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CLIMATE CHANGE AND THE AGRICULTURE SECTOR

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C O N T E N T S

Tuesday, May 21, 2019

CLIMATE CHANGE AND THE AGRICULTURE SECTOR

TUESDAY, MAY 21, 2019

U.S. SENATE,
COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY,
Washington, DC.

The committee met, pursuant to notice, at 9:30 a.m., in room 328A, Russell Senate Office Building, Hon. Pat Roberts, Chairman of the Committee, presiding.

Present or submitting a statement: Senators Roberts, Boozman, Ernst, Braun, Perdue, Thune, Fischer, Stabenow, Brown, Klobuchar, Bennet, Casey, Smith and Durbin.

STATEMENT OF HON. PAT ROBERTS, U.S. SENATOR FROM THE STATE OF KANSAS, CHAIRMAN, U.S. COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY

Chairman ROBERTS. Good morning. I call this hearing of the Senate Committee on Agriculture, Nutrition, and Forestry to order. Today we will hear from a most knowledgeable panel on climate change and the agriculture sector.

Maintaining the health of our planet for future generations is, of course, of paramount importance, but so is feeding the billions of people that populate the earth today and in the years ahead. These topics and how they interact is complex and we are pleased to have this discussion at the Agriculture Committee, whose constituency plays an important role in meeting those challenges.

America's farmers and ranchers are continually learning and evolving in order to improve agriculture production efficiencies and to conserve natural resources, increase resiliency to Mother Nature, and to maintain a profitable business.

Today, obviously, farmers do not produce food in the same manner as previous generations over time. Advancements in science and technology have provided farmers the ability to produce more food, feed, and fiber while using less inputs and resources. Farming practices from a generation ago were not sustainable to produce food at the scope and scale needed to feed today's growing and hungry population around the globe.

The U.S. agriculture sector should be proud of the accomplishments that have been made through voluntary efforts to address environmental sustainability. I will say that again—voluntary efforts, including efforts for which they are not compensated.

It is important to note there has been no single silver-bullet solution that has brought about advancements the U.S. agriculture sector has made in recent decades to improve environmental sustain-

ability. Instead, advancements have been made due to the adoption of a range of technologies and practices, and realizing efficiencies. When combined, all of those separate parts tell us a much greater story that demonstrates how American farmers are able to increase productivity, while at the same time, reduce greenhouse gas emissions, and minimize the impact on the environment. I wish everybody could understand this.

Rather than a silver bullet, it is like a recipe that includes many ingredients—biotechnology, precision agriculture, voluntary conservation practices such as no-till farming, veterinary care, livestock nutrition, and genetics, all of which help our U.S. producers improve environmental sustainability.

Importantly, these efforts have been self-initiated and largely self-funded by America's farmers and ranchers. Obviously, climate change is a complex and global issue. We must be thoughtful, informed, and deliberate in considering potential responses and consequences. If farmers are hindered from utilizing existing technologies and research, or if unsound regulatory decisions are made today on emerging technologies such as genome editing, we can expect an economic result that is, at the least, more costly and, worse, unsustainable for our farmers and ranchers.

The reality is the agriculture and food value chain is complex. It is made of growers, input suppliers, processors, handlers, and consumers, and it is impacted by production cycles that can span several years, weather, disease, perishability, and other factors beyond our human control.

Agriculture is an open system, and we must understand and ensure that American family farms must stay in business. Alternatively, a likely result includes food and fiber production being shifted to countries that do not have the same conservation-minded producers that we have here in the United States, countries that are unable to produce food at the scale of our farmers, ranchers and growers.

I believe agriculture and American farmers and ranchers who live by the concept of continuous improvement and voluntary-based conservation can be a model for other industries and other countries on how to address problems like changes in the climate in a practical, local, and individual way.

I look forward to hearing from the panel on producer perspectives of global climate change and the responses that have already, or are already underway in the agriculture sector to address this challenge. This should be a good learning opportunity for all on the Ag Committee.

With that I recognize the distinguished Senator from Michigan, my buddy——

Senator STABENOW. Thank you.

Chairman ROBERTS [continuing]. my pal——

Senator STABENOW. That sounds like a song, Mr. Chairman.

Chairman ROBERTS [continuing]. stagecoach rider, Senator Stabenow, for any remarks she may have.

STATEMENT OF HON. DEBBIE STABENOW, U.S. SENATOR FROM THE STATE OF MICHIGAN

Senator STABENOW. Well, thank you, Mr. Chairman, for holding a very important hearing today on climate change and the solutions that can come from agriculture. That is what we want to talk about today.

I would first note that we've received a lot of statements from organizations that would love to share their views from groups such as the National Young Farmers Coalition, to National Sustainable Agriculture Coalition, and others. Without objection, I would ask to put these statements into the record.

Chairman ROBERTS. Without objection.

Senator STABENOW. Thank you.

[The following documents can be found on pages 62-95 in the appendix.]

Senator STABENOW. Thank you very much.

I believe there is no greater challenge that will affect the future of the planet, our agricultural economy, and our ability to feed a growing population other than the one we are talking about today. Really, it is the biggest challenge that we have.

My goal today is not to debate the science of climate change—the science is sound. I believe in science. We all do. Sound science has helped our farmers grow the safest, most productive food supply in the world, and we will continue to do so. That same sound science is telling us that climate change from carbon pollution is an urgent challenge. That same science is giving us the tools to confront and address it.

No one understands the stakes and the potential solutions better than our farmers and ranchers. Right now in Michigan, we have seen bomb cyclones, flooding, tornadoes, and other extreme weather events. We are also seeing unusually cold and rainy weather that has kept farmers from getting into their fields, likely lowering yields as we move past the ideal planting window.

Across the country, we have seen a growing and alarming number of extreme natural disasters, wreaking havoc in communities and on farms. According to the nonpartisan Government Accountability Office, climate change could result in crop losses costing up to $53 billion every year for our children and grandchildren.

While our agriculture industry is uniquely affected by climate change, our farmers and food businesses are also uniquely positioned to address the root causes. With the right support, our producers can cut down on their emissions and profit from the adoption of practices to store more carbon in soil and trees. These solutions are good for the environment and good for our farmers' bottom line.

The good news is that many farmers and ranchers are already rising to this challenge, all while continuing to meet the growing global demand for food. The other good news is that our 2018 Farm Bill provides funding support for many of the solutions that are needed.

Producers like the corn growers are partnering with conservation groups to establish innovative organizations like the Soil Health Partnership, the Midwest Row Crop Collaborative, and many oth-

ers. Food companies are forming sustainability alliances and taking additional actions to reduce their carbon footprint.

For decades, farmers have been adopting voluntary, climate conservation practices like cover cropping, no-till farming, and adding more trees as windbreaks and buffers.

Currently, there are 140 million acres of farmland using USDA conservation programs. Since 2012, we have seen the number of farms installing renewable energy systems like solar panels and anaerobic digesters double. Actions resulting in all of them cutting their energy consumption, their costs, and their emissions. Now, through landmark investments, producers have had more opportunities to grow the next generation of biofuels, and to make money in voluntary carbon markets from grassland conservation in North Dakota to sustainable rice cultivation in Arkansas.

With many farmers and ranchers already implementing these practices, our challenge going forward, I believe, is how to scale up and support these efforts. The 2018 Farm Bill is the starting point. This law enacted the most ambitious- and bipartisan-climate-smart agricultural policies to date, with the support of 87 Senators. Changes to crop insurance, working lands conservation programs, and forest health initiatives are helping producers sequester carbon and improve sustainability.

Looking forward, we need to expand the good work that's already happening, all while providing farmers with economic opportunities so they can continue to grow the food that feeds the world. No farmer wants the government telling them how to farm their land. That is not what this is about. We should be strengthening the ways that farmers can benefit from building on the positive steps they are already taking.

In the past, we have risen to face challenges of this magnitude. During the 1930's, our farmers experienced an unprecedented catastrophe during the Dust Bowl. Dust storms buried homes and darkened cities. Crops and livestock were decimated. Children died of pneumonia. Thankfully, our Nation's response matched the challenge. We created thousands of locally led conservation districts, established the Soil Conservation Service at the USDA, and planted over 3.5 billion trees on barren land.

While the problem at hand might be different, the urgency is the same. Proposals to confront this problem must be bipartisan and must meet two goals, in my judgment. They must increase global agricultural production to feed the billions of people who need food, and they must support modern farming, ranching, and forestry practices that reduce greenhouse gas emissions and keep more carbon in our soils and trees.

I believe this Committee has a strong bipartisan framework to accomplish these goals and I am anxious to move forward. Thank you again, Mr. Chairman.

Chairman ROBERTS. I thank the Senator from Michigan for her very comprehensive statement and also outlining some of the things that we both worked on very hard on a bipartisan basis with regard to conservation, crop insurance, and certainly other important items.

We now will hear from the panel. Our first panelist is Mrs. Debbie Lyons-Blythe, a rancher from White City, Kansas. Debbie

Lyons-Blythe is the owner and operator of the Blythe Family Farms, a multigenerational ranch near White City, Kansas. Debbie's ranch includes more than 5,000 acres of native grassland, crop ground, and a seed stock herd of 500 registered Angus cattle.

Debbie has held leadership positions in the Kansas Livestock Association, the National Cattlemen's Beef Association, and is a founding member of the U.S. Roundtable for Sustainable Beef. Debbie is a vocal advocate for the U.S. cattle and beef industries and she is passionate about engaging and educating consumers about the positive story of cattle and beef production through her blog, Facebook, and consumer conferences.

She received degrees in agriculture communications and journalism from Kansas State University, home of the ever-optimistic Fighting Wildcats. Debbie and her husband are parents to five children who also are involved in the family ranching business. Thanks for being here today, Debbie. Please proceed.

STATEMENT OF DEBBIE LYONS-BLYTHE, BLYTHE FAMILY FARMS, WHITE CITY, KANSAS

Ms. LYONS-BLYTHE. Good morning. Thank you, Chairman Roberts and Ranking Member Stabenow, for inviting me to testify today. I am proud to be here representing farmers and ranchers in the conversation about climate change, and I must offer a quick shout-out to all those that are actually at home caring for the livestock today so that I can be here and be their voice.

I know you've all heard the often-quoted statistic that less than two percent of the American population is directly involved in agriculture today, but do you know why that is? It is because in American agriculture we are so good at what we do that the rest of the population does not have to work daily to grow their own food. By our improved efficiencies and technologies other people are free to become scientists, clothing designers, and teachers, and doctors, and data processors, and heck, maybe even legislators.

The beef cattle industry has a great story to tell in the climate conversation. According to the U.S. Environmental Protection Agency, direct emissions from beef cattle only represent two percent of all greenhouse gas emissions in this country, and a recent study published by the U.S. Department of Agriculture found that emissions from cattle "were not a significant contributor to long-term global warming." That is because American agriculture produces agricultural products more efficiently than the rest of the world, and those efficiencies mean real reductions in climate emissions.

Various technologies are helping us produce a safer product that has a small footprint on the environment. One of the technologies that we use at our ranch is genetic testing to identify the best bulls to breed. With a small DNA sample, we can select for those with the best feed efficiency, carcass quality and growth, as well as other important traits. The efficiency traits directly affects sustainability. An animal who will reach harvest faster and still produce a high-quality product will impact the environment for a shorter period of time.

Antibiotics are another technology we utilize to maintain cattle health and which, in turn, allows our cattle to utilize food and

water more efficiently. Hey, it is pretty simple. A sick animal takes longer to gain weight and reproduce, and that results in a larger environmental footprint.

These technologies, or some like them, allow cattle ranchers to produce the same amount of beef today that we were producing in the 1970's with 33 percent fewer animals.

Along with lowering emissions, ranchers have many ways we improve carbon sequestration. For example, the native grass in the Kansas Flint Hills can grow up to 6 feet tall with root systems more than 20 feet deep. Those deep roots are excellent at sequestering carbon in the soil, effectively pulling it out of our atmosphere. It is vital that we maintain and improve the existing grasslands to keep out urban encroachment. Cattle are the best way to utilize, maintain, and improve those grasslands, and ranchers like me are the reason that they exist today.

We also grow crops on our ranch, to feed our livestock, and we use cover crops and low-tillage methods to keep plant material growing in the fields throughout the year. These practices are proven to increase carbon sequestration.

We do it, though, because it's the right thing to do and because it improves our operation, not because we're required by the government. In addition, Blythe Family Farms is a founding member of the U.S. Roundtable for Sustainable Beef, and this organization brought together all segments of the beef supply chain, along with allied partners and many conservation organizations to demonstrate and improve beef sustainability.

Hey, I am not here today to tell you that ranchers across America wake up and say, "How can I improve carbon sequestration?" or "How can I impact sustainability?" Yes, those are buzzwords. They do not mean very much in the country. As ranchers, we have always been focused on conservation, animal welfare, being more efficient, and ensuring that our children and grandchildren will be able to continue that legacy. As my grandpa used to say, "Leave the land better than you found it." Farmers and ranchers are truly the original environmentalists.

In closing, let us talk about climate change policies. We have a simple request to you. Do not support legislation or policies that unfairly target cattle producers. Cattle have a positive role to tell in a healthy, sustainable food system. Cattle ranchers are proud of our history as stewards of our nation's natural resources. The industry takes very seriously its obligation to protect the environment while providing people with a safe and affordable food supply. Thank you.

[The prepared statement of Ms. Lyons-Blythe can be found on page 38 in the appendix.]

Chairman ROBERTS. We thank you, Debbie.

Our next witness is Dr. Frank Mitloehner. He is a Professor and Air Quality Extension Specialist in the Department of Animal Science at the University of California, Davis. He is a globally recognized expert on the subjects of climate change, the livestock industry's role in addressing this challenge, and understanding and mitigating air emissions from livestock operations.

Dr. Mitloehner was appointed to the President's Council on Science and Technology by President Obama. He is a past Chair-

man of the United Nations Food and Agriculture Organization partnership project to benchmark the environmental footprint of livestock production, and has served on committees of the National Academy of Science Institute of Medicine.

Dr. Mitloehner received a Master of Science degree in animal science and agriculture engineering from the University of Leipzig, in Germany, and a doctoral degree in animal science from Texas Tech, home of the ever-fighting Red Raiders.

I look forward to your testimony, Doctor. Thank you very much for coming.

STATEMENT OF FRANK MITLOEHNER, PROFESSOR, DEPARTMENT OF ANIMAL SCIENCE, UNIVERSITY OF CALIFORNIA, DAVIS, DAVIS, CALIFORNIA

Mr. MITLOEHNER. Thank you and good morning, Chairman Roberts, Ranking Member Stabenow, and members of the Committee for inviting me today to discuss the relationship between livestock and climate change.

I am a professor of animal science and air quality specialist in cooperative extension at the University of California, Davis, where much of my work revolves around studying the emissions of livestock in order to determine their contribution to air pollution and climate change. I also spend a good deal of time dispelling the notion that globally, livestock is responsible for more greenhouses gases leading to climate change than the entire transportation sector. This myth is one of the chief reasons we are advised to eat less meat, to protect us from global warming.

According to the U.S. EPA, those sectors of our society consuming fossil fuels such as transportation, electricity, and industry contribute to 80 percent of all greenhouses gases. In contrast, all of animal agriculture combined contributes to 3.9 percent, yet livestock, and therefore our consumption of animal protein, often bears the brunt of the blame for climate change.

So why the misconception? In 2006, the United Nations Food and Agriculture Organization, FAO, published a global study titled "Livestock's Long Shadow." It stated that 18 percent of the world's greenhouse gas emissions were the result of livestock and that globally, livestock was emitting more greenhouse gases than all modes of transportation combined. The claim, incorrect by a long shot, was the result of a methodological error. Whereas FAO used a comprehensive life-cycle assessment when depicting livestock greenhouse gases, it employed a different and simplified method of direct emissions only for transportation. I pointed out the flaw and the FAO owned up to the mistake, but FAO's claim that livestock was responsible for the lion's share of greenhouse gases was the shot heard around the world. To this day, we struggle to un-ring the bell.

It is staggering how many people think that merely us giving up meat, even once a week, will make a significant impact on their individual carbon footprints. A study published in the Proceedings of the National Academy of Science, PNAS, demonstrates that it cannot.

The study titled "Nutritional and Greenhouse Gas Impacts of Removing Animals from U.S. Agriculture" demonstrated that even if

all Americans were to give up meat, such a scenario would reduce greenhouse gases in the U.S. by only 2.6 percent. If every American subscribes to Meatless Mondays, it would only reduce our carbon footprint by 0.3 percent. This is due, at least in part, to the efficiency of U.S. agriculture.

U.S. livestock has shown astonishing progress, economically and ecologically, in past decades. According to the FAO, total direct greenhouse gas emissions from U.S. livestock have declined by 11.3 percent since 1961, while livestock production has more than doubled. This massive increase in efficiency and decrease in emissions has been made possible by the technological, genetic, and management changes in U.S. agriculture since World War II.

Consider that animal herds are at an historic low in the United States without a corresponding decrease in output. In 1950, there were 25 million dairy cows in the United States. Today there are only 9 million dairy cows. They produce 60 percent more milk than their ancestors did. The carbon footprint of a glass of milk is two-thirds smaller today than it was 70 years ago. It is a similar story for beef, swine, and poultry, making U.S. agriculture the envy of the world. We have improved the outputs by holding inputs steady.

Yet we still meet with criticism. I often get asked if U.S. cattle are causing an increase, a report—I repeat, an increase—in global warming. The simple answer is no. Cattle temporarily convert photosynthetic carbon, contained is grasses they consume, into methane. After only one decade, methane is oxidized into atmospheric CO^2 which is then assimilated by plants that are eaten by animals. It is a natural carbon cycle.

As a result, constant cattle herds do not increase atmospheric methane and therefore do not increase global warming. In the U.S., livestock herds have not only been constant but they have been significantly decreased over the last half century, meaning that the related methane has actually decreased as well.

I further submit that livestock allows us to value-add plant agriculture, both in terms of nutritional and economic value. That is, we can make use of marginal land, which is two-thirds of our agricultural land in both the U.S. and worldwide, to raise ruminant livestock that is able to feed on plants inedible by humans and upcycle them into high-quality animal-based foods. Furthermore, according to the PNAS article mentioned above, removing animals from U.S. agriculture would result in a food supply incapable of supporting U.S. populations.

Of course, we would likely produce more pounds of food and more calories per person if we raised only plants, but food security is more than calories. Micro- and macro-nutrients are essential and highly abundant in animal-sourced foods.

In closing, the global population is trending toward nearly 10 billion by 2050, representing an enormous food security and natural resource challenge. Meeting that challenge will require the world to produce both plant- and animal-based foods and to produce them more efficiently, while making the best use of agricultural land, including those considered marginal. First, we need to examine the facts and not engage in hyperbole.

Thank you very much for your attention.

[The prepared statement of Mr. Mitloehner can be found on page 43 in the appendix.]

Chairman ROBERTS. We thank you, Doctor, for your testimony. Senator Fischer has the privilege of introducing Matt Rezac.

Senator FISCHER. Thank you, Mr. Chairman. Today I want to welcome Matt Rezac from Weston, Nebraska to the Committee. I also would like to welcome his wife, Tina, and his sons, Jacob and Chase. We are happy to have all of you here today.

Mr. Rezac is a fourth-generation farmer who manages Rezac Farms, a 2,500-acre family farm consisting of corn and soybean production in eastern Nebraska. Matt is a member of Frontier Cooperative where he is involved with the Ultimate Acre Grower Panel.

In 2017, Rezac Farms was awarded the Conservation Agronomy Award for Outstanding Sustainability by Land O'Lakes SUSTAIN Initiative. Nominees were judged for air quality and greenhouse gas emissions, steps to maintain soil health, and improvement of water quality, among other factors.

Properly managing our environment is important, and Nebraska's agriculture producers who feed and fuel our world know better than anyone about conservation and stewardship. Matt's hard work day in and day out is a testament to that.

Thank you, Mr. Chairman, for holding today's hearing. I look forward to discussing the good work Matt and many of our hard-working producers across the country are doing to conserve our natural resources.

Matt, thank you for your testimony and we are happy to have you here today. Thank you, Mr. Chairman.

STATEMENT OF MATTHEW REZAC, REZAC FARMS, WESTON, NEBRASKA

Mr. REZAC. Thank you for the introduction, Senator Fischer. Members of the Committee, thank you for having me.

Chairman Roberts, Ranking Member Stabenow and Distinguished Members of the Committee, I am Matt Rezac. I'm a 4th generation farmer from Weston, Nebraska. My wife Tina and I farm about 2500 acres in a corn and soybean rotation. Some of the land in our operation has been in the family for close to 140 years. My sons, Jacob and Chase, are also here today.

When we talk about stewardship of the land, and doing what is right for the land, there is no one better than the American farmer. Most of the farmers I know do it for the next generation. On my farm we have always been conscious of what we are doing to the land.

About 20 years ago, I knew I had to do something different. If I was going to stay in business, I knew I had to find a way to be profitable, and I knew I had to take full advantage of technology. I wanted to break outside the box of how we had been farming. I looked at everything we could do and I soon figured out the key was going to be all about soil health.

