U.S. FARMER PERSPECTIVES ON WATER

A communicator's road map for engaging with U.S. farmers around water challenges.

Original research prepared by:

TRUST IN FOOD
A FARM JOURNAL INITIATIVE

With support from American Public Media's The Water Main

An America's Conservation Ag Movement Research Report

LEAD RESEARCHERS AND REPORT AUTHORS

Kinsie Rayburn

Trust In Food, a Farm Journal initiative

Drew Slattery

Trust In Food, a Farm Journal initiative

ACKNOWLEDGMENTS

RESEARCH CONTRIBUTORS AND EXPERT REVIEWERS

Riley Higby – Farm Journal
Alan Barrett – Doane Advisory Services
Amy Skoczlas Cole – The Water Main and American Public Media
Annie Baxter – The Water Main and American Public Media
Nate Birt – Trust In Food, a Farm Journal initiative
Katie Humphreys – Producer Media, Farm Journal

FOREWORD

Sean McMahon – Iowa Ag Water Alliance

PROOFING

Megan LaManna – Copyeditor, Farm Journal

SPECIAL THANKS TO ALL SURVEY RESPONDENTS

The authors especially wish to thank all the farmers, ranchers and growers who took time out of their schedules to generously share their unique perceptions and experiences by completing our survey.

FUNDING SUPPORT ACKNOWLEDGMENT

Financial support for this research was made possible by America's Conservation Ag Movement, a national public-private partnership designed to more rapidly scale the adoption, documentation and beneficial outcomes of conservation agriculture and amplify, accelerate and give voice to the many conservation agriculture programs and activities underway across the U.S. in service to farmers. The partnership's Foundational Partners are:

- Trust In Food, a Farm Journal initiative
- Farm Journal Foundation
- USDA's Natural Resources Conservation Service
- American Farmland Trust
- Corteva
- Ducks Unlimited
- National Corn Growers Association
- National Pork Board
- Sanderson Farms
- Syngenta
- The Nature Conservancy
- Valent

To learn more about this program and other research initiatives to advance conservation agriculture in America and restore public trust in the food system, visit **trustinfood.com**

All research presented in this report was undertaken in an independent manner in accordance with Trust In Food's research policy. The findings of this report were not influenced by, nor contingent upon input from any funding source.

Cover illustration by Grasshopper Geography;
an illustrated map of America's major river systems and their drainage areas

TABLE OF CONTENTS

Photo by Will Parson/Chesapeake Bay Program

ABOUT THIS REPORT

Agricultural producers, referred to as farmers in this report, play a critical role in the wellbeing of our nation's water resources, **yet their unique perceptions of water-issues are largely under studied**.

This limited understanding hampers efforts by groups wishing to engage with farmers to empower and increase efforts aimed at protecting and conserving water resources. To address this, survey responses from over 900 farmers representing every agricultural production region and major production system in the U.S. were collected, analyzed and are presented in this report — alongside an actionable set of recommendations for improving communication and engagement with farmers around water issues.

The purpose of this report is to:
1.) Document the unique perceptions farmers hold related to water resources.
2.) Promote an improved understanding of farmers through diagnostic analyses of these perceptions.
3.) Establish a set of data-driven, actionable recommendations to enhance engagement with farmers around on-farm conservation practices and policy initiatives related to water-issues.

This research was undertaken through a collaboration between Trust In Food, a Farm Journal conservation initiative, and The Water Main, a public impact initiative of American Public Media (APM). It builds on similar research undertaken by The Water Main to assess the general U.S. public's perceptions of water resources and inform enhanced engagement with them. That research can be accessed at thewatermain.org.

TRUST IN FOOD
A FARM JOURNAL INITIATIVE

Trust In Food is a purpose-driven division of Farm Journal dedicated to rebuilding consumer confidence in the U.S. agricultural value chain by partnering with farmers and ranchers to accelerate conservation agriculture practice adoption and maintenance benefiting land, water, air and the financial health of farm businesses. It advances this mission through data science, research, strategic communications and the omnichannel Farm Journal platform in collaboration with conservation organizations, government agencies, agribusinesses, food companies and retailers, and other food system stakeholders. www.trustinfood.com

Farm Journal is the nation's leading business information and media company serving the agricultural market. Started 141 years ago with the preeminent Farm Journal magazine, the company serves the row crop, livestock, produce and retail sectors. www.farmjournal.com

the WATER MAIN

American Public Media (APM), the largest station-based public radio organization in the U.S., is a media group that serves their 20 million listeners 130,000 contributing members by providing informative, enriching and inspiring content. Carried by over 1,000 stations, APM has a multiregional coverage area across the upper Midwest and California. APM supports American agriculture though The Water Main, an initiative of APM that focuses on connecting Americans to the value of water in our lives, and the production of a podcast series called Field Work. www.thewatermain.org

FOREWORD

ENGAGE FARMERS TO CONTINUOUSLY IMPROVE WATER RESOURCES

The U.S. agriculture sector and American farmers are uniquely positioned to provide solutions to some of the world's most pressing environmental challenges in the next half-century. The research and analysis in this report illustrate how U.S. farmers can play an increasingly important role in addressing our nation's water resources. While agriculture has contributed substantially to our nation's water quality and quantity challenges, the findings in this report would suggest that more deeply engaging America's farmers and more effectively harnessing their spirit of innovation and ingenuity will provide a clear path forward for agriculture to also serve as a source of solutions to these same challenges.

While the "U.S. Farmer Perspectives on Water" report offers much cause for optimism, it also indicates that famers may currently under-value agriculture's negative impacts on water quality. The report also points to a current gap in farmers' understanding of America's water infrastructure. At the same time, the report indicates that farmers are highly aware and knowledgeable of the water cycle, the source of their tap water and the beneficial role of wetlands. Overwhelming majorities of farmers are concerned about America's water resources and want politicians to prioritize taking care of them. The findings in this report suggest that efforts to raise awareness among America's farmers and increase their engagement and advocacy efforts would pay dividends for both rural water and urban water infrastructure issues alike.

America's farmers heeded the call of Hugh Hammond Bennett and the Soil Conservation Service (SCS) to substantially reduce soil erosion on America's farms following the Dust Bowl of the 1930s. The SCS became the Natural Resources Conservation Service (NRCS) in the 1990s as the nation's conservation focus shifted to also include water quality in America's streams, rivers, lakes and estuaries and water availability in aquifers, some of which have been severely degraded and depleted by agriculture. Much as it took decades to meaningfully address soil erosion, it will also take time to make progress on the nation's water quality and water conservation challenges. Important progress has already been made on these issues. This report strikes a chord of buoyant optimism that far greater progress in addressing America's water challenges is yet to come in the decades ahead.

The U.S. Farmer Perspectives on Water report demonstrates how communicators can more effectively engage U.S. farmers in deeper, more meaningful and productive dialogues that will spur increased adoption of conservation practices that improve water quality and water use efficiency. That this report is being released during a global pandemic that has already impacted so many lives and will have lasting effects on our society, our economy and our way of life, makes it all the more timely. Throughout these challenging times, American farmers continue to produce the food that we depend on and provide the backbone to strong, safe and reliable agricultural value chains that continue to operate so that groceries are still stocked on shelves or delivered to our homes and families.

Now, more than ever, we need innovative communications strategies and platforms to support the farmers that sustain us. Much as new technology has enabled farmers to vastly increase yields and resource use efficiency while lessening environmental impacts in recent decades, technology will also enable us to reach farmers more effectively and efficiently. The strategies in this report can be utilized to reach farmers through traditional communications platforms as well as digital media tools like webinars, podcasts, social media and virtual field days that can both deliver technical assistance to producers and strengthen our social fabric through increased connectivity. The farmers that we depend on are depending on us to assist in their journey of continuous improvement.

Many of the conservation practices that improve water quality and water use efficiency also benefit other environmental issues such as reducing energy use, greenhouse gas emissions and soil erosion; improving wildlife habitat, biodiversity and on-farm resilience to seasonal climatic variability; reducing flood risk for downstream communities and mitigating the impacts of climate change. This report offers a roadmap for how U.S. farmers can improve water quality and water availability while continuing to produce safe and affordable food, feed, fiber and fuel in an increasingly sustainable manner. Let us heed the call to action herein.

-Sean Patrick McMahon,
Iowa Agriculture Water Alliance

IAWA
IOWA AGRICULTURE WATER ALLIANCE

Photo by USDA-NRCS Montana

THE RIGHT TIME, THE RIGHT PLACE

Having an empowered and equipped farm base reduces the risk of exacerbating current challenges and introducing increased system brittleness in the face of future shocks.

Empowering farmers to continuously improve their water-management practices and equipping them to remain profitable and productive without sacrificing environmental degradation can both aid in addressing nonpoint source (NPS) runoff challenges that impact U.S. waterways and mitigate unintended environmental degradation.

Photo by Lance Cheung, USDA

WATER CHALLENGES IN THE U.S.
MOVING FARMERS FROM A SOURCE TO A SOLUTION

Water is life, as the old proverb goes: without it, no life on Earth could survive. It powers our cities, transports our cargoes, keeps us fed and is a critical component to our hygiene. Arguably, there is no more important natural resource to life as we know it.

Yet over the past few decades, the negative impacts — social, economic, medical and environmental — faced by our nation as a result of water challenges have intensified.

Record-setting[1] precipitation events and floods have created disasters across the U.S., and catastrophic drought[2] has severely impacted local environments, leading to the imposition of emergency water-use restrictions that completely reshape local economies.

Every day the tap water in the homes of millions of Americans contains chemical contaminant levels much higher than recommended or regulated[3].

Each year, nearly 15 million Americans have their water service shut off due to their inability to afford the bill and nearly 2 million do not have access to water and sanitation services at all inside their home[4].

According to the World Economic Forum's Global Risks 2019 Report — water challenges play a central role in five of the top 10 risks currently facing humanity. Of those top five risks, water challenges are central to four risks[5].

Many of these challenges are human-driven: climate change induced increases in extreme weather events, poor public infrastructure management leading to breakdowns, and pollution derived from human society. These challenges are complex, multifaceted and will take a systems-based thinking approach to solve[6].

One clear pathway to addressing and mitigating water challenges — is to engage farmers to continuously improve water management practices.

U.S. farm operations are strategically located at the crossroads of water, food, energy and climate. Farmers rely on water for production and, through their production methods, impact — either in positive or negative ways — water resources. Few other businesses or individuals interact with water resources so deeply, giving farmers an outsized impact to water resources.

Farming operations might play a role as a source in creating water challenges, but they are uniquely positioned to play a role as a solution in solving and preventing water challenges in ways and at scales other industry and population groups cannot.

Put another way, farmers are positioned to play an important role in the frontline defense of our nation's water security and natural resource stewardship — protecting and conserving our most vital natural resource.

All while conducting a balancing act to produce the most abundant food, fuel and fiber harvests in human history during a time of record-low commodity prices and record-high farm bankruptcies[7].

Two farmers in Iowa stand amongst their erosion-mitigation and pollinator friendly installation of native grasses.
Photo by Jason Johnson USDA NRCS Iowa

KEY FINDINGS
U.S. FARMERS' PERSPECTIVES ON WATER

Farmers tended toward very high awareness and understanding levels of the water cycle and other ecosystem processes related to water.

