SOIL HEALTH PRACTICES AND PROGRAMS THAT SUPPORT REGENERATIVE AGRICULTURE

HEARING

BEFORE THE

COMMITTEE ON AGRICULTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTEENTH CONGRESS

SECOND SESSION

SEPTEMBER 14, 2022

Serial No. 117–38

Printed for the use of the Committee on Agriculture
agriculture.house.gov

U.S. GOVERNMENT PUBLISHING OFFICE
49–701 PDF WASHINGTON : 2022

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WITNESSESES

SOIL HEALTH PRACTICES AND PROGRAMS THAT SUPPORT REGENERATIVE AGRICULTURE

WEDNESDAY, SEPTEMBER 14, 2022

HOUSE OF REPRESENTATIVES,
COMMITTEE ON AGRICULTURE,
Washington, D.C.

The Committee met, pursuant to call, at 10:00 a.m., in Room 1300 of the Longworth House Office Building, Hon. David Scott of Georgia [Chairman of the Committee] presiding.

Members present: David Scott of Georgia, Costa, McGovern, Adams, Spanberger, Hayes, Brown, Pingree, Sablan, Kuster, Maloney, Plaskett, O'Halleran, Carbajal, Craig, Harder, Axne, Schrier, Panetta, Bishop, Davids, Thompson, DesJarlais, LaMalfa, Allen, Kelly, Bacon, Johnson, Baird, Mann, Feenstra, Miller, Cammack, Fischbach, Flores, and Finstad.

Staff present: Lyron Blum-Evitts, Ellis Collier, Ashley Smith, Michael Stein, Kelcy Schaunaman, Adele Borne, Josh Maxwell, Ricki Schroeder, Patricia Straughn, and Dana Sandman.

OPENING STATEMENT OF HON. DAVID SCOTT, A REPRESENTATIVE IN CONGRESS FROM GEORGIA

The CHAIRMAN. Welcome, everyone, and welcome. And I thank you for joining us today. And the Committee will come to order.

This is an important hearing, ladies and gentlemen, because we can do without a lot of things, but one thing we cannot do without is food. And there are a number of critical issues threatening the future of our food supply. And we are going to really get into a very important process that must be done if we are going to prevent a food shortage. That is how important this hearing is.

And after my opening statement, Members will receive testimony from our outstanding witnesses today, and then the hearing will be open for questions.

And now, before we get to the business today, I would like to take a moment and yield to our distinguished Ranking Member, Mr. Thompson, for a very important announcement about our newest Member.

Mr. THOMPSON. Well, Mr. Chairman, thank you so much. I would like to reiterate the Chairman's comments in welcoming Representative Finstad to the House Agriculture Committee. Brad is the operator of a family farm and has held numerous positions where he has served as a valuable voice for farmers in rural communities, including State Director for USDA's Rural Development in Min-

nesota, Executive Director of the Minnesota Turkey Growers Association, area director with the Minnesota Farm Bureau, and more.

And so given his extensive background, his knowledge, and experience in agriculture, I can't think of another committee that would be better served by Brad's presence. So welcome, Brad, and we look forward to working with you. And, Mr. Chairman, I yield back.

The CHAIRMAN. Very fine. Welcome, Brad. Good to have you with us.

Ladies and gentlemen, today, our farmers, our ranchers, our foresters are able to use USDA's technical and financial assistance to support a variety of ways to increase soil health. This is what is so important today. Our food comes from the soil. The soil, the earth is the start of our food supply chain, and that is why we wanted to have this hearing, so we could share the latest information about regenerative farming, what we must do to enrich our soil. That is the way we make sure that we have food security.

And I want to just thank so many people who have been active in this and been putting it together, and I want to first mention *Kiss the Ground,* an extraordinary film that opened my eyes to much of what I was only dimly aware. And Mr. Finian Makepeace, what a name, Makepeace, did an extraordinary job. And I am going to show a small clip of it. Mr. Makepeace, thank you. You have really opened our eyes to what we need to certainly address and supply the support that we need for regenerative agriculture.

And additionally, I want to mention the exciting work being funded by the Partnerships for Climate-Smart Commodities Program that is being led by my good friend, Agriculture Secretary Tom Vilsack with the USDA. And just this morning, Secretary Vilsack announced funding for $25 million to the outstanding Rodale Institute to be able to work with the University of Georgia and Emory University in my state, that I represent here in Congress, Georgia. And it will help our farm producers expand their markets, their produce, while reducing greenhouse gas emissions, educating consumers, and developing technology that will improve scalability of their model. This is so important, and I am so very supportive of what Secretary Vilsack is doing with this program. And this project is one of 70 receiving funding. And of course, with it being in Georgia, I can assure you that it will be most successful.

[The prepared statement of Mr. David Scott follows:]

PREPARED STATEMENT OF HON. DAVID SCOTT, A REPRESENTATIVE IN CONGRESS FROM GEORGIA

Good morning and welcome to today's important hearing on soil health and the existing practices and programs that support producers as they protect and improve the health of the soil.

For decades, USDA programs have provided producers with support to address their resource concerns. As a matter of fact, the Natural Resources Conservation Service began as the Soil Conservation Service, with an original focus primarily on soil health and erosion.

Today, farmers, ranchers, and foresters are able to use USDA's technical and financial assistance to support a variety of ways to increase soil health. Addressing soil health helps improve their operations and has additional benefits such as increased water retention and carbon sequestration in the soil.

I would be remiss if I didn't mention the work of the many advocates and innovators who have driven awareness among producers and the public, alike. For example, the excellent moving documentary *Kiss the Ground* directed by Mr. Finian Makepeace who is here with us today that brought attention to soil health. I am

thrilled to play a short clip here today created by individuals involved in that documentary that provides agricultural producers' perspectives on practices and programs that support regenerative agriculture.

I would like to thank our witnesses here today, as well as their supporters. I would also like to thank those who are not able to be here today but have made significant contributions as advocates for innovation in agriculture.

Additionally, I would be remiss if I did not use this opportunity to mention the exciting work being funded by the Partnerships for Climate-Smart Commodities Program at USDA. Just this morning Secretary Vilsack announced funding of $25 million for the Rodale Institute working with the University of Georgia and Emory University to help producers expand markets for their produce, while reducing greenhouse gas emissions, educating consumers, and developing technology that will improve scalability of their model. This is so important and I am so very supportive of what Secretary Vilsack is doing with this program. This project is just one of 70 receiving funding, but with it being in Georgia, I am sure it will be the most successful.

Now I would like to play a clip from the producers of *Kiss the Ground.*

Video Can Be Viewed Here *

With that, I'd now like to welcome the distinguished Ranking Member, the gentleman from Pennsylvania, Mr. Thompson, for any opening remarks he would like to give.

The CHAIRMAN. And now I want to share with you this clip, and I want you to see the brilliance, the dynamic message that *Kiss the Ground* is doing. This is the movement that got me involved with this issue. So I believe our technician is ready to play it. Enjoy and learn.

Oh, just a second. We are going to make sure we get the volume up. We are going to pause for a moment to get the film ready. Thank you. The Ranking Member says technology is wonderful when it is working. So give us a moment, and we will get it going.

What we are going to do, we do have some technological issues. And we are going to now recognize our distinguished Ranking Member, Mr. Thompson of Pennsylvania, for his opening statement, and hopefully, technology will come to our rescue.

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

Mr. THOMPSON. All right, Mr. Chairman, thank you so much. I see our newest Member transitioned from attending virtually to being in person here. So, once again, Brad, welcome. We are so honored and pleased to have you on the Agriculture Committee with your family history of farming and your service in so many different ways to the industry, the number one industry in this country, agriculture. And thank you, and we are glad to have you on the Committee, honored to have you on the Committee.

Mr. Chairman, thank you.

Encouraging soil health and responsible conservation practices in agriculture has been a central goal and a priority supported by Congress since the 1930s and certainly a priority of mine since coming to Congress.

Through the farm bill, producers, landowners can access a variety of conservation programs and tools to incorporate activities that support a variety of natural resources. These programs are voluntary, they are incentive-based, and locally led, while directly

* **Editor's note:** the video is retained in Committee file; and is available at: *https://www.youtube.com/watch?v=npk_eZ0W0kM.*

benefiting the producer and, quite frankly, the economy and the environment. These tools that we provide are why American farmers are really the climate heroes around the world. These tools contribute greatly to the conclusion in research that is pretty striking. It talks about if we want to reduce greenhouse gases around the world, we want to do that on this day of September of 2022, all we need to do is for American farmers, ranchers, and foresters to produce more and export it overseas.

So the farmers and ranchers are the original environmentalists and have adopted proven conservation practices to encourage soil health and other environmental benefits. Producers and landowners are also generating soil health benefits through grazing and active management of forest lands. Science, technology, and innovation have always been important to the success of agriculture, and I would say that is the purest definition of American agriculture.

This continues to be true as we build out technologies that improve soil health. For example, biotechnology, the use of crop protection tools, and access to precision ag technology will help deliver soil health and climate benefits in both short- and long-term. Because of the investments in agricultural research, the U.S. has become the most efficient agricultural producer in the world. In fact, American farmers, ranchers, and landowners produce 287 percent more than in the 1940s with little to no change in inputs. And I believe that this industry is not static, it is dynamic, and we will continue to provide tools. Perhaps we can take that to 400 percent increase by 2035.

Some want you to believe that regenerative agriculture is somehow revolutionary and it is very positive, but soil health has been a fundamental tenant of the farm bill conservation programs from their very inception. In the 2018 Farm Bill, we made improvements to programs like creating a conservation incentive contract that would pave the way for easier adoption of management activities like cover crops. We have also made soil health a major component of the new on-farm conservation innovation trials, and soil health is a central purpose of the Conservation Stewardship Program.

Unfortunately, today's panelists do not represent the breadth of the conservation movement in the United States but a small minority that wants to redefine *regenerative agriculture* as only organic, which is just not true. And while I support farmers who want to receive a premium through organic agriculture, I think that is a wonderful thing, I appreciate the premiums that our organic farmers and ranchers are able to generate through organic agriculture, we cannot let the idea permeate that organic is the only way to be a conservation steward. And attacks on industrial agriculture or conventional agriculture, quite frankly, are divisive and unhelpful.

Now, please don't get me wrong. Soil health is critically important for American agriculture and rural communities around the nation. I got my first introduction on Schrack Farm in Clinton County, a county I am picking back up by the way it looks like, wonderful soil health, a day that we spent there looking at soil samples and the difference and the changes that can be facilitated with good, solid agricultural practices. In fact, I was proud to host and chair actually one of the first soil health hearings in Congress

in 2014 as then-Chairman of the Conservation, Energy, and Forestry Subcommittee.

However, I think it is necessary to make the distinction that organic agriculture production is not the only means of production that promotes and maintains soil health. That will be largely what we are concentrating on at the hearing today: organic agriculture. And I support an all-of-the-above approach when it comes to soil conservation. We also must ensure our USDA's conservation programs remain voluntary, locally led, and incentive-based, and most importantly, keeps the producer first.

The European Union's Farm-to-Fork Initiative has shown that tying food policy to climate policy is harmful to food production and economic viability for all. In fact, the USDA's Economic Research Service found that the EU will see a production decrease of 12 percent and prices increase by 17 percent by 2030 under their Farm-to-Fork Initiative. Worldwide, we will see a nine percent price increase as a result of the EU's adoption. And if there were to be a global adoption of this program worldwide, food prices would increase 89 percent by 2030.

So looking forward to the next farm bill, I am not going to sit idly as we let decades of real bipartisan progress be turned on its head to satisfy people who at their core think agriculture is a blight on the landscape. I have been leaning into the climate discussion, embracing it, and leading, but I am not going to have us suddenly incorporate buzzwords like *regenerative agriculture* into the farm bill or overemphasize climate within the Conservation or Research Title, while undermining the other longstanding environmental benefits that these programs provide.

As we begin the farm bill process, we cannot allow the promises of organic agriculture, which are many, or climate policy to cause us to lose sight of the many other benefits that our current food system provides under the broad goals of farm conservation.

So, Mr. Chairman, thank you so much, I am looking forward to hearing from our witnesses in this hearing, and I yield back.

The CHAIRMAN. Well, thank you, Ranking Member, for your excellent opening statement.

And what we are going to do, we are going to give our hard-working and excellent technicians a little more time to get this film together because it is extraordinary.

And what I would like to do while we give them a little more time is introduce to you in the Committee and those who are watching across the nation our distinguished lineup of witnesses today.

And also, I want to request that other Members just submit your opening statements for the record so that we can get our witnesses' testimony and ensure that we have ample time for everyone's questions. Now, our first witness today is Mr. Jeff Moyer. Mr. Moyer is the Chief Executive Officer of the Rodale Institute. And Mr. Jeff Moyer is doing an excellent job at the Rodale Institute. And then certainly, congratulations to you for the wonderful financial $25 million that we are giving to you today to carry on that excellent work.

Our next witness is Mr. Steve Nygren. Mr. Nygren is the founder and Chief Executive Officer of the great Serenbe, and he is also one

of my constituents. Serenbe is in the great Chattahoochee Hills in Georgia in our 13th district. You are doing such an outstanding job, and you are a national leader in our agriculture industry. Welcome.

Our third witness today is Mr. Ken McCarty, who is a partner in the McCarty Family Farms from Colby, Kansas. Welcome.

Our fourth witness is Mr. Rick Clark, who is the owner of Farm Green and Clark Land and Cattle, and he is testifying on behalf of Regenerate America.

And our fifth and final witness today is Dr. Rebecca Larson, who is the Chief Scientist and Vice President, Government Affairs for the Western Sugar Cooperative.

Ranking Member, what a distinguished group we have today.

And now, as I mentioned this film, and you all are about to witness an extraordinary message about the urgency, the need for us to kiss the ground. All right, technicians, we are ready. Thank you, Ashley.

[Video shown.]

The CHAIRMAN. Thank you. And once again, we apologize for this technical operation, but you got a part of this film. I encourage you to pursue it and see much more. And again, I apologize. Technology sort of interrupted us there.

And now what I would like to do is to start with our testimony. And, as I mentioned, the whole purpose here is to open up this discussion and share with our nation the importance to understanding that the very start of our food supply chain is the Earth, and we are losing the vital component of carbon. And so we have to do all that we can to make sure we are getting this carbon back in the ground, and this is why we are here.

And so our first witness today will be Mr. Moyer. Mr. Moyer, you can start when you are ready.

STATEMENT OF JEFFREY W. MOYER, CHIEF EXECUTIVE OFFICER, RODALE INSTITUTE, KUTZTOWN, PA

Mr. MOYER. Chairman Scott, Ranking Member Thompson, and Members of the Committee, thank you for the opportunity to testify before you today. The written testimony I provided to the Committee expands on the points I will make here.

First, I want to thank you for holding this historic hearing. It is critically important that we focus on the health of America's soil. It is key to solving problems I know you and your constituents are focused on. Members of the Committee, if you are looking for an agricultural method that increases farm profitability, is regenerative, better for the environment, and produces healthier food for Americans, then all you need to do is look beneath your feet. Regenerative organic agriculture, which prioritizes soil health, accomplishes all of that.

A strong, viable economic model that supports American farmers transitioning to regenerative organic agriculture already exists. And it doesn't matter what kind of tractor a farmer drives or what kind of crops they plant. All farms can benefit from regenerative organic practices. But we need to adopt changes now because America's food system is broken. It is too reliant on unstable foreign supply chains, chemical pesticides, and government subsidies for foods that aren't healthy for our constituents or profitable for

America's farming families. And our current agricultural systems are also degrading America's soils.

Recent events have shown that this country must begin working toward food independence. Russia's war against Ukraine exposed dangerous cracks and frailties in the global food system and supply chains. However, this is not a doomsday scenario. We have the tools and the time to fix this and set our farms on a positive track, and regenerative organic agriculture is our path forward.

Rodale Institute is the 75 year old Pennsylvania-based nonprofit research and education institution that I manage. We confront this challenge every day with our staff of Ph.D. scientists and farmers like me, who work to create a resilient food system that improves soil health and the economics of farming. So we champion regenerative organic agriculture. That is because it is reliable, resilient, and does not depend on foreign agricultural inputs like Russian-made synthetic fertilizers.

Regenerative organic farms use a whole-systems approach to grow food that actively restores soil health, which is critical because healthy soil has always been the foundation of successful farming. After all, soil impacts harvests and the long-term viability of any farm. But right now, we are not doing enough to protect our soil. And that is foolish because it is a finite resource key to our survival.

Current estimates suggest that by 2050, soil degradation may reduce crop yields up to ten percent. But research shows organic farming can reverse soil degradation and actually improve soil health. And that is not its only benefit. Regenerative organic agriculture showcases production strategies that conventional farmers can take advantage of like the use of roller-crimpers, along with cover crops, to reduce or eliminate tillage and the need for nitrogen fertilizer. But in order for these practices to be employed at scale, we need to tweak EQIP and crop insurance regulations to incentivize the outcomes we want, not disincentivize them.

Rodale Institute has a 40 year long farming systems trial, the longest of its kind running in this country, where we examine organic agriculture and conventional agriculture side by side in real-world contexts. The study's recent findings show that organic systems will be more profitable for farms while improving soil health.

Members of the Committee, we can make that the standard for this country, more profit for farmers and healthier soil, too. Look, it would be a lot easier if we as humans could just eat soil. No one would go to the supermarket or restaurant and ask for soil laced with fungicides, pesticides, and salt-based fertilizer. We would ask for good organic soil and rich compost. Well, in effect, we do eat soil, or at least the plants we eat do. Let's make it possible for us all to choose a plan that improves our soils, makes farming families more economically secure, and puts America on a path to food independence. Regenerative organic agriculture is how we get there.

Thank you for taking time to listen to my testimony today, and I do look forward to your questions.

[The prepared statement of Mr. Moyer follows:]

PREPARED STATEMENT OF JEFFREY W. MOYER, CHIEF EXECUTIVE OFFICER, RODALE INSTITUTE, KUTZTOWN, PA

I. Introduction

Chairman Scott, Ranking Member Thompson, and Members of the Committee, thank you for the opportunity to testify before you today.

Given your positions on this esteemed Committee, it's likely you already know that America's food system is broken. And it's likely you already know why it's broken. It's too reliant on unstable foreign supply chains, chemical inputs, and government subsidies for foods that aren't nutritious for your constituents or profitable for American farming families.

Conventional agricultural models are also degrading American farmland.

But this is not a doomsday scenario—not just yet. We have the tools and the time to fix this and set our farms on a positive track, and regenerative organic agriculture is our path forward.

A strong, viable economic model that supports American farmers transitioning to regenerative organic already exists, and there's a role for everyone as we make this change, including conventional farmers, organic farmers, lenders, landowners, suppliers, and policymakers.

But we must move to make this transition now. U.S. national security, the health of our people, and the financial stability of the nation's farming families are all at risk.

Rodale Institute, the 75 year old Pennsylvania-based nonprofit and research institution that I run, confronts this challenge every day. Our 100 person staff, including nearly a dozen Ph.D.s and a handful of farmers, are dedicated to creating a resilient food system that works to improve soil health and the economics of farming.

Recent events, such as Russia's war against Ukraine and the subsequent disruptions in the worldwide food system, forced American agriculture into an inflection point and an opportunity.

We shouldn't waste it.

II. American Food Independence

Just as America works towards energy independence, it should work towards food independence. Relying on fragile international supply chains could jeopardize U.S. national security and lead to widespread, unstable food prices for everyday Americans.

A. The War in Ukraine Exposed Dangerous Cracks in the Global Food System

With farmers and commodities experts predicting lower yields, skyrocketing prices, and extreme hunger in some parts of the world, we have to rethink our food systems to break American agriculture's reliance on fragile international supply chains.

If we do this right, we can produce healthier, chemical-free food. That should be a priority because not only must we figure out how to feed this nation, we must feed it better.

The food system that can accomplish that objective—producing enough nourishing food in the United States—is regenerative organic agriculture.

B. The Answer to American Food Independence Can Be Found Right Under Our Feet

Russia's war in Ukraine caused a near doubling of the price of natural gas, a key ingredient in nitrogen fertilizer. The increased cost and limited availability forced some farmers to reduce fertilizer use for their crops, which shrunk yields in some cases. Facing a profitless growing season, some farmers may have given up altogether.

The U.S. Department of Agriculture responded by issuing $250 million in grants to spur U.S. fertilizer production. But that was a Band-Aid for a wound that will never heal. The long-term solution is right under our feet.

Regenerative organic agriculture is a reliable, resilient method of growing food that does not depend on synthetic fertilizers or off-farm inputs. Regenerative organic farms use a whole-systems approach to agricultural production, which actively restores the health of soil. Farms practicing these methods rely on cover crops, crop rotations, reduced-till practices, composting, and, in some cases, fertilization by animal manures—spread by responsible grazing practices—to nourish and enhance soils.

III. The Science

Soil is the foundation of successful farming. It is also the foundation for the ecosystem services that life depends on.

A. Unmitigated Soil Erosion and Destruction Could Jeopardize the Food Supply

Research shows that 30% of the world's arable land (land that is used for growing crops) has become unproductive in the past 40 years due to soil erosion. Soil degradation is the physical, chemical, and biological decline in soil quality occurring in various forms such as erosion, salinization, acidification, compaction, loss of fertility, decline in soil biological activity, and loss of soil organic matter. About ⅓ of the world's soil has already been degraded, and if the current rate of soil degradation continues, all of the world's topsoil could be lost within 60 years.

Unsustainable agricultural practices, such as over grazing, improper land use change, and deforestation—especially clear cutting—are major contributors to soil degradation.

In the U.S., 98 percent of farms practice conventional agriculture, which relies heavily on pesticides and synthetic fertilizers, many of which are toxic to humans, animals, pollinators, and soil micro and macro biota.

In addition, conventional farms usually have low crop diversity, which can contribute to the destruction of biodiversity in soil. That's important because when there are fewer microorganisms in the soil, it compromises nutrient cycling and nutrient availability for plants. The result is weaker plants that are more susceptible to infections and pests and therefore require additional synthetic fertilizers for the plant to grow to maturity. This all leads to increasing dependence on synthetic inputs, increased emissions from the soil, increased water pollution, and reduced soil health.

Current estimates suggest that by 2050, soil erosion may reduce up to 10% of crop yields, the equivalent of removing millions of acres of land from production. Simultaneously, the world's population is expected to exceed nine billion, which puts global food security in jeopardy.

B. Regenerative Organic Agriculture Improves Soil, the Environment, and the Economic Security of U.S. Farming Families

The term "regenerative organic" describes a holistic approach to farming that encourages continuous innovation and improvement of environmental, social, and economic factors. The regenerative organic farming model doesn't just maintain resources—it improves them. In addition, it is a food system that relies on natural cycles and management.

Critically, research shows that organic farming has the potential to diminish soil erosion (Erhart and Hartl *2009*).[1] Soil erosion rates measured under simulated heavy rainfall in the Swiss Farming System and Tillage experiment revealed that organic farming decreased mean sediment delivery compared to conventional farming by 30% (0.54 t ha^{-1} h^{-1}) (Seitz, *et al., 2019*).[2]

- **Key Methods of Regenerative Organic Agriculture:**
  - *Utilizing Organic no-till:* Organic no-till practices are central to maintaining or improving soil quality and vitality in the regenerative organic model. The practice is both a technique and a tool to reduce tillage and improve soil organic matter.
  - *Utilizing the Roller-Crimper:* Employing the roller-crimper tractor attachment is an indispensable tool to avoid destructive practices to terminate cover crops, such as tillage and pesticide application. The roller-crimper, which was developed at Rodale Institute, reduces soil erosion, improves soil health, and increases biodiversity. Of note, Rodale Institute posts the roller-crimper's blueprints online. Those blueprints can be accessed at no financial cost.
  - *Managing Weeds with Cover Crops:* Cover Crops are critical to weed management in a regenerative organic farming system as they actively suppress weed growth and enhance soil health. Cover crops also protect soil from erosion and nutrient loss and play an important role in carbon drawdown.
- **Key Benefits:**
  - *Drought Resistant Crops:* Crop yields under organic farming systems are more likely to be resilient to extreme weather. Rodale Institute's long-running Farming Systems Trial found that in drought years, yields were consistently higher in organic systems. For example, in one case, organic corn yields were found to be 28% to 34% higher than conventional. Part of the organic system's resilience is linked to the increased soil organic matter that has greater moisture holding capacity during a drought episode.

[1] *https://link.springer.com/article/10.1007/s13593-018-0545-z#ref-CR12*.
[2] *https://link.springer.com/article/10.1007/s13593-018-0545-z*.

- *Greater Economic Returns for U.S. Farmers:* Research conducted by Rodale Institute has proven that organic systems earn three to six times greater profit for American farmers. In addition, Flanagan State Bank found from 2016–2020, organic incomes were 163% higher than conventional incomes for corn, 145% higher for soybeans, 182% higher for wheat, and 103% higher for hay. Organic systems also use 45% less energy than conventional systems and improve a farm's soil health by building organic soil matter over time.
- *Less Reliance on Off-Farm Inputs, Especially Synthetic Fertilizers:* Regenerative organic farmers are less vulnerable to foreign supply chain disruptions and price shocks in the agricultural commodities market as they don't use off-farm inputs as much as conventional farmers.
- *Higher Quality Food for Consumers:* Industrial agriculture has depleted soils and bred plants for size and rate of growth—not nutrition—in a narrow pursuit of ever-increasing yields. Additionally, plants are more often exposed to stressful situations in organic systems due to the lack of pesticides use which can lead to increased biosynthesis and accumulation of natural defense substances, such as *phenolic compounds*[3] (Faller & Fialho, *2009*).[4] The food consumed today also contains less protein, calcium, phosphorus, iron, riboflavin, and vitamin C than food produced just a half-century ago. Results from Rodale Institute's projects show that all essential amino acids (except lysine, histidine and methionine) were greater in organic oat grains compared to conventional grains (Omondi, *et al.,* 2021).*
- *Predictable Food Prices:* Relying on the regenerative organic farming model and its domestic inputs can insulate American producers from the unstable costs conventional farming is subject to due to its reliance on foreign agricultural commodities.
- *Carbon Capture and Sequestration:* Research by Rodale Institute shows that after 40 years of management, soil organic matter levels were significantly higher in an organic manure-based system than in the conventional systems studied, which reflects greater carbon sequestration in the organic system (FST 40 year report).*

IV. *Farmer Choice:* The U.S. Government Must Level the "Farmer Playing Field"

Crop insurance is at odds with organic farming. Current federally backed crop insurance policies create disincentives for American farmers seeking to transition to and operate under a regenerative organic model. But it doesn't have to be this way.

A. U.S. Taxpayers and Crop Insurance

Established following the Dust Bowl of the 1930s and expanded since, the U.S. crop insurance program is operated by the Federal Crop Insurance Corporation (FCIC), which is wholly owned by the Federal Government and managed by USDA's Risk Management Agency (RMA). RMA oversees 14 private sector insurance companies, which issue more than one million policies covering nearly 375 million acres of U.S. farm and ranch land.

Under the program, participating farmers receive compensation when farms are ravaged by disasters such as fires, storms, and drought. Indemnity payments are also made to farmers when their yields fall below expectations or if oversupply drives down the prices they can charge. And all of this is underwritten by taxpayer-funded subsidies, which help farmers purchase crop insurance at an annual cost to taxpayers of nearly $10 billion.

B. The Bad News About Crop Insurance Policies

Today's crop insurance programs are impeding widespread adoption of regenerative organic farming methods.

That's because, too often, crop insurance policies provide no incentive to farmers who use regenerative organic methods, such as cover crops and reduced tilling. In fact, the premiums they are charged are typically not discounted, even though the risk of droughts and flooding is substantially lower on regenerative organic land. Likewise, today's policies do not incentivize farmers to use regenerative organic methods, even though they significantly stabilize yields from season to season. Instead, the crop insurance program effectively underwrites conventional intensive

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[3] *https://www.sciencedirect.com/topics/food-science/phenolic-compound.*
[4] *https://www.sciencedirect.com/science/article/pii/S0924224417303679?.*
* **Editor's note:** there was no embedded hyperlink for this in-text reference.

farming, causing harm to topsoil, waterways, the climate, population health, and—most paradoxically—the long-term financial health of farmers themselves.

C. The Good News About Crop Insurance Policies

USDA's newly established $300 million Organic Transition Initiative offers the potential for issuance of a wider array of crop insurance policies that recognize and provide appropriate coverage for the risks faced in regenerative organic agriculture. Similarly, the crop insurance premium subsidies recently announced by Secretary Vilsack for the Transitional and Organic Grower Assistance (TOGA) Program is much-needed to support climate-smart farmers and ranchers.

Crop insurance is far from being the most headline-grabbing aspect of USDA's broad portfolio, but the fact that most producers already rely on crop insurance coverage makes it an unparalleled tool for effecting sweeping change. With USDA and Congress' engagement, RMA will make more climate-smart policies available to America's farmers and ranchers. And this single step has the power to do more than any other to modernize agricultural practices, improve the nutritional content of food, and foster repair of the environment.

D. 2023 Farm Bill

Regenerative organic agriculture demands planning, resources, and investment. The 2023 Farm Bill should include priorities that support American farmers pursuing regenerative organic models.

These priorities include:

1. Allocating funding for cover crop utilization by farmers.
2. Allocating additional funding for the USDA's Organic Transition Initiative, which provides technical and financial assistance to farmers during the 36 month organic transition period.
3. Establishing a Strategic Plan with key stakeholders for data collection, policy creation, monitoring, reporting, and standards development to better serve farmers adopting regenerative organic models.

V. Conclusion

Regenerative organic agriculture can improve soil health and the economics of farming and put the U.S. on a path towards food independence. With proper support at the Federal level, American farmers can be encouraged to adopt the practices that achieve these goals.

Thank you for offering me the opportunity to testify before the Committee. I look forward to your questions.

The CHAIRMAN. And thank you, Mr. Moyer, for your excellent testimony.

And now, Mr. Nygren, you are now recognized for your 5 minutes. And welcome to our Committee.

STATEMENT OF STEVE NYGREN, FOUNDER & CHIEF EXECUTIVE OFFICER, SERENBE, CHATTAHOOCHEE HILLS, GA

Mr. NYGREN. Thank you, Chairman Scott, Ranking Member Thompson, and Members of the Committee, for the honor of addressing you today. My name is Steve Nygren, founder and CEO of Serenbe located in Chattahoochee Hills, Georgia's 13th Congressional District.

I want to talk about soil health and how it leads to economic vitality. My written testimony will expand on these points. It starts with the local farm and farmers. The recognition that we need healthy soil should compel us to recognize our American agrarian economy and what drives it, starting with how we inhabit the landscape. We must produce food locally, implement policies and programs that support this local production, and prioritize regenerative organic farming.

You are aware of the shrinking number of U.S. farmers and the conversion to industrial agriculture, replacing the local family farm. What we do not talk about is the effect on the local agrarian

economy. Industrial ag dollars do not support the local bank, the local hardware store, or the main street merchants in the same way that local farmers do. Rural America has been stripped of its identity and economic stability. We are now feeling some of the negative results of this drastic shift and consolidation.

The good news is there has been a renewed interest in local farms, markets, and foods that continues to accelerate. The pandemic has also placed a spotlight on food production, the increased health issues our country faces, and how people are dramatically reassessing where they live and what they eat.

In 1950, Georgia produced 80 percent of the food consumed in the state. Today, it is a fraction of that amount. We are consuming products imported from around the world and eating food grown on U.S. soil with detrimental chemicals based on relationships with foreign governments. This increased dependence on a global supply chain for our food can make the difficulties of the pandemic seem mild should there be a disruption in our global industrial food system.

I grew up on a generational farm in Colorado. Following college, I became a hospitality entrepreneur. For those of you who worked on the Hill in the 1980s and early 1990s, you might remember the Peasant on Pennsylvania. During this period, I bought a historic farm just outside Atlanta in an area that would later become Chairman Scott's district, enabling my young children to experience in a small way the rural life I had grown up with.

Recognizing the need for investments in local community and our farmlands, in 2000 I drove an effort to save the rural landscape we had come to love with 500 local neighbors. We formed a county overlay for 40,000 acres, saving 70 percent of the land for agriculture. We passed historic legislation for Georgia and in 2004 broke ground on Serenbe, a community model of balanced growth with a working organic farm at its center. Serenbe is an example of how agriculture can be incorporated within developments as a financial and lifestyle advantage.

For $34 a week, 75 families receive a farm share that includes their produce for the week, hundreds more reached through our farmers' market and local restaurants. And to combat food waste, our farm has opened the first citywide compost station. Serenbe stands as a model of the agri-hood movement.

I may have built a town, but Will Harris of White Oak Pastures has saved one. Bluffton, Georgia, has gone from a ghost town to a destination in 1 decade. His transition to regenerative cattle farming now employs 180 people with more than $100,000 in weekly payroll. White Oak is the largest private employer in the county, restoring an economy and changing the lives of one small rural community.

Today, we need programs in place to support and promote the growing market for locally produced food grown in chemical-free soil. Small farms and regenerative organic farmers need an equal opportunity. They need supporting policies, designated dollars that will reach the hardworking farmers in the fields such as Matthew Raiford, who is with us today. Think of soil health as a platform to bring our small towns back to life. When farming and soil is res-

cued, then many other businesses and value-added production will follow.

Soil health is imperative to American health. Through the farm bill and the direct actions of this Committee, you can affect real change for our farmers, our food systems, our economy, and our communities. I urge you to fund organizations that will directly impact small and historically marginalized farmers working to produce regenerative organic foods. Thank you for your time.

[The prepared statement of Mr. Nygren follows:]

PREPARED STATEMENT OF STEVE NYGREN, FOUNDER & CHIEF EXECUTIVE OFFICER, SERENBE, CHATTAHOOCHEE HILLS, GA

Thank you to Chairman Scott, Ranking Member Thompson, and Members of the Committee for the honor to address you today.

My name is Steve Nygren, Founder & CEO of Serenbe, a 20 year old community located in Chattahoochee Hills, in Georgia's 13th District. I want to talk about soil health and how it can lead to economic vitality—my written testimony will expand on these points.

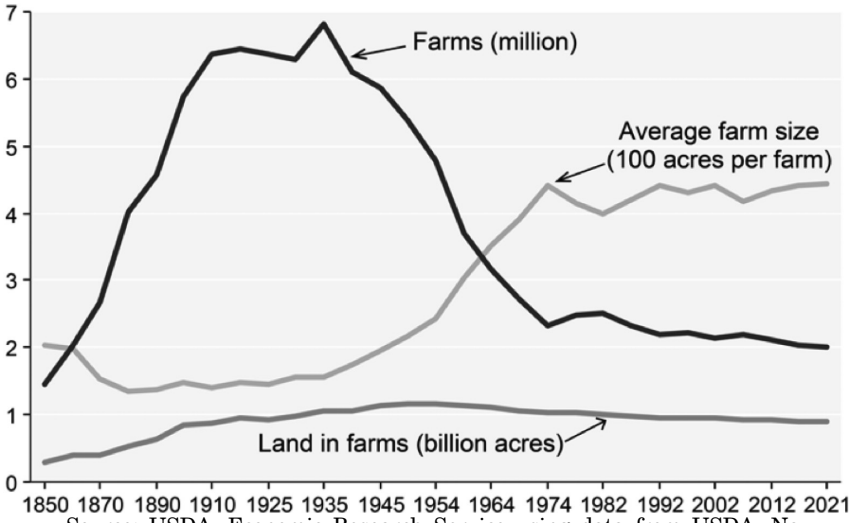
It starts with the local farm and farmers. It leads to the physical and economic health of our citizens and our planet.