First thing I noticed was that we had a serious soil compaction problem on the farm, and that once we started really concentrating on the soil, we saw that soil come back to life. Instead of just treat-

ing the symptoms of poor soil health, we diagnosed the root cause and the world opened up.

Since then, we have always focused on how we can do the right things for our farm. As we think about stewardship and climate today, I would like to share some key points with the Committee on this important topic.

First, technology is critical, and the future of agricultural conservation is precision. Just as I use precision agricultural tools to optimize my production and minimize inefficiency, precision conservation tools and planning help me reduce waste in my production system. In this case, waste means lost top soil and misplaced crop inputs.

On our farm we use variable rate technology and moisture probes in the soil to manage water. We are extremely precise about our nutrient management, making adjustments in season. We use tissue sampling during the growing season to know exactly what the plant needs. Most people do not understand this, but giving a plant too much of a certain nutrient, such as nitrogen, is just as bad as giving it too little, and it just adds to waste.

Precision conservation tools like Land O'Lakes SUSTAIN's Truterra Insights Engine highlight the financial opportunities for different field management systems. The most effective conservation practices are those that have an economic benefit to the farm, either by increasing yield and revenue, or by eliminating waste. Often where a crop field is not profitable, there is a portion of that field experiencing poor soil health due to topsoil erosion or nutrient losses. By using precision conservation tools, we can see how an unprofitable part of the field might be better in a conservation program. By focusing on net profitability, these precision tools can help farmers achieve their business goals while also improving their stewardship of natural resources.

Second, crucially, no one farmer, entity, or sector has all the answers and capabilities to accomplish alone what is needed. It takes all of us working together—farmers, the government, and the private sector—to deliver climate solutions.

My stewardship journey is a one of relationships and collaboration. We could not have accomplished what we did on my farm without my District Conservationist and my local NRCS office. NRCS has worked with me to tailor conservation solutions to my own farm. Unfortunately, my local NRCS office is overworked, and truthfully, overwhelmed. The time it takes to really sit down with a farmer and tailor conservation solutions is enormous.

To fill some of that void, I turned to my local co-op, Frontier Cooperative. Frontier has been a leader in sustainability and they joined the Land O'Lakes SUSTAIN program when it launched in 2016. Frontier embraced bringing agronomists out to the farm, educating farmers about being more efficient. The availability of robust data, analytics, and insights allows me to work with my agricultural retailer to employ practices in a far more targeted and impactful way than ever before.

The bottom line is this: on-farm conservation is not just good for the environment. It also supports a stronger rural economy through increased resiliency and profitability for farmers like me. To maxi-

mize both environmental benefits and economic benefits, it takes everyone working together.

We might not always see it or talk about it as a climate issue. I know the weather is changing, but I try to control what I can control. That is why you will hear us talk about things like maintaining soil health, protecting water quality, and controlling erosion. The practices that achieve those goals also help provide climate solutions. For example, I know what we are doing with soil health can help with weather variability and make my farm more resilient at the same time.

In closing, I want to emphasize the importance of farm economics. It is critical that climate solutions make economic sense for farmers. Providing market and policy incentives that complement the goals I have discussed will be vitally important.

In today's farm economy, we are not farming to rake in a profit. We are not making money, and we are farming to lose as little as possible. My top priority is to make sure my farm is healthy and strong when Jacob and Chase are grown up. I know focusing on stewardship makes economic sense.

Mr. Chairman and members of the Committee, thank you for the opportunity to testify on this important issue. I look forward to answering any questions.

[The prepared statement of Mr. Rezac can be found on page 50 in the appendix.]

Chairman ROBERTS. Well, thank you, Matt. I am going to suggest, if you will, please, have your wife Tina and your two sons, Jacob and Chase, stand up if you would.

[Applause.]

Chairman ROBERTS. I think that young man looks like a future farmer for sure.

Our next witness will be introduced, at length——

Senator STABENOW. At length?

Chairman ROBERTS [continuing]. if she chooses to go down all of the honors that this next witness certainly deserves. He is no stranger to our Committee or, for that matter, any committee in the Congress. He is a recognized leader and champion for agriculture. We are very privileged have back to the Committee a former Secretary but now President—has a ring to it, doesn't it?—President of the U.S. Dairy Export Council in Arlington, the Honorable Thomas Vilsack, who will now be introduced by Senator Stabenow.

Senator STABENOW. Well, thank you, Mr. Chairman. I think you have done a great job of it already, but we do want to welcome Secretary Tom Vilsack back to the Committee. Obviously this is not his first time at the witness table. Today he joins us as the President and CEO of the U.S. Dairy Export Council, where he is leading its mission to strengthen the dairy industry through increased exports and innovation.

Secretary Vilsack joined the U.S. Dairy Export Council in January 2017, after serving 8 years as the Nation's 30th Secretary of Agriculture and the longest-serving member of President Obama's Cabinet. While at the Department, he worked to strengthen the American agricultural economy, invest in the future of rural Amer-

ica, and conserve our land and water. There has been no better spokesperson for rural America than Secretary Vilsack.

Prior to his appointment, he served two terms as Governor of Iowa, in the Iowa State Senate, and as the mayor of Mt. Pleasant, Iowa. So we are so pleased to have you back with us to talk about the important work that you are in involved in. Welcome.

STATEMENT OF THE HONORABLE THOMAS J. VILSACK, PRESIDENT AND CHIEF EXECUTIVE OFFICER, U.S. DAIRY EXPORT COUNCIL, ARLINGTON, VIRGINIA

Mr. VILSACK. Thank you very much, Senator, and Mr. Chairman, thank you very much for the opportunity to be here today, and I am certainly honored to be with the other panelists.

I want to express appreciation for this hearing on behalf of the 39,000 family farmers who are in the dairy business. They operate farms across the country and they help to employ nearly 3 million people who are involved in the dairy industry across the country.

You have heard many sound climate environmental reasons for conducting this hearing, but I would like to focus on a competitiveness concern, and I think that is a reason for having this hearing. Domestic and international consumers and customers are increasingly demanding that dairy products and all food products be sustainably produced. It puts us at a competitive advantage if we can make the case.

The dairy industry has a good story to tell but it is challenging itself to tell an even better story in the future, but it needs willing partners from the government and the private sector.

In 2009, the dairy industry made a commitment to reduce across the supply chain 25 percent of their emissions by 2020, based on intensity. The dairy farmers across the country employed a variety of technologies and techniques. You have heard of some of them already this morning. Soil health improvements with no-till and cover crops, better grassland management with rotational grazing, improved feed efficiency, exercising the four R's with reference to nutrient management—the rate, amount, place, and time—adopting methods of capturing methane and converting it into fuel and energy to provide power for their operations, and along with processors, support of the development of an innovation center for the U.S. dairy industry and started a company called Newtrient that is looking at creative ways of dealing with manure management.

The FAO recently reported that producers in North America, dairy producers in North America, were the only dairy producers across the country and the world that actually reduced their emissions, with a five percent reduction overall. The industry has basically reduced their emissions by close to 20 percent, very well on pace for their 25 percent goal by 2020.

We are simply not satisfied with simply reducing emissions. I think the time has come for the dairy industry, specifically, and agriculture, generally, to look at creative ways to get to a net zero emission operation. That is a tall order, but I think there are a number of steps that could motivate and accelerate that effort.

First, establishing a series of pilot farms that could aggregate all of the existing technologies and techniques that are currently being used. This would allow us to measure and verify the conservation

and emission results. It would also allow us to identify the costs associated with this type of farm and assist all of you in determining the financial incentives and policies that would accelerate adoption.

It is no surprise to this Committee, nor to the members of this panel, that dairy farms, along with other farms, have had some challenging economic times. So it is important and necessary that we look for financial incentives and financial inducements to get to net zero. I think we can continue to expand significantly the development of ecosystem markets that will help generate the revenue necessary to adopt these technologies.

We need to promote new technologies in seed genetics. I had a recent conversation with Dr. Chory out at the Salk Institute. She is working on research that will eventually, in her view, lead to corn and soybeans and the root systems for those two commodity crops being able to significantly increase carbon sequestration.

Developing better sensors so we have a better understanding of the amount of carbon that is being sequestered in our soil. Feed additives that can reduce methane currently exist but are going through a regulatory process that is very time-consuming. Improved manure management. There are literally thousands of ways in which we can use the fiber, the water, the chemicals, the materials from manure to create new opportunities and new business opportunities in rural America.

This is going to require an increase in focus of research dollars in the public sector, a modernization of our regulatory systems designed to keep pace with this incredible pace of change, and financial incentives to encourage farmers to adopt these technologies and techniques.

This is a climate imperative but it is also, I would suggest, a marketed imperative. That is why this hearing is incredibly important. I want to take this opportunity, as a citizen of this country, just simply to thank this Committee for the fact that you are approaching this in a bipartisan way. I suspect that there are many out in the countryside that appreciate this Committee's approach toward problem-solving, and it is a pleasure and honor to be here this morning.

[The prepared statement of Mr. Vilsack can be found on page 54 in the appendix.]

Chairman ROBERTS. Tom, thank you so much for coming back and thank you for all that you have done on behalf of agriculture.

Debbie, many of the initiatives you described in your testimony are self-initiated and self-funded. You emphasized that. Can you describe some of the tools that the beef industry has at their disposal to expand their knowledge and efforts on issues like environmental sustainability?

Ms. LYONS-BLYTHE. So, you know, there are many different tools that we can utilize specifically for research and other information. I will tell you that I rely very heavily upon Kansas State University and other university information as far as research, and I really feel that that is a tremendous outreach for education and opportunity.

In addition, cattle ranchers have funded the Beef Checkoff, and through the Beef Checkoff we have done a lifecycle assessment.

That study has really highlighted a lot of the practices that we have been using through the last 30 years, and the improvements that we have made already. It is a very comprehensive—and I think Dr. Mitloehner can probably speak to that more than I can—but a very comprehensive study that really, truly looks at the sustainability of beef. We are very proud of the role that beef does play in sustainability.

Chairman ROBERTS. I thank you for that. Matt, your testimony provides a compelling story about the technology and voluntary conservation practices that you and, of course, farmers across the country install on your operation.

Your testimony also highlights that many producers like yourself implement sustainable conservation practices on their farms, not only through government assistance but willingly out of their own pocket. Can you expand upon the conservation work and practices that farmers like yourself voluntary incorporate which are not compensated by the Federal Government, and how do these efforts generate both a return on investment and an environmental benefit?

Mr. REZAC. I think that any time you look at improving your soil health, whether it is out of your own pocket or doing it through a government program like a CSP or an EQIP program, which you guys have worked hard on, any time you can create soil health and make it better people are going to see a return on that.

So I do not—you know, they are willing to take it out of their own pocket in order to help on topsoil erosion and stuff like that. To be quite honest with you, a lot of people, I think, have a hard time even finding these programs. You know, they do not know that they are really out there unless you really look for them and dig into it. I think that is probably one of the biggest problems. These people cannot—they just do not know those programs are available to them. You know, without having a good NRCS person that can really reach out to you and show you what is available, they have a tough time with that.

Chairman ROBERTS. I really appreciate that. Thank you for bringing it up. That gets back to what Senator Stabenow and I have always talked about, and that is access and information. So we will take a more direct look at that. Dr. Mitloehner, U.S. farmers and ranchers are small businesses. They face tight margins and very limited budgets. The operators of those farms must generate a profit to stay in business. We all know the competitive nature of food production. What suggestions or cautions would you provide to the Committee on how best to balance the need to preserve the health of our planet as well as grow food for a global population in a manner that is environmentally sustainable and economically competitive for U.S. farmers and ranchers in the world market? I might add, in rereading this question it is a lot like discussing U.S. history since 1865, but why don't you give it a shot.

Mr. MITLOEHNER. Yes. Well, thank you for the question. Now I live and work in California and our farmers are among the most productive ones in the world. We also have a lot of pressures on those farmers, for example, regulatory pressures. For example, our livestock industry is supposed to reduce greenhouse gas emissions by 40 percent within the next 11 years. That is 4–0. So that is a

tall order. Some of our farmers say "We have enough. We are leaving California. We go elsewhere."

Recently—I tell you a story—recently a farmer from Hanford came to me. He runs a 1,000-head dairy in Hanford. He said, "I have enough. I am leaving California. I am going to Texas. I made a trip the other day to West Texas and I met with the planning commission, with the local planning commission, and they asked me what I want to do, and I said, I want to start a dairy here. They asked me how many cows" and he said, "I want to have 3,000 cows." The Texan asked him, "Well, why do you want to limit yourself to 3,000?" He looked at me and said, "Can you imagine that happening in California?"

The reason why I am telling you this is because if increased pressures make farmers move, then that leads to leakage. Leakage means that they take emissions with them. We will not reduce emissions through these kind of regulatory pressures but we increase them. This is something that I really want to caution the Committee about, because this is something that happens more and more frequently.

Chairman ROBERTS. I truly appreciate that. I beg the indulgence of my colleagues here. I am going to wrap this up pretty quick.

Tom, you discussed some of the voluntary initiatives that the U.S. dairy industry has undertaken, like the Net Zero Project. As part of the U.S. Dairy Export Council, what has been your experience with the international dairy sector's efforts to improve production efficiencies and utilize technology?

Mr. VILSACK. Let me give you one example. I mentioned the fact that there is a feed additive that can reduce methane from the front end of the cow by 30 percent. The Europeans and the New Zealanders who we compete with on the global stage are in the process of getting regulatory approval for the use of that feed additive, and they will likely get it within a year to a year and a half. We will probably be two, three, 4 years down the road, based on our regulatory system and structure, to get approval for the use of that feed additive.

That puts us at a competitive disadvantage in terms of the global market. As I said earlier, people are very interested in making sure that their food is sustainably produced, and that is a market advantage. I will tell you, our international competitors are looking at ways in which their systems can be streamlined to the point that they get these new technologies in the marketplace more quickly and, therefore, in a position to market more effectively in the global market.

Chairman ROBERTS. Thank you for that. I had another question but I think we will just put that aside for the time being.

Senator Stabenow.

Senator STABENOW. Thank you, Mr. Chairman. And thank you to all of you. We know that our farmers and ranchers are on the front lines and have more at stake for healthy soil and clean water than anyone, and we all have a stake, a huge stake in this. Thank you for what you do.

Let me start with Secretary Vilsack first, regarding carbon markets. Secretary Perdue has talked about his interest in carbon markets, and Secretary Vilsack, your USDA helped farmers increase

their revenue through several pilot carbon market projects. I mentioned before grasslands management in North Dakota and rice cultivation in Arkansas. It seems like there is so much more that we could do in this area. I am sure that there is. So what can Congress and USDA do to help farmers and ranchers create new revenue streams through voluntary carbon markets?

Mr. VILSACK. Well, first of all, it is to make sure that you continue to fund and support the Conservation Innovation Grant program, which provided assistance and help in setting up these markets, and second, working with the land-grant university system to create better measuring, certification, and verification systems so that—the reality is if you can quantify, measure, and verify a conservation result you can market it. The challenge is for us to have accurate measurements.

That is why it is important, from my perspective, as we create these pilot farms, that allow us to basically create the environment in which, with land-grant university partnerships and outside resources, we can measure and quantify and verify what specific conservation activities will do, and then basically use that as a basis for creating a large-scale ecosystem market. You cannot ask farmers to do this on their own. They simply do not have the resources. They have the will but not the resources. So there needs to be a partnership. The government needs to be part of it, and I think the private foundation world needs to be part of it as well. So that would be one thing, in support for the Conservation Innovation Grant program and making sure that land-grant universities are involved, intimately involved in the measurement and certification of ecosystem markets.

Senator STABENOW. Thank you. To me, this is a very important opportunity on a number of fronts—both in terms of revenue stream for farmers and ranchers, but also on where we need to go in terms of managing and sequestering carbon.

Mr. VILSACK. I would just add one additional point and that is that there are—and I am not exaggerating here—there are literally thousands of business opportunities in terms of agricultural waste being converted into chemicals, materials, fabrics, fibers, fuel, and energy. We ought to be committed, as a country, to creating this bioeconomy, which would create a multitude of new revenue streams for farms and ranches across the country. Again, there are a variety of programs within USDA that could be supportive of this. I think they all need to be brought to bear so we can showcase and provide an example for folks to see that it is possible.

Senator STABENOW. I agree. Thank you.

Mr. Rezac, welcome to you and your family. You are clearly an industry leader in this whole area, and I appreciate your emphasis on precision agricultural tools and how they can minimize inputs, save money, and ultimately help the environment.

Can you talk about some of the barriers to entry—you mentioned NRCS—and what needs to happen there? I share your concern about making sure NRCS field staff are available and so on. What are some of the barriers to entry for producers who want to start using precision agriculture tools? How do we take what you are doing and increase adoption so that every one of your neighbors

and those around the country are taking the impressive steps that you have been taking?

Mr. REZAC. Well I think, first off, to really answer that correctly is I do not want to put myself up here above everybody else, because there is a high percentage of farmers out there who are doing great things like this. It is not just me sitting up here trying to do it. There are a multitude of farmers that are doing phenomenal things right now on their farms, and they are really looking at things like soil health, taking advantage of precision tools.

As far as on the side of the NRCS and really trying to break barriers there and trying to help them out, I think for them the main thing to do—we need the government assistance programs. That is huge for us. It helps people look at that in a way that, okay, well, if I can bring in extra income to start using some of these conservation programs, I am all about it. There are a lot of people out there that say, I cannot afford to take any more cost and put it into my ground, because we are already to the point where we are just bleeding. You know, people do not want to take any more money out of their pocket, trying to do something that is going to be good for their farm but they cannot afford to do that anymore.

So I think the biggest thing that they could as well is start working with your private sectors, your Land O'Lakes, your Frontier Co-op. It is such an outreach that you can get to a multitude of farmers so much faster than just you guys alone trying to push out there and reach out.

We talked about programs earlier and trying to get people to see that. That would be one way to help get them programs out there faster.

Senator STABENOW. Thank you. I have a number of other questions. I will wait. I did want to ask one other thing of Secretary Vilsack, and that is, exactly what do we need to do, from the Federal Government side and the private sector, to make your vision a reality for the Net Zero project in the dairy industry?

Mr. VILSACK. I think encouraging the Department of Agriculture to make this a focus, creating the opportunity to take the existing programs that are already funded, for which there are resources, and target those resources in creating a series of pilots that take all of the technologies, all of the various things that farmers are doing individually, and put them in a central location, measure and verify and quantify the results, create an ecosystem market that supports this, and then develop a series of revenue opportunities from products that could be made. Again, when you separate the water from the solids and manure you have a variety of new business opportunities that could be created, using USDA programs to support that new business and incorporating the land-grant university system.

We have got a showcase. We have to show people what is possible. In doing so you will also be able to evaluate the costs. There is just no question farmers cannot do this on their own. There needs to be a significant partnership, not just with government but with the private sector as well. I think if we establish ecosystem markets, if we establish new business opportunities, then I think you will see a tremendous adoption on the part of American farm-

ers. They are interested in doing this. They want to do it. They just have to have partnerships to be able to do it.

Senator STABENOW. Thank you. Thank you, Mr. Chairman.

Chairman ROBERTS. Senator Ernst.

Senator ERNST. Thank you, Mr. Chair, very much, and thanks to our panelists for being here today as well. It has been very enlightening, and Secretary Vilsack, it is always good to have an Iowan testifying in front of us today as well.

While working on the 2018 Farm Bill I supported a number of initiatives to increase support for conservation activities that benefit soil health, including cover crops resource, conserving crop rotation, and advanced grazing management. I worked on a number of these with our Ranking Member.

These improvements to increase adoption of the most impactful conservation activities for soil health as well as increasing access to land and conservation support for young and beginning farmers will play a critical role in supporting our farmers and ranchers, especially in Iowa, who continue to face devastating storms and, of course, extreme weather events as they work to build soil health, productivity, and resiliency in the face of all of those various challenges.

Mr. Mitloehner, I would like to start with you. You had stated the primary greenhouse gas of concern for ag, and especially for livestock is methane, and you did describe that a little bit. Can you further describe the gas and then, again, how it interacts in the atmosphere compared to other various types of greenhouse gases?

Mr. MITLOEHNER. Yes. There are three main greenhouse gases—CO^2, carbon dioxide; nitrous oxide; and methane. The first two are long-lived climate pollutants. For example, CO^2 lives for 1,000 years. Once we emit CO^2 with our vehicles, let's say, it stays there for 1,000 years.

Same for nitrous oxide, but methane is very different. Methane has a lifespan of only 10 years. What that really means is that if, let's say, a dairy that has 1,000 cows had been in existence for, let's say, 50 years, then it added new methane for the first 10 years, after which new methane that is generated is emitted at the same amount as methane that is destroyed, because methane is different from the other gases insofar that it is not just emitted but also destroyed globally, at the same level. So there is a destruction process called hydroxyl oxidation and that occurs constantly.

So any kind of discussions that I am part of is a discussion where that fact is left out, and it should not be left out because it is critical.