Around eight in 10 farmers require their political candidates to have a stance on water conservation and protection.

Many farmers believe they will likely face water challenges in the future such as fresh water supply and demand issues and an increase in flood events.

Around nine in 10 farmers say they take action on a daily basis to protect and conserve water.

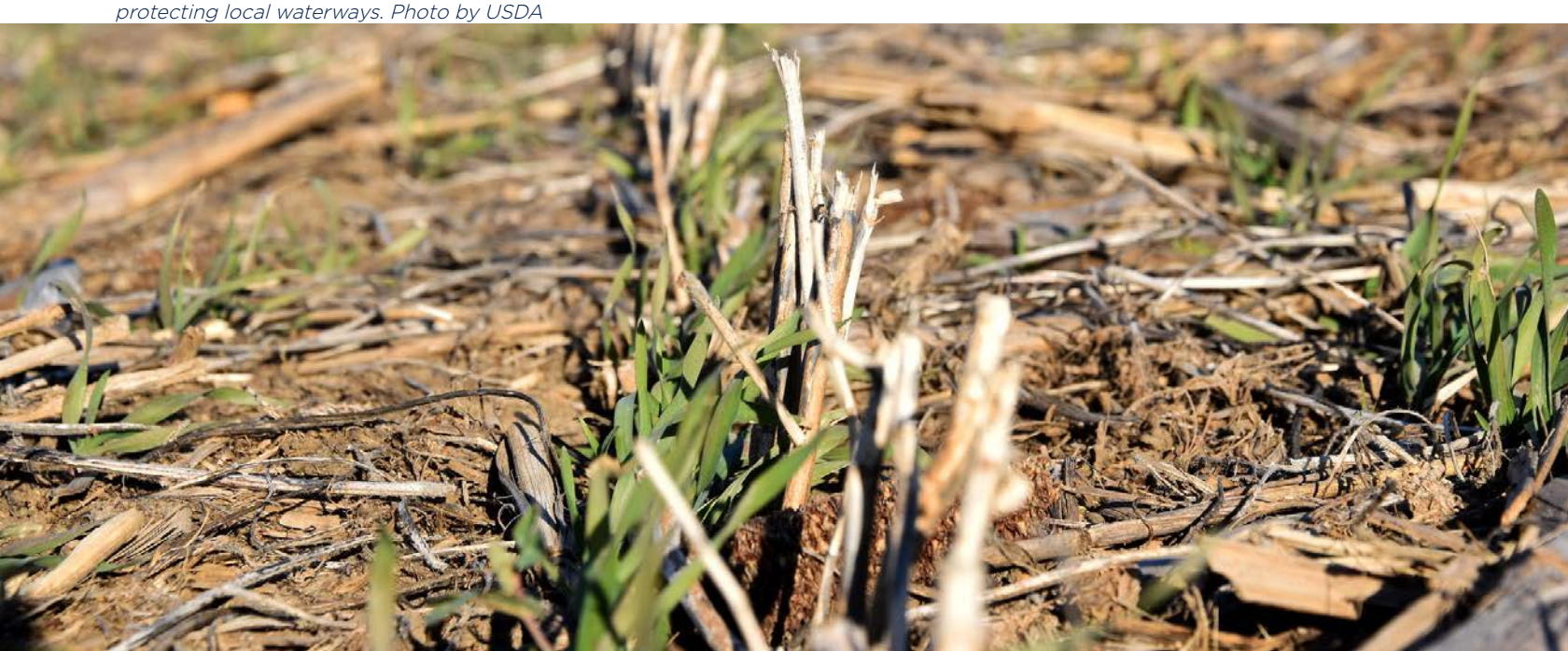
Farmers might undervalue the role of excess nutrients entering waterways and causing agriculture related water pollution.

Farmers showed low awareness levels around the water affordability issues many members of the general population face, including discontinuation of service.

Most farmers are concerned about the future of America's water resources but are divided on the degree of severity to the issues the nation faces.

Farmers are divided and largely unsure what drives the cost of tap water.

A winter cover crop emerges among soybean and corn residue in a no till field. Cover crops prevent erosion and nutrient runoff, protecting local waterways. Photo by USDA



ACTION PLAN
A COMMUNICATOR'S GUIDE TO ENGAGING FARMERS

Strengthen the foundation farmers need to serve as solutions to water challenges.

- Build awareness and understanding among farmers of the potential impact their individual and collective farm management practices can have on downstream communities, industries and infrastructure.
- Build awareness and understanding among farmers of the outsized positive impact they can have, individually and collectively, on the health and wellbeing of the nation's water resources and infrastructure.

Engage with farmers through mitigation and resilience-building programs aimed at minimizing water challenges.

- Build on the high baseline levels of concern farmers have for water issues to engage through geographically and culturally targeted tactics.
- Using the common ground of financial obligation and challenges which many farmers understand, motivate farmers to take action on their farm to better steward water resources and create a cascading "ripple effect" that can affect urban centers and struggling population groups downstream.

Empower farmers to maintain and improve their role as a solution to water challenges.

- Engage farmers as stakeholders in message creation and delivery to ensure relevance and buy-in.
- Equip farmers with the tools, education and systemic frameworks they need to continuously improve the concept of agriculture as a solution to water-related issues.
- Acknowledge the challenges but celebrate the successful implementation of practices that improve downstream water quality to prevent farmers from being misunderstood or mischaracterized — give a larger platform to the solutions agriculture is providing to water challenges.

Photo by USDA NRCS

“Water is a win-win or a lose-lose situation.”

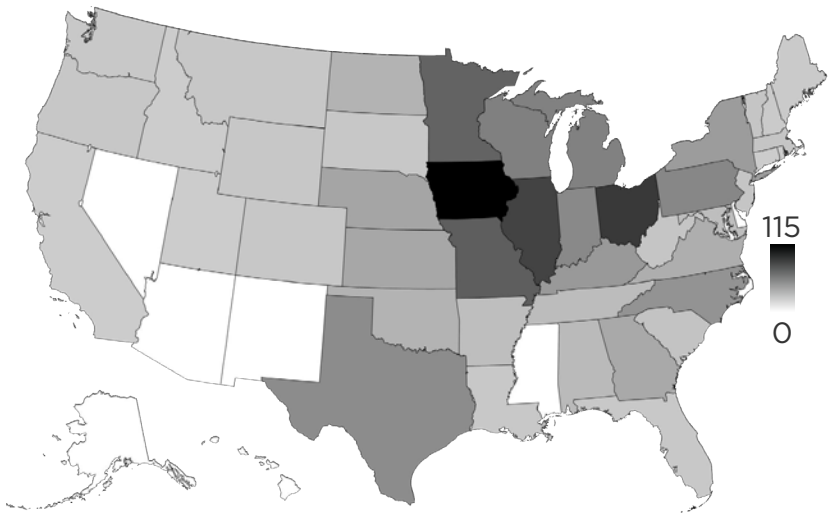
— Brian, Iowa Farmer

A constructed wetland in Floyd County, Iowa. Edge of field practices such as this play a critical role in filtering farm field runoff water, preventing nitrates from entering local waterways. Photo by Jason Johnson, USDA-NRCS.

RESPONDENT DEMOGRAPHICS

The sample of respondents to this survey generally reflects the demographic distribution of the 3.4 million U.S. agricultural producers documented in USDA's 2017 Census of Agriculture, other than in regard to age (this sample skews older[8]).

GEOGRAPHIC DISTRIBUTION



DEMOGRAPHIC DISTRIBUTION

Gender	
N = 912	Response Percent
Male	67%
Female	32%
Refused	1%

Age Range	
N = 912	Response Percent
18-19	0.2%
20-29	0.5%
30-39	3%
40-49	5%
50-59	12%
60-69	26%
70-79	28%
80-89	18%
90+	3%
Refused	5%

Highest Level of Education	
N = 912	Response Percent
Less than high school	2%
High school incomplete	4%
High school graduate	40%
Some college, no degree	14%
Two-year degree	10%
Four-year degree	18%
Some postgraduate or professional schooling, no postgraduate degree	1%
Postgraduate or professional degree	7%
Refused	4%

Part I:
What do farmers know about water issues facing the U.S.?

Photo by Phil Goodwin

Awareness and Understanding of Water Issues Among U.S. Farmers

In this first section of the report, we analyze responses to questions designed to illuminate how aware farmers are of water issues facing the nation and what their understanding of these issues is. This provides insights into the perceptions and drivers that shape the way farmers view the world related to water. It pinpoints areas where farmers might be farther ahead of the curve, as well as areas where they might be behind.

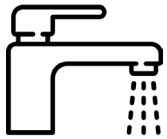
In illuminating these points, a robust foundation for communication and engagement programs to build upon, tailoring their approach to the farmer's profile of strengths, weaknesses and needs is provided.

KEY FINDINGS

Farmers tended toward very high awareness and understanding levels of the water cycle and other ecosystem processes related to water.

Farmers showed low awareness levels around the water affordability issues many members of the general population face, including discontinuation of service.

Farmers might undervalue the role of excess nutrients entering waterways and causing agriculture related water pollution.



Farmers are divided and largely unsure what drives the cost of tap water.

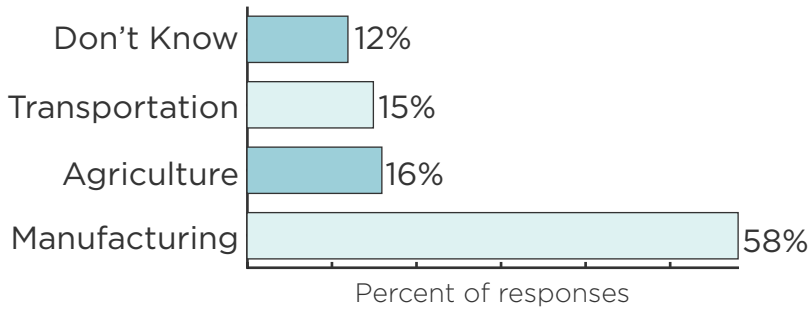
Farmers show minimal awareness that the nation's water and wastewater infrastructure are in need of greater investment than any other infrastructure area.

"Water and ag go hand-in-hand: without good ag management you don't have good water; without good water management you don't have good ag."

— Sam, Kentucky Farmer

Farmers might undervalue the role of excess nutrients entering waterways and causing agriculture related water pollution.

Of the following industries or sectors, which one do you think POLLUTES water the most?



A majority of farmers (58%) identified the manufacturing industry as the largest contributor to water pollution. Agriculture and transportation were both minimally connected to pollution in the respondent's minds, with each scoring a response rate of 15%. Notably, one in every eight farmer respondents (12%) reported they did not know which industry pollutes water the most.

According to the U.S. Environmental Protection Agency (EPA), agriculture-related nonpoint source (NPS) pollution is the leading source of NPS water pollution in America's rivers and streams; the second-largest source for wetlands; and a major contributing source for lakes[10]. Based on the EPA's reporting, response rates to this question point to a misperception around the unintended impact of excess nutrients entering waterways.

