THE BENEFITS OF PROMOTING SOIL HEALTH IN AGRICULTURE AND RURAL AMERICA

HEARING

BEFORE THE

SUBCOMMITTEE ON CONSERVATION, ENERGY, AND FORESTRY

OF THE

COMMITTEE ON AGRICULTURE
HOUSE OF REPRESENTATIVES

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THE BENEFITS OF PROMOTING SOIL HEALTH IN AGRICULTURE AND RURAL AMERICA

THURSDAY, SEPTEMBER 18, 2014

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON CONSERVATION, ENERGY, AND FORESTRY,
COMMITTEE ON AGRICULTURE,
Washington, D.C.

The Subcommittee met, pursuant to call, at 11:30 a.m., in Room 1300 of the Longsworth House Office Building, Hon. Glenn Thompson [Chairman of the Subcommittee] presiding.

Members present: Representatives Thompson, Gibbs, Crawford, Lucas (*ex officio*), Walz, Nolan, DelBene, and Peterson (*ex officio*).

Staff present: Brent Blevins, Josh Maxwell, Nicole Scott, Tamara Hinton, John Konya, Liz Friedlander, Robert L. Larew, Matthew McKenzie, Mike Stranz, Evan Jurkovich, and Riley Pagett.

OPENING STATEMENT OF HON. GLENN THOMPSON, A REPRESENTATIVE IN CONGRESS FROM PENNSYLVANIA

The CHAIRMAN. This hearing of the Subcommittee on Conservation, Energy, and Forestry, entitled, *The Benefits of Promoting Soil Health in Agriculture and Rural America,* will come to order. I would like to welcome everyone today. Good morning. I really do want to welcome everyone to this hearing of the Conservation, Energy, and Forestry Subcommittee on the topic of soil health, or healthy soils, which is critically important to American agriculture and strong farming communities.

Congress has long recognized the importance of promoting soil health across the country, starting with the establishment of the Soil Conservation Service in 1935 as a permanent part of USDA. The need for this agency came in response to a persistent problem of soil erosion across the country, particularly in the Dust Bowl region.

Now, the Soil Conservation Service, which eventually became the Natural Resources Conservation Service, that we know today, plays an important role in preserving soil health across the country by providing producers with voluntary assistance in monitoring and assessing soil conditions on their land. As our predecessors did for us in the past, we owe it to future generations to do what we can today, and understand and recognize the importance of healthy soil.

The Earth's population is projected to grow to roughly nine billion people by the year 2050. Given the growing demands on farmland everywhere, we must invest in the necessary resources, and best practices, to be certain that producers have the capacity to

meet this growing need. To that end, I am particularly proud of this Committee's work on conservation programs during the deliberation of the newly enacted farm bill. We came together in a bipartisan fashion to reauthorize and strengthen our title II programs, even in the face of significant budget cuts.

It is heartening to see how farmers, ranchers, and foresters across the country have made promoting the health and sustainability of soil a fundamental priority. For example, I see this all the time across the 5th District of Pennsylvania, where farmers are engaging in innovative practices, including no-till practices, cover cropping, and adhering to other best practices in order to preserve the nutrients in the soil. Additionally, it is important for us to remember that soil health is closely linked with water quality.

In addition to the great work being done at the state and county levels, I am proud that so many of the farmers and foresters in Pennsylvania have taken voluntary steps to promote soil health in order to do their part to assist in the recovery of the Chesapeake Bay. Our farmers and ranchers are the best stewards of the land. They continually adapt to protect our natural resources, despite the overly burdensome regulatory environment imposed upon them. And whether it is protecting our drinkable water supply, keeping nutrients for the next crop year, or maintaining a supply of forage for livestock, there is no shortage of reasons why we must continue to innovate when it comes to promoting soil health.

We have a great set of witnesses to testify today, and I want to thank them for sharing their expertise with the Subcommittee. It is good to see Chief Weller before us today. He has the task of implementing all the work that we did in the farm bill, and I look forward to hearing the agency's perspective on this topic.

I am also pleased to welcome a constituent of mine, a friend, Mr. Jim Harbach. I have said—long said that farmers are the original environmentalists, and that belief has been re-affirmed after having the opportunity to tour his farm, among so many others in the region. And I want to thank him for taking time to make the drive down from Clinton County this morning.

[The prepared statement of Mr. Thompson follows:]

PREPARED STATEMENT OF HON. GLENN THOMPSON, A REPRESENTATIVE IN CONGRESS FROM PENNSYLVANIA

Good morning. I want to welcome everyone to this hearing of the Conservation, Energy, and Forestry Subcommittee to review the benefits of promoting soil health in agriculture and rural America.

Congress has long recognized the importance of promoting soil health across the country, starting with the establishment of the Soil Conservation Service in 1935 as a permanent part of USDA.

The need for this agency came in response to a persistent problem of soil erosion across the country, particularly in the Dust Bowl region.

The SCS eventually became the Natural Resources Conservation Service we know today, and plays an important role in preserving soil health across the country by providing producers with assistance in monitoring and assessing soil conditions on their land.

As our predecessors did for us in the past, we owe it to future generations to do what we can today to understand and recognize the importance of healthy soil.

The Earth's population is projected to grow to roughly nine billion people by the year 2050. Given the strains on farmland everywhere, we must invest the necessary resources to be certain that producers have the capacity to meet this growing need.

To that end, I am particularly proud of this Committee's work on conservation programs during the deliberation of the farm bill.

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For example, I see this all the time across the 5th district of Pennsylvania, where farmers are engaging in no-till practices and adhering to other best management practices in order to preserve the nutrients in the soil.

Additionally, it is important for us to remember that soil health is closely linked with water quality.

I am proud that so many of the farmers and foresters in Pennsylvania have taken voluntary steps to promote soil health in order to do their part to assist in the recovery of the Chesapeake Bay.

Our farmers and ranchers are the best stewards of the land and continually adapt to protect our natural resources despite the overly burdensome regulatory environment imposed on them.

Whether it's protecting our drinkable water supply, keeping nutrients for the next crop year, or maintaining a supply of forage for livestock, there is no shortage of reasons why soil health is important to rural America.

We have a great set of witnesses set to testify today, and I want to thank them for sharing their expertise with the Subcommittee.

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I've long said that farmers are the original environmentalists, and I believe that after having the opportunity to tour his farm.

I want to thank him for taking time to make the drive down from Clinton County this morning.

I now want to recognize the Ranking Member for his opening statement.

The CHAIRMAN. And I want to now recognize my good friend and Ranking Member for his opening statement.

OPENING STATEMENT OF HON. TIMOTHY J. WALZ, A REPRESENTATIVE IN CONGRESS FROM MINNESOTA

Mr. WALZ. Well, thank you, Chairman Thompson, and thank you again for holding this bipartisan and important hearing. Chief Weller, thank you for being here. Thank you for the work you do. Also a thank you to the full Committee Chairman. Mr. Lucas is here. He is passionate about this subject, and has made that known for a very long time, since I have known him, and so I thank you for continuing to make the importance of soil health a priority.

Members have expressed a deep interest in this. Whether it is flooding that happened early in the spring in my district, or wildfires, or other things that impact soils, Members want to know what the research is showing. They want to know what happened. And we know, and we have the data to prove it. For example, in 2012, average corn yield was 126.2 bushels where cover crops were employed, 115 bushels without it. So we know—understand that it works. It is an economic issue. It impacts everything from water quality to the farmers' bottom lines, so we need to make sure that we get that right.

One of the things I know that is somewhat of a challenge, and we see it happen when we have flooding incidents and things, is how do we employ cover crops and work through RMA, FSA, and some of those issues that may preclude it, where a farmer has to determine between crop insurance and cover crops when those issues come up? It is not because they don't want to get it right, and it is not because they don't understand the importance of it.

We just have to make sure that, as we put regulations in place, they mesh with what are the best practices.

I would also like to welcome and introduce one of my constituents, Ms. Jill Sackett, who is a University of Minnesota extension educator. With her passion, she will need to talk to the Chairman afterwards. You two could talk for hours on soil health and cover crops. But she comes to us from Mankato, Minnesota, in Blue Earth County, where the soil is literally so black it is blue, and some of the most productive farmland in the country. I welcome you, and, as an educator, I welcome you as the teacher's teacher.

You are here today to explain to us, and help us make decisions based on science and best practices, to ensure, as the Chairman so clearly pointed out, that we can continue feeding the world, while continuing to figure out a way that we can feed an ever hungrier, ever expanding world with fewer producers on less landmass, so that land and that soil are becoming more important.

So thank you all for being here today, thank you for this work, and with that, I yield back my time to the Chairman.

The CHAIRMAN. Thank you, Ranking Member. Now it is a privilege and honor to recognize the Chairman of the full Agriculture Committee.

OPENING STATEMENT OF HON. FRANK D. LUCAS, A REPRESENTATIVE IN CONGRESS FROM OKLAHOMA

Mr. LUCAS. Thank you, Mr. Chairman, and I appreciate the opportunity to offer a few thoughts. First and foremost, thank you to you and the Ranking Member, and all the Members of the Subcommittee. All the hearings that you have held, all the work that you did, laid the groundwork for an even stronger conservation title in this year's farm bill. Had you not gone through all those witnesses, handled all those questions, done your work to enable the full Committee to do its work, we wouldn't have the title and provisions that are indeed there, so I very much appreciate that.

And I am particularly pleased, I will agree, that we have this particular subject as something to look at today, the soil. Any farmer will tell you that, right along with their children and their grandchildren, they have no greater asset than the soil on their farm. And that, like their children and grandchildren, it is a living entity too. It has to be addressed and nurtured, has to be taken care of, grown, and improved. So thank you in that regard.

And, of course, to the Chief and to the Service, very—how can you describe the history of what was the Soil Conservation Service, the NRCS now? A group that, in many challenging times, dealing with many diverse issues in many diverse parts of the country, has consistently worked with farmers and ranchers to make sure that our most valuable resources are preserved. Soil, water, air quality, all of those sort of things. Just a huge success story.

I look forward to the comments from the Chief about the issues that he is addressing these days, and how he intends to implement those provisions that affect soil health in the Agricultural Act of 2014, as well as the second panel of witnesses, who clearly are very knowledgeable people from diverse backgrounds across the country, with this common perspective of our soil. But ultimately, once again, gentlemen, ladies, all of you, thank you for a very productive

session, and a very productive farm bill, and let us continue our work here today. I yield back, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Chairman. Now it really is a privilege and honor to welcome our first witness to the table, Mr. Jason Weller, Chief of the Natural Resources Conservation Service with the United States Department of Agriculture. Chief Weller, please take as much time as you might consume, and please begin when you are ready.

STATEMENT OF JASON WELLER, CHIEF, NATURAL RESOURCES CONSERVATION SERVICE, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.

Mr. WELLER. Well, thank you very much, Chairman Thompson, Ranking Member Walz, Chairman Lucas, and Members of the Committee. My name is Jason Weller, and I appreciate the flexibility and forbearance here of the Committee to allow me a little extra time here. I have the presentation down to about 48 minutes. Hopefully that is okay.

The CHAIRMAN. Is there a Motion for Reconsideration?

Mr. WELLER. I will try and keep it brief. But I thought it would be good just to start at the outset and provide a little bit—hopefully I exhibit some of the passion we have for this topic. I will have to say, in my view, our renewed focus, is a return to the past in some respects. Mr. Lucas referred to our almost 80 year history as an organization, coming back to our roots, literally, on soil. The palpable excitement and energy it is creating not only within NRCS, but also with our brothers and sisters in the Soil and Water Conservation districts across the United States, and with farmers and ranchers themselves. This approach to managing our soils as a living ecosystem, as well as the physical and chemical properties of the soil, is something that we are really excited about.

But before I begin, also, I just want to be really clear at the outset too that this is not about any one agency. This is not about NRCS. Overall we play a small role in this movement. What this is is a broad coalition, a broad, exciting group of folks, from—beginning with farmers and ranchers themselves, to the land-grant universities, extension services, ag retailers, foundations, private individuals, nonprofit groups, you name it. There is a huge constellation of groups who are working on this topic of soil health. They are bringing tremendous innovation, new ideas, excitement, resources.

And this is something where—and, as an example, where we are actually having to run to keep pace with producers. Producers have been at this for a long time, in many cases decades. They have been the true pioneers in these approaches for soil health. We are learning from them. And this is an example where we are having to run to keep pace with producers. It is very exciting to be part of this movement. So with that, let me begin here with the presentation.

So first let me just begin with the overall definition of what is *soil health?* Soil health is the capacity of soil to function as a vital, living ecosystem that sustains plants, animals, and humans. So what we are doing when we focus on soil health is we are trying to protect that ecosystem, the soil ecosystem, to support the life

within the ecosystem, as well as the other properties of the soils, ultimately to benefit life above the soil, the plants that grow the food and fiber we depend upon. And soil is really important because it provides some key functions that we rely on.

So, for example, it regulates the flow of water. When it rains or snows, or when the irrigation water is applied, what happens to that water? Does it leave the fields in runoff? Does it infiltrate in with the soil structure? As it gets into the soil structure, do the soils help to buffer and filter that water? So it provides an important crucial component for helping to clean the waters. Soils also then help cycle the nutrients, nutrients that are applied to farm fields through fertilizers, manures, and other sources, as well as the nutrients that are available from the environment itself, decomposition of the plant matter, and actually deposition from the atmosphere itself.

It provides structures, supplies a medium for plants to grow in, but also provides support for human structures. Some of the most critical information, when you are an engineer, you are designing a road, a highway, a railway, a runway, a building, a stadium, you worry about what you are building on. It is the soil structure itself we depend upon to help support human economic activity.

And the fifth really critical component of soil is it sustains life. At the end of the day, all life on Earth depends upon soil, and the function soils provides to grow the feed—the food, the fuel, the fiber we really need. It helps the plants transform the energy from the sun itself. It depends upon the soil medium for that conversion of the sun's energy into energy that we then can use as life.

Talking about life—speaking about life, so, for many years, our organization, many in our culture, have been focused on the physical and chemical properties of soil. Some have never lost sight, as Mr. Lucas pointed out. Many farmers and ranchers know that the soil is alive. But we are increasingly becoming aware of what is actually happening in that ecosystem below the surface of the Earth, what is happening in the soils. And what we are learning is that the life in the soils is among the most verdant—abundant source of life—diversity of life on Earth.

So in the soils, there are millions of species of microorganisms, and billions of organisms in the soil itself that are all interrelated in an ecosystem, a web. They interrelate with each other, they feed each other, they transfer nutrients and energy between themselves. Just—one fact, for example. Just in 1 teaspoon of soil, there are more microorganisms in that 1 teaspoon of soil than there are people on Earth. Billions of microorganisms in that soil.

The bacteria that lived in the rhizosphere, around the root structure, that help feed nutrients into the plants, and in return the plants feed carbohydrates, literally the sugar, to those bacteria, you could fit 40 million of those bacterium on the head of a pin. An incredible array of life. That life includes bacteria, fungi, algae, arthropods and other insects, protozoa, larger vertebrate animals, and they all are there working together to bring energy, and life, and food throughout this whole structure. And, at the end, having a robust life force within the soil itself helps support the production of cropland whether it is for food, whether it is just for vegetation for wildlife.

And the role of those life forms are really critical. They help shred—the surface of the Earth. They help shred the biomass that resides in the soils. They help decompose that biomass, turn it into humus. Turn it into the really rich organic structure of the soils themselves. They create micro-pores and macro-pores for water to infiltrate into the soil structure. They create actual room for the microbes and little organisms to live. They help cycle nutrients out of the atmosphere, in the soil itself, and fertilizers that are applied to the soils. They help make the soil more efficient in the processing, the cycling of those nutrients. And, ultimately, they also help clean the water, as the water moves through the soil structure. So the organisms are crucial overall not just to help the soils, but, really, to the health and quality of our environment.

Mr. Chairman, you referenced a challenge that we are looking at in the coming years. What this is is a chart from the United Nations estimating world population growth. And, as you talked about, within the next 40 years, we estimate there are going to be nine billion people, an additional two billion people on Earth. This is both an incredible challenge, but also an incredible opportunity for American agriculture.

So, in order to feed these additional two billion people over the next 40 years—okay, one fact that is just continually—kind of blows me away is that we are going to have to grow as much food in the next 40 years as we have, as a world civilization, over the last 500 years. So if you think back to before Magellan was even thinking about the Earth being round, before he even circumnavigated the globe, you think about all lifetimes and the food that was grown over that time period, we are going to have to grow in half a lifetime the same amount of food to feed that surging world population, and we are having to do that on a smaller land base.

Just here in the United States, in the last 30 years, upwards of 43 million acres of land have been converted from agricultural lands to non-ag lands, economically developed, which is part of economic development. That is great. But out of those 43 million acres, a land area the size of the State of Washington, 14 million acres are the prime soils, the most productive soils on Earth. That is land area the size of the State of West Virginia which has been paved over and converted to other uses.

So we have a massive challenge to grow food, we have less land to do it on, how are we going to do it? And here is the opportunity. This is a call to action to help support farmers and ranchers to begin investments today in improving and protecting the vibrancy and the health of their soils so they can be sustainable and grow that food and fiber, not just maintain yield, but boost yield, for decades to come.

So I talked a little bit about some of the benefits of soil health, touched upon this. Healthy soil helps improve the water infiltration. So, when it rains, the water actually doesn't run off the field, it gets into the soil itself. It improves the water holding capacity of the soil. So by increasing the organic matter and the porosity of the soil, you get more water in the root zone, where the crops can get at that water.

It helps improve water quality, protects our streams and rivers, and also our aquifers. It increases the nutrient availability of fertilizers, and manure, and poultry litter, but also just the decomposing biomass. It helps cycle those nutrients, makes them available again for what we need those nutrients for, which is to grow food. It helps save energy. Producers can be more efficient with their use of their farm equipment, the irrigation pumps. It helps save wear and tear on their equipment, which is, at the end of the day, saving them money, putting more cash in their pockets. And it helps improve the health of the plants, the crops themselves. It makes those crops more drought resistant, also more tolerant of high water events. It helps—makes those fields and those crops more resistant to pests and disease. So all the way around we believe there are a tremendous number of benefits you can garner from healthy soils.

We view soil as a living factory, and when that factory is optimized, when you have all those critters working together, helping to feed the—cycle of the nutrients, feed the crops, you can then optimize the yield coming off those crops, off the farm fields. As a producer put it, succinctly, and probably most articulately, anything can have quality, but only living things can have health. And that is what we are focused on, the health, and how do you nurture the health of the microorganisms, the ecosystem below the surface of the soil.

We have four basic principles when we talk about soil health from a macro perspective. What are the four basic principles that, when we work with a farmer or rancher, that we can then help apply on the land? Number one is minimize disturbance. So there is the physical, the biological and chemical disturbance of the soil, so you can minimize the disturbance.

Number two is you want to maximize the diversity of the plants living and having their roots in the soil. So, as we have learned from ecologists, ecosystems that are diverse in their populations are more resilient to stress, to drought, to pests, to disease. So the more diversity you have in your crops in the soil, the more diversity of the microorganism you are going to have below, in the surface of the soil itself.

The third is you want to keep your soils covered for as much as possible to protect them from the erosive effects of wind and water. And also, fourth, you want to have living roots in the soil for as long as possible. So when, traditionally, folks would fallow their fields, if you can instead, have living roots there to capture the solar radiation, the energy from the sun to actually feed the organisms in the soil for as long as possible, again, you are maximizing the energy that is going to be stored in banking that soil, making it again available for crop production.

So one of the key principle—one of key practices, Chairman, you have already referenced is no-till. This addresses two of those key principles, in terms of minimizing disturbance of the soil, but also maintaining a residue on the soil. So it is actually an interesting fact recently learned that today we estimate across the U.S. there are about 67 million acres of cropland that is in continuous no-till. That is roughly 23 percent, 24 percent of the U.S. crop—overall crop size.

In—just in terms of avoiding lost carbon to the atmosphere, so keeping the carbon in the soils, where it is helping protect the vibrance of the soils to grow crops, that is about 8.8 million metric tons of CO_2 equivalent emissions that are avoided, that we are actually keeping in the soils. That is equivalent to burning 990 million gallons of gas, or powering 1.9 million passenger vehicles per year that are now being kept in the soils to help protect crops, and help with the organic content—maintain the organic content in the soils. So we view no-till practices as one of the greatest approaches to improving the health of the soils.

Here is a close-up of what a no-till operation looks like in the field. I know you are very familiar with this. Today's farming implements can penetrate through that plant residue, drill the seeds in to the soil structure. And that mulch you see there on the surface, then, it has a number of benefits. Number one, it protects those soils from the erosive power of wind, and from water. It helps shade out weeds, so you have less pressure from weeds coming in and crowding out the valuable cash crop. It keeps that soil cool.