The recognition that we need healthy soil should compel us to reorganize our American agrarian economy and what drives it—starting with how we inhabit the landscape. We must produce food locally, implement policies and programs that support this local production, and prioritize regenerative organic farming.

You are very aware of the shrinking number of U.S. farmers and the conversion to industrial agriculture, replacing the family farm. The U.S. lost ⅔ of farms during the 25 years period from 1945–1970. What we don't talk about is the damage to the local agrarian economy. Industrial ag dollars do not support the local banks, the local hardware stores, or the main street merchants in the same way that local farmers do. *Prior to this Industrialization, every rural community processed its farm production locally. These foods were also consumed locally. Every farm community had an abattoir and butcher, a grist mill, a creamery, a vegetable packing shed, and all other necessary infrastructure to maintain a local foodshed. Farmers strove to increase the value of their production by adding as much quality as they could. In essence, they were competing against each other in their local market. After the Centralization, the goal was to merely meet "minimum standards" and accept commodity prices for it.* Rural America has been stripped of its identity and economic stability. *And it doesn't end on the country roads but bleeds into the suburbs and urban centers.*

Farms, land in farms, and average acres per farm, 1850–2021

Million farms, billion acres, or 100 acres per farm



Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, Censuses of Agriculture (through 2017) and *Farms and Land in Farms: 2021 Summary* (February 2022).

We are now feeling some of the negative results of this drastic shift and consolidation.

The good news is there has been a renewed interest in local farms, markets and foods that continues to accelerate. The pandemic has also placed a spotlight on food production, the increased health issues our country is facing and how people are dramatically [reassessing] where they live and what they eat.

In 1950, Georgia produced over 80% of the food consumed in the state.[1] Today it is a fraction of that amount. We are consuming products imported from around the world and eating food grown on U.S. soil with detrimental chemicals based on relationships with foreign governments. This increased dependence on a global supply chain for our food could make the difficulties of the pandemic seem mild—should there be a disruption to our global industrial food system.

I grew up on a generational family farm in Colorado. Following college I entered a different segment of the food industry as a hospitality entrepreneur opening restaurants across the county. For those of you who worked on the Hill in the 1980s and early 1990s, you may remember my restaurant, the Peasant on Pennsylvania. During this period, I bought a historic farm just outside of Atlanta—in an area that would later become Chairman Scott's district—enabling my young children to experience in a small way the rural life I had growing up.

Recognizing the need for investment in the local community and our farmlands, in 2000, I drove an effort to save the rural landscape we had come to love with 500 neighboring landowners. We formed a county overlay for 40,000 acres saving 70% of the land for agriculture. In 2003, we passed Transfer Development Rights (TDR)[2] legislation for Georgia and in 2004 broke ground on Serenbe, as a community model of balanced growth[3] with a working organic farm at its center, Serenbe Farms.[4] Serenbe is an example of how agriculture can be incorporated within developments, as a financial and lifestyle advantage. For $34/week, 75 families receive a farm share that includes their produce for the week. Hundreds more are reached through

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[1] Sanford H. Bederman. SOUTHEASTERN GEOGRAPHER Vol. 10, No. 2, *A Special Issue on Agriculture in the South* (November 1970) (*https://www.jstor.org/stable/i40182694*), pp. 72–82 (11 pages) Published By: University of North Carolina Press.

[2] Georgia Planning. *Transfer of Development Rights.* April 23, 2007. *https://georgiaplanning.org/student_reports/2007/13--TDR%20and%20Chatt%20Hill/CHC_TDR_report.pdf.*

[3] Serenbe. *https://www.serenbe.com* Accessed September 11, 2022.

[4] Serenbe Farms. *https://serenbefarms.com* Accessed September 11, 2022.

our farmers market, local restuarants—and to [combat] food waste, our farm has opened the first citywide compost station. *Americans throw away about 25% of the food they purchase for at-home consumption.*[5] The Serenbe model and the emergence of the Agrihood[6] movement is replacing the indulgence in the golf course communities of the 1980s and 1990s.

The 2040 Farms Under Threat analysis from American [Farmland] Trust (AFT) mapped development scenarios for every state in the U.S. If recent trends continue, 798,400 acres of Georgia's farmland will be paved over, fragmented, or converted to uses that jeopardize agriculture. That's 7%. And the equivalent of losing 7,200 farms, $756 million in farm output and 10,700 jobs.[7] *This speaks to not only the loss of the most productive versatile and resilient soils, it points out the loss of farms, farm output, farm jobs. These are compounded by the inland migration that will result from coastal flooding.* We can slash conversion, save farmland and safeguard the future of agriculture and the environment by choosing compact development.

The local regenerative organic farm is an economic solution. I may have built a town but Will Harris of White Oak Pastures, has saved one. Bluffton, Georgia has gone from a ghost town to a destination in a decade. His transition to regenerative cattle farming[8] now employs 180 with more than $100,000 in weekly payroll—White Oak is the largest private employer in the county restoring the economy and changing lives in one small rural community.[9]

Many people are interested in returning to the land and there is a growing market for locally produced food grown in soil without chemicals. But we need programs in place to support and promote these efforts. Small farms and organic regenerative farmers need an equal opportunity. They need supportive policies with designated dollars that reach hard working farmers in the fields. A few examples of Georgia organizations that support farmers to thrive by providing funds and programs are Georgia Organics and The Conservation Fund.

The member-supported, nonprofit organization, Georgia Organics, has been rooted in providing direct support to small and organic farmers across our state since the 1970s. It has more than doubled the number of organic farms in the state through its organic transition campaign—bringing nearly 3,000 more acres under organic management. They prioritize direct outreach to farmers and also provide advice and assistance with paperwork and organic requirements. They pair their organic transition work with a farmer Accelerator Program that coaches farmers on business planning, recordkeeping, and other skills that support financial stability for farms. They point to staff training on the organic certification process and maintaining close relationships with producers as two key elements of their success.[10]

In 2018, with financial support from the USDA Office of Partnerships and Public Engagement and the Bradley-Turner Foundation, Georgia Organics led a 1 year project to develop a supply chain and marketplace around Certified Organic peanuts that could support small farmers. One of their Accelerator Program participants, Sedrick Rowe, is building the organic peanut sector in Georgia, one farmer at a time.[11] Rowe worked with Georgia Organics to experiment with organic peanut production and build the Georgia Organic Peanut Association.[12] He entices more farmers to transition by showing that organic peanut production is both healthier and more profitable.

The Conservation Fund is working to secure farmland with its Working Farms Fund (WFF), to create patient pathways to [affordable] land ownership and build

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[5] American Farm Bureau Foundation for Agriculture's Food and Farm Facts book (2021 edition) *https://www.agfoundation.org/resources/food-and-farm-facts-2021.*

[6] Urban Land Institute. *Agrihoods: Cultivating Best Practices.* 2018. *https://2os2f877tnl1dvtmc3wy0aq1-wpengine.netdna-ssl.com/wp-content/uploads/ULI-Documents/Agrihoods-Final.pdf.*

[7] American Farmland Trust. *Farms Under Threat.* 2022 *www.farmland.org/farmsunderthreat.*

[8] Little, Amanda. BLOOMBERG. *The Biggest Ideas in Farming Today are Also The Oldest.* March, 5, 2021. *https://www.bloomberg.com/opinion/articles/2021-05-15/the-biggest-ideas-in-farming-today-are-also-theoldest?.*

[9] White Oak Pastures. *Our [Transition]. https://whiteoakpastures.com/pages/our-transition* Accessed September 11, 2022.

[10] Georgia Organics. *Farmers Services: Accelerator Program. https://farmerservices.squarespace.com/accelerator* Accessed September 11, 2022.

[11] Black Farmer Network. *Sedrick Rowe Organic Farmer. https://blackfarmersnetwork.com/sedrick-rowe-rowe-organic-farm/* Accessed September 11, 2022.

[12] Georgia Peanut Tour. *Growing Peanuts for The Organic Market. https://georgiapeanuttour.com/2019/09/growing-peanuts-for-the-organic-market/* Accessed September 11, 2022.

wealth for a diverse community of next generation farmers.[13] In the 2021–2022 year they were able to save eight Georgia farms across 705 acres, securing $5.9M in land, supporting 33 farmers and $100k was invested directly in on-farm infrastructure. Plus 75% of the farm business are minority/immigrant/women-owned.[14] WFF partnerships include Common Market, a distributor of [sustainable], local farm foods helping farmers connect to new markets by providing access to a wide variety of wholesale and retail customers and connecting them with [institutions] and communities throughout the Southeast.[15]

Think of soil health as the platform to bring our small towns back to life. This foundational element can be local networks of agriculture, supply and retail. When farming and the soil is rescued, then many other businesses and value-added production will follow. After a while, we'll have fully functioning towns again, built on social and economic roles that give people a reason to think that life is worth living.

Soil health is imperative to America's health.

Through the farm bill and the direct actions of this Committee, you can affect real change for our farmers, our food systems, our economy and our communities. I thank the Committee for their time, and urge you to fund organizations that will directly impact small and historically marginalized farmers working to produce regenerative organic foods. In 2020, only 1% of producers of color received EQIP and CSP funding.[16]

Supporting innovative farmers and ranchers in adopting conservation practices is key to adapting to and mitigating climate change while also improving water and air quality, soil health, and even profitability. Farm bill conservation programs provide cost share and technical assistance (TA) to help producers implement these practices, but these programs often need more funding and staff to address service gaps and fulfill demand. More must be done to equitably scale up long-term adoption of conservation and climate-smart practices by farmer-leaders, and to set up systems of support to help others build the same resilience. In the 2023 Farm Bill, AFT recommends that Congress:

Increase Conservation Program Funding

- Increase funding to meet demand for financial support and TA, especially for practices that improve soil health, contribute to climate and water resilience, and reduce GHG emissions.
- Expand funding set asides for historically marginalized producers.

Support Producers in Long-Term Adoption of Soil Health and Climate-Smart Practices

- Increase funding for the EQIP Conservation Incentive Contracts program and focus these longer 5–10 year contracts on soil health practices to mitigate transition risks.
- Direct NRCS to continue to increase TA capacity, fill service gaps, and streamline programs to address bottlenecks, reduce producer wait times, and improve implementation.
- Improve the Technical Service Provider program to enable additional qualified experts to provide TA.
- Establish a peer-to-peer program that offers CSP awardees and experienced EQIP awardees training and financial incentives to mentor other producers interested in trying out conservation practices.
- Increase funding for Conservation Innovation Grants and Trials and soil health demonstrations. Prioritize applications that measure soil health improvements and carbon sequestration.

Help Small-Scale and Historically Marginalized Producers Access USDA Programs

- Increase support for small-scale farms by creating an Office of Small Farms, by piloting a tiered payment rate system that increases EQIP and CSP payments for small farms, and by tailoring application processes to small-scale growers' needs.

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[13] The Conservation Fund. *Working Farms Fund. https://www.conservationfund.org/our-work/working-farms-fund* Accessed September 11, 2022.

[14] Conservation Fund. *Summer Update 2022. https://www.conservationfund.org/images/WFF22-Summer-Update-Brochure-081722.pdf.*

[15] The Common Market. *https://www.thecommonmarket.org* Accessed September 11, 2022.

[16] American Farmland Trust. *2023 Farm Bill Recommendations.* July 2022. *https://farmland.org/wp-content/uploads/2022/07/AFT_2023_Farm_Bill_Recommendations_Summary.pdf.*

- Fund Community-Based Navigators to help historically marginalized producers apply for NRCS programs.
- Support NRCS in continuing its examination of potential inequities that may disadvantage producer participation based on farm size, race, income, or gender through the current application process, program ranking criteria, or payment rate-setting process.

Improve NRCS Program Application Processes and Increase Transparency

- Direct NRCS to streamline the application process for practices that address multiple resource concerns, especially practices that help farmers adapt to and/or mitigate climate change.
- Direct NRCS to regularly share additional aggregated information on program applicants and awardees based on race, gender, farm size, income level, and funded practices.
- Direct USDA to regularly share additional information on program outcomes, including GHG reductions, carbon sequestration, water quality, and soil health.

These specific programs and recommendations were pulled from the American Farmland Trust "Building Resilience in a Change World: AFT's 2023 Farm Bill Recommendations".[17]

Additional legislation to highlight is the Agriculture Resilience Act,[18] that supports soil health through crop insurance, EQIP, CSP and state assistance. Authored by folks at NSAC (National Sustainable Agriculture Coalition), this legislation is currently looking for cosponsors, it is a marker bill that we hope gets adopted into the farm bill.

I look forward to your questions.

The CHAIRMAN. And thank you, Mr. Nygren, for your excellent testimony.

And now, Mr. McCarty, please begin when you are ready.

STATEMENT OF KEN MCCARTY, PARTNER, MCCARTY FAMILY FARMS LLC, COLBY, KS

Mr. MCCARTY. Good morning, Chairman Scott, Ranking Member Thompson, and Members of the Committee. Thank you for allowing me to join the conversation today as you prepare for the upcoming farm bill. I am Ken McCarty, and I look forward to discussing what regenerative agriculture means to McCarty Family Farms.

My three brothers and I are fourth-generation dairy farmers, originally from a small farm in Bradford County, Pennsylvania, where my family farmed for more than 100 years. In the late 1990s, my parents began searching for opportunities that would allow my brothers and I to continue our family's farm. Eventually, that led us to Rexford, Kansas, where we have gradually grown our business to include five dairies, three dairies in northwest Kansas, one in southwest Nebraska, and most recently a partnership dairy with another fourth-generation family farm in Mercer County, Ohio. We also own and operate a milk condensing plant at the Rexford Farms that reduces the freight to move our finished products by 75 percent while reclaiming 65,000 gallons of fresh water every day. We are currently in the process of building a state-of-the-art dairy farm near the original Rexford Dairy and expanding the processing capacity of the milk plant.

Continually improving our farm management and implementing sustainable farming practices is key to the success and growth of

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[17] American Farmland Trust. *2023 Farm Bill Recommendations.* July 2022. *https://farmland.org/wp-content/uploads/2022/07/AFT_2023_Farm_Bill_Recommendations_Summary.pdf.*

[18] National Sustainable Agriculture Coalition. *Agriculture Resilience Act.* April 2021. *https://sustainableagriculture.net/wp-content/uploads/2021/04/ARA-Section-by-Section-2021_FINAL.pdf.*

our business. Every day, we strive to create wholesome dairy foods in a responsible and sustainable manner, and we are deeply committed to regenerative ag practices and have been recognized as a leader in that space. For example, McCarty Family Farms is Validus DairyCARE-certified, FARM Program-verified, and a Certified B Corp. And for the past 2 years, we have been recognized as a best-for-the-world B Corp in the environmental impact area. We have also received multiple awards from the U.S. Dairy Innovation Center, National Milk Producers Federation, IDFA, the State of Kansas, and others. Also, since 2016, we have worked annually with sustainable environmental consultants to evaluate and verify our ecosystem impact, which is reported publicly on our website.

This approach to transparency and third-party validation helps us market our milk and creates a foundation for sustainable business growth. As an example, we sell most of our milk to Danone North American, another Certified B Corp and a leading global food and beverage company who processes our milk into products such as Dannon, Oikos, Octavia, and Light & Fit yogurts.

Regenerative agriculture may be a buzzword for some, but for McCarty Family Farms, it is a holistic mindset that encourages us to consider a multitude of practices across our farms, especially those associated with core values like soil health, resource conservation, animal welfare, and the welfare of our team members, families, and communities. Practices such as cover crops, reduced tillage, improved nutrient management, and excellent animal care practices under one coherent vision can optimize the performance and sustainability of our farms.

In general, regenerative agriculture should provide measurable economic, social, and environmental benefits that help improve rather than just sustain our ecosystems. And we have been able to demonstrate just that. For example, water conservation technologies have helped to save millions of gallons of fresh water every year while reducing our input costs. Enhancements to animal welfare has helped ensure more milk production with fewer resources consumed.

For McCarty Family Farms and our partners, regenerative agriculture must move beyond a qualitative concept towards making decisions based on quantitative outcomes. By benchmarking and tracking our environmental and economic performance, we can better understand the impacts and make better business decisions. In general, these regenerative efforts have helped demonstrate that dairy farming and all of agriculture can be a part of the solution for our climate and our economy while, of course, helping to feed the world.

At times, USDA programs are helpful to incentivize new ideas and reduce up-front costs when a clear short-term ROI isn't possible. And while we know regenerative practices produce economic benefits in the long-term such as increased efficiency and resilient yields and improved market opportunities, up-front costs can still be a barrier to implementation. Traditional ag lending looks year-to-year, while regenerative agriculture takes a longer-term view, which is why conservation funding and incentives are crucial to greater adoption.

When considering USDA conservation programs, budgets are just one barrier to greater adoption. Challenges such as EQIP backlogs, rigid contract structures, cumbersome applications, and burdensome follow-up reporting create additional strain. We work with our partners, including Danone, to explore different financing and incentive models. USDA programs such as the Conservation Innovation Grant for On-Farm Trials allowed us to work with non-Federal partners such as Danone, Sustainable Environmental Consultants, and National Fish and Wildlife Foundation to finance scalable regenerative management.

By considering the applications and contract costs to farmers and allowing farmers to work with familiar partners rather than just USDA alone, I believe programs can support more farms investing in regenerative agriculture. We need a simpler, more streamlined process to engage with USDA and other stakeholders to implement a wider variety of regenerative innovations.

Thank you for your time today, and I look forward to answering your questions.

[The prepared statement of Mr. McCarty follows:]

PREPARED STATEMENT OF KEN MCCARTY, PARTNER, MCCARTY FAMILY FARMS LLC, COLBY, KS

Good morning, Chairman Scott, Ranking Member Thompson, Members of the Committee. Thank you for allowing me to join the conversation today as you prepare for the upcoming farm bill. I'm Ken McCarty and I look forward to discussing what regenerative agriculture means to McCarty Family Farms

Introduction

My three brothers and I are fourth generation dairy farmers originally from a small farm in Bradford County Pennsylvania where my family farmed for more than 100 years. In the late 1990s my parents began searching for opportunities that would allow my brothers and I to continue our family's farm. Eventually that led us to Rexford, Kansas where we have gradually grown our business to five dairies. Three dairies in Northwest Kansas, one in Southwest Nebraska and most recently a partnership dairy with another fourth-generation farm in Mercer County Ohio. We also own and operate a milk condensing plant at the Rexford farm that reduces the freight to move our finished products by 75% while reclaiming 65,000 gallons of fresh water per day. We are currently in the process of building a state-of-the-art dairy farm near the original Rexford dairy and expanding the processing capacity of the milk plant.

Continually improving our farm management and implementing sustainable farming practices is key to the success and growth of our business. Every day we strive to create wholesome dairy foods in a responsible and sustainable manner, and we are deeply committed to regenerative agricultural practices and have been recognized as a leader in that space.

For example, McCarty Family Farms is Validus DairyCARE certified, FARM Program verified and are a Certified B Corp and for the past 2 years, we have been recognized as a "Best For the World" B Corp in the Environmental Impact area. We have also received multiple awards from the U.S. Dairy Innovation Center, National Milk Producers Federation, IDFA, The State of Kansas, and others. Also, since 2016, we have worked annually with Sustainable Environmental Consultants to evaluate and verify our ecosystem impact which is reported publicly on our website.

This approach to transparency and third-party validation helps us market our milk and creates a foundation for sustainable business growth. As an example, we sell most of our milk to Danone North America—another certified B Corp and a leading global food and beverage company—who processes our milk into products such as Dannon, Oikos, Activia and Light & Fit yogurts.

What is Regenerative Agriculture?

Regenerative Agriculture may be a buzz word for some, but for McCarty Family Farms it is a holistic mindset that encourages us to consider a multitude of practices across our farms; especially those associated with core values like soil health,

resource conservation, animal welfare, and the welfare of our team members, families, and communities. Practices such as cover crops, reduced tillage, improved nutrient management, and excellent animal care practices under one coherent vision, can optimize the performance and sustainability of our farms.

What are the benefits of Regenerative Agriculture?

In general, regenerative agriculture should provide measurable economic, social, and environmental benefits that help improve, rather than just sustain our ecosystems and we have been able to demonstrate just that. For example, water conservation technologies have helped us save millions of gallons of fresh water every year while reducing our input costs. Enhancements to animal welfare have helped ensure more milk production with fewer resources consumed.

For McCarty Family Farm and our partners, regenerative agriculture must move beyond a qualitative concept towards making decisions based on quantitative outcomes. By benchmarking and tracking our environmental and economic performance we can better understand the impacts and make better business decisions

In general, these regenerative efforts have helped demonstrate that dairy farming, and all of agriculture can be a part of the solution for our climate and our economy, while of course helping to feed the world.

Policy Recommendations

At times, USDA programs are helpful to incentivize new ideas and reduce up-front costs when a clear, short-term ROI isn't possible and while we know regenerative practices produce economic benefits in the long term such as increased efficiency, resilient yields, and improved market opportunities, up-front costs can still be a barrier to implementation. Traditional ag. lending looks year-to-year, while regenerative farming takes a longer-term view which is why conservation funding and incentives are crucial greater adoption.

When considering USDA conservation programs, budgets, are just one barrier to greater adoption. Challenges such as EQIP backlogs, rigid contract structures, cumbersome applications and burdensome follow up reporting create additional strain.

We work with our partners, including Danone, to explore different financing and incentive models. USDA programs such as the Conservation Innovation Grant for On-Farm Trials allowed us to work with non-Federal partners such as Danone, Sustainable Environmental Consultants and National Fish & Wildlife Foundation to finance scalable regenerative management. By considering the applications and contract costs to farmers and allowing farmers to work with familiar partners rather than just USDA, I believe programs can support more farms investing in regenerative agriculture. We need a simpler more streamlined processes to engage with USDA and other stakeholders to implement a wider variety of regenerative innovations.

Thank you for the time today and I look forward to answering your questions.

The CHAIRMAN. Thank you, Mr. McCarty, for your excellent testimony.

And now, Mr. Clark, please begin when you are ready.

STATEMENT OF RICK CLARK, OWNER, FARM GREEN & CLARK LAND AND CATTLE, WILLIAMSPORT, IN; ON BEHALF OF REGENERATE AMERICA

Mr. CLARK. Chairman Scott, Ranking Member Thompson, Members of the Committee, thank you for having me here today. I am absolutely honored.

My name is Rick Clark. I am a fifth-generation farmer from west central Indiana, and we farm about 7,000 acres of row crops.

Folks, this is urgent and it is critical that we have bipartisan action on the topic at hand today. I am a Republican, and I have spoken to thousands of farmers across this country, and not once has my party affiliation come up. The witnesses here today do not represent the diversity of regenerative farmers and ranchers. We are especially missing voices of indigenous leaders and farmers of color. And it is critical in this farming journey that you have the support of your family, and I am going to tell you, they have my back.

American farmers are the most productive in the world, but we have to acknowledge the condition our soils are in. We are in trouble. Five-point-six tons per acre per year of soil are leaving our fields. I am not here today to offend the practices of any farmer, and we have to understand the heritage and history they have. We also need to understand our soil is fragile and degrading right in front of our eyes, which leads me to why I am here today. Adopting soil health practices can slow down and reverse the degradation of soil. I want to leave you today with the confidence that regenerative agriculture can be incorporated into any farming operation and be far better for your bottom line.

After decades of heavy tillage on our farm, a 1″ rain event created so much erosion on our farm, I knew it was time to do something different. Like thousands of farmers, I started cover cropping through EQIP. This is an essential program to increase farmers' comfort level of change. In my written testimony, there is a photo of my soil and my neighbor's soil just 20′ apart from each other. The difference is astounding. My soils have water infiltration rates of 20″ per hour, and the neighbors have an infiltration rate of ½″ of rain per hour. Our soils have 1.5 million earthworms per acre; the neighbor's farms have nearly zero earthworms.

So how do we get there? We need to follow the six principles of soil health. One, context. This is key. While practices change from Texas to Indiana, principles are universal. Two, minimize disturbance; three, maximize diversity; four, living roots; five, armor the soil; six, animal integration.

Here is a little bit more about our operation. We have not used starter fertilizer, seed treatments, fungicides, insecticides, pesticides, phosphorus, or potassium in 8 years. And to boot we are organic with no tillage. I am far down this path, but any farm can start and experience incredible results with ecologically and economically, especially with proper education and support. And note, it doesn't have to be organic.

Cover crops are doing more than protecting and building soil. On our operation, cover crops have become an offensive juggernaut with cereal rye giving us upwards of $435 per acre worth of NPK and legume cover crops giving us upwards of $969 worth of value when terminated with a roller-crimper at maturity. Most farmers can't achieve this without tools, education, and changes to crop insurance rules that require termination well before maturity.

On our farm, we have currently reduced diesel fuel consumption by 50 percent, chemistry and fertility by 100 percent, and, based on regional input spending averages, we are saving $1,957,000 annually.

Last, our farm is more resilient against flood and drought, we are more resilient to supply disruptions, and we have a systematic approach that will be economically profitable and viable for generations to come. We need to help American farmers integrate cover crops into their operation within their context. We need to also help American ranchers adopt regenerative grazing practices.

On behalf of Regenerate America Coalition, we are pushing to ensure the next farm bill robustly supports regenerative ag. We need better education and technical assistance, equitable opportunities and access, infrastructure and processing, healthy and re-

gionally sourced food, farmland preservation, incentives for soil health and risk mitigation.

Thank you so much for allowing me to speak today. I look forward to future hearings and conversations with each of you.

[The prepared statement of Mr. Clark follows:]

PREPARED STATEMENT OF RICK CLARK, OWNER, FARM GREEN & CLARK LAND AND CATTLE, WILLIAMSPORT, IN; ON BEHALF OF REGENERATE AMERICA

Dear Honorable Chairman Scott, Ranking Member Thompson, and Members of the Committee—thank you for providing me the opportunity to testify before you today.

My name is Rick Clark. I am the owner and operator of Clark Land and Cattle, a 7,000 acre regenerative-organic farm near Williamsport, Indiana, where we have transitioned from conventional tillage to 100% organic no-till and use 100% cover crops and non-chemical termination (roller-crimpers) to build soil health and soil organic matter as we suppress weeds and sequester carbon. I am a fifth generation family farmer. Our family has farmed this land since the 1880s, producing food and agricultural products during each generation in what we have believed to be the best and most innovative ways that the latest science and our personal experience taught us was vital to keeping the land healthy and viable to be handed down to the next generation.

I am honored to be here on behalf of Regenerate America,[1] where I serve as a member of the Farmer Leadership Council. Regenerate America is a national, bipartisan coalition of farmers, businesses, nonprofits and individuals. Alongside thousands of farmers and ranchers across the country, I am asking Congress to make soil health and regenerative agriculture a primary focus in the 2023 Farm Bill.

I want to thank Chairman Scott for having the vision and courage to call this hearing today about what I believe is one of the most important issues of our time: *How will we, as farmers and a nation, continue to feed ourselves and our families and neighbors in ways that are the least harmful to the land and have the most beneficial impacts for recovering our soils and human health?*

I also want to thank Ranking Member G.T. Thompson, who, as a fellow farmer not only knows the challenges that farmers face personally, but also as someone who is in a critical leadership position, has the chance to help farmers transition to better soil health and climate-smart practices at a time of economic instability and increasing threats posed by inclement weather.

As a registered Republican, I want to say that healthy soil and improving our nation's soil resource need not be a political issue. Soil health is truly our common ground, and is one of the most bipartisan issues I have found as I have transitioned our family's farm over the past 13 years and worked with thousands of farmers across the country to help them save money and climate-proof their own fields through regenerative soil health practices. We cannot afford to make soil health a political issue today. This is about helping farmers and our nation.

While it is an incredible honor to be here representing on behalf of the regenerative agriculture movement, among such distinguished experts, I feel it is important to acknowledge that not any one of us portray the breadth and origins of regenerative agriculture. The principles and practices that help us rebuild soil health and ecosystem function combine indigenous knowledge, adaptive holistic management frameworks, and recent discoveries in science and technology; it needs all, and is all.

Many critical voices and perspectives are missing from this hearing today. And, might I remind us, that many of these practices and principles were utilized by earlier generations of American farmers, and many of our parents and grandparents. Farmers and ranchers are, by nature, land stewards, however, because of policies and other long-lasting intentions, such as "get big or get out" of the 1970s, our practices have been steered away from what is ultimately best for farmers and the betterment of the soil.

The State of Our Soils

In addition to being a farmer, I have had the incredible honor of crisscrossing the entirety of this country to train farmers in regenerative and biological approaches. Because of this, I have visited and seen hundreds of farms in 25 states. While American farmers and ranchers are at the heart of this country and are some of the most

[1] Regenerate America. 2022. *https://regenerateamerica.com/*.

innovative, successful, and productive farmers in the world, I want to be crystal clear for a moment to recognize the perilous state of our soils—the real wealth of our nation, the foundation of American resilience and prosperity. The situation is urgent and must be considered as such.

Changing land use, particularly the shift to our modern systems of agriculture in the United States and across the world, has been one of the biggest **drivers** of many issues we face today. Through mismanagement, our land and our soil are now heavily degraded and in many cases barely function, or worse, are completely desertified.

Right now the majority of American agricultural soils (over 50%) are severely degraded.[2, 3] We are losing topsoil at a rate of 5.6 tons per acre (ten times faster than it is being replenished).[4] Conventional practices have led to the Corn Belt completely losing ⅓ of its topsoil.[5] This is causing serious flooding, drought and soil loss and erosion, and depletion of water resources across rural America, leading to a concerning loss of biodiversity, significant declines of on farm stability, and is costing our farmers $44 billion annually.[6] One study found lost topsoil in my state of Indiana is causing annual losses of $362 million, and 6–9% in annual crop yield reductions per county.[7]

This is greatly concerning to me, and is a huge problem for food security and national security. I want to make clear that it's not just a question of carbon or greenhouse gasses. To a large extent, in breaking our soils, we've broken the hydrological cycle, carbon storage capacity, and nutrient cycle. Much of our land's soil is degraded to such a state it is no longer properly functioning, and it will only be worsened by climate change.

Over the past several decades, farmers across the country have faced increasingly severe weather events, such as swings between drought conditions and sudden, intense rainfalls and windstorms that are not only battering crops and profitability for that season, but also washing away their long-term profitability with massive erosion events that are leaving vast scars on the land across millions of acres of farmland.

Just 2 years ago, on August 10, 2020, the Midwest experienced the most expensive thunderstorm in U.S. history, with winds gusting over 100 miles per hour over

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[2] *https://www.politico.com/agenda/story/2017/09/13/soil-health-agriculture-trend-usda-000513*.

[3] The numbers in the United States are mirrored around the world, with scientists estimating that some 52% of global agricultural land is degraded.

[4] *https://www.farmprogress.com/soil-health/economics-soil-loss*.

[5] Thaler, Evan A., Larsen, Isaac J., and Yu, Qian. 2021. *The extent of soil loss across the US Corn Belt.* PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, 118(8), *https://www.pnas.org/content/118/8/e1922375118*.

[6] The $44 billion per year includes lost productivity, along with sedimentation and eutrophication of water reservoirs according *https://www.farmprogress.com/soil-health/high-cost-soil-erosion*. Sartori, *et al.* (2019) estimated the global costs of soil erosion due to water at $8 billion annually, reducing global food production by 33.7 million tonnes and raising prices by up to 3.5%.

[7] Thaler, Evan A., *et al.* "The extent of soil loss across the US Corn Belt."

a 14 hour period while a derecho traveled over 770 miles across Nebraska, Iowa, Minnesota, Indiana and Ohio.[8] These winds moved with hurricane force, devastating over $11.5 billion in corn and soybean crops across the Midwest and damaging an estimated 14 million acres of crops in Iowa, and millions more acres across the Corn Belt.[9]

These storms are both a **cause and a consequence** of soil erosion. This spring, the derecho that ripped through the Midwest caused an estimated 3–12 tons of lost soil per acre (1 ton is approximately equal to a pickup truck bed full of soil) on South Dakota farms on the day the storm hit.[10] The maximum amount farmers in the region can lose before it impacts their production levels is *~5 tons per acre per year.*[11]

As these extreme weather events occur more regularly, now is the time to invest in helping farmers climate-proof their fields, increase resilience, and build soil health, rather than continuing to pay out billions of dollars in disaster assistance. Agriculture is one of the few sectors that can not only reduce its emissions but with the right management practices, can be emissions negative. Failure to act will have a catastrophic impact on our ability to grow food to feed ourselves and other nations and will have a significant and increasingly negative impact on our economy over the coming decades.

The State of Farm Economics

Just as farmers and ranchers are needing to transition to better soil health and regenerative farming practices, current market and policy conditions impede the process or make it nearly impossible, significantly harming our nation's ability to meet present and future challenges of climate change.

Today, our farmers are facing unprecedented challenges. Record high farm input costs, short supply of fertilizers, price inflation, and supply chain disruptions from the pandemic and war in Ukraine are squeezing already razor-thin margins and jeopardizing farmer's livelihoods. Fertilizer prices have risen 300% since 2021.[12] According to Farm Progress: "Since 2020, all nitrogen fertilizers are now more than double in price: anhydrous is up by 131% and urea by 110%. Potash is up by 120%. In October of 2021 alone, the price of anhydrous fertilizer jumped 26% from the previous month to levels not seen since 2008."[13] This year alone, nitrogen fertilizer, which accounts for more than 50% of the commercial fertilizer used by farmers, is expected to see price increases of more than 80% from the previous year.[14] This is forcing farmers to decide between planting fewer acres or selling out to keep from going into foreclosure, and lower supplies of commodities means increased prices for consumers.

Subsidies have been the knee-jerk response. In 2020, U.S. farm subsidy payments rose to a record $46.5 billion, triple the normal amount, which was up from $22.4 billion from the year before in 2019.

A big question is: what are America's farmers and the U.S. taxpayer really getting from these subsidies? The government is willing to hand this money out but we get very little back in return. In our current system, subsidy payments often end up promoting farming practices that are **not** improving soil health or resilience. While I do believe these programs should remain voluntary and incentive-based, they would be improved by implementing a tiered system wherein farmers and ranchers who are utilizing best practices receive the biggest share of the subsidy benefits. We

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[8] Sorace, Stephen, "Iowa farmers devastated after derecho damages 14 million acres of farmland, grain bins", *Fox Business New,* August 24, 2020. *https://www.foxbusiness.com/markets/iowa-farmers-devastated-after-derecho-damages-14-million-acres-of-farmland-grain-bins*.

[9] Barreda, Virginia, "Today marks 2 years since devastating Aug. 10 derecho slammed Iowa", *Des Moines Register,* August 10, 2022. *https://www.desmoinesregister.com/story/weather/2022/08/10/iowa-weather-two-years-since-derecho-blew-across-state/10286537002/*.

[10] Gewin, Virginia. June 6, 2022. "A Wild, Windy Spring Is Creating a Soil Erosion Nightmare for Farmers". *Civil Eats. https://civileats.com/2022/06/06/a-wild-windy-spring-is-creating-a-soil-erosion-nightmare-for-farmers/*.