Senator ERNST. Yes. I think some of us are pretty struck today because we have heard that methane is horrible, we need to reduce our livestock herds, and we should have Meatless Mondays. We have heard that time and time again. It's been done in various Federal agencies in past administrations. You are saying, overall, the risk with methane for climate change is very, very small.

Mr. MITLOEHNER. No, I am not saying that. Methane is an important climate pollutant. It is almost 30 times more potent than CO^2. What I am saying is that if we maintain constant herds, livestock herds and flocks, then we are not increasing methane, and

therefore we are not increasing global warming as a result of that methane.

Senator ERNST. Okay. There are ways to mitigate that as well.

Mr. MITLOEHNER. If we mitigate—and if we mitigate—then we are counteracting global warming, because that is a very effective tool, and we are using that.

Senator ERNST. Okay. That is really interesting. I think it is, again, pretty enlightening to all of us.

Secretary Vilsack, one of the Green New Deal's goals is to remove greenhouse gas emissions from the ag sector, specifically the ag sector. This would impact everything from the fuels that power farm equipment to dairy cows that are also a source of emissions. How can the businesses and the producers that you represent coexist in a world where the Green New Deal would be implemented within 10 years?

Mr. VILSACK. Well, Senator, I think it is—I look at this from the opportunity standpoint. We talked just about methane, for example. I found out recently that you can—if you capture methane, potentially you can use methane as a substitute for water in the development of concrete. I mean, there is a whole new bio-based opportunity out there that would allow agriculture to be a leading indicator on this issue of climate and create more jobs and particularly jobs in rural areas.

So it seems to me that what we want to be able to do is not necessarily focus on whether we should eliminate industries but whether we can figure out ways in which those industries can create new opportunities, and I think agriculture, in particular, has a unique role to play. That is why I am urging the government, at every level, to support the establishment of these pilot farms where we can prove the case that you can get to net zero emissions, and then prove the case of additional business opportunities and additional revenue streams that can be created that will make it easier for farmers to do what they already want to do, and are, in some cases, already doing at their own cost.

Senator ERNST. Mm-hmm.

Mr. VILSACK. This is a brave, new world out there, and this is just an incredibly important hearing today because it raises the awareness of people that there is an opportunity side to this discussion. It is not a situation where it is all negative. There are a lot of positive opportunities here.

Senator ERNST. Thank you for that. I think there is a lot of tremendous opportunity as well. What I would hate to see is us going down the road of heavy-handed government mandates and regulation when we truly are at a point where so many of our farmers and ranchers are doing this on their own. We do have businesses that are looking at ways of converting other waste-type products into productive materials.

I would say Iowa is a true leader in a number of those initiatives and we have not done it because the Federal Government forced us to do it. We are doing it because we want to be stewards of the environment.

So I do think it is a great opportunity but I would just caution that I think we can do this well on our own without the Federal Government mandating to our farmers and ranchers something

that they well cannot afford, without significant help from the Federal Government.

Thank you very much, Mr. Chair.

Chairman ROBERTS. Senator Bennet.

Senator BENNET. Thank you. Just to jump off that comment, Mr. Rezac, could you talk a little bit about the way the incentives and disincentives work for things like no-till and cover crops? You talked about not being able to put one more dollar in the ground. What is it we could do, or the country could do, to incentivize these kinds of sustainable efforts more broadly, in your view, when you get to the point of view of the farmer or rancher on their piece of land?

Mr. REZAC. Well, I think, you know, the CSP program, Conservation Stewardship Program, I mean, that is a great spot to be at. It is just getting it out there to let people see it and know how to take advantage of that. That is our number one thing right now, because, you know, no-till has a lot to do with that, split application of nitrogen. There are a multitude of deals there. You might have a spot on that farm that it's extremely poor and you never really raise anything on it, but yet what do we do as farmers? We do what we do every year—we plant it. Even though it has never done anything for us, we still plant it.

Well, why are we planting a piece and throwing so much money into it when it is never bringing us any return? Why don't we put it into a conservation program and bring—maybe we break even. Maybe we do not lose as much money that way.

Senator BENNET. Are there things that we could do to change the conservation programs and make them more useful, more flexible, or more helpful?

Mr. REZAC. I do not mind where they are at now. I think any time that you can make it a little bit easier to use, more access, not as much paperwork, to go through. The reason I say that is because you have got Land O'Lakes and Jason Weller, who built that Truterra program. He has made that in a way that we can really see that visually, what some of these programs can do for us on our farm and profitability wise. That right there is the right direction, in my opinion.

Senator BENNET. Mr. Secretary, it is nice to see you and it will not surprise you, you know I have a question for you about the role that forests can play in all this. Do you want to say a word about that?

Mr. VILSACK. Well, clearly, to the extent that we have got better forest health, we are going to have greater carbon sequestration, we are going to have fewer fires, which emits the carbon back into the atmosphere. Again, Senator, I am going to take this in the same direction I took the earlier questions. Let us look at the opportunity side. We have got a lot of diseased wood out there that could potentially be hazardous fuel for fires. What could we do with it that would retain that carbon?

Well, we could create a construction opportunity for high-rise buildings out of that diseased wood. There are a number of multistory buildings that are now being constructed with wood as being the sort of the structural foundation. That creates a new business opportunity. It creates a new opportunity for mills. It creates new

rural development. Focusing and providing resources from the Federal Government to help create those kinds of businesses could go a long way to improving forest health, maintaining the carbon sequestration capacity of the forest, and create better-paying jobs, particularly in rural areas, which even with this economy today are still needed.

Senator BENNET. The Secretary makes an excellent point. I would just say to the Chairman in addition to that, the ability to move with speed, you know, when you have something like the issues that we have had in the West, in Colorado, with bark beetle, the longer these trees stay up there the less valuable they are. If you cannot harvest them now because of rules and regulations, the value of them dissipates. So that is another issue that we can fund.

Thank you to the panel. I want to thank the Chair for holding this hearing. I think it is incredibly important, this pathway to creating value in rural America through the climate change issues that we face. I think it is enormously important, so thank you

Chairman ROBERTS. Thank you, Senator Bennet.

Senator Fischer.

Senator FISCHER. Thank you, Mr. Chairman.

Matt, you mention several production practices that you have begun to implement in your operation, and I know farmers and ranchers all across our state, all across this country do that as well.

I am a cattle rancher as well, Debbie, and we began, in the mid 1980's, to use holistic resource management on our ranch, because, first of all, the improvement to the ground, the improvement to the livestock, the improvement for family life. Most people think of that as a planned grazing system when, in reality, it is a goal-setting system. You alluded to that when you said you are looking at practices. So you are going to have a farm that your kids are going to be able to use.

We look at goals we want to see on our land in the next 50 to 100 years, what we want that land to look like, and I would propose that that is not unusual for people in agriculture at all.

You talk about a number of those inputs where you can conserve natural resources and you can produce crops more efficiently. Can you explain, in a little bit of detail, to the benefit of this Committee, on what a variable rate fertilization system is? How you use soil moisture probes to conserve irrigation water, and why tissue sampling helps you maximize both of those efforts?

You know, here we all talk about no-till, and we act like that is the only thing out there. As the Secretary said, there are a lot of opportunities out there for people in agriculture. Can you tell us about them?

Mr. REZAC. When you talk about no-till, for me that is like old history. That is 40 years ago, if you ask me. When you get into some of the stuff you are talking about there with the moisture probes, what we do is we use the moisture probes to actually monitor the amount of water that is in our soils and how fast our crop is actually taking up that water. So when it is at a high usage rate, we can go ahead and kick the irrigation on and we can see, firsthand, exactly how much water we need to raise that crop. If it is

not using it, we do not have to be running the irrigation. That is one of the ways.

Variable rate technology, on the fertilizer side of things, if we have got an area in that field that does not need as much fertilizer, why should we be putting the same amount there as we would in another spot that might need more? So that is how all that works as far as the variable rate technology side of things.

Getting on the soil sample side and tissue samples, what we like to do is tissue samples in season. We will actually sample every Monday throughout the growing season, we do tissue samples. We get them back and then we can monitor exactly where that plant is, what it needs for nutrients, what it is lacking, or what it might have too much of, and then we can adjust, on the fly, in-season, as we go to raise our crop that way.

Senator FISCHER. I know, Mr. Secretary, you talked about the establishment of pilot farms. I worry about that, because I think we live in the real world, and we have to make sure that the practices that we do, as ag producers, that they work in the real world and we have to look at the cost of those too.

So I guess my comment to you on that would be I would hope we could look at those opportunities, but instead of having government set up pilot farms, work instead with producers on their land and meet their economic challenges that they have as well.

Mr. VILSACK. I am not suggesting that the government own these farms or that they control them. What I am suggesting is that you take a partnership with a landowner, a farmer, and basically say what would it take for you to incorporate all of the technologies that are out there, and allow us to see what that result, the cumulative result would be from such a pilot? So that would be basically providing the farmer the resources to be able to utilize all of these technologies, and then take that information and say these technologies, working together, do the following. Let's figure out a way in which we can have policies and incentives that encourage farmers to do more of this. We have to showcase this, right?

Senator FISCHER. Right.

Mr. VILSACK. We have to elevate it and showcase it. That is what I am talking about.

Senator FISCHER. Right. That is—I would love to work with you on that. Debbie, my apologies for not wearing my pin today. I am glad you did.

When we look at EPA and some of the regulations there, I have concerns, as a rancher. The House Appropriations Committee, they released their EPA Appropriations Bill and it is aiming to subject livestock producers throughout the country to greenhouse gas reporting requirements. They did so by omitting a provision that has long been included in the bill text. It is obvious, based on the research, that livestock simply are not the significant contributor to climate change. I thank you for your testimony on that.

You know, last year I championed a bipartisan bill. We had 24 Republicans, we had 15 Democrats, where we changed a law that would have required farmers and ranchers to report emissions under CERCLA. I hate to see us turn back there after we had such a bipartisan effort.

Can you tell us, are cattle producers prepared to report greenhouse gases to the Federal Government, and will this in any way contribute to solving climate change?

Ms. LYONS-BLYTHE. I think that is exactly the point that I would like to make is, is that really, truly going to help to have farmers and ranchers filling out more paperwork about the emissions rather than actually doing the work?

We are out there doing the work already and helping us fill out more paperwork is not going to assist at all.

Senator FISCHER. Okay. Thank you, Debbie, and Matt, Mr. Secretary, thank you for the information, and you, Doctor, as well. Excellent testimony, Doctor.

Thank you, Mr. Chairman.

Chairman ROBERTS. Thank you, Senator.

Senator Smith.

Senator SMITH. Thank you, Chair Roberts and Ranking Member Stabenow. This is a very interesting conversation, as others have said, and, you know, I have learned, in Minnesota, that when you talk about the impacts of climate change it is true that you can address climate change and that can be good for our planet, it can be good for our health, and it can also be good for our economy. What I hear, really, all of you in different ways saying is that we can—if we do this well that we can accomplish that. So I want to sort of stay on that opportunity message that Secretary Vilsack is suggesting here.

So, you know, in the 2018 Farm Bill, it included several provisions that helped farmers improve soil health and carbon sequestration on working lands. It sounds like Mr. Rezac, that is a lot of what you have been talking about. I actually worked with Senator Ernst to make sure that the farm bill included increased incentive payments within the Conservation Stewardship Program that will help to achieve these goals.

In Minnesota, CSP is incredibly popular and important. We have nearly 7,000 CSP contracts that have been awarded to Minnesota farmers and ranchers, so it is really important.

So let me just ask, Mr. Rezac, if you could just—from your testimony you have talked a lot about this and how these conservation programs on working lands really help you, kind of help to align the incentives that make sense for you and your farm. Could you just talk a little bit more about that, and what we need to do on the Federal Government side to make sure that those efforts kind of align with what you are trying to accomplish on your farm?

Mr. REZAC. I think one of the main things—there are so many different ways we could go with this, because there are just so many different opportunities and stuff you can take advantage of there. One of the main things I think people need to realize when they hear "Conservation Stewardship Program" is—and you hear about, conservation, in general, people always have green on their mind right away, right? It is planting cover crops, it is doing all that stuff. I am not going to ever say that cover crops are not a good thing. Just sometimes it is not a reality for us.

Last fall, for instance, by the time we got done harvesting, it was so wet we had to wait for farms to actually freeze so we could get

in there to get that crop out. How are we going to plant cover crops in frozen ground? That does not work.

So it is not for everybody. I am not saying there is not certain areas, and if you manage properly that you cannot take advantage of them, but it is not always about cover crops. You can get into other things, as far as buffer strips around creek lines. Like I said, I kind of talked about it earlier, if you have a poorer spot in that farm or that field, maybe you could go to like a butterfly habitat or something like that. I know that sounds really out there for a farmer, but it pays really well. So it is something to look into, you know.

Senator SMITH. Yes. Well, you know, as you are saying, every farmer knows that you farm in reality, not in the abstract, and so that is why I think it is so important to listen to ranchers and producers and growers about what is going to work, as we try to get these incentives aligned the way we need to get them aligned.

Mr. REZAC. Yep.

Senator SMITH. I remember the time that I heard a farmer say to me, for the first time, "I am really in the business of growing soil." I was like, "What the heck are you talking about?" I understand it so much better now.

Secretary Vilsack, you and I had a chance to talk a week or so—several weeks ago, I guess it was now, about the incredible challenges that we are seeing in dairy around the country, and certainly in Minnesota. You know, and when I look into the eyes of Minnesota dairy—a Minnesota dairy farmer who tells me for the first time in 114 years they are not milking a cow on the dairy because of the weather challenge and the price challenges and so forth. Yet you have such an optimistic message about how, if we think about all of the opportunities for creating new revenue streams, what a difference it can make.

Could you just talk a little bit about—because I know you understand this so well—the kind of how we think about this opportunity in a time of such intense challenge, in dairy, especially?

Mr. VILSACK. Well, 30 percent of all the agricultural production in this country gets exported, and I think we have to understand that customers around the world are going to be demanding more sustainable practices, and they are going to want to know more about how the food that they are purchasing was produced. So there is a business case to be made to assist farmers in making sure that they are the most sustainably—the most sustainable stewards they can possibly be.

You know, I think it is government's responsibility not only to provide the resources but also to create ways in which those resources can be leveraged. The CSP program and so forth is all great but are there ways in which we can take the results from that investment and then market that result to a corporation or an entity that is interested in that result, to satisfy some regulation that they have or just because they want to be able to show that they are socially conscious?

That is why I think it is important for us to accurately measure and quantify and verify what is being done on these farms, and then basically say to the financial markets, this is a result that can be marketed, that can be sold, that can be invested in. That brings

resources to that farm that is not relying on the farmer. It leverages those resources.

Then if you can take the waste product from that production process and you can figure out all of the different opportunities that could be created, all the business opportunities, the processing opportunities that could be created very close to where that biomass is being created, and you have a regulatory system that acknowledges and rewards that—I mean, we have got a lifecycle analysis now at EPA on biomass that does not necessarily encourage the development—and you continue to provide resources like the REAP program and all the other programs we have talked about today, I think you essentially create a multitude of opportunities and a multitude of revenue streams for that farmer, so that you commoditize, if you will, all of these opportunities.

That is why I just think, for the dairy industry, in particular, they are primed and ready to do this. They just need partners.

Senator SMITH. Thank you, Mr. Chair. I am proud of the work that General Mills in Minnesota is doing, and Land O'Lakes, and Cargill and others, in this—it is a demonstration that it is government, private sector, and farmers and ranchers making it happen.

Chairman ROBERTS. We thank you, Senator.

Senator Boozman.

Senator BOOZMAN. Thank you, Senator Roberts and Senator Stabenow for bringing you all to testify. We have such a distinguished panel that represents a variety of sectors within the agriculture industry and is working hard to improve it.

Matt, you mentioned, in your testimony, that "we fall into the trap of that is how we have always done it." It is interesting because that is certainly true in the Senate, as we deal with our problems. In doing so, you have implemented so many different practices that you outlined, and I am so excited about the technology. I used to have a bunch of cows, and the way that things have come so far, in a relatively short period of time, really is exciting.

You have done a good job of embracing the technology and things. Tell me about your neighbors. Are they doing the same thing?

Mr. REZAC. We definitely have quite a few of them. Like I said earlier, there is a high percentage of farmers out there that are doing things correctly and taking advantage of technology. With that being said, what is the average age of farmers nowadays?

Senator BOOZMAN. It is 59, 60.

Mr. REZAC. When it comes to technology, I mean, nothing against that but that is tougher for them to take on. You know, when our younger generation, we are all taking advantage of it and moving forwards. I mean, we love it. It is the best thing that is out there right now and just keep it coming, you know. When it does not work it is the worst thing in the world, right, but when it is working there is nothing better.

Senator BOOZMAN. Right.

Mr. REZAC. It is hard for some of them that have done it the correct—or the way that they have always done it their entire life. It is hard for them to make that change.

Senator BOOZMAN. All of you mentioned, which I think is so important, the idea of incentives versus unfunded mandates, and certainly the unfunded mandate approach would not be good for farmers to take it up at all.

Are there any particular things that you have found on the farm that were more beneficial than others? What have been a couple of things that have really made a difference?

Mr. REZAC. I would say a couple—you know, some of the most eye-opening things on the technology side would have probably been when we went to variable rate technology, you know, and even on the seeding side of things just being able to have individual row shutoffs, stuff like that, which was quite a few years ago, but we have seen a huge difference in that very first year and a huge payback. It costs to get started in it, quite a bit, but we did see a huge payback immediately.

Senator BOOZMAN. Secretary Vilsack, we appreciate you being here and appreciate again all of your efforts in the past. In Arkansas, we have less than 100 dairy farms left in the state, and in my particular county, not too many years ago, we probably had over 200 just in the one county. It really is remarkable.

You mentioned, trying to get new products on the market. You have been around a long time in a variety of different ways of serving, including serving as the Secretary. What can we do as a Committee? How can we help you? How can we help the farm community move things forward so that we can be competitive with our European friends and the rest of the world?

Mr. VILSACK. Senator, I will try to answer that very quickly. Number one, I think you need to continue to be champions of research. Certainly this Committee has been, but we need to invest more in food and agricultural research than we have, number one. Number two, I think there is an opportunity to review the regulatory systems and the amount of time it takes for regulatory systems to approve new technologies.

I mean, you have got seed genetics, you have got the feed attitudes, you have got improved manure management techniques that all may require regulatory approval in order to be able to get into the field and get into and be providing positive benefits. It takes a long time—too long, too long—in this day and age of massive change and rapid change. We need to streamline the process without sacrificing the quality of their review. I think it can be done.

When I was Secretary, we looked at biotechnology. It took 90 months, when I became Secretary, it took 90 months to get approval of a biotech trait, and we had a goal to try to get it down to 12 months. I think when I left it was 18 months. That was just simply taking a look at the decision tree and saying why are all these people having to be involved in this process?

So those would be several suggestions I would make, and then, finally, making sure that you continue to fund these programs that are working—CSP, REAP, EQIP—and not use them when you are facing some financial difficulties to balance the books.

Senator BOOZMAN. Very quickly, because we are out of time, you mentioned, you know, the importance of finding new markets. Forty percent of the ag product in Arkansas is exported. We simply have to do this in an effort to compete.

Mr. VILSACK. There is no question about that, and our competitors are——

Senator BOOZMAN. Again, solve our problems with excess capacity by buying into the idea that we have one customer here and dozens overseas.

Mr. VILSACK. We represent five percent of the world's consuming population, the 95 percent that lives outside of the U.S.

Senator BOOZMAN. Right. Thank you very much. Thank you, Mr. Chairman.

Chairman ROBERTS. We thank you, Senator Boozman.

Senator Klobuchar, it is good to see you.

Senator KLOBUCHAR. Thank you, Mr. Chairman. Thank you for holding this important hearing and thank you to our witnesses.

We have seen several recent administrative actions related to the renewable fuel standard that have greatly concerned both farmers and the renewable fuel industry. Actions like the EPA's continued use of small refinery hardship waivers that are concerning, not just because thy are hurting our farmers but also because every gallon of biofuels we use displaces a gallon of oil that reduces emissions, as we talk about climate change. In fact, a recent USDA study showed that first-generation biofuels reduce greenhouse gas emissions by between 39 and 43 percent.

Secretary Vilsack, do you agree that the misuse of small refinery waivers can be considered what we will call demand destruction?

Mr. VILSACK. I think, Senator, there are two things that need to happen, from my perspective, on the biofuels side. One is year-round E15, which would certainly be helpful. You cannot undercut that decision to go to year-round E15 with waivers that basically reduce the amount of biofuel that is being produced. These waivers, I understand the importance of them for small refineries, but periodically they have been given to refineries that are owned by Exxon and Chevron, fairly large companies, which clearly are not financially struggling.

So, you know, I think it would be certainly helpful if we saw fewer of those waivers and more year-round E15.

Senator KLOBUCHAR. Okay. Thank you.

Mr. Rezac, can you tell us how important data measurement and verification is to demonstrating the good work that ag is doing on the ground? How do you think USDA could do a better job of collecting that conservation data?