Actually, when you have bare soil, on the hot summer months, you can actually cook the microbes in the soil itself. You can actually kill the microbes. It also increases the drying out of the soils and the plants, creating plant stress. The mulch itself can actually serve, then, as the biomass, as the fungi, and the mites, and other critters decompose that biomass into organic matter. So that also serves as a feedstock to help boost the organic matter in your soils.

And why does organic matter matter? So here is a chart that shows what happens when you increase the organic matter.

So across the bottom there you see the percent of organic matter in your soils. And as you increase that organic matter over time, you can actually boost the water holding capacity of your soils. More organic matter means more water. You create a reservoir in your fields to hold water when it rains or snows, or when you irrigate. So a rough rule of thumb, for every one percent increase in organic matter, you increase the water holding capacity of an acre by 25,000 gallons of water. So soil health is a great way to help capture—when you irrigate, or when it rains, it helps create more drought resiliency for your crop fields.

Here is a side by side comparison of two fields of different tillage practices. This comes from Brookings County, South Dakota. On the left you see a no-till operation. On the right you see a conventional till operation. This is—this photo, I understand, was taken a couple hours after 1″ rain. So on the left you could see the water has infiltrated. There is no evidence of water on that field, and you see no evidence of soil transport, no movement of the soils. On the right you could still see—even several hours after, you still see ponding of water. You see it is slick. You see the actual—there—in this photo you can eyeball, there is—literally tons of soil have moved in that field, in some cases probably off that field. That water isn't getting into the root zone. It is not being stored in that soil for future growing seasons in the warmer summer months. It has probably been moved off—down off the field, where that water, and the nutrients, and very expensive inputs the farmer has invested in are now lost.

Another key practice that we use is cover crops. A lot of folks have been talking about cover crops. What you see here is a shot of a field of rye. In this case, it has actually been rolled down. It has been crimped, so the crop has been terminated. But instead of harvesting that biomass, what this farmer is doing is keeping that biomass in place to serve as a mulch. So cover crops serve, again, the core principles. In this case, you are having—you are maximizing—you are leaving the roots. You are bringing root diversity to the soil, and you are helping, again, to keep that soil covered. So when you have the shot of that rye grass that has been rolled down, it again, serves as that mulch to moderate temperatures, protect the soils, serve as the feedstock for organic matter. Cover crops are a really valuable tool.

So we are trying to get to what happens? What does this do—so what? What does this mean for actual production of food? So if you remember, back in 2012, we had one of the worst droughts in half a century, impacted almost the entire Union, in terms of the drought. And so some partners at the Sustainable Ag Research and Education Program at USDA, as well as the Conservation Technology Information Center, they did a survey from producers in the Central Midwest, here in these seven states, and they reached out to 759 producers, and they asked, what was your use of cover crops, and if you used cover crops. What happened to your yield? Well, we actually learned it was positive.

So what you see here is a comparison from those who responded to the survey, producers that used cover crops as part of their rotation, they had about 11 percent higher yield off their drought-stricken fields than folks that did not use cover crops as part of the rotation. Again, it is about improving the health of the soils through all the benefits of cover crops, mulching, the biomass, that they get an 11 bushel—11 percent increase in yield. And for soybeans, it was even higher. It was over 14 percent increase in yield for soybeans for folks that use cover crops.

So, again, here is an example of how cover crops can help. At the end of the day, in my view, it is one of the best risk management tools we can offer a farmer or rancher from our quiver of conservation practices, but this is a great risk management tool. It helps not only maintain yield, but also protects farmers in periods of stress.

Another core practice is nutrient management. So, part of an overall effective soil health management system is how you manage the nutrients of your soils. So there are the nutrients you apply through fertilizer, manure, poultry litter. It is the available nutrients that are left over from last year's application of fertilizers. It is the biomass, the residue that is left over from the crops. It is the actual deposition of nitrogen from the atmosphere, and how the microbes attenuate and incorporate those nutrients.

So a nutrient management plan, using the 4R's of the *right* source, at the *right* time, the *right* rate, the *right* amount, using the 4R approach is part and parcel of an effective soil health management system. And this is something that NRCS is working very closely with foundations, research community, certified crop advisors, institutes, you name it. There is a broad array of folks who

are working with producers to incorporate effective nutrient management into the soil health systems.

Beyond row crop, though, I have talked a lot about row crops, we also are very interested and excited about—how do you improve soil health on range and pasture? So we have talked about how tillage is a disturbance to the soil. Well, overgrazing also is a disturbance of the soil. It is a biological disturbance. When you overgraze, you are stressing the plants. You actually have smaller root mass below the soils. You get more opportunity, then, to heat the soils, to cook those microbes, create drought stress in the plants—you provide more opportunity for weed penetration, invasive penetration.

So what you see here, again, is out of South Dakota, a side by side comparison. On the left you have a pasture/range area that is in continuous grazing, and on the right you see a shot of a pasture that is in rotational grazing. So you are still getting the biomass and the necessary feed for livestock off rotational grazing, it just requires more intensive management of the livestock so they don't overgraze.

Well, what does grazing have to do with it? How does it impact soils? What this shot is is a side by side of similar soil, same soil type out of South Dakota. On the left is a continuous grazing, and on the right is a rotational grazing. Same soil type. And you can see on the right the color—the hue of that soil is richer and deeper. That is reflective of more organic matter that is in that soil. And it is kind of hard to see there, but you can actually see the roots from the grasses that penetrated not inches, but feet deep into that rotational grazed soils.

That is important, because those roots then create pores for water to infiltrate in, and for the nutrients, better access deeper into the soil profile. More habitat, again, for those microbes. So at the end of the day, the soils on the right are going to be more drought resistant, more resistant to invasives and weeds. And so, overall, you are going to have a more sustainable yield of forage off those lands than you would off a continuously grazed system.

At NRCS, because of our focus on soil health, I just wanted to share something—very excited about, and it is kind of a big deal. For the first time, as I am aware, anywhere on Earth, we actually have mapped out the soil carbon stock for a continent. So what we completed over the last couple years is a survey across the United States. And we then, using our knowledge of soils, we have mapped out here what is the current stock, our banking of organic matter across the United States. These different colors here, those hues, the darker the blue, the more organic soils.

You can see down, for example, in Florida, in the Everglades, or in northern Minnesota, in the forests of Northern Minnesota, high organic soils, so there is going to be a lot of organic matter there. In the desert, Southwest, obviously not much organic matter in the desert environment. As you can see, then, the gradiation of the organic content.

Why is this important? So, for a conservation planter, or an agronomist, a farmer, you want to understand, what is my organic matter? What is my organic content? So now that we have that base underlying understanding of the soil pattern—or content—or-

ganic content, we also know the carbon carrying capacity for those soils. So then we can prescribe the most effective soil health management system to help not only protect the organic matter, but also boost organic matter in your soils.

What this is, this reflects what you all have accomplished. This reflects the investment that this Committee has made through its vision, its support for conservation, and how conservation is critical to the success of soil health, and the implementation, that it is not just in corners of the country, but in literally all 50 states.

What you see here are plots of EQIP contracts, Environmental Quality Incentives Program contracts, and conservation stewardship program contracts over the period of 2009 through 2013, and was basically called out the soil health beneficial practices. So conservation crop rotation, cover crops, rotational grazing, mulch, no-till. So we looked at what are the core soil health practices, and the geo-plot of them, and this is what it looks like. Turns out we entered into over 74,000 contracts on over 44 million acres across the United States. This is what your investments in working land programs looks like when you look at it from the lens of soil health.

Beyond dollars, and tons, and acres, what it really, though, amounts to is us working with farmers and ranchers, with people, with producers. And so we are working very hard with partners, like with the National Association of Conservation Districts, with other organizations, to identify leaders in soil health across the country. So when we have been profiling producers, one of the best ways to actually share this information is to get other producers up to speed, excited about—engaged in soil health is they hear it from another farmer or rancher themselves. So we have examples of—profiles of these pioneers in soil health from across the country.

Now, I wanted to highlight one of these pioneers. It is a farming operation. This is Ricky and Russell Wiggins out of Alabama. They are cotton and peanut farmers. They farm about 2,700 acres in Alabama. And when they started in the soil health journey, their soil organic matter was around .75 percent, less than one percent soil organic matter in their soils. Well, they decided, well, we wanted to try out some new soil health practices, so they converted to conservation tillage systems. They use high residue cover crops. You can see from the field there, they leave the rye grass in the fields to provide high residue to protect their soils, and provide better organic matter. And over time, over several years of using the soil practices, they have now increased their soil organic matter to over three percent.

Well, what does that mean? It means their soils are, first, number one, easier to work with. They are more pliable. So then, when they have peanuts, they want to plow the fields, it is easier to pull those plows. They have to burn less fuel. They have to replace their implements, their tips and their plows, less often. Their terraces need less working, less maintenance cost in the terraces. When it does rain, the terraces flow clean. That means there is less maintenance in their ditches, in their water conveyance canals. So overall it is saving them money, saving them wear and tear, saving them fuel. And, in periods of drought like they experienced a couple years ago, when other producers in their area were not able to plant because the soils were dry, they could plant. They got a crop

in the ground, they are able to get a harvest, because of their approach for soil health.

And I would just like to conclude with just a real focus on why you—this Committee funds our agency. As the Chairman and Mr. Lucas pointed out, we work with America's farmers and ranchers. The programs that you fund help us work one on one with families. These are investments in businesses, in communities, in the economic success of these folks. And you are making investments in infrastructure, in the infrastructure of America's capacity to feed not only itself, but feed the world for generations to come.

And, upon reflection, to me, something that is simple, but so easily overlooked as soil, it turns out it is fundamental, it is intrinsic to our ability to feed ourselves, to ensure the quality of our environment, and to ensure, ultimately, our economic well-being as a nation. So, with that, Mr. Chairman, I would be happy to answer any questions that you have. Thank you for the time.

[The prepared statement of Mr. Weller follows:]

PREPARED STATEMENT OF JASON WELLER, CHIEF, NATURAL RESOURCES CONSERVATION SERVICE, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.

Good morning, Chairman Thompson, Ranking Member Walz, and Members of the Subcommittee. Thank you for the opportunity to be here today to discuss the importance of soil health for our nation's agriculture, our environment, and our future.

Introduction

For almost 80 years, the Natural Resources Conservation Service has been a pioneer in voluntary conservation, working with agricultural producers; forest managers; local, state, and Federal agencies; local communities; and innumerable partners to maintain healthy and productive working landscapes.

Largely in response to the devastating effects of the Dust Bowl, on April 27, 1935, Congress passed Public Law 74–46 in which it recognized that "the wastage of soil and moisture resources on farm, grazing, and forest lands . . . is a menace to the national welfare," and it directed the Secretary of Agriculture to establish the Soil Conservation Service (SCS) as a permanent agency in USDA. As President Franklin Roosevelt expressed in a letter to all state governors in 1937, "The nation that destroys its soil, destroys itself."

In 1994, Congress changed SCS's name to the Natural Resources Conservation Service (NRCS) to better reflect the broadened scope of the agency's focus. However, NRCS continues to fulfill the conservation legacy established in 1935 by Hugh Hammond Bennett, even as it adapts to changing concerns and takes on new responsibilities to address present and future challenges.

Today, our focus on soils goes beyond erosion to include the overall *health* of our nation's soils. When we speak of improving soil health, we are talking about actually enhancing the soil's capacity to function as a vital, living ecosystem that sustains plants, animals, and humans.

Previously, we were mostly concerned with the chemical and physical qualities of soil, so focusing on soil health reflects a fundamental shift in the way we view and manage soils. As one farmer recently observed, "Anything can have quality, but only *living* things can have health."

Improving soil health simultaneously addresses many of our nation's most pressing natural resource needs. A healthy soil has better water holding capacity and therefore resilience to extreme weather like drought and heavy precipitation. Because improving soil health promotes water infiltration, this helps recharge the subsoil with water so more is available in time of need, and this greater infiltration means less nutrient and sediment runoff to our streams, lakes, and oceans. Conservation systems that enhance soil health also help increase carbon sequestration and organic matter, enhance nutrient cycling, provide pollinator habitat, reduce energy use, and produce the food, fiber, and bioenergy needs of our rapidly growing population. Farmers tell us that enhancing soil health also increases their profitability, thereby strengthening rural economies.

NRCS Role

NRCS has developed and launched an integrated campaign that emphasizes conservation planning that focuses on soil health and builds the information, tools, and knowledge needed to help producers enhance the health of their soils. There are many components of this effort that build upon one another. To date, we have focused on:

- Ensuring that the scientific basis for improving soil health is reflected in agency conservation practice standards.
- Reviewing scientific literature and case studies to provide information needed by farmers on the benefits of soil health management systems to their "bottom line".
- Modeling efforts at the national scale to help inform estimates of environmental benefits that may be achieved through accelerated soil health management adoption.
- Aligning funding priorities of our Conservation Innovation Grant Program to support soil health adoption needs.
- Leveraging NRCS's network of Plant Materials Centers to conduct coordinated evaluations of cover crop mixes and their impacts on soil health across different regions, and to use these Centers as soil health training sites.
- Ensuring that all field staffs across the U.S. are trained in the basics of soil health. In just 6 months, we trained over 2,000 NRCS staff and partners on the fundamental principles for improving soil health.
- Establishing an on-line training library that currently holds 28 soil health webinars conducted by university and government scientists, farmers, and other partners. The training library is available to agency staff as well as the general public. Since January 2013, over 11,500 people have participated in or viewed these soil health training webinars.

In addition, NRCS has established a Soil Health Division responsible for acquiring, transferring, and implementing the latest technologies for increasing soil health. Soil Health Specialists across the country will work directly with producers, NRCS field staff, and a wide array of partners to assist in soil health management system implementation. Our Plant Materials Centers and partner field sites will be used as a national network of training and demonstration areas to promote adoption. While our initial focus is on cropland, we are already making plans for enhancing soil health on range and forest lands.

Partnerships in Soil Health

Partnerships are key to the success of improving the health of our nation's soils. The soil health movement is exciting to be part of due to the speed of innovation and adoption by farmers and ranchers, as well as because of the huge array of partners—including agricultural production associations, universities, Soil and Water Conservation Districts, Federal agencies, and nonprofit conservation organizations—that are leveraging each other's expertise and resources. Collectively, we are bringing forward new ideas, solutions, and practical on-the-ground know-how to support producers.

For NRCS, the core of our partnership is with individual farmers and ranchers with whom we work daily to plan and implement soil conservation measures that help them achieve their economic and conservation objectives. These producers are making positive soil health decisions field by field that together are generating benefits for not only their operations, but also at larger geographic scales such as in river or lake basins.

The conservation programs supported by the 2014 Farm Bill are making a crucial difference in helping producers start soil health management systems on their operations. Soil health management is a systems approach that brings together suites of conservation practices that minimize soil disturbance, diversify soil biota, and maintain living roots and soil cover year round. Since 2009, significant numbers of producers have implemented soil health management practices through the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP) as shown in the chart below.

Occurrences of Select Soil Health-Related Practices Applied in EQIP Contracts Fiscal Years 2009 to 2013

Practice Code	Practice Name	Number of Contracts	Amount (Acres)
328	Conservation Crop Rotation	3,468	707,256
329	Residue and Tillage Management, No-Till/Strip Till/Direct Seed	4,514	3,040,608
340	Cover Crop	9,541	2,294,294
484	Mulching	3,000	114,015
512	Forage and Biomass Planting	13,062	939,807
528	Prescribed Grazing	6,575	10,072,933
590	Nutrient Management	13,742	5,212,792
Grand Total		53,902	22,381,705

Occurrences of Select Soil Health-Related Practices in CSP Contracts Fiscal Years 2010 to 2013

Practice/ Enhancement Code	Practice Name	Number of Contracts	Amount (Acres)
328	Conservation Crop Rotation	497	290,333
329	Residue and Tillage Management, No-Till/Strip Till/Direct Seed	389	192,765
340	Cover Crop	313	85,522
CCR99	Resource-Conserving Crop Rotation	1,484	577,622
PLT02	Monitor key grazing areas to improve grazing management	6,904	13,364,174
SOE05	Intensive no-till (Organic or Non-organic systems)	217	104,463
SQL04	Use of Cover Crop Mixes	2,848	916,493
WQL10	Plant an annual grass-type cover crop that will scavenge residual nitrogen	1,959	667,171
WQL13	High level Integrated Pest Management to reduce pesticide environmental risk	5,567	5,640,044
WQL21	Integrated Pest Management for Organic Farming	115	61,417
Grand Total		20,293	21,900,003

NRCS is also partnering with diverse organizations, such as USDA's Risk Management Agency and Farm Service Agency, the National Soybean Association, Midwest Cover Crops Council, National Wildlife Federation, Univ. of Missouri, National Crop Insurance Services, Inc., and others to develop national guidelines for cover crops to ensure their beneficial use in crop production.

NRCS is also working with the National Association of Conservation Districts to leverage the expertise and local delivery capacity of Conservation Districts to develop an inventory of demonstration sites to promote adoption of soil health management systems across the nation.

To accelerate the knowledge of and exposure to soil health practices on farming and ranching operations, we partnered earlier this year with USDA Sustainable Agriculture, Research, and Education (SARE), the Howard G. Buffett Foundation, and the Soil and Water Conservation Society to hold a National Cover Crop and Soil Health Conference that reached over 6,000 producers in a single day on the benefits of cover crops and soil health management systems.

We are partnering with the National Corn Growers Association, Monsanto, The Nature Conservancy, Environmental Defense Fund, USDA's Agricultural Research Service, and numerous universities in establishing and evaluating soil health demonstration field sites to encourage adoption of soil health promoting practices.

Finally, NRCS is partnering with the Farm Foundation and the Samuel Roberts Noble Foundation to encourage adoption and elevate awareness of the economic, environmental, and production benefits of soil health management systems. And we are partnering with the National Grazing Lands Coalition to begin efforts to increase soil health knowledge and adoption on rangelands and pastures.

Benefits for Agriculture and the Environment

The benefits of healthy soils are tangible for the producer, the environment, and ultimately the public. Farmers and ranchers in nearly all parts of the country, across a wide range of climate zones and cropping systems, are reporting that they see connections between improved soil health and more consistent (and often higher) yields, higher profit margins, and more weather-resilient operations.

Weather resilience in soils has always been important and will continue to be even more so as we work to improve our natural defenses against climate change and extreme weather, such as extended droughts and severe storms, as well as indirect effects such as changing threats from pest populations and plant diseases. Healthy soils will be a key component for agricultural producers to successfully adapt to these challenges and will help ensure that we can continue to meet the food demands of a growing population. We are already seeing specific examples of how healthy soils are making a difference.

Following the historic drought in 2012, USDA–SARE and the Conservation Technology Information Center surveyed over 750 farmers about their use of cover crops. Cover crops, which are grown during the off-season to reduce erosion, conserve moisture, and build organic matter, are an important tool for enhancing soil health. In the seven states hit hardest by drought in 2012, farmers using cover crops in their production mix had corn and soybean yields that were 11–14 percent higher than those without a cover crop.

In addition to survey information from producers, NRCS has learned of positive soil health results directly from individual producers. For example, Steve Groff farms 225 acres in Lancaster County, Pennsylvania, where he grows corn, soybeans and small grains, as well as pumpkins. Through more than 30 years of using no-till and multi-species cover crops, Mr. Groff reports that he has increased his soil organic matter from two percent to almost five percent, and has obtained yields that exceed local averages by ten percent.

Gabe Brown, who farms about 2,000 acres near Bismarck, North Dakota, keeps soil covered with dense, diverse plants and cover crops, while also integrating livestock into his soil health management system. Mr. Brown reports that he has more than doubled his soil's organic matter content, and these healthy soils have resulted in higher than county-average yields.

In Carroll, Ohio, Dave Brandt farms a corn-soybean-wheat rotation on 1,500 acres. For more than 35 years, he has used a soil health management system with no-till, diverse cover crop mixes, and crop rotations; and has increased his soil's organic matter from two percent to over five percent. Even during the drought of 2012, Mr. Brandt reported that he averaged 170 bushels of corn per acre, which was nearly twice the yield of his conventional farming neighbors.

Ray Styer, who grows corn silage and multi-species cover crops on 80 acres in Rockingham County, North Carolina, reports that he has more than tripled his soil organic matter and obtained yields that are 4 tons per acre above the county average.