[11] Gewin, Virginia. June 6, 2022. "A Wild, Windy Spring Is Creating a Soil Erosion Nightmare for Farmers". *Civil Eats. https://civileats.com/2022/06/06/a-wild-windy-spring-is-creating-a-soil-erosion-nightmare-for-farmers/*.

[12] Campbell, Lindsay, "Farmers Struggle to Keep Up With the Rising Costs of Fertilizer: Fertilizer prices have skyrocketed as much as 300 percent since early 2021. Is there any relief in sight?", *Modern Farmer,* March 2, 2022. *https://modernfarmer.com/2022/03/fertilizer-prices/*.

[13] Fatka, Jacqui, "DOJ investigation sought for fertilizer price hikes", *Farm Progress,* December 9, 2021. *https://www.farmprogress.com/farm-policy/doj-investigation-sought-fertilizer-price-hikes*.

[14] Carlson, Claire, "Skyrocketing Fertilizer Prices Gouge Farmer Profits, Groups Blame Consolidation", *The Daily Yonder,* March 15, 2022. *https://dailyyonder.com/skyrocketing-fertilizer-prices-gouge-farmer-profits-groups-blame-consolidation/2022/03/15/*.

will not be able to subsidize our way out of this crisis, but by incentivizing soil health practices, farmers can regain independence and reduce reliance on inputs.

The situation is highlighting the extent to which our current food production system is trapping farmers in a cycle of dependency. Farm debt is rising by 4% each year,[15] yet even as more of the food dollar leaves the farmers' pocket, rural communities are left behind as those dollars leave the local economy. At one point during the pandemic, cattle prices had declined by 18%, while box beef prices increased by 80%. And just 14% of every food dollar goes to the farmer today.[16] According to an American Farm Bureau Federation survey, a strong majority of farmers/farmworkers think financial issues (91%), fear of losing the farm (87%), and farm or business problems (88%) impact the mental health of farmers.[17] I encounter this all the time—from loans, insurance, peer pressure, markets, to simply not jeopardizing the livelihood of the farm, there is so much stress on the farmer's plate, there is so much out of their control.

Subsidies and inputs are, at best, band-aids to the current farm crisis—at worst, they are exacerbating it. **Regenerative agriculture is a permanent solution that works for farmers of all sizes, from small diversified farms to large scale row-crop producers like me, all across the nation, and benefits not only farmers and their families but all Americans.**

The Soil Solution

Regenerative agriculture focuses on improving soil health using a variety of agricultural management practices that work in alignment with natural systems. Increasing soil organic matter content in our soils can reduce or stop soil erosion, and improve aggregate stability, water infiltration, water retention, nutrient cycling, plant health, crop yields, crop resilience, biodiversity, and more. More organic matter in the soil also means we are moving carbon from the atmosphere and depositing it into the soil, where it can be a net positive for the planet and society.

When we are looking at a farm or ranch, regenerative agriculture incorporates six key components. The first one is really important and unique to each person, the other five are the principles that are employed depending on your context:

1. **Understand Context:** Economic, personal, community, ecological, climate, bioregion, *etc.*
2. **Minimize Disturbance:** This refers to tillage, chemical fertilizers, pesticides, and more.
3. **Establish a "Living Root":** Have a plant photosynthesize and pump carbon-based exudates into the soil to feed the soil biology for as long as possible throughout the growing season.
4. **Provide Soil Armor:** cover cropping or ensuring to leave mulch or plant residue is critical. Bare soil exposed to the elements harms soil health, so it's recommended to always have some living or dead debris covering the soil.
5. **Integrate Animals:** Have one or more types of animals move across your fields if it can work in your context, otherwise known as planned grazing.
6. **Enhance Diversity:** Add diversity to whatever it is you are growing—this could be planting diverse hedgerows throughout the farm, installing owl boxes, integrating honeybees, or diverse multi-species cover crops.

Important practices for implementing these principles include: cover cropping, no-till/reduced-till, planned/adaptive multi-paddock (AMP) grazing, diverse crop rotations, and much more.

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[15] *https://farmdocdaily.illinois.edu/2018/08/agricultural-debt-continues-to-increase-2.html*.

[16] **Editor's note:** this footnote was blank in the submitted statement.

[17] American Farm Bureau Federation. 2019. "Rural Stress Polling Presentation". *https://www.fb.org/files/AFBF_Rural_Stress_Polling_Presentation_04.16.19.pdf*.

My Regenerative Journey

I was fortunate enough to see some of the problems of soil loss coming almost 2 decades ago, when I began my transition to no-till and cover crops. Many years ago when we were still practicing conventional tillage, there was a 1″ rain event that created so much erosion on my farm, I was determined to do something about it. This was the turning point for me.

> ***A 1″ rain event should not cause any issues on your land****—your soil should easily be able to absorb and retain that water (for every additional 1% of soil organic matter, any acre can capture* ***an extra 27 thousand gallons more water).***[18] ***We do not have a "flood problem" when it rains 1″ to 3″*** *in an hour and most of the water runs off—we have a water infiltration problem.*

As I've incorporated more regenerative soil health practices over the years, I have been able to reduce my input costs on fertilizer (chemistry and fertility) to zero dollars and decrease our fuel usage by 60%. Currently, I'm saving $286 per acre per year on avoided inputs—*that's $2 million in savings per year on 7,000 acres.* And I'm maintaining stability through hard times.

Here is a great example of where savings come from on my operation:

The Power of Legume Cocktails

	N	$ N	18-46-0	$ P	0-0-60	$ K	Total $$
May 20	75	$83.25	65	$74.10	177	$134.52	$291.87
June 4	114	$126.54	122	$139.08	267	$202.92	$468.54
June 8	**262**	**$290.82**	**189**	**$215.46**	**610**	**$463.60**	**$969.88**
July 24	52	$57.72	33	$37.62	32	$24.32	$119.66
Cocktail cost = $33/a		**N = $1.11/lb**		**P = $1.14/lb**		**K = $0.76/lb**	

August 1, 2022.

Farmers usually look to cover crops and no-till as defenses to combat a problem like erosion. But, once you become comfortable with cover crops and no-till, they become offensive juggernauts, providing far more benefits than just erosion control. We are currently utilizing **complex mixes of cover crops, no-till, and non-chemical termination with roller-crimpers across our row crop operation growing corn and soybeans.** I was able to eliminate the practice of "burning down" or killing cover crops with herbicides in 3 years. I now use a roller-crimper to flatten cover crops, which provide a mulch for soybeans to suppress weeds. I always encourage farmers to not till or plow their fields. Every time you till, you not only make your soil more vulnerable, you are also regerminating weeds.

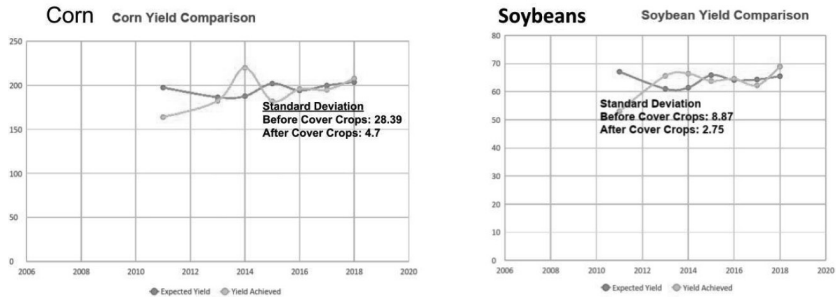
[18] **Editor's note:** this footnote was blank in the submitted statement.

Photo: My farm is doing **non-chemical termination** of a **diverse cover crop** with **roller-crimper** while simultaneously direct seeding cash crop with **no-till drill.**

We're not just saving costs, we're bringing in a healthy profit that gives us the room to experiment and incorporate new practices that we can then share with others. The farm's best return on investment (ROI) was when we reduced inputs by 60%. The yields were increasing year over year. This is when corn was valued at $3.75 and soybeans were at $7.85.

Another key point is that although yield is a critical benchmark, what is not talked about sufficiently and is honestly even more important, is **yield stability.** Conventional systems are not only vulnerable to increasingly severe cycles of flood and drought (because poor soil health limits the amount of water retention and absorption), they are also at the mercy of global energy pricing, as chemical inputs are tied to those markets. The hyper focus on yields has ultimately made our soils more vulnerable and therefore less consistent because of drought, flood, *etc.* Maximizing returns in a single year is simply not as critical as being able to produce year after year in a sustainable fashion, resilient to both weather and markets.

Stability



Yield stability on my operation through soil health practices.

5,600 of our 7,000 acres are also certified organic and the rest are in transition. As I mentioned previously, I first turned to regenerative practices to combat erosion and soil loss. My regenerative journey put me within reach of the market opportunity and demand for domestically produced organic products. However, as I always tell farmers, whatever you're doing, whether or not you are doing organic, soil function is what really matters.

No-till organic isn't always easy, but I am particular about doing things a different way in order to prove this model. And, because myself and so many other farmer leaders around the country have challenged ourselves, these practices are now much more accessible and within reach than when I began my journey.

It is very important to understand that this is a systematic approach to building soil health, human health, and ensuring water quality. When you start down the

regenerative journey, you see soil change before your eyes. Increased water infiltration rates, increased water holding capacity, increased aggregate stability, increased earthworm counts, increased beneficial organisms, increased nutrient density, and increased microbial activity: these accomplishments are only done if you follow the principles of soil health. Period.

Photos: Two shovels full of soil, taken Sunday Sept 11th, 2022 during a rain event. **Left: my neighbor's corn field. Right: my soybean field** planted into cover crops that were terminated while green with roller-crimper. Fields are only 15 yards apart.

Above are two photographs of a shovel full of soil. The neighbor's field is on the left. It has no aggregate stability, no visible earthworms, slow infiltration rate around ½″ per hour, very little water holding capacity, and no root exudates that would feed the microbes and create soil aggregation. On the other hand, the shovel full of soil on the right is from one of our fields. It has aggregate stability that measures down 8″, this soil's infiltration rate is now 20″ an hour and the earth worm count is currently 1.5 million earthworms per acre (compared to when we began this trajectory it was near zero).

The difference of healthy soil is the difference of input cost reductions, it is the difference of flooding or drought, it is the difference of wind and water erosion rates and keeping fertility on my land, it is the difference between knowing my family is safe from so many harmful chemicals, and, it **is** possible for all farmers and ranchers to implement this principles in all agriculture in every region of this country and experience substantial results.

As my fellow regenerative agriculture pioneer, Gabe Brown, says, "Whether your primary concern is a farmer's bottom line, rural economic recovery, climate mitigation, reversing biodiversity collapse, cleaning our water and air, rehydrating our land so aquifers charge and springs flow again, providing land access for minorities and beginning farmers, or addressing the health crisis, regenerative agriculture provides the solution."

5. Scaling Up Regenerative Ag

Over the past several years, I have witnessed incredible advances in the adoption of regenerative agriculture practices. The demand for regenerative agriculture is here and on the rise—now is time for all of us to help farmers lead this incredible opportunity for our country.

While the expansion and adoption of practices like no-till and cover cropping is important (in 2017, 104 million acres were under no-till production, 15.4 million acres were under cover crops), by combining these practices we can achieve far greater financial and ecological benefits, which is a tremendous opportunity that we must more broadly support.

I want to share a few **case studies** from my fellow farmers that demonstrate this is not an anomaly for my farm in Indiana. Yes, this can work with farmers in your district. Soil health practices work in every corner of our country.

David Brandt, Carroll, Ohio: [19, 20]

- One of the first and likely the longest term no-till farmers in Ohio. 100% no-till since 1971.
- He currently has 736 acres of no-till row crops and cover crops on his corn, wheat, and soybean operation, and uses a diverse cover crop species mix with 8- to 14-way blends.
- In 1971 the soil organic matter on David's newly purchased farm was 0.75%. By 2019, the soil organic matter ranged from 6.8% to 8.0%.
- David's ability to infiltrate water has increased from less than 25,000 gallons per acre to more than 175,000 gallons of water per acre.
- From 150–250 pounds of nitrogen fertilizer per acre for corn in 1971, he now uses 20–30 pounds. He uses no fertilization for his soybeans. No fungicides or insecticides. No seed treatment.
- His cash crop yields have been increasing by an average of 5% annually for the past 5–6 years.
- His input costs have decreased 72–78% from 2009 to 2019.
- David also has a cover crop seed company and a seed-cleaning business that operate on the farm.
- The operation now involves three generations of the family that are actively involved.
- "It will take 6–7 years to change or improve a soil with just no-till, but that time can be shortened to 4–5 years or as few as 3 years if you also use the right blend of cover crops."

Loran Steinlage, West Union, Iowa: [21]

- Second-generation farmer, owns and operates FLOLOfarms, farming 750 acres in Iowa's northeast corner, and custom farms another 750 acres in West Union with his wife, Brenda. Currently producing corn, soybeans, cereal rye, winter wheat, malt barley and buckwheat.
- Uses relay cropping, the practice of planting the second crop into the first crop before harvest. This allows him to grow a crop 365 days a year, even under snow.
- Loran also uses no-till, interseeding, cover crops, and controlled traffic farming.
- Works in equipment design for technology that helps farmers build soil health.
- Restored native trout to his stream by purifying water and improving water quality.
- While other farmers in the area are focused on growing row crops at scale, Loran is focused on increased crop diversity, reducing the costs of production, and ultimately getting off the "commodities treadmill".

Keith Berns, Bladen, Nebraska[:] [22, 23]

- Fourth-generation farmer; operates 2,500 acres of irrigated and dryland corn, soybeans, rye, triticale, peas, sunflowers, and buckwheat under no-till in south central Nebraska.
- Co-owns and operates Green Cover Seed, one of the major cover crop seed providers and educators in the United States, which sells 120 different cover crop varieties. In 2021, Green Cover sold enough cover crop seeds to cover a million acres. The seeds are non-GMO and not treated, and there are plans to sell certified organic seed mixes.
- Honored by the White House as a 2016 Champion of Change for Sustainable and Climate-Smart Agriculture.
- Developed the SmartMix Calculator^{ATM} [24] one of the most widely used cover crop selection tools.

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[19] *https://understandingag.com/case_studies/brandt-farms-case-study/*.
[20] *https://www.nrcs.usda.gov/wps/portal/nrcs/oh/soils/STELPRDB1166409/*.
[21] *https://www.agtechsowhat.com/agtechsowhatepisodes/2021/9/8/getting-off-the-commodities-treadmill*.
[22] *https://greencover.com/keith-berns/*.
[23] *https://non-gmoreport.com/articles/green-cover-seed-leads-the-charge-on-cover-crop-growth/*.
[24] *https://smartmix.greencoverseed.com/*.

- Appointed by Nebraska Governor to serve as Chairman of Nebraska Healthy Soils Task Force.
- Teaches on cover crops and soil health more than 30 times per year to various groups and audiences.

Dan DeSutter, Attica, Indiana[:][25, 26, 27, 28]

- Owns and operates Hoosier Grassfed Beef, a 5,000 acre grassfed beef and organic row-crop operation where he practices organic no-till and uses cover crops to build soil health.
- The livestock and row-crop model allows the cows to graze cover crops in the off season, increasing the number of days the cows are on fresh pasture.
- The no-till organic system relies on a multi-pronged approach to weed management that includes cover crops, roller-crimpers, mowing and electrical termination.
- Actual production history (APH) in corn is 30 to 35% over the county average.

One thing each of these regenerative farmers has in common is that they focus on educating other farmers in these practices. At the same time, larger scale studies are confirming what we already knew: farmers across the country are achieving profitability, resilience, and economic benefits with soil health systems. The National Association of Conservation Districts and Datu Research found that soil health practices can result in an economic return of over $100 per acre,[29] while American Farmland Trust found soil health practices to improve bottom lines between $4–$824 per acre per year.[30]

The Soil Health Institute recently interviewed 100 farmers in nine Midwestern states who have adopted soil health systems on corn and soy operations to determine the impact of soil health practices on profitability.[31] Through adopting soil health systems:

- Net income increased for 85% of farmers growing corn and 88% of farmers growing soybean
- Average costs decreased by $24/acre for corn and $17/acre for soybean
- Average net farm income increased by $52/acre for corn and $45/acre for soybean
- 67% reported a higher yield than their conventional system
- 100% reported improved water quality
- 97% reported increased crop resilience to extreme weather
- 93% reported increased access to their fields
- 83% reduced fertilizer inputs

Congress Must Support the Advancement of Regenerative Agriculture

There is much more awareness and support for adopting soil health today than when I started, such that a farmer can pair cost share programs, private sector incentives, and advice from local farmers to implement systems correctly, so that their farm doesn't have to suffer a huge loss in profitability during the transition. However, there are still widespread barriers that have led to low adoption rates nationwide.[32] Congress has an incredible opportunity to remove barriers for farmers and ranchers and **invest in regenerative transition across the board** to address a wide range of policy issues from restoring food security and public health, to reviving rural America, to building climate resilience. Here are some of the top priority areas:

Ensure all farmers and ranchers are getting access to education and technical assistance: Seeing results on my operation took time, but with the right

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[25] *https://hoosiergrassfedbeef.com/about-our-farm*.

[26] *https://www.nytimes.com/2016/02/07/business/cover-crops-a-farming-revolution-with-deep-roots-in-the-past.html*.

[27] *https://www.ccsin.org/post/dan-desutter-fountain-county*.

[28] *https://www.morningagclips.com/farmer-teacher-student/*.

[29] National Association of Conservation Districts, "Case studies show big economic benefits of soil health practices," August 29, 2017, *https://www.nacdnet.org/newsroom/case-studies-show-big-economic-benefits-soil-health-practices/*.

[30] American Farmland Trust, "Quantifying Economic and Environmental Benefits of Soil Health," *https://farmland.org/project/quantifying-economic-and-environmental-benefits-of-soil-health/*.

[31] Soil Health Institute and Cargill. 2022. "Economics of Soil Health Systems in Midwest Corn and Soy". *https://soilhealthinstitute.org/economics*.

[32] **Editor's note:** this footnote was blank in the submitted statement.

education, we can enable more farmers and ranchers to shift to and realize the immense benefits of regenerative soil health practices. We want producers to have success with these practices the first time so they will stick with them. We know **education, especially farmer-centered and farmer-led, is absolutely essential for successful adoption.** With the right knowledge and support, we can see positive economic and ecological results within the first year, and significant changes within 3 years.

Our current conventional agriculture education and technical assistance systems are not adequately addressing the fact that the average farm in America is still losing over 5.8 tons of topsoil per acre per year. The agriculture education that is available today favors short-term results and chemistry-oriented solutions while overlooking biological and physical soil function. America's farmers, and the institutions that support them, need urgent access to updated education that promotes resilient, healthy soil and the transition to regenerative agriculture, based on the latest cutting-edge science and context-based principles for climate adaptation. This must include deep context-based education not only for cropping systems, but also for regenerative pasture and rangeland management, with an emphasis on opportunities for the integration of crops and animals.

While I in no way think that livestock are a fit for every farmer, we need to understand the critical role of livestock in building soil health (one of the most efficient and quickest ways possible). While everyone's situation is different, as Will Harris says, "I would argue that truly degraded land cannot cost-effectively be regenerated without animal impact. Every ecosystem I am familiar with had animal impact in its evolution."[33] The benefits of grazing can double carbon sequestration—for example, Gabe Brown realized significant carbon gains on his farm from no-till but the real change came from integrating livestock. We must make sure transition tools for implementing planned/AMP grazing like cost share for mobile fencing are much more widely available.

It is very important that we do not offend any farmers with their current practices. We are not here to put anyone down or say they are doing it wrong. This is why teaching is so critical. When I speak to a group of farmers, I hope to instill a thinking process to change one or two dynamics of their farm. This is success. Ultimately, it needs to work for your economics and your situation.

Access to USDA soil health programs—a hand up not a hand out: To get farmers started but ultimately save the government money. I have so much gratitude and appreciation for programs like EQIP because it is literally what allowed me to begin this journey. The cost-share paid for the cover crop seed and let me see the benefits without the risk. This was huge. Farmers are generally not eager for change but programs like this, especially if they were extended out to 5 years, would allow for much more confidence and staying power through the transition. Long-term and individualized support is vital so farmers don't walk away from the practices after their contracts end. I have seen this happen too many times.

To rebuild soil, we need to help farmers and ranchers cover more of the land with living plants for more of the year. And we need to ensure support for cover crops and equipment like roller-crimpers are more regionally available.

BIPOC, Tribal, women, beginning, limited resource, and veteran farmers and ranchers, as well as small farms are often likely to use soil health principles in their operations, but face barriers in accessing USDA programs and support. As a result, historically underserved producers and small operations struggle to access and retain farmland, and have to fight to start out and keep up in the farming business. We need to make sure all farmers can get the support they need to start building soil health.

Rebuild local and regional infrastructure for processing to make the regenerative transition economically feasible: The current lack of access to local processing and markets for producers is preventing a huge opportunity to increase net farm or ranch profitability and keep more food dollars inside local economies. Investing in local and regional access to infrastructure, processing and markets will help regenerative producers make new products available and meet the increasing consumer demand for their products, while reducing foreign supply chain dependence and increasing domestic food supply. Increasing access will allow more farmers to integrate regeneratively managed livestock or specialty crops into their cropping systems (building soil health and reducing reliance on chemical inputs), while improving public health and providing local food security during times of crisis. And if the farm has access to processing and distribution, the farmers can operate on any scale that's comfortable for them.

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[33] *https://www.youtube.com/watch?v=lroe4pXNtKw*.

Removing barriers and incentivizing soil health in financing and insurance: The finance and insurance products that farmers rely on have immense potential to support a transition to regenerative agriculture, but current policies have created a system that often undermines, or even actively prevents, common sense soil health practices that reduce risk on farms—resulting in large scale soil loss and land degradation at an enormous cost to U.S. taxpayers.[34]

Over the past decade, crop insurance has become the most important component of the farm safety net. The Federal Crop Insurance Program (FCIP), administered by the USDA Risk Management Agency (RMA), receives a greater portion of funding than all conservation programs combined, and has more than 90 percent of U.S. cropland enrolled.[35]

Crop insurance payouts have nearly doubled in the last decade in the face of ever increasing extreme weather.[36] Without mitigating actions, one study found that rising temperatures could increase annual subsidies by $2.2 billion (or 34%), while USDA research found that unmitigated climate impacts could increase subsidies for key crops by $4.2 billion annually.[37] This is putting the entire program in danger over the long term.

The most effective way that we have of reducing on-farm risk is applying conservation practices that build soil health. As my own experience and that of my fellow farmers has shown (and the lesson applies whether or not you take out crop insurance), these practices decrease production risk in the face of increasing flood and drought, and improve long-term resilience and stability for farmers.

If we are to have an effective farm safety net, then we have to help farmers reduce risk (*i.e.,* increase conservation practice adoption) so we can keep premiums affordable, save rising taxpayer costs, and keep the farm safety net resilient and strong for producers in the years to come. **This means bolstering crop insurance** by removing outdated barriers and creating incentives that recognize the risk-reduction benefits of soil health and conservation practices and reward farmers implementing those practices—it's like a "good driver" discount on your car insurance. By improving your soil health, you're making your operation less risky and providing significant benefits to society.

When the day comes that carbon markets fully arrive, farmers will absolutely need the principles of soil health to leverage that opportunity. Healthy soil is what's going to get the outcomes needed to make participation in carbon markets successful.

If Congress provides the resources and correct program funding for the transition to climate adaptive and soil regenerating practices, farmers, ranchers and rural America will thrive.

Mr. Chairman, supporting America's farmers and ranchers in adopting soil health, regenerative agriculture and climate-smart practices is both an imperative and the opportunity of our time—not only to avert imminent food supply and insecurity issues, but also to reverse soil degradation, safeguard food security, farm profitability and productivity, revive rural communities, and mitigate the impacts of a changing climate.

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[34] *https://www.nrdc.org/sites/default/files/federal-crop-insurance-program-reforms-ip.pdf.*
[35] *https://sgp.fas.org/crs/misc/R46686.pdf.*
[36] *https://www.nrdc.org/sites/default/files/federal-crop-insurance-program-reforms-ip.pdf.*
[37] *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2902688.*

- Chairman scott, ranking member Thompson, members of the committee, thank you for having me here today. I am honored.
- Name - 7,000 row crops
- Folks this is urgent and its critical that we have bipartisan action on the topic at hand today.
- I am a republican and I have spoken to thousands of farmers across this country and not once has my party affiliation come up.
- The witnesses here today do not represent the diversity of regenerative farmers & ranchers. We are especially missing voices of, indigenous leaders, and farmers of color.
- And, it is critical in this farming journey that you have the support of your family. They have my back.

American farmers are the most productive in the world but we have to acknowledge the condition our soils are in. We are in trouble.

  - 5.6 tons per acre per year of soil are leaving the fields
- I am not here to offend the practices of any farmer and we have to understand the heritage and history they have. We also need to understand our soil is fragile and degrading right in front of our eyes.
- which leads me to why I'm here today…

- Adopting soil health practices can slow down and reverse the degradation of soil.
- I want to leave you today with the confidence that regenerative agriculture can be incorporated into any farming operation and be far better for your bottom line

- After decades of heavy tillage, a 1 inch rain event created so much erosion on our farm, I knew it was time to to do something different.
- Like thousands of farmers, I started cover cropping through EQIP - this is an essential program to increase farmers comfort level of change.
- In my written testimony, there is a photo of my soil, & my neighbor soil just 20 feet apart. The difference is astounding.
- My soils:
  - Water infiltration rate of 20 inches per hour on my farm; neighbors ⅛ per hour
  - 1.5 m; earthworms per acre; neighbors, nearly zero.

So HOW do we get there? FOLLOW The 6 principles of soil health

1. Context - This is key - while practices change from texas to indiana, principles are universal.
2. Minimize disturbance
3. Maximize diversity
4. Living roots
5. Armor the soil
6. Animal Integration

- A little more about our operation:
-
- We have not used starter fertilizer, seed treatment, fungicide, insecticide, pesticides, P or K, in 8 years!
- And to boot, we're organic with no tillage
- I am far down this path, but any farm can start and experience incredible results both ecologically and economically, especially with proper education & support. And note, it doesn't have to be organic.

as Nutrients

	0-0-60	$ K	Total $$
	133	$101.06	$228.56
	213	$161.88	$345.24
6	**281**	**$213.56**	**$435.26**
6	65	$49.40	$215.60

P = $1.14/lb **K = $0.76/lb**

- Cover crops are doing more than protecting and building soil!
  On our operation, cover crops have become an offensive juggernaut, with cereal rye giving us $435 worth of NPK and Legume cover crop up to $969 per acre when terminated with roller crimper at maturity.
- Most farmers can't achieve this without tools, education, and changes to crop insurance rules that require termination well before maturity.

On our farm, we have currently reduced diesel fuel consumption by 50%,
chemistry and fertility by 100%,
And based on regional input spending averages, we are saving
$ 1,957,000

Lastly, our farm is more resilient against flood and drought,

we are more resilient to supply disruptions.

and we have a systematic approach that will be economically profitable and viable for generations to come.

We need to help american farmers integrate cover crops into their operation within their context.
We need to also help american ranchers adopt regenerative grazing practices.

On behalf of the Regenerate America coalition, we are pushing to ensure the next farm bill robustly supports regenerative ag. We need:

1. **Better Education & Technical Assistance**
2. **Equitable Opportunity And Access**
3. **Infrastructure & Processing**
4. **Healthy And Regionally Sourced Food**
5. **Farmland Preservation & Access For Under-served Producers**
6. **Incentives for Soil Health & Risk Mitigation Through Crop Insurance And Lending**

Thank you so much for allowing me to speak today! I look forward to future hearings and conversations with each of you.

The CHAIRMAN. Thank you. Excellent testimonies we are getting here today, right on target. Thank you.

And now, Dr. Larson, you are now recognized for your 5 minutes.

STATEMENT OF REBECCA L. LARSON, PH.D., CHIEF SCIENTIST AND VICE PRESIDENT, GOVERNMENT AFFAIRS, WESTERN SUGAR COOPERATIVE, DENVER, CO

Dr. LARSON. Chairman Scott, Ranking Member Thompson, and Members of the Committee, thank you for inviting me here today. I have a Ph.D. in plant science and 22 years of diverse experience with sugarbeets. I work for 800 small family farmer owners of Western Sugar Cooperative. We have a 100 year history that spans 110,000 acres across Colorado, Nebraska, Wyoming, and Montana. I help measure the environmental impact of our farmers' practices and guide their investment in public research. Included with my

written testimony is the data substantiating the gains our farmers have made in soil health and regenerative agriculture.

Soil health is critical for farmers. It reduces crop inputs, increases crop productivity, and instills resiliency in the agroecosystem. The USDA recognizes four soil health principles: minimize soil disturbance, keep soil covered, maintain living roots, and employ diverse crop rotation. Tillage, mechanical work into the soil, works against three of those principles and is arguably the biggest threat to soil health.

I am here to provide concrete examples from our cooperative and national trends that demonstrate conventional farming has made significant gains in soil health. Since the 1950s, modern agriculture has enabled exponential adoption of conservation tillage across the U.S. Today, a majority of conventionally produced U.S. commodity crops use conservation tillage. One out of every five is no-till. Clearly, farmers value soil health, as ⅓ of conservation tillage was adopted with zero outside incentive.

I see similar trends for sugarbeets. Eighty-two percent of Western Sugar growers use conservation tillage, which has tangibly improved soil health and imparted other dramatic environmental benefits. At the same time, our yield has climbed from 8,000 to more than 11,000 pounds of sugar per acre. This is true sustainable intensification.

Conventional agriculture paved the way with conservation tillage. More recently, no-till organic cropping has emerged. However, most organic systems still rely on tillage, especially row crops, small grains, and vegetable crops. For both conventional and organic farms, adoption of conservation tillage is highly dependent on soil type, climate, scale, and cropping system. Ultimately, for Western Sugar farmers, the adoption of genetically engineered sugarbeets with glyphosate tolerance has allowed for widespread elimination of plowing and conversion to conservation tillage.

Some claim pesticides are harmful to soil health. We have not found that to be true. Our farm measurement across Western Sugar shows microbial diversity and function is up six-fold following the adoption of conservation tillage, despite judicious use of pesticides. The data suggests tillage is far more detrimental to soil health than pesticides. Despite that, in the last decade and a half Western Sugar farmers have cut the quantity of pesticides applied by 40 percent and reduced the overall environmental impact by 92 percent, similar to national trends across conventional farming. Technology on the horizon will further reduce reliance on pesticides in the future. However, mandates against pesticides today will hurt, not help, the climate-smart agenda, most critically in the areas of food waste and land conversion.

Cover crops also promote soil health. Most closely associated with organic farming, it is also used in conventional systems across the United States. Implementation varies by region and cropping system, as does method of cover crop termination. Western Sugar farmers use cover crops under a variety of circumstances. However, our primary soil armor is a residue left from the previous crop, which also serves to promote soil health as we integrate in livestock for managed grazing, further building soil health.

Conservation crop rotation is also key to soil health. All Western Sugar growers rotate a diverse range of crops, including the occasional perennials. These rotations include high-residue and low-nitrogen-demand crops that balance nutrient demands and protect the biodiversity that is important to crop health.

The evolution of conventional ag practices has reduced soil erosion by 35 percent across the United States. It is important to recognize that the U.S. is currently a leader in climate-smart ag, and farmers are accepting of further improvement. Innovations in modern, conventional agriculture are primed to achieve climate-smart goals. Programs authorized by this Committee like CIG, the Sustainable Ag Research and Education Program, and EQIP have been highly effective in helping growers adopt climate-smart practices. Western Sugar has used these programs to improve nutrient stewardship and implement high-carbon soil amendment to regenerate soil health.

As you turn your attention to drafting the next farm bill, I encourage you to continue to support programs like these and invest in outcomes-based solutions that keep the farmer in the driver's seat as they understand the nuance in their production system. It is also imperative to bolster research for agricultural outcomes to enable our next step change in farming.

In summary, conventional farming has employed conservation practices like reduced tillage, cover cropping, and diverse rotations and are continuing to innovate. Thank you for the time today, and I look forward to taking questions.

[The prepared statement of Dr. Larson follows:]

PREPARED STATEMENT OF REBECCA L. LARSON, PH.D., CHIEF SCIENTIST AND VICE PRESIDENT, GOVERNMENT AFFAIRS, WESTERN SUGAR COOPERATIVE, DENVER, CO

Chairman Scott, Ranking Member Thompson, and Members of the Committee, thank you for inviting me today. I have a Ph.D. in Plant Science and 22 years' diverse experience with sugarbeets. I'm work for the 800 small family farmer-owners of the Western Sugar Cooperative. The cooperative spans 110,000 acres across Colorado, Nebraska, Wyoming, and Montana. I help measure the environmental impact of our farmers' practices and guide their investment in public research. Included with my written testimony is the data substantiating the gains our farmers have made in soil health and regenerative agriculture.

Soil health is critical for farmers and the environment. For the farmer healthier soil reduces crop inputs, increases crop productivity, and instills resiliency in the agroecosystem. For the environment, it can help mitigate climate change, using the soil as a sponge to absorb carbon from the atmosphere.

The USDA recognizes four soil health principles: (1) keep soil covered, (2) minimize soil disturbance, (3) employ diverse crop rotation, and (4) maintain living roots.[1] Tillage, mechanical working of the soil, works against three of the four principles making it arguably the biggest threat to soil health.

I am here to provide concrete examples from our cooperative and national trends that demonstrate conventional farming has made significant gains in soil health. Since the 1950s,[2] modern agriculture has enabled exponential adoption of conservation tillage across the U.S.[3] Today, a majority of conventionally produced U.S. commodity crops use conservation tillage; 1 out of 5 acres is no till. Clearly, farmers value soil health, as a third of conservation tillage was adopted with zero outside incentive.[4] I see similar trends for sugarbeet; 82% of Western Sugar growers use conservation tillage (*Figure 1*). The switch to conservation tillage improved soil health and imparted other dramatic environmental benefits: (1) erosion is down 90% (*Figure 2*), (2) soil microbial diversity and function is up six-fold (*Figure 3*), (3) fuel consumption and greenhouse gas emissions are down 40% (*Figure 4*), and (4) water use efficiency is up 30%. Concurrently, yield has climbed from 8,000 to more than 11,000 pounds of sugar per acre,[5] true sustainable intensification (*Figure 5*). Conventional agriculture paved the way with conservation tillage. More recently no till

organic cropping has emerged.[6] However, most organic systems[23] still rely on tillage,[7, 8] especially row crops, small grains, and vegetable crops. For both conventional and organic farms, adoption of conservation tillage is highly dependent on soil type, climate, scale, and cropping system.[4, 6, 9, 10] Ultimately, for Western Sugar farmers, the adoption genetically engineered sugarbeets with glyphosate tolerance allowed for widespread elimination of plowing and conversion to conservation tillage.