Mr. REZAC. I am not too sure how to get into that answer exactly, but in order to collect all that data and moving forward, I think something like the—are you looking at something along the lines of like the Truterra program, or——

Senator KLOBUCHAR. Well, Senator Thune and I had this Agriculture Data Act, because we wanted to—because USDA currently manages and stores producer conservation data, but the study—what we are trying to do is get it out there so people like you can have it, so you learn best practices and things like that.

Mr. REZAC. Gotcha.

Senator KLOBUCHAR. Mm-hmm.

Mr. REZAC. So I think right away we are going right back to the Truterra program and how he had come out with that program and showed us what is available out there.

Senator KLOBUCHAR. Mm-hmm.

Mr. REZAC. You know, I think that is one of the main ways to get it to us.

Senator KLOBUCHAR. Okay. REAP, the Rural Energy for America Program, specifically supports nearly every form of renewable energy as well as energy efficiency on farms and ranches. Secretary Vilsack, what can we do to make sure that the REAP program reaches more farmers and ag producers so they can benefit from energy efficiency, renewable energy investment?

Mr. VILSACK. I think maintain funding and not reduce it, and making sure that, in the context of what I have discussed here today about a pilot, to the extent that you could use the pilot to upgrade an understanding of how REAP could be used for methane capture and reuse would be incredibly important.

I think you also have to combine the REAP efforts with looking at EPA and the lifecycle analysis that they are currently doing on biomass to make sure that there are other opportunities that could be created if that regulatory barrier were removed. So it is a combination of things.

Senator KLOBUCHAR. Thank you. Ms. Lyons-Blythe, you have been using innovative approaches to improve soil health and grazing practices. What can we learn from innovative ranchers who want to both increase productivity while taking care of their land and livestock? What do you think are some of the most effective ways to increase profit while preserving land and livestock?

Ms. LYONS-BLYTHE. Yes. So I think one of the things that we have been talking about with being farm ground, there is really, truly a huge amount of grasslands west of me, Kansas and west, except for that very important area in California. Truly, it is all about maintaining grassland, keeping the land in that pristine prairie and making sure that we can continue to farm and ranch—specifically ranch—on those areas.

You know, one of the things that farmers and ranchers are doing, and that I would encourage—each of you have asked about what this Committee can do and what government can do to help us—I think one of the things is to partner with private industries at least in paying attention to the research that is already out there. For example, the U.S. Roundtable for Sustainable Beef and the lifecycle assessment that has been done by the beef industry, we have got a lot of really good data showing that we are doing a great job and that beef cattle are really doing well.

Senator KLOBUCHAR. Okay. One last question, Secretary Vilsack, on dairy. I know you work with dairy. Is there more we can immediately do—this is off of the climate change issue—to assist our dairy farmers as we are seeing more and more small dairies close down?

Mr. VILSACK. Well, I think there is a short-term and long-term answer to that question and I will give you the short-term answer. I think to the extent that there is going to be another round of tariff assistance because of the tariffs that there be additional resources for export assistance so that we can continue to expand significantly where we market U.S. dairy products, from an export perspective.

We have seen exports rise but we obviously need to do a bit more of that. That is one thing that could be done. I am sure National Milk has got a whole series of ideas that they would be happy to share with you.

Senator KLOBUCHAR. All right. Thank you.

Chairman ROBERTS. Senator Brown—Braun. Pardon me.

Senator BRAUN. Thank you, Mr. Chair and Ranking Member Stabenow, and thank you for—when I came to you with this very subject to do it in a subcommittee that I chair that he offered to do it on a larger forum.

It has been a great conversation. I have been involved in farming, tree farming and row crops for many, many years. I was a turkey farmer for 32 years. I am looking at the value equation in farming currently, and I remember, 30 years ago, you had hundreds of local suppliers. They are almost all now gone, concentrated increasingly into fewer and fewer folks that sell the inputs.

Where is the responsibility—and I address this to Mr. Vilsack first—among the corporations that increasingly become more concentrated in this whole discussion? You know, we talk about farmers who, to me, look hamstrung with the economics and the perils of existing at the lower end of the food chain, all the things that need to be done to address climate and, more importantly, profitability at the production level. What is your opinion on how we challenge increasingly fewer and fewer that seem to be doing okay and prospering in a generally gloom farm economy, when you look at farmers in general?

Mr. VILSACK. A couple of things, I think, Senator. The reason why we are in this situation is because we have moved away from publicly financed research, and now the research is being privately financed, which means that people expect a profit in exchange for the investment that they make in research. So one suggestion would be to significantly focus on increasing public research opportunities that creates information that is available to new entrepreneurial enterprises.

Second, I think you also want to take a look at the patent laws. I mean, the reality is the pace of change is so accelerated today, the question is whether or not the patent laws, in terms of the length of time that you provide protection, are reasonable. I think if you look at those two things you would spur a lot of innovation, a lot of entrepreneurship, and a lot of competition for the farmer dollar.

Senator BRAUN. Thank you, and I want to ask this question to Matt. Your story, in terms of what you are coping with on the farm, looking at precision fertilization, you know it needs to be done but you have to spend a little money, you know, to actually take advantage of it. Many farmers are older. They do not embrace the technology.

What is your feeling, because your livelihood, I know, has been—I remember, just recently, 10, 12, 15 years ago, an acre of soybeans, $70 to $100 on inputs, corn $140 to $170 per acre, now double or triple. When Sonny Perdue was sitting there I said, "When are we going to start to challenge the industry itself?" which I directed that question to Mr. Vilsack a moment ago, to get more involved, maybe providing relief to farmers, where, again, look at the

value equation there, where they are selling inputs for two to three times as much as they did 10 years ago, and you are paying that much more.

I liked when you said no-till, grass waterways, riparian waterways, CRP, WRP. I have done them all. Those are ways to be conservationists, but it still comes down to how do you make the investment that farmers have to make in a climate like this, where you barely can pay the interest, in some cases?

Mr. REZAC. I think you just hit everything right on the head.

Senator BRAUN. Thank you.

Mr. REZAC. I mean, trying to make money right now, today, in the farm economy is virtually impossible. I mean, we are doing everything we can to try to do it right, but it is so tight that trying to ask somebody to put in any extra money to try to make something go in what I would say is the right direction is extremely hard for anybody to grasp right now. I mean, that is—when you are already, like I said, bleeding, how do you ask them to bring—to take more money? You know, it is not going to happen. Number one, they cannot.

There are a lot of bankers that are saying, "No, you cannot spend any more money." This is what is right for the country. This is what is right for the ground, and moving forward, and for conservation and everything else, but it just does not matter. If you do not have the money to spend you cannot keep moving forward.

So I think the programs and stuff like that is a huge incentive moving forward. If we have programs out there that take advantage of and use, and people can see that and say, "okay, if I do this, this, and this, on a sustainable platform, I can bring in this much money extra per year for my farm." That is huge.

I mean—we talk about—I do not even know if I should get into this, but we talked about carbon credits a little bit. I get excited when I hear that. I have looked into it, I have read about it, and I am like, that is a whole new avenue of income, like we have talked about. To get to there you have to have a carbon score on your farm. How do you get to a good carbon score? You create great solutions and have good soil health. You use conservation practices. That gets you to a higher number on your sustainability side which will obviously create more carbon credits that you can hopefully sell for income. It all kind of works together.

Senator BRAUN. Thank you for that honest depiction, and I challenge the industry, publicly, to maybe look at what they can do to help out everything we have been talking about, you know, along with doing some things through government. I think it is going to be a joint challenge to get through this tough stretch. Thank you.

Chairman ROBERTS. Thank you, Senator Braun. Well, Coop, you made it back.

Senator THUNE. I do not know if you were all waiting just to be able to stay here a little longer and answer a few more questions, but thank you, Mr. Chairman. I appreciate you all being here, and I know there are a lot of issues when it comes to conservation, the conservation title in the farm bill that many of us care deeply about. We know more than anything else that farmers and ranchers depend upon their land for their livelihood, and so being a good environmental steward is vital to their success.

So I would ask—I would like to maybe ask Mrs. Lyons-Blythe and Mr. Rezac, in your testimonies you mentioned that your families have implemented conservation practices on your operations. Could you take just maybe a quick moment to explain the value of these practices and how they have added to your operations?

Ms. LYONS-BLYTHE. You know, I want to give an example of what is happening right now in White City, Kansas. So we have been getting a lot of rain, and my family, my father-in-law, would have begun no-till and reduced tillage back in the 1960's before it was really the thing, and it was very unique back then. So we have been doing this for a long time.

It has been an interesting opportunity to see the fields recently, that the erosion that has been happening on those fields that are getting tillage practices and are actually doing things in a more conventional way. Our fields are maintaining water, increasing soil health, keeping the topsoil where it needs to be. It is not in the ditches. Specifically for our fields that farming is really absolutely paying off. We have done that on our own, since the 1960's.

Senator THUNE. Great. Mr. Rezac?

Mr. REZAC. I mean, I think, probably—I mean, I could talk about increased yields, stuff like that, that has happened over the time—since we have changed a lot of our practices and looking at more at the soil health side of things. I will just go to something really quick here. Just the other day, I mean, I am in the middle of planting season right now. It is raining back home, I believe. It is supposed to be anyway.

I was just out in the field here the other day and I was digging, looking for seed, and this is just going to be, just pure life right here. I'm digging along and there are earthworms everywhere. You know, and when I see that type of stuff it is like, okay, we are doing the right thing here. I mean, look at the abundance of earthworms working in this ground. I mean, they are just—and that was not there 20 years ago. I mean, you find them here—I can remember being a kid. I was going to go fishing with Grandpa. We would go dig for earthworms. It was tough to find them. Now I can find them anywhere I want on my farm.

Senator THUNE. Good. Dr. Mitloehner, in your testimony you mentioned that there was a lot of misinformation out there regarding livestock production's contribution to carbon emissions. Could you speak to livestock production's small fraction of overall carbon emissions?

Mr. MITLOEHNER. Yes. In the United States, according to the Environmental Protection Agency, all livestock species combined produced about 3.9 percent of all greenhouse gases. So that is one of the lowest numbers in the world today.

Senator THUNE. In terms of the—you mentioned also that greenhouse gas emissions from U.S. livestock have declined by more than 11 percent since the 1960's, at the same time that livestock production has more than doubled. What changes have occurred in production, livestock production, to account for that increased efficiency?

Mr. MITLOEHNER. Well, there are different changes. So first of all we have drastically reduced herd sizes. So, for example, the dairy industry went from 25 to 9 million cows. The beef industry, at its

peak, was at 140 million. Today they are at 90 million. So we have drastically reduced herd sizes but we have, at the same time, increased productivity.

We have installed a veterinary system that prevents animals from getting sick or treats them. We have improved reproductive rate, we have improved the genetic material, and we have learned to feed a well-balanced diet to our animals, and that combination has allowed us to optimize performance of animals and lower environmental impacts to rates that we have never seen before.

Senator THUNE. Okay. You can answer this and maybe Ms. Lyons-Blythe as well. In the 2018 Farm Bill, we expanded haying and grazing flexibility on CRP-enrolled acres, which should make the program a more attractive option for landowners.

What are the benefits of having cattle graze that rangeland as opposed to leaving it ungrazed?

Ms. LYONS-BLYTHE. So, you know, I think the very best way to maintain grasslands is, of course, to have cattle grazing on it, and in the Flint Hills of Kansas that encourages biodiversity, it cuts out the opportunity for invasive species. So we are able to enhance the grasslands simply by grazing it. That is absolutely positive.

In addition, it also enhances wildlife populations. What is good for cows is good for wildlife.

Senator THUNE. Yes, and we like that in South Dakota, for pheasants.

In your testimony you discussed the concept of upcycling.

Ms. LYONS-BLYTHE. Yes, sir.

Senator THUNE. I think we have all heard of recycling, but upcycling is a relatively new idea. Could you just tell us a little bit more about what the benefits are?

Ms. LYONS-BLYTHE. Very quickly, upcycling is absolutely a superpower that cows have, because cows have a rumen. They have four different compartment to their stomach that we do not have. They can eat things that would normally go to the trash.

So the quickest example is that in the ethanol industry the corn, it is called wet distiller's grain, that would be left over from creating ethanol, used to go to a landfill. Researchers have found that cows can eat that. So we now work with a nutritionist, because it is important that we know exactly how much they eat, and make sure that they have it in a balanced diet. We can feed that to cows.

They do the same things with potato peelings in Idaho and chocolate in Pennsylvania, and even leftover pizza crusts from the Tony's Pizza plant near Kansas.

Senator THUNE. There you go. Thank you. Thank you, Mr. Chairman.

Chairman ROBERTS. Well, thanks, Coop.

Senator Casey.

Senator CASEY. Mr. Chairman, thanks very much for recognizing me and also for having this hearing. Both you and the Ranking Member should be commended for this. I want to thank our witnesses.

As you can notice here, we are all in and out, going to different hearings or other meetings, so I am sorry I was back and forth. I probably will not get to the whole panel but I want to thank you for your testimony, for your presence here, and also for helping to

teach us things that we need to know. In the back-and-forth of today, even in my limited time here, I learned a lot, so I appreciate that.

I want to direct my questions to Secretary Vilsack. I want to start with a note about legislation that I worked on for years, that we finally got passed in 2016, which is the Global Food Security Act. I would not have been the lead Democrat on that were it not for Dick Lugar. Dick Lugar, one day we were on the Foreign Relations Committee, brought me into it, so I want to commend him and we are thinking of him today and his recent passing.

After Dick Lugar left I worked on the bill with Mike Johanns, and then Mike Johanns left the Senate and Johnny Isakson and I worked together and we finally got it passed.

What that act will do is codify the Feed the Future program, and so it was good that we finally got that over the goal line just three years ago.

I start with that because we know not simply the urgency of dealing with food insecurity around the world but also the link, as the Director of National Intelligence in 2015, reporting the link between food insecurity—or food security itself and national security, food insecurity leading to greater instability that contributes to the growth of extremism, violence, and crime, and frankly, worse.

So we have made good progress. I am holding in my hand—Mr. Chairman, I do not mind if I would ask, at your consent, to place in the record a document entitled "U.S. Policy Road Map: A Drive to Transform Global Food and Nutrition Security," by Kimberly Flowers, January 19, CSIS Briefs. If I could have that made part of the record.

Chairman ROBERTS. Without objection.

[The following document can be found on page 96 in the appendix.]

Senator CASEY. I will just read one sentence from it. It is about eight pages and 38 footnotes. I will not read all of them but it said, at the bottom of the first page, from—and I am quoting directly—"From 2010 to 2017, U.S. targeted strategies and investments in inclusive agricultural growth and nutrition programming decreased poverty"—and this is worldwide now—"decreased poverty by 23 percent and stunting by 32 percent in areas where Feed the Future operated," that great U.S. program, stunting meaning the problem that children have when they do not have nutrition.

So that is a huge accomplishment by the American people, with American tax dollars, with a government program. So, if anything, we want to continue that, and I know there is bipartisan support for that.

That is the long predicate to my question for Secretary Vilsack. When you look at Feed the Future, Food for Peace, the newly created U.S. Development Finance Corporation, and other efforts to provide adequate tools to take action, other than that, and maybe even in addition to that, do you think these initiatives provide support for resiliency and food security in the face of climate-related disasters, which the U.N. is telling us right now are undermining a lot of that progress?

Mr. VILSACK. Senator, I think anything that can provide assistance and help to people that have been devastated by their commu-

nities being flooded out or destroyed when coastal waters rise obviously are important. I think it is also important for the U.S. to provide leadership in this area, which is why I think this hearing is so important. I think we have the opportunity to show the world how you can get agriculture to become a net zero emitter, the processes, the opportunities that can be created.

We often have conversations about this as if it were a barrier or a drag on agriculture, but I think it is an opportunity to open up new revenue streams, new market opportunities for American agriculture, and allow American agriculture to inform and educate agriculture around the world. That is what I hope we would be working toward, and it is not just government. It is obviously not just the farmers. It is also, as has been mentioned, it is the industry, the ag industry and the food industry.

Just so everybody understands the significance of this industry, food and agriculture employs, directly or indirectly, 43 million people. That is 28 percent of the American work force. It impacts 20 percent of the American economy. The reason we have security in this country, in part, is because we are a food-secure nation. We should never, ever, ever take that for granted. Many countries, as you mentioned, that are not food secure are places where there are high levels of unemployment, high levels of poverty, and high levels of dissatisfaction.

So we are absolutely blessed with American agriculture and we need to make sure that we find new ways to keep it profitable and keep folks on the farm.

Senator CASEY. Well, thank you, Secretary Vilsack and I thank the members of the panel. I appreciate the can-do spirit. It is very much American to be able to talk about opportunities, not just challenges. I will have some more questions for the record, Mr. Chairman, but I want to thank you and the Ranking Member for doing this.

Chairman ROBERTS. I appreciate that, Senator Casey.

Secretary Vilsack, and, for that matter, anybody on the panel, there is a hill about 10 miles west of Dodge City, Kansas, and I would invite you all to come out there. It has sort of a flat top to it. Rumor has it that is where Marty Robbins used to sing before he went down to El Paso and got shot in the back, which was truly unfortunate. He should have stayed in Kansas.

At that site there is a plant that uses effluent from Dodge City, Kansas, and National Beef, which goes into four lagoons. On the fourth lagoon you have water that is available for irrigation. Then the rest of that goes into these large balloon-like—I do not know what to call them other than just they capture all the methane. The methane then goes to another process that processes natural gas, which certainly helps out with Dodge City and their energy needs, and, for that matter, the whole surrounding area.

I did not even know that was in operation until I went back to Dodge and they said, "You have got to come out and see this." That was an astounding kind of accomplishment. Tom, you spoke of that. All of you have spoken to that. That is the kind of thing—and they did it on their own.

So I was just amazed at how that touches almost every environmental challenge that we could think of and ends up in a profit.

So thank you all. This is going to conclude—I am sorry.

Senator STABENOW. Mr. Chair, I just wanted to add, if I might, that rather than agriculture being on the defense, today it is about being on the offense and leading. I mean, the reality is that agriculture can be leaders in solving this pollution crisis that is affecting all of us by creating energy independence. This is about opportunity.

So I would just encourage all of you to be speaking from the standpoint of leadership and opportunity, because agriculture can make a huge difference right now in solving a multiple set of problems, and I appreciate your coming. Thank you.

Chairman ROBERTS. This is going to conclude our hearing today, but I really want to thank each of our witnesses. You are carrying the message, and the proper message, by taking time to share your perspectives on climate change and ag sector's responses to this challenge. I really thank you for taking time out of your very valuable schedule.

To my fellow members, we ask that any additional questions you may have for the record be submitted to the Committee Clerk five business days from today, or by 5 p.m. next Wednesday, May 29th.

The Committee is adjourned.

[Whereupon, at 11:22 a.m., the Committee was adjourned.]

A P P E N D I X

MAY 21, 2019

Testimony

on behalf of the

National Cattlemen's Beef Association

with regard to

"Climate Change and the Agriculture Sector"

submitted to the

United States Senate
Committee on Agriculture, Nutrition, & Forestry

Pat Roberts, Chairman

submitted by

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Owner
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May 21, 2019
Washington, D.C.

Thank you, Chairman Roberts and Ranking Member Stabenow, for allowing me to testify today. My name is Debbie Lyons-Blythe. I come to you as a landowner, cattle rancher and constituent to speak to you about climate change and what we are doing on Blythe Family Farms to address the issue. Blythe Family Farms, LLC is owned and operated by my husband Duane Blythe and me, along with our five grown children, who are all shareholders. We manage more than 5,000 acres of native grassland and crop ground in the Flint Hills of Kansas, where we run 300 cows and calves and an additional 250 heifers. The land where we live and raise our cows and family is where my husband's great grandparents settled in 1890, making our children the fifth generation to live and work on this land.

The beef cattle industry has a great story to tell in the climate conversation and the facts support that. According to the U.S. Environmental Protection Agency, direct emissions from beef cattle only represent 2% of all greenhouse gas emissions in the country. A recent study published by the U.S. Department of Agriculture found that emissions from cattle "were not a significant contributor to long-term global warming."

Cattle producers graze cattle on approximately 660 million acres, nearly one-third of the United States' land mass. In addition to providing grass for our cattle, pasture and rangeland provides the important climate service of sequestering carbon in the soil. Since our livelihood is made on the land, through the utilization of our natural resources, being good stewards of the land not only makes good environmental sense; it is fundamental for our industry to remain strong. Climate change policies that *unfairly* target cattle producers fail to recognize the positive role of cattle and beef in a healthy, sustainable food system and misguided policies can threaten the viability of our industry.

Threats from urban encroachment, natural disasters and government overreach impact our industry too and keep us from putting land stewardship into practice. Ranching has several positive effects beyond just the health of the soil and flora. Several species of wildlife, from large ungulates to small pollinators, benefit from the open spaces which working ranches provide. Preserving these large, unbroken landscapes is critical to habitat conservation and the ultimate success of local wildlife. When ranchers are regulated out of business, these vast lands are often divided and sold in small-acre parcels, greatly impeding the migratory habits of these species. Put simply, wildlife depends on the work that we do to maintain water sources, foster robust forage production, and keep landscapes intact.