While these examples show that soil health is making a difference in the lives of individual farmers, their families, and their profitability, the broader public value of the conservation investment should also be recognized. The value of soil health for resilient food production systems is seen in the marketplace every day. Benefits to the environment are also demonstrable.

Our Conservation Effects Assessment Project, which has now evaluated conservation impacts covering over 300 million acres of cropland, has estimated that the same practices we use to enhance soil health—such as no-till, cover crops, and crop rotation—have reduced edge-of-field sediment loss by 47–73 percent, phosphorus loss by 33–59 percent, and nitrogen loss in runoff by 35–58 percent.

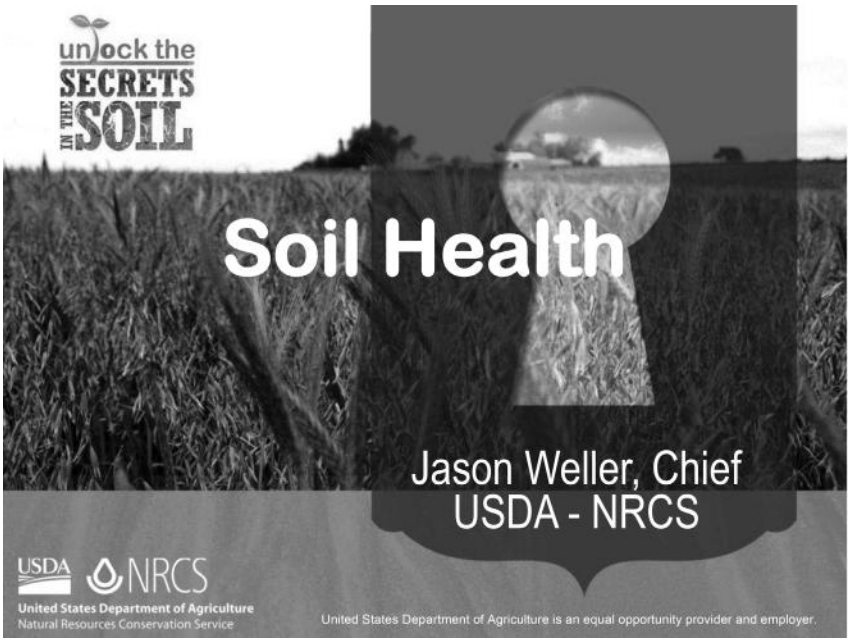
Yet, there is more to be done. Events like drought in Texas and California and algal blooms in Lake Erie and Lake Champlain, coupled with the need to meet the demand for food, fiber, and fuel for a growing population, tell us the time is now to enhance the health of our nation's soils.

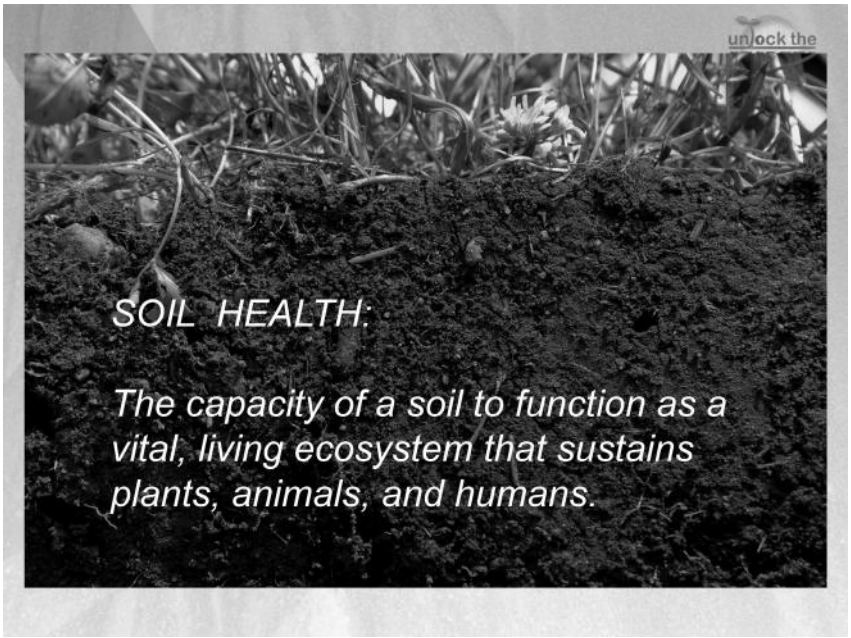
Conclusion

Mr. Chairman, I will conclude by saying that I believe improving the health of our nation's soils is one of the most important things that we can do for this and for future generations. That is because improving soil health not only supports growing the food, fiber, and fuel needed by a rapidly expanding world population, but it also allows us to simultaneously address some of our nation's most pressing natural resource needs. It allows us to increase resiliency to extreme weather events, improve water quality, increase carbon sequestration, enhance habitat for pollinators and other wildlife, increase farm profitability, and we believe also reduce economic risk associated with crop production.

I thank you for the opportunity to be here today, and I will be happy to answer any questions you may have.

POWERPOINT PRESENTATION



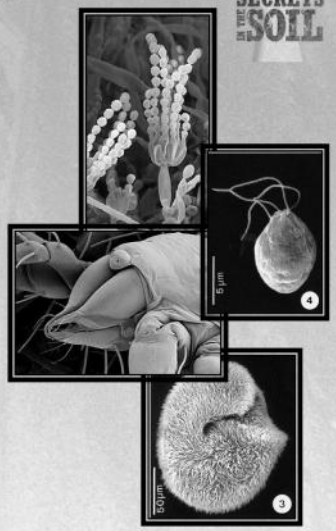


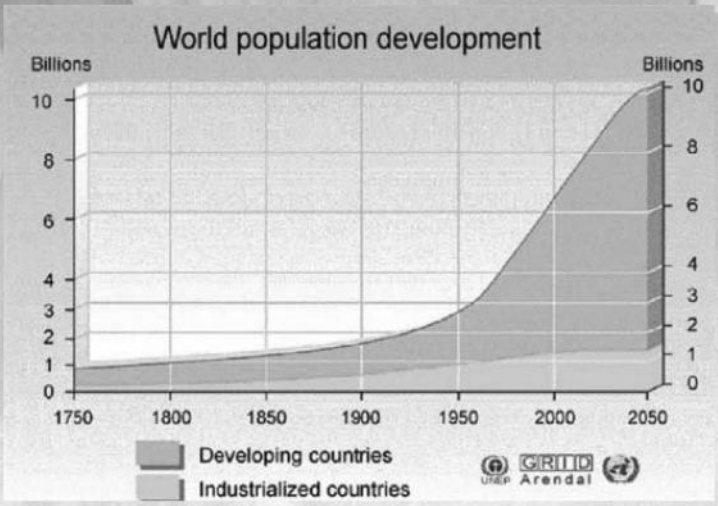
The Elegant Universe Below…

More microorganisms in a teaspoonful of soil than there are people on earth

Soil microorganisms help:

- Make nutrients available to crops
- Bind soil particles together to increase water infiltration, reduce erosion, and reduce runoff



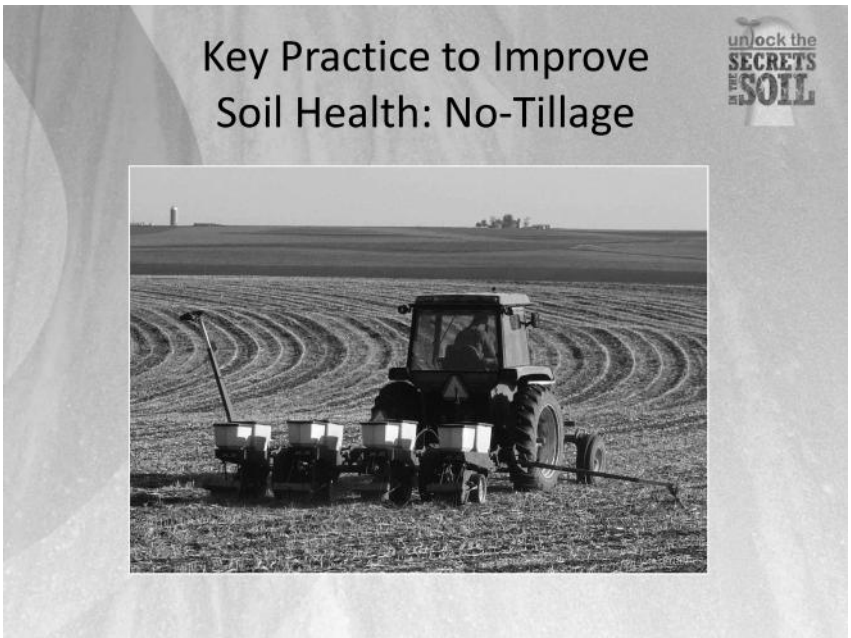


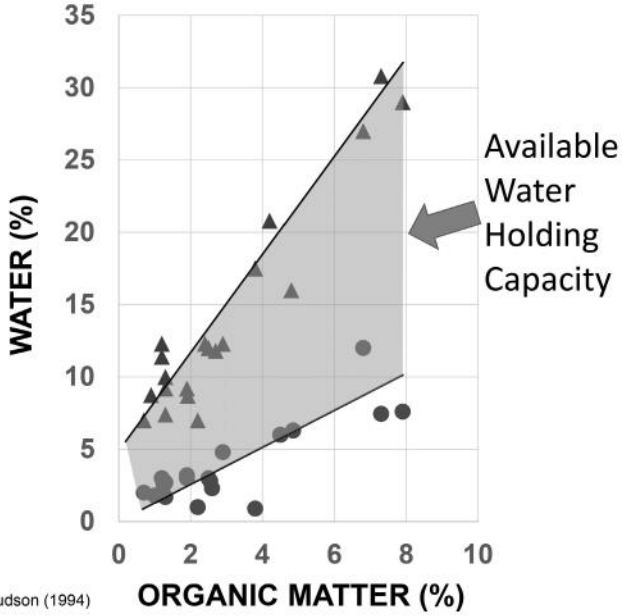
Improving Soil Health Can:

- ✓ Increase water infiltration
- ✓ Increase available water holding capacity
- ✓ Improve water quality
- ✓ Increase nutrient availability
- ✓ Save energy
- ✓ Improve plant health

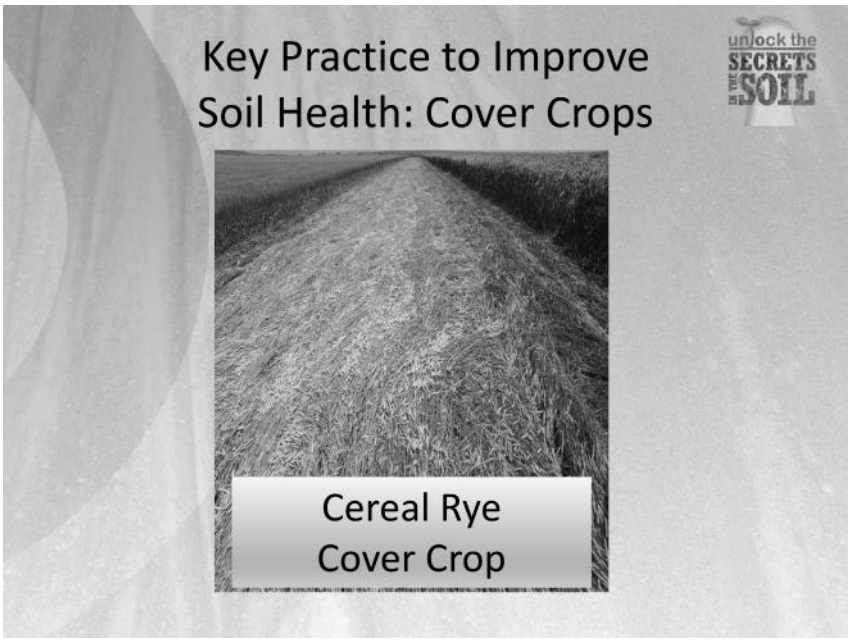
All while maintaining or increasing production!!!

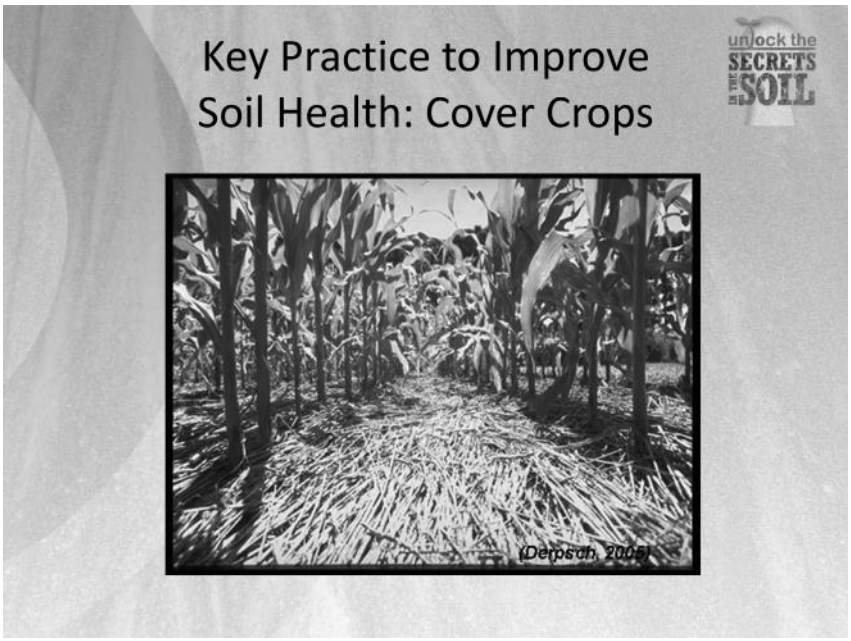
Soil is a Living Factory

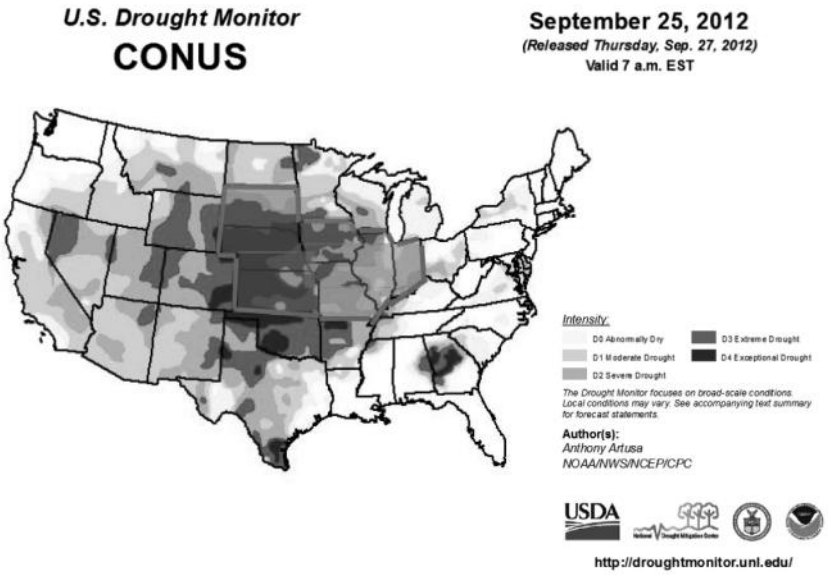

Key Practice to Improve
Soil Health: No-Tillage
unlock the
SECRETS
IN THE
SOIL

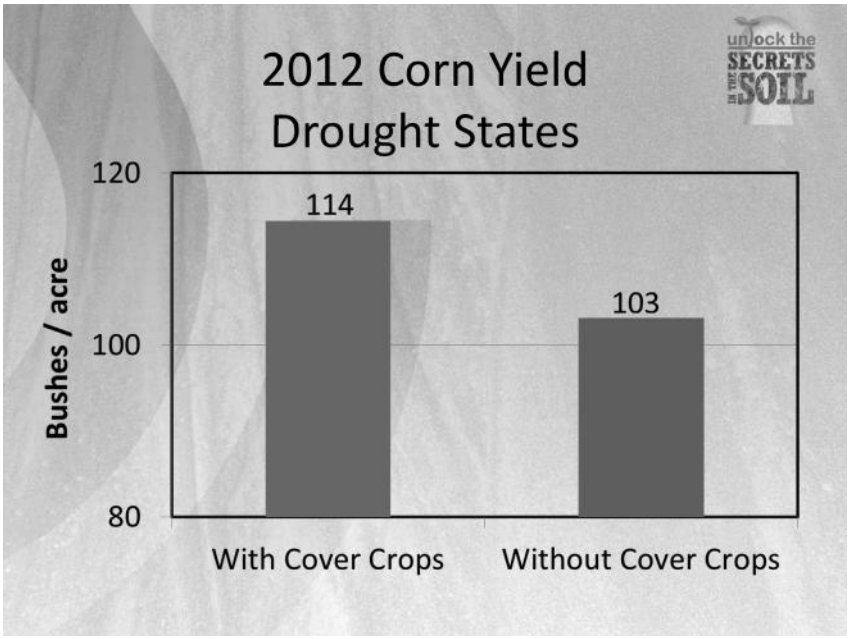


Adapted from Hudson (1994)


Key Practice to Improve
Soil Health: Cover Crops
unlock the SECRETS IN THE SOIL
Cereal Rye
Cover Crop

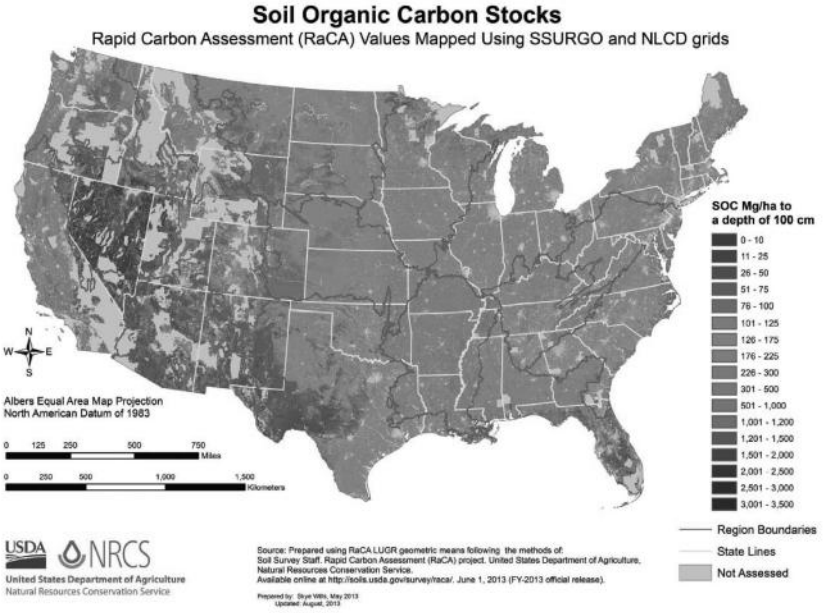

Key Practice to Improve
Soil Health: Cover Crops
unlock the SECRETS IN THE SOIL
(Derpsch, 2005)

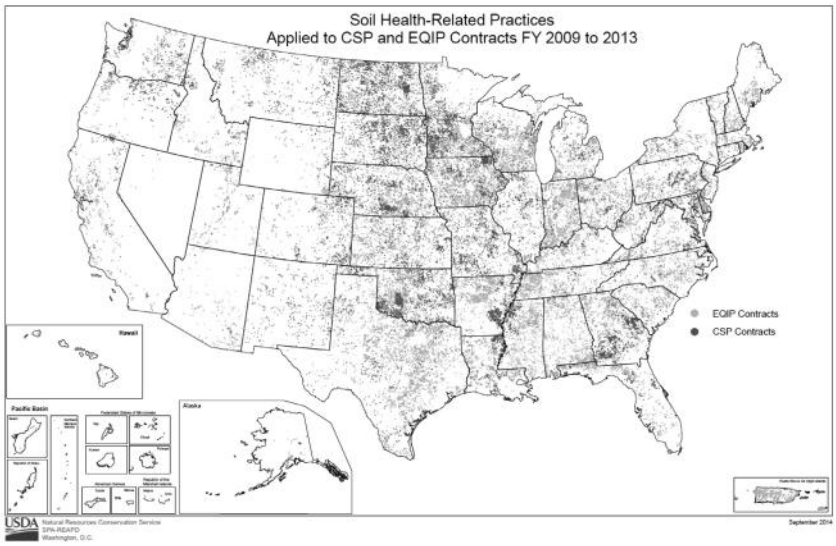

U.S. Drought Monitor
CONUS
September 25, 2012
(Released Thursday, Sep. 27, 2012)
Valid 7 a.m. EST
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
Author(s):
Anthony Artusa
NOAA/NWS/NCEP/CPC
USDA
http://droughtmonitor.unl.edu/