FARMER INSIGHTS: EXPERIENCES INFLUENCE WORLDVIEWS

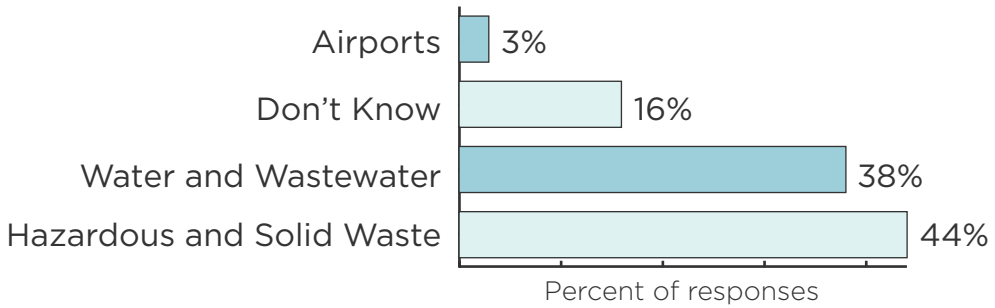
Several factors could be driving the low levels of recognition of agriculture's role in water pollution:

- Farmers recognize their own operations, and the agricultural industry as a whole, are much cleaner today than it was in years past, and might assume agriculture-related pollution must be down as well[11].
- Rates of water-related regulation and litigation have steadily increased in scale and in profile, as have catastrophic water quality issues (i.e. Flint, Des Moines Water Works).
- The issue of legacy nutrients[A] remains largely absent from public discourse around agriculture's role in water pollution resulting from nutrient runoff and is largely under debate by the scientific community.
- Science changes faster than opinions, and opinions are hard to change[12,13]. During the 1970s, '80s, and '90s a large amount of high-profile public awareness and regulation efforts related to the manufacturing and energy industries' water pollution levels took place, including the 1972 Clean Water Act[14]. It is likely many current farmers entered into the agricultural sector during those decades of high-profile water quality issues coverage that attributed water pollution to the manufacturing industry and not as the result of excess nutrients entering waterways.

[A] The phenomenon of "legacy pollution" refers to the slow release of man-made pollutants over time into an ecosystem due to various natural geologic and hydrologic processes. In many cases pollutants found in water today can be between 10 and 30 years old, meaning they were utilized in agricultural production decades ago. https://blogs.darden.virginia.edu/globalwater/2018/06/01/how-old-is-your-nutrient-pollution/

Farmers are mostly unaware of the state of America's water infrastructure and its need for rehabilitation investments.

As far as you know, which ONE of the following areas of infrastructure needs the most investment?



This question divided respondents: 44% responded that they believe hazardous and solid waste infrastructure need the biggest investment, while 38% responded water and wastewater infrastructure require it. Only 3% believe airports are in need of the largest investment, and 16% responded not knowing which area has the biggest need.

Analysis revealed low awareness levels among respondents in relation to which area of infrastructure they believed is in need of the most investment[15]. The EPA estimates that to maintain adequate service levels across the U.S.'s water and wastewater infrastructure, $472 billion dollars of investment will be required over the next 20 years[16].

FARMER INSIGHTS: THE RURAL CONTEXT

In part, farmer responses might be understood in the context of the rural areas in which they often live. These communities tend to have land classified for locally undesirable land uses, or LULUs[17]. Frequently, structures such as power plants, factories and waste management facilities are located in these areas, placing farmers in closer proximity to such land classifications and facilities than their urban neighbors.

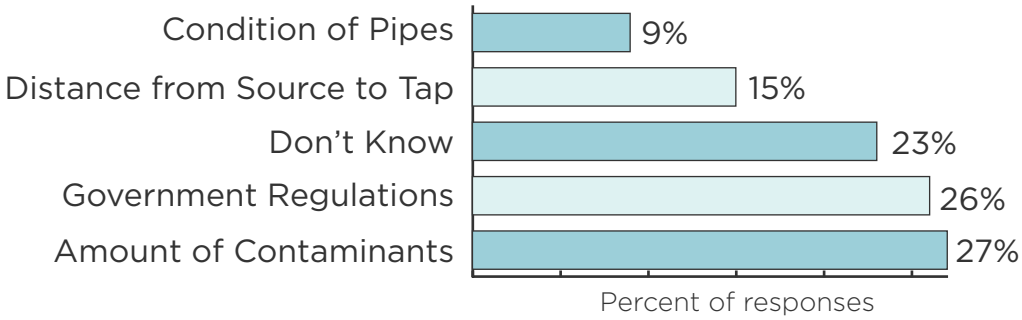
In many cases, urban area residents never see their waste management infrastructure — only the collection point they use. However, in rural areas, waste management sites have historically been routine eye (and nose) sores for the population, not to mention the environmental degradation caused by these sites.

On the other side of this, as many farmers and those in rural areas do not rely on community-based water/wastewater infrastructure for their water services, they are likewise unaware of the degradation of urban systems.

Response rates to this question can be explained by a lack of exposure and awareness of farming communities to the needs of urban water infrastructure, juxtaposed with a disproportionately high exposure to the effects of waste management infrastructure needs.

Farmers are mostly unsure what the primary driver for the cost of tap water is.

Generally speaking, which of the following has the BIGGEST impact on the cost of tap water?



Farmer perceptions of the factors affecting tap water costs varied and were distributed rather evenly, with no single response securing higher than a 27% response rate and three responses receiving essentially equivalent rates when margin of error is accounted for.

Farmers are divided and largely unsure what drives the cost of tap water. Research by the U.S. Bureau of Reclamation has shown the primary contributor to the cost of public drinking water services is derived from the treatment (removal of contaminants) needed to render the water safe for human consumption[18]. The same research points to maintenance as the second-biggest driver of drinking water costs, with government regulation scoring third.

FARMER INSIGHTS: HIGH-PROFILE HISTORY

In recent years, many situations demonstrating the negative impact of water source quality issues on public water utilities ability to operate have occurred, such as the Flint, Mich., crisis and the Des Moines Waterworks lawsuit[19,20]. The high-profile nature of these and other cases, as well as agriculture's implication in the Des Moines Waterworks lawsuit, has likely created a high awareness level and perception among some farmers of the impact source water contamination has on water service cost.

FARMER INSIGHTS: A CASE OF UNCERTAINTY

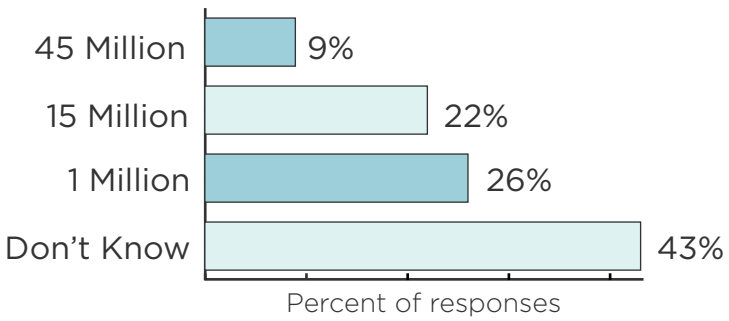
The response rate of "do not know" could be due to the potentially low number of farmers who rely on water services provided by a public utility and incur treatment costs. Agricultural producers typically live in rural areas with little or no access to public water systems. In many cases, their drinking water likely comes from an on-premises, privately managed well. In total, 43 million people living in the U.S. rely on a private well for their water[21]. Many of these households might be unaware of their water's contaminant levels and thus are unaware of the connection between contaminant removal and cost incurrence[22].

Photo by Serenity Mitchell

Photo by Sharon McCutcheon

Farmers are largely unaware of how many Americans are faced with water shut-offs due to an inability to pay their bill.

How many Americans get their water shut off each year because they cannot afford to pay their water bills?



Almost half of farmers, nearly 43%, responded they do not know how many Americans have their water service shut off each year due to affordability issues, identifying this as the most uncertain area for farmers across the entire survey. Following the "don't know" response rate, nearly 26% responded 1 million Americans face water shut-offs each year, 22% responded 15 million Americans are affected, and 9% responded 45 million Americans face this issue.

According to a 2016 industry estimate, nearly 15 million people living in the U.S. have their water shut off each year due to an inability to pay their bills, with some water utility providers having as high as a ~20% total shut-off rate for all customers[23].

FARMER INSIGHTS: A LARGELY INVISIBLE ISSUE

Similar to the previous question on treatment costs, of particular note here is the high level of responses indicating "don't know." In fact, this question had the highest rate of "don't know" responses of the entire survey. One interpretation of the driver for the high rate of farmers who don't know the national water shut-off rate could be because many farmers do not have a conventional water bill, they might not fully realize the size and seriousness of this financial burden on many households.

As previously discussed, many farmers do not rely on water supplied by public utilities in their homes and, as such, likely do not pay a traditional water service bill to a utility service provider as the majority of the U.S. does. The costs associated with water that many farmers pay tend to come in the form of well construction and maintenance, the power generation needed to operate the pumps that move water from its source into the home and fields, and the purchase of any water usage credits required in certain regions.

Farmers are highly aware and knowledgeable of issues related to the water cycle.

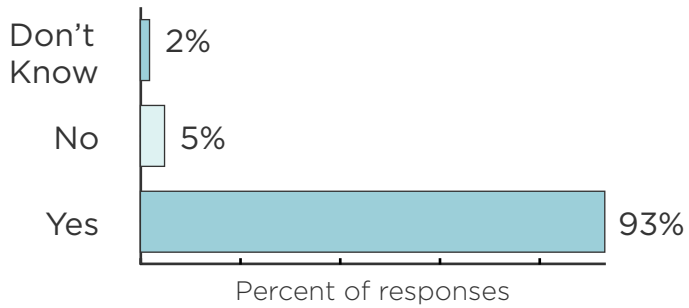
93% of farmers stated they know the original source of their tap water, 65% chose the correct answer regarding the role of wetlands, and 68% chose the correct answer regarding the destination of rainwater in most U.S. towns.

FARMER INSIGHTS: A WATER-CONNECTED AND RELIANT EXISTENCE

Source of tap water

93% of farmers surveyed responded they know the source of their tap water. As mentioned previously, many farmers typically live in rural areas with little or no access to public water systems, relying instead on private wells they manage. Regardless of their crop or livestock production mix, farmers rely on water and the local hydrologic cycle to maintain production. Thus, farmers are extremely connected to local water resources and likely to be aware of them and their uses, driving the high affirmative response rate.

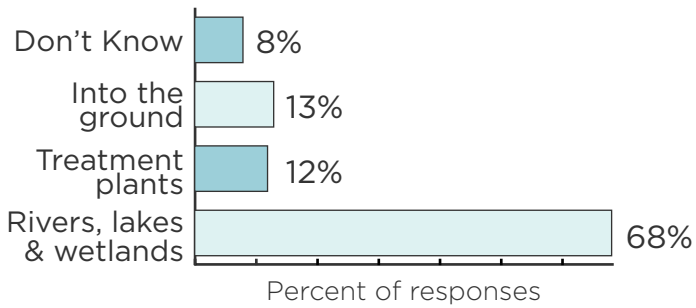
Do you happen to know the original source of the tap water in your home, such as a river, reservoir or underground aquifer?