Taking care of the land is a top priority for our ranch, as well as most ranches in the United States. The Kansas Flint Hills is a tallgrass prairie biosphere that used to stretch from Canada to Mexico, providing grazing for millions of buffalo, elk, deer and other wildlife. Today, because of urban encroachment, only four percent of the tallgrass prairie remains and that is due to the efforts of cattle ranchers. The native grass in the Flint Hills can grow to six feet high, with root systems more

than 20 feet deep. It has been proven that those deep roots are excellent at sequestering carbon in the soil—effectively pulling it out of our atmosphere. At my ranch, we implement grazing management strategies to improve grassland biodiversity, decrease weeds and invasive species, optimize wildlife populations, and reduce erosion—all factors that support the native prairie ecosystem. In addition, we have installed multiple solar pump powered wells to provide alternative water for cattle, protecting the riparian areas and allowing for better grazing management.

Additionally, we grow crops to feed our livestock and my husband's father was ahead of his time in the 1960's in using low-tillage or no-tillage methods. By keeping plant material growing in the fields throughout the year, we reduce weeds, retain water, and enhance soil fertility and organic matter. Since my son's return to the farm, we have grown more crops for our cattle with the implementation of cover crops and no-till farming to enhance our soil – these practices are proven to increase carbon sequestration.

Beyond improving the land, our ranch is an example of how cattle ranchers use various technologies to help the animals to increase efficiency, thereby mitigating environmental impact. This increase in efficiency and quality of cattle has always been a part of the rancher's toolkit. Through genetic testing, we determine which of our bulls is superior in the traits that enhance meat quality, feed efficiency, and growth—as well as mothering ability, docility, fertility and calving ease. Efficiency traits directly affect beef sustainability; an animal who will reach harvest faster and yet produce a high-quality meat product will impact the environment for a shorter period of time. I remember the first predictors of a cow's breeding potential in the 1980s were simple: we took the weights of each animal and used them to predict their mature size and the mature size of their calves. Today, we take a DNA sample either through blood or tissue and submit it to a lab to predict their genetic capability to produce calves with superior efficiency. Of course, not all ranchers have this technology available because of price and availability. But it is the responsibility of seedstock ranchers like me to provide the superior genetics that have been proven through technology. In other words, I raise registered Angus bulls that have been DNA tested and selected for these superior traits and I sell them to the area ranchers to breed to their cows and improve the entire calf crop for years to come. These technological enhancements are vital to increasing efficiency and therefore environmental impact of the nation's cowherd. This technology allows us to produce the same amount of beef today that we were producing in the 1970's with 33 percent fewer animals.

Another way that our ranch, and many others in America, are directly impacting the environment in a positive way is by "upcycling". First of all, cattle are amazing in that they can eat grass, which is inedible to humans, to create a high value, nutrient dense protein product. In addition to that already amazing ability, cattle are able to "upcycle" -- use by-products of other industries that used to end up in the trash and feed it to our cattle. At my farm, we upcycle a by-product of ethanol production called distillers grain. Previously it was taken to a landfill or dump site and discarded.

But beef nutrition researchers found that it could be fed in measured quantities to cattle, providing a new source of protein and beef nutritionists began helping us formulate rations to actually use this new resource instead of discarding it as waste. This provides protein to the cattle and keeps a large amount of material from ending up in a landfill, preventing the generation of additional greenhouse gases. Distillers grain is merely one example. There are many by-products that are fed to cattle to enhance their diet in a safe and efficient manner, including potato peelings in Idaho, bakery trimmings near a pizza factory, and even by-products of chocolate near Hershey, Pennsylvania. Do you remember the news story about the truck load of discarded Skittles candy that was taken to a dairy farm to be used as feed? Some people questioned why we would feed candy to cows, but a cow's rumen is filled with specialized bacteria that needs a variety of sugar to live and be able to digest the grass and plant material she eats. Skittles can be good for cows and better still those discarded candy pieces didn't end up in the trash!

Ranchers continually work to improve the health and well-being of their animals, using new technologies and innovations. In terms of sustainability and climate, antibiotics are an important technology that maintains healthy cattle which allows the animals to utilize feed and water resources efficiently. A sick animal takes longer to gain weight and/or reproduce and that results in larger environmental footprint. Judicious and responsible use of antibiotics ensures that we will be able to protect animal health and raise animals in the most environmentally-friendly way we can.

Blythe Family Farms is engaged in the climate conversation on a national level as well. We are a founding member of the U.S. Roundtable for Sustainable Beef, a multistakeholder organization that brings together the beef supply chain, partners from allied industries, and NGOs to demonstrate and improve beef sustainability. I have served on the board of the organization and am the co-chair of the organization's outreach arm that aims to educate and engage the beef supply chain about beef sustainability.

When the U.S. Roundtable for Sustainable Beef (USRSB) began conversations, it was a tremendously different focus than conversations from years ago. Past conversations revolved around top-down arbitrary expectations that were truly not helpful or nationally scalable due to geographic differences across the country. USRSB changed this. It began from a discussion on how we, as members of the beef value chain, can directly and measurably impact sustainability. To do this, it brought together cattle ranchers and feedyards, who comprise the majority of the membership in the USRSB, along with retailers like McDonald's, Arby's, Wendy's, and others, as well as beef packers and processors, and non-governmental organizations and universities. Ranchers have been an integral part of the conversation from the beginning and have been delivering the message to improve our individual ranches and the entire ranching community. USRSB recently released its Framework for Beef Sustainability and is encouraging operations all along the beef value chain to measure their individual impact of key areas in sustainability which

we identified as: Water Resources, Land Resources, Air & Greenhouse Gas Emissions, Efficiency & Yield, Animal Health & Wellbeing, and Employee Safety & Wellbeing.

The Roundtable is an example of ranchers leading the way in a conversation. Cattle ranchers took the initiative to identify their unique footprint in beef sustainability, demonstrating their positive contributions to landscapes, wildlife populations, rural communities, our nation's economy, and a global food supply. But we also reflected on opportunities where we can improve. It demonstrates our commitment to doing right by the land, responsibly raising animals, caring for the people who raise beef, and making money to support our families and the next generation of beef producers.

Thank you for the opportunity to provide testimony today. The U.S. cattle industry is proud of its history as stewards of our nation's natural resources. The industry takes very seriously its obligation to protect the environment while providing the nation with a safe and affordable beef supply. Cattle producers are America's original conservationists, and we work hard every day to ensure that we can pass our operations on to the next generation. Our family, and America's cattle producers, are committed to remaining environmentally, economically, and socially sustainable for generations to come.

Testimony before the
Committee on Agriculture, Nutrition and Forestry
U.S. Senate

Written statement provided
by Frank Mitloehner, Ph.D.

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May 21, 2019

Animal Agriculture and Climate: Separating Fact from Fiction

Thank you, Chairman Roberts, Ranking Member Stabenow and Members of the Committee, for inviting me today to discuss livestock and climate change.

As a professor of animal science and air quality specialist in cooperative extension in the Department of Animal Science at the University of California, Davis, much of my work revolves around studying the emissions of livestock in order to determine their contribution to air pollution and climate change. My position at UC Davis puts me in the leading agricultural state in America, where half of all U.S. produce and 20 percent of all dairy products are being produced. In addition, California is fourth in terms of beef production in the United States.

I speak throughout the world on animal agriculture, including debunking the myth that it poses the greatest environmental threat to our planet. There's a notion that globally, livestock produces more greenhouse gases (GHGs) leading to climate change than the entire transportation sector. This global comparison is then erroneously applied to the United States, and we are advised to eat less animal-source food (e.g., meat) to protect us from global warming and other environmental harm.

It's reminiscent of something Daniel Kahneman, a psychologist, behavioral economist and Nobel prize winner, once said. "A reliable way to make people believe in falsehoods is frequent repetition, because familiarity is not easily distinguished from truth."

In other words, the more we hear it, the more we believe it. And we hear it a lot.

It hits us from many directions, including Hollywood. For example, the actor Leonardo DiCaprio signed on last year as an investor and advocate of Beyond Meat, a plant-based protein company.

"Livestock production is a major contributor to carbon emissions," he said. "Shifting from animal meat to the plant-based meats developed by Beyond Meat is one of the most powerful measures someone can take to reduce their impact on our climate."

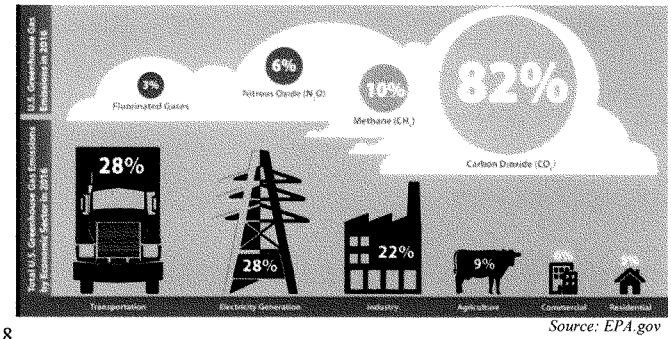
It also comes from some of our most trusted news sources – The Washington Post, The New York Times and the Guardian among them. They've printed articles and editorials espousing how detrimental animal agriculture is to Earth's well-being – even suggesting we should tax beef to deter people from eating it.

GHGs: setting the record straight

A healthy portion of animal agriculture's bad rap comes from the falsehood that livestock is *the major* source of GHGs. By way of background, GHGs – primarily carbon dioxide, methane and nitrous oxide – act as a ceiling or barrier that prevents the sun's radiant beams from dissipating into the universe after they hit Earth. The gasses trap the sun's heat, causing Earth to heat up like a giant greenhouse; hence, the name "greenhouse effect."

GHGs are not altogether nefarious. In fact, they have been with us since the beginning of time. As a matter of fact, Earth would be uninhabitable (i.e., too cold) without them. The problem today

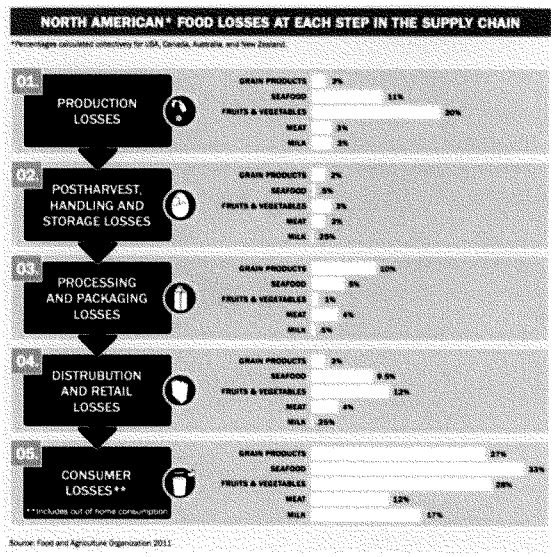
– and the reason why GHGs have become part of our vernacular – is that we have an overabundance of GHGs, which is causing Earth to *over*heat.



Source: EPA.gov

In the United States, we rely heavily on the Environmental Protection Agency (EPA) to supply us with GHG data. Based on EPA's 2016 report, the following sectors/activities contribute to GHGs accordingly: transportation – 28 percent, energy – 28 percent, industry – 22 percent and agriculture – 9 percent. The agricultural figure includes animal agriculture at 3.9 percent.

As an aside, it is worth noting if we could ever tackle the enormous problem of food waste in our country, we would see much lower GHG numbers for agriculture and our overall food supply chain. Forty percent of food produced in the United States goes to landfills, and that food waste is the largest contributor to agriculture's carbon – and overall environmental – footprint. This unacceptable amount of wasted food ranges from the most perishable commodity, fruit and vegetables (50-plus percent), all the way to animal-sourced foods such as meat and milk (20 percent). It is also worth noting that the majority of the United States' food waste does not occur at the farm level (i.e., producer) but at the consumer level.



Though agriculture's contribution to GHGs is significant, it pales in comparison to other sectors, even with such a high amount of food waste. And as we have already established, extracting animal agriculture from the EPA's agricultural figure shows a much lower number indeed. Information

such as that is very different from the popular belief that livestock – and therefore, our consumption of animal protein – should bear the brunt of the blame for climate change.

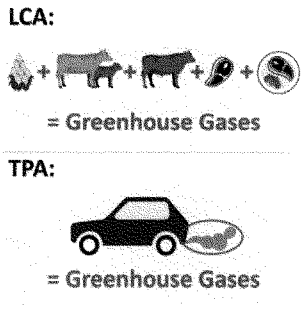
So, why the misconception?

Casting a long shadow on the facts

In 2006, the United Nations' Food and Agriculture Organization (FAO) published a global study titled "Livestock's Long Shadow." It stated, among other things, that livestock was contributing a staggering 18 percent to the world's GHG emissions. The FAO drew a startling conclusion: Globally, livestock was emitting more GHGs than all modes of transportation combined.

The claim was incorrect, having come about as the result of an error in the methodology used to gather data.

Whereas FAO used a comprehensive life-cycle assessment (LCA) when depicting livestock's GHG effect, it employed a different, simplified method of direct emissions only (tailpipe assessment) when looking at transportation. The details of this often-confused difference in methodologies between cows versus cars was recently described by the lead FAO author.



As a result, transportation's impact was underestimated (and thus, livestock's relative impact overestimated) in an apples-to-oranges comparison.

I pointed out the report's flaw during a speech to fellow scientists in San Francisco soon after it was published. An AP reporter who was in the audience put the story on the wire, which opened a floodgate of media calls and inquiries. The BBC's Richard Black pointed out the error in his article "UN body to look at meat and climate link." The story was published on March 24, 2010, and to its credit, FAO owned up to the mistake.

Several years later, I chaired the Livestock Environmental Assessment and Performance Partnership (LEAP), an FAO partnership committee. With the help of dozens of the world's leading experts, we now have global guidelines on how to conduct LCAs for all livestock and feed commodities. To this day, the "LEAP guidelines" are considered the "gold standard" for LCAs worldwide.

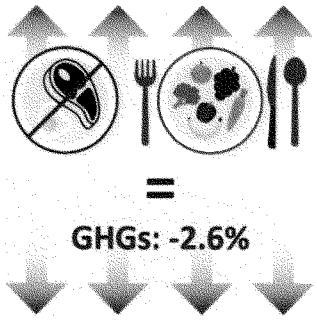
LEAP notwithstanding, FAO's claim that livestock was responsible for the lion's share of GHGs was the shot heard around the world. So much so, we continue to struggle to "unring" the bell. I believe that's due in part to misunderstanding and in part to special-interest groups using the (mis)information to further their agendas. Regardless, falsehoods do nothing to help us arrive at solutions to real and major climate change mitigation, and that is perhaps the biggest shame of it all.

Giving up meat won't solve the problem

It's staggering how many people continue to think that merely giving up meat – even once a week – will make a significant impact on their individual carbon footprints.

A study published in the Proceedings of the National Academy of Science (PNAS) takes the argument to an extreme to demonstrate that it simply cannot.

The study – "Nutritional and greenhouse gas impacts of removing animals from U.S. agriculture" – supports and expands on evidence that livestock is responsible for a relatively small piece of the GHG pie in the United States.



Imagining for a moment that Americans have eliminated *all* animal protein from their diets, Professors Robin White and Mary Beth Hall demonstrated in 2017 that such a scenario would lead to a reduction of a mere 2.6 percent in GHGs throughout the United States. Subscribing to Meatless Monday only would bring about a 0.3 percent decrease in GHG emissions. A measurable difference to be sure, but far from a major one.

Incidentally, the solely plant-based agriculture hypothesized by Professors Hall and White would result in various negative results, economic and nutritional among them. For example, we would be able to produce 23 percent more food by volume, but the plant-based food would fall short of delivering essential nutrients to the U.S. population, they concluded.

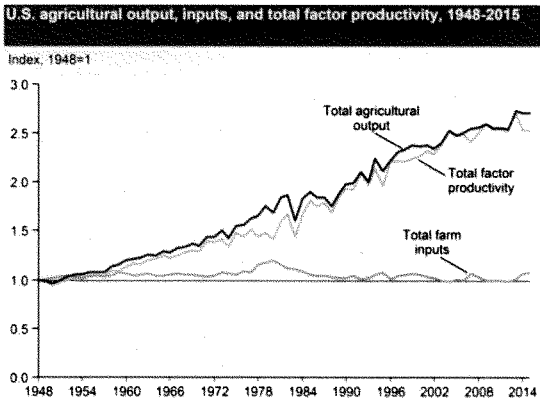
We've come a long way

According to the United Nations Food and Agriculture's statistical database, total direct greenhouse gas emissions from U.S. livestock have declined 11.3 percent since 1961, while livestock production has more than doubled. This massive increase in efficiency and decrease in emissions have been made possible by the technological, genetic and management changes that have taken place in U.S. agriculture since World War II. Specifically, these include: efficiencies in reproduction; better health, brought about in part by vaccinations and advances in health care; the application of "high-merit" genetics; and more energy-dense diets.

As a result, animal herds are at an historic low in the United States without a corresponding output level. For example, in 1950, there were 25 million dairy cows in the United States. There are 9 million presently, but today's herd produces 60 percent more milk than their ancestors did. Put another way, the carbon footprint of a glass of milk is two-thirds smaller today than it was 70 years ago.

Not so in much of the world, however. Case in point: In the United States, about 23,000 pounds of milk is produced per dairy cow each year. In Mexico, it takes up to five cows to produce the same amount of milk as one U.S. cow, and in India, it takes up to 20. These statistics point to the United States having the lowest GHG emissions per unit of milk of any country in the world. It's a similar story for other ruminant and non-ruminant animals that produce meat in the United States. In fact, emissions from all U.S. livestock species are much lower than those in Brazil, China, India and countries in the European Union, among others.

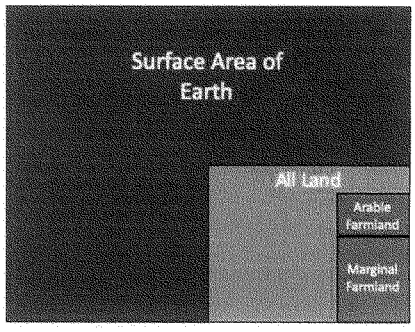
In 1970, there were 140 million head of beef cattle in the United States. There are 90 million today, but we are nevertheless producing the same amount of beef (24 million tons). We are experiencing this phenomenon in the swine industry as well, where we have seen a tripled pig crop and a concurrent 76 percent reduction in land use, a 25 percent reduction in water use and a nearly 8 percent reduction in GHG emissions since 1960.



Source: USDA, Economic Research Service, *Agricultural Productivity in the U.S.* series data as of October 2017

U.S. agriculture is today the envy of the world, having improved the outputs while holding inputs steady.

Making good use of what we have



Critics of animal agriculture suggest we could better use our farmland to grow crops (instead of raising animals) and thus reduce GHGs. To put the issue in perspective, think of the surface area of Earth as an 8½-inch-by-11-inch sheet of paper. One-fourth of that sheet is all land. Of that post-card-sized parcel representing all land, we have approximately the area represented by a business card, which is all agricultural land on which we produce food. However – and here's the rub – not all agricultural land is the same. Two-thirds of the business card is "marginal" farmland. In other words, it is not conducive to growing fruits and vegetables due to poor soil nutrients and/or lack of moisture. Yet, we can use marginal agricultural land to raise ruminant livestock that is able to eat feed such as grasses that are inedible by humans and upcycle them to high-quality animal-based foods. And there's more to consider.

Why we need animal agriculture

According to Professors Hall and White, "Removing animals from U.S. agriculture would reduce agricultural GHG emissions, at the same time creating a food supply incapable of supporting the U.S. population's nutritional requirements."

Many critics of animal agriculture are quick to point out that we could produce more pounds of food and more kcals per person if we raised only plants. What the argument fails to consider is

that there is a more robust and even sensible perspective on nutrition: Food security is not so much about producing enough calories, but essential micro- and macro nutrients.

It's hard to make a compelling argument for a calorie deficit in the United States, given the high rates of obesity that exist in children and adults, particularly in lower-income households. And it should go without saying that not all plant life is edible or desirable. Livestock is a way for us to value-add plant agriculture, both in terms of nutritional value and economic value.

More to the problem than "meats" the eye

Where the environment is concerned, foregoing animal-source food is not the panacea many would have us believe. Neither will it help us meet the food and nutritional issues that lie ahead.

The global population is on trend to reach nearly 10 billion people by 2050, representing an enormous food security and natural resource challenge. Meeting that challenge will require the world to produce both plant- and animal-based food and to produce them more efficiently, using high-quality and marginal agricultural lands.

But first, we need to examine the facts, not engage in hyperbole.

About Frank Mitloehner, Ph.D.

Frank Mitloehner, Ph.D., is a professor and air quality specialist in cooperative extension in the Department of Animal Science at the University of California, Davis. As such, he shares his knowledge and research with students at the undergraduate and graduate levels, with members of the scientific community and with those who work with and for the critically important agricultural industry, domestically and abroad.