2012 Corn Yield
Drought States
unlock the SECRETS IN THE SOIL
Bushes / acre
120
100
80
114
103
With Cover Crops
Without Cover Crops

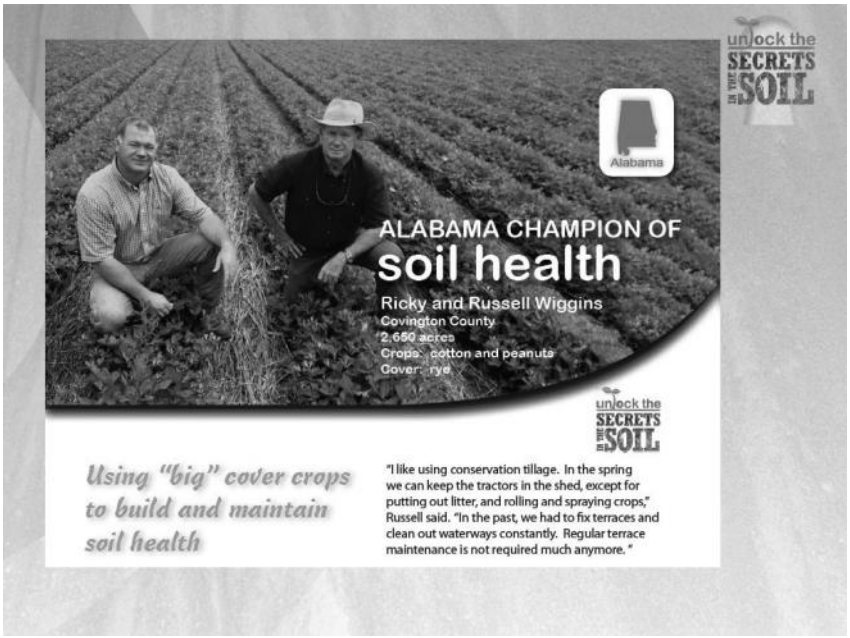
unlock the
SECRETS
IN THE
SOIL
NRCS

Continuous Grazing
Rotational Grazing


Soil Organic Carbon Stocks
Rapid Carbon Assessment (RaCA) Values Mapped Using SSURGO and NLCD grids
SOC Mg/ha to a depth of 100 cm
0 - 10
11 - 25
26 - 50
51 - 75
76 - 100
101 - 125
126 - 175
176 - 225
226 - 300
301 - 500
501 - 1,000
1,001 - 1,200
1,201 - 1,500
1,501 - 2,000
2,001 - 2,500
2,501 - 3,000
3,001 - 3,500
Region Boundaries
State Lines
Not Assessed
N
W
E
S
Albers Equal Area Map Projection
North American Datum of 1983
0 125 250 500 750 Miles
0 250 500 1,000 1,500 Kilometers
USDA
NRCS
United States Department of Agriculture
Natural Resources Conservation Service
Source: Prepared using RaCA LUGR geometric means following the methods of:
Soil Survey Staff. Rapid Carbon Assessment (RaCA) project. United States Department of Agriculture, Natural Resources Conservation Service.
Available online at http://soils.usda.gov/survey/raca/. June 1, 2013 (FY-2013 official release).
Prepared by: Skye Wills, May 2013
Updated: August, 2013


Soil Health-Related Practices
Applied to CSP and EQIP Contracts FY 2009 to 2013
EQIP Contracts
CSP Contracts
Hawaii
Pacific Basin
Alaska
USDA
Natural Resources Conservation Service
SPA-REAPD
Washington, D.C.
September 2014

PROFILES IN
soil health
Champlain Valley Farmer Focuses on Soil and Water Quality.
MONTANA
PROFILES IN
soil health
Farming Changes Focus on Soil Health
unlock the SECRETS IN THE SOIL
OKLAHOMA
PROFILES IN
soil health
Jimmy Emmons
Dewey County, Oklahoma
2,000 acres
Crops: Wheat, alfalfa, canola, cow/calf operation
Covers: Multi-species
IOWA
PROFILES IN
soil health
MRBI Conservation Practices Improving Soil Conditions, too.


unlock the SECRETS IN THE SOIL
Alabama
ALABAMA CHAMPION OF
soil health
Ricky and Russell Wiggins
Covington County
2,650 acres
Crops: cotton and peanuts
Cover: rye
unlock the SECRETS IN THE SOIL
Using "big" cover crops to build and maintain soil health
"I like using conservation tillage. In the spring we can keep the tractors in the shed, except for putting out litter, and rolling and spraying crops," Russell said. "In the past, we had to fix terraces and clean out waterways constantly. Regular terrace maintenance is not required much anymore."

Helping people help the land
unlock the SECRETS IN THE SOIL

The CHAIRMAN. Thank you, Chief, I very much appreciate your testimony. The chair would like to remind Members that they will be recognized for questioning in order of seniority from Members who were present at the start of the hearing. After that, Members will be recognized in order of arrival, I appreciate the Members' understanding. And I am—after saying all that, I am going to defer to last. I will recognize the Chairman of the full Agriculture Committee for 5 minutes for questions.

Mr. LUCAS. Thank you, Mr. Chairman. Chief, tell us, from your perspective, your vantage point, kind of on the front line of all these issues, how you see the resources that you have at the Service, how you see the needs evolving out there, how you see the science coming together. Tell us, and I am asking you a general purpose question for a general purpose answer, how you see the response out in the community. And we will hear more from that from the second panel. Just give us a feel where you believe we are in this endeavor to bring a greater focus to the living soil.

Mr. WELLER. Thank you. I think where I began my testimony, in part the excitement and the energy, is really—you can feel it. And the passion that we have focused within NRCS that really believe with all their fiber this is the right thing to do, and they are very excited about it. And in part these folks, like Mr. Ray Archuleta may be some of you may have met, he has been working—he is a conservation agronomist with NRCS, and he has been talking about soil health for decades. And the fact this is all now coming to fruition has helped energize NRCS employees.

But because we are now taking, the last several years, a real focus on now—beyond just talking about it, but actually providing training for folks, that it is really energized our field folks, who have been very busy and very focused on delivering program assistance and planning assistance. But it has helped a lot of folks reorient back to the creation of our agency, and it is there—farmers and ranchers, and to help them improve and manage their soils. I think that return that—literally getting our hands dirty in the soil has really been energizing and enervating for NRCS.

But from the producer side, this is an example where, instead of having to push a wet rope uphill, try this out, we are actually getting pulled up the hill. We are trying to hold on to the rope as hard we can because the producers are very motivated, very excited. They are innovating. They are the ones that are coming up with a lot of these different practices. They are doing strip trials in their fields. They are using different cocktails of cover crop mixes. They are willing to subject their fields to different experiments, and all this, and they are coming back with great information that then they are sharing with their neighbors, and other producers in their communities, and within their own agricultural associations.

The level of excitement and the momentum is only building, and that has been very rewarding to be part of, and to help NRCS play that role. The resources this Committee provides, and Congress provides our agency, are, in my view, critical, and very much part and parcel of helping to get soil health practices implemented. It is that one on one technical assistance planning which is so crucial to help impart that knowledge.

But then, in some cases, it is folks who want to give it a try, but they are leery of the cost, or it may be encumbering risk. It is a transition to a different cropping system. We can help offload some of that risk, and allow them to experiment with different nutrient management approaches, and cover crops, and tillage practices to help them get up to speed. I think we are well equipped for it. We have a ways to go, but we have had a great start, and there is a lot of opportunity.

Mr. LUCAS. In my home area, Chief, the advance in technology, the private industry, the people who produce our seeds, and build our equipment, the general phrase is precision agriculture. It just goes hand in hand with this, wouldn't you agree? The technology that has been developed out there by industry that enables us to literally do, foot by foot, acre by acre, what is appropriate for the soil.

Mr. WELLER. And precision agriculture is a definite example where—this is where our agency really has got to pick up pace, where I think the degree of innovation that is coming out of the research community, but particularly from the agricultural implement dealers, and the researchers, it is incredible. In precision agriculture, it absolutely is part and parcel, and can definitely—even make soil health even more effective. You can optimize your use of nutrients, and manage your soils most effectively. So, yes, precision agriculture is a great tool for improving the health of your soils.

Mr. LUCAS. Mr. Chairman, I would simply note that, from the founding of—from the first arrival of Europeans, perhaps the way to describe it, until a century ago, the concept of mining the soil existed. It was a resource that you utilized, then you moved on. Starting in the 1930s, perhaps, with a particular focus in my region and the southern, the Great Plains, and the east side of the Rockies, and the evolvement of the Soil Conservation Service, the predecessor to the NRCS, the focus began to shift that this was something that was not to be used and thrown away, but it was to be truly nurtured. And now we are apparently taking the next step, so progress is a positive thing, and we are in that direction. With that, I yield back to the Chairman my remaining time.

The CHAIRMAN. I thank the Chairman for yielding back. I now recognize the gentleman from Ohio for 5 minutes.

Mr. GIBBS. Thank you, Chairman. Thank you, Chief, for being here. You need to ratchet up that passion a little bit more. It is great, because obviously it is—but I have been doing no-till probably for 20 years, so you are not—don't have to tell me. It has been great—back in the 1990s, and—Soil and Water Conservation Board. And the partnership with NRCS, and the county conservation districts is the way to really go, and the EQIP program, when it all comes together, it works really good. And in my area, it is almost all no-till. I live in eastern central Ohio. Probably pretty hard to see an old—plow anymore.

But in your written testimony you talk about events like drought in Texas, and California, and the algae blooms in Lake Erie, and I want to talk about that a little bit, because, as you know, we have algae bloom problems, especially on the western part of the lake, but a couple years ago it was throughout the lake, because Lake Erie is the most sensitive lake because it is so shallow. And here,

not—just several weeks ago, City of Toledo had to shut down the drinking water to half a million people for 3 days.

And I want to give kudos to the—Howe Farm Bureau. They are putting in a million dollars to try to address the problem, because farmers want to find a solution. They want to be part of the solution, and—and I think there are other causes. And one thing that frustrated me, we don't know what all the causes might be. We are speculating. We have the sewage treatment plants, and combined sewer overflows, and you have runoff, and all that.

But for my first question, I know Robert E. Latta, my colleague from Ohio, has a bill out there to try to address causes. I am looking at it, as my Chairman of the Committee I—trying to look at—causes and solutions. What—obviously no-till helps mitigate the spread, or the erosion, but we are starting to see, and I want to see if you concur with this, during heavy rain events, I mean talking, like, getting 4″ or 5″ in an hour's time—I am sure Chairman Lucas would like to have some of that water. We get it once or twice a year.

You know, that does a couple of things. If our sewage treatment plants end up over capacity—they have direct discharges. And—even all the practice we do in agriculture, those kind of events, it is a challenge. Would you agree that that is where a lot of the—we have—I guess—the conservation we are putting in to address normal weather activities. It is those extremes is where the problem is, or am I just——

Mr. WELLER. My understanding is, yes, at the end of the day, if it rains so much, there is only so much that a field can attenuate, and so the basic conservation systems, like no-till, is an effective way for normal precipitation. When you have extreme weather events, yes, you are going to have—no matter what, you are going to have water—but it is also, then, looking at a systems approach for conservation, so it is looking about how you buffer your fields.

Mr. GIBBS. Yes.

Mr. WELLER. To the extent you have till lines, you are draining the fields through—water management practices, you could, again, help attenuate what comes out of the till lines. It is looking at cover crops as part of the overall no-till operation. It is the nutrient management I talked a little bit about earlier.

Mr. GIBBS. Let me just follow up: and I don't know the answer to this. I am not certain. In my area, like I said, we do all no-till. We don't have heavy soil. I have HAL ground, highly arable land. Now, out in northwestern Ohio, I guess the soils are heavier. I know in some parts it is really heavy. What is—is no-till hard to adapt in those heavy soil, or does it work as well, or——

Mr. WELLER. I—my understanding is it is effective, that folks are using no-till, even in those heavier soils. It is perhaps a different management approach, and it takes some adjustment, but it is something that can be adapted, even through a heavier soil environment.

Mr. GIBBS. Okay. Because that would be helpful to address this issue, especially in northwestern Ohio, in that—in the Maumee Watershed up there—so that is—Mr. Chairman, I just wanted to bring that up because it is a huge challenge, and it is—of course, it is not just in Lake Erie. We—you mentioned here, and I know

in the Chesapeake Watershed, and there are some other areas that we have that. There are other factors, such as weather.

And, like I said a moment ago, it is good to see that organizations like Ohio Farm Bureau putting up a million dollars to partner with Ohio State University and others, EPA and all the others, to try to address this and find solutions. But agriculture wants to find a solution, to be part of the solution, so I yield back.

The CHAIRMAN. I thank the gentleman for your—I also thank the gentleman for—as someone who now—certainly within my Congressional district shares Lake Erie with the good Members in Ohio, and I appreciate you bringing up the impact, and how this could help mitigate the most recent situation there.

Chief, thanks so much for your testimony, and, as Mr. Gibbs said, your passion. It was very evident, and I thank you for that. Chief, can you discuss—you had made reference to the work that we did with the 2014 Farm Bill. You know, what impact do you expect from those provisions that we have provided you, those tools we provided you? What do you expect the new law to have on soil health?

Mr. WELLER. So starting with just—thank you very much. Title II is an incredibly strong title. Starting with the streamlining of the programs, and consolidating basically into the financial assistance program, into a stewardship program, and then into an easement program, that streamlining is going to help our folks in the field, reduce some confusion for producers. And we want to focus on soil health. We then sort of have the financial assistance program that helps get the practices in place, the stewardship, which will then help take—allow producers to take their nutrient management, and their tillage, and their cover crop use to the next level, in terms of overall stewardship.

And then you included the Regional Conservation Partnership Program, which is this overarching *smörgåsbord* of opportunity, and that, then, allows for innovation. And—so we held an original sign-up earlier this summer. We are having a two-step approach here to the first RCPP sign-up. We have received close to 600 applications to the new Regional Conservation Partnership Program, and many of those applications include a focus on soil health.

And what is exciting here is because this program then turns the keys over to the partners, they devise where they want to work, how they want to work, what programs they want to use, who is enrolling in the program. They can then devise new, innovative ways to practice soil health, to get it on the landscape, to get it into a river basin.

What title II has provided us is to give the agency a lot of flexibility to go out and do the good work, in this case, of helping producers apply soil health, but then it also has energized and provided a lot of impetus to the conservation community, through the regional program, to get their resources, ideas, excitement, energy, partnership to the table, and they can then also push out, and move out, and demonstrate what can be done in soil health as well.

The CHAIRMAN. Excellent. And how about—can you give us an update of—sounds like we have provided you some pretty effective tools. Was there—it is good to hear. That is very affirming. Just kind of an update, in terms of implementation, we know that—

when there are changes made it takes time in order to align the resources with the implementation. They—any kind of insight, in terms of implementation of those provisions?

Mr. WELLER. Well, hopefully you are hearing good implementation. I would like to think, our agency, one of the hallmarks is we are no drama mamas at NRCS. We have actually gotten title II implemented. So we haven't yet gotten the regs implemented, but because in title II you included language there that allowed us to use our underlying regulation, as long as we updated our programs to fit with the new law, the new statute.

We have enrolled EQIP. We have done—we are about to complete enrollment with CSP. We are going to get close to 10 million acres in CSP. We have pushed out all $300+ million of ACEP money across the United States, enrolling 129,000 acres in ACEP. We have the voluntary public access money out the door. We have the Watershed Rehab Program. We are going to get almost all of the $250 million invested into hundreds of projects across the United States. So we have implemented.

What we are now, then, moving into is the actual following up with the regulations. And so those regulations will be out early this fall. We already have one out of the chute, which is sort of a catch-all regulation that sort of covers some of the miscellaneous issues, and we have three more, then, regulations that are coming, the Conservation Stewardship Program rule, EQIP program rule, and the new easement program, ACEP, rule. Those will be out this fall.

The CHAIRMAN. Excellent. Well, I personally believe, and I think the Members here would agree that the environment has benefitted so much by the voluntary effort and work of our farmers and ranchers, in collaboration with—from USDA, the professional—USDA, which we are very appreciative of. I think it is a much more productive approach, using a spirit of collaboration, as USDA is known for, than perhaps maybe a sister agency, such as the EPA, which seems to take a more punitive approach.

But that said, what do you see as the—we are not 100 percent onboard with some of these practices. They haven't really been embraced. Why do you think they are—is there resistance out there to some of this—it is not new science. It is kind of old science that has kind of resurfaced. What do you see as the barriers to enlisting more—with your collaboration, more farmers and ranchers to engage?

Mr. WELLER. At the end, when you were asking a farmer to change how they work their land, and in some cases it is—this is what their dads did, and their granddads, and their great-granddads, it works. And the old adage, don't fix what is not broken, if they can get a crop, they are making a living, they are doing okay, why introduce what could potentially be a risk to trying something different?

And that is where we at NRCS, and the broader coalition of folks who are looking at this, need to really get our arms around the science and economics of soil health. First, beyond just anecdotally, we really have to have robust peer reviewed science that talks about the actual risk management. Second, we have really got to get down to dollars and cents. At the end of the day, the most effective conservation is conservation that helps save money, or actually

makes money. That's because you are talking to businesspeople. They have to make a living. They have to pay a mortgage. They want to send their kids to school. So if you are asking them to invest a lot of money out of their own pocket, it has to make sense, and work on their operation.

And getting our arms around the economics, and demonstrating again that soil health practices not only manage risk, but can also help make money, or at least save money, at the end of the day, you have a net gain in the profit of that business, and those are the two critical things that we are really focused on getting answers to.

The CHAIRMAN. Great. Thanks, Chief. At this point we are willing to yield any additional time to my colleagues for additional follow-ups.

Mr. LUCAS. Just simply, Mr. Chairman, that I would note that the Chief is doing an outstanding job, and the agency is working through a lot of things that we have thrown at them, but clearly they are on the right track, and incentive-based voluntary conservation is still what life is all about.

The CHAIRMAN. It is working. Thank you, Mr. Gibbs. Chief, thank you very much for your——

Mr. WELLER. Thank you.

The CHAIRMAN.—leadership, your passion on this. And we look forward, as a Subcommittee, to continue to work with you in a strong partnership, as well as the full Committee.

Mr. WELLER. Thank you, sir. We very much appreciate that partnership.

The CHAIRMAN. My pleasure. The—I now—would like now to welcome to the table our second panel of witnesses, Mr. John Larson, CEO, National Association of Conservation Districts, Ms. Shanon Phillips, Director of Water Quality, Oklahoma Conservation Commission, Oklahoma City, Oklahoma, Mr. Jim Harbach, Farm Manager, Schrack Farms, Loganton, Pennsylvania, Sugar Valley, Ms. Jill Sackett, Extension Educator, Ag Production Systems, University of Minnesota Regional Office, Mankato, Minnesota.

I want to thank the witnesses for making the time and the investment to come here to share your perspectives on this very important issue. And I now recognize Mr. Larson for 5 minutes.

STATEMENT OF JOHN LARSON, CHIEF EXECUTIVE OFFICER, NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS, WASHINGTON, D.C.

Mr. LARSON. Thank you. Good afternoon, Chairman Thompson, Chairman Lucas, and Members of the Committee. I am John Larson. I welcome the opportunity to be here, and to talk about this important topic of soil health. I am the Chief Executive Officer of the National Association of Conservation Districts, and I have worked directly with conservation districts for more than 18 years, prior to which I worked full time as an agricultural producer, running my family's irrigated farm in Royal City, Washington.

NACD is a nonprofit organization that represents America's 3,000 conservation districts, their state and territory associations, and the 17,000 men and women who serve on their governing

boards. Districts are the local government part of the conservation delivery system, and work with millions of cooperating land owners and operators to help them manage and protect land and water resources on all private lands, and many public lands, in the United States, utilizing that voluntary, incentive-based approach. I like to think of the conservation districts as the original pioneers of soil health. Soil health is, and has been, one of the top priorities of conservation districts across the nation since their creation in the 1930s. In fact, soil health is the very reason that districts were created.

Long term nationwide conservation and production practices have resulted in better protection of our precious soil and water resource base, the foundation of our nation's food supply. Conservation districts play a key role in this process by working with local producers and land owners to implement critical conservation practices on the ground. In Indiana, districts are key members of the multi-partner Conservation Cropping System Initiative that has vaulted that state to a leading position in the soil health movement. In North Dakota, the Burleigh County Conservation District adopted soil health as its major focus 20 years ago, and today national and international visitors have come to the district for soil health tours and workshops. Other districts are renting no-till drills, supplying cover crop seed, facilitating farmer-led soil health advocates, providing no-till test plots, and much, much more.