Role of Wetlands

Responses to this question are likely driven by the inherent understanding of drainage and the hydrologic cycle created and fostered through agricultural production. In addition, the presence of wetlands and the impact of a damaged wetland on farm acres has been heavily communicated by the USDA to farmers. As a result of continual engagement, coupled with deep experience, it is a reasonable outcome that farmers are able to correctly identify the role wetlands play in the ecosystem.

In most U.S. towns, when it rains, where does most of the water that goes into storm drains end up?



Actionable Insights:
Engagement Recommendations

Engage with farmers through awareness building and educational activities around the role of their individual and collective farm management choices in mitigating the introduction of excess nutrients into waterways, using an approach tailored to account for their unique perceptions.

Recognizing farmers might feel underappreciated due to the way their commitment to water stewardship is often under-represented (or entirely omitted) in public discourse, care should be taken to prioritize recognizing and highlighting the many positive improvements they are responsible for, rather than relying on an adversarial and accusatory framing and playing "the blame game."

Substantial emphasis should be placed on educating and informing early-career or beginning farmers about the role of agriculture in water quality, including the loss of in-field nutrients due to runoff, as well as equipping them with the requisite skills to enable ongoing business development and intellectual responsiveness related to natural resource stewardship as scientific consensus and understanding improves over time.

Engage farmers in public advocacy efforts to raise awareness of water infrastructure needs strategically.

Recognizing farmers might rely on access to public water infrastructure differently than many others across the U.S., efforts to engage farmers on ballot and advocacy initiatives to secure increased public funding should build a robust case for the dire investment need.

Photo by National Park Service

Actionable Insights:
Engagement Recommendations

Raise awareness among farmers of the large number of Americans who face water service shut-off due to affordability issues by establishing a common ground between farmers' deep understanding of financial obligations with water affordability issues faced by many households.

Farmers, arguably as much as any other group, have a deep awareness and understanding of the effect financial obligations can have in the context of low annual income: in 2019 total farm operation bankruptcies were up 24% from 2018 and the U.S. total farm debt is expected to surpass $415 billion[24].

Farmers tend to have a deep understanding of the impact of financial obligations — and how failure to meet those obligations can limit access to land, equipment and inputs. Because of that context, it is reasonable to believe many farmers would be receptive to discussing the unintended economic impact of farming practices that impair water quality on downstream water users. Working collaboratively with farmers to understand the outcomes of farming practices on neighboring communities could have a positive impact on farmer-led efforts to conserve, protect and improve water quality.

Create engagement efforts for farmers around water issues tailored to match their high levels of hydrologic systems understanding.

This high level of understanding among farmers about the source of their water and the function of wetlands points to a high level of natural resources awareness. As such, engagement with farmers around water should build on their high levels of basic issue comprehension and awareness. Additionally, this bolsters the reliability and trustworthiness of the farmer population as an informed messenger group and experts. Opportunity exists to establish farmer credibility through the use of their shared experiences to communicate with the general public about the connectivity between water resources, agricultural production and how farmers have acted as natural resources stewards, not just users.

USDA NRCS field staff working with a Texas cattle rancher to ensure protection of local waterways through use of livestock fencing. Photo by USDA NRCS Texas

Part II:
How concerned are farmers about water issues in the U.S.?

Mississippi River floodwaters destroy a corn field near Yazoo City, MS. USDA Photo by Lance Cheung.

Corn shows the affect of drought in Texas. USDA photo by Bob Nichols.

Concern Levels Related to Water Issues Among U.S. Farmers

In this section of the report, we analyze responses to questions designed to chart out how concerned farmers are related to water issues. This is designed to demonstrate potential motivations or precursors to motivation present among farmers. Through engagement programs, these findings can be used to drive conservation practice adoption and support for policy initiatives.

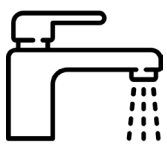
This data highlights overall high frequencies of concern among farmers with a weighting toward lower, but present, levels of concern.

KEY FINDINGS

Farmers expressed more concern with the quality and availability of naturally occurring water resources, compared to community water systems, yet still have some concern over community water infrastructure.

Most farmers are concerned about the future of America's water resources but are divided on the degree of severity to the issues the nation faces.

Farmers believe they will face water challenges in the future such as fresh water supply and demand issues and an increase in flood events.



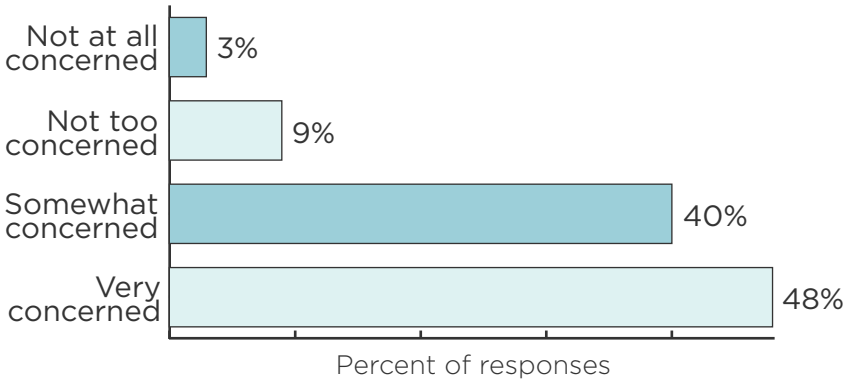
Few farmers expressed high levels of concern around the safety of the tap water in their home.

"Nothing is more important to [*our operation*] than water."

— Michelle, South Carolina Farmer

Most farmers are concerned about America's water resources, but not always at the highest level of concern.

How concerned are you about the future of America's water RESOURCES, such as lakes, rivers and streams?



88% of farmers responded they are "very" or "somewhat" concerned about America's water resources, with 12% responding that they are "not too" or "not at all" concerned.

Many farmers are concerned about the future of America's water resources but less than half are very concerned. Water issues are forecast to be one of the major issues facing the U.S. in coming years. According to the 2018 National Climate Assessment, "The quality and quantity of water available for use by people and ecosystems across the country are being affected by climate change, increasing risks and costs to agriculture, energy production, industry, recreation and the environment ." By 2040, nearly half of the lower 48 states will experience high water risk according to World Resource Institute's[26] Aqueduct data set[27].

FARMER INSIGHTS: AN EXISTENTIAL THREAT

Farming is integrally linked to water. It is as much of a farm input as any seed or fertilizer. Given farmers' reliance on water, it is unsurprising farmers are concerned about water resources. Additionally, research has found that concern levels are a determinant of likeliness to act[28,29]. High concern among farmers presents a clear opportunity to engage a willing audience in the common cause of supporting America's water resources.

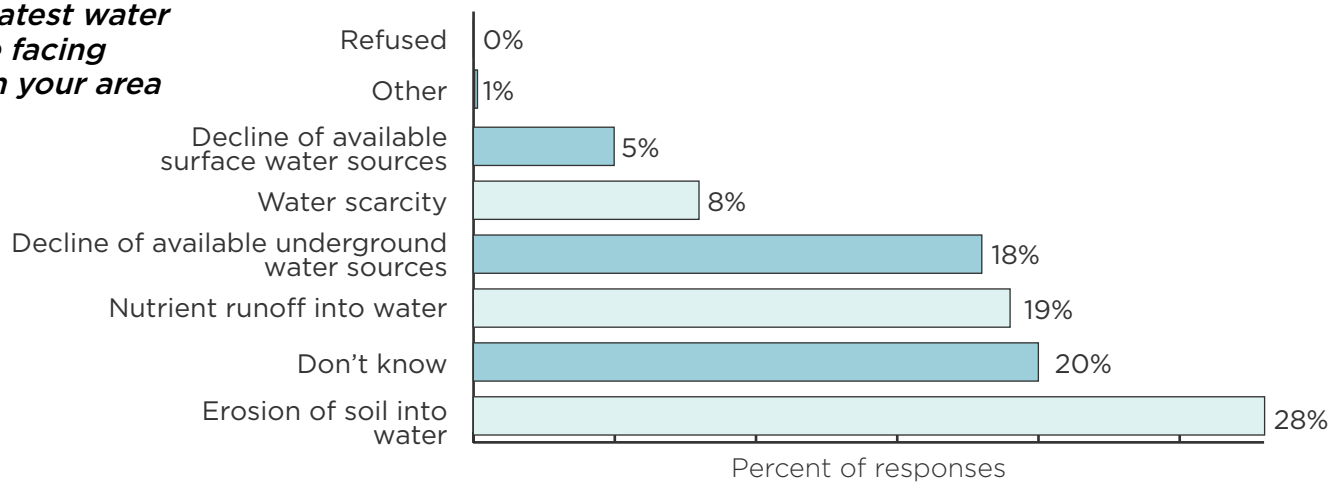
FARMER INSIGHTS: ABUNDANT BUT DIVIDED CONCERN

Almost all (88%) farmers responded they are concerned about water resources to some extent. This finding is in line with several other data points identified: farmers tend to agree on the issue but are divided in the degree of severity. As farmers who are reliant on access to high-quality water resources and who interact with water resources regularly, this group should skew toward higher levels of concern rather than being split. This might be driven by significant levels of skepticism related to weather and climate-related science across farmer groups[30].

Photo by USDA Texas

Farmers face many diverse water challenges but are surprisingly uncertain on which challenges are most impactful.

In your opinion, what is the greatest water challenge facing farmers in your area



Farmers were asked, of the five options offered, which is the greatest challenge facing farmers in their area. The largest percentage of respondents identified soil erosion into water (28.3%). Following that response rate were nutrient runoff (19%), declining underground water availability (18.2%), water scarcity (8.5%) and declining surface water availability (4.7%).

FARMER INSIGHTS: UNIQUE GEOGRAPHIES CREATE UNIQUE CHALLENGES, BUT UNCERTAINTIES REMAIN

This survey captured responses from farmers operating in 43 states across all nine USDA farm resource regions[31] and all nine U.S. climate regions as defined by National Oceanic and Atmospheric Administration (NOAA)[32]. The distribution of challenges identified can be linked to the geographic sample distribution of farmer locations. Water challenges are generally driven and constrained by geography and climate; in the Western U.S. water scarcity is the most pressing issue[33], while in the Midwest soil erosion and nutrient runoff are more pressing[34], and in the Southeast the primary concern is groundwater decline[35].

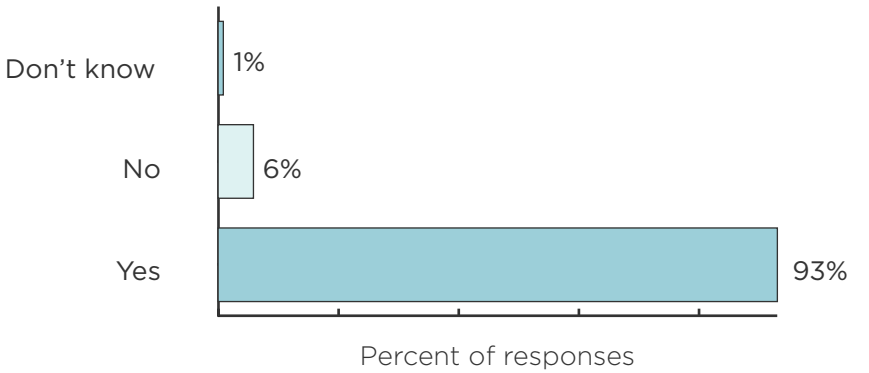
Nearly one in five respondents stated they do not know the greatest water challenge facing farmers in their area. Given that each option in this question has the potential to greatly impact production yield and quality, it is surprising so many farmers would answer they don't know. This phenomenon is a prime area for further research and understanding why farmers feel uncertain could be an impactful data point.