He is committed to making a difference for generations to come, and thus, is passionate about understanding and mitigating air emissions from livestock operations, as well as studying the implications of these emissions for the health and safety of farm workers and neighboring communities. In addition, he is focusing on the food challenge that he believes will become a reality as the world's population grows to nearly 10 billion by 2050.

Dr. Mitloehner is frequently sought after for his expertise and ability to bring stakeholders together to address issues regarding air quality, and agricultural efficiencies and sustainability. His work in this regard has included serving as chairman of a global United Nations Food and Agriculture Organization (FAO) partnership project to benchmark the environmental footprint of livestock production. He was a workgroup member on the President's Council of Advisors on Science and Technology (PCAST) under President Barack Obama, and a member of the National Academies of Science Institute of Medicine (IOM) committee on "A Framework for Assessing the Health, Environmental, and Social Effects of the Food System."

He received a master of science degree in animal science and agricultural engineering from the University of Leipzig, Germany, and a doctoral degree in animal science from Texas Tech University. Soon after completing his doctorate, Dr. Mitloehner was recruited in 2002 to the University of California, Davis, to fill its first-ever position focusing on the relationship between livestock and air quality.

He resides in Davis, California, with his wife and their two children.

Statement of Matt Rezac

To the Committee on Agriculture, Nutrition and Forestry
of the United State Senate

Climate Change and the Agriculture Sector

May 21, 2019

Chairman Roberts, Ranking Member Stabenow and Distinguished Members of the Committee, I am Matt Rezac.

I'm a 4th generation farmer from Weston, Nebraska. My wife Tina and I farm about 2500 acres in a corn and soybean rotation. Some of the land in our operation has been in the family for close to 140 years. My sons Jacob and Chase are also here today.

When we talk about stewardship of the land, and doing what's right for the land, there's no one better than the American farmer. Most of the farmers I know do it for the next generation. They want to ensure we leave the land better for our kids and grandkids than how we received it. I get frustrated about the misconception of farmers blindly dumping chemicals all over their farms because it's just not the case. Not only do we care deeply for the health of our farms, in this farm economy, you can't afford to be inefficient and waste inputs.

I also know there is room for improvement. But farmers are often stubborn. Farmers tend to be followers, following what your dad did and often falling into the trap of, "well that's how we've always done it."

On my farm, we have always been conscious of what we are doing to the land, but about 15 or 20 years ago I knew I had to do something different. If I was going to stay in business, I knew I had to find a way to be profitable, and I knew I had to take full advantage of technology. I wanted to break outside the box of how we had been farming, and I didn't want to be part of the herd. I looked at everything we could do. I read all that I could, talked to anyone that would listen and I soon figured out the key was going to be all about soil health. First thing I noticed was that we had a serious soil compaction problem on the farm, and that once we starting really concentrating on the soil, we saw that soil come back to life. Instead of just treating the symptoms of poor soil health, we diagnosed the root cause and the world opened up.

Since then, we've always focused on how we can do the right things for our farm and protect our soil and water for the future. As we think about stewardship and climate today, I would like to share some key points with the Committee on this important topic.

Technology and Innovation is Key

First, technology is critical, and the future of agricultural conservation is precision. Just as I use "precision agriculture" tools to optimize my production and minimize inefficiency, precision conservation tools and planning help me reduce "waste" in my production system. In this case, waste means lost top soil and misplaced crop inputs. On our farm we use variable rate fertilizer, and moisture probes in the soil to manage water. We are extremely precise about our nutrient management, making adjustments in season. We use tissue sampling during the growing season to know exactly what the plant needs. Most people don't understand this, but giving a plant too much of a certain nutrient, such as nitrogen, is just as bad as giving it too little, and it just adds to waste.

Precision conservation tools like Land O'Lakes SUSTAIN's Truterra Insights Engine highlight the financial opportunities for different field management systems. The most effective

conservation practices are those that have an economic benefit to the farm, either by increasing yield and revenue, or by eliminating waste. Often where a crop field is not profitable, there is a portion of that field experiencing poor soil health due to topsoil erosion or nutrient losses. By using precision conservation tools, we can see how an unprofitable part of the field might be better in a conservation program. For us, it might mean that instead of losing $300 on that acre, we could break even. By focusing on net profitability, these precision tools can help farmers achieve their business goals while also improving their stewardship of natural resources.

Farmers, the Private Sector and the Government Have to Work Together

Second, crucially, no one farmer, entity or sector has all the answers and capabilities to accomplish alone what is needed. It takes all of us working together – farmers, the government, and the private sector – to deliver climate solutions.

My stewardship journey is a one of relationships and collaboration. We could not have accomplished what we did on my farm without my District Conservationist and my local NRCS office. NRCS has worked with me to tailor conservation solutions to my own farm. But unfortunately, my local NRCS office is overworked, and truthfully, overwhelmed. The time it takes to really sit down with a farmer and tailor conservation solutions is enormous.

To fill some of that void, I turned to my local co-op, Frontier Cooperative. Frontier has been a leader in sustainability and they joined the Land O'Lakes SUSTAIN program when it launched in 2016. Frontier embraced bringing agronomists out to the farm, educating farmers about being more efficient. Now that they are working on the sustainability side of things, Frontier Coop and Land O'Lakes SUSTAIN have an amazing ability to reach a lot of farmers. The availability of robust data, analytics and insights allows me to work with my agricultural retailer to employ practices in a far more targeted and impactful way than ever before.

The bottom line is this: on-farm conservation is not just good for the environment. It also supports a stronger rural economy through increased resiliency and profitability for farmers like me. To maximize both environmental benefits and economic benefits, it takes everyone working together.

Agriculture Has a Critical Role to Play on Climate Solutions

Third, because we're embracing technology and because we are willing to work together, farmers are ready to lead on climate solutions.

Just think of the scale of American agriculture. Every day, farmers like me make stewardship decisions that impact more than 1.4 billion acres of rural lands. The men and women that make management decisions on that land every day are making a positive difference and leading the way on climate solutions.

We might not always see it, or talk about it, as a climate issue. I know the weather is changing, but I try to control what I can control. That's why you'll hear us talk about things like maintaining soil health, protecting water quality and quantity, and controlling erosion. But the

practices that achieve those goals also help provide climate solutions. For example, I know what we are doing with soil health can help with weather variability and make my farm more resilient at the same time.

With today's technology, and with help from Frontier Coop and from my District Conservationist, I can do a better job on all of these goals than ever before.

Solutions Must Make Economic Sense for Farmers

In closing, I want to emphasize the importance of farm economics across all of these important topics.

As I mentioned today, I am proud that farmers are good stewards of the land, and that we pay for and carry out a lot of our conservation work voluntarily. I am proud that we embrace technology and precision conservation. And I know that working together we can continue to lead the way on stewardship.

But above all of these important elements, it is critical that climate solutions make economic sense for farmers. Providing market and policy incentives that complement the goals I have discussed will be vitally important. When you talk to me about a new practice or about doing something different, the very first thing I need to know is how the economics will play out in my field.

In today's farm economy, we aren't farming to rake in a profit. We're not making money, and we're farming to lose as little as possible. I'm speaking to you as a fourth-generation family farmer whose top priority is to make sure my farm is healthy and strong when Jacob and Chase are grown up. I know focusing on environmental stewardship also makes economic sense, when it's done right. I strongly believe that with the right policy and the right incentives, farmers can keep improving across the board. We can produce an abundant food supply, safeguard resources for the future, maintain our businesses, and lead the way on climate solutions.

Mr. Chairman and members of the Committee, thank you for the opportunity to testify on this important issue. I look forward to answering your questions.

Written Testimony of The Honorable Thomas J. Vilsack, President and CEO, U.S. Dairy Export Council

May 21, 2019

U.S. Senate Committee on Agriculture, Nutrition, and Forestry

"Climate Change and the Agriculture Sector"

Introduction

Chairman Roberts, Ranking Member Stabenow, and members of the Committee, thank you for holding this important hearing this morning. I am thrilled to be back here with all of you to discuss the critical issues facing rural America, our food system and the environment. I come before you this time as President and CEO of the U.S. Dairy Export Council (USDEC).

By way of some background, USDEC is a non-profit organization representing the global trade interests of U.S. dairy producers, cooperatives, proprietary processors, ingredient suppliers, and export traders. Our mission is to enhance demand for U.S. dairy products and ingredients by securing market access and assisting suppliers to meet market needs to facilitate sales.

With that background, you might be wondering, "Why is an export organization here to talk about climate change issues?" Put simply, the U.S. dairy industry has become ever more reliant on exports to the point that one out of every six days' worth of milk is now exported. It's therefore imperative that we lead our global competitors not only in product availability, quality, and innovation, but also in sustainability. And I think we have an excellent story to tell on that front.

Overview

For generations, U.S. dairy farmers have been stewards of their land's natural resources, the foundation of their livelihood. As farming practices and technologies have evolved throughout time, U.S. dairy producers have continuously produced safe and nutritious products and used progressively fewer resources to do so. Today, dairy farms across the country are increasingly adopting conservation tillage, diverse crop rotations, and cover crops to improve soil health; precision feed management to achieve cow health and production efficiencies; and innovative manure management technologies to produce energy and reduce air and water quality impacts. These practices, however, must be further researched and made more affordable so they can be implemented at scale. In addition to the demand for more transparency and better environmental performance, low milk prices are making it increasingly difficult to run a successful dairy operation. Our dairy farmers are looking for new sources of income and we believe that their environmental stewardship can provide just that.

With the exponential increase in scientific and technological discoveries, U.S. dairy is on the cusp of a radical change allowing it to meet this century's needs. These advancements offer an incredible opportunity to those who are willing and ready to adopt them, and challenges for those who are not. This opportunity applies equally to the dairy industry as a whole. U.S. dairy must take advantage of our community's collective knowledge and experience to form a system of proven production practices and technologies that bring beneficial economic and environmental results and provide a pathway for continuous improvement to all farms. If we act quickly and decisively, we will demonstrate leadership in the global market and answer demands for greater transparency and documented improvements in environmental impact. If we manage this transition collectively and allow all farms access to the resources they need, the dairy industry will be able to ensure the long-term opportunities for sustainability and resiliency of all dairy farms regardless of their size.

A New Initiative

Newtrient LLC, a company established by the 12 largest milk cooperatives representing nearly 20,000 dairy farmers to address the economic, environmental, and technological needs of the industry, has launched a new initiative, the Net Zero Project, to affect this transformational change. With the endorsement of USDEC, the Innovation Center for U.S. Dairy, the Global Dairy Platform and the National Milk Producers Federation, the Net Zero Project will demonstrate that dairy farming is integral to any solution purporting to address climate change, water quality, and water and food security. It will show how U.S. dairy can help feed a projected 9 billion people by 2050 all while minimizing its climate impact to "net zero."

Over the last several years, Newtrient and the Innovation Center for U.S. Dairy have worked to establish the scientific and on-the-ground technical knowledge required to voluntarily reduce dairy farms' environmental footprint. Over the past 10 years, the Innovation Center has brought together the collective action of the entire dairy sector together in a voluntary manner to address environmental and sustainability challenges. For example, Newtrient has developed scientific and economic models to quantify the economic and environmental benefits associated with selected dairy farm technologies and practices. Further, Newtrient has developed a catalogue that has evaluated the effectiveness, resilience and business prospects of over 200 manure management and handling technologies. The analysis, knowledge, and experience gained through these efforts suggest that the dairy industry could achieve net-zero emissions. The Net Zero Project is a significant step in translating the dairy community's research into on-the-ground results and achieving this aspirational goal.

The Net Zero Project will use demonstration farms to explore the combined impact of several of the most promising state of the art technologies and management practices. The project's objective is threefold: 1) to determine the feasibility of a net zero or net positive carbon footprint goal; 2) to analyze dairies' potential to recycle and prevent the loss of nutrients; and 3) to work toward carbon neutrality and minimized water quality impacts while preserving dairy's reputation, markets, and profitability. The Net Zero Project will address the obstacles – financial, technical or political – standing between the U.S. dairy sector and these goals by harnessing the collective energy of farmers, researchers, and industry. In doing so, it will establish itself as a large-scale solution to the world's environmental and food security challenges.

Demonstration Farms

This new demonstration farm initiative is part of a broader portfolio of science-based practices and resources available to dairy farms to achieve net-zero GHG emissions and improved water quality outcomes. These resources, which can be implemented individually or in concert with one another, are available to all farms regardless of size, geography, or management style. The role of the demonstration farms is to quickly identify and showcase technologies and management practices that will help farms achieve net-zero emissions and minimize their water quality impact. The goal is *not* to find a single, transformational technology. The goal is to highlight entire suites of practices and technologies, which are available to and economically viable for farms of varying sizes and geographies. Some solutions will only be applicable to small farms. Others will only be achievable with the scale of larger operations. Many will be size-neutral, such as improved genetics or feed management. The Net Zero Project recognizes the diversity of America's dairies and seeks to improve the environmental and economic sustainability of each in turn. Our aspirational goal for net-zero emissions will not be achieved by every farm individually, but rather, by the collective efforts of all farms, cooperatives, and processors.

We will initially establish 4-5 demonstration sites with existing commercial operations. Although the farms already exist, using them as laboratories for innovation won't come cheap. Each farm will be used to evaluate the systems approach of progressive genetics, advanced feed production and management, and innovative manure management required to achieve net zero emissions. We look forward to working with our friends at USDA to access the research expertise offered by ARS, ERS, and NIFA, and to leverage the grants available through NIFA and CIG to build out our prototype farms. We are also anticipating working with the Department of Energy, the Environmental Protection Agency, the Foundation for Food and Agriculture, and private philanthropists to help fund these initial 4-5 locations.

Through this project, we will demonstrate the industry's collective commitment to addressing the public's, consumers', and regulators' concern about our environmental footprint. We will show dairy farmers, cooperatives, and processors the potential pathways to increase their voluntary stewardship efforts and ensure the long term economic and environmental viability of their operations.

Moving from Demonstration to Implementation

The dairy sector has a long way to go to achieve our aspirations, but this initiative marks a monumental first step. The Net Zero Project demonstration farms will serve as a proof of concept. The research and analysis performed here will undergird the Project's other enterprise – improving farmer engagement. These steps are not sequential; improving farmer engagement can and should be constantly on our minds.

Many producers are already implementing practices to reduce their environmental footprint, and even more seek to do so, but are constrained financially. From a technical and financial standpoint, USDA plays a critical role in strengthening the viability of a farmer's operation. In the current farm economy, where milk prices prevent many farmers from even breaking even, USDA's role is even more important. Under my direction, USDA undertook research and developed a framework to help farmers, ranchers, and foresters to respond to climate change. The Building Blocks for Climate Smart Agriculture and Forestry guided the agency in its farmer engagement and placed a premium on producer-led adaptation and resilience. USDA must adopt a long-term outlook on farming and the rural economy which recognizes farms not only as producers of food and fiber, but also providers of energy and clean air and water.

The Farm Bill authorizes USDA to provide a variety of tools to engage producers. Currently, NRCS uses EQIP to provide $90-100 million in cost share funds to dairy producers annually. The CIG and RCPP programs can play a large role in increasing the adoption of sustainable practices, too. But to achieve our goals, NRCS programs will have to be more fully funded and made more amenable to innovation. Congressional restrictions and agency interpretation place eligibility requirements on programs like CSP and create barriers for those wanting to adopt new technologies. For instance, we envision a Conservation Stewardship Program that could assist in the development and adoption of advanced feed management solutions on dairies. We are aware of feed additives that significantly reduce the methane emissions associated with enteric fermentation. These additives require FDA approval for widespread use, and while we aren't asking for a relaxation of the review process, we wish to see a prompt and expedient decision that prioritizes safety and efficacy. If the feed additives improve feed efficiency and animal welfare, they will be quickly adopted throughout the industry. If, on the other hand they bring

the producer no economic gain, then they should be considered for eligibility as part of NRCS's EQIP or CSP programs.

Feed additives are a fine example of sound regulatory policy making a difference. In addition to cost-sharing voluntary conservation efforts, USDA and partner agencies must modernize the regulatory review process for new technologies in order to attract additional investments. Federal funding will be required to establish the Net Zero Project's demonstration farms, but our goal is to work with policy makers to create an environment conducive to increased investments by farmers, technology providers, and those benefiting from their ecosystem services. Only then will these solutions scale, and only then will the current model for dairy production be revolutionized.

In short, we - the dairy sector, Congress, and USDA - need to rethink the way voluntary conservation is funded and delivered. Our struggling farm economy and the natural resources upon which we depend demand it. Federal funding for existing Farm Bill Conservation programs is, and will continue to be, critical to farmers who take on additional production risks for improved environmental outcomes. However, Congress and federal agencies must also modernize the regulatory review process, while maintaining its integrity, so that farmers and ranchers can access the technologies required for them to protect our environment. Congress and federal agencies must also set in place policies that recognize dairies' role in the provision of ecosystem services and incentivize the investments of farmers and other private entities to this end.

Engagement

We are undertaking this bold initiative in response to the domestic and global demand for transparency and environmental performance as additional attributes of safe and nutritious dairy products. We know that we can and will do better, but the work must start now. We also know that today's dire economic outlook makes this a difficult, perhaps even politically dangerous, time for the dairy sector to engage in this conversation. Yet, we remain optimistic that more profitable times are on the horizon, because the dairy farm of the future will not only provide milk, but also energy and ecosystem services. Through this project, we hope to demonstrate that carbon neutrality and minimized water quality impacts can be profitable for farms, and even monetized through ecosystem service crediting, and lay the groundwork for increased investment in voluntary conservation.

Our success will not be the result of legislation or regulation, but rather the result of hundreds of thousands of daily, weekly and annual independent, individual decisions made by tens of thousands of dairy producers. The magnitude of our net-zero goal is better understood if one considers the cycles of operating a dairy. Our goal will be achieved through successive seasons of breeding decisions and

lactation, representing multiple generations of cows, and several crop seasons worth of planting and harvesting decisions. The average farmer makes about 40 years of cropping, breeding, and management decisions. When considered in this light, achieving the net-zero goal will require the collective management decisions of several generations of dairy farmers, some of which are yet to be born. The groundwork for a carbon-neutral dairy sector already exists, but it must be further developed, nurtured, and cultivated. We have a commitment to stewardship and a crop of promising technologies and practices. What we need is quick and resolute action by Congress, USDA, and EPA to support producer-led conservation, and a series of demonstration farms to show farmers throughout the country how to proceed.

Some individual farms may not achieve net zero. Others may already be there and still others may go beyond that, to the point where they sequester, capture, and mitigate more greenhouse gases than they emit. The objective is to incentivize and account for each farmer's and processor's individual as part of an industry-wide commitment. The contributions to the goal will vary with each producer, each processor, each handler in the value chain, and that is appropriate if we are to recognize and respect the diversity of dairy sizes, production practices, and regional concerns.

Closing

Mr. Chairman, in closing I'd like to thank you for your dedication to strengthening rural America and the opportunity to speak about climate change and the agriculture sector's ability to mitigate its effects. I urge you to consider the Net Zero Project as an example for voluntary conservation and an innovative solution to our country's economic and environmental concerns. I look forward to working with you on these issues and welcome any questions you may have.

DOCUMENTS SUBMITTED FOR THE RECORD

MAY 21, 2019

May 21, 2019

The Honorable Pat Roberts
Chairman
Senate Committee on Agriculture
328A Russell Senate Office Building
Washington, DC 20510

The Honorable Debbie Stabenow
Ranking Member
Senate Committee on Agriculture
328A Russell Senate Office Building
Washington, DC 20510

Dear Chairman Roberts and Ranking Member Stabenow:

On behalf of the members of the American Coalition for Ethanol (ACE), I write to thank you for today's hearing on "Climate Change and the Agriculture Sector" and to highlight a report we have published which demonstrates how farmers and low carbon renewable fuels such as corn ethanol can be part of the solution to reducing greenhouse gas (GHG) emissions and getting the rural economy back on track.

ACE is a grassroots advocacy organization, powered by rural Americans from all walks of life who have built an innovative industry that delivers homegrown biofuel and food for a growing world. Our 500 members include U.S. ethanol biorefineries, investors in biofuel facilities, farmers, and companies that supply goods and services to the U.S. ethanol industry. More can be found about ACE at ethanol.org

Congressional action on climate could be viewed as a cost or a chance for new economic opportunities. As you know, U.S. farmers are already under tremendous financial stress. Net farm income is collapsing, expenses are on the rise, and bankruptcies are at the highest level in the last decade. Ongoing trade tensions resulting in lost markets and weather-related disasters are only adding insult to injury.

While the production and use of renewable fuels has provided a meaningful economic boost for farmers and rural America, the Environmental Protection Agency's (EPA) mismanagement of the Renewable Fuel Standard (RFS) has undermined ethanol demand. EPA's "small refinery waivers" have contributed to the first decline in ethanol use in 20 years, with U.S. consumption falling from 14.49 billion gallons in 2017 to 14.38 billion gallons in 2018. The waivers also damage markets for farmers.