Through these, and other efforts, conservation districts across the nation are helping producers and land owners get the tools that they need to continue caring for the land and provide food, feed, fiber, and fuel for the world. We firmly believe that it is better to invest in long term conservation practices today than to be forced to pay the escalated cost of repair in the future.

The benefits of improving soil health reach far beyond the farm. Health soils lead to higher water quality, by allowing for better nutrient cycling, and reducing sediment runoff, a better ability to manage water, reduce flood damage, an increase in the amount of soil carbon sequestration that the soil does itself. The benefits of nutrient management on soil fertility within a productive and healthy cropping system utilize soil health practices that are assisting producers. As the Chief mentioned, the 4R's nutrient stewardship approach, in which producers apply the right source of nutrients at the right rate, at the right time, and in the right place, fits perfectly into soil health.

In the past several years NACD and its member conservation districts and associations have been working hard to put a renewed focus on soil health. These efforts include partnering with NRCS on an integrated campaign to increase the adoption of soil health management practices by America's farmers and private land owners. By increasing the health of our soils, the campaign ultimately seeks to produce systematic, continental-scale improvements in soil, water, air, wildlife, all while enhancing the long term agricultural productivity, and providing the best return on the nation's conservation investment over the long term.

However, while we are seeing improvements nationwide in both the recognition and the need for the adoption of best management practices for soil health, there is still work to be done. Specifically,

we see five main areas that need—that are needed in the future: (1) developing specific soil health conservation practice criteria; (2) increasing soil health research, both the scientific and economic; (3) training NRCS conservation district and other partners and employees; (4) ensuring farm bill programs facilitate farm bill health—healthy soils adoption; and (5) communicating the benefits of soil health to both the agriculture and urban audiences.

In summary, to make measurable improvement in soil health at the national level, will require a locally led voluntary coordinated effort. Because of their strong relationships with local land owners, as well as with their strong reputation as a trusted source of conservation planning and implementation at the local level, conservation districts are well poised to continue to play a leading role in these efforts in the partnership with local, state, and Federal partners.

Mr. Chairman, as you stated, the population is expected to hit nine billion by 2050. We believe that the widespread adoption of soil health practices is what will make us successful in meeting that need. If we act now, we have the chance to make a difference on the land that will last for generations. Thank you for the opportunity to be here today, and for holding this hearing to help shine a spotlight on the important issue of soil health. I look forward to your questions.

[The prepared statement of Mr. Larson follows:]

PREPARED STATEMENT OF JOHN LARSON, CHIEF EXECUTIVE OFFICER, NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS, WASHINGTON, D.C.

Good morning, Chairman Thompson, Ranking Member Walz, and Members of the Subcommittee. Thank you for the opportunity to testify on the important topic of soil health. I am John Larson, Chief Executive Officer of the National Association of Conservation Districts (NACD). I have worked directly with conservation districts for more than 18 years, prior to which I worked full-time as an agriculture producer, running my family's irrigated farm in Royal City, Washington.

NACD is the nonprofit organization that represents America's 3,000 conservation districts, their state and territory associations, and the 17,000 men and women who serve on their governing boards. Conservation districts are local units of government established under state law to carry out natural resource management programs at the local level. Districts are the local government part of the conservation delivery system and work with millions of cooperating landowners and operators to help them manage and protect land and water resources on all private lands and many public lands in the United States.

The association was founded on the philosophy that conservation decisions should be made at the local level with technical and funding assistance from Federal, state and local governments and the private sector. As the national voice for conservation districts, NACD supports voluntary, incentive-based natural resource conservation programs that benefit all citizens.

I like to think of conservation districts as the original pioneers of soil health. Soil health is, and has been, one of the top priorities of conservation districts across the nation since their creation in the 1930s. In fact, soil health is the very reason why districts came into being.

In the early 1930s, along with the greatest depression this nation ever experienced, came an equally unparalleled ecological disaster known as the Dust Bowl. Following a severe and sustained drought in the Great Plains, the region's soil began to erode and blow away, creating huge black dust storms that blotted out the sun and swallowed the countryside. Thousands of "dust refugees" left the black fog to seek better lives.

But the storms stretched across the nation as soil blown from the Great Plains reached east to New York. Dust even sifted into the White House and onto the desk of President Franklin D. Roosevelt.

On Capitol Hill, while testifying about the erosion problem, soil scientist Hugh Hammond Bennett threw back the curtains to reveal a sky blackened by dust. Con-

gress unanimously passed legislation declaring soil and water conservation a national policy and priority and creating the Soil Conservation Service to fight it. Because nearly ¾ of the continental United States is privately owned, Congress realized that only active, voluntary support from landowners would guarantee the success of conservation work on private land.

In 1937, President Roosevelt wrote the governors of all the states recommending legislation that would allow local landowners to form soil conservation districts. Today, nearly every county in the U.S. and several territories, are served by a conservation district.

As many of you will remember, 2 years ago, our nation experienced a drought of proportions we haven't seen since the 1930s and 1950s. However, despite this extreme drought, we didn't enter into a modern-day Dust Bowl situation. There's a good reason for that—and it's something that all of us in the conservation community can be proud of: careful, long-term nationwide conservation and production practices that started mainly in response to the Dust Bowl of the 1930s. The implementation of these practices has resulted in better protection of our precious soil and water resource base—the foundation of our nation's food supply.

While we can't control weather conditions, strong, locally-led conservation planning can help alleviate the impacts of extreme weather events in the future. Conservation districts play a key role in this process by working with local producers and landowners to implement critical conservation practices on the ground.

For example, in Indiana, districts are key members of the multi-partner Conservation Cropping System Initiative that has vaulted the state to a leading position in the soil health movement. In North Dakota, the Burleigh County Soil Conservation District adopted soil health as its major focus 20 years ago; today, national and international visitors have come to the district for soil health tours and workshops. Other districts are renting no-till drills, supplying cover-crop seed, helping to organize aerial seeding of cover crops, facilitating farmer-led soil health cadres, providing no-till test plots, and much more.

Through these and other efforts, conservation districts across the nation are helping producers and landowners get the tools they need to continue caring for the land and providing food, feed, and fiber for the world. We firmly believe that it's better to invest in long-term conservation measures today, than to be forced to pay for the escalated costs of repair in the future. Without question, we believe that soil health is the key to the future productivity of agriculture and the protection of our natural resources.

"Soil health" is defined as "the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans." Healthy soil ecosystems allow for increased water infiltration, improved water-holding capacity, enhanced nutrient cycling and sequestration, and increased biodiversity.

Historically, soil management activities focused on the physical and chemical functions of the soil. Today's emphasis on soil health recognizes the critical importance of biological function in the soil. "Soil Ecology" emphasizes that soil is a living ecosystem. This ecosystem is impacted by chemical (*i.e.,* fungicides), biological (monocultures) and physical disturbance (tillage) that diminish soil function.

There are four key management principles to improve soil ecosystem function: (1) minimize the chemical, biological, and physical disturbance in the soil; (2) keep the soil covered as much as possible throughout the year; (3) maintain a living root, growing for as long as possible, to feed the soil microbes and transfer more solar energy into the soil; and (4) increase crop diversity above ground to add biological diversity to the soil. These basic management activities are central to improving soil health.

The benefits of improved soil health reach far beyond the farm. Healthy soils lead to higher water quality, by allowing for better nutrient cycling and reducing sediment runoff; a better ability to manage water and reduce flood damage; and an increase in the amount of carbon sequestered in the soil itself.

Due to its increased water-holding capacity, healthy soil is more resilient against drought; it is also naturally less prone to disease and pest problems, thereby allowing farmers to optimize their use of crop protectants. And because healthy soil requires fewer petroleum-based products for tillage it also saves on energy use and costs.

In the past several years, NACD, and its member conservation districts and associations, have been working hard to put a renewed national focus on soil health. These efforts include partnering with the USDA Natural Resources Conservation Service on an integrated campaign to increase the adoption of soil health management practices by America's farmers and private landowners. We anticipate conservation districts providing guidance to determine their local soil health needs and finding ways to best implement a suite of practices aimed at improving soil health.

It is important that districts remain the boots on the ground to help solve local natural resource issues. By increasing the health of our soils, the campaign ultimately seeks to produce systemic, continental-scale improvements in water, air, and wildlife—all while enhancing long-term agricultural productivity and providing the best return on the nation's conservation investment over the long term.

NRCS and conservation districts are not alone in this effort—we're seeing an increasing interest from a wide range of stakeholder groups, organizations and businesses that recognize the potential benefits of healthy soil to production improvements, sustainability, profitability and resource protection—all of which are advantageous to their stakeholders. Many of these organizations are poised to help spread the word about the basics and benefits of soil health and to encourage their adoption.

NACD also recently was awarded, a $750,000 Conservation Innovation Grant to promote soil health over a 3 year period. Through this project, we seek to significantly scale up the number of farmed acres nationwide that are managed for soil health. The project addresses two main barriers: a shortage of economic and cost-benefit information on soil health management; and insufficient transfer of knowledge to farmers of available, innovative practices and technologies for local conditions.

Through the formation of a national "farmer advocate" network-organized by NACD and facilitated by its local districts, and state and territory associations—this project will raise awareness of and increase the adoption by farmers and landowners of soil health practices. This includes farmer-to-farmer information on the use of new soil testing procedures, timing of cover cropping practices, considerations on what practices to use for wet and cool soils, on-farm demonstrations, and the development of strategies to broaden and accelerate action. The project will also provide a series of economic case studies to serve as the basis for an expert-reviewed economic analysis on the value of soil-health practice implementation.

Through these and other efforts, conservation districts are proud to be leading the way in soil health.

However, while we are seeing improvements nationwide in both the recognition of the need for, and the adoption of, best management practices for soil health, there is still work to be done. Specifically, we see five main areas of need for the future: (1) developing specific soil health conservation practice criteria; (2) increasing soil health research—both scientific and economic; (3) training NRCS, district and partner employees; (4) ensuring farm bill programs facilitate soil-health adoption; and (5) communicating the benefits of soil health to both agriculture and urban audiences.

In summary, to make measurable improvements in soil health at the national level will require a locally-led, voluntary, coordinated effort. Because of their strong relationships with local landowners, as well as their strong reputation as a trusted source of conservation planning and implementation at the local level, conservation districts are well poised to continue to play a leading role in these efforts, in close partnership with local, state and Federal partners.

Mr. Chairman, if population growth projections are correct, in a few short decades our population will hit nine billion. To feed this many people will require a significant increase in food production, and we will have to do it while coping with erratic weather conditions and while still conserving our natural resources. We believe that the widespread adoption of soil health practices is what will make us successful. If we act now, we have a chance to make a difference on the land that will last for generations.

A recent resolution, H. Con. Res. 95, underscores this very point—expressing the sense of Congress that voluntary, incentive-based, private land conservation, provided in partnership with local soil and water conservation districts, is necessary to sustain natural resources, meet the needs of a growing population, and ensure safe, abundant, and adequate resources for current and future generations. We are extremely pleased to see our Representatives in Washington expressing support for locally-led, natural resource conservation and its critical value to our nation's economic and food security. The cause of conservation crosses geographic, political and economic boundaries; it is truly something that everyone can support. Caring for our soil and other natural resources is one of the greatest legacies we can leave for our future generations. We urge all of you to support this commonsense, bipartisan resolution.

Thank for you the opportunity to be here today and for holding this hearing to help shine a spotlight on the important issue of soil health. I look forward to your questions.

The CHAIRMAN. Thank you, Mr. Larson. Thank you for your testimony.

Ms. Phillips, you are now recognized for 5 minutes.

STATEMENT OF SHANON PHILLIPS, DIRECTOR, WATER QUALITY DIVISION, OKLAHOMA CONSERVATION COMMISSION, OKLAHOMA CITY, OK

Ms. PHILLIPS. Thank you, Mr. Chairman, Committee Members. My name is Shanon Phillips. I am with Oklahoma Conservation Commission, and I very much appreciate the opportunity to speak with you this morning about soil health, and its relationship to water quality. I think many of us appreciate how critical soil health is towards a strong agricultural industry, but, unfortunately, fewer people seem to appreciate how critical it also is towards supporting and protecting the nation's water supplies.

And we have already talked about how soil health can reduce water pollution, because healthier soils have greater infiltration rates, which means there is less runoff of pollutants that then enter our nation's waterways. Healthier soils require less supplemental fertilization, which also means lower opportunities for pollution of nutrients to our nation's waterways. And, finally, healthy soils are living soils, which promote a multitude and variety of microbial communities, which also break down some pollutants into compounds that are less problematic when they enter our waterways. And we know, from data that has been provided by states to the U.S. EPA, that at least 60 percent, shown here by the colored wedges on the pie chart, of the pollutants which cause impairments to water bodies and our nation's waters are related to pollutants that come from soils.

Now, water bodies are recognized as being impaired when they are not meeting the Clean Water Act goals, which means that they are not fishable, they are not safe for swimming, or they are not—they don't provide safe drinking water. And we have already talked this morning about some of the more significant consequences related to the situation in Toledo this summer, when they were—when they had to turn off the taps. But those types of toxic bloom and algae blooms are happening all over the nation, from New York State, to Wisconsin, to Oregon, down to Texas, Kansas, and Oklahoma.

And those—but the good news about those types of water quality problems is we do know how to solve these water quality problems, and we can do so through voluntarily conservation programs, such as those that are provided for in the farm bill. And we know that through our partnership with the U.S. EPA that in over 500 streams all across this nation we have solved those types of water quality impairments through these types of voluntary programs.

And I am very happy to report that in Oklahoma, in fact, we are one of the most successful states in the nation at demonstrating this type of success. There is only one state in the nation, in fact, that has more success than Oklahoma does at showing how these voluntary conservation programs that bring a partnership of local landowners, conservation districts, USDA, NRCS, and FSA, and the State Conservation Agency together to implement these conservation practices and solve water quality problems.

One of the reasons that we have been so successful in Oklahoma is because we have also made EPA a part of that partnership. And I recognize that that makes a lot of people very nervous, but what we are doing with EPA is we are utilizing their funds from the Section 319 Clean Water Act program to provide technical support to support water quality monitoring. We are using their technical support to design that water quality monitoring, and we are using that data to prove to EPA and others that these conservation programs not only assist farmers in maintaining their operations, but they also solve water quality problems without additional regulation.

So, with that, I would be happy to answer any questions.

[The prepared statement of Ms. Phillips follows:]

PREPARED STATEMENT OF SHANON PHILLIPS, DIRECTOR, WATER QUALITY DIVISION, OKLAHOMA CONSERVATION COMMISSION, OKLAHOMA CITY, OK

Thank you for the opportunity to testify today about the relationship between soil health and water quality. I'm certain you're aware of the Natural Resources Conservation Service's (NRCS) campaign to raise awareness about the importance of soil health and to provide private landowners the knowledge, skills and tools to protect this resource. The impetus behind this campaign lies with the increasing demands on our soil resources and the agricultural community to cost-effectively feed the world. We can thank progressive farmers and agricultural experts all around the globe who have developed methods, knowledge, and skill sets to help address this problem and we can thank the NRCS for bringing these tools to the U.S. agricultural community.

The importance of protecting our national soil resources, which were built over geologic time and heavily impacted through settlement and development of our continent, is relatively obvious as it relates to the promotion of a strong agricultural industry, which, in turn, is critical for a healthy national economy. Scientists estimate that as much as 60% of carbon has been lost from agricultural soils since the 1800s. This loss in organic matter affects a soil's capacity to absorb and hold nutrients and water, which are critical for production of crops and livestock forage. However, protection of our soil resources is also mandatory for protection of the nation's water resources.

Erosion of soil particles, washing of compounds from the soil, and changes in soil structure which affect water infiltration are some of the most significant sources of water quality problems in the U.S. According to the U.S. Environmental Protection Agency, approximately 777,759 or 67 percent of impaired miles of U.S. streams and rivers and 9,794,360 or 40 percent of impairments to acres of lakes, reservoirs and ponds are caused by pollutants related to soil erosion or leaching of pollutants from soils such as excess nutrients, sedimentation, turbidity (suspended particles), pathogens, and pesticides.

In August of this year, the City of Toledo, Ohio was in the news related to toxins from bluegreen algae blooms which made the city water supply from Lake Erie unusable. Bluegreen algae blooms, which sometimes produce deadly toxins, happen all over the U.S., from New York to Oregon and from Wisconsin to Texas. A July fourth holiday bloom in 2011 in Grand Lake, Oklahoma dramatically impacted the local community and made the news for sickening one of our Senators. At least 38 waterbodies in New York had suspected or confirmed bluegreen algae blooms this summer, and toxin production above safe levels was confirmed in at least seven of those systems.

Algae blooms occur and persist when a waterbody receives more nutrients than it can naturally assimilate. These excessive nutrients are often related to soil erosion and the washing of pollutants from land surfaces. Agriculture, although certainly not the only source, is one of the most significant sources of nutrients in the U.S.

The good news is that we know and have demonstrated how to reduce these nutrient and sediment-related impacts from agriculture. These successes have been demonstrated all over the nation and many of them are chronicled on the EPA Nonpoint Source Success Story Website at: *http://water.epa.gov/polwaste/nps/success319/*. This website highlights at least 508 waterbodies across the nation where water pollution problems have been solved. Most of these programs relied on voluntary conservation programs to help states and local partners clean up waterbodies affected

by pollution which resulted from soil erosion or the washing of pollutants from the soil.

I'm especially proud of the Oklahoma record of demonstrating success at addressing these water quality problems. Oklahoma is a national leader at building partnerships among private landowners, conservation districts, NRCS, the state conservation agency (Oklahoma Conservation Commission), and the EPA to solve nonpoint-driven water quality problems.

Nonpoint source pollution results when rainfall or snowmelt washes pollutants off or out of the land and into streams. It is much more difficult to measure or control than point source pollution, which is generally thought of as pollution from a defined source, such as a pipe at a waste-water treatment plant. In states like Oklahoma where the majority of land is privately held and used for agricultural production, conservation programs to protect and reduce the impacts from agriculture have been very successful. In fact, only one other state in the nation has more success at addressing water quality programs through voluntary, nonpoint source programs. The EPA Nonpoint Source Success Story webpage currently lists 39 different Oklahoma watersheds where voluntary, agriculturally-based conservation programs have solved water quality problems and another six are pending in the coming months.

These successes have been possible through the partnership formed as a response to solve the economic and natural resource devastation associated with the Dust Bowl. This partnership among the local landowners, local conservation districts, NRCS, and the state conservation agency has a long history of effectively working to address soil erosion. However, by including EPA in this partnership, we're able to definitively document that this partnership is also successful at addressing water quality impacts that are, at least in part, associated with agricultural production.

States are provided funding through the EPA Clean Water Act Section 319 Program which can be used to monitor waters for nonpoint source pollution-related impacts and to document water quality improvements from conservation programs. These funds can also be used to support boots on the ground personnel who can help the ever-shrinking NRCS staff work with landowners to implement conservation practices. Finally, the 319 funds can be used to supplement cost-share dollars available to landowners to help them install and maintain these effective conservation practices.

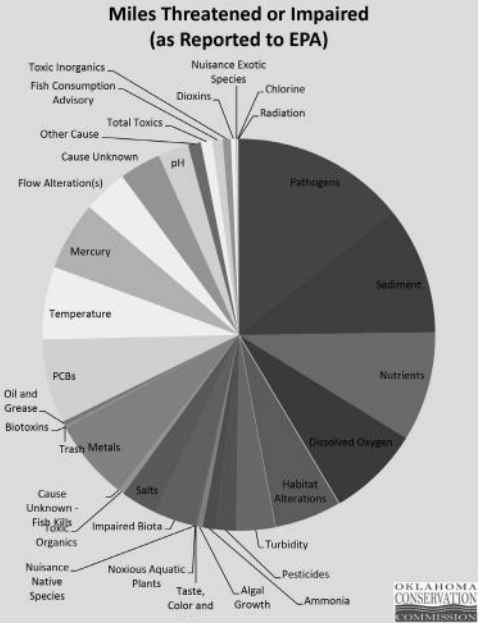
Without the EPA partnership, there would not be a Nonpoint Source Program in Oklahoma, nor would there be any documented Nonpoint Source Success Stories. We would not be able to prove that voluntary programs can successfully address water quality problems on our agricultural lands because our limited state and Federal funds from other programs are focused on other purposes. Finally, the EPA oversight and technical support for the 319 program is both beneficial for the overall program and critical toward legitimizing program results.