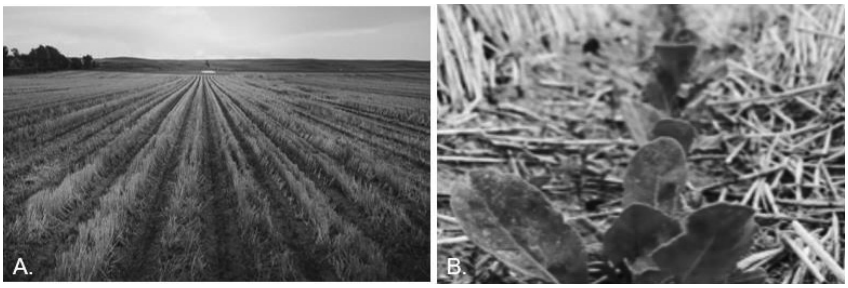
Some claim pesticides are harmful to soil health. We have not found that to be true. On farm measurement across Western Sugar shows microbial diversity and function is up six-fold following the adoption of conservation tillage (*Figure 3*), despite judicious use of pesticides. The data suggests tillage is far more detrimental to soil health than pesticides (*Figure 9*), consistent with reports in the literature.[11, 12, 13, 14, 15, 16] Despite that, in the last decade and a half Western Sugar farmers have cut the quantity of pesticides applied by 40% and reduced the overall environmental impact by 92%, similar to national trends in conventional farming.[17] Western Sugar, like all beet sugar cooperatives, determines what seeds can be planted on our farms. We require the seed largely defend itself against prevalent pests and diseases, allowing for robust integrated pest management. Combined with disease prediction models and precision application tools, pesticides are used with the highest levels of stewardship. Technology on the horizon will further reduce reliance on pesticides in the future.[18, 19, 20] However, mandates against pesticides today will hurt, not help climate-smart agendas, most critically in the areas of food waste[21] and land conversion.[22]

Cover crops also promote soil health. Most closely associated with organic farming, it is also used in conventional systems across the U.S.[23, 24] Implementation varies by region and cropping system,[25] as does method of cover crop termination. Western Sugar farmers use cover crops under a variety of circumstances: (1) 15–20% of sugarbeet harvest occurs early enough to be followed by a fall-seeded crop like winter wheat, (2) where irrigation allows, fall-seeded cover crops are planted following regular harvest as well, and (3) spring planted rye is used to protect delicate seedlings from prevalent, seasonal winds and shows promise for additional weed management (*Figure 7*). However, our primary soil armor is the residue left from the previous crop (*Figure 1*) which also serves to promote soil health.[26, 27] Across Western Sugar, crop residue allows for the integration of livestock through managed grazing further building soil health.[28]

The USDA recognizes conservation crop rotation[29] is also key to soil health. All Western Sugar growers engage in this practice, rotating small grains, corn, dry edible beans, and sugarbeets. Many also integrate perennial crops such as alfalfa in the rotation. These diverse rotations such as these that include high residue and low nitrogen demand crops are paramount for soil health by balancing nutrient demands in the agroecosystem and protect biodiversity important to crop health.[30, 31]

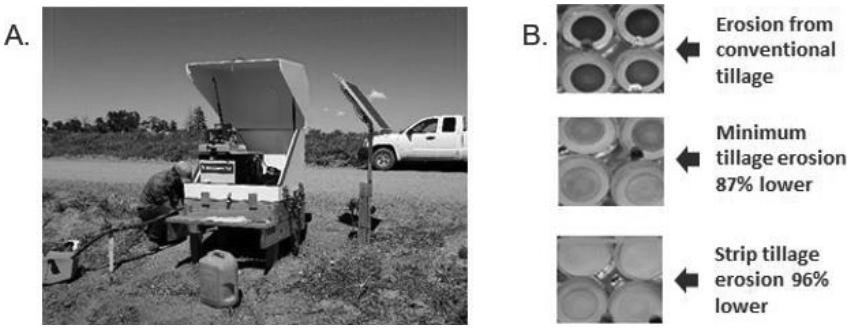
The evolution of conventional ag practices has reduced soil erosion by 35% across the U.S.[32] It is important to recognize the U.S. is a leader in climate-smart ag,[33, 34, 35] and farmers are accepting of further improvement. Innovations in modern, conventional agriculture are primed to achieve climate-smart goals. Programs authorized by this Committee—the Conservation Innovation Grants (CIG), the Sustainable Ag Research and Education (SARE) program, and the Environmental Quality Incentives Program (EQIP) have been highly effective in helping growers adopt climate-smart practices. Western Sugar has used these programs to improve nutrient stewardship and implement high carbon soil amendment[36] to regenerate soil health (*Figure 8*). As you turn your attention to drafting the next farm bill, I encourage you to continue to support programs like these and invest in outcome-based solutions that keep the farmer in the driver's seat as they understand the nuance of their production system. It is also imperative to increase investment in agricultural research to develop frontier technologies that will drive the next step change in farming. In summary, conventional farming practices have improved soil health by employing conservation tillage, cover cropping and diverse crop rotations and are continuing to innovate. Again, thank you for inviting me to be here today. I look forward to taking questions.

(Figure 1)



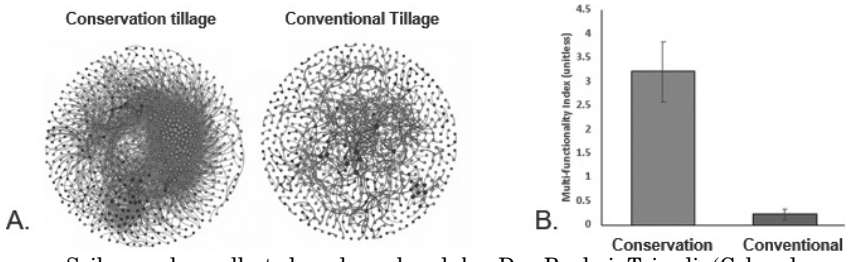
Photos from a Western Sugar farm using conservation tillage. (A) sugarbeets planted into previous crop's wheat stubble. (B) zoomed in image of sugarbeets growing in wheat stubble. Residue prevents wind/water erosion and evaporative loss of water; remaining roots feed the micro/microbiome & build organic matter.

(Figure 2)



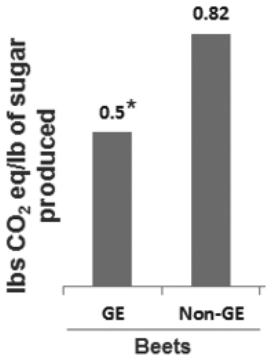
Western Sugar partnered with the Irrigation Innovation Consortium (FFAR project, Dr. Jay Hamm, Colorado State University) on a 3 year study collecting samples in edge-of-field monitoring to determine the impact of conservation tillage on irrigation-based soil erosion. Water was collected during each rain and irrigation event (A). Sediment and nutrient load were analyzed following filtration of the samples (B). Conservation tillage significantly reduces erosion and therefore protects water quality.

(Figure 3)



Soil samples collected and analyzed by Dr. Pankaj Trivedi (Colorado State University) to compare the soil microbiome under conventional and no-tillage systems from across the cooperative. Greater diversity in bacteria (A, blue dot) and fungi (A, orange dot) under conservation tillage (A). Soil function was also measured by Dr. Trivedi by measuring nutrient cycling (B); greater diversity/quantity of soil microbes = six-fold higher nutrient cycling (B). Western Sugar continues to financially support Dr. Trivedi ($30,000/annually) in the development of soil health bioindicators.

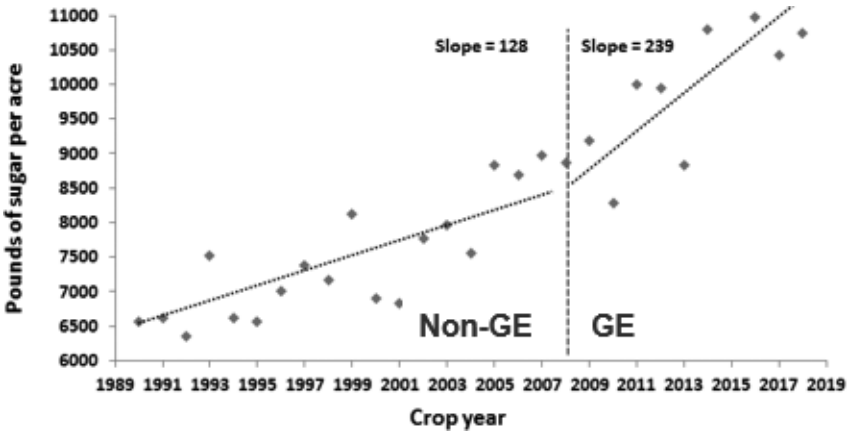
(Figure 4)



*conservation tillage has reduced emissions from soil 83%.

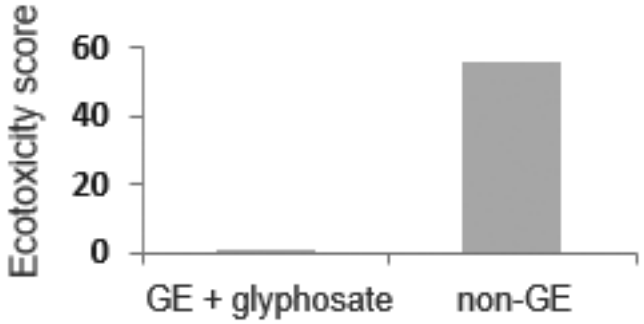
Western Sugar hired Dr. Douglas Warner and his team (University of Hertfordshire, UK) to conduct a lifecycle assessment of sugarbeet production in the cooperative before and after the introduction of genetically engineered (GE) sugarbeets. Emissions dropped 40% with GE sugarbeets primarily because of the adoption of conservation tillage. Note emissions are denoted in terms of units of production this is a key component of sustainable intensification. Ignoring productivity can force the unintended consequence of land conversion and market leakage.

(Figure 5)



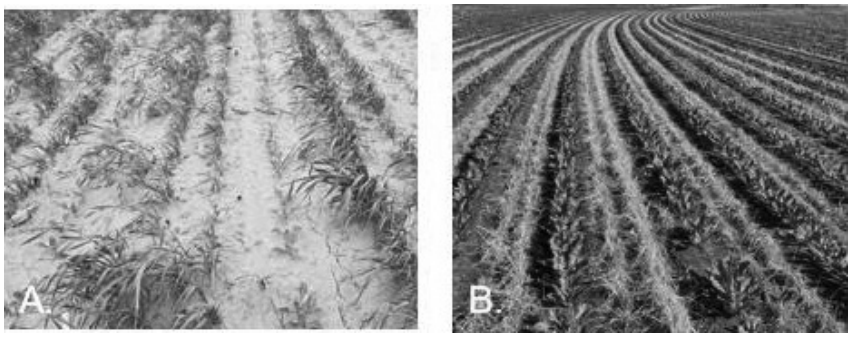
As *Lancet Commission* noted, environmental gains must be balanced against productivity to protect the global environment. Promoting environmental gains that reduce per unit productivity can lead to worsening climate change as additional acres are converted from native habitat to cropland to compensate for yield losses with a growing population. It is imperative Climate-Smart agendas focus on sustainable intensification: improving environmental outcomes while promoting yield. Western Sugar has made significant advances in climate-smart practices while also improving crop productivity 30% thanks to the adoption of genetically engineered (GE) sugarbeets.

(Figure 6)



All beet sugar cooperatives operate as closed systems, approving what seed can or cannot be sold to our growers and enabling robust integrated pest management. Western Sugar requires the plant be [able] to defend itself against seven prevalent pests and diseases. In addition, switching from non-genetically engineered (GE) and conventional herbicides to GE and glyphosate has reduced the environmental impact of sugarbeet production 92% as determined from pesticide fate and risk modeling conducted by Dr. Douglas Warner at the University of Hertfordshire in the UK.

(Figure 7)

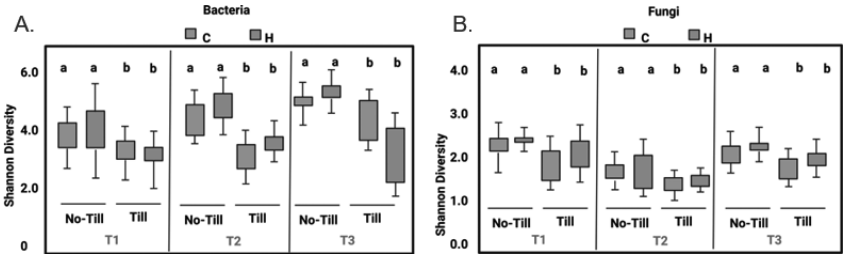


Western Sugar farmers who use cover crops tend to use wheat or rye (fast growing & cold tolerant). Some growers plant cover crops between rows (A), others seed the whole field to wheat then strip-till prior to planting sugarbeets (B). Western Sugar is currently funding development of best management practices for spring planted rye cover crops for additional weed control and resistance management at the University of Wyoming (Dr. Andrew Kniss) and Montana State University (Dr. Lovreet Shergill).

(Figure 8)

Western Sugar pioneered the use of a factory waste stream for beneficial use in high carbon soil amendment Using this product to regenerate soil health improves soil water holding capacity, reduces soilborne nitrous oxide emissions, increases long-term soil carbon sequestration potential and avoids methane emissions from land-filling the product [*status quo* (A); repurposing waste for beneficial use (B)]. The product has now been applied to nearly 6% of acres across the Rocky Mountain West with tangible improvements to soil health quantified by Dr. Bijesh Maharjan at the University of Nebraska. Growers readily adopted the practice because of the immediate benefit of improved crop productivity [visual impact on corn (C) and dry beans (D)].

(Figure 9)



Dr. Pankaj Trivedi at Colorado State University analyzed population diversity of bacteria (A) and fungi (B) in different production systems (no-till or tillage) and with herbicide (H) and without herbicide (C) mimicking options for Western Sugar producers. Samples were collected at three different times (T1–T3). In all instances, tillage was the main driver of diversity loss; use of herbicides did not impact diversity (statistical significance denoted by letter above box plot, those with different letters are statistically different from one another).

[Endnotes]

[1] *https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/soils/health/?cid=stelprdb1048783*.

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The CHAIRMAN. And thank you for your excellent testimony, and all of you, powerful. And this is why we are having this hearing.

Now at this time, Members will be recognized for questions in order of seniority, alternating between Majority and Minority Members. Each of you will be recognized for 5 minutes to get your questions in. And please, as always, keep your microphones muted until you are recognized so that we can eliminate background noise.

And now I recognize myself for 5 minutes.

First of all, you all were just brilliant in helping to confirm our great need here. And this great need is what I refer to as a Paul Revere moment. It might not be the British that are coming, but if we do not listen to you and what you are saying about the urgency of regenerative farming, dealing with the source of our food, which is the soil, we will have a food shortage in this country.

And I want to start with you, Steve, Mr. Nygren, my friend. You mentioned the status of us in the world. You mentioned also the status of us in our rural communities. And I tell people all the time, you love the milk, you love the beef, but it is in our rural communities, which must grow the vegetation, the soil enrichment, which feeds our animal stocks. Tell us, the shape that we are in right now and your level of concern about our food security in this nation if we don't move forthrightly on what you have suggested.

Mr. NYGREN. Thank you, Mr. Chairman. Having grown up on a farm in the 1940s and the 1950s and then moving to Georgia, in both states, I have seen the rural communities go from vital centers and economic centers to places that are many times ghost towns, with many people having to change careers. I have 18 first cousins. They have all left the industry except for three, and they are larger farmers today.

The idea of our food system is not only going to affect what we eat but the very economic fiber of this country. And I think some of the things that you see that have happened in rural America is an example of the changing systems that we have had. As you have heard today, there are solutions that will both give us better food and an economic foundation for our rural areas, and the farm bill could really change that.

The CHAIRMAN. Thank you. And Mr. Moyer, you are doing a wonderful job at Rodale. Tell us about your work there. And do you agree with me, if we fail to move on this, we could be facing a food shortage? Please.

Mr. MOYER. Thank you for the question, Chairman Scott. Yes, of course, it is critical that we move rapidly to make adjustments to allow farmers to express their desire to improve the health of their soil. Regenerative agriculture, regenerative organic agriculture is all part of a journey. And we are not suggesting that conventional agriculture or conventional farming has not made great advances since the 1950s, but we also have a long way to go. The concept that we simply want to sustain a current system or current set of practices to maintain what we have is not adequate. We really need to move forward rapidly with the concept of regenerating the health of our soil to build up earthworm populations, as Mr. Clark already told us about between his farm and his neighbor's. We can do that. Again, we have the tools, we have the time, we have the ability. We need support from Members of this Committee and from policymakers in order to just tweak some of the programs that we have to allow farmers to make the decisions on their landscapes to improve the health of their soil.

The CHAIRMAN. Thank you. And, Mr. Clark, I want to get to your salient points because I believe you are right on target here. What will happen if we do not regenerate our soil? Where we will be in a world where we have to depend upon Russia for our food? We are already depending upon Russia, for 66 percent—they control 66 percent of the world's fertilizer. Yes.

Mr. CLARK. Chairman Scott, thank you for the question. Yes, we have gone down this journey, and we have weaned ourselves off of these inputs, and we have become more resilient, less negativity toward instability within the world. And yes, we need to preserve our soil because that is going to be the future of the farming industry.

The CHAIRMAN. Thank you. And now I recognize the distinguished gentleman from Pennsylvania, our outstanding Ranking Member Thompson, for your 5 minutes.

Mr. THOMPSON. Mr. Chairman, thank you so much. I appreciate your leadership. I appreciate, it is just a pleasure to work with you on something we are both very passionate about agriculture.

The CHAIRMAN. Same.

Mr. THOMPSON. Some of the numbers—well, I referenced a number that our productivity has increased 278 percent since the 1940s. Just a couple months ago, we were 287 percent, so the differential is not an erosion of soil health. And I think we all acknowledge that. There are other factors that go into productivity, and productivity is important. We are providing so much more food and fiber and building material and energy resources on the lands. I used to call it rural America. I call them essential America today

because they are essential to every American family, what we produce.

But the factors are, quite frankly, it has been the inflation. It has been the elimination of crop protection tools. It has been the fertilizer that has not been available. That is what has impacted and put us at risk of being able to provide all the food that needs to be produced at this point. That is a nine percent reduction. Those things are all fixable. They are just bad policy that has come out of out of Washington.

I have had a chance to travel around as Ranking Member to a lot of different states, talk with a lot of different farmers and ranchers, foresters, and just people in central America. In my home state, the Commonwealth of Pennsylvania, which is one of the top ten cover crop states—excuse me—in the United States, there has been a 33 percent increase in cover crop use since 2012, which is outstanding. Now, again, this is an industry that is not static, it is dynamic, and we can do even better. And I think we are all dedicated to that. And that data came from the 2017 USDA Census of Agriculture.

However, in my travels to almost 40 states over the past 19 months, I have seen that cover crops are not economic or applicable across all farmlands, which is why the hearing today is so important. I have been in states—specifically, it was in Texas with the dry conditions. If they put a cover crop in, it is going to suck every bit of moisture out of the ground. And whatever crop that you are looking to produce will not flourish, will not grow, certainly will not produce a significant yield.

So, Dr. Larson, do you agree that we have to make available all the tools in the toolbox and that prescribing or endorsing certain practices or systems like regenerative organic agriculture in a silo, alone, could stifle research, technology, and innovation of future practices?

Dr. LARSON. Absolutely. There is no scientific consensus on the best practice to farm because there is too much nuance in farming. So when you look at the Rocky Mountain West, you mentioned it would suck all the water out of the ground. So our growers use cover crops very judiciously. So after they dig their sugarbeets out of the ground, the ground could be left there. Instead, they often opt to plant a subsequent cash crop like winter wheat if they can get in there early enough. Otherwise, if they get in late, they will plant something like rye to keep the ground covered.

We have a lot of money that we are investing at both the University of Wyoming and Montana State to be able to create cover crops for weed manage in the spring as well and explore additional options. But ultimately, if we didn't have access to adequate technology such as herbicides to control a broadleaf weed and a broadleaf crop, we would be in big trouble and wouldn't be able to implement the conservation tillage that we have today.

Mr. THOMPSON. Yes, a lot of diversity it is—American agriculture is—well, that is something I think all the Members of this Committee are very passionate about, but it is—and there are a lot of similarities, right, when you walk from one farm to another, different parts of country, but there is differences, too, the climate

and soil types and weather patterns. And so it really is—there is no single tool. We have to use every tool in the toolbox.

Mr. McCarty, it is nice to meet somebody whose family originated next to my district anyway, Bradford County. I am in McKean County right next door. It is one of my counties in Pennsylvania. And I get it, you all—the size of your farms—I guess first question, Mr. McCarty is, how many dairy cows does your family farms have altogether?

Mr. MCCARTY. So in total today across the five dairies we milk about 13,000 cows. And once our expansion is done, we will be close to 19,000 milking cows.

Mr. THOMPSON. That is pretty impressive. Knowing Bradford County, I have family in Bradford County, I am guessing that you were in the average statistics where in Pennsylvania, where dairy is our number one agriculture commodity of our largest industry, agriculture, and there are 5,200 dairies and the average herd size is 91, so that is quite—the geography makes a difference for you all with the states and where you have moved to.

So let me just finish up by making the point, small farmers can't always take on the risks that large farms can when adapting new practices, and I certainly don't want to be the person who walks on to one of their farms and tells them the Federal Government mandates that they upend their economic viability of their operations and livelihoods for the sake of climate change, especially when they aren't the bad actors in the first place.

So one of the things that I know, and I think the Chairman is committed to this, we are looking at how do we protect the small farmer and specifically like the small dairy farmers in my district and the small producers across the United States who can't afford always the risk that someone like with an economy-of-scale like your family has taken on?

So, Mr. Chairman, I know my time has well expired. I appreciate your patience today.

The CHAIRMAN. Oh, my pleasure. And the point you made about our dairy farmers, they have informed me that now, right now, we are losing a dairy farmer every single day. That is 365 this year and next year. So you have hit upon a very important thing. And of course, we are addressing that, along with our beef cattle, where we are losing 17,000 small beef cattle ranchers every year. When you put that together with our hesitancy to move forthrightly on our soil erosion, we have a burgeoning crisis. That is why we are here. Thank you for your excellent remarks.

And now we will hear from the gentlewoman from Connecticut, Mrs. Hayes, who was also the Chairwoman of the Subcommittee on Nutrition, Oversight, and Department Operations. Mrs. Hayes, you are recognized for 5 minutes.

Mrs. HAYES. Thank you, Mr. Chairman.

My district is a growing leader in climate-smart agriculture. Our producers use ecofriendly practices like cover crops to run their small, diversified farms. Last month, I hosted a roundtable in my district, with U.S. Deputy Secretary Dr. Jewel Bronaugh. Farmers there stressed how committed they were to expanding their regenerative agricultural practices. Unfortunately, as many of you know, this can be expensive and risky. This is especially true for the

small farmers and new and beginning farmers that I represent in Connecticut's Fifth District.

As this Congress continues to make critical investments to mitigate climate change, I am hoping that our witnesses can provide testimony that gives us solutions to help farms of all sizes. Mr. Moyer, you talked about soil health quite extensively. Can you tell me a little bit about how improved soil health can protect farmers against increased drought and flooding? Because that is what we are hearing a lot about in my State of Connecticut.

Mr. MOYER. Certainly, and thank you for the question. There are certain things we can do with soil health and certain things we can't. We can't change the weather, we can't change weather patterns, we can't change the impact of climate change. What we can do is change the soil's ability to interact with weather. So we can, as you heard from other testimony here this morning, we can change the soil's ability to hold and retain water. So while we heard western states, they say it is too dry to go cover crops, we have many farmers in western states that say it is too dry not to grow cover crops. We can grow cover crops, hold moisture in the plant. *Cover crops* is a term, but it doesn't really clearly spell out all the varieties of crops that we can grow as cover crops. There are hundreds and hundreds of different species of crops we can grow that all serve different purposes. So while we say *cover crops* as one word, there are many different tools that we can use.

So we are suggesting that farms have the ability, through changes and tweaks in our EQIP and crop insurance legislation in the farm bill, that will allow farmers to make those decisions on their own farm, whether they are conventional or organic, to try to improve the health of their soil and improve their ability to interact with changing weather patterns to build resiliency and sustainability into their production models.

Mrs. HAYES. Thank you. I appreciate that and look forward to getting more information. I can tell you every news station in my home state last week was running stories about drought and showing just the devastation to small farmers and what it means, we can't change weather patterns, so we need to really be proactive in solutions to how do we engage differently in these environments.

Mr. Clark, you talked about your family's farm switching to regenerative agricultural practices.

Mr. CLARK. Yes.

Mrs. HAYES. Can you talk to us about some of the positive changes you saw in the first few years after those switches?

Mr. CLARK. Right. Thank you for the question. Representative Hayes, thank you. Yes, when we started this journey several years ago, we were actually at a point where I was having discussions with my wife, I am not sure if we are going to be able to afford to plant corn and beans anymore. We have to do something different. So the first immediate thing that we saw was the simple fact that the soil came to life. You could see it change right in front of your eyes. We have aggregate stability now that is that is 8″ deep. We have water infiltration rates of 20″ an hour. We have water holding capacity. We are sequestering carbon, all of these things we are doing, and you can see a lot of these changes with

very simple tests. You can have a hammer, ring, a couple of tubes full of water, and you can show soil health every single day.

So the immediate thing that we saw was just the breath of fresh air that we are now able to expand and grow vertically and not just be tied to a corn and soybean type rotation.

Mrs. HAYES. Thank you, that is very important information.

Mr. Nygren, the Working Farms Fund at the Conservation Fund has helped 33 farmers secure land in the past few years. How can we better engage to expand those programs so that more farmers can access them and have help with conservation on the ground?

Mr. NYGREN. I believe make sure that the money is going to organizations that do not have large overhead so that it is hitting the farmers actually in the fields. And there are many organizations that are connected directly with the small farmers, and I think we need to be aware of those programs and how the money is distributed.

Mrs. HAYES. Thank you. Right on time. Mr. Chairman, I yield back.

The CHAIRMAN. Good job. And now the gentleman from California, Mr. LaMalfa, is recognized for 5 minutes.

Mr. LAMALFA. Thank you, Mr. Chairman. Dr. Larson, you are beet grower or cover that in Colorado, and I heard some really positive things, some of the methods that you have been able to utilize there, a lot of it gearing around no-till. Tillage is being looked down upon more and more these days, but that might apply well for beets and other crops. But do you see that there are other crop types that can be readily converted to no-till that—I mean, is this supposed to be a one-size-fits-all for all crops be converting to no-till?

Dr. LARSON. It is absolutely not one size fits all. As I mentioned, controlling broadleaf weeds and a broadleaf crop thanks to genetically engineered sugarbeets with glyphosate tolerance was a gamechanger for us. If you can control the weeds, you don't need to use mechanical removal or tillage to get rid of them. So there are a lot of crops like ours that are difficult to control weeds in that require some alternative method to control them. And often, farmers rely on tillage. Overwhelmingly, organic and conventional farmers rely on tillage.

Mr. LAMALFA. Certainly, okay. So when you talk about the beets, you have had to use genetically modified so that you can use different types of pesticides?

Dr. LARSON. Yes, to use a specific herbicide that helps control the weeds more consistently and completely.

Mr. LAMALFA. Did you see any market reverberations for switching to genetically modified seeds?

Dr. LARSON. No, we did not.

Mr. LAMALFA. Okay. All right. Mr. Moyer, you mentioned in the testimony that America's food system is broken, and conventional ag models are degrading farmland. Now, way back in the 1930s in the Dust Bowl and even before that, but the Federal Government set on a path to try and do things to conserve soil because we saw some terrible outcomes from weather and such affecting soil. So much work has been done over the years before this concept of doing things to conserve soil, not lose it to erosion and things of

that nature. So we have seen tremendous gains made in crop yield, and less labor being required for agriculture in this country. It used to be 50 percent. Now, it is less than one percent of people work in agriculture these days, it seems. So labor's declined, land use has declined in order to get increased crop yields.

So one thing I found and am in strong agreement with you on is the reliance on international food supply is really going to be dangerous for all of us. We see Russia's invasion of Ukraine. The world is going to be in a bad way. With that, India and Hungary have decided they are not going to export grain this year. And so we are going to have a real 2023 food supply issue, as well as the gas and fertilizer needs that we have to produce fertilizer, natural gas. So Sri Lanka has tried to go against using fertilizer and such, and their economy is collapsing. The Netherlands, the Dutch dairy farmers are in an all out protest over that. And we see Canada, our friendly neighbor to the North, go in that direction, too. But The Netherlands will close 11,000 farms and affect over 17,000 farmers.

So if our government enacts similar measures, getting rid of nitrogen and all these things, it would have a catastrophic effect on the U.S. food supply and also the world. So the suggestion to reapproach farming as regenerative organic seems to be counterintuitive to part of the testimony. So how is it when we have a global food shortage, that when we are talking about these alternative forms of farming and we are going to end up with less food and less crop grown, or we are converting to cover crops, we are going to have lower yield with *regenerative organic* as you term it, how is that going to work in a world that is already going to see perilous food shortages, as even promised by President Biden?

Mr. MOYER. Well, I think there is—thank you for the question, Congressman. I think there are a whole lot of issues that you stated that need to be unpacked. It is not as simple as saying organic or regenerative organic food production has lower yields. That is not true. Our science and our research indicates that we can match or in many cases during drought or when it is either too wet or too dry, our regenerative organic yields surpass those of conventional farming.

Mr. LAMALFA. I farm rice. My family has been doing it since 31 and my cousin since 13.

Mr. MOYER. Yes.

Mr. LAMALFA. When you farm organic rice, you lose yield, and it costs a lot more. So which ⅓ of the people aren't going to get food?

Mr. MOYER. So I am suggesting that a lot more research needs to be done in the area of regenerative organic agriculture to show how we can sustain yields that are equal or greater than conventional yields. It is not all about—we are sacrificing short-term yield for long-term stability in our soil. And yes, while we have reduced erosion, over the years, we are down to a national average of 6 ton per acre, which is not something we can sustain. There are many different forms of soil degradation. Erosion is just one of them. Nutritional quality and nutritional content of the soil is another. Microbial activity, biological activity is another. We have lost over 50 percent of the soil's fungal capacity to maintain the integrity of a

phytonutrient called ergothioneine. Ergothioneine has a health impact on our——

Mr. LAMALFA. On the whole, yields have been increasing and more production has been coming out of the land. Now, we need to do things to conserve soil and keep going in that direction, but a one-size-fits-all—if government ends up, because of this climate change situation, forcing this on farmers, we are going to be in a bad way in this country as our people and others around the world look to us——

The CHAIRMAN. Unfortunately, the——

Mr. LAMALFA. I appreciate it, Mr. Chairman. I yield back.

The CHAIRMAN. And I appreciate your line of questioning. You hit the nail on the head. This is exactly why we are here, to avoid a food shortage in our nation. Thank you for your questions.

And now the gentlewoman from Ohio, Ms. Brown, is now recognized for 5 minutes.

Ms. BROWN. Thank you, Chairman Scott and Ranking Member Thompson, for holding this hearing today. And thank you to our expert panel for being here. Your perspectives are helpful as we look ahead to the next farm bill.

Unlike organic agriculture, which must meet Federal standards and are subject to inspections, *regenerative agriculture* lacks a clear scientific definition. And it is currently not governed by any USDA standards. So my question is for Mr. Clark, but I welcome others to jump in if they have thoughts as well. Mr. Clark, should USDA clarify and set standards as to what it means to label something *regenerative?*

Mr. CLARK. Yes. And thank you for the question, Representative Brown, and you are exactly correct. There is not a standard definition of *regenerative ag.* I am not saying today that we need one, but if we do work toward that goal, let's keep it simple. Something like incorporating agricultural practices that continue to build soil health. That is pretty simple. And yes, I think that that type of nomenclature or designation needs to be on the food that is available for the consumer.

Ms. BROWN. Any others?

Dr. LARSON. I would like to comment on that, too, if I may, please. I think it is very dangerous to try and come up with a blanket statement or a blanket label for one particular type of practice because there is so much nuance in it that requires physical measurement of the impact of the practices that you are implementing. One of the studies cited by Mr. Moyer gave an example of erosion differences between different cultivation practices. And it showed that conventional no-till had far superior erosion prevention capability than the best management practices within organic. So we want to be very careful about trying to say one particular type of production practice should have the label of regenerative and rather focus on measuring the physical outcomes that we all desire to have to mitigate climate change.

Ms. BROWN. Thank you. Thank you all. It seems to me that further clarity can also help consumers understand what it means when they see a product at the grocery store with the words *farmed using regenerative techniques.* So I appreciate your responses.

Mr. Clark, in your testimony, you also talked about the demand for scaling up regenerative agriculture practices. As we look to the next farm bill, what can we as Congress and the USDA do to be supportive of these efforts?

Mr. CLARK. Yes, I am sorry. Did you say scaling up? Is that what you said?

Ms. BROWN. Yes, sir.

Mr. CLARK. Yes, yes, what we need to do is we have to start with the education process. We have to make sure that the teachers are in place. I think it is absolutely imperative that when a farmer goes down this road of change and they are so unfamiliar with this, they need the guidance, the support to help make the very first time they try this to be successful because I am afraid if they do not have success, they will not come back. Believe me, I have heard every excuse. I live too far north, it is too cold, growing season is too short. I have heard them all. So we need to take those excuses away and help build that confidence within that farmer.

So within answering your question, we need to make sure the six principles of soil health are implemented and that they then are put on a system that monitors the progress. Teaching and support group is so critical here. Thank you.

Ms. BROWN. Thank you. And if you could just go over those six points again very quickly.

Mr. CLARK. Sure. You need to—it is context, it is diversity, the living root, armor the soil, integrate livestock, and I am—and minimize disturbance. That is my number one. Thank you. Minimize disturbance. So those are the six.

Ms. BROWN. Okay, thank you. So much for reminding us, and thank you for your comments.

Mr. Chairman, with that, I yield back.

The CHAIRMAN. And now the gentleman from Indiana, Mr. Baird, is now recognized for 5 minutes.

Mr. BAIRD. Thank you, Mr. Chairman and Ranking Member. I really appreciate having this conversation. And I always appreciate the witnesses taking the time to share their background and ideas with the Committee so we can have a better idea of some of the issues that we have in the farm bill.

But my first question goes to Dr. Larson. And it has to do with the idea that others on the panel have claimed that organically produced food is more nutritious because the soil in their system is healthier. What does the science say about that? Any thoughts there?

Dr. LARSON. Yes, thank you for the question. I am happy to provide copious amounts of scientific research from peer-reviewed journals that shows that there is no correlation between soil health and nutrition within a plant. I can also show you that there is no scientifically credible evidence that suggests that food grown through organic practices is safer or more nutritious than food grown with conventional ag. Just to give a couple of examples of where some of that fear-based marketing can have negative effects, especially for marginalized and low-income communities, is that when people are led to believe that one type of production practice is safer or more nutritious than another, it actually drives down total consumption of fruits, vegetables, and grains. So there can be a nega-

tive impact from not speaking to the facts of science and scientific consensus.

[The information referred to is located on p. 98.]

Mr. BAIRD. Very good.

Mr. MOYER. I would add that Rodale Institute would be more than happy to supply additional data that showcases the opposite side of that conversation because science can show what people want it to show, but there are clear differences in nutritional quality of crops that are produced in soils that are farmed differently.

[The information referred to is located on p. 89.]

Mr. BAIRD. Thank you. You can submit those to the Committee.

So Dr. Larson, one more question. Can you elaborate on your comment about how the wholesale elimination of pesticides will hurt, not help climate-smart in this? And you specifically referenced effects on food waste and food conversion. Can you make any additional comments about those issues?