The economic stakes are high. Farmers are obviously concerned that climate policy could result in increased costs for fuel, fertilizer, and other inputs. But there is also opportunity. Congress could provide rural America with concrete benefits from climate-centered policies that outweigh potential negatives, such as recognizing the role agriculture can play to mitigate climate change and increasing the use of low carbon fuels.

The United States Department of Agriculture (USDA) has made it clear agriculture can play an important role in mitigating climate change through soil carbon sequestration. USDA identifies sequestration as "among the best options for carbon storage in terrestrial ecosystems," and estimates that U.S. farmers already store 20 million metric tons of carbon per year. USDA forecasts that agriculture could store an additional 180 million metric tons per year, representing an estimated 12-14 percent of total U.S. carbon emissions annually.

Last year ACE published a report titled "The Case for Properly Valuing the Low Carbon Benefits of Corn Ethanol" to highlight how U.S. farmers and ethanol producers are improving efficiencies, investing in technologies, and adopting practices to dramatically reduce lifecycle GHG emissions from corn ethanol. This report explains how increasing the use of corn ethanol beyond levels called for in the RFS will help reduce GHGs. It also calls on EPA to adopt the latest U.S. Department of Energy "GREET" model for making determinations about ethanol's lifecycle GHG emissions, because EPA's own analysis overstates reality. Finally, the White Paper reinforces USDA's conclusion that agriculture can help mitigate climate change and connects the dots between no-till corn production and low carbon ethanol which could generate an economic premium with an appropriate market incentive.

According to the most recent (2018) version of the GREET model, average corn ethanol reduces lifecycle GHG emissions by 45 percent compared to gasoline. If the GREET model is updated to account for the increased adoption of reduced tillage corn production, enhanced efficiency fertilizer use, and for soil carbon sequestration from corn, it is possible ethanol will reduce GHG emissions by between 50 and 60 percent compared to gasoline in the not-too-distant future.

Unfortunately, significant agriculture carbon sequestration practices are currently left untapped due to a lack of proper market drivers, but work is underway at the state level to gain access to low carbon markets based on adopting soil health production practices. According to South Dakota State University, if all of South Dakota's 6 million corn acres were eligible to sell carbon offsets on the voluntary market it could mean nearly $90 million per year in revenue for the state's farmers.

ACE believes unlocking the marketplace for low carbon fuels creates the economic driver to help farmers adopt practices that maximize atmospheric carbon sequestration in soil. For example, if the California Low Carbon Fuel Standard (LCFS) accounted for soil carbon sequestration benefits from low and no-till corn production, Midwest ethanol delivered to the LCFS market could receive a $0.26 per gallon premium at current credit prices in California and at current soil organic carbon (SOC) sequestration rates found in the Midwest. This would generate an additional $26 million in revenue per year for a 100 million gallon ethanol facility, creating meaningful rural economic and farmer benefits.

As the committee begins this timely discussion about the role of agriculture in climate change, the current economic stakes intensify the need for policies which can provide a meaningful return on investment. I hope the ACE White Paper is a helpful guide to recognize that rewarding U.S. farmers for practices that sequester carbon in the soil and increasing the use of low carbon fuels like corn ethanol can be part of the solution to reduce GHGs and get the rural economy back on track.

Thanks for your consideration and please let me know if I can help answer any questions you or your staff may have about the ACE White Paper.

Sincerely,

Brian Jennings, CEO
American Coalition for Ethanol (ACE)

5000 S. Broadband Lane, Suite 224 Sioux Falls, SD 57108 605-334-3381 ethanol.org

Testimony for the Record

Offered by John Larson
Senior Vice President
American Farmland Trust

Prepared for the
Senate Committee on Agriculture, Nutrition, and Forestry

May 21, 2019

American Farmland Trust is the nation's leading conservation organization dedicated to protecting America's farmland and ranchland, promoting sound farming practices, and keeping farmers on the land. Since its founding in 1980 by a group of farmers and citizens concerned about the rapid loss of farmland to development, AFT has helped save millions of acres of farmland and led the way for the adoption of conservation practices on millions more.

Chairman Roberts and Ranking Member Stabenow,

On behalf of American Farmland Trust, thank you for holding today's important hearing on Climate Change and the Agriculture Sector. This hearing is an important first opportunity to hear from farmers and ranchers about their concerns and the work that they are already doing to combat climate change. AFT recognizes that you were both instrumental in passing a piece of bipartisan climate change legislation—the 2018 Farm Bill—and looks forward to building on the momentum that that bill and this hearing have created.

Our climate is changing, and without swift action few will feel the impact more directly than farmers and ranchers. At the same time, these stewards of the land can—and must—be part of the solution to climate change. Farmland and ranchland have an important role to play in sequestering carbon to the benefit of all. Importantly, many environmental practices that decrease emissions or sequester carbon have the benefit of improving farmers' and ranchers' resiliency and economic performance. For example, using cover crops can lead not only to increased soil carbon but also to improved water retention for greater resiliency to drought. Similarly, precision agriculture technologies for fertilizers can lead to not only fewer GHG emissions in the form of nitrous dioxide, but also decreased input costs. AFT sees the opportunity to do a great deal of work in the nexus of combatting climate change and improving famers' and ranchers' bottom lines.

AFT emphasizes three important steps towards improving climate outcomes on farms and ranches.

First, there is a need to reduce emissions from farm and ranch operations. Under current management practices, the agricultural sector produces approximately 9 percent of total US greenhouse gas (GHG) emissions. This can be substantially reduced with various practices and technologies. Advances in crop genetics, irrigation technologies, precision agriculture, and on-farm renewable energy generation, coupled with a focus on climate-smart agricultural practices that aim to enhance soil health, hold great potential to reduce emissions from agriculture. AFT encourages an "all of the above" method that supports farmers and ranchers in implementing the practices and technologies that make the most sense for their operations.

Second, a greater emphasis must be placed on farming and ranching practices that sequester carbon. The opportunity to do so is great: soils (excluding permafrost) store two to three times more carbon than the atmosphere and two to five times more carbon than in the vegetation.[1] Where past land use practices have resulted in the loss of 50 percent of soil carbon, climate-smart agricultural practices can not only stop the loss, but reverse it, putting atmospheric carbon back into our soil. Climate-smart farming practices include no-till, cover cropping, nutrient management, composting, and improved grazing management, as well as advanced practices that involve manure digesters, biochar, and other tools. And their power is significant. For example, adopting an individual practice such as growing cover crops on the bare soils after harvest of the five primary crops (i.e., corn, soybean, cotton, rice, and wheat) could sequester 103 million metric tons of carbon dioxide equivalent per year.[2] And additional agronomic practices can be stacked to sequester multiple times this value. Among the suite of natural climate solutions, these agricultural practices are among the lowest cost opportunities to mitigate climate change. Again, AFT supports an "all of the above" method that supports farmers through direct incentives, environmental markets, and/or better quantification of economic outcomes of conservation practices to be used in educating farmers and ranchers.

Third, it is imperative to prevent higher future emissions by retaining farmland. When farmland is lost to development, the land converts to uses that produce significantly higher GHG emissions—such as a sprawling subdivision that requires more car travel than concentrated urban development—than the former farm. AFT studies in California and New York have shown that farmland emits up to 66 times fewer GHGs than developed land uses per acre on average. This increase in emissions from farmland development is compounded by the fact that we lose the opportunity for farmers and ranchers to manage the land to actively sequester carbon. Each acre lost means more pressure on the remaining acres of this finite resource, making it more likely for the remaining land to be managed more intensely for food production and potentially less likely that the remaining farmland will be managed to optimize environmental benefits. In sum, when we retain farmland, we put a stop to activities that would otherwise exacerbate climate change, while simultaneously retaining the ability to increase carbon sequestration on those lands.

These three actions—reducing emissions, sequestering carbon, and protecting farmland and ranchland—are essential to the future of agriculture and our planet. Farmers and ranchers are already taking steps in these directions, bolstered in part by funding from federal programs including the 2018 Farm Bill. According to the 2017 Census of Agriculture, for example, the acreage under cover crops increased to 15 million from 10 million in 2012. However—while recognizing this as an impressive increase over five years and noting that not all acres are equally suited to cover cropping—this still represents a small fraction of the over 900 million acres of agricultural land in the United States.

Similarly, our nation has had only minimal success preventing irreplaceable agricultural land from being developed. AFT's recent "Farms Under Threat" report shows that the U.S. is losing 1.5 million acres of farmland and ranchland a year—or three acres every minute. In the 20-year period between 1992-2012, our nation lost the equivalent of all the farmland in Iowa. Beyond this, the land we are losing fastest is our

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[1] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

[2] Joseph E. Fargione, Steven Bassett, Timothy Boucher, Scott D. Bridgham, Richard T. Conant, Susan C. Cook-Patton, ... Bronson W. Griscom, 2018. *Natural climate solutions for the United States*. Nature, 4 (11). https://advances.sciencemag.org/content/4/11/eaat1869

best farmland, that which is most productive, most versatile, and most resilient to droughts, extreme heat, and storms.

Our farmers and ranchers are poised to build on their existing efforts to reduce GHG levels and sequester carbon—a compelling argument to retain as much farmland and ranchland as we can. Beyond this, agriculture provides many environmental and socioeconomic co-benefits, including food production, wildlife and pollinator habitat, water recharge and purification, and rural viability.

AFT is also ready and willing to do its part, having launched a National Climate Initiative in 2017 to focus our work in this area. In the months and years ahead, AFT's Climate Initiative will continue to promote smart solar siting to increase renewable energy while protecting farmland; conduct additional research on land use and climate impacts; help farmers adopt new soil health practices; explore market-based solutions to climate change; promote a new wave of farmland protection; and work with legislators to find federal policy solutions among other activities.

Today's hearing is a vital step in the right direction. American Farmland Trusts thanks you again for taking this opportunity to highlight the work of farmers and ranchers who are combatting climate change, and for your leadership on issues of climate change in the agriculture sector.

EARTHJUSTICE
BECAUSE THE EARTH NEEDS A GOOD LAWYER

May 21, 2019

Chairman Pat Roberts
Senate Committee on Agriculture, Nutrition and Forestry
United States Senate
Washington, D.C. 20510

Ranking Member Debbie Stabenow
Senate Committee on Agriculture, Nutrition and Forestry
United States Senate
Washington, D.C. 20510

Re: Senate Committee on Agriculture, Nutrition, and Forestry hearing on Climate Change and the Agriculture Sector

Dear Chairman Roberts and Ranking Member Stabenow:

On behalf of our millions of members and followers from around the country, we would like to thank the Senate Committee on Agriculture, Nutrition, and Forestry for holding today's hearing on Climate Change and the Agriculture Sector—the first Senate committee hearing on climate change and agriculture. We appreciate the Committee's focus on this critically important issue.

We all agree that climate change is an existential problem that requires immediate solutions to start to curb the alarming rate of warming we are experiencing. And we believe that farmers and ranchers are uniquely positioned to help mitigate against this real and growing threat. Agriculture is also the sector of our economy that is most affected by the changed and more extreme weather resulting from climate change.[1] And it is also a sector that has tremendous potential to reduce emissions and mitigate the warming trend we are experiencing.

Any discussion of solutions to agriculture's contributions to global warming can begin with the climate-friendly conservation measures in the 2018 Farm Bill. This laudable piece of legislation contains policies and programs that support many agricultural practices that have been well-demonstrated – at all scales, for all crops and products, in all regions of the country – to be both effective at reducing greenhouse gas emissions and water pollution, and increasing resilience to

[1] U.S. Global Change Research Program, *Fourth National Climate Assessment* (David Reidmiller et al., eds., 2018), https://nca2018.globalchange.gov/chapter/21/

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changed weather and profitability.[2] Adopting federal programs that incentivize climate-friendly practices in the country will bring up to $50 billion in annual societal benefits in the U.S., including improved water and air quality, reduced erosion, and on-farm value through greater productivity.[3] Increasing adoption of soil health practices to half the farms in the US could, on an annual basis, mitigate 25 million metric tons (MMT) of greenhouse gas emissions, reduce 344 million pounds of nutrient loss to the environment and eliminate 116 MMT of soil erosion.[4]

Unfortunately, these practices are still not yet widely accessible to or adopted by American farmers and ranchers. For instance, merely 3% of all U.S. cropland currently plant cover crops, and only 2 to 5% of US croplands receive federal funds to implement soil health practices under EQIP and CTA, the NRCS's two biggest conservation programs.[5] Our challenge, then is to increase the accessibility of these programs and to help scale up and accelerate adoption of these demonstrated, sustainable practices. To do so will include both reducing regulatory barriers and current policies that encourage or incentivize unhealthy practices and expanding programs and policies that support healthy soil practices,[6] as well as providing ample funding for more research and training, outreach, and assistance.[7] Funding must also be increased to assist farmer and ranchers in getting access to even the existing federal and state programs.

Agriculture is now a significant contributor to climate change. For example, in 2016, American agriculture[8] was responsible for 8.6 percent of total anthropogenic greenhouse gas emissions, generating emissions roughly equivalent to the annual emissions from 139 coal-fired power plants or 125 million passenger vehicles.[9] The vast majority of these emissions can be attributed to methane (45%) and nitrous oxide (53%), as opposed to carbon dioxide (2%).[10]

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[2] Paustian, Keith, Johannes Lehmann, Stephen Ogle, David Reay, G. Philip Robertson, and Pete Smith. "Climate-smart soils." Nature 532, no. 7597 (2016): 49.

[3] The Nature Conservancy. "rethink Soil: A Roadmap for U.S. Soil Health." (November 1, 2016).

[4] *Id* at 9.

[5] Biardeau, L., Crebbin-Coates, R., Keerati, R., Litke, S., & Rodríguez, H. (2018). Soil Health and Carbon Sequestration in US Croplands: A Policy Analysis. https://food.berkeley.edu/wp-content/uploads/2016/05/GSPPCarbon_03052016_FINAL.pdf

[6] Lehner, P. H., & Rosenberg, N. A. (2018). A Farm Bill to Help Farmers Weather Climate Change. *J. Food L. & Pol'y, 14*, 39.

[7] Lehner, P., & Rosenberg, N. (2018). Promoting Climate-Friendly Agriculture for the Benefit of Farmers, Rural Communities, and the Environment. *Natural Resources & Environment, 33*(1).

[8] The agricultural sector includes methane (CH4) and nitrous oxide (N2O) emissions from enteric fermentation in domestic livestock, livestock manure management, rice cultivation, agricultural soil management, and field burning of agricultural residues; as well as carbon dioxide (CO2) emissions from liming and urea fertilization. *See* US EPA, *1990-2016 Greenhouse Gas Inventory* (2018) at 357 (5-1). https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

[9] EPA Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

[10] EPA Greenhouse Gas Inventory. Note that methane and nitrous oxide, however, are about 30 and 300 times (respectively) more powerful than carbon dioxide at trapping heat in the Earth's atmosphere.

By scaling up practices that have been proven to be successful – by increasing carbon sequestration, improving soil health, reducing greenhouse gas emissions, and increasing yields and thus profits for farmers and ranchers – we can make agriculture climate neutral or "net-zero."[11] States are also working to help scale up these programs,[12] and federal action will be magnified many times as states amplify federal efforts.

We believe that farmers and ranchers should inform these policies given the tremendous impact agriculture has on climate change and the tremendous impact climate change has on agriculture. We look forward to more engagement by the Committee on this important topic and look forward to providing assistance.

Sincerely,

Peter Lehner, Managing Attorney
Carrie Apfel, Staff Attorney
Sarah Saylor, Senior Legislative Representative
Claire Huang, Science Fellow
Earthjustice

[11] Lehner, Peter and Rosenberg, Nathan, Legal Pathways to Carbon-Neutral Agriculture (October 1, 2017). Michael B. Gerrard & John C. Dernbach, eds., Legal Pathways to Deep Decarbonization in the United States (2018 Forthcoming); Environmental Law Reporter, Vol. 47, p. 10845, 2017. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3040919

[12] Earthjustice, "State Soil Health Initiatives: Building Momentum," (2019). https://earthjustice.org/sites/default/files/files/Summary-State-Soil-Health-Initiatives.pdf

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United States Senate Committee on Agriculture, Nutrition and Forestry

Climate Change and the Agriculture Sector

Testimony submitted by

Mr. Paul T. Dacier, Executive Vice President & General Counsel

Indigo Agriculture, Inc.

May 21st, 2019

Chairman Roberts, Ranking Member Stabenow, and Members of the Committee:

Thank you for the opportunity to submit testimony for the hearing on, Climate Change and the Agriculture Sector, Senate, 116th Cong. (2019). The Committee's leadership on this topic is important for agriculture for two reasons. Farmers need tools that help plants resist stress so that they become more resilient in light of drought and higher temperatures associated with climate change, and it is possible to help farmers reduce their footprints to become carbon positive. We appreciate your consideration of a profitable role for farmers in addressing climate change.

Indigo Agriculture, Inc. ("Indigo") was founded in 2014 and is headquartered in Boston, Massachusetts, with its commercial office based in Memphis, Tennessee. In mid-2017, we opened international offices in Buenos Aires, Argentina, and Sydney, Australia, and have also added offices in Europe, India, and Brazil.

We help farmers reduce input costs and create new profitability opportunities, not only driven by microbial and soil health, but also driven by data sciences and artificial intelligence – leveraging agronomy, finance, and logistics. Indigo takes a systems approach to agriculture and to transparent sourcing, resource efficiency, and sustainability for farmers. This approach has enabled eleven business units; and most notably last week, CNBC ranked Indigo as the most innovative company in the world. This is the first time an agriculture company has been awarded the top spot on the CNBC Disruptor 50 list.[1]

Helping Plants Resist Stress

Over the past four and a half years, we have worked toward making farmers more profitable, agriculture practices more environmentally sustainable, and consumer preferences for traceability and quality more realistic. Indigo uses naturally discovered beneficial microbes residing in plant tissues to **improve crop yield in cotton, wheat, rice, corn, and soybeans, harnessing nature to help farmers sustainably feed the planet. There are billions of living organisms per acre of land and millions of living organisms that survive in plants per acre. Indigo focuses sourcing decisions on the tens of thousands of microbes that improve plant health per acre. Our products are based on plant microbes that have existed for millennia in nature, independent of human influence.**

[1] "Meet the 2019 CNBC Disruptor 50 Companies." *CNBC*, 15 May 2019. https://www.cnbc.com/2019/05/15/meet-the-2019-cnbc-disruptor-50-companies.html. *See also* https://www.indigoag.com/pages/news/indigo-ag-ranked-top-cnbc-disruptor.

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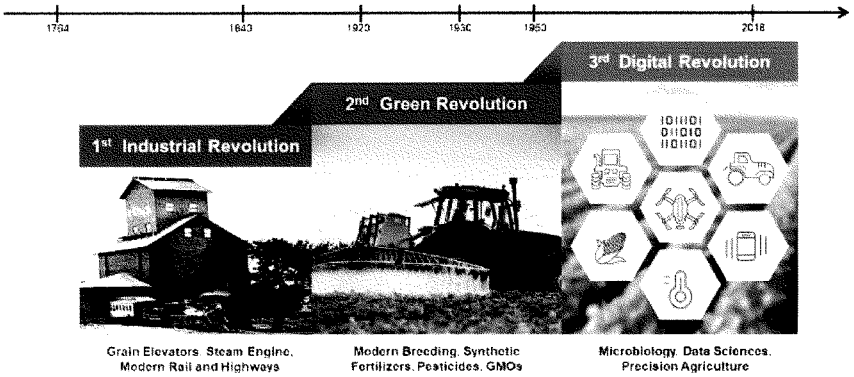
Indigo microbes reside within the plant and reinforce its health throughout the season by improving its water use efficiency, nutrient intake, and stress tolerance. Inspired by insights from the human microbiome, Indigo began with the hypothesis that naturally occurring microbes living inside a plant—known as "endophytes"—are vital to its health. By using sophisticated sequencing techniques and tapping the knowledge of collaborators, Indigo has assembled a world-class database of genomic information from these microbes, resulting in innovative, nature-derived products that complement a plant's natural processes to improve resilience across various stages of plant development, while also boosting crop yields.

We Are on the Cusp of a Third Revolution in Agriculture



As our President, CEO, and Director, David Perry, explains, agriculture today is a commodity business, and farmers get paid for volume. If farmers don't get paid for sustainability or quality, then they won't invest in those things. The agriculture system has been evolving since the Industrial Revolution to the Green Revolution and now to, the Beneficial Agriculture Revolution, where microbiology, data sciences, and precision agriculture meet. We come into this era out of necessity, just as other eras evolved to meet societal needs. If Dr. Norman E. Borlaug had not developed successive generations of wheat varieties when faced with challenges in transforming agricultural production in the 1940s and 1950s, would he have been able to prevent hunger, famine and misery around the world?[2] Similarly, if we do not

[2] About Norman E. Borlaug, Founder, The World Food Prize, 1970 Nobel Peace Prize Laureate, accessed 19 May 2019. https://www.worldfoodprize.org/en/dr_norman_e_borlaug/about_norman_borlaug/.