Farmers believe water challenges are on the horizon.

93% of farmers believe there will be an increase in demand for water in the next two decades, 69% believe there will be a decrease in the supply of fresh water, and 63% believe there will be an increase in flooding. Levels of natural resource use, weather events resulting in flooding and a population estimated to reach 9 billion people by 2050[36] are often discussed in the agricultural sector as each could change the agricultural landscape.

FARMER INSIGHTS: CHALLENGES AT THE DOOR

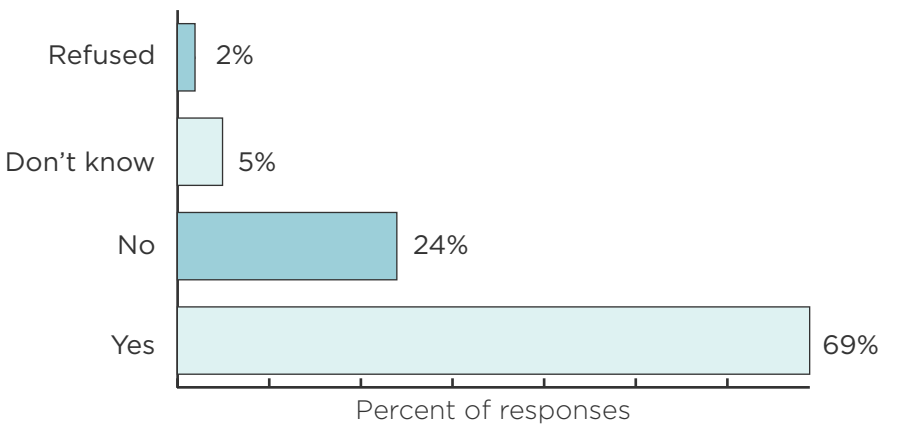
Is an increase in demand for freshwater?



Increased demand for fresh water

Demand for water is projected to grow in the coming decades, according to the National Environmental Education Foundation[37]. An extreme majority of respondents (93%) stated they think an increase in demand for water is likely in the next 20 years. This response rate is likely driven by the growing number and profile of interstate lawsuits around freshwater consumption[38] and water shortage issues such as what California saw in the past decade[39]. Many farmers have directly faced water demand issues already. Likewise, on the global stage, major metropolitan areas such as Cape Town, South Africa[40] and Chennai, India[41] faced the real threat of water demand outstripping water supply.

Is a decrease in the supply of fresh water likely?



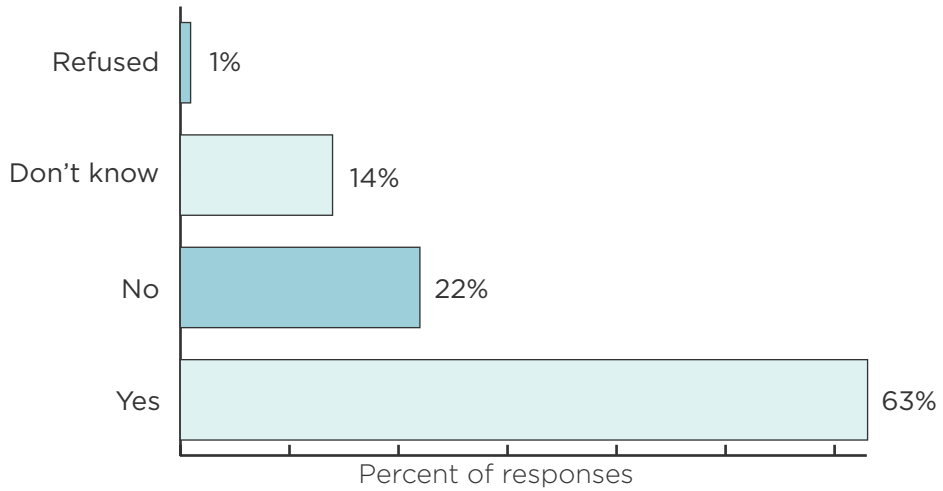
Decrease in supply of fresh water

Scientists report freshwater availability in the U.S. is expected to decrease in the coming decades[42], according to the 2018 National Climate Assessment. The majority of respondents (69%) replied they do believe a decrease in the supply of freshwater is likely over the next 20 years. This response rate is likely driven, in part, by the recent high-profile water shortages referenced here. Additionally, while flooding and record rainfall might be a current trend in many places, according to the National Drought Monitor lab at the University of Nebraska-Lincoln, much of the country (over 50% at times) has experienced persistent drought levels since the year 2000[43].

Increase occurrence of flooding

A significant majority (63%) of farmers responded they believe an increase in flooding will occur in the next two decades. Warnings about the risk posed to crop production by flooding are regularly issued to farmers by the U.S. National Oceanic and Atmospheric Administration (NOAA) and USDA[44]. In 2019, USDA issued 1,351 excessive rain, moisture and humidity designations across the 2,163 county or county regions it serves[45]. That equates to 62% of USDA service areas under disaster designations for excessive water. It is highly likely a majority of farmers have either experienced a flooding event, know someone who has experienced such an event, or heard about the impact of floods on other farms. This could explain why over two-thirds of responding farmers view flooding as an increased risk in the next 20 years.

Is an increase in flooding likely?



Landon Kerby, NRCS district conservationist spot checks new drop nozzles meant to conserve water used to irrigate crops on a center pivot sprinkler system in Morton, Texas. Photo by USDA NRCS Texas

Farmers mostly show concern for America's water infrastructure future, this is juxtaposed to their low awareness on its investment needs

Almost 86% of farmers surveyed responded they are concerned, to some degree, about the future of America's drinking water infrastructure. Only 12% of farmers said they aren't concerned, and less than 2% said they were unsure.

When asked which portion of America's infrastructure needs the largest investment for its renovation and continued usability, only 38% of farmers named water infrastructure. This highlights a disconnect where farmers are concerned about water infrastructure but aren't aware of the scale of the investment needed.

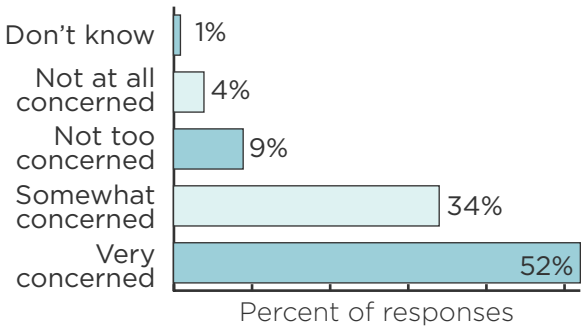
As mentioned elsewhere in this report, water infrastructure is in dire need of attention, with the EPA estimating that to maintain adequate service levels across the U.S., $472 billion dollars of investment will be required over the next 20 years[46].

66% of farmers surveyed expressed some level of concern about the safety of their home's drinking water. Of particular note here, is that only two individuals out of the 912 who responded to this question claimed they "do not know" if they are concerned or not — indicating a decision has likely been made in regard to the safety level of drinking water for the vast majority of farmers.

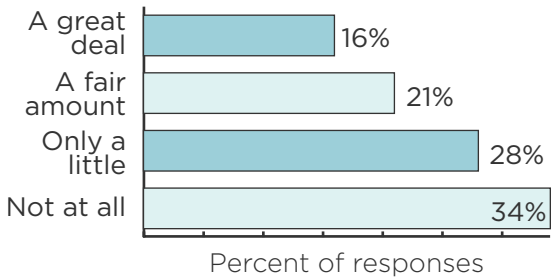
It is estimated roughly 8% of community-managed water systems across the U.S. don't meet EPA quality standards and each year nearly 32 million cases of waterborne disease occur[47]. This is in addition to cases such as Flint, Mich., where the long-term effects of contaminant exposure in drinking water are less understood. However, this is not just an urban issue. Research by the U.S. Geological Survey has concluded that almost one in four private wells contain contaminate levels above public health recommendations and regulations[48].

While the U.S. enjoys some of the safest and cleanest drinking water in the world, it still faces significant challenges and areas for improvement.

How concerned are you about the future of America's drinking water INFRASTRUCTURE, such as pipes, pumps and treatment systems?



How much do you worry about the safety of drinking water from your tap at home?



FARMER INSIGHTS:
SELF-MANAGED WATER SOURCES

It is important to keep in mind many farmers operate in rural areas and might rely on private wells (over 15 million households rely on these or similar sources[49]) for their drinking water, rather than community-managed water systems. In these situations, there is no service provider who ensures water quality through regular treatment and testing — this is left up to the household to manage itself. A household with well-supplied water is likely closer linked to their water source than a household with a community-managed source because the maintenance of that well is their obligation.

Photo by Grendelkhan


Photo by USDA NRCS Montana

Actionable Insights:
Engagement Recommendations

Move farmers from low or middle levels of concern to high levels, through engagement and communication efforts.

Knowledge levels are not the only factor at play in the decisions people make. Levels of concern also matter[50]. Many successful environmental behavior-change efforts aim to increase a population's level of concern on an issue, then redirect that increased level of concern into action.

While there are high concern frequency rates among farmers toward water resource issues — many farmers self-report themselves to be only marginally concerned. A priority should be placed on moving these "marginally concerned" farmers into the "very concerned" group, to help facilitate the change process. This could be accomplished by designing programming that builds off their moderate concern as a foundation for increasing their levels of concern.

Utilize farmers' generally high frequency of concern for water issues as a foundation to engage with them through both mitigation and resilience-building programs aimed at minimizing and preparing them for future water stressors.