Dr. LARSON. Yes, thank you so much for the question. Twenty-twenty was recognized by the UN as the year of plant health. And, as a plant pathologist, that made me very happy. Forty percent of all food waste happens on-farm before anything gets to the grocery store because there is poor pest and disease management. So access to pesticides to be able to control those pests and diseases on-farm is critically important. And more and more farmers are engaged in integrated pest management that reduces their reliance on synthetic fertilizers, and emerging breeding techniques like gene editing are going to reduce reliance on pesticides even further, but need to be able to control the pests and diseases that are going to be prevalent on farms.

Mr. BAIRD. And one more question for you, Dr. Larson, if you will. In your testimony, you mentioned Western Sugar farmers would not have been able to transition to no-till or conservation tillage without the use of glyphosate. Will you expand upon the role of glyphosate and what it plays in facilitating conservation practices in the farms? And why do some claim it is detrimental to soil health?

Dr. LARSON. Yes, thank you so much. For us controlling broadleaf weeds, which are a prevalent weed species across the Rocky Mountain West, is very difficult in a broadleaf crop. It is hard to kill something that is very similar in nature without dinging the crop as well. So it is critical. When we got glyphosate, it allowed farmers to have more consistent and complete weed control so they could put away their plows, they could put away their cultivation equipment and not have to disturb the ground anymore. They had chemical correction.

And because of the sentiment that glyphosate is killing the soil microbiome, we actually have invested tens of thousands of dollars doing routine soil analysis across all of our farms to show that the depth and breadth and diversity and soil function has not been affected by the application of glyphosate. In fact, the diversity and activity of our soil microbiome is up six-fold, suggesting that tillage itself is far more detrimental to soil health and the soil microbiome than chemical applications.

Mr. BAIRD. Thank you very much. And I see my time is almost over, so I yield back.

The CHAIRMAN. Thank you, Mr. Baird.

And now the gentlewoman from Maine, Ms. Pingree, is recognized for 5 minutes.

Ms. PINGREE. Thank you very much, Mr. Chairman. And thank you so much for holding this hearing. It is a critically important topic as we go into work on the next farm bill, and I am very grateful for that. And I want to thank all the witnesses. You have all really given us a lot of interesting testimony from all points of view, but it all leads back to an important understanding of how critical soil health is to both dealing with climate change and then the future of farming and success for our farmers, so thank you for that.

I am glad to hear about all of this because I think the more we can move conventional agriculture into regenerative practices, the better off we will all be and better off our environment and our farmers will be. But I have a particular interest in organic farming, having been a certified organic farmer myself and involved in it for a very long time, also a big fan of the Rodale Institute. So thank you so much, Mr. Moyer, for being with us today.

I know you have done some work there, sort of a more of a big-picture scale about conversion to organic agriculture and soil health and how much carbon can actually be sequestered out of the atmosphere. And since that is such a critical topic right now, what techniques do we use to sequester carbon, can you talk a little bit more about the studies that have been done there and sort of the quantification of how much carbon we can sequester?

Mr. MOYER. Yes, thank you very much for the question about the conversation around carbon and carbon sequestration. We know that the way we manage soils can have a huge impact on its ability to sequester carbon. Many of our practices that we employ, we have already discussed about cover crops, and we may have discussed about crop rotations. These are all tools that farmers can implement to sequester carbon. It is becoming more and more critical. The amount of carbon we can sequester is certainly dependent upon the relationship between the practices that we are superimposing on the landscape and the soils innate ability through clay particles and the different soil types to sequester carbon.

What is equally as important is that we sequester carbon at greater depths. As those of us who are being pulled into the concepts around carbon marketing, want to know that our carbon is not simply cycling. If you are aware of carbon, then you are aware of the word *carbon cycle,* which means it moves throughout the environment. It is in the air, it is in the water, it is in the soil. And we want to be able to sequester carbon at greater depths so it is more permanently sequestered and not volatilized back into the atmosphere.

So yes, our work at Rodale Institute is continually exploring and expanding the concepts around carbon sequestration, and we have a tremendous amount of data that we would be more than happy to share with this Committee and with you in particular.

Ms. PINGREE. Thanks so much. We will look forward to exploring that more.[1] And I do appreciate your mention of the deep roots, which was also one of the principles that Mr. Clark mentioned.

Now I am going to get a little more technical or I guess into the weeds, which is sort of a bad pun. But, we are talking a little bit about the use of glyphosate and how challenging it can be, particularly, in organic farming to deal with weeds, to deal with sort of ending the life of your cover crop and doing so with no-till. And so if maybe Mr. McCarty or Mr. Clark, you both are practicing organic farmers on a big scale, how do you deal with this challenge or how do you see us looking at that in the future and what more research or support needs to be out there to avoid having to use herbicides in practices like we are talking about?

Mr. CLARK. Great, great question. Thank you for the question. What we have found is the basis for our weed suppression is the biomass that is generated by the cover crop. Then you mechanically terminate that cover crop with a roller-crimper. You are creating a mat, a mulch, an armor on the soil. And this armor does many, many things. And you can now look at arid environments that make the claim we can't grow cover crops here, but once you armor the soil and eliminate or mitigate the evaporation that is taking place and you build that soil health, you are building the aggregate stability, you are building your water holding capacity. So when it rains, and your neighbor says, "Hey, I have a 1″ of rain, how much did you get?" Your answer is, "I got it all because it went into the ground."

Ms. PINGREE. That is great. I have to move to Mr. McCarty, but I do appreciate that and maybe I can follow up with you. And thanks for reminding us that this topic is nonpartisan. So Mr. McCarty, what do you do as a technique? I thought the roller-crimping is interesting.

Mr. MCCARTY. Yes, so one thing that I think is important to know is that my farms are not organic farms. We are non-GMO project verified, but we are not organic. But the practices that we use to mitigate the use of pesticides is varied, we live in a very different climate than what Rick lives in. And we utilize cover crops. We have explored different planting population densities and planting row widths to try to shade out those weeds faster. We are working on different varieties of cover crop programs that will help choke out pests, weeds, especially those that are resistant to current herbicide chemicals. We are also looking at different crop rotations and exploring those types of crop rotations where we can break that weed cycle, as opposed to a corn on corn on corn type of cropping cycle. All of those different methodologies have shown some and varied levels of effectiveness at controlling weed populations across our farms.

Ms. PINGREE. Thank you.

The CHAIRMAN. Unfortunately, the gentlelady's time——

Ms. PINGREE. I am out of time. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. I appreciate that.

And now the gentleman from Iowa, Mr. Feenstra, is recognized for 5 minutes.

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[1] **Editor's note:** Mr. Moyer's supplementary material submission is located on p. 87.

Mr. FEENSTRA. Thank you, Chairman Scott and Ranking Member Thompson, for holding this hearing today.

I want to start out by just giving a shout-out to our producers. They do an amazing job. They are the breadbasket to the world. They are the literal ones that are producing the food. My district, Iowa's Fourth District, is either number one or two in the nation when it comes to corn and soybean production. Actually, my county where I live, Sioux County, is number one when it comes to corn and cattle and other things. So I take this very seriously.

And I want to say this about our producers—my in-laws are one of them—is that we take soil health very seriously. Why do we take it seriously? Because when you have good soil health, you also create more production. It goes hand-in-hand, literally goes hand-in-hand. So our farmers in the Midwest, in Iowa, are every day looking at better ways to create soil health from cover crops and no-till to rotations to terraces, you name it. And I think about when I was a kid, when we hear about how if we can only get 125 bushel of corn per acre, today the farmer is looking at over 200, and if he doesn't get over 200, it is a disappointment. And frankly, in Sioux County, if we don't hit over 250, we are upset. It is just amazing what has happened.

But there is always research that is needed, and that is why I love my land-grant institution so much, Iowa State University that does a tremendous job.

And with that, Dr. Larson, I would like to ask, Iowa State is doing a lot of different research on hybrids, on soils and stuff like that. Where do you see more research needed from our land-grant institutions?

Dr. LARSON. Thank you for the question. Having worked in basic research at a university and USDA myself, I see a lot of value in what these third-party researchers do. To me, there are a lot of really interesting ideas that come out of academic research that lack the capability to be scaled, and so we need a way for universities to have better structure and scalability. I think that is first and foremost.

And I think one thing that has not been mentioned on this panel is that all of these great practices that we have talked about today, soil scientists recognize they only have the capacity to offset current emissions. If everybody everywhere around the world that is farming did all of those practices, it would only sequester enough carbon to offset what we emit today, does nothing for the legacy load. So soil scientists are crying for frontier technologies like high carbon soil amendment, perennial grains that are going to allow us to be able to start pulling down and actually draw down on that legacy load. And universities will play a big role in that.

Mr. FEENSTRA. Yes, I agree 100 percent, Dr. Larson, and thank you for those comments. And I love the academic arena that is looking at different things. But we always have to remember that, my in-laws, the producers out there, they want to do what is best, they really do, but they also want to make a living. They want to add value. And we see this, and if you could talk about this, Dr. Larson. So, we talked about academic. I was an academic. I was a professor. How do we take it from academia to the real world? And I think about Iowa State Extension, by the way, started in my

hometown, Hull, Iowa. But how do we deploy these new strategies and get the farming community to add value to what they are already seeing in production?

Dr. LARSON. We are big fans of private-public partnerships. So I will give you a quick example from Nebraska. Western Sugar farmers pulled dollars out of their pockets, funded a university scientist to see can we improve nutrient stewardship. He demonstrated in 110′2 that we can, but that is not enough to convince farmers that that is the option, going forward. So we applied for a USDA SARE grants and got $75,000 that allowed us to test that on five large pivots to show our growers that even though we have increased yield 35 percent, we can cut back on fertilizer by 30.

Mr. FEENSTRA. Yes.

Dr. LARSON. So that is an excellent example of scale-up from academic to practical.

Mr. FEENSTRA. And you nailed it, right? If you can cut back fertilizer, that is an input cost and a significant input cost, especially today, right? And that helps added value. And I sometimes think that we are going at it the wrong way is how do we add value to the production? Because that is all the farmers want. They want to have great soil, they absolutely do, but they also have to make a living. And we are the breadbasket to the world, and we continually will be, all right? Everybody looks to us, all right? And I don't ever want anybody to think that we are the monsters in the room. We are not. I mean, our producers are the greatest people in this great country. And I just, I am here to say, how can I help them? How can we make a difference? I know, Dr. Larson, you think the same thing. So thank you. With that, I yield back.

The CHAIRMAN. Thank you.

And now the gentlewoman from Iowa, Mrs. Axne, is recognized for 5 minutes.

Mrs. AXNE. Thank you, Chairman Scott. Thank you to my colleague from Iowa, Representative Feenstra. He is absolutely right. We have the best stewards of the environment in Iowa because we got a lot of farmers. And you all certainly know all about that.

Thanks for being here. This is a really important topic. And, as you just heard Representative Feenstra describe what we produce in Iowa, we have the best soil in the country, often described as black gold, that we absolutely want to keep and that we are unfortunately scared that this runoff is going to continue, that we will continue to see less nutrients, and so we are doing everything we can to protect it. So today is a very important discussion. Thank you.

There is some serious concerns about the sustainability of our practices. It has been estimated that the Corn Belt has lost ⅓ of our topsoil, and we are losing it ten times faster than that of replenishment. And the studies estimate that soil loss in Iowa is worse than any other state, greatly endangering our state's biggest asset and the ability for future generations to farm as their predecessors had.

But thankfully, there are a lot of tools that we can utilize to help combat this problem, and studies are showing that farmers are utilizing those tools to combat that soil loss. Cover cropping of course, for example, is a key regenerative approach to help us rebuild our

soil. And while there are a number of USDA programs that can be used to support cover cropping, I was particularly pleased to see the USDA rollout the Pandemic Cover Crop Program, a $5 per acre incentive crop insurance to help farmers employ cover crops as a risk management tool. It is a bill I am on, so I am pretty supportive of it.

You may know that in 2021 in Iowa, this program incentivized over 850,000 acres of cover crops with over 4.2 million to Iowa farmers to incentivize soil health. And nationwide last year, almost $60 million for cover crops were distributed on over 12 million acres, so it is clearly successful. And codifying it in the next farm bill will ensure farmers have long-term opportunity to ramp up the opportunity for cover crop adaptation. So let's hopefully get my legislation, the COVER Act (H.R. 8527, Conservation Opportunity and Voluntary Environment Resilience Program Act), passed because it will ensure resilience in the crop—I like that thumbs up from the crowd over there—insurance program to strengthen this long-term success.

So let me get to a producer right here, Mr. Clark. Obviously, we know you utilize cover crops on all your acres. Can you elaborate on what you have seen with implementing cover crops, and what has it done for your soil health, your yields, your input? Let's talk bottom line here.

Mr. CLARK. Yes, exactly. Well, so many times, Representative Axne, a farmer's success is based on yield. And we are looking at how are we going to maximize our ROI per acre on everything that we have in the farming operation. So when you start to look at the journey that we were on, when we were absolutely maximizing our efficiency on the farm, we were at 100 percent no-till, 100 percent cover crop, and a 60 percent reduction of inputs. So we were still using some fertilizers, some chemistry, but at a greatly reduced rate. We had yields that were increasing year over year, and our stability within the system had gone from a yield variance of 30 bushels of corn to less than 5. So that means it is a stable environment. When you have a stable environment, you then are powerful because then you can react to market fluctuations. When something crazy happens and the markets spike and they take off, you have the ability and the comfort to safely sell into that anomaly because you have this stability now that has been created. And it is not just 1 year, it is 2. This is multiple years of seeing this stability. Thank you for the question.

Mrs. AXNE. Well, and listen, thank you for that answer. If there is anything I know, certainty for our farmers is the number one thing that they are looking for.

Mr. CLARK. I would like to say that there is a county in Iowa, Washington County is a tremendous—I am not sure whose district that would be in—tremendous county, and that is a county that absolutely—they feed off of each other, and they are just growing this. This soil health regenerative movement is exploding in that county.

Mrs. AXNE. Well, that is good to know, and I will absolutely check into it.

So I want to follow up a bit here on this need for more education on technical assistance, which you have mentioned. I want to real-

ly—because I hear from our farmers, and they are talking about the great soil testing and the data that they are getting from that and how they are using it. Do you think that is an area where we could be using more technical assistance in soil testing and interpretation of those results?

Mr. CLARK. Oh, yes. Oh, yes. Well, here is what we are doing at home in Indiana. Every year, we have a USDA NRCS training on our farm, so we are talking to the leaders of the state within USDA. They contact the district conservationists. The DCs are coming to our farm, and we are having a soil health day on our farm. And exactly—we are doing these principles. We are showing the—like the slake test or a slope test. We are showing these things. Then these DCs get to understand this because the DC is the first contact that farmer is going to have. It is imperative that this group of individuals are properly trained so they know how to have a conversation about what is that guy down the road doing?

The CHAIRMAN. The gentlelady's time has expired unfortunately.

Mr. CLARK. Thank you.

The CHAIRMAN. And now I recognize the gentlelady from Minnesota, Mrs. Fischbach, is recognized for 5 minutes.

Mrs. FISCHBACH. Thank you very much, Mr. Chairman. I appreciate the opportunity. And, first, even though I am from Minnesota and we don't often agree with people from Iowa, I just wanted to join Mr. Feenstra in thanking the producers, because I really think that is something that we don't always do and really recognize them as a vital part of the country. And I strongly share his thoughts on the producers and their concerns and their care for the soil health and that we really should be here to help them. And so I just wanted to just reiterate what Mr. Feenstra had mentioned.

And then I just wanted to—Dr. Larson, I appreciate all of your thoughtful answers and have been listening carefully. And in your opinion, Dr. Larson, how do we correct the narrative that American agriculture has killed our soils? And I know that one of the other panelists actually had said that in the written testimony, and so I just wanted to see what your thoughts on how we stop that kind of narrative that is going through America?

Dr. LARSON. Yes, I appreciate that question. As you know, as a scientist and looking at the scientific literature, doing direct physical measurements of the soil to show improvements is tough because the soil by itself is very heterogenic. There is not much uniformity. So to be able to get concrete data and be able to measure very, very tiny changes and this very variable background in immediate time is tough. So we have pivoted to actually looking at the soil microbiome, so measuring the little microbes that are there, the fungi and the bacteria, to understand how our cultural practices impact that dynamic because all of those critters that are in the soil are responsible for ultimately building soil health, cycling nutrients and sequestering carbon. So I think that getting those tools affordable and in the hands of farmers is critical. And I am a strong believer in trying to create bioindicators. So instead of having to look at the entirety of the soil microbiome community, find some key indicator species that can reliably be used to predict in real time what cultural practices are helping or hurting so that we can get that real-time measurement.

Mrs. FISCHBACH. And I appreciate that answer. And I would just say I think that we also just need to really recognize and continue to talk about, like Mr. Feenstra did, that for producers that is their first concern: soil health. It is their livelihood. They need to make a living. And I am just concerned that this kind of narrative that agriculture is ruining soil is a problem, but there are certainly things that we can do to help change that, and I appreciate it.

And with that, Mr. Chairman, I will yield back.

The CHAIRMAN. Thank you.

And now the gentlewoman from Washington, Ms. Schrier, is recognized for 5 minutes.

Ms. SCHRIER. Thank you, Mr. Chairman. And welcome to all of our witnesses. I am loving this discussion. As this Committee examines soil health practices with the farm bill on the horizon, it is worth exploring existing USDA programs that aid growers looking to improve the health of their soils, as we have heard a lot about today. One of the lesser known programs, although I just heard a nod to it earlier, is SARE, the Sustainable Agriculture Research and Extension Program. SARE is a USDA research program that provides grants to farmers to focus research on their very specific needs and communicate their findings and best practices to their community. SARE has funded nearly 200 projects in Washington State alone, focusing on a broad range of topics, including soil additives, tree fruit pests, and sustainable grazing practices.

I am currently working on a bill to modernize SARE to ensure that we are maximizing every tool at our disposal to improve ag research capacity and our ability to study novel regenerative practices that will improve soil health and on-farm productivity.

Dr. Larson, I would love to get your input here. We know that programs like CSP are very popular and often oversubscribed, even in the neighborhood of like three to one in Washington State. I was wondering if you could talk a little bit about SARE or other small-dollar programs that have an outsized impact on soil health and associated climate and yields, as we just heard, benefits?

Dr. LARSON. Yes, so as an academic myself, I appreciate this question. There is so many cool things that happen in 110′2. And academics are very quick to say, hey, look what I did. Now, let's do that on every farm across America. It is not that simple. And I am a huge fan of SARE and promote it widely across all of the sugarbeet cooperatives because it is a very useful tool to help bridge from that interesting academic idea to prove scalability. And we see it honestly as a stepping stone. So I mentioned we are able to use a SARE grant to show our farmers that what happened in 110′2 in this instance is going to work at large scale, that we can cut back fertilizer 30 percent even though we have increased yield 35 percent. And it provides a foundation of data now for next week.

Dr. Bijesh Maharjan at the University of Nebraska and Western Sugar are jointly submitting a CIG On-Farm Innovation Trial grants with the data that we obtained from SARE, the learnings that we had from SARE about the hurdles for grower adoption to be able to scale it up across 100 farmers in two states over 5 years. So SARE is a really important program, and I am so happy that you are expanding and supporting that program.

Ms. SCHRIER. I love that answer because especially now with scarcity of fertilizer and increased costs, the notion that you can cut inputs and increase yields is so important.

I also wanted to highlight the Washington Soil Health Initiative. It is an innovative partnership between Washington State Department of Agriculture, Washington State University, and the Washington State Conservation Commission. And the initiative established a coordinated approach to soil health across the state. The initiative is currently doing a state-of-the-soils assessment to track soil health over time in region and different soil types and developing soil carbon verification metrics for the State Sustainable Farms and Field Program that provides funding for farmers and ranchers to adopt climate-smart practices, and we need the data to back those up. So this is a unique model that uses a multi-pronged approach to study the scientific nuances, while providing pathways for adoption of behavior change. This initiative requires tremendous coordination, and I am so proud to say that Washington State is leading the way.

And as we look to the next farm bill, the initiatives staff highlighted for me and my staff that a national soil health effort would greatly benefit from similar coordination and collaboration between agencies, universities to unify and maximize the impact. So we need to make sure, for example, that we have adequate and diverse staffing like economists and sociologists, data scientists, in addition to farmers to demonstrate the impacts of regenerative practices in organized national and regional adoption efforts. So I look forward to working with my colleagues to provide Federal investment in the SARE program and in these collaborative programs to improve soil health across the board.

And I yield back. Thank you for this discussion.

The CHAIRMAN. Thank you, Ms. Schrier.

And now the gentleman from Minnesota, Mr. Finstad, please, is recognized for 5 minutes.

Mr. FINSTAD. Thank you, Mr. Chairman. First and foremost, I just want to say it is so great for me to be here. This is my first Committee hearing as a new Member to Congress. And it couldn't be a better Committee hearing to be at and a Committee to be on.

I am a fourth-generation farmer from southern Minnesota. Soil is important to us. It is something that we have passed on generation to generation, and the health of the soil is so important that my family actually started and owns and operates a soil laboratory. So you can imagine I am geeking out here today with all of you and the interest that you have in soil health, so it is near and dear to me.

When I look at what we do in southern Minnesota, it is so generationally driven that we care about our land because we know that that is what we have to pass on. And so I am proud to say that my senior in high school, oldest son, has taken an interest in farming, so the soil is pretty important to us and making sure that we are leaving it better for him to farm in the next generation.

But as I look at farming practices and policy that we have the opportunity to discuss here, I like looking at data and I like trying to understand the science behind the data and understanding the application and the implication of the policies that we do here.

So, Dr. Larson, a 2017 survey found that more than 95 percent of Nebraska growers use herbicide to terminate cover crops. A 2021 study found that about 80 percent of all U.S. growers use herbicides to terminate cover crops. And so presumably, this is because herbicides are the most effective methods to do that. And, as a farmer and as someone that has seen the pros and cons and the effects of using herbicides and using them at the right rate at the right time to control cropping decisions, my question, Dr. Larson, is would you agree that herbicides are an important tool for growers to have available at our fingertips to improve cover crop adoption in the United States?

Dr. LARSON. Absolutely 100 percent. And I appreciate that question. If we lose those tools, it is going to be a major step backwards in terms of conventional agriculture that dominates a majority of the farming acres. If we take those away, mechanical removal is the next best option, and that is going to disturb the soil, it is going to release the carbon that was captured in the soil back into the atmosphere, and it is going to destroy the soil microbiome down beneath the soil.

Mr. FINSTAD. Thank you, Dr. Larson. And, for me, the discussion of herbicides and the use of herbicides, the when and the where and the how, is just a real and alive issue for me, someone that grew up walking beans in southern Minnesota. There was definitely great value in that work ethic and that family bonding that happened during that process. But there is also the efficiencies gained and the yields that we were able to see the increase based on the timely use of herbicide and the right use of herbicides. And I will say that as we as farmers are asked to feed a growing global world, it is so important for us to have that balance and maybe not a one-size-fits-all or nothing approach. So I appreciate your willingness to be here today and your adding to this conversation and all of you for the work that you are doing, again, to preserve the soil that is the greatest asset that we have to pass on to our next generation, so thank you all.

I yield back, Mr. Chairman.

The CHAIRMAN. Thank you. And now the gentleman from California, Mr. Panetta, is recognized for 5 minutes.

Mr. PANETTA. Thank you, Mr. Chairman. Thank you to our witnesses. And, Mr. Finstad, welcome. I look forward to working with you. It is good to be here. Thank you.

I come from the Central Coast of California. Obviously, we have a lot of specialty crops there. As you know it and as I like to say, you name it, we grow it. But despite that, I feel that my producers in my district are doing a lot when it comes to paving the way for climate-smart, soil-smart farming practices.

To that end, I want to address a bill that Representative Baird from Indiana and myself have put forward, H.R. 7752, the Plant Biostimulant Act. As some of you may be aware, plant biostimulants are an emerging and rapidly growing ag input that have the ability to improve and enhance our soil health. The plant biostimulant category covers a diverse set of technologies, but most of the products are derived from naturally occurring materials or microbes that were discovered to be beneficial to the soil or plant health or even both.

Now, similar to how probiotics are good for us, plant biostimulants can increase diversity of the soil microbiome, fix nitrogen in the soil, make nutrients more available to the plants, and improve soil structure that increase water holding capacity or organic content. The bill that we introduced would create a Federal definition for *plant biostimulants,* which is a term that has not yet been defined at the Federal level. It would also amend and clarify two other related definitions and authorize USDA to perform a soil health study on plant biostimulants so that we can fully understand and advance the contributions to better our soil health. That is why I do believe that H.R. 7752 is an important bill.

Now, Mr. Clark or Mr. McCarty that is virtual, have you heard of the term *plant biostimulant?*

Mr. CLARK. Oh, yes. I am glad you brought this up.

Mr. PANETTA. Great.

Mr. CLARK. This is right where I want to be.

Mr. PANETTA. In what way?

Mr. CLARK. I am not a biologist, but I do know that there is a living, breathing microbiome below our feet. And I feel like, through our journey, I was very stubborn in not pursuing these avenues of bringing these stimulants to the farm because this is going to speed up the soil health-building process. Okay? So my stubbornness has probably delayed our seeing this by a few years, but I think if a person is in a high-tillage environment and they want to transition to regenerative practices, this is what you add as an augmentation to your system. And it is a system. The microbial package has got to be a system just like anything else is.

Mr. PANETTA. Yes. Now, Mr. Clark, what do you think we in Congress or this Committee could be doing better to ensure further education around plant biostimulants or other innovative soil health technologies and practices?

Mr. CLARK. I think there needs to be—academia needs to have students that are going to go out and we need to identify more of this microbial biome. And then what do certain sectors do? For example, I think where we are going to head one day is we are going to sit down and we are going to say, "Okay, what are your three biggest weed problems? What is your next cash crop going to be? And now this is the cocktail package we are going to put together and augment it with a stimulant package because it is going to create an environment that water hemp, for example, is not going to want to germinate and grow in." That is where this needs to go.

Mr. PANETTA. Great. And that starts with the passing of the Plant Biostimulant Act, right?

Mr. CLARK. Yes.

Mr. PANETTA. Great. Thank you.

Mr. CLARK. Thanks for bringing this up.

Mr. PANETTA. Just checking.

Mr. Moyer, let me pivot to you. Your testimony describes regenerative organic. In my district, look, we get it when it comes to the value of organic and the reason why consumers trust that label. Now I met with a group yesterday that referenced how *regenerative* could mean six or seven different things when it comes to agriculture. To me, that seems to complicate things for our longstanding organic producers that have relied on the National Or-

ganic Program for years to market and certify their products. Can you discuss, Mr. Moyer, whether there is a need to formalize that definition at the Federal level at the USDA and what the lack of standards or consistent definitions might mean for producers on both sides of the conversation?

Mr. MOYER. Yes, a complicated question, and thank you very much for it. I do not think that we need a national standard at this point in time. We have great partnerships with industry and nonprofits and the Federal Government currently, so we do have a standard out there for regenerative organic that is being rolled-out across the world, and we are seeing great success in that partnership between the Federal Government, nonprofits, and the food industry, giving people the opportunity to have great input and impact into how they define it.

Mr. PANETTA. Thank you, Mr. Moyer. I am out of time. Mr. Chairman, I yield back.

The CHAIRMAN. Absolutely. Thank you.

And now the gentleman from Nebraska, Mr. Bacon, is recognized for 5 minutes.

Mr. BACON. Thank you, Mr. Chairman.

It is great to have a Nebraska panelist with us as well, so welcome. In fact, my first question is for you, Dr. Larson, if I may. I have read this, and I want you to just give me your comments if it is true or not or your insights. People say organic food is produced without the use of pesticides, but that is not really the case. While organic production cannot use synthetic pesticides, you can still use organic pesticides. Because these organic pesticides are generally less effective, they tend to be used more intensely. And organic producers often have to apply them multiple times throughout the growing season. Dr. Larson, can you talk more about how organic herbicides are not always better for soil health and just give us your insights?

Dr. LARSON. Yes, so organic farmers do have the capability to use non-synthetic herbicides, so oftentimes, they will resort to things like acids. Acetic acid is a common one to terminate cover crops. But they primarily rely on tillage in order to destroy cover crops and manage weeds. And even in the no-till organic system that—if you look at the Rodale Institute's website—indicates they still have to plow every other year. And so if you have taken the time to sequester all that carbon into your soil and then you reintroduce a plow, whether it is every year or every other year, that carbon storage is not permanent. It is reversible. And so when they go through with that plow, they are releasing all of that carbon that they have stored and worked so hard for back into the environment. But yes, tillage is the primary thing that they rely on. But yes, many people think that there are no chemicals in organic, but there are. They are just natural and usually less effective.

Mr. MOYER. I would like to correct one statement, having being at Rodale Institute. If you look at the data that we put out there, and I would encourage you to look at the facts that we do not till every other year. That is not the system that we are employing. So tillage is not the enemy, depending on how and where you do it, and I think we can mitigate many of those problems.

Mr. BACON. But you do use organic herbicides or pesticides, right?

Mr. MOYER. I am sorry?

Mr. BACON. But you do use organic—I want to make sure I get my right terms on here—inputs.

Mr. MOYER. We use organic inputs?

Mr. BACON. Okay.

Mr. MOYER. I am sorry——

Mr. BACON. The question was—okay, let me find my right question here, go back to this one. You are still using organic pesticides. Am I correct?

Mr. MOYER. We do not.

Mr. BACON. Okay.

Dr. LARSON. I will recognize the fact that I did cite the Rodale Institute's website directly, and it is within my written comments that says that with organic no-till, you have to plow every other year. I don't implement it, I don't know much about it, but that was just pulled from Rodale Institute's website.

Mr. BACON. Okay. And with that, Mr. Chairman, I will yield back.

The CHAIRMAN. Thank you.

And now the gentlewoman from North Carolina, Ms. Adams, who is also the Vice Chair of the Committee on Agriculture, is now recognized for 5 minutes.

Ms. ADAMS. Thank you, Mr. Chairman. Thank you so much also to the Ranking Member for today's hearing on soil health. And to our witnesses, thank you for your testimony.

Soil is the source of our lives, and it is responsible for life on Earth. So listening to our witnesses today describe a broken food system and sound the alarm—the alarm is going off—the alarm to increasing soil degradation leads me to acknowledge that regenerative agriculture is part of the solution to this crisis. It has also proven to be a profitable way to farm, but yet only one percent of American farmland is certified organic and farmed regeneratively. So it is time for a massive shift to save our agri-system.

Mr. Clark, the importance of conservation opportunities has been cited throughout this panel. Farmers can sign up for climate-friendly bundles under the Conservation Stewardship Program, but not many do. What incentives can we provide to farmers to increase their participation in CSP?

Mr. CLARK. Right, that is a great question. I think it goes back to the teaching again. I think, unfortunately, there may be just plain and simply the farmer does not have faith in that individual to guide them in the right direction. For example, I mentioned earlier in testimony that we have teachings at our farm through USDA NRCS. We were very fortunate to have a very great group of young DCs. Every one of these DCs did not have any agricultural background. So it is imperative that the proper teaching is given to these folks so that they then can properly implement these great programs like CSP, EQIP, no-till programs and such. So thank you for the question, Representative Adams.

Ms. ADAMS. Education is the key.

So, Mr. Nygren, in my home State of North Carolina, millions of hogs and chickens are being raised in large factory farms. These

operations are clustered within communities of color, and many have faced environmental and health impacts. So how can more regenerative agriculture help strengthen the economies of rural communities in North Carolina?

Mr. NYGREN. We realize that we have lost a lot of our small family farms. They are the ones that really support the agrarian economy, the local merchants. And if we bring small farms back into our rural communities across the United States, we will not only have a local food system that doesn't depend on the fossil fuels to get it to the shelf, but it can go directly from the farms to the consumer. But it will really stimulate the local economy, which will totally change our small towns across America.

Ms. ADAMS. Okay, thank you. So let me ask Mr. Clark about regenerative practices that that you have undertaken. You mentioned that the transition to some can take years, while incentives are sometimes only focused on the short-term. So how were you able to successfully bridge that gap?

Mr. CLARK. Yes, that that is a great question. It takes courage. You have to be faithful and understand that you are starting to work with Mother Nature. And we need to figure out how the best ways are to accommodate working with this microbial biome. I mean, this was just 15 years ago. I knew nothing about this. It has been there for a long time. I knew nothing about it. I am not a biologist. I am not an expert in this area. I do know that biology exists. I have seen it. I have a microscope myself. I can get it out. I can look at things. I don't know what they are all called. But I can see the change. I can see the numbers are different. So it is very, very important that you surround yourself with positive people that give you reinforcement. This is very important. Negativity brings everybody down, so positive reinforcement, and everyone is on the journey, the ride of the journey. And that is what this is. You are trying to figure out how to work and grow with Mother Nature and build soil health and what we haven't talked much about today is human health.

Ms. ADAMS. Thank you, sir. I am out of time.

Thank you so much.

Mr. CLARK. Human health is very important also.

Ms. ADAMS. Thank you, sir. I am out of time. Mr. Chairman, I yield back.

Mr. CLARK. Thank you.

The CHAIRMAN. And thank you, Vice Chairlady.

And now gentlelady from Florida, Mrs. Cammack, is now recognized for 5 minutes.

Mrs. CAMMACK. Well, thank you, Mr. Chairman, and I appreciate the conversation today regarding soil health. Representing a state that produces over 300 specialty crops and is a major contributor to our nation and the world's agriculture, this is a very important topic.

I am going to focus in on a couple of key issues, but this first question goes to all of our panelists. We can start going down the line. First and foremost, thank you for being here today both to, as I said, the Chairman and the Ranking Member.

But I want to start out with a discussion about biochar in agricultural production and its application. In Florida, the use of

biochar derived from wood products or waste is viewed as a positive new advancement for soil health and agricultural production. For example, there are a number of nurseries, citrus groves, and others who have incorporated the use of biochar into their operations. Now, according to the University of Florida's Institute of Food and Agricultural Sciences, IFAS, biochar can have benefits for waste production, energy production, carbon sequestration, and soil fertility without sacrificing any production tools needed. Now, moreover, UF IFAS notes that biochar can positively and simultaneously improve crop yields and reduce fertilizer requirements for crops in certain environments, and we are going to continue to push for additional studies on this issue. But would any one of our witnesses be able to speak to the potential benefits for both producers and soil health by increasing the use of biochar in certain production areas throughout the United States?

Dr. LARSON. I would like to speak to that question if that is okay?

Mrs. CAMMACK. Wonderful.

Dr. LARSON. We actually got a grant just this morning from the Partnerships for Climate-Smart Commodities that is focused on this exact principle, high carbon soil amendment with biochar. This is imperative in terms of trying to address our soil health challenges. As I mentioned, all the stuff that we have talked about today that is currently recognized in conservation practice standards by NRCS is not enough to do more than just offset current emissions. We need frontier technologies such as biochar and high carbon soil amendment to help repair some of the damage from the past and be able to take care of some of that legacy load of carbon within the atmosphere. And this is an excellent opportunity. We are actually recycling a waste stream from our factory to implement this high carbon soil amendment, but the overarching goal of our project is to be able to build in best management practices to this brand new interim conservation practice standard 808 as the biochar infrastructure is developing across the nation.