Thank you for your attention today and for your support for voluntary-based conservation programs such as those provided for in the farm bill. Meaningful, measurable progress towards protecting our nation's economic and natural resources health is possible due to this support. Please also recognize EPA as a critical, beneficial partner in this effort as well. I am pleased to answer any questions that you might have.

POWERPOINT PRESENTATION

Sources of Water Pollution

- At least sixty percent (colored wedges in pie chart) of impairments to rivers and streams are predominantly related to substances or soil particles washing from the land surface and out of the soil interface



Potential Consequences of Failure to Address Water Quality Problems

- Waterbodies are recognized as impaired because they don't provide safely drinkable/fishable water
- Impacts are variable and can range from waters that aren't as pretty to toxins that can shut down your liver or cause permanent brain damage or death

OKLAHOMA CONSERVATION COMMISSION

The Good News

- We know how to solve these problems
- We can do so, in many cases through voluntary programs
- The solution involves the voluntary partnership between landowners, NRCS, state conservation agencies, ***and EPA***

OKLAHOMA CONSERVATION COMMISSION

Questions?

Shanon Phillips
Water Quality Director
Okahoma Conservation Commission
405-522-4728
Shanon.phillips@conservation.ok.gov

The CHAIRMAN. Thank you, Ms. Phillips, for your testimony.

Mr. Harbach, once again, welcome to Washington, and go ahead and proceed with your testimony for 5 minutes.

STATEMENT OF JAMES HARBACH, FARM MANAGER, SCHRACK FARMS, LOGANTON, PA

Mr. HARBACH. Thank you. Good afternoon, Chairman Lucas, Chairman Thompson, and Members of the Committee. I would like to thank everyone here today for the honor of sharing some of my life experiences, and especially Congressman G.T. for his confidence in me. I am very fortunate to have been part of agriculture for more than 40 years. On our operation, I have witnessed the transition from conventionally plowed ground to no-till. Some of our fields have been—not been plowed for 40 years. We have seen firsthand the transformation of our soils, and the positive results when you farm in nature's image.

In the last decade, with the addition of cover crops, and the belief that plants feed the soil, instead of soil feeding the plants, we have seen incredible results. Some examples include organic matter increases of one percent in 3 years, and steady state infiltration rates that average 4½″ per hour.

I have no fancy degrees, no financial incentives to be here today, and I don't enjoy public speaking, but I have a passion for our soils, and the land around the world. I am not an organic farmer, although we no longer use insecticide or fungicides, and only a fraction of the herbicides and fertilizers that we once applied. I used to be part of the group of traditional thinking farmers, but by attending national conferences, field days, and visiting open-minded farmers around the country, I now have an understanding of the important symbiotic relationships that are achieved when you farm in nature's image. Our farm is part of a like-minded nationwide soil health community that believes that soil health holds the answers to all of our problems.

Agriculture today is farming a degraded resource, and has accepted this as normal. Despite our best efforts, our soil has lost the ability to effectively absorb rainwater, are void of biological life, and are depleted of nutrients. Our soils are so degraded that we must rely on industrial inputs to keep our farmlands productive.

We now have a broken water cycle as a result of a broken carbon cycle. The loss of soil organic matter has contributed to carbon dioxide levels in the atmosphere because we have robbed the soils of its carbon. Soil organic matter has many, many functions, water infiltration, water holding capacity, groundwater recharge, and its ability to cycle and store nitrogen, along with other nutrients.

On this slide, our soils have infiltration rates of over 4½″ per hour. And I would like you to notice this slide here, notice the rapid infiltration into soil, instead of creating—erosion, this field—above the road this field has drains—in the shop area, so the water is a little bit muddy coming off of a shield area. There is 18″ pipe there bailing water out into this field, and it dissipates within 100 yards. And this is some of the things that we have been seeing. On our farms we no longer have water leaving our fields. Even with 4″–4½″ of rain events, we don't see any erosion.

Conservation programs have historically reacted to resource concerns, instead of being proactive to address the source of the problem. We need to start promoting proactive conservation, instead of reactive conservation. NRCS has embraced soil health as one of their core programs. It is a good start, but what we need is a mammoth soil health education program to teach farmers, Federal and state agencies, regulators, universities, children, and the general public. Farmers need to understand how the soil functions before they will value it as a resource, but government programs need to motivate farms to adopt soil health principles. Many do the opposite. They enable poor stewardship.

As we look to the future direction of government crop insurance programs that guarantee price and yield, we need to have a premium structure that promotes soil building techniques, and, conversely, provides a disincentive for soil degrading practices. Taxpayers should not be on the hook for supporting production agriculture that exports more topsoil nutrients and soil carbon than actual crop products.

The benefits of healthy soil need to be acknowledged in the regulatory process. We need regulatory agencies to recognize that well managed farms with healthy soils are the key to reducing agricultural problems.

In this slide, you can see the—a distinct line there where manure was applied. The following day we had a 3″ rain event. You can see where the—none of the nutrients moved along that line, which tells us that, in order to keep the nutrients on the land, we need to keep the water on the land. This field also has excellent water infiltration capacity.

Thank you for this opportunity. I will be looking forward to questions.

[The prepared statement of Mr. Harbach follows:]

PREPARED STATEMENT OF JAMES HARBACH, FARM MANAGER, SCHRACK FARMS, LOGANTON, PA

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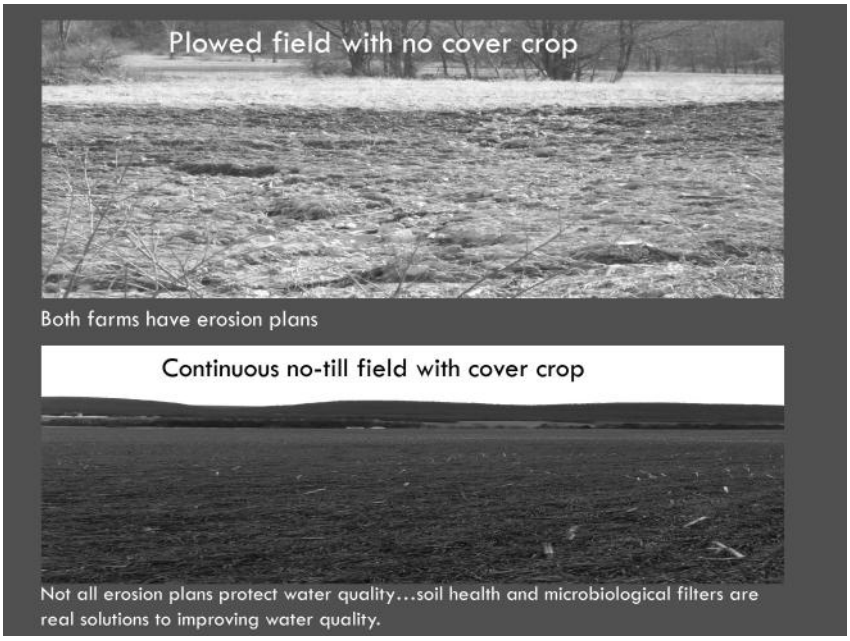

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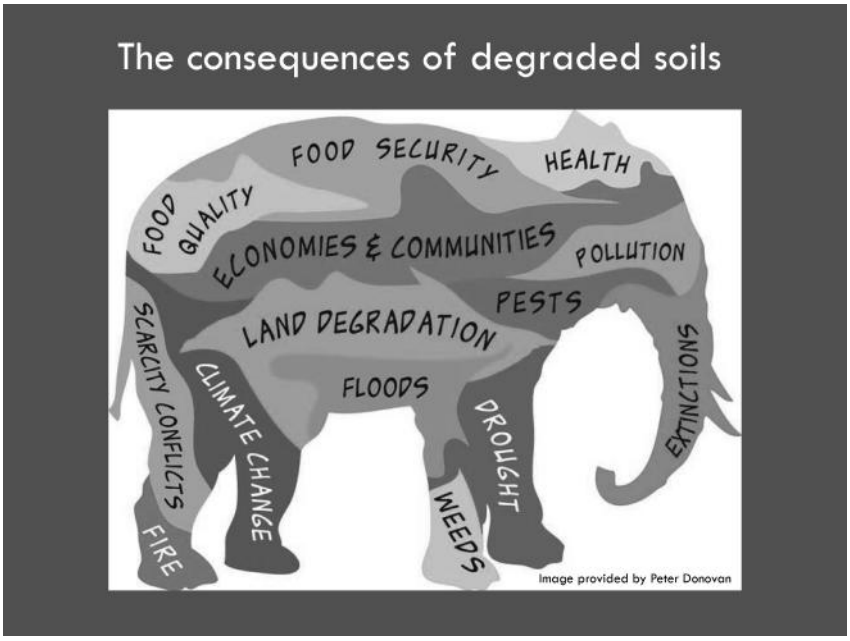

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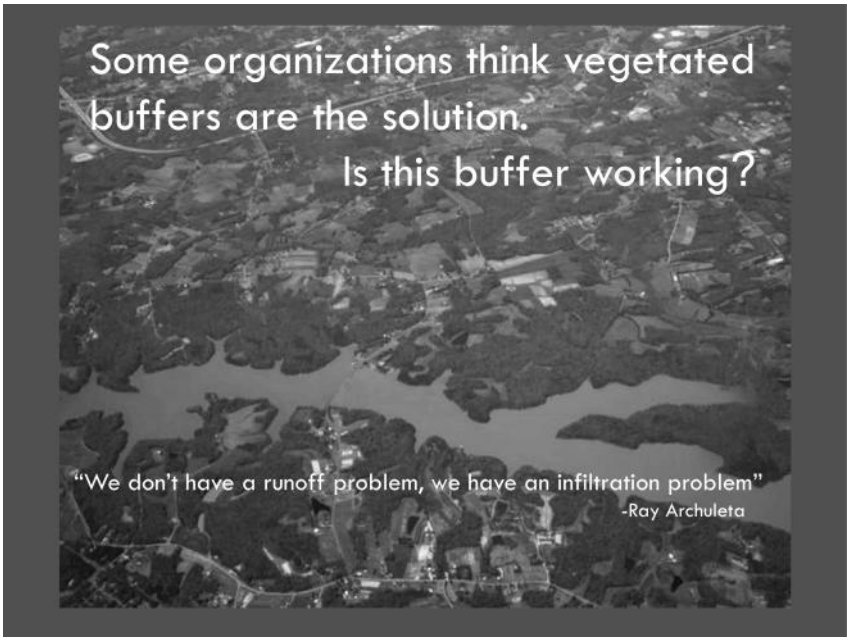

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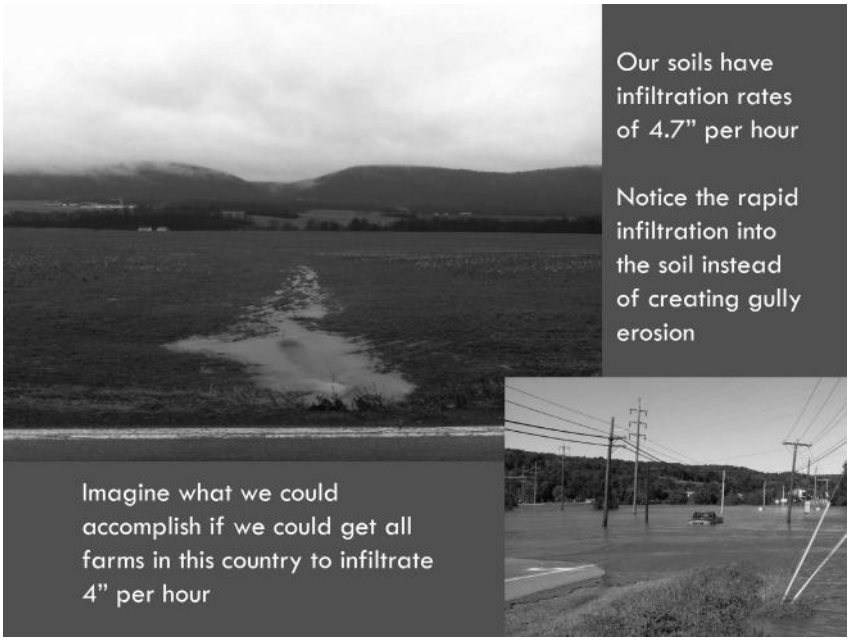

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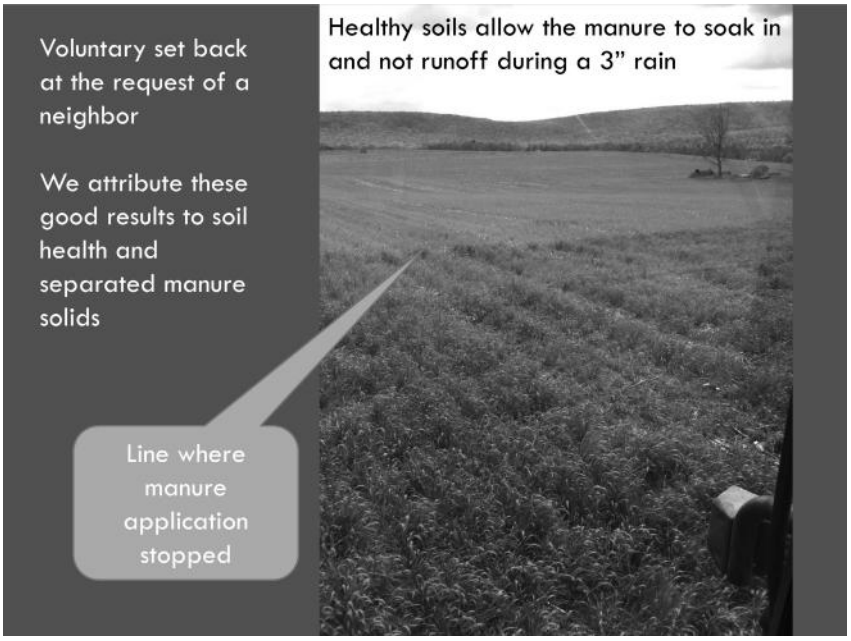

The benefits of healthy soils need to be acknowledged in the regulatory process. We need regulatory agencies to recognize that well managed farms with healthy soils are the key to reducing agricultural pollution.

Food for Thought

More independent, government funded studies need to be conducted on the effects of fertilizer, herbicides, GMO's and pesticides on the soil community and human health. We cannot rely on industry to fund these studies and produce unbiased results.

Each state needs to have long term, no-till farms that exhibit improvements in soil health. These farms need to be central in soil health research and education programs. Soil health farms need to monitor improvements in profitability, water infiltration and retention, soil organic matter increases and soil generation.

Can agriculture sequester enough soil carbon to make a measureable difference in atmospheric CO_2 concentrations? In the book *Cows Save the Planet and Other Improbably Ways of Restoring Soil to Heal the Earth,* Dr. Christine Jones states that every 1 tonne increase in soil organic carbon represents 3.67 tonnes of CO_2 sequestered from the atmosphere.

Can healthy soils significantly reduce rain water runoff?

Do healthy soils leak nutrients or does this only occur in poorly structured and poorly managed soils?

Changing weather patterns are linked to soil management. Bare, exposed, dry soils put more heat into air and change flow patterns above the fields. Bare soils do not cycle the water, lowering the ability for the plants to contribute to local moisture.

New soil testing technologies like the Haney Soil Health Tool and Solvita CO_2 Burst that measure biological life and nutrient availability need to be promoted and incorporated into crop nutrient recommendations.

What will motivate farms to achieve good soil health and increase the soil organic matter—regulations or education and gaining a better understanding?

If you promote soil health principles, be prepared for a huge push back from the agriculture industries that sell products to farmers. Once a farm restores healthy soils, few of these products are needed and it will reduce industry sales.

Farmers that contract with NRCS and are given incentive payments for installing practices (EQIP, CREP, CRP, WRP) should be required to attend soil health trainings and education programs.

We need to develop Soil Health Management Plans that take into account the soil infiltration rates, soil organic matter, and soil enhancing practices on the farm.

The CHAIRMAN. Thank you, Mr. Harbach, very much. Your testimony is appreciated.

Ms. Sackett, welcome, and whenever you are ready, go ahead and proceed with your 5 minutes of testimony.

STATEMENT OF JILL L. SACKETT, EXTENSION EDUCATOR, AGRICULTURE PRODUCTION SYSTEMS, UNIVERSITY OF MINNESOTA EXTENSION REGIONAL OFFICE, MANKATO, MN

Ms. SACKETT. I would like to start by thanking the Chairman, and all Committee Members, for inviting me here today to testify, and to be able to share a Minnesota cover crop story with each of you.

I started my professional career with cover crops basically the minute I started my professional career with Extension. I did my best to hit the ground running, and, thankfully enough, I had some really good resources out there on a national level, like SARE, on a regional level, like the Midwest Cover Crop Council, and then probably about 20 years off and on of cover crop research from the state, some great soil and water conservation districts, and some wonderful farmers. At that time, adoption rates of cover crops were very low. But we all forged ahead, and we were hosting education events. We were doing demonstration plots, and we were working with some amazing farmers that had innovative ideas.

We quickly figured out that there are two main focuses for why Minnesota farmers are interested in cover crops, the first of which is soil health, which is why we are here today. Now, when you ask a farmer, why are you interested in trying cover crops, the phrase *soil health* may not actually be what comes out of his or her mouth, but what they do describe definitely makes up quality, healthy, productive soils. They share with us that they would like to see a decrease in soil erosion, an increase in soil organic matter, an increase in natural nutrient cycling. They want to see more water infiltration. During drought, they want to be able to have higher water holding capacity in that soil, all of which are part of what makes a soil healthy.

The second point, and not surprising for the Land of 10,000 Lakes, is water quality. What we noticed in Minnesota the last few years, unfortunately, is that we tend to have far too much water in the spring, and far too little water in the summer and fall. Cover crops are one of the few practices that actually allow us to deal with both of those issues.

The use of cover crops allows us to take up excess water, to take up excess nutrients, and the roots help hold our soil in place, all of those things we want in our fields, where we need them most. On the flipside, when it comes to drought, a living plant can actually shade the soil, a dead cover crop can mulch the soil, both of which help decrease soil evaporation.

This brings us to an excellent story that shows the interrelationship of cover crops, soil health, and water quality. In 2013 it wouldn't stop snowing and raining, and a lot of our farmers in southeast Minnesota weren't even able to plant their cash crops. Some of them decided to plant cover crops, many for the first time

ever, in order to keep their soil in place, and to keep any nutrient that they had put on that soil in that field. The farmer in question here decided to use oilseed radish, and in September he called and said, I don't know what to do. It is really dry, and yet these plants are growing robustly. The roots are 3″ in diameter, the leaves are bushy and about 2½′ tall. What do I do? My neighbors are telling me that I need to just plow it under and get rid of it. My NRCS person is telling me, no, leave it be, you need to protect that soil.

He had gotten my phone number from his soil and water conservation district, and he gave me a call because he knew I had had some experience with oil seed radish. And, in my experience, the chemical makeup of this particular plant allows it to decompose quickly in the spring, so I encouraged him to not listen to his neighbors, and listen to his NRCS agent instead, and leave it be. And that is where we left our conversation. This June I was pleasantly surprised to find an e-mail from him, where he told me that the oil seed radish had basically dissolved by planting time, and that the soil conditions were some of the best he had ever seen in his 41 years of planting. But my favorite line from the e-mail was, "We showed them."

I would like to end today with just a few thoughts. The efforts of a few have become the efforts of many in the last few years. NRCS, with the EQIP program, the ag media, soil and water conservation districts, extension, nonprofits, we are all working together, and we are doing our best to give a unified message out there about cover crops and soil health. We know this is only a small part of the conservation puzzle, but we also know that, for high quality soils, for good quality water, cover crops can be one of the ways we can reach those two goals. Thank you.

[The prepared statement of Ms. Sackett follows:]

PREPARED STATEMENT OF JILL L. SACKETT, EXTENSION EDUCATOR, AGRICULTURE PRODUCTION SYSTEMS, UNIVERSITY OF MINNESOTA EXTENSION REGIONAL OFFICE, MANKATO, MN

A Minnesota Cover Crop Story

Ms. Jill L. Sackett
Extension Educator, Agriculture Production Systems—University of Minnesota Extension
State Co-coordinator, Minnesota—USDA Sustainable Agriculture Research and Education

I began my career with University of Minnesota Extension thanks, in part, to a USDA Sustainable Agriculture Research and Education grant that focused on cover crop demonstration and education. Cover crop use at that time was very low, but research and farmer experiences from around the Midwest were making a valid argument for why farmers should be using them. I had some personal experience with cover crops due to my location in south central Minnesota; numerous vegetable canning facilities are located there and some farmers choose to plant cover crops after these early harvested cash crops. Even more importantly, however, I had the expertise of the Midwest Cover Crop Council; local research from University of Minnesota, Minnesota Department of Agriculture, and USDA Agricultural Research Service; and a few experienced Soil and Water Conservation District personnel and farmers to guide me in my efforts. Some of these resources already had 15 or more years of cover crop experience. In the beginning there was some polite skepticism, some eye-rolling and, in some cases, actual sleeping in the back row. But, I can honestly say there was also genuine interest in the message I was sharing.