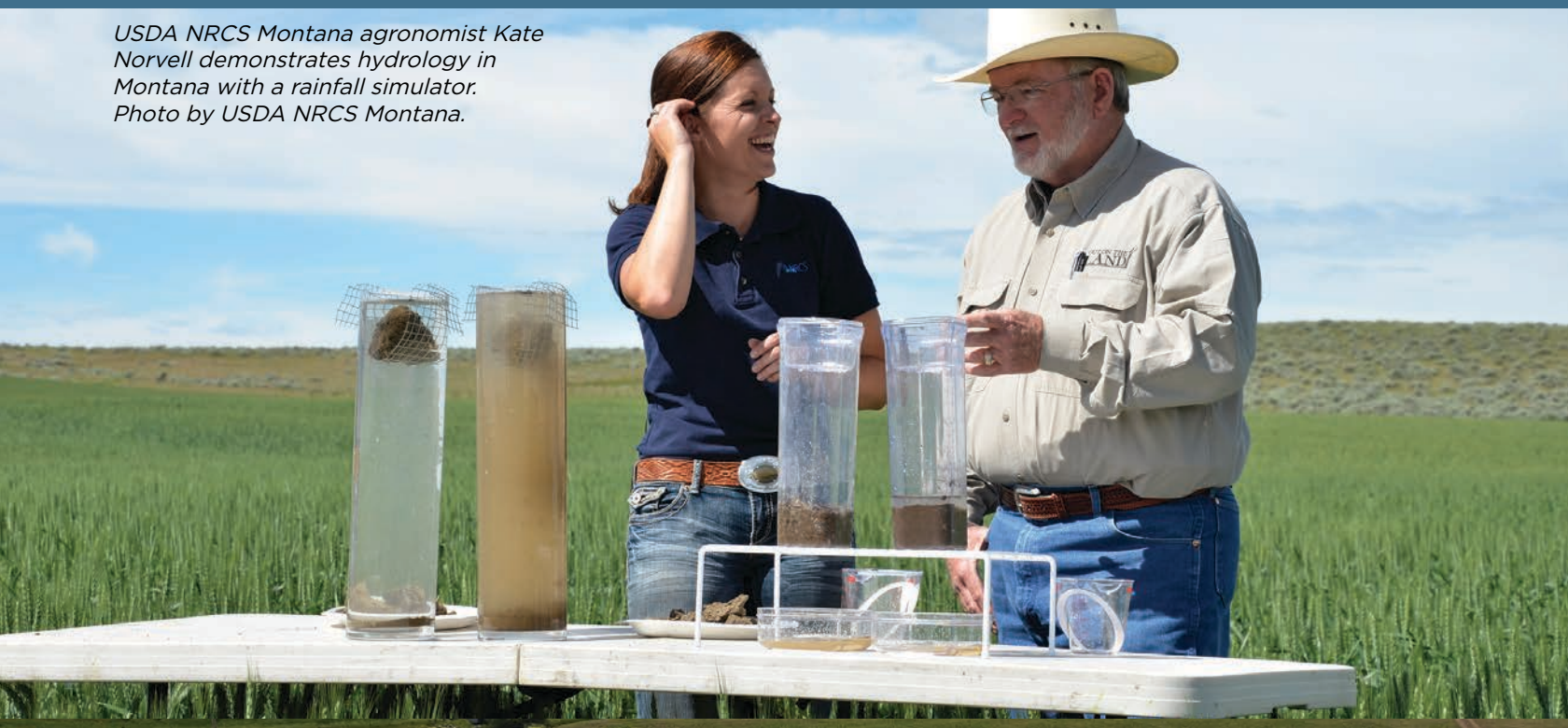
Responses to these questions present an opportunity for communicators to engage concerned farmers and learn more about their perspectives on levels of water use, declining freshwater supplies and the value of implementing conservation agriculture or resiliency focused farm management practices.

Learnings from this increased understanding can be used to inform outreach and education tactics to be delivered among farmers who might not perceive these impacts to be realities. Farmers know they use more water than non-farmers and as is evident from responses to open-ended questions in this research, they also realize it is not in their own best interest to deplete or damage water sources.

Create engagement tactics that are geographically relevant or linked to local issues.

Water related issues and frequency of media coverage vary across the nation's farm regions. To successfully engage farmers on the topic of increased water quality conservation and improvement, communication tactics need to be geographically relevant to the target farmer audience. Some states experience flood events more than others, and some states have active water rights policies whereas others do not. Ensuring the delivery of salient messaging is essential to farmer engagement.

Part III:
What Actions Do U.S. Farmers Take Toward Water Issues?



USDA NRCS Montana agronomist Kate Norvell demonstrates hydrology in Montana with a rainfall simulator. Photo by USDA NRCS Montana.

Bioreactors, such as this one being installed in Iowa, filter water as it leaves the farm field, preventing nitrates from entering local waterways. Photo by USDA NRCS Iowa.

Action Levels Toward Water Issues Among U.S. Farmers

In the final section of this report, we analyze responses to questions that demonstrate the levels at which farmers take action around water issues. Responses to the action-oriented questions demonstrate a farmer population that is highly engaged in addressing water challenges.

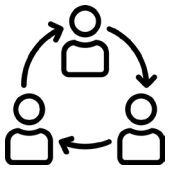
These findings can be used to accelerate programs by using farmers' already high engagement to scale further action.

KEY FINDINGS

Around nine in 10 farmers say they take action on a daily basis to protect and conserve water.

"I try to stay involved in local politics around water issues."

— George, Ohio Farmer



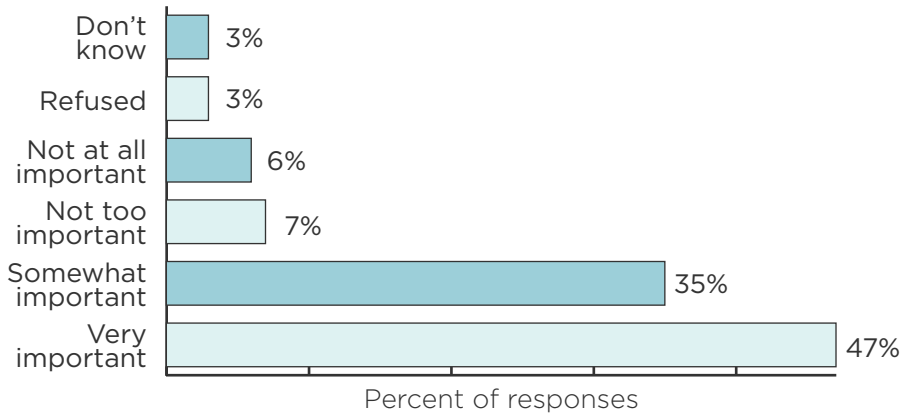
Less than half of farmers share information about water issues with their peers once a month or more frequently.

Around eight in 10 farmers require their political candidates to have a stance on water conservation and protection.

Around 6 in 10 farmers are interested in learning more about water related issues.

Most farmers consider water issues when choosing who to vote for.

When deciding who to vote for, how important is it to you that a candidate says taking care of water resources is a priority for them?



A majority of farmers (82%) stated it is very or somewhat important to them the candidate they vote for prioritizes taking care of water resources.

Similar to other questions, while the majority of farmers agree it is important that their candidate support protecting water, there are divided levels of just how important this is. 35% of farmers replied it is somewhat important while 47% responded that it is very important.

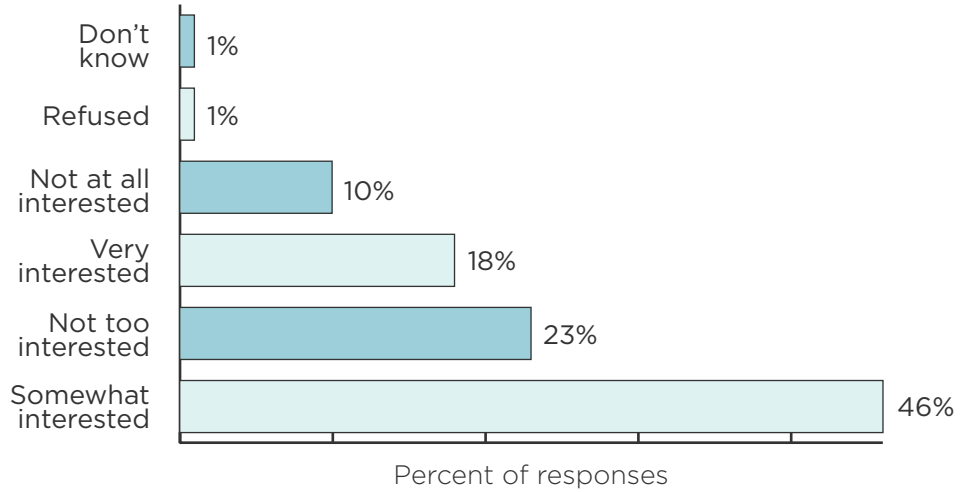
Elected officials are responsible for decision making on regulation, bond and tax initiatives, and infrastructure investments related to water resources; they play a critical role in either alleviating or exacerbating the challenges people face. By holding elected officials responsible for water protection and investment, individuals can ensure the issues are addressed.

FARMER INSIGHTS: REGULATION'S UBIQUITOUS INFLUENCE

A primary driver for farmers' prioritization of candidates who vow to protect water is likely related to farmer's history with federal regulations. Many farmers have felt unfairly burdened by government water regulations over the years, and many politicians campaign across farmland on promises to address this . As with other voters, most farmers tend to vote in favor of candidates whose views align with their own. This includes an appreciation for the role water plays in agricultural production. As one farmer from Nebraska stated, "Without water, there is no food."

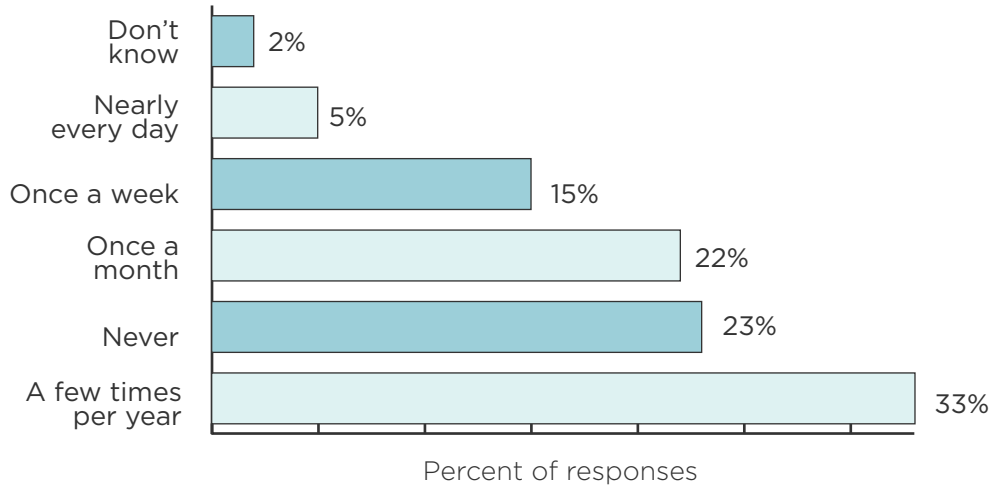
Farmers want to learn more about water related issues but are not as likely to share information.

How interested are you in learning more about water and water related issues?



64% of respondents stated they are very to somewhat interested in learning more about water and water-related issues while 33% are not too or not at all interested.

How often do you share information with others about water and water related issues?



When asked about how frequently they share water-related information, farmer-respondents stated they don't tend to share very frequently. 42% of farmers stated they share water-related information anywhere from daily to once a month, while 56% share a few times a year or never.

FARMER INSIGHTS:
FORMAL EDUCATION DOES NOT NECESSARILY DICTATE INTEREST IN LEARNING

Of the 64% that are very to somewhat interested in learning more about water-related issues, 59% self-reported themselves as less formally educated, meaning they have taken up to some college course but have obtained no formal degree. Of respondents that have a two-year degree to a doctorate, 39% stated they were interested in learning more.

This finding is interesting in relation to a belief that individuals who are less formally educated have less interest in learning more about different topics. This finding from the research challenges that belief and shows level of education is not always an indicator of receptiveness.

