing industry and providing a framework that supports best practices for a more viable world.

www.aem.org/sustainability

American Farmland Trust

American Farmland Trust was founded in 1980 to save America's farms and ranches. As leaders in conservation agriculture, we have three priorities: protecting farmland, promoting environmentally sound farming practices and keeping farmers on the land.

www.farmland.org

CERTIS Biologicals

Certis is a pioneer in providing growers around the world with proven bio-based crop protection solutions. As we celebrate our 20-year anniversary, we remain firmly committed to sustainable biological innovations which promote healthy crops, people, and the planet.

www.certisbio.com

CORTEVA™ agriscience

At Corteva Agriscience, our purpose is to enrich the lives of those who produce and those who consume. We equip farmers with the solutions they need to produce what our food system and global population demands, while conserving resources and sustaining the land.

sustainability.corteva.com

Ducks Unlimited

Ducks Unlimited Inc. is the world's largest nonprofit organization dedicated to conserving North America's disappearing waterfowl habitats. Guided by science and dedicated to program efficiency, DU works toward the vision of wetlands sufficient to fill the skies with waterfowl today, tomorrow and forever.

www.ducks.org

Innovation Center for U.S. Dairy
HEALTHY PEOPLE • HEALTHY PRODUCTS • HEALTHY PLANET

U.S. Dairy has a vision to be an environmental solution. That's why the industry set 2050 environmental stewardship goals for air, land and water. These collective goals represent an industrywide commitment to leverage the strength of dairy's diversity, enhance our natural resources and create a brighter, more sustainable future.

www.usdairy.com/sustainability

National Corn Growers Association

The National Corn Growers Association represents nearly 40,000 corn farmers nationwide and the interests of more than 300,000 growers who contribute through checkoff programs in their states. Our vision is to sustainably feed and fuel a growing world.

www.ncga.com

Nutrien Nutrien Ag Solutions

Customized based on unique needs and geared toward specific challenges, our whole-acre sustainable ag solutions increase ROI by measuring positive environmental outcomes while making efforts traceable from farm to market. Products, practices and predictability combine with tangible proof to deliver increased profit and production for our growers.

www.nutrienagsolutions.com/sustainable-ag

pork checkoff

For more than five decades, America's pig farmers have been committed to sustainability and continuous improvement. We are guided by six principles embodied in our We Care commitment: Food Safety, Animal Well-Being, Environment, Public Health, Our People and Community.

www.porkcares.org

Sanderson Farms
GOOD, HONEST CHICKEN

Sanderson Farms is committed to doing our part to promote a healthier planet. Our obligation to protect our environment by conserving natural resources, recycling resources utilized in our operation and creating renewable resources when possible is at the heart and soul of our farming process.

www.sandersonfarms.com/our-chickens/sustainably-raised/

SIMPAS Trimble POWERED

SIMPAS™ and SIMPAS-applied Solutions™ (SaS™) make it easy and profitable for farmers to prescriptively apply multiple insecticides, fungicides, nematicides and micronutrients in one simple pass. Available 2021.

www.SIMPAS.com

Sorghum Checkoff

Sorghum is the grain that gives—to farms, to families and to ecosystems. Its unique qualities make it a healthy choice for sustainable lifestyles and communities while sorghum growers are actively contributing to the resilience of soils and habitats in the face of increasing climate challenges.

www.sorghumcheckoff.com/sustains/sorghum-sustains

The Nature Conservancy

The Nature Conservancy has worked for years to develop strong, trusting relationships within the ranching community and the beef supply chain. We use our lands to work with and support neighboring ranchers, and to develop and test science-based management practices.

www.nature.org/workinglands

VALENT®

Valent U.S.A. is committed to supporting growers and ag retailers in enhancing the sustainability of their operations by providing proven solutions that can be used in cooperation with sustainable agriculture practices.

www.valent.com/sustainable-agriculture

FARMJOURNAL FOUNDATION

The Farm Journal Foundation is a nonprofit corporation that works with farmers and producers, next generation populations and national-level policymakers to advance the capability and understanding of modern agriculture's leadership role in feeding the world.

www.farmjournalfoundation.org

TRUST IN FOOD
A FARM JOURNAL INITIATIVE

Trust In Food empowers farmers to catalyze economic, environmental and social improvements by explaining the why, how and what next of adopting on-farm conservation and sustainability practices.

www.trustinfood.com

www.agweb.com/acam