This is a great way to take material that could just sit and rot and cause emissions into the atmosphere and turn it into a high carbon, stable form of carbon that can be injected directly into the soil. This is going to be a gamechanger in terms of replacing compost. It is going to be a gamechanger for dealing with food waste. It is an excellent opportunity for everybody, going forward.

Mrs. CAMMACK. Wonderful. Thank you so much for that.

Mr. CLARK. I am not an expert in biochar. I don't claim to be. But what I would like to say is that when you implement the principles of soil health, you increase your biomass that you are producing from your cover crops, you are feeding this microbial biome. I am not sure that in that instance biochar is going to benefit me as much as I can benefit with mechanically terminating cover crops that will feed this microbial biome. But again, I am not an expert.

Mrs. CAMMACK. I appreciate your insight, Mr. Clark.

Mr. MOYER. Yes, I would agree with you, Rick. I think it depends where you are in the spectrum of transition and the quality and the current health of your soil. What we have noticed is that soils that are highly degraded, the input of biochar makes a big difference, same with those biostimulants that we talked about ear-

lier. And as you progress in your journey towards a healthier soil, you see less and less impact or measurable impact from that biochar. But there is certainly an opportunity there to have great success by using these new tools.

Mr. MCCARTY. I would add to that as well that, in particular, where I live in the country in northwest Kansas, in particular in the areas such as the one we are going through today under extreme drought conditions, cover crops might not be an issue. Frankly, they are not an issue or an option right now for most dryland farmers. But having the tool of biochar available in the toolbox allows for continued improvements in soil health, carbon sequestration in years when implementing cover crop programs are not a viable option, such as this year.

Mrs. CAMMACK. That is wonderful. And my time is about to expire. I have a follow-up question that I will submit for the record. If we could get a response, I sure would appreciate it. And thank you all for appearing before the Committee today. Thank you, Mr. Chairman. I yield back.

The CHAIRMAN. Thank you.

And now the gentleman from Georgia, Mr. Bishop, is recognized for 5 minutes.

Mr. BISHOP. Thank you very much, Mr. Chairman. And let me thank you and Ranking Member Thompson for hosting this hearing. It is very, very timely. And I want to thank our witnesses and a special shout-out to Mr. Nygren, who is from Georgia. And I would like to address this question to Mr. Nygren.

I was very pleased to see you mentioned Mr. Will Harris in your testimony. As you know, I represent the Second District in Georgia where Mr. Harris lives and where he operates White Oak Pastures. He has been recognized throughout our state, the nation, and even globally for his impeccable stewardship and commitment to regenerative agriculture. Mr. Sedrick Rowe, also referenced in your written statement, is another constituent of Georgia's Second District, and many of the practices that he implements on his farm demonstrate benefits for both soil health and mitigating climate change.

So I have several questions to follow up on your written testimony. You mentioned the efforts to build the organic peanut sector in Georgia and how organics can be more profitable. Can you tell us what makes organic farming more profitable? And how does the transition to organic farming affect the bottom line cost of production?

Second question, you stated that industrial agriculture damaged the local agrarian economy. Do you believe that the ultimate goal is to replace industrial farming with local regenerative farms? And if so, will the production of food from these farms be sufficient to feed the growing population in the U.S. and across the world? Or do you think the number of regenerative farms should be increased to build a more resilient supply?

And finally, you in your testimony discuss the threat that is posed by the development of agricultural land. And you mentioned the loss of jobs and farm output. How can existing programs help and our easement programs a viable way to keep land in production? Those are three questions. I hope you caught them.

Mr. CLARK. Is that question to me or Mr. Moyer?

Mr. BISHOP. It is to Mr. Nygren I think.

Mr. NYGREN. Yes, I can answer the economic piece, but I would yield to Mr. Moyer to talk about the science.

Mr. BISHOP. Very good. Very good.

Mr. NYGREN. Yes. But if you look at Will Harris in your own district, I think you would admit that the local merchants and the local economy, there was a lot of vacant housing that existed a couple decades ago.

Mr. BISHOP. Absolutely.

Mr. NYGREN. And it was when he changed his farm practices—and I don't know the science, I just know the economics of it—that totally changed the economy for the entire county. I believe you now have a housing shortage. You have a complete employment base that is being attracted to your county that did not exist before Will Harris changed his practices.

Mr. BISHOP. Absolutely. Absolutely.

Mr. NYGREN. I will yield if possible to Mr. Moyer to talk about the science of that.

Mr. BISHOP. Okay.

Mr. MOYER. I am not sure what the question was about the science or the economics. I mean, there is really a great difference in the economics of organic agriculture because what we are seeing is a marketplace that is supporting farmers at the point of purchase for the true cost of producing that food. So many organic farmers, depending on their scale, do not necessarily avail themselves to government subsidy programs. They are making money by selling the product at a point of purchase for the value that it takes to produce that crop. And that has really been able to change the economic picture of many farms across the country.

Mr. BISHOP. The other question I really would like to follow up on, and any panelists can chime in on this. Do you believe that the ultimate goal is to replace industrial farming with local regenerative farms? And if so, will the regenerative farms be sufficient to feed the growing U.S. population or do you think the number of regenerative farms should be an increase so we have a more resilient supply chain?

Dr. LARSON. A meta-analysis that was recently completed shows that organic agriculture at scale lags behind conventional farming to a point of 20 percent. And if they were able to implement best management practices, that yield gap may increase up to 34 percent compared to conventional farming, and I will provide those citations.[2]

The other issue that you face is you can reduce, or you can increase that—decrease that yield gap between conventional organic, and at optimum, scientists predict that you could get between an eight to nine percent yield drag, which, as Mr. Moyer indicated in his testimony, a ten percent loss of yield due to soil health degradation would be devastating for climate change because it would require millions of acres to be converted. And there is nothing more detrimental to the protection of climate change and biodiversity than land use change.

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[2] **Editor's note:** the supplementary material referred to located on p. 98.

The CHAIRMAN. The gentleman's time has expired.

And now I recognize the gentleman from Georgia, Mr. Allen, for 5 minutes.

Mr. ALLEN. Thank you, Mr. Chairman, and thank you to our panel for your expertise.

Obviously, innovation is important to this nation. However, we have been in our districts for the last month, and I have gotten an earful from the people. My constituents are sick and tired of this government perpetrating its will on them on what to drive, what is morally right and wrong, and it is one issue after the other. And so well, it is just, I don't care if the policies are terrible. This is just the way it is going to be. And, I am afraid we are caught up in another one of those things here where we are talking about changing the way we feed this country. And obviously, the importance, it is a national security issue.

And, the best example that that I have is Sri Lanka. I mean, that government perpetrated on its farmers banning the use of synthetic fertilizers and pesticides. We are already having issues with that on our farms today, and it is going to affect yields this year, I mean, what the EPA is trying to do to them. The result of this was catastrophic. Yields for rice fell by 20 percent within the first 6 months of the policy, driving up food prices and forcing the largely self-sufficient country to import substantial quantities of rice to feed its people. We can't have this in this country. Plus the fact that what our farmers have been able to achieve in yields and other things has really allowed us to participate in feeding the whole world. The whole world is using us as an example of the freedom to innovate and to produce yields and to use the products available to us to do that.

And there are no better conservationists than our farmers. This land has been, most of it, been in their families for generations. They have to protect the land, and we have to assist them with that, but we don't need these one-size-fits-all government policies that are creating havoc in the marketplace out there.

Dr. Larson, you talked about the wholesale elimination of pesticides and how that is going to affect what we are dealing with here. You specifically referenced effects on food waste and land conversion. Any way to predict what is going to happen? If this is—like I said, we don't want to be another Sri Lanka.

Dr. LARSON. Why don't I give you a personal example of when mandates have gone wrong in my own life? So I live in Boulder County, Colorado. The County Commissioners passed a ban on all GMOs and pesticide usage on Boulder County open space that encompassed a lot of our sugarbeet acreage because they had some folks come in and promise them that no-till organic was possible and would have better environmental and economic outcomes for our farmers. Well, 10 years later almost and millions of dollars spent trying to scale that up, there is not a single organic or conventional farmer that has switched to that within our geography because it has been too difficult to amass enough biomass with a spring-planted cover crop. So they have reverted back to what the farmers had done and come to their conclusions on their own to promote soil health because the science never added up and the economics never added up.

Mr. ALLEN. And with that, without objection, Mr. Chairman, I would like to submit an article for the record titled, *In Sri Lanka, Organic Farming Went Catastrophically Wrong.* This article was published on March 5, 2022, in FOREIGN POLICY and dives further into Sri Lanka's organic crisis.

The CHAIRMAN. Without objection, Mr. Allen.

[The article referred to is located on p. 78.]

Mr. ALLEN. Thank you very much.

Dr. Larson and others on the panel—and we have about 50 seconds here—claim organically produced food is more nutritious because the soil in their system is healthier. What does the science say on this matter?

Dr. LARSON. As I mentioned, I will provide some scientific literature because I think what is important is to look at the peer-reviewed literature in terms of scientific consensus on this matter.[3] And there isn't any evidence that the food produced through organic farming methods is more nutritious, safer, or healthier for people to consume. And in fact, promoting that misconception that does not agree with scientific consensus is causing Americans, especially low-income and marginalized communities, to purchase and consume fewer fruits, vegetables, and grains that was found from an Oxford University study.

Mr. ALLEN. Yes. And for the record, Mr. Chairman, I grew up on raw milk, and I am still here. So anyway, with that, I yield back.

The CHAIRMAN. Yes, sir. I did, too.

Mr. ALLEN. And you are still here.

The CHAIRMAN. Right from the cow on my grandfather's farm where I grew up.

Mr. ALLEN. On my dad's farm.

The CHAIRMAN. There you go. All right. And now the gentlewoman from the U.S. Virgin Islands, Ms. Plaskett, who is also the Chair of the Subcommittee on Biotechnology, Horticulture, and Research for 5 minutes.

Ms. PLASKETT. Thank you very much, Mr. Chairman. Thank you so much for convening this hearing and for the Members who have offered your questions. And this has really been very informative. I am really appreciative.

I have a question for Mr. Moyer. In your written testimony, sir, it includes three priorities, funding for cover crop utilization; two, additional funding for USDA organic transition initiatives; and three, strategic planning to better serve farmers adopting regenerative organic models. Why are these three the most important priorities for Rodale, and to what extent can existing programs achieve these goals?

Mr. MOYER. Well, thank you very much for the question and opening up the conversation around support mechanisms for farmers wishing to make that transition. We have heard throughout the testimony today that education is clearly important to farmers. Anytime a farmer is making a transition—and we are not suggesting we do away with industrial agriculture. We are suggesting we transition agriculture from one mode of production to something that is more focused on soil health.

[3] **Editor's note:** the supplementary material referred to located on p. 98.

In order to make that transition, you have farmers—no matter what the transition is, people need help and guidance, support, education, consulting, and we want to make those dollars at the Federal level available for farmers who choose, not who are mandated, but who choose to make a difference in their farming operation, whether in whole or in part, by acre or by crop. The USDA program allows for multiple implementation strategies. But farmers need that guidance and support in order to make that change. They need to know that they are not alone in making that transition and that there are support mechanisms in place.

Ms. PLASKETT. Thank you. In my district of the Virgin Islands, our farmers are operating on very small farms. And so they need to really be conscious of soil health because to be able to pass it throughout generations, this is an important component. So, as you said, this is not mandated. This is a choice. And I think it is important for USDA to provide the support, and so I am grateful to you for sharing with us those priorities and how that is done.

Mr. Nygren, your written testimony refers to soil health as the platform to bring our small towns back to life. You mentioned that you believe value-added production will follow healthy soil. Do you believe that these are areas where soil health should be targeted, and how do we do that?

Mr. NYGREN. I think one of the important things in the entire discussion is that we are not suggesting one or the other. I think this is talking about giving the small farmers, the farmers that are willing to address the science, an equal chance and that has not happened with a lot of the policy and the funds that come out of the past farm bills. And that is one thing that you can change in this farm bill, to give them simply an equal chance with the industrial farms.

Ms. PLASKETT. Right. Thank you. And I am so glad that both of the witnesses are pointing this out, that what we are giving individuals are choices, particularly for small farmers. I know that often in testimony that I have heard, it plays well to say that these are absolutes and that the Democrats are forcing you to do something. That creates a good sound clip. But that is not what we are talking about here in the farm bill. What we are talking about is giving those who are interested the opportunity to do that. And I think that that is what we, as all Members, used to be interested in doing.

Mr. Clark, thank you as well for your testimony and for your measured responses. I am really very appreciative of that. Your testimony mentions the need to build local and regional processing infrastructure. In the Virgin Islands we are very interested in how do we bring value added? How do we do that processing infrastructure? How does that impact soil health in that?

Mr. CLARK. Yes, it is very important that the—one of the principles of soil health is integrating livestock, and then you have to be able to have an outlet for those livestock to go to. So it is very important that we have processing facilities for small operations, medium-sized operations, and the larger operations. I see this as a benefit to building soil health because integrating livestock, we do it on our farm. If you want to increase soil health the quickest and the most efficient way, you need to have livestock on your

property, and you need to follow the proper rotational grazing rules.

Ms. PLASKETT. Thank you. Thank you so much, again, to the Chairman, and I yield back.

The CHAIRMAN. Thank you very much. And now, ladies and gentlemen, we have reached the end of this outstanding, informative, and historic hearing. I want to thank each of you. Mr. Jeff Moyer, CEO of Rodale Institute, Kutztown, Pennsylvania, thank you.

My good friend, Mr. Steve Nygren of Georgia, founder and CEO of Serenbe, Chattahoochee Hills, Georgia, and my constituent, thank you for your leadership over the years. You pioneered this area years ago, and you stuck to it. I followed your career closely through the years jointly with mine, as you have.

Mr. Ken McCarty, partner of the McCarty Family Farms in Colby, Kansas, I can't thank you enough for dramatizing and hitting the critical nature, the crisis that we face for the future of our food supply. Thank you.

And to Dr. Rebecca Larson, Ph.D., Chief Scientist and Vice President, Government Affairs, Western Sugar Cooperative of Denver, excellent, all of you. Thank you.

And we also had—did I miss—oh, Rick Clark, there he is. Rick, I can't thank you enough. You sound the alarm. Paul Revere will be very proud of you. As I said, the British might not be coming, but a food shortage, a crisis is coming if we fail to act. So I want to thank you, Rick, owner, Farm Green and Clark Land and Cattle of Williamsport, Indiana. I can't thank you enough.

And it is so important that we clearly point out how important our soil it is. It is the earth. The good Lord created us from there. As he scooped down to the earth, we come from there. We are a part of it. And so I just want to thank you because we call it Mother Earth for a reason. It is the origination of us, our food, our existence, and we have to take care of it. And you all have helped us here. The nation is grateful. I think we have opened a light and showed that we are moving ahead. And this was why it was important for this Committee to do it. And I want to thank you.

And you heard from both the Republicans and Democrats, who shared their feelings, individual of our sincere appreciation, and their top-of-the-line interests to make sure that we never have a food shortage. In order to do that, we have to take care of our soil that produces our food and our survival.

So I can't thank you enough. And I just want to say God bless you and thank you. And Oh, I see. Who seeks recognition?

Mr. BAIRD. Congressman Baird. Congressman Baird from Indiana.

The CHAIRMAN. Oh, yes, Mr. Baird. Go right ahead.

Mr. BAIRD. I just wanted to add to what you have said and welcome and express my appreciation for Mr. Clark from my district being here and being on the panel. So thank you for letting me do that.

The CHAIRMAN. Amen. And I say to you, thank you for having Mr. Clark.

Mr. CLARK. It was an honor to be here. Thank you.

The CHAIRMAN. As I said, I know if he were here, but I said Paul Revere would be proud of him. He sounded the alarm for us to get ready, and we are going forward with this.

So under the Rules of the Committee, the record of today's hearing will remain open for 10 calendar days to receive additional material and supplementary written responses from the witnesses to any question posed by a Member.

And with that, this hearing of the Agriculture Committee of the House of Representatives in Congress is adjourned.

[Whereupon, at 12:38 p.m., the Committee was adjourned.]

[Material submitted for inclusion in the record follows:]

SUBMITTED STATEMENT BY HON. ALMA S. ADAMS, A REPRESENTATIVE IN CONGRESS FROM NORTH CAROLINA; ON BEHALF OF ENVIRONMENTAL WORKING GROUP

Agriculture is a significant and growing *source*[1] of greenhouse emissions. In particular, *nitrous oxide*[2] emissions from fertilizing crops and animal feed, and *methane*[3] emissions from livestock and their manure, are growing sources of greenhouse gas emissions. Unless we reduce agricultural emissions of nitrous oxide, carbon dioxide and methane, we will fail to achieve the greenhouse gas reductions *needed to*[4] avoid the worst impacts of the climate crisis.

Voluntary conservation programs administered by the Department of Agriculture could play a significant role in reducing greenhouse gas emissions and help ensure farms are better able to withstand the extreme weather caused by climate change. Conservation practices that reduce greenhouse gas emissions can also improve air and water quality and provide habitat for wildlife.

But, because of its misplaced spending priorities, USDA *turns away*[5] two out of every three farmers seeking conservation assistance designed to reduce greenhouse gas emissions. The historic funding included in the Inflation Reduction Act for conservation practices could help reduce this backlog and reduce emissions. But Congress must reform these programs to fulfill the promise of the IRA funding and ensure it flows to greenhouse gas reducing practices.

To accomplish this goal, Congress must:

- **Reform CSP.** Congress *should reform the Conservation Stewardship Program (CSP)*[6]* to make the reduction of greenhouse gas emissions its primary purpose. Congress should reward "early adopters" by linking CSP eligibility to past climate stewardship; focusing funding on practices that reduce emissions; prioritizing contracts to reward those that include multiple emissions-reduction practices; and prohibiting CSP spending on practices that increase greenhouse gas emissions.
- **Reform EQIP.** Congress should expand and reform the *Environmental Quality Incentives Program (EQIP)*[7] to make climate the *primary purpose of EQIP incentive contracts;*[8] provide 90 percent cost-share for EQIP practices that reduce greenhouse gas emissions; reduce Federal cost-sharing for structural practices that provide few environmental benefits; create a methane emissions demonstration project; and prohibit EQIP spending on practices that increase greenhouse gas emissions.
- **Reform CRP.** Congress should *expand and reform*[9] the Conservation Reserve Program (CRP) by increasing program funding and focusing CRP enrollment on marginal, environmentally sensitive land through *long-term and permanent*[10] easements. In general, 80 percent of CRP acres should be enrolled through CLEAR30, Conservation Reserve Enhancement Program agreements, or continuous enrollment categories.
- **Reform ACEP.** Reform the Agricultural Conservation Easement Program (ACEP) by increasing funding for wetland reserve easements; making past and future climate stewardship a condition for enrollment in Agricultural Land Easements (ALE); and prohibiting ALE easements on farmland that increase greenhouse gas emissions.

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[1] *https://cfpub.epa.gov/ghgdata/inventoryexplorer/#agriculture/entiresector/allgas/category/all*.

[2] *https://cfpub.epa.gov/ghgdata/inventoryexplorer/#iallsectors/allsectors/nitrousoxide/invent sect/all*.

[3] *https://cfpub.epa.gov/ghgdata/inventoryexplorer/#iallsectors/allsectors/methane/invent sect/all*.

[4] *https://www.science.org/doi/10.1126/science.aba7357*.

[5] *https://www.ewg.org/news-insights/news/2021/08/growing-farm-conservation-backlog-shows-need-congress-spend-smarter*.

[6] *https://www.ewg.org/news-insights/news/2022/08/usda-conservation-stewardship-program-could-do-more-tackle-climate*.†

* **Editor's note:** footnotes annotated with † are retained in Committee file.

[7] *https://www.ewg.org/news-insights/news/2022/04/climate-change-isnt-high-priority-12-billion-usda-farm-stewardship*.†

[8] *https://www.ewg.org/news-insights/news/2022/05/few-states-are-prioritizing-climate-usda-incentive-bonus-program-0*.†

[9] *https://www.ewg.org/news-insights/news/2022/09/we-must-expand-and-reform-usdas-conservation-reserve-program-0*.†

[10] *https://www.ewg.org/news-insights/news/2022/04/its-time-reform-conservation-reserve-program-not-reason-you-might-think*.†

Practices that reduce greenhouse gas emissions [11] are not getting enough support from USDA conservation funding. For example,

- Just *20 percent of EQIP funding* [12] supports practices that reduce greenhouse gas emissions, and some EQIP funding supports those practices that increases emissions.
- Almost 40 percent of *CSP practices offered* [13] between 2017 and 2022 scored poorly for reducing greenhouse gas emissions, according to USDA.
- Most CRP acres are returned to production after contracts expire, *releasing soil carbon* [14] into the atmosphere, and the number of acres enrolled in long-term CREP agreements is falling.
- Farmers enrolled in ALE are not required to take steps to reduce greenhouse gas emissions.

Congress should also take steps to prohibit misleading claims about the benefits of conservation practices, including "regenerative agriculture" claims. Unlike *organic claims,* [15] which must meet *Federal standards* [16] and are subject to *audits,* [17] assertions that foods regenerate soil are not tied to Federal standards and do not require third-party verification. Some private and nonprofit regenerative *standards and auditors* [18] have emerged, but there is not yet a *widely accepted* [19] definition of the term "regenerative," and farmers and food companies do not have to seek third-party audits when making these claims. As a result, many food companies make *misleading "regenerative" claims* [20] that have created significant consumer confusion.

Congress should also support efforts to scale up the production of plant-based or vegetarian options. USDA has provided *$50 billion in subsidies* [21] to livestock operations since 1995 but just $30 million to plant-based or vegetarian operations. By investing in plant-based or vegetarian alternatives, Congress would support not only consumer choices that reduce greenhouse gas emissions but also farmers' growing soybeans, wheat, mushrooms, and pulse crops, and *more than 50,000* [22] jobs.

Thank you for the opportunity to submit testimony for the record.

SUBMITTED ARTICLE BY HON. RICK W. ALLEN, A REPRESENTATIVE IN CONGRESS FROM GEORGIA

FP

[*https://foreignpolicy.com/2022/03/05/sri-lanka-organic-farming-crisis/*]

Analysis [1]

In Sri Lanka, Organic Farming Went Catastrophically Wrong

A nationwide experiment is abandoned after producing only misery.

March 5, 2022, 7:00 a.m.

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[11] *https://www.ewg.org/sites/default/files/2022-02/EWG%20Conservation%20Testimony%20-%20Conservation%20Programs%20-%202-2-22.pdf*.†

[12] *https://conservation.ewg.org/*.

[13] *https://www.ewg.org/news-insights/news/2022/08/usda-conservation-stewardship-program-could-do-more-tackle-climate*.†

[14] *https://iopscience.iop.org/article/10.1088/1748-9326/ab0399*.†

[15] *https://www.ams.usda.gov/rules-regulations/organic/labeling*.

[16] *https://www.ams.usda.gov/rules-regulations/organic/labeling*.

[17] *https://www.ams.usda.gov/services/enforcement/organic*.

[18] *https://regenorganic.org/#storytime*.

[19] *https://www.frontiersin.org/articles/10.3389/fsufs.2020.577723/full*.†

[20] *https://www.ewg.org/news-insights/news/2022/05/beware-misleading-regenerative-soil-claims-non-organic-foods*.†

[21] *https://www.ewg.org/news-insights/news/2022/02/usda-livestock-subsidies-near-50-billion-ewg-analysis-finds*.†

[22] *https://www.plantbasedfoods.org/wp-content/uploads/PBFA-Jobs-Report-2019.pdf*.†

[1] *https://foreignpolicy.com/channel/analysis/*.

Tea pickers remove weeds at an organic tea plantation in the southern district of in Ratnapura, Sri Lanka, on Aug. 3, 2021. Ishara S. Kodikara/ AFP Via Getty Images.

By **Ted Nordhaus**,[2] the executive director of the Breakthrough Institute, and **Saloni Shah,**[3] a food and agriculture analyst at the Breakthrough Institute.

Faced with a deepening economic and humanitarian crisis, Sri Lanka called off an ill-conceived national experiment in organic agriculture this winter. Sri Lankan President *Gotabaya Rajapaksa*[4] promised in his 2019 election campaign to *transition the country's farmers*[4] to organic agriculture over a period of *10*[4] years. Last April, Rajapaksa's government made good on that promise, imposing a nationwide ban on the importation and use of synthetic fertilizers and pesticides and ordering the country's two million farmers to go organic.

The result was brutal and swift. Against claims that organic methods can produce comparable yields to conventional farming, domestic rice production fell 20 percent in just the first 6 months. Sri Lanka, long *self-sufficient*[5] in rice production, has been forced to import *$450 million* worth of rice even as domestic prices for this staple of the national diet surged by around *50 percent.*[6] The ban also devastated the nation's tea crop, its primary export and source of *foreign exchange.*[7]

By November 2021, with tea production falling, the government partially lifted its fertilizer ban on key export crops, including tea, rubber, and coconut. Faced with angry protests, soaring inflation, and the collapse of Sri Lanka's *currency,*[8] the government finally suspended the policy for several key crops—including tea, rubber, and coconut—last month, although it continues for some others. The government is also offering *$200 million*[9] to farmers as direct compensation and an additional $149 million in price subsidies to rice farmers who incurred losses. That hardly made up for the damage and suffering the ban produced. Farmers have widely *criti-*

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[2] *https://foreignpolicy.com/author/ted-nordhaus/*.
[3] *https://foreignpolicy.com/author/saloni-shah/*.
[4] *https://www.economist.com/asia/2021/10/16/a-rush-to-farm-organically-has-plunged-sri-lankas-economy-into-crisis*.
[5] *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4815756/*.
[6] *https://economynext.com/sri-lanka-seeks-rice-bailout-from-china-after-fertilizer-ban-89819/*.
[7] *https://www.ifad.org/en/web/latest/-/blog/a-second-chance-for-sri-lankan-tea*.
[8] *https://www.reuters.com/world/asia-pacific/sri-lanka-declares-economic-emergency-contain-food-prices-amid-forex-crisis-2021-08-31/*.
[9] *https://www.aljazeera.com/news/2022/1/26/sri-lanka-200-million-compensation-farmers-organic-crops-drive*.

cized [10] the payments for being massively insufficient and excluding many farmers, most notably tea producers, who offer one of the main sources of employment in rural Sri Lanka. The drop in tea production alone is estimated to result in economic losses of *$425 million.*[11]

Human costs have been even greater. Prior to the pandemic's outbreak, the country had proudly achieved *upper-middle-income status.*[12] Today, *half a million people* [13] have sunk back into poverty. Soaring *inflation* [14] and a rapidly *depreciating currency* [14] have forced Sri Lankans to cut down on food and fuel purchases as prices surge. The country's economists have called on the government to *default* [15] on its debt repayments to buy essential supplies for its people.

The farrago of magical thinking, technocratic hubris, ideological delusion, self-dealing, and sheer shortsightedness that produced the crisis in Sri Lanka implicates both the country's political leadership and advocates of so-called sustainable agriculture: the former for seizing on the organic agriculture pledge as a shortsighted measure to slash fertilizer subsidies and imports and the latter for suggesting that such a transformation of the nation's agricultural sector could ever possibly succeed.

A worker carries leaves at a tea plantation in Ratnapura, Sri Lanka, on July 31, 2021. Ishara S. Kodikara/AFP Via Getty Images

Sri Lanka's journey through the organic looking glass and toward calamity began in 2016, with the formation, at Rajapaksa's behest, of a new civil society movement called *Viyathmaga.*[16] On its *website,*[17] Viyathmaga describes its mission as harnessing the "nascent potential of the professionals, academics and entrepreneurs to effectively influence the moral and material development of Sri Lanka." Viyathmaga allowed Rajapaksa to rise to prominence as an election candidate and facilitated the

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[10] *https://www.ucanews.com/news/sri-lankan-farmers-reject-govt-compensation-paddy-price/95903.*

[11] *https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Sri%20Lanka%20Restricts%20and%20Bans%20the%20Import%20of%20Fertilizers%20and%20Agrochemicals_New%20Delhi_Sri%20Lanka_05-14-2021.pdf.*

[12] *https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2019-2020?fbclid=IwAR3gkSoxhIjTSuxJzaLmwI6rMKhLwOY-vT_-vIVutL1OoW_AQuvcuqw5Dww.*

[13] *https://www.theguardian.com/world/2022/jan/02/covid-crisis-sri-lanka-bankruptcy-poverty-pandemic-food-prices.*

[14] *https://www.reuters.com/world/asia-pacific/sri-lanka-declares-economic-emergency-contain-food-prices-amid-forex-crisis-2021-08-31/.*

[15] *https://asia.nikkei.com/Economy/Sri-Lanka-economists-tell-government-to-default-on-bond-buy-food.*

[16] *https://www.cpalanka.org/wp-content/uploads/2020/11/CPA-Report-Technocratic-Populism-and-the-Pandemic-State.pdf.*

[17] *http://www.viyathmaga.org/about/.*

creation of his election platform. As he prepared his Presidential run, the movement produced the "*Vistas of Prosperity and Splendour,*"[18] a sprawling agenda for the nation that covered everything from national security to anti-corruption to education policy, alongside the promise to transition the nation to fully organic agriculture within a decade.

Despite Viyathmaga's claims to technocratic expertise, most of Sri Lanka's leading agricultural experts were kept out of crafting the agricultural section of the platform, which included promises to phase out synthetic fertilizer, develop two million organic home gardens to help feed the country's population, and turn the country's forests and wetlands over to the production of *biofertilizer.*[19]

Following his election as President, Rajapaksa appointed a number of Viyathmaga members to his cabinet, including as minister of agriculture. Sri Lanka's Ministry of Agriculture, in turn, created a series of committees to advise it on the implementation of the policy, again excluding most of the nation's agronomists and agricultural scientists and instead relying on representatives of the nation's small organic sector; academic advocates for alternative agriculture; and, notably, the head of a prominent medical association who had long promoted *dubious claims*[20] about the relationship between agricultural chemicals and *chronic kidney disease*[21] in the country's *northern agricultural provinces.*[22]

Then, just a few months after Rajapaksa's election, COVID–19 arrived. The pandemic devastated the Sri Lankan *tourist sector,*[23] which accounted for almost half of the nation's *foreign exchange*[24] in 2019. By the early months of 2021, the government's budget and currency were in crisis, the lack of tourist dollars so depleting foreign reserves that Sri Lanka was unable to pay its debts to *Chinese creditors*[25] following a binge of infrastructure development over the previous decade.

Enter Rajapaksa's organic pledge. From the early days of the Green Revolution in the 1960s, Sri Lanka has *subsidized*[26] farmers to use synthetic fertilizer. The results in Sri Lanka, as across much of South Asia, were startling: Yields for rice and other crops more than doubled. Struck by severe *food shortages*[27] as recently as the 1970s, the country became food secure while exports of tea and rubber became *critical sources*[28] of exports and foreign reserves. Rising agricultural productivity allowed widespread urbanization, and much of the nation's labor force moved into the formal *wage economy,*[29] culminating in Sri Lanka's achievement of official upper-middle-income status in 2020.

By 2020, the total cost of fertilizer imports and subsidies was close to *$500 million*[30] *each year.* With fertilizer prices rising, the tab was likely to increase further in 2021. Banning synthetic fertilizers seemingly allowed Rajapaksa to kill two birds with one stone: improving the nation's foreign exchange situation while also cutting a massive expenditure on subsidies from the pandemic-hit public budget.

But when it comes to agricultural practices and yields, there is no free lunch. Agricultural inputs—chemicals, nutrients, land, labor, and irrigation—bear a critical relationship to agricultural output. From the moment the plan was announced, agronomists in Sri Lanka and around the world warned that *agricultural yields*[31] would fall substantially. The government claimed it would increase the production of manure and other organic fertilizers in place of imported synthetic fertilizers. But

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[18] *http://www.doc.gov.lk/images/pdf/NationalPolicyframeworkEN/FinalDovVer02-English.pdf.*

[19] *https://www.frontiersin.org/articles/10.3389/fsufs.2021.606815/full.*

[20] *https://island.lk/gmoa-president-misleading-the-public/.*

[21] *https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Sri%20Lanka%20Restricts%20and%20Bans%20the%20Import%20of%20Fertilizers%20and%20Agrochemicals_New%20Delhi_Sri%20Lanka_05-14-2021.pdf.*

[22] *https://www.bbc.com/news/uk-19628295.*

[23] *https://www.trade.gov/country-commercial-guides/sri-lanka-travel-and-tourism.*

[24] *https://economynext.com/sri-lanka-ends-2019-with-us7-6bn-in-forex-reserves-39859/.*

[25] *https://www.wsj.com/articles/deepening-debt-crisis-in-sri-lanka-stokes-controversy-over-chinese-lending-11642514503.*

[26] *https://www.canr.msu.edu/prci/publications/Policy-Research-Notes/PRCI_PRN_3.pdf.*

[27] *https://www.nytimes.com/1974/05/13/archives/sri-lanka-short-of-food-faces-an-economic-crisis-people-are-well.html.*

[28] *https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/publications/otherpub/60th_anniversary_managing_sri_lankas_foreign_reserves.pdf.*

[29] *https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2019-2020?fbclid=IwAR3gkSoxhIjTSuxJzaLmwI6rMKhLwOY-vT_-vIVutL1OoW_AQuvcuqw5Dww.*

[30] *https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Sri%20Lanka%20Restricts%20and%20Bans%20the%20Import%20of%20Fertilizers%20and%20Agrochemicals_New%20Delhi_Sri%20Lanka_05-14-2021.pdf.*

[31] *https://www.ft.lk/front-page/Inorganic-fertiliser-ban-could-harm-production-with-major-implications/44-719325.*

there was no conceivable way the nation could produce enough fertilizer domestically to make up for the shortfall.

Having handed its agricultural policy over to organic *true believers,*[32] many of them involved in businesses that would stand to benefit from the fertilizer ban, the false economy of banning imported fertilizer hurt the Sri Lankan people dearly. The loss of revenue from tea and other export crops dwarfed the reduction in currency outflows from banning imported fertilizer. The bottom line turned even more negative through the increased import of rice and other food stocks. And the budgetary savings from cutting subsidies were ultimately outweighed by the cost of compensating farmers and providing public subsidies for imported food.

Workers are seen at a tea plantation in Ratnapura, Sri Lanka, on July 31, 2021. Ishara S. Kodikara/AFP Via Getty Images.

[32] *https://www.pmdnews.lk/presidential-task-force-for-green-agriculture-established/*.

A Sri Lankan farmer carries paddy on his head in a field on the outskirts of Sri Lanka's capital, Colombo, on Sept. 7, 2018. Lakruwan Wanniarachchi/AFP Via Getty Images.

Farming is, at bottom, a fairly straightforward thermodynamic enterprise. Nutrient and energy output in the form of calories is determined by nutrient and energy input. For most of recorded human history, the primary way humans increased agricultural production was by adding land to the system, which expanded the amount of solar radiation and soil nutrients available for food production. Human populations were relatively small, under one billion people in total, and there was no shortage of arable land to expand onto. For this reason, the vast majority of anthropogenic changes in global land use and deforestation has been the result of agricultural extensification—the process of converting forests and prairie to cropland and pasture. Against popular notions that pre-industrial agriculture existed in greater harmony with nature, 3/4[33] of total global deforestation occurred before the industrial revolution.