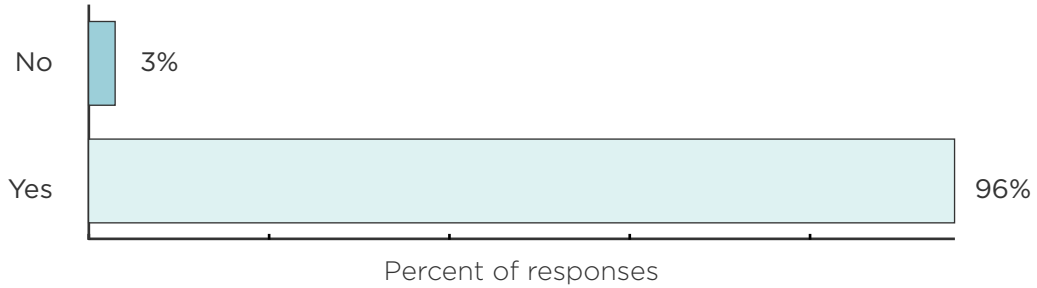
FARMER INSIGHTS:
SPEAK TO FARMERS AT THEIR LEVEL

Farmers operate in a water-dependent profession. As this research has found, farmers' self-reported water resource-related knowledge levels are high and many likely feel their knowledge levels are adequate for the job they do and the lives they lead. However, there are still water-related knowledge gaps that farmers may be less aware of, such as the invest needed to update water infrastructure or affordability issues that millions of people face each year. This finding should be viewed as an encouragement to communicate with farmers more about water, especially outside of topics such as water cycles and the role of wetlands.

USDA NRCS field staff demonstrates soil health practices to farmers at a field day.
Photo by USDA NRCS South Dakota

Nearly all farmers state they take action to conserve and protect water daily.

In your day-to-day life, do you try to do things that conserve water or protect water from pollution?



Nearly all farmer respondents (96%) stated yes, they do try to take action daily to conserve and protect water resources, while only 3% responded no, they do not. To conserve water each day, people either actively think about conservation, ingrain it into their routines or both.

FARMER INSIGHTS: A UNIQUE RELATIONSHIP WITH WATER

Farmers have a different relationship to water than the general public — they rely on it for their livelihood, they live near it and their daily actions on the farm affect the local water ecosystem. Additionally, agricultural production is reliant on water, and many water-protecting and water-conserving behaviors/practices/technologies are a routine part of daily farm management.

Too little water, as well as too much, can damage a crop to a point beyond profitability. Efficient use and timely application of inputs, such as water and fertilizer, are essential to a farmer's success.

Communication tactics should address this when engaging with farmers to highlight the direct benefits of water conservation as well as the benefits to downstream communities.

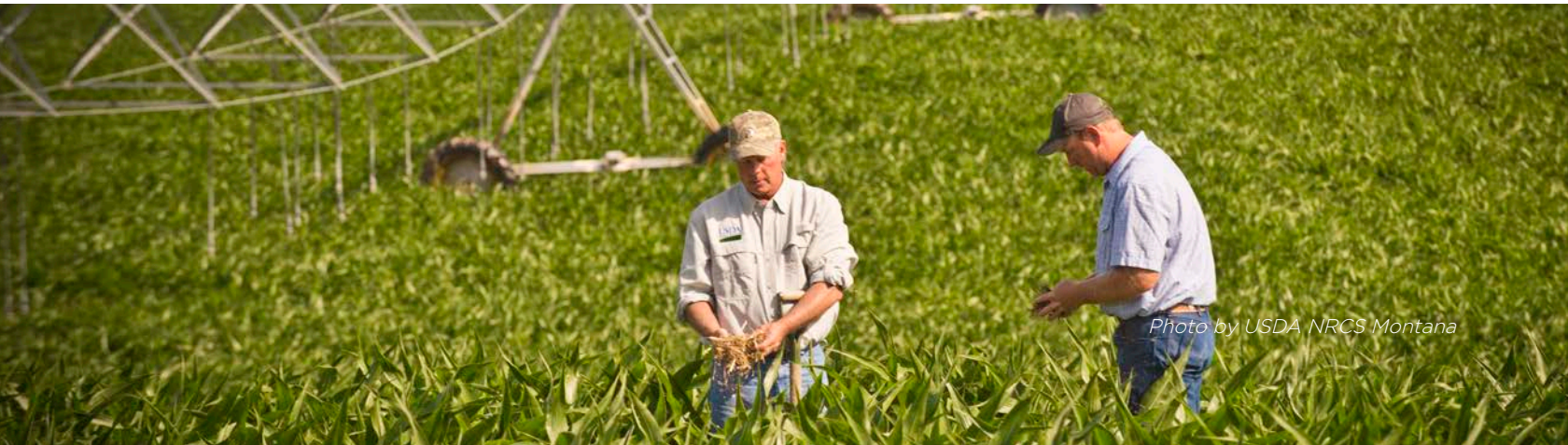


Photo by USDA NRCS Montana

Actionable Insights:
Engagement Recommendations

Mobilize farmers to act in support of increased institutional investment in water infrastructure and more effective water regulations.

Farmers, just like the general public, are voters and taxpayers — their support is critical for government agencies to obtain when implementing activities to solve water challenges. Responses to this survey show farmers place critical importance on their political candidate's stance on water. While farmers might not rely on public water infrastructure in the way urban communities do, as voters and taxpayers their support is nonetheless critical.

To mitigate a common concern among farmers that agricultural regulations are often implemented without farmer input, it is important to solicit producer input. Research has found that leaders who engage stakeholders early can help drive increased understanding and acceptance of proposed systems change. The same research finds stakeholder engagement strengthens trust that the change is credible, meaningful and equitable. Farmers should be called upon as subject matter experts to co-create water regulation and investment programs.

Empower continuous improvement by engaging with farmers through education.

Farmers are an open audience interested in learning more about water related issues but the messages they receive need to be salient and geographically relevant. Capitalizing on this hunger for new information, organizations can empower and equip farmers with emerging science and best practices to ensure their operations see continuous improvement in their environmental outcomes.

Cover crops residue prevents soil runoff and creates a healthy environment for soil health and prevent erosion and runoff entering local waterways. Photo by USDA South Dakota

Actionable Insights:
Engagement Recommendations

Celebrate water quality wins led by farmers to scale adoption of water-focused, on-farm management practices.

Communicators can use the comments made by farmers to showcase their conservation story to stakeholders along the agri-food value chain, including the public. If a farmer establishes a buffer strip, for example, he or she is making a sacrifice by retiring that land to safeguard adjacent waterways by mitigating runoff and soil erosion. Voluntary adoption of such practices speaks volumes about the importance farmers place on water quality. Farmers might feel too much public attention is placed on the negative impacts of agriculture, without coverage of the many positive outcomes agriculture provides. Giving a larger platform to the positives might motivate farmers to engage in conservation activities.

Utilize farmers' high likelihood to routinely take action to protect and conserve water as a foundation to 1.) position them as vanguards and leaders of the water conservation movement and 2.) encourage the implementation or scaling of in-field water quality improvement practices

Farmers feel largely misunderstood and that the non-farming population does not necessarily understand the efforts they take to save or protect water. Communicators can support farmers by creating messages that increase understanding of what in-field water conservation or quality improvement practices look like and the effect they have on downstream water quality. This is an opportunity to highlight water conservation practice successes and engage farmers in a way they can share their water protection efforts and actions. As water heroes are identified and lauded, it is likely more farmers will feel they too have a story to share and might be more comfortable sharing.

Migrating waterfowl forage in a rice field in coastal Texas. Agriculture provides critical habitat for aquatic wildlife.
Photo by USDA NRCS Texas

CONCLUSION

Mississippi River Delta
Photo by Universal Images Group

One of the main variables in the increased adoption of conservation agriculture is time[52]. Change is not something that tends to happen in a short amount of time. Regardless of how dire the need is, time is still needed to understand the impact, develop solutions and do so in a way that mitigates further damage[53]. The 1930's dustbowl prompted the creation of the Soil Conservation Service, now referred to as the NRCS, whose charge continues to be to usher in more sustainable, conservation-based farming practices that conserve and protect our natural resources.

Government, state-led and other agricultural agencies have worked together with farmers for decades to reach the increases that NASS and ERS have reported on in the past seven years.

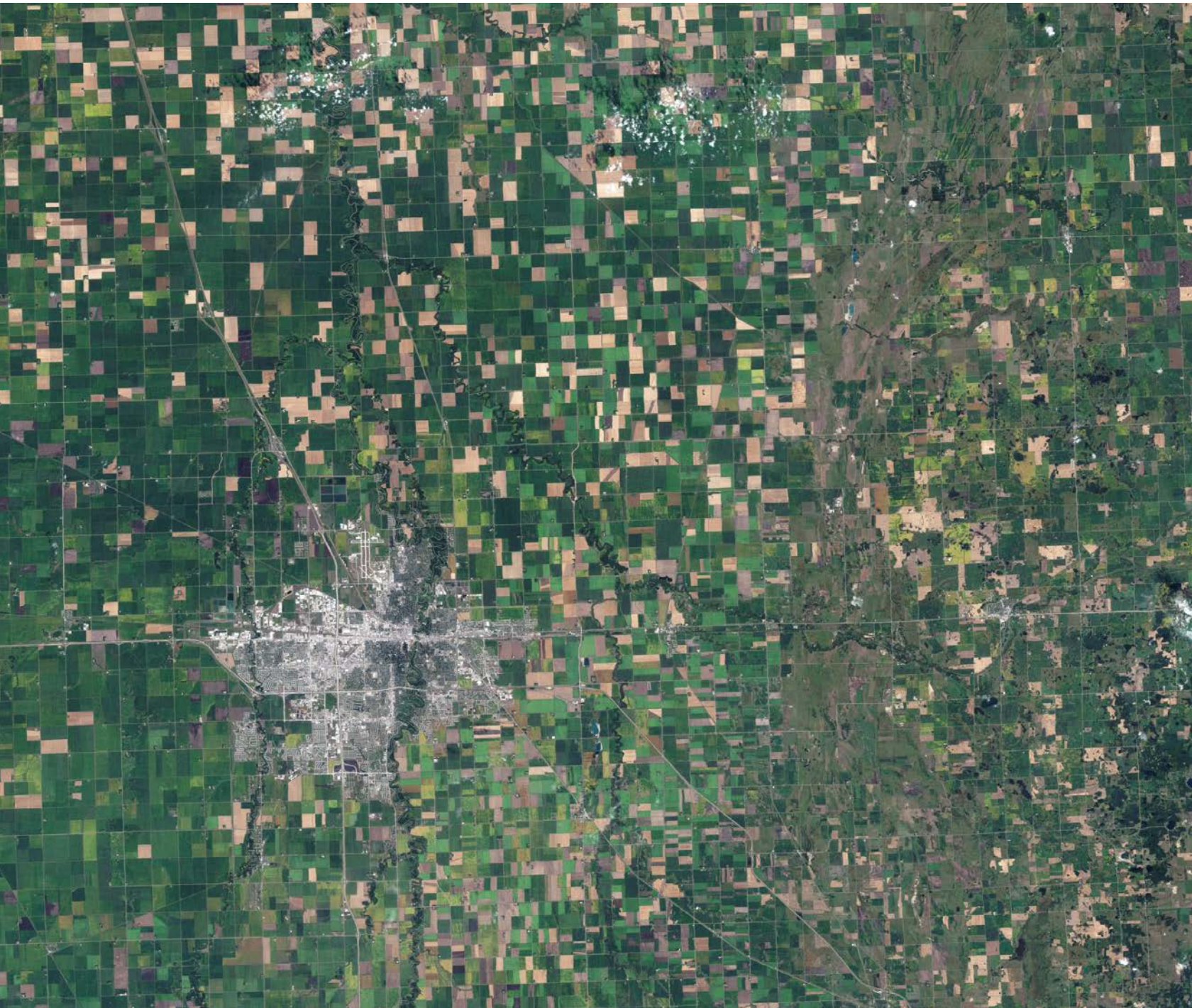
That upward trend is still tracking, but there is a disconnect between what farmers do, how they are perceived and what they perceive to be agriculture's impact on downstream water quality.