Minnesota's interest in cover crops is driven by two things: soil health and water quality. Those of us who work with cover crops have learned that each situation is unique and the first question we need to ask an individual farmer is, "why are you

interested in using cover crops?" The phrase "soil health" is rarely what comes out of a farmer's mouth, but what he or she does say definitely points towards a desire for healthy, quality soil. Many of these farmers will mention being concerned about soil erosion from wind and rain, wanting to increase soil organic matter percentage, or a desire to increase their soil nutrient levels. Cover crops can help with these, and many more, issues. I distinctly remember a Carver County farmer telling me that his soil just wasn't what it used to be. It was no longer a dark, rich color; it was difficult to work up; and his yields were no longer what he felt they should be. He had very real concerns over the health of his soil and it's the reason he started looking into adding cover crops to his farm operation.

Minnesota is known as the "Land of 10,000 Lakes." We actually have 11,842. And, we're home to 6,594 rivers and streams. All told, we have just over 13 million acres of surface water. "Water, water, everywhere," and yet we also have had to deal with our fair share of drought conditions. Too often lately, there are places in Minnesota that deal with flooding in the spring and then drought in the summer and fall. Needless to say, Minnesota knows water, and we're well aware of how important it is to our 26 million acres of agricultural land as well as to our drinking needs and recreational activities. Research and common sense show that having growing plants on the land as long as possible helps to use excess water and nutrients and also helps keep the soil in place. During dry periods, the shading action of a green plant or the mulching action of a dead plant can help decrease soil water evaporation. With their potential to assist in water quality and quantity, cover crops are definitely starting to draw attention.

One particular example comes to mind. During the spring of 2013, the snow and rain were so heavy and constant that much of southeastern Minnesota was unable to plant their cash crops. Some farmers made the decision to plant a cover crop for the first time ever so that their fields wouldn't be bare. One particular farmer had come to me that September, after having dealt with an incredibly wet spring and a summer drought that had hit quite hard, concerned over how to manage his cover crop of oil seed radish. The radishes were growing robustly and he was concerned about how they would affect soil moisture levels and spring planting. His neighbors were encouraging him to till them under. His local NRCS person was encouraging him to leave them. I shared my experiences with oil seed radish and encouraged him to leave the radishes and forego any fall tillage. In most years, the radish would easily winterkill with the advent of Minnesota's cold winter temperatures and the spring thaw would trigger a quick decomposition of the dead plants. I suggested that if he didn't feel comfortable with that decision, he could till some of the radishes under while leaving some alone. He could then compare the two management options in the spring. That was how we left our conversation and then this June I received an unexpected e-mail from him. Against the opinions of a few of his neighbors, he decided to leave those radishes alone last fall. He said that the dead radishes "dissolved by planting time." He went on to share that he was surprised to find that he only needed one light pass with a field cultivator before planting his 2014 cash crop and that the field's soil tilth was "about as good as I've seen in 41 years of planting." My favorite quote of the message, however, was "we showed 'em."

Cover crop adoption in Minnesota is still low, but the last 2 years have seen a marked increase in interest. The original groundbreakers have continued their work with cover crops, but others have also joined the efforts. The number of groups working with cover crop research and education has drastically increased and efforts are being made to work together as much as possible to ensure a uniform message. More workshops and field days than ever before are being held and the number of interested farmers attending these events is also increasing. The USDA Natural Resources Conservation Service has increased cover crop funding via their Environmental Quality Incentives Program. The agriculture news media is inundating print and Internet news sources with cover crop stories. The efforts of a few have now become the efforts of many. Continued effort, however, depends on funding. To increase interest in cover crops, more education is needed. To better answer farmers' questions, more demonstration and research projects are needed.

Cover crops are only a piece of the puzzle, however. We also need to see an increase in conservation tillage practices like strip till or no-till; additional crops in our rotation instead of only one or two; and an increased use of best management practices. Minnesota wants soils that are healthy and productive and water resources that are managed for high quality and appropriate quantity. Cover crops can help reach these goals.

POWERPOINT PRESENTATION

A Minnesota Cover Crop Story

Jill L. Sackett - Extension Educator

Subcommittee on Conservation, Energy, and Forestry
House Committee on Agriculture
September 18, 2014

UNIVERSITY OF MINNESOTA
EXTENSION
Driven to Discover℠

Cover Crops

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Soil Health

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Water Quality

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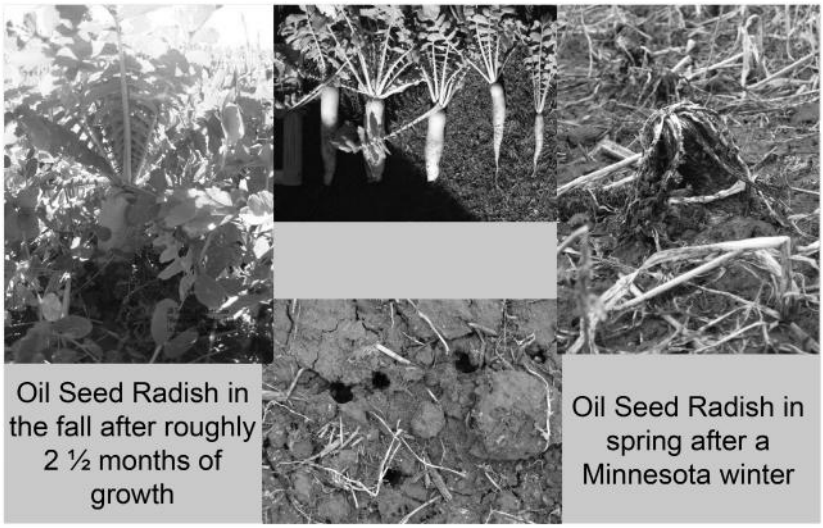

Oil Seed Radish in the fall after roughly 2 ½ months of growth

Oil Seed Radish in spring after a Minnesota winter

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Thank you.

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The CHAIRMAN. Ms. Sackett, thank you very much for your testimony. We will now proceed with questioning, and once again I will recognize the Chairman of the full Agriculture Committee, Mr. Lucas, for 5 minutes.

Mr. LUCAS. Chairman, I appreciate your indulgence. I would ask this question of the panel. In the challenges you face out there, what are the greatest challenges? Is it lack of cooperation between entities back home? Is it persuading the very traditional farmers to try something new? Just what are your chief challenges in moving your message forward? And whoever wants to go, whoever wants—I have 4½ minutes. I am listening.

Mr. HARBACH. I will take that one. We are very active in Pennsylvania with the PA No-Till Alliance, and we spend a lot of our time—given a lot of our time to education, and seminars, and field days. And the biggest problem we have is just getting people to understand. There is a lack of understanding. I live in a valley with a lot of Amish community, and they are not ones to come out to this kind of stuff, so to penetrate them is difficult. But, basically, it is just the lack of understanding from the farmers' perspective.

It took me several years, and I am probably a slow learner, but it took me several years to get where I am today, and it is really hard to expect a farmer to get there overnight. It is going to take a long time to get that level of understanding.

Mr. LUCAS. I will admit to you I still remember my freshman Agronomy class at Oklahoma State, this is a third of a century ago, and going home, and having a long discussion with my maternal grandfather, who I farmed with, about just what was going on in that soil. I still remember that discussion, so I appreciate what you are saying.

Mr. LARSON. Chairman Lucas, one of the things that we have to be cognizant of is that, when we are talking about agricultural production, we are talking about a business, and so this is a business decision. And with that, we can't just go off of anecdotal information. We need to have good, sound research. We need to have case studies. We need to have the ability to demonstrate not just from the perspective of many that have done it, but from the perspective of how it fits into that business decision that is going to impact, potentially, their economic viability.

Because the value of the practices we are talking about can be demonstrated to be a sound economic decision. We just need to come up with a more consistent way to partner together. And I am very proud of the work that conservation districts do to be that collaboration point around the country to give that information to folks that has the science behind it, that has the research behind it. And that is a part of every aspect of what we can do in a partnership. I am very proud to work with SARE, and with Rob Myers, on the national work group for cover crop and soil health.

And it is conservation districts, it is extension, it is soil societies, it is agronomists. It is the entire spectrum of ag retailers and others working together to come up with this information that we can share on a consistent level, and in a consistent way, that gives confidence, and that producers can put trust in. And if we can get there, and we are getting there, then we are really going to see improvement.

Mr. LUCAS. Ms. Phillips, do you think that part of the reason we have such a coordinated effort in Oklahoma, a willingness in both public and private to work on these issues, is still a legacy of the miserable Dust Bowl, and what our predecessors went through, and the suffering that they encountered?

Ms. PHILLIPS. Yes, I do agree that the Dust Bowl showed us how we could come together and work cooperatively on a problem. I mean, we have been working that same way, and applying those same principles, ever since. It is something that we can't forget.

Mr. LUCAS. In my hometown, we had 14,000 people on the Census roll in 1930, after the Dust Bowl of the Depression, of the 1930s, the droughts of the 1950s all left, we are not quite back to 4,000 people yet, so the quality of soil will impact the ability of your citizens, your fellow neighbors, to be able to create a livelihood. The ulcerations you can still see if you fly over much of my part of western Oklahoma, in spite of all of the decades of efforts, so—anyway, I thank you all for being here. I appreciate your observations, and it is good that we do learn from our past, and move forward in a more positive fashion. With that, Mr. Chairman, I yield back.

The CHAIRMAN. I thank the Chairman for yielding back. Now recognize the gentleman from Ohio for 5 minutes.

Mr. GIBBS. Thank you, Mr. Chairman. First I have to start and ask Mr. Larson a question. I think you might know one of my constituents. He was President of your organization a few years ago, Gary Mass?

Mr. LARSON. Absolutely.

Mr. GIBBS. Now you know why we have such good conservation practices in my area, right? Hey, I wanted to ask—well, first I wanted to say to Mr. Harbach, in your slide, you said you had 4.7″ of rainfall in an hour, and you were able to prevent runoff in the field. Could you just expound on that a little bit?

Mr. HARBACH. We have done some extensive water infiltration tests, and we have the ability—that is our average water infiltration capability. That is a steady state, until we can absorb that water. But we have had rainfall events that have been over 3″ and 4″ in an hour, and not had issues—not having water leaving the fields. And that photo is one of the—is a good way to explain what is happening.

We have not seen that up and until the last couple years. Even though we have been no-tilling for 40 years, it wasn't until we started cover cropping that we saw those real advantages. And Chief Weller had mentioned that it is a systems approach, and——

Mr. GIBBS. Yes.

Mr. LARSON.—we need to understand that it takes all of those to make it work.

Mr. GIBBS. What we are going to find out—in my questions to the Chief—we have the algae bloom problem, especially in Lake Erie, it is from these big event—rainfall events. You know, it is the sewage treatment plants overflowing. I think it is probably the agricultural—there are preliminary testing results. I think we are starting to see that. I think that is going to be a finding, so this is really key, Mr. Chairman, to address that. When I heard you say

that, I thought that is pretty remarkable, and you have something going good there, and we can—we need to learn more about that.

I wanted to ask Ms. Phillips particularly, the proposed waters of the United States rule that has come up with the U.S. EPA and the Army Corps, how does that—how do you see that—is that affecting conservation programs?

Ms. PHILLIPS. Well, I am probably not the best person to speak on that because I work entirely in a voluntary program, and so we don't implement any regulation.

Mr. GIBBS. Well, the reason that I am asking you that is because I understand you run a voluntary program, but the proposed rule is—they had to do this interpretive rule, then, to exempt your—the programs, and I just question whether you have that, because everything—supposed to be general farming practice is supposed to be exempt.

I guess my words of wisdom to you would be I think it will have an impact on conservation programs in a negative way, and could open the door for farmers not wanting to be more amenable to working with NRCS and others, and that concerns me just—maybe——

Ms. PHILLIPS. I think certainly, as you have stated, that there are a lot of people who are very concerned about the proposed rule, and they are concerned about the way that it was formulated, and that states weren't brought into the process. And so it would seem that many people—and I would agree with this recommendation, that EPA needs to step back and pull partners back into the process, and take a new—take—start over.

I think that they should have—we have learned—they should have learned from many of their other approaches toward rules of this type is that you are most successful when you bring your partners to the table from the beginning, and work together.

Mr. GIBBS. Yes. And, of course, the House, I guess it was last week, passed a bill that said time out to—and go back to the states. And in my subcommittee hearing here a few weeks ago, as far as we could tell, not one state EPA or counterpart supports the proposals—excuse me, the proposed rule, so that is a red flag to me.

Mr. Larson, on the—working with farmers, and doing conservation practices, how do you—do you see different things going on in different areas of the country? You know, different challenges, but different—maybe different practices might work in Oklahoma, might not work in Ohio? How do you address that? Are there any problems, challenges, in Washington that make it more difficult?

Mr. LARSON. Well, the part that I look at is that the true value of conservation districts is that they are part of that local community. And of those boards, those are volunteer members. They are elected or appointed members that serve on those conservation district boards, and they have perspective of their local community. So they help to come up with a suite of practices that is based on working with our Federal and state partners of what works there.

And the Burleigh County example is a very good one, because they have been, for 20 years, highlighting, and demonstrating, and refining the guidance that they give to the rest of the community. And that is critically important, because it is a site specific issue.

The 4.7 infiltration rate is great, but we know that there are other soils not very far away that would never reach that potential unless under very careful management, utilizing soil health practices that potentially aren't the same, or implemented. So that is one of the pieces that—at that local level.

Mr. GIBBS. Right. Yes. Just a comment—quick comment, Mr. Chairman. I agree with you 150 percent, because when I was in my local conservation soil and water board, they instituted a nutrient training program, in conjunction with Ohio State University, and the Ohio EPA, and the NRCS, and it is working. We are actually decreasing the TMDL loads in the watershed, and we are able to keep—in—the jobs in place, and actually grow that business, and actually decrease the load. So you are absolutely right. Like I said earlier, this structure we have is the right structure to work for, and we need to make sure we protect that. So I yield back, thank you.

The CHAIRMAN. I thank the gentleman. I will take the liberty of my 5 minutes now.

Ms. Sackett, as the product of another great land-grant university, who is currently 3–0 in the Big Ten, I just want to say, the—I wanted to check with you—obviously you have a very—a passion for this. You have done your preparation, you are an asset and a resource. You are part of the boots on the ground with our NRCS partners. You know, the importance of ensuring that our ag extension staff are trained in the basics of healthy soils, any idea—can you give us some idea, how are we doing with that task, with our ag extension? What is the bigger picture with our ag extension staff across the nation?

Ms. SACKETT. Well, I can only speak for Minnesota, because that is obviously what I know best, but, in Minnesota, we have local extension educators, regional extension educators, and then our state specialists, and we are encouraged to focus on certain areas. So, for instance, my focus is conservation sustainable ag. A colleague of mine, it is soils. So you can kind of see how, even though we are all focusing on these different bits and pieces, we most definitely see where we are coming together.

And just because one of us is focused on cover crops, for instance, doesn't mean that we are not sharing with each other. We regularly have staff development meetings. Each of us have funds to attend professional development. I go to regional cover crop and soil health events. Some of my other colleagues are also attending those things.

We are doing our best to educate ourselves about these efforts on a national, regional, and state level, and then we are doing our best to talk to each other. And you can't leave out the farmers, and the other partners in the whole puzzle. It definitely comes down to working together and having that communication, so that we are all on the same page.

The CHAIRMAN. All right. Thank you very much.

Mr. Larson, how can conservation districts better leverage Federal programs to get the maximum success of dollars to make the biggest impact? For example, using both the 319 funds from the EPA and the NRCS funding.

Mr. LARSON. Well, I think that Shanon has an excellent example from Oklahoma, in the way that they have taken the different Federal programs, and then matched it up with state programs to get right to the heart of the matter. And having, again, the conservation districts engaged that have that local knowledge, and ability to identify issues.

And with these conservation practices, part of it is, and I think that Jim would agree, that it is potentially an increase in management responsibility by the producer, and so one of the things is to have willing participants. And so working with those that are willing, that want to do this, it is going to help to then show the value of soil health. The voluntary incentive-based approach is going to work when you have willing participants, that—then we are going to see that escalation of stewardship.

The challenging part in the scenario, and one that I am very—and I thank the Chairman and the Members of the Committee for the work on the 2014 Farm Bill, is that the conservation title was escalated, and it was given more importance. When you look at it in relationship to title I, it is the first time in history where we have more funding in title II than we had in title I. And we certainly see that as a movement in the right way for not only those wishing to do conservation, and the incentive-based approach, but also for the justification and defense of what we are trying to do with this program, to the value of the American public.

Here is a program that is providing clean water, that is providing clean air, that is providing wildlife habitat, that is providing those natural resources that we need. And so whatever we can do to help to get others within the halls to understand the value of that, that certainly is something that is a goal that we should try and achieve.

The CHAIRMAN. Thank you. Mr. Harbach, Jim, you have been using this practice for some time. Did you—I mean, using these practices, do you deplete or do you enrich the nutrition and quality of your soil through the practices that you are using, and specifically related to some of the really basic parts of soil nutrition, like nitrogen?

Mr. HARBACH. Well, we have learned, just in the last year, is that, through healthy soils, and the organic matter levels that is in there, there is a system through the—root system, and through the photosynthesis that allows for nitrogen to be taken out of the atmosphere, and we have lost that ability to do that through tillage, and through the fact that we don't keep crops growing 365 days a year. That can't—without that crop growing, we can't support that system that gets the free nitrogen from the air. So that is why we are more—that is why we are so reliant on inorganic fertilizers.

And when you hear people talk about—you hear the soil health enthusiasts that say that—well, I am using less fertilizer now. That is why. And I am not sure if that answered your question, but, no, those—the soil health only adds in every aspect.

The CHAIRMAN. Yes. And you were kind enough to invite me to your farm not too long ago, about a month ago or so, and if I recall right, I believe it was—was it nitrogen that you have increased by one percent over time?

Mr. HARBACH. Well, that would be the soil organic matter levels that we have been able to increase in our soils. And the old school thought is that that is not possible. But what we have found is that—and people talk about the advantages of cover crops, but the cover crop, from—the advantage that we see is that we are able to harvest sunlight 365 days a year to grow that—to allow that process to happen. And it is the plants feeding the soils that is accomplishing those soil organic matter gains.

And that is critical, and that is the systems approach things that we are talking about, when we are talking about people not being willing to do that for economical reasons. But once they understand how the soil functions, then they start asking the questions, how do I do that? Because they can't afford not to do that. It is the understanding that we need to get people to get to.

The CHAIRMAN. You mentioned that you no longer use insecticides and fungicides, and only a fraction of the herbicides and fertilizer that you once used. What are the direct benefits or challenges you see with using so much less fertilizer and herbicides?

Mr. HARBACH. It is not really a challenge. Initially it is, to make that first big step, but there is so much research done. And I have to say, from ARS, and I know you guys support ARS, there are a lot of good things coming out of there, because that is research that is done that is not industry funded, and we we need to increase that.

By not using the insecticides or as many chemicals, it is all that systems approach thing, that once you achieve soil health, you have the beneficial bugs, you have the ones that take out the critters that you are applying an insecticide for, or maybe a fungicide, the fungicide is very hard on soils, and we need to get people to understand that once you have achieved that certain level of soil health, that some of these other input costs can go away.

The CHAIRMAN. All right. I want to thank all the witnesses for great testimony on an important topic. And, before we adjourn, I want to invite—the Chairman yields—I do want to say that this is a bipartisan issue. I know that both the Ranking Member of the full Committee was hoping to be able to—he was here for a time, and didn't have, really, the window to offer his support in kind of an opening statement. And my Ranking Member on the Subcommittee, this is very important to him as well. They just had conflicts that occur here, unfortunately, and they very much appreciate all the witnesses' testimony today.

I have heard healthy soils described as harvesting sunlight, and using the natural processes of photosynthesis, where, in the past, when we thought of agriculture, we thought it depleted the soil. Now it is very apparent that with certain agricultural practices, we can actually grow soil, for the benefit of everyone. So thank you so much for all the witnesses.

Under the rules of the Committee, the record of today's hearing will remain open for 10 calendar days to receive additional materials and supplementary written responses from witnesses to any questions posed by a Member. This hearing of the Subcommittee on Conservation, Energy, and Forestry is now adjourned.