Even so, feeding ourselves required directing virtually all human labor to food production. As recently as 200 years ago, more than 90 percent of the global population labored in agriculture. The only way to bring additional energy and nutrients into the system to increase production was to let land lie fallow, rotate crops, use cover crops, or add manure from livestock that either shared the land with the crops or grazed nearby. In almost every case, these practices required additional land and put caps on yields.

Starting in the 19th century, the expansion of global trade allowed for the import of guano-mined from ancient deposits on bird-rich islands—and other nutrient-rich fertilizers from far-flung regions onto farms in Europe and the United States. This and a series of technological innovations—better machinery, irrigation, and seeds—allowed for higher yields and labor productivity on some farms, which in turn freed up labor and thereby launched the beginning of large-scale urbanization, one of global modernity's defining features.

But the truly transformative break came with the invention of the Haber-Bosch process by German scientists in the early 1900s, which uses high temperature, high pressure, and a chemical catalyst to pull nitrogen from the air and produce ammonia, the basis for synthetic fertilizers. Synthetic fertilizer remade global agriculture and, with it, human society. The widespread adoption of synthetic fertilizers in most

[33] *https://www.nature.com/articles/s41467-021-22702-2.*

countries has allowed a rapid increase in yields and allowed human labor to *shift from agriculture* [34] to sectors that offer higher incomes and a better quality of life.

The widespread application of synthetic fertilizers now allows global agriculture to feed nearly eight billion people, of whom about four billion depend on the *increased output* [35] that synthetic fertilizers allow for their sustenance. As a result, the modern food systems that have allowed global agriculture to feed Earth's population are far more energy intensive than past food systems, with synthetic fertilizers accounting for a significant source of the energy for crops.

As synthetic fertilizers became increasingly available globally after World War II and combined with other innovations, such as modern plant breeding and large-scale irrigation projects, a remarkable thing happened: Human populations more than *doubled* [36]—but thanks to synthetic fertilizers and other modern technologies, agricultural output *tripled* [37] on only 30 percent more land over the same period.

The benefits of synthetic fertilizers though go far beyond simply feeding people. It's no exaggeration to say that without synthetic fertilizers and other agricultural innovations, there is no urbanization, no industrialization, no global working or middle class, and no secondary education for most people. This is because fertilizer and other agricultural chemicals have substituted human labor, liberating enormous populations from needing to dedicate most of their lifetime labor to growing food.

A Sri Lankan farmer applies fertilizer at a vegetable farm in Horana South, Sri Lanka, on Oct. 25, 2017. Lakruwan Wanniarachchi/AFP Via Getty Images

Virtually the entirety of organic agriculture production serves two populations at opposite ends of the global income distribution. At one end are the 700 million or so people globally who still live in extreme poverty. Sustainable agriculture proponents fancifully call the agriculture this population practices "*agroecology.*" [38] But it is mostly just old-fashioned subsistence farming, where the world's poorest eke out their survival from the soil.

They are the poorest farmers in the world, who dedicate most of their labor to growing enough food to feed themselves. They forego synthetic fertilizers and most other modern agricultural technologies not by choice but because they can't afford them, caught in a poverty trap where they are unable to produce enough agricultural surplus to make a living selling food to other people; hence, they can't afford

[34] *https://www.sciencedirect.com/science/article/pii/S0304387817300172.*
[35] *https://ourworldindata.org/how-many-people-does-synthetic-fertilizer-feed.*
[36] *https://ourworldindata.org/yields-vs-land-use-how-has-the-world-produced-enough-food-for-a-growing-population.*
[37] *https://www.pnas.org/content/109/31/12302.*
[38] *https://thebreakthrough.org/journal/no-10-winter-2019/after-agroecology.*

fertilizer and other technologies that would allow them to raise yields and produce surplus.

At the other end of the spectrum are the world's richest people, mostly in the West, for whom consuming organic food is a lifestyle choice tied up with notions about personal health and environmental benefits as well as romanticized ideas about agriculture and the natural world. Almost none of these consumers of organic foods grow the food themselves. Organic agriculture for these groups is a niche market—albeit, a lucrative one for many producers—accounting for less than one percent of global agricultural production.

As a niche within a larger, industrialized, agricultural system, organic farming works reasonably well. Producers typically see *lower yields.*[39] But they can save money on fertilizer and other chemical inputs while selling to a niche market for privileged consumers willing to pay a premium for products labeled organic. Yields are lower—but not disastrously lower—because there are ample nutrients available to smuggle into the system via manure. As long as organic food remains niche, the relationship between lower yields and increased land use remains manageable.

The ongoing catastrophe in Sri Lanka, though, shows why extending organic agriculture to the vast middle of the global bell curve, attempting to feed large urban populations with entirely organic production, cannot possibly succeed. A sustained shift to organic production nationally in Sri Lanka would, by most estimates, *slash yields*[40] of every major crop in the country, including drops of 35 percent for rice, 50 percent for tea, 50 percent for corn, and 30 percent for coconut. The economics of such a transition are not just daunting; they are impossible.

Importing fertilizer is expensive, but importing rice is far more *costly.*[41] Sri Lanka, meanwhile, is the world's fourth largest tea exporter, with tea accounting for a lion's share of the country's agricultural exports, which in turn account for *70 percent*[42] of total export earnings.

There is no conceivable way that export sales to the higher value organic market could possibly make up for sharp falls in production. The entire global market for organic tea, for example, accounts for only about 0.5 percent of the global tea market. Sri Lanka's tea production alone is larger than the entire global *organic tea market.*[43] Flooding the organic market with most or all of Sri Lanka's tea production, even after output fell by half due to lack of fertilizer, would almost certainly send global organic tea prices into a spiral.

The notion that Sri Lanka might ever replace synthetic fertilizers with domestically produced organic sources without catastrophic effects on its agricultural sector and environment is more ludicrous still. Five to seven times more animal manure would be necessary to deliver the same amount of nitrogen to Sri Lankan farms as was delivered by synthetic fertilizers in 2019. Even accounting for the overapplication of synthetic fertilizers, which is clearly a problem, and other uncertainties, there is almost certainly not enough land in the small island nation to produce that much organic fertilizer. Any effort to produce that much manure would require a vast expansion of livestock holdings, with all the additional environmental damage that would entail.

Sustaining agriculture in Sri Lanka, for both domestic consumption and high-value export products, was always going to require importing energy and nutrients into the system, whether organic or synthetic. And synthetic fertilizers were always going to be the most economically and environmentally efficient way to do so.

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[39] *https://www.nature.com/articles/nature11069.*
[40] *https://www.canr.msu.edu/prci/publications/Policy-Research-Notes/PRCI_PRN_3.pdf.*
[41] *https://island.lk/looming-spectre-of-rice-shortage/.*
[42] *https://www.ifad.org/en/web/latest/-/blog/a-second-chance-for-sri-lankan-tea.*
[43] *https://phys.org/news/2021-09-sri-lanka-revolution-threatens-tea.html.*

Sri Lankan President Gotabaya Rajapaksa (center) waves to supporters during a rally ahead of the upcoming parliamentary elections, near Sri Lanka's capital, Colombo, on July 28, 2020. Ishara S. Kodikara/AFP Via Getty Images

While the proximate cause of Sri Lanka's humanitarian crisis was a bungled attempt to manage its economic fallout from the global pandemic, at the bottom of the political problem was a math problem and at the bottom of the math problem was an ideological problem—or, more accurately, a global ideological movement that is innumerate and unscientific by design, promoting fuzzy and poorly specified claims about the possibilities of alternative food production methods and systems to obfuscate the relatively simple biophysical relationships that govern what goes in; what comes out; and the economic, social, and political outcomes that any agricultural system can produce, whether on a regional, national, or global scale.

Rajapaksa continues to insist that his policies have not failed. Even as Sri Lanka's agricultural production was collapsing, he traveled to the U.N. climate change summit in Glasgow, Scotland, late last year, where—when not dodging *protests* [43] over his human rights record as Sri Lankan defense minister—he touted his nation's commitment to an *agricultural revolution* [44] allegedly "in sync with nature." Not long afterward, he *fired two* [45] government officials within weeks of each other for publicly criticizing the increasingly dire food situation and *fertilizer ban.*[46]

As farmers begin their spring harvest, the fertilizer ban has been *lifted,*[47] but fertilizer subsidies have not been restored. Rajapaksa, meanwhile, has established yet another *committee* [48]—this one to advise the government on how to increase organic fertilizer production in a further demonstration that he and his agricultural advisors continue to deny the basic biophysical realities that constrain agriculture production.

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[43] *https://declassifieduk.org/greenwashing-genocide-the-uk-welcomes-sri-lankas-notorious-president/.*

[44] *https://slembassyusa.org/new/component/content/article/58-headline/2409-speech-by-president-gotabaya-rajapaksa-at-the-rediscovering-nitrogen-solutions-and-synergies-for-climate-change-health-biodiversity-and-circular-economy-cop26-side-event-scotland-uk-on-31-october-2021.html?Itemid=101.*

[45] *https://www.news18.com/news/world/amid-economic-crisis-sri-lankan-president-sacks-critical-minister-and-official-issues-gag-order-for-others-4625522.html.*

[46] *https://abcnews.go.com/International/wireStory/sri-lanka-leader-sacks-minister-criticized-farm-policy-82067841.*

[47] *https://www.reuters.com/markets/commodities/sri-lanka-rows-back-organic-farming-goal-removes-ban-chemical-fertilisers-2021-11-24/.*

[48] *https://www.pmdnews.lk/presidential-task-force-for-green-agriculture-established/.*

Much of the global sustainable agriculture movement, unfortunately, has proven no more accountable. As Sri Lankan crop yields have plummeted, exactly as most mainstream agricultural experts predicted they would, the fertilizer ban's leading advocates have gone silent. Vandana Shiva, an Indian activist and ostensible face of anti-modern agrarianism in the global south, was a booster of the ban but turned mute as the ban's cruel consequences became clear. Food Tank, an advocacy group funded by the Rockefeller Foundation that promotes a *phase-out*[49] of chemical fertilizers and subsidies in Sri Lanka, has had nothing to say now that its favored policies have taken a disastrous turn.

Soon enough, advocates will surely argue that the problem was not with the organic practices they touted but with the precipitous move to implement them in the midst of a crisis. But although the immediate ban on fertilizer use was surely ill conceived, there is literally no example of a major agriculture-producing nation successfully transitioning to fully organic or agroecological production. The European Union has, for instance, promised a full-scale transition to sustainable agriculture for decades. But while it has banned *genetically modified crops*[50] and a variety of *pesticides*[51] as well as has implemented policies to discourage the overuse of synthetic fertilizers, it still *depends heavily*[52] on synthetic fertilizers to keep yields high, produce affordable, and food-secure. It has also struggled with the disastrous effects of overfertilizing surface and ground water with manure from livestock production.

Boosters of organic agriculture also point to Cuba, which was forced to abandon synthetic fertilizer when its economy imploded following the Soviet Union's collapse. They fail to mention that the average Cuban lost an estimated *10 to 15 pounds*[53] of body weight in the years that followed. In 2011, Bhutan, another darling of the sustainability crowd, promised to go *100 percent organic by 2020.*[54] Today, many farmers in the Himalayan kingdom continue to *depend*[55] on agrochemicals.

In Sri Lanka, as elsewhere, there is no shortage of problems associated with chemical-intensive and large-scale agriculture. But the solutions to these problems—be they innovations that allow farmers to deliver fertilizer more precisely to plants when they need it, bioengineered microbial soil treatments that fix nitrogen in the soil and reduce the need for both fertilizer and soil disruption, or genetically modified crops that require fewer pesticides and herbicides—will be technological, giving farmers new tools instead of removing old ones that have been proven critical to their livelihoods. They will allow countries like Sri Lanka to mitigate the environmental impacts of agriculture without impoverishing farmers or destroying the economy. Proponents of organic agriculture, by contrast, committed to naturalistic fallacies and suspicious of modern agricultural science, can offer no plausible solutions. What they offer, as Sri Lanka's disaster has laid bare for all to see, is misery.

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Saloni Shah is a food and agriculture analyst at the Breakthrough Institute. Twitter: *@SaloniShah101*

SUPPLEMENTARY MATERIAL SUBMITTED BY JEFFREY W. MOYER, CHIEF EXECUTIVE OFFICER, RODALE INSTITUTE

Insert 1

Ms. PINGREE. . . .

. . . And since that is such a critical topic right now, what techniques do we use to sequester carbon, can you talk a little bit more about the studies that have been done there and sort of the quantification of how much carbon we can sequester?

Mr. MOYER. Yes, thank you very much for the question about the conversation around carbon and carbon sequestration. We know that the way we manage soils can have a huge impact on its ability to sequester carbon. Many of our practices that we employ, we have already discussed about cover crops, and

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[49] *https://foodtank.com/news/2017/12/sri-lankan-food-production/.*
[50] *https://ec.europa.eu/environment/europeangreencapital/countriesruleoutgmos/.*
[51] *https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0256719.*
[52] *https://data.worldbank.org/indicator/AG.CON.FERT.ZS?locations=1W-EU.*
[53] *https://www.pbs.org/newshour/show/cuba-can-teach-america-farming.*
[54] *https://www.reuters.com/article/us-bhutan-emissions-farming/to-build-a-greener-economy-bhutan-wants-to-go-organic-by-2020-idUSKCN0RS0DO20150928.*
[55] *https://kuenselonline.com/achieving-organic-pledge-not-possible-agriculture-officials/.*

we may have discussed about crop rotations. These are all tools that farmers can implement to sequester carbon. It is becoming more and more critical. The amount of carbon we can sequester is certainly dependent upon the relationship between the practices that we are superimposing on the landscape and the soils innate ability through clay particles and the different soil types to sequester carbon.

* * * * *

So yes, our work at Rodale Institute is continually exploring and expanding the concepts around carbon sequestration, and we have a tremendous amount of data that we would be more than happy to share with this Committee and with you in particular.

Ms. PINGREE. Thanks so much. We will look forward to exploring that more.

I. Soil Health and Drought

Enhancement of soil organic carbon (SOC) and soil organic matter (SOM) is the foundation of soil health improvement. It has been shown that increasing soil organic carbon and soil organic matter enhances drought tolerance in agricultural systems. A 1% increase in soil organic carbon is estimated to result in a 2% to >5% increase in soil Available Water Holding Capacity depending on the soil texture (Olness and Archer, 2005). In a review paper, Lal (2020) concluded that management practices that enhance soil health by restoring SOM content increase soil water retention and the plant's available water capacity. Ankenbauer and Loheide (2016) quantified the effect of soil organic content on soil water retention and water use by plants in the Tuolumne Meadows, a groundwater-dependent ecosystem in the Sierra Nevada of California. They reported a substantial dependence of soil water retention on soil organic content by correlating Van Genuchten soil water retention parameters with soil organic content, independent of soil texture. Their results showed that the increased water retention by soil organic matter contributes as much as 8.8 cm to transpiration, or 35 additional water-stress free days, during the dry summer when plants experience increased water stress. Izum and Wagai (2019) evaluated the extent to which SOC build-up could reduce agricultural drought risk. Using statistical analysis of spatially-explicit global crop and soil datasets, they reported that relatively small enhancement in topsoil (0–30 cm) organic carbon content (OCtop) could increase drought tolerance of the food production systems operating over 70% of the global harvested area (particularly drylands). By closing the gap between current and upper limit of tolerance levels through SOC addition of 4.87 GtC at the global scale, farmers' economic output in drought years would increase by ~16%. Their findings highlight that progress towards multiple development goals can be leveraged by SOC enhancement in carbon (C)-poor soils in drier regions around the world. Oldfield, *et al.,* (2019) developed a quantitative model exploring how SOM relates to crop yield potential of maize and wheat in light of covarying factors of management, soil type, and climate. They found that yields of these two crops are on average greater with higher concentrations of SOC. A survey study by Soil Health Institute showed that 97 out of 100 farmers have the perception that soil health management systems improve yield resilience (Bagnall, *et al.,* 2021).

The real-world benefit of increased SOC as a benefit to farmers is demonstrated by the resilience and long-term yield stability in organic systems within Rodale Institute's Farming Systems Trial during periods of drought and low rainfall (Lotter, Seidel, and Liebhardt 2009). Over a fourteen year period, organic corn yield was 5% higher than conventional while conventional soybean was 5% higher than organic (these represent statistically significant differences). During most low rainfall or drought years during that same time period, the organic systems out-yielded the conventional system which was attributed to higher soil water retention due to higher soil organic carbon levels in the organic system. This yield stability along with price premiums in organic results in increased economic stability for organic farmers (Hanson, Lichtenberg, and Peters 2009, Pimentel, *et al.,* 2005). Concerning flood mitigation, data from the Farming Systems Trial demonstrate improved hydraulic properties (Alfahham, *et al.,* 2021) and soil structure that is related to carbon fractions of soil aggregates (Littrell, *et al.,* 2021) in the organic systems that are expected to increase water infiltration and retention. Recent yet unpublished data (currently under review) from the Farming Systems Trial is finding water infiltration rates in some organic systems are double the conventional tilled and no-till systems. These results are corroborated by studies that include long-term systems trials from across the United States, including the Farming Systems Trial, that conservation practices that include organic fertility, cover crops, and reduced tillage re-

sult in improved soil hydraulic properties (Bagnall, Morgan, Bean, *et al.,* 2022) that result in greater food security (Bagnall, *et al.,* 2021).

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Insert 2

Mr. BAIRD. . . .

But my first question goes to Dr. Larson. And it has to do with the idea that others on the panel have claimed that organically produced food is more nutritious because the soil in their system is healthier. What does the science say about that? Any thoughts there?

* * * * *

Mr. MOYER. I would add that Rodale Institute would be more than happy to supply additional data that showcases the opposite side of that conversation because science can show what people want it to show, but there are clear differences in nutritional quality of crops that are produced in soils that are farmed differently.

II. Nutritional Quality in Our Food System and Relationship to Soil Health

The information below is specifically addressing Representative Baird's request to provide references related to nutritional quality of food that is grown using different methods and the link between soil health and nutritional quality. My comment on this topic at the hearing was in response to Dr. Larson's comment that there is no data to support the correlation between soil health and nutrition in a plant and no evidence that organic food is safer or more nutritious than food grown using conventional ag. Therefore, included here are references related to food safety as well as nutritional quality.

A. Safety

The largest health concern related to consumption of conventionally grown foods is the risk of exposure to toxic chemicals from pesticides. There is an increasing body of evidence indicating high exposure to pesticides through diet in the United States (Lu, *et al.,* 2008) and that dietary intervention that includes organic food reduces or eliminates this health risk (Lu, *et al.,* 2006, Curl, Fenske, and Elgethun 2003, Hyland, *et al.,* 2019). Using data from three U.S. sources: The Pesticide Data Program of the U.S. Department of Agriculture, the Marketplace Surveillance Program of the California Department of Pesticide Regulation, and private tests conducted by Consumers Union, Baker, *et al.* (2002) found statistically higher levels of pesticide residues on conventional *versus* organic crops. The USDA data indicated that 73% to 90% of all conventional crops had pesticide residues, depending on crop category. Only 23% of organic samples had pesticide residues. When researchers controlled for persistent, legacy chemicals that have long been banned the conventional crops dropped from 73% to 71% but the organic samples dropped to 13%, suggesting that exposure from organic crops is not from current management but past practices. Baranski, *et al.* (2014) has done the most recent and rigorous analysis of food safety concerning organic and conventional foods. This meta-analysis included data from 343 comparative studies and found that the incidence of pesticide residue on conventional crops to be four times higher than organic crops and that conventional foods had significantly higher cadmium levels, one of three recognized highly toxic metals, lead and mercury being the others. Neither of these studies reported on the toxicity of the chemicals found on food samples, an area of concern requiring more research.

B. Nutritional Quality

During the past 70 years, grain yields have more than doubled (Tilman, *et al.* 2002) and global food production tripled (FAO 2018), mostly through improved varieties and increased use of pesticides, fertilizers, and irrigation. While this increase in food production has reduced worldwide chronic malnourishment it has come at a cost to the environment, the soil, and potentially human health. More than ⅓ of the Earth's soils are now degraded (Cherlet, *et al.,* 2018, Middleton and Thomas 1997), limiting their potential to adequately provide human nutrition (Lal 2009). Soils of the United States have also suffered degradation with significant soil carbon loss (Collins, *et al.,* 2000, Senthilkumar, *et al.,* 2009, Sanderman, Hengl, and Fiske 2017) through tillage and conventional practices (Douds, Jr., *et al.,* 1995, Hepperly, Douds, and Seidel 2006, 2007) that put food security and human nutrition at risk (Ghimire, Machado, and Bista 2018, Lal 2009). Nearly one in nine people worldwide suffers from chronic malnourishment and it is estimated that more than half of all people suffer from "hidden hunger" whereby caloric demands are met but levels of micro-nutrients are below levels sufficient to maintain proper health (Welch and Graham 2000, Welch 2002). This may be attributed to the decline of the concentration of minerals, vitamins, and proteins of grains, fruits and vegetables that has occurred over the past 70 years, coinciding with the aforementioned soil degradation (Davis 2009, Davis, Epp, and Riordan 2004, Jarrell and Beverly 1981). Davis, Epp, and Riordan (2004), using U.S. Department of Agriculture nutritional data in 1950 and 1999 found significant declines in the concentration of protein, calcium, phosphorus, iron, riboflavin (vitamin B2) and vitamin C for 43 vegetables and fruits measured. Similarly, protein concentrations in grains in the U.S. and Europe have declined significantly [corn: ~8% (Davis 2009, Scott, *et al.,* 2006), sorghum ~18%, rice ~18% wheat ~30%, barley ~50% (Simmonds 1995)]. The apparent negative relationship between increased yield and reduced nutrient concentrations in food that has occurred over the past 70 years has been termed a "dilution effect" (Davis 2009, Jarrell and Beverly 1981) and typically occurs when fertilization with one or a few macro-nutrients increases crop yields, resulting in a decline in other micro-nutrients. How this drop in nutritional quality is linked to soil degradation and has broadly affected human health is basically unexplored.

We recognize that there is a gap in knowledge in how soil health impacts crop nutritional quality. This is partly due to the fact that few studies have concurrently measured soil quality and nutritional quality and older studies measured only a small set of nutrients such as macro- and micro-minerals. It is now recognized that macro- and micro-mineral levels are largely regulated by plant needs and the inherent property of soils. However, there is a need to look at a broader suite of important human nutrients in our foods. Considering that most studies find soil health improved under organic management, studies comparing nutritional quality of organic and conventional foods is a starting place to link soil and human health. Several meta-analysis studies have shown higher mineral, vitamin, protein, or phytonutrient concentrations in organic foods (Barański, *et al.,* 2014, Brandt and

Mølgaard 2001, Worthington 2001, Williams 2002, Heaton 2001, Benbrook, *et al.,* 2013, Lairon 2010). The most recent study that includes the most data points and crop categories, Barański, *et al.* (2014), found higher levels of most classes of antioxidant compounds in organic foods. Another meta-analysis of the published comparisons of the content of secondary metabolites and vitamins in organically and conventionally produced fruits and vegetables conducted by Brandt, *et al.* (2011) showed that in organic produce the content of secondary metabolites is 12% higher than in corresponding conventional samples. These secondary metabolites are natural constituents in plants, which play a role in human health and prevention of numerous human diseases (Sreenivasulu and Fernie, 2022). Since synthetic pesticides are not used in organic systems plants are more exposed to biotic stresses which triggers biosynthesis of defense-related secondary metabolites in organic foods and vegetables. Reganold, *et al.* (2010) found similar increases of antioxidant compounds in organic strawberries grown in California in the same soil type, same varieties, and under the same climatic conditions. Organic strawberries also had a longer shelf life and improved taste. What was unique is that comprehensive soil analysis indicated across the board improved microbial species richness and functional diversity in the organic soils, suggesting that soil microbes may play a role in regulating antioxidant concentrations or other health benefits. There is a limited yet growing set of studies that have compared the nutritional quality of organic and conventional foods grown in the same soil, under the same set of environmental conditions in replicated, long-term, side-by-side trials. (Ren, *et al.,* 2017, Mitchell, *et al.,* 2007, Koh, Kaffka, and Mitchell 2013, Mukherjee, *et al.,* 2020, Omondi, *et al.,* 2021, Pearsons, *et al.,* 2022). All have shown increases of some key nutritional compounds in the organically grown crops. Adding data to this expanding body of work has been a recent focus of Rodale Institute, testing grain in the 42 year old Farming Systems Trial and also in the new Vegetable Systems Trial.

It should also be noted that few studies have tested animal products such as milk and beef. Those that have find higher nutritional quality in organic products that may be attributed to increased forage from pasture in organic systems (Benbrook, *et al.,* 2013, Średnicka-Tober, *et al.,* 2016). The clearest result from these studies is that organic milk and beef improve the Omega 6/Omega 3 fatty acid ratio by increasing omega 3 fatty acids and decreasing omega 6 fatty acids. One study of milk sampled across the United States (Welsh, *et al.,* 2019) found higher levels of bovine grown hormones in conventional compared to organic milk samples and pesticide and antibiotics in most conventional milk products that were undetected in the organic milk products. Again, suggesting that organic products are safer through reduced human exposure to toxic compounds.

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III. Regenerative Agriculture and the Soil Carbon Solution

The research related to soil carbon sequestration and the benefit of regenerative organic agriculture is summarized in a recent white paper published by Rodale Institute—*Regenerative agriculture and the soil carbon solution* (Moyer, *et al.,* 2020). This literature review provided a comprehensive set of studies looking at soil carbon sequestration across farming systems and the worlds climatic zones. It highlighted new data related to farming practices and the mechanisms leading to soil carbon sequestration.

In cropping systems, the use of cover crops alone may provide small gains in soil carbon sequestration (1.17 Mg CO_2e per ha per year) (Poeplau and Don 2015) but including multiple conservation practices within a good crop rotation (3.14 Mg CO_2e per ha per year) (Drinkwater, Wagoner, and Sarrantonio 1998) and the addition of compost (8.66 Mg CO_2e per ha per year) (Hepperly, *et al.,* 2009) in temperate regions typical of the majority of U.S. cropping regions could sequester significantly more carbon in the nations soils. The potential is even higher in perennial systems and warmer climates with greater plant biomass production potential (Beer, *et al.,* 1990, Vicente-Vicente, *et al.,* 2016) but data is limited for these regions, including the southern parts of the United States. New data in the last 5–10 years has demonstrated the tremendous potential of adaptive grazing to sequester carbon in the soil (13.7–29.36 Mg CO_2e per ha per year) (Gosnell, Charnley, and Stanley 2020, Rowntree, *et al.,* 2019, Rowntree, *et al.,* 2020, Stanley, *et al.,* 2018, Machmuller, *et al.,* 2015). Previous models of livestock systems that ignored soil carbon may not have captured this potential. These findings become more profound when we consider a great portion of the global land base is not suitable for cropping but is suitable as pasture and rangeland for livestock. Therefore, the global potential to drawdown carbon through adaptive grazing may be as high as a 77% offset of global greenhouse gas emissions. If we were to apply conservation practices and installation of perennial systems across the globe, we start to see the potential for regenerative organic agriculture to significantly offset total greenhouse gas emissions. However, the capacity for soils to store carbon is limited and can approach maximum and diminishing levels over time so soil carbon sequestration is a short-term solution while other technologies and strategies work to reduce greenhouse gas emissions from other sectors in order to bring the climate into balance.

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References annotated with † are retained in Committee file.

IV. Organic Rice Production and Yields

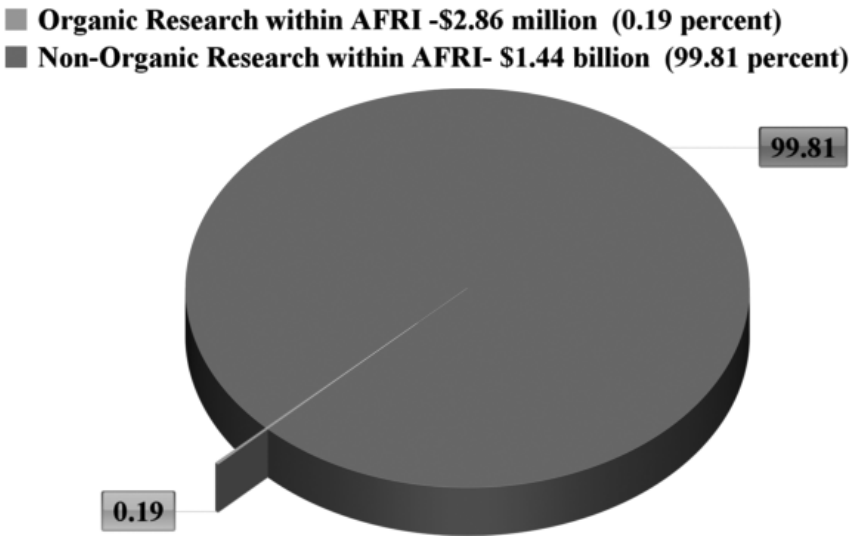
Organic systems are knowledge-based, and farmers work in harmony with nature. There might be cases whereby organic rice producers failed to grow crop successfully but there are numerous rice farmers that transitioned to organic successfully and profitably. A report by Texas A&M shows that the acreage of organic rice in Texas has steadily increased over the past decade, driven by increased market demand (Zhou, *et al.,* 2021). Since 1995, organic rice acreage has increased in the U.S. by almost six-fold, with a majority of acreage being grown in the Southern U.S. The acreage in Texas alone reached more than 17,000 acres in 2020. A report by Sullivan (2003) provides additional examples of successful organic rice producers across the county.

Demand in the U.S. for organic rice exceeds domestic supply encouraging significant competition from imports. While there is substantial potential for growth and expansion of the U.S. organic rice sector, the industry needs insight into the economic opportunities in the organic rice market to take advantage of this potential.

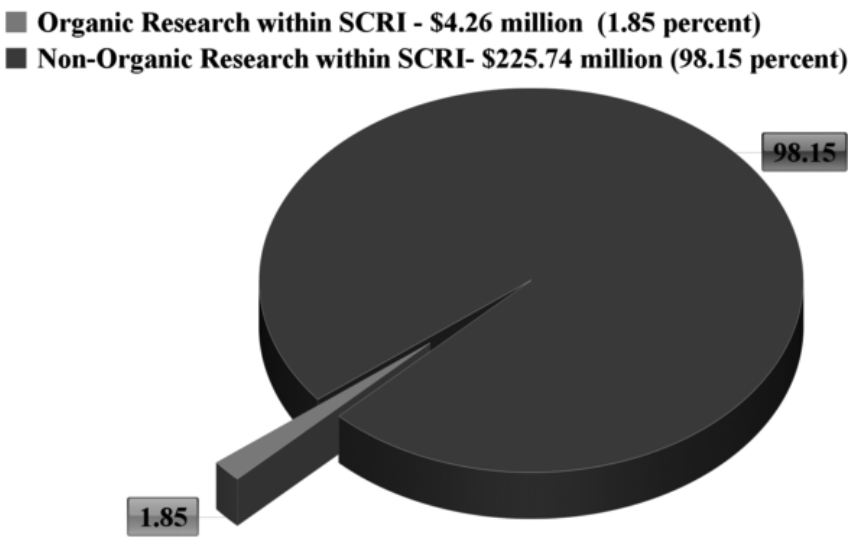
A study in Bhutan (Tashi and Wangchuck, 2015) compared organic and conventional rice production within and between three agroecological zones (AEZ) under farmers' management in Bhutan. There was no statistically significant difference in grain yields between organic and conventional rice farms. They found that the production cost from a hectare of land was significantly higher in organic farms, so without a price premium conventional rice was more profitable. However, if organic rice receives a premium price, then the organic system was similar or more profitable than the conventional system.

Studies comparing organic production to the standard or conventional form of production have found reduced yields in organic that are typically 10–18%, yet organic systems are more profitable, largely due to increased price premiums (Crowder and Reganold 2015). We also need to emphasize that a small portion of public funds for agricultural research have been devoted to organic farming (see figure below). With more investment of public funds in organic farming research, including more funding for breeding organic varieties, the farmers in the U.S. could close that yield gap and grow organic rice and other commodities successfully and benefit from premium prices currently available across the world.

[Organic funding in Agriculture and Food Research Initiative (AFRI) 2011–2015 (%)]



[Organic Research within Specialty Crop Research Initiative (SCRI) 2010–2014 (%)]

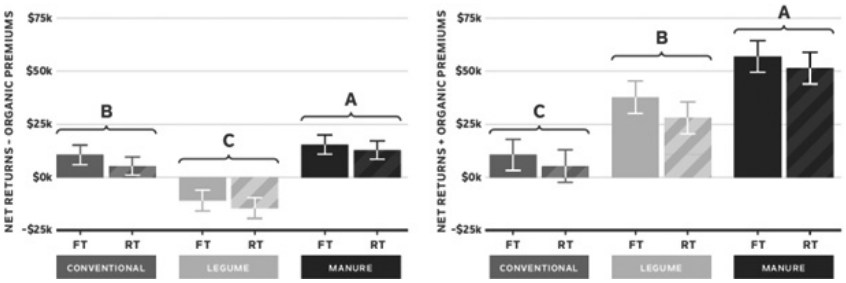


Source : *https://www.nationalorganiccoalition.org/organic-research*.

In the Farming Systems Trial at Rodale Institute, the diversified organic system maintains yields over time similar to the conventional system (Lotter, Seidel, and Liebhardt 2009, Hepperly, Douds, and Seidel 2006, Pimentel, *et al.,* 2005, Pearsons, *et al.,* 2022). Recent economic analysis that includes twelve years of no-till production indicates that a diversified organic cropping system is more stable (less risk) and more profitable than conventional and low-input organic systems without price premiums (see figure below. Pearsons 2022, under review). This study also found reduced yields in the no-till conventional compared to the tilled conventional system

which may be a reason more farmers in the U.S. are not wholly embracing no-till farming.

Figure 5.7. Net returns



(Left, without organic price premiums; Right, with organic price premiums) of each of the systems in the Farming Systems Trial from 2008–2020. All systems Including Conventional, Organic Legume, and Organic Manure systems were spit into full-till (FT) and reduced-till (RT).

References:

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References annotated with † are retained in Committee file.

V. Tillage and Organic Pesticide Use

A. Tillage

Organic crop farming does typically use tillage to control weeds. Reducing tillage in organic systems has been a major area of research for Rodale Institute over the past 20 years. Rodale Institute pioneered the development of the roller-crimper, a tool used in organic and conventional farming to increase use of cover crops and reduce tillage (Moyer 2020). Despite tillage in organic systems, the soil health in the organic systems in the 42 year Farming Systems Trial at Rodale institute have improved soil health and increased soil organic carbon levels compared to the conventional system (Hepperly, Douds, and Seidel 2006, Hepperly, *et al.,* 2009, Hepperly, *et al.,* 2007, Littrell, *et al.,* 2021). This is most pronounced in the diversified organic system that includes compost and perennial forages. In 2008, reduced tillage systems were added as a treatment in all of the farming systems, which is continuous

no-till in the conventional system and rotational no-till in the organic systems since tillage is still used to plant cover crops and small grains. Recent studies measuring soil organic carbon and other soil health indicators (Littrell, *et al.,* 2021, Alfahham, *et al.,* 2021, Sanderman, *et al.,* 2021) find higher soil carbon in the organic systems, which is more pronounced at deeper depths, while the conventional no-till system has the lowest soil health amongst all comparative systems when looking at multiple soil health indicators. This is due to the combination of cover crops, compost, crop rotation and reduced tillage in the organic systems. Most studies comparing tillage systems have been done under conventional management, limited crop rotation, and without conservation practices such as cover crops, manures, and compost. If we dig deeper (literally), a recent meta-analysis of 1061 pairs of published data comparing tilled and no-till management found increased soil organic carbon at the surface but a loss of soil organic carbon at deeper layers, resulting in a net carbon loss from no-till (Cai, *et al.,* 2022). However, the benefits of conservation practices that are standard in organic production are corroborated by other studies that include a larger set of studies across the United States (Bagnall, Morgan, Bean, *et al.,* 2022, Crystal-Ornelas, Thapa, and Tully 2021, Bagnall, Morgan, Cope, *et al.,* 2022).