Research has found engagement of stakeholders leads to long-term viability and acceptance of change. This report, and the findings herein, are meant to serve as a way for water communicators to strengthen relationships between farmers, the agri-food value chain and the public to secure clean water, in perpetuity, for everyone.

“Every day is Earth Day to a farmer; we are always doing everything we can to keep water resources clean.”

— Mike, Ohio Farmer

Satellite imagery of North Dakota and Minnesota shows the inter-connection between farmland, water resources like lakes and rivers, and our cities (Fargo, ND in the bottom left).
Photo by NASA Earth Observatory, Jesse Allen



Appendix

USDA NRCS Virginia Cropland Agronomist Chris Lawrence (right) gives former NRCS Assistant Chief Kirk Hanlin a hands-on experience with healthy soil following a soil health demonstration event. Photo by USDA / Lance Cheung

METHODOLOGY

A survey instrument was co-developed by researchers from Trust In Food and The Water Main, comprising a mix of open-ended and multiple-choice questions. To facilitate improvements in social marketing and behavior change program design, questions were fashioned to provide insight into the awareness, understanding, concern and action levels farmers hold related to water-issues[54]. Questions were designed to closely match those survey questions administered by The Water Main in their general public-facing research[55].

The survey was administered over the phone by trained research professionals, participation was voluntary and non-compensated. Respondents were selected at random from Farm Journal's audience database. Each individual was asked to answer the questions to the best of their ability and had the option of passing on any questions they preferred not to answer. All respondents were required to currently serve in an operator or owner-operator role for a U.S. farm business, which includes at least 20+ crop acres and/or 20+ head of livestock or they were disqualified from completing the survey.

In total, 912 individuals representing agricultural production across 43 U.S. states and representing production in all nine USDA agriculture resource regions, completed the survey[56]. Only three questions received a greater than 1.5% response rate for the "refuse to answer" response choice. A 3% +/- margin of error should be considered for the survey responses, based on a total sample size of 912, a 95% confidence level, and a total U.S. farmer population of 3,399,83457. All percentages have been rounded to the nearest whole number unless otherwise stated, as such some totals might not equal 100.

Care should be taken when generalizing the findings in this report to the total U.S. farmer population, while the respondent sample here closely matches the national averages in terms of most demographics, it is not entirely weighted or balanced.

The term farmer is used throughout this report for simplicity to refer to all respondents, no matter their production style or scale. For the purposes of this report, it refers to all agricultural producers including rancher, grower and others.

The respondent sample population here is slightly skewed toward older individuals compared to the USDA's reported age distribution of farmers. This survey relied on landline phone numbers to collect responses, which potentially skewed the respondents disproportionately toward older farmers. All questions were analyzed twice: first with all 912 responses included in the data set and then with all responses from individuals 80 years old or older removed from the data set. These two response rates were then compared to identify at what level did the age bias impact findings. When compared, all question response rates deviated by 3.7% or less, demonstrating minimal age bias impact.

OPPORTUNITIES FOR FUTURE RESEARCH

- Farmer respondents frequently responded “don’t know” to questions throughout the survey. This could be driven by unique cultural/social aspects of farmers’ psychological profiles — understanding it could help unlock new ways to engage with them successfully.

- A surprisingly high number of farmers stated they don’t know what the biggest water-related threat farmers face in their local area. Understanding why this phenomenon occurs could help organizations combat misinformation and engage with farmers more effectively around risk mitigation and management.

- The USDA’s Economic Research Service (ERS) states the “Agriculture, food and related industries contributed $1.053 trillion to U.S. gross domestic product (GDP) in 2017, a 5.4% share. The output of America’s farms contributed $132.8 billion of this sum — about 1% of GDP.” As a billion-dollar contributor to a trillion-dollar industry, U.S. farm operations play an important role in the agricultural sector, but they are not the only players. It would be interesting to learn more about farmers’ mental modeling of what they perceive is represented by the term “agricultural sector.” This could provide valuable insights into response rates to the question on which industry respondents believe is the largest contributor to water pollution.

USDA NRCS field staff meet with landowners to discuss conservation land management practices to conserve water. Photo by USDA NRCS Texas

REFERENCES

1 https://www.npr.org/sections/thetwo-way/2018/01/25/580689546/harvey-the-most-significant-tropical-cyclone-rainfall-event-in-u-s-history
2 https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2018/04/17/drought-returns-to-huge-swaths-of-us-fueling-fears-of-a-thirsty-future
3 https://www.pnas.org/content/115/9/2078
4 https://www.closethewatergap.org/wp-content/uploads/2019/11/Dig-Deep_Closing-the-Water-Access-Gap-in-the-United-States_DIGITAL_compressed.pdf
5 http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf
6 https://www.sciencedirect.com/science/article/pii/S1877050915002860
7 https://www.reuters.com/article/us-usa-farms-bankruptcy-idUSKBN1ZT2YE
8 https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/usv1.pdf
9 https://www.epa.gov/dwreginfo/information-about-public-water-systems
10 https://www.epa.gov/nps/nonpoint-source-agriculture
11 Dean AJ, Fielding KS, Newton FJ. Community Knowledge about Water: Who Has Better Knowledge and Is This Associated with Water-Related Behaviors and Support for Water-Related Policies?. PLoS One. 2016;11(7):e0159063. Published 2016 Jul 18. doi:10.1371/journal.pone.0159063
12 Iñiguez G, Tagüeña-Martínez J, Kaski KK, Barrio RA (2012) Are Opinions Based on Science: Modelling Social Response to Scientific Facts. PLoS ONE 7(8): e42122. https://doi.org/10.1371/journal.pone.0042122
13 McHale, John (2019) The Changing Information Environment. Rutledge.
14 https://www.epa.gov/laws-regulations/history-clean-water-act
15 https://trend.pewtrusts.org/en/archive/spring-2019/how-development-of-americas-water-infrastructure-has-lurched-through-history
16 Drinking Water Infrastructure Needs Survey and Assessment, U.S. Environmental Protection Agency, March 2018.
17 Lipschitz, Forbes. (2014). Not in My City: Rural America as Urban Dumping ground Architecture, Media, Politics Society. Vol 6, No. 2
18 https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2002WR001592
19 https://www.npr.org/sections/thetwo-way/2016/04/20/465545378/lead-laced-water-in-flint-a-step-by-step-look-at-the-makings-of-a- crisis
20 https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0078433
21 https://www.usgs.gov/mission-areas/water-resources/science/domestic-private-supply-wells?qt-science_center_objects=0#qt- science_center_objects
22 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5783670/
23 https://www.foodandwaterwatch.org/sites/default/files/rpt_1810_watershutoffs-web2.pdf ; https://apnews.com/3374e977ec01412da0fbf8a023db248c
24 https://www.npr.org/2019/11/10/778097948/farm-bankruptcies-surge
25 https://nca2018.globalchange.gov/
26 https://www.wri.org/
27 https://www.wri.org/aqueduct
28 Davies A, Simon J. The value and role of citizen engagement in social innovation. A deliverable of the project: “The theoretical, empirical and policy foundations for building social innovation in Europe” (TEPSIE) European Commission– 7th Framework Programme, Brussels: European Commission, DG Research, 2012. [Google Scholar])
29 Kaiser FG, Fuhrer U. Ecological behavior’s dependency on different forms of knowledge. Appl Psychol-Int Rev. 2003;52(4):598–613.10.1111/1464-0597.00153 . [CrossRef] [Google Scholar])
30 https://www.researchgate.net/publication/259863697_US_Agricultural_Producer_Perceptions_of_Climate_Change
31 https://www.ers.usda.gov/webdocs/publications/42298/32489_aib-760_002.pdf?v=42487
32 https://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php

33 https://waterforfood.nebraska.edu/-/media/projects/dwfi/documents/resources/2019-agricultural-water-transfers-report.pdf?la=en
34 https://serc.carleton.edu/microbelife/topics/deadzone/index.html
35 https://www.climate.gov/news-features/featured-images/groundwater-declines-across-us-south-over-past-decade
36 https://www.nationalgeographic.com/foodfeatures/feeding-9-billion/
37 https://www.neefusa.org/nature/water/increasing-demand-and-decreasing-supply-water
38 https://www.wsj.com/articles/the-water-wars-that-defined-the-american-west-are-heading-east-11575315318
39 https://www.npr.org/sections/thetwo-way/2015/05/06/404630607/california-regulators-adopt-unprecedented-water-restrictions
40 https://www.npr.org/2018/01/23/579784235/drought-stricken-cape-town-braces-for-water-to-run-out-in-april
41 https://www.npr.org/sections/goatsandsoda/2019/06/25/734534821/no-drips-no-drops-a-city-of-10-million-is-running-out-of-water
42 https://nca2018.globalchange.gov/
43 https://droughtmonitor.unl.edu/Data/Timeseries.aspx
44 https://www.noaa.gov/media-release/spring-outlook-historic-widespread-flooding-to-continue-through-may
45 https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index
46 Drinking Water Infrastructure Needs Survey and Assessment, U.S. Environmental Protection Agency, March 2018.
47 https://theconversation.com/the-us-drinking-water-supply-is-mostly-safe-but-thats-not-good-enough-115028
48 https://pubs.usgs.gov/circ/circ1332/
49 https://www.cdc.gov/healthywater/drinking/private/wells/index.html
50 Levy, Anat & Orion, Nir & Leshem, Yossi. (2016). Variables that influence the environmental behavior of adults. Environmental Education Research. 24. 1-19. 10.1080/13504622.2016.1271865.
51 https://thehill.com/opinion/energy-environment/438280-epas-water-rules-are-finally-starting-to-make-sense-for-farmers
52 Conallin, John & Dickens, Chris & Hearne, Declan & Allan, Catherine. (2017). Stakeholder Engagement in Environmental Water Management. 10.1016/B978-0-12-803907-6.00007-3.
53 Leung, Y.W.; Rosenthal, S. Explicating Perceived Sustainability-Related Climate: A Situational Motivator of Pro-Environmental Behavior. Sustainability 2019, 11, 231.
54 http://www.drexel.edu/~/media/Files/greatworks/WI12/Social-Marketing-Behavior-Book.ashx
55 www.thewatermain.org/water-study
56 https://www.ers.usda.gov/webdocs/publications/42298/32489_aib-760_002.pdf?v=42487
57 https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/usv1.pdf

Sand bags protect a corn field in central Missouri from floodwaters.
Photo by FEMA

Photo by Frank McKenna

Original research prepared by:

TRUST IN FOOD
A FARM JOURNAL INITIATIVE

trustinfood.com

An America's Conservation Ag Movement Research Report