[Whereupon, at 1:03 p.m., the Subcommittee was adjourned].

[Material submitted for inclusion in the record follows:]

SUBMITTED LETTER BY CHRIS JAHN, PRESIDENT, THE FERTILIZER INSTITUTE

September 18, 2014

Hon. GLENN THOMPSON,
Chairman,
Subcommittee on Conservation, Energy, and Forestry,
House Committee on Agriculture,
Washington, D.C.;

Hon. TIMOTHY J. WALZ,
Ranking Minority Member,
Subcommittee on Conservation, Energy, and Forestry,
House Committee on Agriculture,
Washington, D.C.

Re: Hearing entitled: "The benefits of promoting soil health in agriculture and rural America"

Dear Chairman Thompson and Ranking Member Walz:

The Fertilizer Institute (TFI) is the leading voice of the fertilizer industry, representing the public policy, communication and statistical needs of producers, manufacturers, retailers and transporters of fertilizer. The Institute's members play a key role in producing and distributing vital crop nutrients, such as nitrogen, phosphorus and potassium, which are used to replenish soils throughout the United States that in turn produce healthy and abundant supplies of food, fiber and fuel. TFI, on behalf of its members, appreciates the opportunity that today's hearing presents for our industry to talk about the important role that fertilizer plays in improving and maintaining soil health.

The World's population is predicted to reach 9.4 billion people by 2050. Industry experts agree that increased food production will be achieved by intensified crop production and not by an expanded arable land base. As a result, commercial fertilizers have a critical role to play in boosting crop production to the levels necessary to meet the demands of this rapidly growing world population. Crop nutrients such as nitrogen, phosphorus, potassium, and secondary and micronutrients such as calcium, zinc and iron are responsible for between 40 and 60 percent of today's total food production and will be a necessary component in producing nutritious food in the most environmentally sensitive manner possible.

Fertilizer is a Key Contributor to Soil Health

Fertilizers play an important role in soil health. Research indicates that larger crops resulting from balanced crop nutrition significantly benefit soil organic carbon. In short, larger crops return a greater amount of carbon to the soil system than those limited by poor fertility. Halverson, *et al.* (1999) noted that increasing soil organic carbon with increasing nitrogen fertilization contributed to improved soil quality and productivity, as well as improved carbon sequestration. Additionally, Chu, *et al.* (2007) evaluated balanced *versus* nutrient-deficiency fertilization on soil microbial biomass, activity, and bacterial community structure in a long-term (16 years) field experiment. Long-term fertilization greatly increased soil microbial biomass and dehydrogenase activity. Soil organic matter contributes significantly to soil health. Relative to crop nutrition, soil organic matter enhances nutrient cycling by acting as a reservoir of nutrients that can be released to the soil under optimum conditions. For a high yielding corn production system (250 bu/acre), a soil with 2.5 percent organic matter could provide 20 percent of the annual recommended nitrogen. The average estimate of available nitrogen, used by agronomist, is 20 pounds of available nitrogen for every 1% of organic matter.

* Halvorson, A.D., C.A. Reule, and R.F. Follett. 1999. *Nitrogen fertilization effects on soil carbon and nitrogen in a dryland cropping system.* SOIL SCI. SOC. AM. J. 63:912–917.

* Chu *et al.* 2007. *Soil microbial biomass, dehydrogenase activity, bacterial community structure in response to long-term fertilizer management.* SOIL BIOL. BIOCHEM. 39(11): 2971–2976

4R Nutrient Stewardship

Meeting global food demand is not enough and the fertilizer industry today is also committed to promoting science-based, sustainable fertilizer best management practices that boost crop production while minimizing impacts to the environment. At the heart of that commitment is what is known as 4R nutrient stewardship, a framework to achieve cropping system goals, such as increased production, in-

creased farmer profitability, enhanced environmental protection and improved sustainability.

The 4R nutrient stewardship principles are the same globally, but how they are used locally varies depending on field and site specific characteristics such as soil, cropping system, management techniques and climate. The scientific principles of the 4R framework include:

Right Source—Ensure a balanced supply of essential nutrients, considering both naturally available sources and the characteristics of specific products, in plant available forms.

Right Rate—Assess and make decisions based on soil nutrient supply and plant demand.

Right Time—Assess and make decisions based on the dynamics of crop uptake, soil supply, nutrient loss risks, and field operation logistics.

Right Place—Address root-soil dynamics and nutrient movement, and manage spatial variability within the field to meet site-specific crop needs and limit potential losses from the field.

It is important to stress that all four "Rs" must be used together because there is no single practice or "silver bullet" that will prevent nutrients from being lost to the environment.

In 2011, the USDA revised their standard for managing farm nutrients with a goal toward employing new technologies to reduce runoff and improve water quality. The 4Rs are a component of the Natural Resources Conservation Service Conservation Practice Standard Code 590. For more information on 4R nutrient stewardship, I invite you to visit *http://www.nutrientstewardship.com*.

4R Research Fund: Demonstrating the Impacts of 4R Nutrient Stewardship

In addition the 4R nutrient stewardship program, the fertilizer industry has established the 4R Research Fund with the goal of establishing sustainability indicators and environmental impact data for implementation of 4R nutrient stewardship across North America. It provides needed resource support with a focus on measuring and documenting the economic, social and environmental impacts of 4R nutrient stewardship.

Having just completed its first year in existence, to date the fund has granted nearly $2.4 million in support of science-based research aimed at addressing cropping system productivity and concerns regarding nutrient losses into the environment. USDA's Agricultural Research Service (ARS), for example, has been awarded funds for a project in partnership with Heidelberg University, Ohio State University, The Nature Conservancy and the International Plant Nutrition Institute (IPNI) to evaluate the impacts of adopting practices associated with 4R Nutrient Stewardship, as well as the impact of the Western Lake Erie Basin (WLEB) 4R Certification program on crop productivity and profitability, water quality, and perceptions of growers, nutrient service providers and residents. For additional information on the 4R Research fund and the list of current projects, I invite you to visit *http://www.nutrientstewardship.com/funding*.

Fertilizer Use Efficiency

Data released by the U.S. Department of Agriculture in May 2011, shows that between 1980 and 2010, U.S. farmers increased corn production 87.5 percent while using four percent fewer fertilizer nutrients. Although the factors that contribute to increasing food prices and food scarcity are complex, one thing is for sure—the use of fertilizer is a necessary component in the solution to further increase efficient and environmentally sensitive production of food for the world.

TFI would like to thank the Subcommittee for the opportunity to submit these comments for the record. We look forward to continuing to work with you on this and other important agriculture issues. If you or your staff would like to discuss this letter or the enclosed materials, please contact Clark Mica via e-mail at [**Redacted**] or telephone at [**Redacted**].

Sincerely,

CHRIS JAHN,
President.

ATTACHMENT 1

WHAT ARE THE 4Rs?

4R nutrient stewardship provides a framework to achieve cropping system goals — increased production, increased farmer profitability, enhanced environmental protection and improved sustainability. To achieve these goals, the 4R's incorporate the:

RIGHT FERTILIZER SOURCE *at the* **RIGHT RATE,** *at the* **RIGHT TIME** *and to the* **RIGHT PLACE.**

Properly managed fertilizers support cropping systems that provide economic, social and environmental benefits. On the other hand, poorly managed nutrient applications can decrease profitability and increase nutrient losses, potentially degrading water and air.

4R nutrient stewardship requires the implementation of best management practices (BMPs) that optimize the efficiency of fertilizer use. The goal of fertilizer BMPs is to match nutrient supply with crop requirements and to minimize nutrient losses. Selection of BMPs varies by location, and those chosen for a given farm are dependent on local soil and climatic conditions, crop, management conditions and other site specific factors.

Other agronomic and conservation practices, such as no-till farming and the use of cover crops, play a valuable role in supporting 4R nutrient stewardship. As a result, fertilizer BMPs are most effective when applied with other agronomic and conservation practices.

HOW YOU CAN PUT 4R NUTRIENT STEWARDSHIP TO WORK FOR YOU!

To utilize the 4Rs to achieve your cropping system goals, apply the **Right Source** of fertilizers that are in — or are easily converted to — compounds best used by the target crop. Apply the **Right Rate** of fertilizer to match nutrient supply with crop requirements. Apply fertilizer at the **Right Time** so nutrients will be available when crop demand is high. Apply or maintain fertilizer in the **Right Place** where the crop can access the nutrients most effectively. Applying these general practices will minimize nutrient transport from fields and maximize crop uptake and utilization.

- EDUCATE YOURSELF
- CONSIDER WAYS TO EXPAND YOUR 4R PRACTICES
- SPREAD THE WORD!

Visit **www.nutrientstewardship.com** (available March 2011)

Information in this brochure was developed utilizing materials available from The Fertilizer Institute, the International Plant Nutrition Institute, and the Canadian Fertilizer Institute.

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4 nutrient stewardship

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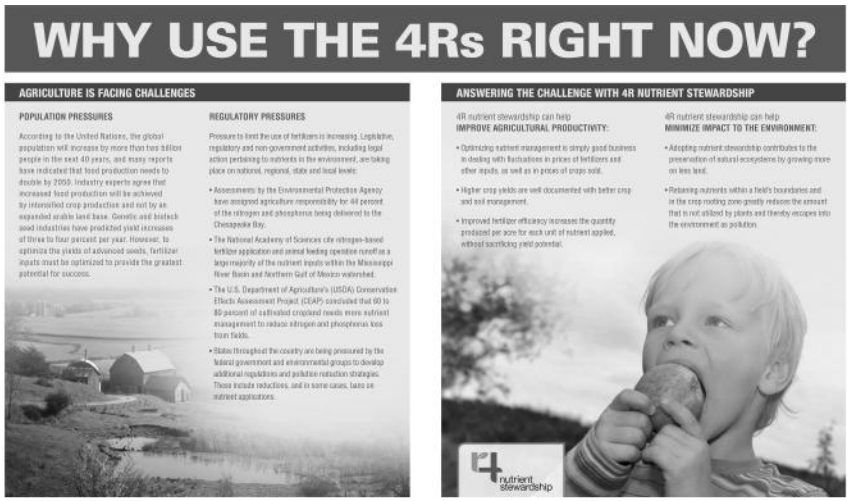
Nourish, Replenish, Grow

4R NUTRIENT STEWARDSHIP



WHY USE THE 4Rs RIGHT NOW?

AGRICULTURE IS FACING CHALLENGES

POPULATION PRESSURES

According to the United Nations, the global population will increase by more than two billion people in the next 40 years, and many reports have indicated that food production needs to double by 2050. Industry experts agree that increased food production will be achieved by intensified crop production and not by an expanded arable land base. Genetic and biotech seed industries have predicted yield increases of three to four percent per year. However, to optimize the yields of advanced seeds, fertilizer inputs must be optimized to provide the greatest potential for success.

REGULATORY PRESSURES

Pressure to limit the use of fertilizers is increasing. Legislative, regulatory and non-government activities, including legal action pertaining to nutrients in the environment, are taking place on national, regional, state and local levels:

- Assessments by the Environmental Protection Agency have assigned agriculture responsibility for 44 percent of the nitrogen and phosphorus being delivered to the Chesapeake Bay.
- The National Academy of Sciences cite nitrogen-based fertilizer application and animal feeding operation runoff as a large majority of the nutrient inputs within the Mississippi River Basin and Northern Gulf of Mexico watershed.
- The U.S. Department of Agriculture's (USDA) Conservation Effects Assessment Project (CEAP) concluded that 60 to 80 percent of cultivated cropland needs more nutrient management to reduce nitrogen and phosphorus loss from fields.
- States throughout the country are being pressured by the federal government and environmental groups to develop additional regulations and pollution reduction strategies. These include reductions, and in some cases, bans on nutrient applications.

ANSWERING THE CHALLENGE WITH 4R NUTRIENT STEWARDSHIP

4R nutrient stewardship can help **IMPROVE AGRICULTURAL PRODUCTIVITY:**

- Optimizing nutrient management is simply good business in dealing with fluctuations in prices of fertilizers and other inputs, as well as in prices of crops sold.
- Higher crop yields are well documented with better crop and soil management.
- Improved fertilizer efficiency increases the quantity produced per acre for each unit of nutrient applied, without sacrificing yield potential.

4R nutrient stewardship can help **MINIMIZE IMPACT TO THE ENVIRONMENT:**

- Adopting nutrient stewardship contributes to the preservation of natural ecosystems by growing more on less land.
- Retaining nutrients within a field's boundaries and in the crop rooting zone greatly reduces the amount that is not utilized by plants and thereby escapes into the environment as pollution.

4 nutrient stewardship

ATTACHMENT 2

IMPLEMENTING THE 4Rs

Agriculture is being challenged to maintain profitable farm economics, while meeting the increased product demands of a growing population, and responding to increased scrutiny of land and resource management. Agricultural sustainability means addressing economic, environmental and social goals.

4R nutrient stewardship is an innovative approach to fertilizer best management practices (BMPs) to help achieve agricultural sustainability. The 4Rs imply there are four aspects to every fertilizer application and it provides a simple framework to assess whether a given crop has access to the necessary nutrients. To help identify opportunities to improve fertilizer efficiency and prevent nutrient movement from each field, ask:

Was the RIGHT FERTILIZER SOURCE given to the crop at the RIGHT RATE, RIGHT TIME, and in the RIGHT PLACE?

The four aspects of fertilizer management are interconnected, and none of the four can be right when any one of them is wrong.

PUT 4R NUTRIENT STEWARDSHIP TO WORK FOR YOU!

A key finding, detailed in multiple United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) reports, indicates that groups of best management practices work better than single practices. In fact, USDA NRCS strategies include encouraging management efforts to address nutrient source, rate, time, and place. For specific BMP recommendations, contact a local crop advisor, extension agent or other trusted agronomic advisor.

- EDUCATE YOURSELF
- EXPAND YOUR 4R PRACTICES
- SPREAD THE WORD!

Visit www.4Rnutrientstewardship.com for more information. (Available March 2011)

The Fertilizer Institute

nutrient stewardship

IMPLEMENTING 4R Nutrient Stewardship on the FARM RIGHT NOW

The Fertilizer Institute

4R NUTRIENT STEWARDSHIP

THE RIGHT TIME IS RIGHT NOW.

4R PRINCIPLES

The 4R nutrient stewardship principles are the same globally, but how they are used locally varies depending on field and site-specific characteristics such as soil, cropping system, management techniques and climate. The scientific principles of the 4R framework include:

RIGHT SOURCE – Ensure a balanced supply of essential nutrients, considering both naturally available sources and the characteristics of specific products, in plant available forms.

RIGHT RATE – Assess and make decisions based on soil nutrient supply and plant demand.

RIGHT TIME – Assess and make decisions based on the dynamics of crop uptake, soil supply, nutrient loss risks, and field operation logistics.

RIGHT PLACE – Address root-soil dynamics and nutrient movement, and manage spatial variability within the field to meet site-specific crop needs and limit potential losses from the field.

STEPS TO IMPLEMENTING THE 4Rs ON THE FARM

STEP 1 – Identify economic, social and environmental goals that cropping system objectives should address specific to each field and operation.

STEP 2 – Select BMPs that are specific to the soil, climate, cropping system and goals identified by the grower.

STEP 3 – Integrate BMPs for all goals and adjust as needed.

STEP 4 – Document the 4R nutrient stewardship plan.

EXAMPLE GOALS FOR STEP 1

Goals will likely vary between farm operations and may even vary between fields; the following are some commonly identified grower goals.

ECONOMIC GOALS
- Improve net farm income.
- Contribute to improved regional economic development.

SOCIAL GOALS
- Improve the quality of farm family housing, diet and education.
- Improve productivity of farm labor by appropriate use of emerging technologies that increase efficiencies of field operations and reduce costs per unit of crop harvested.
- Improve access to sources of information to assist in farm management decision making.

ENVIRONMENTAL GOALS
- Maintain or reduce unwanted losses of nutrients to the environment:
  - Reduce soil erosion of nutrient containing soil particles;
  - Reduce volatile ammonia (NH_3) emissions;
  - Reduce nitrification / de-nitrification losses of nitrous oxide (N_2O) and di-nitrogen (N_2).
- Reduce energy use per harvested unit of farm production.
- Improve recycling of crop nutrients from crop residues and livestock manures.

EXAMPLE BMPS FOR STEP 2

SOURCE – Select appropriate fertilizer and on-farm nutrient sources for the cropping system including consideration for commercial fertilizer form, enhanced efficiency fertilizer products, manure or biosolids.

RATE – Utilize grid or zone soil testing and rate recommendations, use nutrient budgets to plan management and application schemes (including yield goal analysis, crop removal balance and plant tissue analysis); utilize variable rate application technologies to address spatial variability; use in-season methods to make in season decisions such as leaf color charts, chlorophyll meters, or optical sensors.

TIME – Follow recommended times for nutrient applications; when necessary utilize enhanced efficiency fertilizers for controlled nutrient release and urease or nitrification inhibitors; utilize split applications to improve crop nutrient uptake.

PLACE – Utilize application methods that limit nutrient losses; incorporate fertilizers; adjust applications to avoid unnecessary applications to non-crop areas; couple applications with appropriate soil conservation practices; utilize controlled drain management in tile drained fields.

nutrient stewardship

SUBMITTED LETTER BY JEFF M. SANDS, DIRECTOR OF PUBLIC POLICY, AGRICULTURAL RETAILERS ASSOCIATION

9/25/2014

Hon. GLENN THOMPSON,
Chairman,
Subcommittee on Conservation, Energy, and Forestry, House Committee on Agriculture,
Washington, D.C.;

Hon. TIMOTHY J. WALZ,
Ranking Minority Member,
Subcommittee on Conservation, Energy, and Forestry, House Committee on Agriculture,
Washington, D.C.

Chairman Thompson, Ranking Member Walz, and distinguished Subcommittee Members:

The Agricultural Retailers Association (ARA), suppliers to America's farmers, would like to commend the House Agriculture Subcommittee on Conservation, Energy, and Forestry for holding the recent hearing entitled *"The Benefits of Soil Health in Agriculture and Rural America."* The hearing was an appropriate demonstration of oversight on the recently passed Agricultural Act of 2014 and highlighted the importance of an agronomic concept that is rapidly being adopted by growers across the country.

ARA membership is largely comprised of crop input suppliers that provide not only the products needed to grow a crop but also the trusted agronomic counseling that growers depend on to keep a profitable and sustainable farming operation. It would not be an overstatement to say that soil health is at the core of every transaction and interaction that takes place through an ARA member facility. The concepts that serve as the foundation for the soil health movement have been embedded within our agronomy services for some time and we are elated to see Congress discuss this important topic.

An exciting area of opportunity in soil health arose as the hearing proceeded was partnerships. Between the recently passed farm bill and the amplified interest in improving soil quality, we have seen an incredible uptick in the amount of partnerships between the agriculture industry, government, and conservation-oriented groups. A testament to this trend is the recently formed National Working Group on Cover Crops and Soil Health that current ARA Chairman, Gary Farrell of Ag Enterprise Supply, serves on to promote those very important concepts. Gary also helped to create and serves as Co-Chair of the Washington Soil Health Working Group but while Gary is a leader, he is certainly not the only agricultural retailer to be interested in advancing soil health.

Partnerships that bring stakeholders together and utilize core competencies of each group will be the key to helping the soil health campaign reach ultimate fruition. The membership of the Agricultural Retailers Association, with their depth and breadth of agronomic knowledge, experience, and technology, have a great deal to offer this cause and would hope to be a source of information to the House Agriculture Committee as you consider this topic further. This subcommittee's great work in crafting the Conservation title of the 2014 Farm Bill has provided ARA membership with the opportunity to work closer with USDA and other partners to provide growers with the information they need to unlock their soils potential. As a result of the Regional Conservation Partnership Program and other provisions, we are proud to say that our relationships with groups such as the National Association of Conservation Districts, Conservation Technology Information Center, and USDA–NRCS are the strongest that they have ever been and we are eager to see the work product that results from these alliances.

At a time when agricultural production is crucial to our economy and environmental stewardship is essential to preserving our natural resources, soil health is perhaps more timely a topic now than ever before. The Agricultural Retailers Association thanks Chairman Thompson and Ranking Member Walz for their dedication to this important cause and would encourage committee members and staff to look to ARA as an additional resource should you seek more information on soil health efforts taking place at the farm gate.

Thank you for your consideration of our perspective. Should you have any questions, please contact ARA at [**Redacted**] or [**Redacted**].

JEFF M. SANDS,
Director of Public Policy,
Agricultural Retailers Association.

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