B. Pesticides in Organic Systems

Rodale Institute farm and research staff employee an Integrated Pest Management approach on all organic production that includes cultural, mechanical, and biological strategies with chemical strategies as a last resort. Currently the Rodale Institute does not use any pesticides for management in organic grain or forage cropping systems. We are using USDA Certified Organic-approved pesticides to manage insects and disease in vegetable and fruit production. Materials used include oils, kaolin clay, botanical extracts, hydrogen peroxide, minerals such as sulfur and copper, and biologicals that target specific pests. None of the organically approved products fall under the category of Restricted-Use. Most conventional products fall under the category of Restricted-Use because they pose a significant health risk to the applicator, farm workers, the nearby community, and the environment. They therefore require training and an applicators license to purchase and apply.

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References annotated with † are retained in Committee file.

SUPPLEMENTARY MATERIAL SUBMITTED BY REBECCA L. LARSON, PH.D., CHIEF SCIENTIST AND VICE PRESIDENT, GOVERNMENT AFFAIRS, WESTERN SUGAR COOPERATIVE

Insert

Mr. BAIRD. . . .

But my first question goes to Dr. Larson. And it has to do with the idea that others on the panel have claimed that organically produced food is more nutritious because the soil in their system is healthier. What does the science say about that? Any thoughts there?

Dr. LARSON. Yes, thank you for the question. I am happy to provide copious amounts of scientific research from peer-reviewed journals that shows that there is no correlation between soil health and nutrition within a plant. I can also show you that there is no scientifically credible evidence that suggests that food grown through organic practices is safer or more nutritious than food grown with conventional ag. Just to give a couple of examples of where some of that fear-based marketing can have negative effects, especially for marginalized and low-income communities, is that when people are led to believe that one type of production practice is safer or more nutritious than another, it actually drives down total consumption of fruits, vegetables, and grains. So there can be a negative impact from not speaking to the facts of science and scientific consensus.

There is no credible evidence that organic food is safer, more nutritious, or healthier than conventionally produced food. Firstly, the National Organic Program (NOP) is managed under the marketing arm (Agricultural Marketing Service) of the USDA and nowhere on the website does the USDA assert that organic production leads to a healthier product.[1] Upon creation of the NOP, then Secretary Dan Glickman stated "Let me be clear about one thing, the organic label is a marketing tool. It is not a statement about food safety. Nor is 'organic' a value judgment about nutrition or quality."[2]* Furthermore, when outlining steps for food safety, the FDA makes no reference to buying or consuming organic food.[3] However, consumers still buy organic based on the perceived superiority of the product in terms of health, safety, and nutrition.[4] These false assumptions are rooted in misleading marketing claims.[5] **The scientific consensus differs: organically produced food is no safer, healthier, or more nutritious; it is just more expensive.**

- *Stanford University study (2012):* Examined results of 240 peer-reviewed studies. There was no clinically relevant difference between organic and conventional food. There were a limited number of instances where pesticide levels were different between the two systems, but of no biological relevance. **Conclu-**

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[1] *Organic Regulations* | Agricultural Marketing Service (*usda.gov*) (*https://www.ams.usda.gov/rules-regulations/organic*).

[2] Miller, H.I. (2019) *Buying 'organic' to get 'authenticity'? Or safer and more nutritious food? Think again. And again.*† MISSOURI MEDICINE. 116 (1): 8–11.

* **Editor's note:** references annotated with † are retained in Committee file.

[3] *Food Safety at Home* † | FDA (*https://www.fda.gov/consumers/free-publications-women/food-safety-home*).

[4] Gundala, R.R., Singh, A. (2021) *What motivates consumers to buy organic foods? Results of an empirical study in the United States.*† PLOS ONE. *https://doi.org/10.1371/journal.pone.0257288*.

[5] press *release_distribution_0383762_77592.pdf* † (24-7pressrelease.com) (*https://www.24-7pressrelease.com/attachments/038/press_release_distribution_0383762_77592.pdf*). **Editor's note:** the above link is to a third-party posting site; the origination of the report is from the Academics Review website blog posting (*https://academics-review.bonuseventus.org/2014/04/why-consumers-pay-more-for-organic-foods-fear-sells-and-marketers-know-it/*) and original link is (*https://academics-review.bonuseventus.org/wp-content/uploads/2014/04/AR_Organic-Marketing-Report_Print.pdf*).

sion: there is no strong evidence of a clinical benefit to organic food consumption.[6]

- *The Alliance for Food and Farming, representing organic and conventional farmers* launched a safety calculator to combat the misinformation of the Environmental Working Group's dirty dozen. **This tool takes USDA market basket data and peer-reviewed literature to easily illustrate how detection of pesticide residue does not equal risk** (*e.g.,* a child could ingest thousands of servings a day of blueberries without negative effects).[7]
- *A systematic review of the literature conducted by researchers in Greece (2007)* concluded ". . . what should be made clear is that 'organic' does not automatically equal 'safe.'"[8] The same authors published in the University of Cambridge Press said "**If producers adopt proper agricultural practices and consumers maintain hygienic conditions, risks associated with food contaminants can be minimized, regardless of the food's organic or conventional origin.**"[9]
- *Health Canada meta-analysis on nutrient composition (2017)* dispels many myths of the ties between soil health and modern agriculture on reduced nutrient content in fruit, vegetables, and grains. The comprehensive review of the literature showed no biologically relevant change in nutrient content over time and no evidence of a link to soil health (as Mr. Nygren, Mr. Clark, Mr. Moyer all claimed). However, they did state "statistically significant decreases in the content of particular mineral nutrients per dry weight of fruits, vegetables, or grains . . . were not likely to have any significant impact on the nutritional health of consumers, a fact glossed over in some popular press reports citing these studies." The main driver of these differences was dilution effect. As yield increased, some nutrients decreased without any biological relevance. A fact that the authors highlight as critical since "**the benefits from increased yield of crops in addressing world hunger are significant.**"[10]
- Despite the lack of evidence in the scientific literature, Mr. Moyer claimed in oral testimony that I was wrong about my assertions of the lack of health benefit for organic food. Mr. Moyer cites Faller and Fialho (2019) in his written testimony in support of organic food containing more beneficial phenolic compounds. This is not what the authors concluded. The authors evaluated the impact of heat on phenolic compound stability and found organic produce more sensitive to heat processing than conventional. However, the conclusion was **"polyphenols showed a positive correlation with antioxidant capacity in raw and cooked vegetables from both types of agriculture" meaning conventional or organic.**[11]
- Mr. Moyer then cites his own research from Rodale Institute to justify grains produced with organic methods are superior nutritionally to conventionally produced grains. However, **as the table excised from that publication demonstrates, there was no statistical difference between production systems** (see table below).[12] So this study does not show any superiority of organic grains.

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[6] Smith-Spangler, C., *et al.* (2012). *Are organic foods safer or healthier than conventional alternatives? A systemic review.*† ANNALS OF INTERNAL MEDICINE. *https://doi.org/10.7326/0003-4819-157-5-201209040-00007*.

[7] *Calculate—Safe Fruits and Veggies* (*https://www.safefruitsandveggies.com/calculate/*).

[8] Magkos, F., Arvaniti, F, Zampelas, A. (2007) *Organic Food: buying more safety or just peace of mind? A critical review of the literature.*† CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION. 46(1): *https://doi.org/10.1080/10408690490911846*.

[9] *Putting the safety of organic food into perspective* † | NUTRITION RESEARCH REVIEWSs | Cambridge Core (*https://www.cambridge.org/core/journals/nutrition-research-reviews/article/putting-the-safety-of-organic-food-into-perspective/5C8EC98C76B56852375507CE9B29EE1F*).

[10] Marles, R.J. (2017) *Mineral nutrient composition of vegetables, fruits and grains: the context of reports and apparent historical declines.*† JOURNAL OF FOOD COMPOSITION AND ANALYSIS. 56: 93–103.

[11] Faller, A.L.K., Fialho, E. (2009) *The antioxidant capacity and polyphenol content of organic and conventional retail vegetables after domestic cooking.* FOOD RESEARCH INTERNATIONAL. 42(1): 210–215.

[12] *Long-term organic and conventional farming effects on nutrient density of oats* | RENEWABLE AGRICULTURE AND FOOD SYSTEMS | Cambridge Core (*https://www.cambridge.org/core/journals/renewable-agriculture-and-food-systems/article/abs/longterm-organic-and-conventional-farming-effects-on-nutrient-density-of-oats/75F08331A10BACBB3672AA6550493C4F#supplementary-materials*).

Supplementary Materials

Supplemental Table 1: Mineral concentration in oat grain under organic and conventional grain cropping systems at the Farming Systems Trial. Key: LEG (organic legume); MNR (organic manure); CNV (conventional); T or NT (tilled or no-till). Means within a column followed by the same letter are not significantly different (LSD, $\alpha = 0.05$)

	B	Ba	Ca	Cu	Fe	K	Ni	Cr	Vd	Pb	Cd	As	Al	Str	Na
							mg Kg^{-1}								
CNV–NT	5.515a	5.3675a	770.66a	3.7275a	37.593a	3,775.1a	2.175a	3.855a	0.155a	0.0925a	0.07a	0.45a	6.53a	2.1a	41.472a
CNV–T	5.385a	5.2575a	809.13a	4.1025a	39.45a	3,782.8a	1.995a	3.48a	0.17a	0.075a	0.0725a	0.4575a	6.115a	1.98a	45.308a
LEG–NT	5.59a	5.43a	756.11a	3.83a	37.855a	3,770.9a	1.8375a	3.2425a	0.155a	0.06a	0.0675a	0.4625a	5.21a	2.04a	42.297a
LEG–T	5.3775a	5.245a	790.56a	3.835a	40.935a	3,658a	1.7375a	3.46a	0.17a	0.08a	0.0675a	0.4725a	8.1625a	2.01a	40.99a
MNR–NT	5.7575a	5.6025a	812.77a	4.3225a	42.228a	3,832.8a	2.3525a	4.4675a	0.1675a	0.1425a	0.07a	0.475a	5.715a	2.15a	45.057a
MNR–T	5.52a	5.3925a	804.53a	4.8775a	38.588a	3,942.4a	1.7725a	3.6275a	0.17a	0.0825a	0.0725a	0.495a	6.45a	2.17a	43.98a
							Standard Errors								
CNV–NT	0.1546	0.1465	23.094	0.1719	0.9628	183.07	0.2688	0.2836	0.002887	0.0149	0	0.0173	1.1784	0.0799	1.0765
CNV–T	0.0656	0.0547	12.505	0.1943	2.2187	71.489	0.1121	0.4233	0.005774	0.0185	0.0025	0.0131	0.6086	0.0261	1.9704
LEG–NT	0.1257	0.1197	14.924	0.0528	1.5901	44.14	0.12	0.3507	0.005	0.01	0.0025	0.0155	0.2333	0.0819	0.8785
LEG–T	0.1063	0.0992	16.185	0.1248	2.3869	98.721	0.1501	0.3711	0.005774	0.005774	0.0025	0.0144	1.7818	0.1125	1.2279
MNR–NT	0.1411	0.1355	28.118	0.6472	1.8566	88.686	0.3057	0.4474	0.004787	0.063	0	0.0126	0.0603	0.1453	0.7725
MNR–T	0.1774	0.1788	18.02	0.7638	0.434	158.33	0.0487	0.0898	0.007071	0.008539	0.0025	0.0202	0.7276	0.0819	0.8987

Misleading consumers about the benefits of organic food are not without consequence. **This fear-based marketing most directly impacts low income and marginalized communities, both in terms of health and prejudice.** Hence, calls for FDA and FTC to begin enforcing truth in labeling laws for organic food.[13] **As the FTC revisits and updates Green Guides in 2022, it is an excellent opportunity to clamp down on the unscientific claims of the organic food industry.**[14]

- **False marketing claims affect our psyche.** Organic labels have been proven to trick the brain into thinking something tastes better.[15] In a self-fulfilling prophecy of sorts, the more people consume organic food, the more they believe their false assumptions that organic food is more healthful, tastier, and less caloric.[16]
- **Misinformation promotes bias and discrimination.** So much misinformation has been presented to society, that whether or not someone consumes organic food now dictates how others view their honesty, openness and overall disposition.[17] As research shows, this bias would unduly affect historically underserved, low income and marginalized communities.[18]
- **False claims promote obesity.** The perceived health of a food creates a halo which unconsciously drives consumer over-consumption.[19, 20] Therefore, false claims around the "health" of organic food can spur weight gain.
- **False claims disproportionately impact low-income families**. Promoting misinformation about organic produce being safer than conventional produce leads low-income families to consume fewer fresh fruits and vegetables regardless of production method.[21] As Dr. Elizabeth Pivonka, President of Produce for Better Health Foundation notes "we have been concerned . . . for some time, that safety fears may be another barrier to consumption of these healthy and nutritious foods. The impact of the fear-based messaging on low-income consumers is especially troubling since many don't have access or can't afford

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[13] *FDA and FTC need to end anti-GMO deception in organic food advertising* † | THE HILL (*https://thehill.com/opinion/technology/399939-fda-and-ftc-need-to-end-anti-gmo-deception-in-organic-food-advertising/*).

[14] *FTC Guide Revision: Avoiding Misleading Environmental Claims* † (*natlawreview.com*) (*https://www.natlawreview.com/article/environmental-marketing-claims-regulatory-and-litigation-outlook*).

[15] Apaolaza, V., Hartmann, P., Echebarria, C., Barrutia, J.M. (2017) *Organic label's halo effect on sensory and hedonic experience of wine: A pilot study.* JOURNAL OF SENSORY STUDIES. *https://doi.org/10.1111/joss.12243*.

[16] Prada, M., Garrido, M.V., Rodrigues, D. (2017) *Lost in processing? Perceived healthfulness, taste and caloric content of whole and processed organic food.* APPETITE. 114: 175–186.

[17] Richentin, J., Perugini, M. (2022) *The organic diet effect on person perception.* APPETITE. 168: 105696.

[18] Dimitri, C., Dettmann, R.L. (2012) *Organic food consumers: what do we really know about them?* † BRITISH FOOD JOURNAL. 114(8): ISSN:0007–070X.

[19] Her, E., Seo, S. (2017) *Health halo effects in sequential food consumption: The moderating roles of health-consciousness and attribute farming.* INTERNATIONAL JOURNAL OF HOSPITALITY MANAGEMENT. 62: 1–10.

[20] Sundar, A., Kardes, F.R. (2015) *The role of perceived variability and the health halo effect in nutritional inference and consumption.* PSYCHOLOGY AND MARKETING. *https://doi.org/10.1002/mar.20796*.

[21] Huang, Y., Edirisinghe, I., Burton-Freeman, B. (2016) *Low-income shoppers and fruit and vegetables. What do they th[i]nk?* † NUTRITION TODAY. 51(5): 242–250.

organic"[.][22] Scientists from John Hopkins found similar alarming results when interviewing low-income residents in Baltimore and concluded "Consumers' perceptions of organic can swamp or compete with other messages about healthy eating."[23]

As outlined above, presence of minute levels of pesticide in food has no impact on human health. However, some claim that even if pesticides are not a risk through food consumption, they negatively impact soil health. Again, this does not align with the scientific consensus. We also have not found this to be true as evidence by the data from Western Sugar farms submitted with my written testimony.

- One study looking at conventional *versus* organic farming impacts on biodiversity concluded **conventional systems, even those using herbicides, can match the ecological benefit of organic farming.** Since implementing the conventional practices required less expense and maintained high yields, the authors conclude reducing farm impacts would be better served by expanding conventional farming's best management practices rather than switching to organic systems.[24]
- Examining long-term effects of glyphosate on the soil microbiome, one group of scientists showed greater diversity between sites than between treatments and that "**high taxonomic and functional microbial diversity was observed in all treatments**".[25] This goes against claims of Dr. Kristine Nichols of the Rodale Institute quoted in *Kiss the Ground* stating soils on conventional farms are "essentially devoid of life".
- Yet another study in a sensitive desert environment found ". . . **no evidence of glyphosate effects on the soil microbiome**"[.]26
- The lack of impact of glyphosate on the soil microbiome holds true even with repeated, prolonged use. A study in wheat production using glyphosate for over 20 years found less than 1% of the soil microbiome was impacted and when combined with no-till provides positive environmental benefits.[27]
- Another study in wheat, found **pesticides did not affect the diversity of the soil microbiome**.[28]

The alternative to chemical management of weed species, is tillage. Less than 3% of the organic crop production acreage in the United States uses "no-till" practices,[29] therefore tillage is extensively used in these systems. Tillage has a major, negative impact on soil health regardless of frequency. Even single tillage events significantly alter soil chemical, physical and microbial properties.[30] Therefore, **one can't help but question whether no-till organic is the "soil health solution", since Rodale Institute even highlights: "We have found that organic no-till practices year after year do not yield optimal results, so our organic systems utilize reduced tillage and the ground is plowed only in alternating years."**[31]

The scientific consensus is clear, there is no nutritional, health (soil or human), or safety advantage for organic production systems. However, there is a clear risk when organic production is implemented at scale: loss of productivity. If there is any hope for climate change mitigation, land conversion must cease. Therefore, we must

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[22] *Fear-Based Messaging Reduces Produce Consumption—Both Organic and Conventional* †— CALIFORNIA AGRICULTURE NEWS TODAY (*californiaagtoday.com*) (*https://californiaagtoday.com/fear-based-messaging-reduces-produce-consumption/*).

[23] Rodman, S.O., *et al.* (2014) *"They just say organic food is healthier": perceptions of healthy food among supermarket shoppers in southwest Baltimore.*† THE JOURNAL OF CULTURE AND AGRICULTURE. 36(2): 83–92.

[24] Barre, K., Le Viol, I., Julliard, R., Chiron, F., Kerbiriou, C. (2018) *Tillage and herbicide reduction mitigate the gap between conventional and organic farming effects on foraging activity of insectivorous bats.*† ECOLOGY AND EVOLUTION. 8(3): 1496–1506.

[25] Babujia, *et al.* (2016) *Impact of long-term cropping of glyphosate-resistant transgenic soybean on soil microbiome.* TRANSGENIC RESEARCH. 25: 425–440.

[26] Gornish, *et al.* (2020) *Buffelgrass invasion and glyphosate effects on desert soil microbiome communities.* BIOLOGICAL INVASIONS. 22: 2587–2597.

[27] Schlatter, *et al.* (2017) *Impacts of repeated glyphosate use on wheat-associated bacteria are small and depend on glyphosate use history.*† APPLIED AND ENVIRONMENTAL MICROBIOLOGY.

[28] Lupwayi, *et al.* (2020) *Profiles of wheat rhizobacterial communities in response to repeated glyphosate applications, crop rotation and tillage.*† CANADIAN JOURNAL OF SOIL SCIENCE. *https://doi.org/10.1139/cjss-2020-0008*.

[29] *https://www.ers.usda.gov/webdocs/publications/90201/eib-197.pdf.*†

[30] Kraut-Cohen, *et al.* (2020) *Effects of tillage practices on soil microbiome and agricultural parameters.* SCIENCE OF THE TOTAL ENVIRONMENT. 705: 135791.

[31] *Farming Systems Trial*—Rodale Institute (*https://rodaleinstitute.org/science/farming-systems-trial/*).

strive towards optimizing sustainable intensification from acreage already dedicated to agriculture. Thankfully, environmental benefit does not need to come at the cost of productivity.

Organic production cannot compete with conventional production systems regarding yield, improving soil health, and overall sustainable agriculture. The preeminent source of information for yield performance comparison is peer-reviewed, published results from both on-farm and research-scale data. Even more reliable yield performance comparisons can be concluded from analyzing all available published data, known as meta-analysis. Many meta-analyses comparing yields with various approaches have been published in the last decade and all come to the same conclusion: **yield is roughly 20% lower for organic production systems than conventional.**

- *University of California-Berkley meta-analysis (2015):* **organic yields are 19.2% lower than conventional.** Yield gaps **could be reduced to 8–9%** through multi-cropping/crop rotation. However, those conservation practices improved yields in both conventional and organic systems.[32] Therefore, as both systems improve, organic production continues to lag in productivity.
- *Universidad de Buenos Aires meta-analysis (2021):* **organic yields were 25% lower than conventional.** When considering lower use intensity [*e.g.,* organic systems needing to take land out of food production for year(s)], **overall organic productivity was 29–44% lower than conventional.**[33]
- *Technical University of Munich meta-analysis (2018):* **organic production systems have 15% greater variability in yield compared to conventional**. The authors also highlight reduced tillage, cover cropping and crop rotation applied in conventional systems had positive impacts on soil health and biodiversity.[34]
- *A meta-analysis published in the prestigious peer-reviewed journal,* ***Nature*** *(2012):* **organic yields are 34% lower than conventional contrasting most comparable production systems.** The authors did note yield gaps vary by scale of the operation, crop being grown, and cultural practice employed, with **certain legumes and perennials having just 5% lower yield in organic production.** The data led the authors to conclude that the lower productivity of organic production systems results ". . . in more widespread deforestation and biodiversity loss, and thus undermining the environmental benefits of organic practices".[35]

Claims made in the hearing of organic yields being superior to conventional based on the small-plot research generated on Rodale experimental farms contradict the scientific consensus on the matter. That data should be considered an experimental outlier unsuitable to challenge facts presented and reviewed in the scientific literature. Furthermore, it has been known since at least the 1940s that small plots bias yield estimates.[36]

The loss of productivity in organic systems has real consequences. As Mr. Moyer noted in his written testimony: a "10% [reduction] of crop yields, [is] the equivalent of removing millions of acres of land from production". Further, as noted by the EAT-Lancet Commission[37] the biggest threat for agricultural contributions to climate change is unrealized yield potential that forces more native land into agricultural production. Clearly, from the data presented, a wholesale switch to organic farming would result in major land conversion, biodiversity loss, and increases in land-based emissions which further exacerbates climate change. The mission of regenerative agriculture is not to maximize profits (*e.g.,* accepting price premiums for lower productivity systems), but to reduce environmental impact associated with

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[32] Ponsio, L.C., *et al.* (2015) *Diversification practices reduce organic to conventional yield gap.*† PROCEEDINGS OF THE ROYAL SOCIETY B. DOI:10.1098/rspb.2014.1396.

[33] Alvarez, R. (2021) *Comparing Productivity of Organic and Conventional Farming Systems: a Quantitative Review.* ARCHIVES OF AGRONOMY AND SOIL SCIENCE, DOI:10.1080/03650340.2021.1946040.

[34] Knapp, S., van der Heijden, M.G.A. (2018) *A global meta-analysis of yield stability in organic and conservation agriculture.*† [NATURE COMMUNICATIONS]. 9: 3632.

[35] Seufert, V., Ramankutty, N., Foley, J.A. (2012) *Comparing the yields of organic and conventional agriculture.*† NATURE. 485(7397): 229–232.

[36] *Bias in the Use of Small-size Plots in Sample Surveys for Yield* |Semantic Scholar (*https://www.semanticscholar.org/paper/Bias-in-the-Use-of-Small-size-Plots-in-Sample-for-Sukhatme/918d445c37d3e04dc7efd28c89e9497efd94a186*). **Editor's note:** the original article is from the May 11, 1946 publication of *Nature,* Vol. 157. p. 630; and is available at (*https://www.nature.com/articles/157630b0.pdf*).

[37] *https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31788-4/fulltext*.

production. If all farmers ignored yield, we would be facing an environmental and humanitarian crisis.

Some would argue that a loss in yield is acceptable because of the overwhelming benefit that organic production has on soil health. But those assumptions are false. As outlined above, judicious use of pesticides does not impact soil health, but even more consequential is the overall **best management practices within conventional agriculture can exceed the soil health benefits of organic production.**

- Again, as the authors of the meta-analysis published in *Nature* noted, the lower productivity of organic production systems results ". . . in more widespread deforestation and biodiversity loss, thus undermining the environmental benefits of organic practices".[4]
- My fellow panelists at the hearing provided data in their written testimony that supports the fact conventional agricultural advances soil health:
  - Mr. Moyer states "Critically, research shows that organic farming has the potential to diminish soil erosion (Erhart and Hartl 2009)." **This statement references a non-peer reviewed book chapter in which the authors acknowledge they never directly measure erosion,** but rather infer erosion through "measured topsoil thickness". This is an inadequate measurement for soil retention, especially in organic farming that injects high rates of manure and compost into the system that confound soil physical measurements.[38]
  - Mr. Moyer goes on to state "Soil erosion rates measured under simulated heavy rainfall in the Swiss Farming System and Tillage experiment revealed that organic farming decreased mean sediment delivery compared to conventional farming by 30% (0.54 t ha^{-1} h^{-1}) (Seitz, *et al.,* 2019)." However, **Mr. Moyer fails to inform the Committee of the authors overall conclusion in this study: conventional with no-till is over three times as effective at erosion reduction than reduced till organic.** To quote the authors of the manuscript: "This study demonstrated that reduced tillage in organic farming decreased sediment delivery (0.73 tha^{-1} h^{-1}) compared to intensively tilled organic plots (1.87 tha^{-1} h^{-1}) by 61%. *Nevertheless, the combination of conventional farming and no tillage showed the lowest sediment delivery (0.24 t* ha^{-1} h^{-1}*)*".[39] This is not surprising as even as Mr. Moyer admits in an interview that "no-till" organic is a misnomer and is really "rotational tillage".[40]
  - Mr. Clark cites four farmer success stories in his testimony. The one with the greatest advancement in soil health is Mr. David Brandt of Carroll, Ohio. He has vastly increased soil health as evidenced by an increase in organic matter from 0.75% to 6.8–8%. Mr. Brandt is a conventional farmer who uses synthetic fertilizers and herbicides. **This directly contradicts Mr. Clark's and Mr. Moyer's assertions that regenerative organic is needed to promote soil health.**
  - Further evidence of the power of conventional agriculture in promoting soil health is provided by Mr. Clark's citation of the Soil Health Institute's survey.[41] **Mr. Clark did not highlight the fact these farmers' accomplishments were the result of conventional, not organic agriculture.** As evidenced from the data tables in the survey, the farmers achieved all these benefits to soil health, even while using conventional systems (including GMO seeds, synthetic fertilizer, and pesticides).
    - The fertilizer savings were due to ". . . farmers implementing nutrient management practices such as grid soil sampling (86%), variable rate fertilizer application (82%), and split application of nitrogen (89%) as part of their soil health management system."
    - Although not explicitly stated by the authors, it is inferred a majority of the farmers in the study used GMO seed and none were organic producers from statements like the following: "Some farmers planted non-GMO corn

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[38] Armstrong-Brown, S.M., Cook, H.F., Lee, H.C. (2000) *Topsoil characteristic from a paired farm survey of organic* ***versus*** *conventional farming in southern England.* BIOLOGICAL AGRICULTURE AND HORTICULTURE. 1: *https://doi.org/10.1080/01448765.2000.9754863*.

[39] Seitz, S., *et al.* (2019). *Conservation tillage and organic farming reduce soil erosion.*† AGRONOMY FOR SUSTAINABLE DEVELOPMENT. 39: *https://doi.org/10.1007/s13593-018-0545-z*.

[40] "tillage is limited, and best described as rotational tillage" *An Introduction to the Organic No-Till Farming Method*† | ECOFARMING DAILY (*https://www.ecofarmingdaily.com/build-soil/tillage/book-week-organic-no-till-farming/*).

[41] *Economics of Soil Health Systems in Midwest Corn and Soy*—Soil Health Institute (*https://soilhealthinstitute.org/our-work/initiatives/economics-of-soil-health-systems/*).

or soybean after adopting a soil health management system that provided a price premium" contained with the document.

Last, during the hearing claims were made of the agricultural system being "broken"[42] alongside alarmist statements of global topsoil erosion in the next 60 years.[43] As noted in the National Resources Inventory, erosion from U.S. farmland is down 35%.[44] As Mr. Moyer notes in his written testimony, "98 percent of farms practice conventional agriculture", so this improvement is directly driven through advancements in conventional farming. **Hence, the system is not broken; we don't need a replacement for a functional system, we need to continue to build upon it's demonstrated success.**

As One World Data, led by Oxford University scientist Dr. Max Roser, found claims of "only 60 harvests left" is "overblown", yet "repeated over and over". Despite the fact no reference to this "fact" can be found in any scientific literature, just newspaper headlines.[45] Through analysis of the data it was determined "Half of the soils managed with conservation management had a lifespan greater than 5,000 years; and 40% exceeded 10,000 years." They agree that improvements are possible and needed, especially in areas with high amounts of bare soil, but warn these alarmist claims not based in science ". . . forces some people towards solutions that are ineffective or counterproductive. Some blame the decline . . . on the use of fertilizers and other chemical inputs." However, the authors highlight "In some contexts organic farming can play a role, but it's not the ultimate solution. Misleading headlines convince people that it is."

SUBMITTED QUESTIONS

Questions Submitted by Hon. Salud O. Carbajal, a Representative in Congress from California

Response from Jeffrey W. Moyer, Chief Executive Officer, Rodale Institute

Question. Mr. Moyer, it seems some hesitancy in implementing regenerative practices comes from concerns that farmers may see their yield decrease, hurting their bottom line.

How can Congress help educate growers across the country on the benefits of implementing the regenerative practices you've outlined today?

Answer. We must understand that farmers take on a fair bit of risk every year in their operations based on uncertain markets, shifts in weather patterns, unstable supply chains and fluctuating costs. To add in an additional risk of "changes in production models" can often be more than the system can bare, even if those changes lead to positive farm (soil health and economics) and global outcomes.

Congress can help by instituting language in the farm bill that works to mitigate this risk through: enhanced EQIP regulations that encourage practices, based on science, that improve soil health; restructure crop insurance programs that reduce premiums for farmers/ranchers/producers that are attempting to implement regenerative organic practices; adjust tax structures or cost supports designed to help farmers/ranchers/producers during the USDA mandated 3 year transition period where the farmer/rancher/producer is required to produce farm commodities or products using organic or regenerative organic certification standards but due to regulatory statues and labeling regulations, must market their commodities or products as conventional.

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[42] "Given your positions on this esteemed Committee, it's likely you already know that America's food system is broken." Mr. Moyer's written testimony page 1 of 14. "While American farmers and ranchers are at the heart of this country and are some of the most innovative, successful, and productive farmers in the world, I want to be crystal clear for a moment to recognize the perilous state of our soils—the real wealth of our nation, the foundation of American resilience and prosperity. The situation is urgent and must be considered as such." Mr. Clark's written testimony page 2 of 17.

[43] "About ⅓ of the world's soil has already been degraded, and if the current rate of soil degradation continues, all of the world's topsoil could be lost within 60 years." Mr. Moyer's written testimony page 3 of 14.

[44] *2017NRISummary—Final (1).pdf* (*C:/Users/rlarson/Downloads/2017NRISummary_Final (1).pdf*).

[45] *Do we only have 60 harvests left?*—Our World in Data (*https://ourworldindata.org/soil-lifespans*).

Response from Rick Clark, Owner, Farm Green & Clark Land and Cattle; on behalf of Regenerate America

Question 1. I am encouraged to hear about the successes of your regenerative farming practices. It is possible to grow food for our nation and the world while also benefiting the environment. You are proof of that.

Mr. Clark, you have clearly found success in your regenerative practices and could very well serve as a model for other farmers across the country.

How did you implement regenerative farming? Was it trial and error or research? And how can Congress help take the lessons you and others have learned and use that knowledge to help other farmers successfully transition to regenerative farming?

Answer. Our old farming practices created a lot of erosion. All it took for me was a 1″ rain event to realize something had to change, and so we started looking at no-till practices and at adding cover crops. At the time, I had no idea what regenerative was and what it could do for the soil. This was originally a defensive reaction to a problem, but when I began to understand the power that cover crop species have, I was then able to turn our system into an offensive juggernaut.

The number one driver for me in my quest to maximize regenerative practices was Mother Nature. She created situations that I had no idea how to combat. My willingness to stay the course and test and learn on our own farm has gotten us to where we are today.

That is how we began implementing the principles of soil health and getting our soil ready for the reduction of inputs—it was all trial and error, because there were not many or any organizations or educators teaching this at the time, and I didn't know other farmers trying this. We have since taken our farm to the summit of soil health practices and eliminated all inputs. This makes us very solid for the future generations coming on board.

What Congress must recognize is that funding for soil health practices and conservation programs are an essential step to help farmers improve soil health, but these funds alone don't guarantee success for the farmer. Education, research, and technical support are necessary for successful implementation at scale. In order to see the results I have had on my farm across the country, America's producers urgently need access to updated education and peer-to-peer support systems, based on the latest science and context-based principles for building soil and climate adaptation. That means we need to include a focus on regenerative agriculture and soil health in Title VII of the farm bill which increases funding for regenerative agriculture research, education, and technical assistance. We need train-the-trainer programs for Extension personnel so that they can help farmers with this needed transition. We also need to foster a feedback loop between the research, education, and Extension technical service providers so that the latest research on regenerative agriculture and soil health are being shared with farmers and ranchers across the country.

Question 1a. How did you determine what combination of cover crops would best benefit your fields and how should other farmers make this determination? Is this an area where USDA could offer assistance to help growers make better informed decisions?

Answer. There were not a lot of people to talk to about cover crops at that time, so I made the decision that we would test on our farm and see what works and does not work. Today, there are so many outlets for farmers to find information about regenerative practices like cover cropping, but we still have to remember that change is hard and there needs to be a solid support group available to help these farmers in real-time. The farmer needs to be supported to have success when they are trying new practices for the first time; if they are not, they may be discouraged from trying new practices in the future.

This is an area that the USDA can and should be offering assistance in, but to do so, we must first ensure that USDA agents are educated in the principles of soil health. Successful applications of cover crops depend upon a deep understanding of the context of the region, and what would work best for the soil type, the production system, and the climatic region.

Learning how to effectively use cover crops can take some time, and it's imperative that producers receive both technical assistance and financial incentives over a period of time. We have seen producers try cover crops one year and if not immediately successful, abandon the practice. This is especially true in drier areas of the county, and once this happens, farmers share with other farmers "it does not work here." This is unfortunate, because we have seen tremendous success with cover crops in these areas, but it can take a few years to see the economic and ecological

benefits. Farmers must receive the proper support to get them over the learning curve to reap the incredible benefits of cover crops.

The farmer cannot be expected to jeopardize the livelihood of their farm to implement a concept they are not familiar with—that is why education and consistent support are necessary to the success of any planned programs in the future.

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