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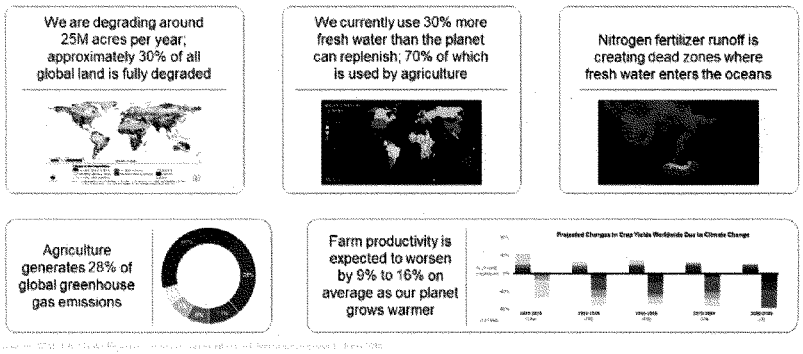
lead in the United States and globally in reducing greenhouse gas emissions, what will that mean for a growing global population expected to reach over nine billion people by 2050 and 11.2 billion by 2100?[3]

Helping Farmers Become Carbon Positive

Humans have caused atmospheric carbon dioxide to rise fifty percent above pre-industrial levels, putting us on-track for severe climate change. Twenty-five million acres are degraded globally per year, and approximately thirty percent of all global land is fully degraded. Thirty percent more fresh water is used than the planet can replenish, seventy percent of which is used by agriculture. Nitrogen runoff creates dead zones. Agriculture generates twenty-eight percent of global greenhouse gas emissions, and farm productivity is expected to worsen by nine to sixteen percent on average as the planet grows warmer.



As long as farmers are producing commodities, farmers lack incentives, financial incentives, to adopt technologies and practices that shift these dynamics and improve sustainability and quality. If we decommoditize agriculture and enable farmers to produce, and get paid additionally for producing, what buyers and consumers want, the agriculture industry could change rapidly.

[3] "World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100," *United Nations, Department of Economic and Societal Affairs*, 21 June 2017 New York. https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html.

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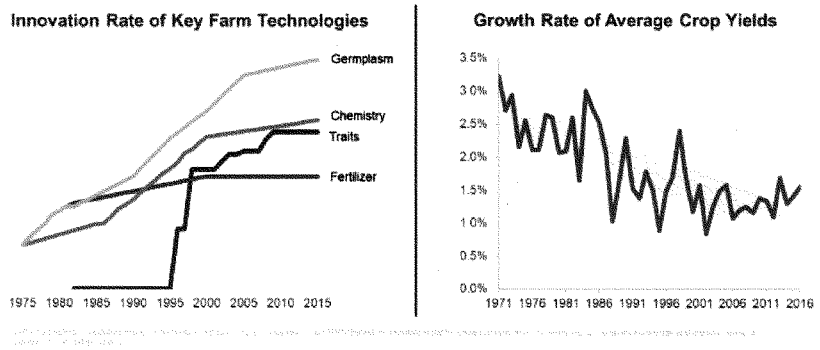
Over the last fifty years, agricultural productivity has been driven primarily by the increased use of four things: synthetic fertilizer, agricultural chemicals, plant breeding and hybridization, and, more recently, genetically modified traits (GMOs). Innovation in those four technologies has been plateauing over the past fifteen years. Since around 2000, we have not seen significant innovation in fertilizer, just one new class of agricultural chemicals in the United States, and only incremental benefits on top of GMO traits developed in the 1990s. Plant breeding ("germplasm" in the figure above) has continued to provide benefits, largely realized in corn.



Despite this plateau in innovation, however, there has been a dramatic increase in price. Over the same forty-year timeline, there has been about a four hundred percent increase in the costs of these technologies. Most of this has happened over the past fifteen years and has been driven primarily by the costs of seeds and fertilizer. It is important to note that while costs have increased significantly, yields have increased only slightly. As part of the income calculation after input prices, not surprisingly, the result of this is that farmer margins are at unsustainably low levels. Today, farm profitability, specifically net farm income is down by forty-nine percent since 2013.[4]

[4] "Highlights From the March 2019 Farm Income Forecast," *USDA Economic Research Service*, 7 March 2019. https://www.ers.usda.gov/topics/farm-economy/farm-sector-income-finances/highlights-from-the-farm-income-forecast/.

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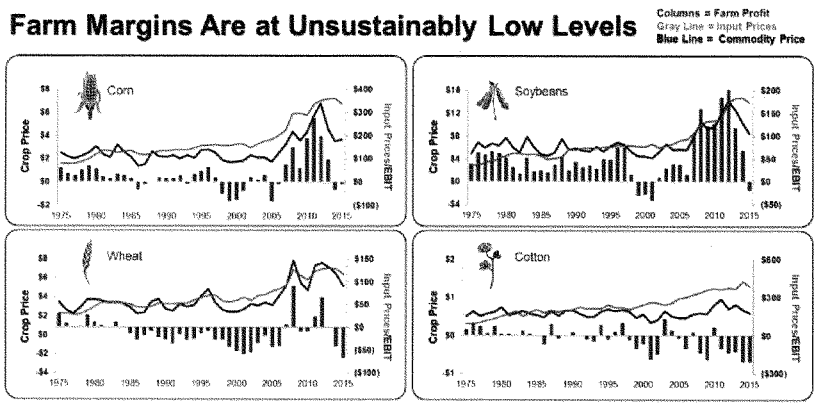
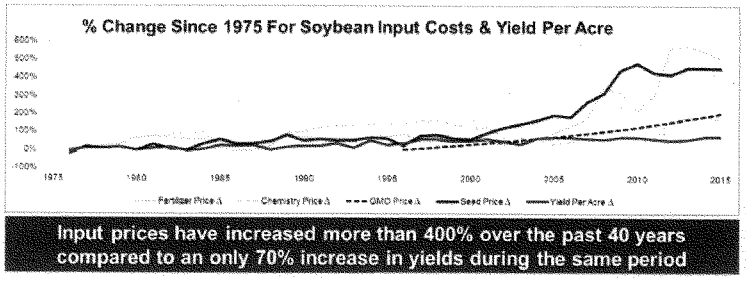
Farm Margins Are at Unsustainably Low Levels



Here we see the largest four crops in the United States. In each of those crops, we have graphed the input price (red), the commodity price (blue), and the gray bars, which represent farmer profitability (or lack thereof). There are a few remarkable takeaways here. Historically, profitability rose and fell with commodity price. Recently, we have seen spikes in commodity price, where both profitability and input prices soared. While commodity prices have since come down, they are still at historically high levels. Despite the agricultural innovations of the last forty years, farmers today are not necessarily economically better off than they were in 1975.

Input Companies Continue Capturing an Increasing Share of Farm Value Despite Plateauing Innovation in their Core Technologies



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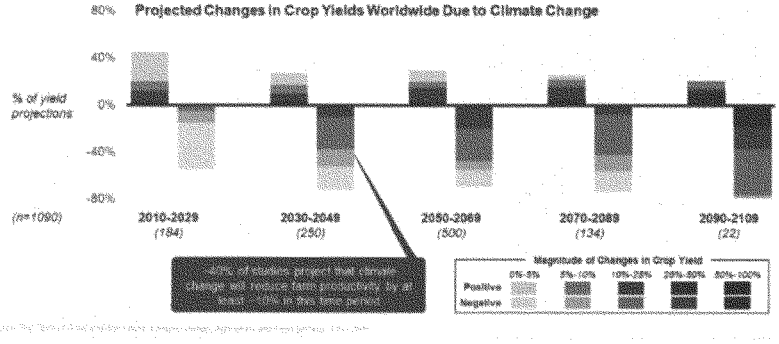
With consolidation among suppliers, money is flowing from farmers to input providers. Indigo is focused on reversing that flow of money — putting it back into farmers' pockets and reinvested in their local communities. If we are successful, we improve the economics of farming substantially, giving farmers increased market power, premiums at harvest, and data-based agronomic information. The business of farming needs to be economically attractive, bringing in new farmers, in order to sustain and expand the farming community and the opportunity for future generations to experience the American agricultural way of life.

I do not have to tell you this, as I know this Committee takes farmer profitability seriously. Today's hearing highlights the unique opportunity for Congress to constructively change the trajectory of agriculture in helping farmers become carbon positive in a way that has serious financial upside for farmers and rural communities. The three dynamics at play – farmer profitability, environmental sustainability and the consumer need for nutritious food – are three unique parameters, in addition to forestry and others, in which this Committee may consider climate change and the agriculture sector.

Policy Direction May Incentivize Farmers As Has Never Been Done

As we witness in the global commodity trading dynamic, yield as the single driving factor in grain pricing has left farmers with surplus stocks at low market values. On top of geopolitical dynamics, experts project that climate change will further lower farm productivity.

Experts Project that Climate Change Will Further Lower Farm Productivity and Worsen Over Time



Imagine if farm productivity were measured in more ways than by yield. Imagine if products were separated in markets where differentiated qualities could capture extra dollars by farmers. Imagine if sustainability had a value in grain that is currently comingled.[5] Imagine if farmers were to be paid for

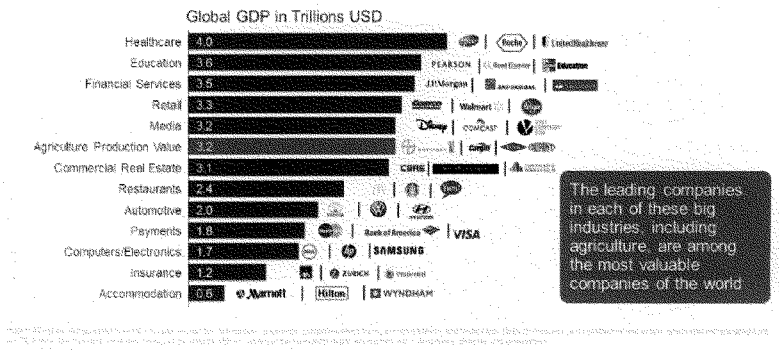
[5] Akers, Gred. "Indigo Ag partners up with Anheuser-Busch on sustainable rice," *Memphis Business Journal*, 11 May 2019. https://www.bizjournals.com/memphis/news/2019/03/11/indigo-ag-partners-up-with-anheuser-busch-on.html.

meeting foreign or local market demands uniquely, for ecosystem services, for carbon credits, for managing risk differently, for water quality and quantity improvements or for additional benefits such as more nutritious crops. Could soil health and food production be enhanced together?

> *What if this could be done? If only we could do this, what would result? We don't obsess over whether it can be done. The majority of innovations today are done in the reverse order, reverse discovery. We are doing discovery of something that turns out to be a valuable answer to the original question without presuming it . . . What if . . . not how can that work... -Flagship Pioneering CEO and Founder Noubar Afeyan*[6]

Are we asking the right questions that farmers need asked? These options for farmers do not occur in a vacuum, but in a multi-trillion-dollar industry.

Agriculture Is One of the World's Largest Industries



In an industry this large, policy makers can signal and create financial incentives for farmers beyond what has ever been done. And done so in such a manner that allows for participation to the extent that the incentives make sense for individual farmers and to the extent that premium markets for crops are provided. Thus, an incentive structure should be large enough to matter to farmers; and even smaller steps could be taken by this Committee in the meantime. As the Congress considers another disaster bill, we are reminded that disasters strike multiple times a year.[7] Finding ways to mitigate risks for farmers within the current Farm Bill incentive structure, disaster assistance, and in our nation's physical infrastructure could be steps toward addressing farmer profitability through financial and technical

[6] *See* https://www.flagshippioneering.com/people/noubar-afeyan.

[7] Childs, Jan. "Federal Aid Lacking for Midwest Farmers Who Lost Grain, Seed in Flooding." *The Weather Channel*, 02 April 2019, https://weather.com/news/news/2019-04-02-midwest-floods-farm-aid.

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resources designed in light of climate change. The opportunities for farms to profitably become carbon positive include additional quality and traceability benefits in providing healthy food and conserving natural resources for future generations. For example, these co-benefits may pertain to water availability in Kansas and water quality in Michigan. Regenerative agricultural practices are being adopted today and can be scaled now. Doing so will cost less than doing nothing at all. And doing so profitably, we believe, will depend on decommoditizing agriculture.

Climate policies, in many forms, will continue to be considered in the private sector, and an incentivized approach for agriculture and climate change could be cost effective for consumers and taxpayers. Consumers and companies are changing the way they think about food and want to know where and how it is produced. In connecting buyers and sellers of grain in Indigo Marketplace™,[8] buyers may consider consumer preferences and sustainability goals for differentiated products that meet certain farming practices and quality and traceability preferences in food, fuel, and fiber. This is done in ways that consumers find valuable and are willing to pay more for – an opportunity for farmers to differentiate value-added products. Beyond our own marketplace, companies across industries use shadow pricing for carbon, not only to market to consumer preferences, but to address underlying drivers of those preferences. There are real costs associated with risks from resource depletion and weather disruption, and Dr. Joseph E. Aldy at Harvard Kennedy School explains that "[T]he rapid adoption of internal carbon pricing shows that companies increasingly recognize its importance to competitive operations and strategy."[9]

This month, carbon dioxide reached 415 parts per million for the first time in human history, according to NOAA.[10] We cannot wait and need government to constructively engage in climate change and the agricultural sector. Visionary leaders may call on America's farmer heroes to overcome barriers to adoption of conservation practices, but we will need a system that unlocks this incredible financial potential. Every day we do not spend working on this new beneficial system is a day we are not adding value to the farmers who could be increasing their profitability, addressing foremost societal concerns, and reinvesting in rural communities.

Indigo looks forward to the development of sustainable agricultural technologies based on the plant microbiome and by offering a business model to growers that improves farmer profitability, sustainability, and the connection of consumer preferences with farming practices. Thank you for the opportunity to present these remarks.

[8] Indigo Marketplace™ https://www.indigoag.com/indigo-marketplace.

[9] Aldy, Joseph and Gianfranco Ginfrate. "Future-Proof Your Climate Strategy. Smart companies are putting their own price on carbon." *Harvard Business Review*, Vol. 97 Issue 3, May-June 2019 pp. 87-97.

[10] Earth System Research Laboratory Global Monitoring Division, Mauna Loa, Hawaii, National Oceanic and Atmospheric Administration. United States Department of Commerce, accessed 17 May 2019. https://www.esrl.noaa.gov/gmd/ccgg/trends/monthly.html.

The Honorable Pat Roberts
Chairman
Senate Committee on Agriculture, Nutrition, and Forestry
Washington, DC 20515

The Honorable Debbie Stabenow
Ranking Member
Senate Committee on Agriculture, Nutrition, and Forestry
Washington, DC 20515

RE: In Regards to the Climate Change and Agriculture hearing before the U.S. Senate Committee on Agriculture, Nutrition, and Forestry

Date: May 21, 2019

The National Young Farmers Coalition ("Young Farmers") thanks the U.S. Senate Committee on Agriculture, Nutrition, and Forestry for calling this hearing on climate change and agriculture. Climate change is an increasing threat to agricultural production and rural economies across the United States. Agriculture also holds great potential to mitigate further climate change through adoption of practices that sequester carbon in agricultural soils and reduce on-farm emissions. We look forward to this hearing and thank the Honorable Pat Roberts and Debbie Stabenow for highlighting this pressing issue.

Our members across the country increasingly report challenges to their farm operations due to climate change: the West has seen intense drought and water scarcity which threatens farmers' ability to irrigate their crops and depletes soil moisture necessary for dryland farming; the East Coast had major crop losses last year due to intense rain and flooding; and hurricanes in the South decimated many crop and livestock operations, causing billions of dollars in damages. This year, floods in the Midwest have cost over $214 million in damages to crops and livestock in Iowa alone, and continue to disrupt planting and shipment of agricultural products.[1]

In our 2017 national survey of our coalition, 66 percent of respondents said that they had experienced shifting weather patterns on their farms and 53 percent of respondents attributed these changes to climate change.[2] This finding is consistent with Young Farmer's 2016 survey of young farmers and ranchers in the Colorado River Basin, which found that climate change was the third most frequently cited agricultural concern among respondents.[3] That survey also found that young farmers prioritize on-farm conservation efforts known to help farmers adapt to and mitigate climate change.

Our farmers' concerns echo the scientific consensus on the urgency of climate change and its impact on agricultural production. The International Panel on Climate Change Special Report on Climate[4] and the United States Global Change Research Program's Fourth National Climate Assessment[5] both project devastating impacts for agriculture, including declining productivity in both crops and livestock and increasing vulnerability of rural communities, unless we take rapid and coordinated action.

To assist young farmers in adapting to drought and building resilience to climate change, the National Young Farmers Coalition provides training, builds farmer networks across the U.S., and advocates for policy change at the state and federal level. Our Western Water Trainings give young farmers across the

West a foundation in state water law and policy, and offers them the knowledge and tools they need to help shape our water future.

In addition to providing trainings, Young Farmers has been advocating for soil health and climate-related legislation at the state and federal level. The Southern Maine Young Farmers Coalition is advocating for climate legislation in the State of Maine, and two affiliated chapters in New Mexico advocated to pass state soil health legislation that recently passed. In D.C., the National Young Farmers Coalition policy staff worked with both the House and Senate agriculture committees to reauthorize the farm bill conservation programs. Currently, we are gathering farmer and stakeholder research to develop a federal climate change policy platform.

Young Farmers would like to thank the Senate Committee on Agriculture, Nutrition, and Forestry for calling this hearing and for exploring ways that farmers and ranchers can contribute to climate change mitigation. We look forward to working with you to find climate solutions that will help farmers and ranchers build successful and sustainable farm businesses for generations to come.

Sincerely,

Martin Lemos
Interim Executive Director
National Young Farmers Coalition

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[1] The Office of the Governor of Iowa Kim Reynolds, "Governor Reynolds requests expedited Presidential Major Disaster Declaration for Missouri River flooding" March 2019, https://governor.iowa.gov/2019/03/governor-reynolds-requests-expedited-presidential-major-disaster-declaration-for-missouri

[2] Sophie Ackoff, et al., "Building a Future with Farmers II," November, 2017, https://www.youngfarmers.org/resource/building-a-future-with-farmers-ii/.

[3] Kate Greenberg, et al., "Conservation Generation," National Young Farmers Coalition, February 2016, http://www.youngfarmers.org/wp-content/uploads/2016/02/NYFC15_water-report_Feb3_low.pdf.

[4] IPCC: "Summary for Policymakers, Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty", 2018.

[5] Jay, A., et al., "Overview. In Impacts, Risks, and Adaptation in the United States", 2018. Fourth National Climate Assessment, Volume II

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real and significant, but it is also related to concerns about ocean debris and other waste issues, environmental pollution of microplastics, and the state of water quality and soil health.

We respectfully submit that a holistic approach is the most appropriate means of addressing consumer expectations. Admittedly, some others do not agree. A very recent example that demonstrates this difference in perspective may be found in the May 20, 2019, Wall Street Journal, which reported, "The American Chemistry Council said Maine's recent ban on polystyrene containers is misguided because foam uses less energy and water than paper- or corn-based alternatives, mainly because it weighs less." See *In the Plastic-Bag Wars, the Industry Fights Back*. On this point, PBPC respectfully disagrees with our friends at the American Chemistry Council. A claim that polystyrene containers are environmentally superior to plant based materials based on energy and water use, but disregarding various other environmental considerations, such as waste disposal, is the sort of narrow comparison of products that is a disservice to public discourse and the environmental objectives consumers value.

At PBPC, we view the bioeconomy as holding tremendous potential to address a full sweep of environmental concerns and foster strong improvements in rural prosperity. The foundation of this potential is American farmers' leadership in sustainable production practices, an accomplishment that does not receive adequate attention. Upon that foundation, advances in chemical engineering are reshaping bioproducts technology and dramatically expanding their functional capabilities. With a commitment to sustainable production practices from the farm through manufacturing, various **bioproducts offer substantial improvement in packaging over legacy products in terms of greenhouse gas emissions, waste management, water quality and soil health.**

PBPC stands ready to serve as a resource to the Committee as it considers the bioeconomy's role in **addressing the diverse economic and environmental needs of rural, suburban, and urban communities across America. Additional information regarding the PBPC may be found at "PBPC.com" or by contacting Ben Gruitt at** Ben@PBPC.com.

Sincerely,

Mary K Solecki

Mary Solecki
Plant Based Products Council Spokesperson

STATEMENT OF THE NATIONAL SUSTAINABLE AGRICULTURE COALITION

SUBMITTED TO UNITED STATES SENATE COMMITTEE ON AGRICULTURE, NUTRITION, & FORESTRY

REGARDING "CLIMATE CHANGE AND THE AGRICULTURE SECTOR"

MAY 21, 2019

WASHINGTON D.C.

Chairman Roberts, Ranking Member Stabenow, and members of the Senate Agriculture Committee,

Thank you for holding today's Senate Agriculture Committee hearing to examine climate change and agriculture. Climate change has and will continue to impact agricultural productivity and viability in the United States. At the same time, farmers and ranchers are uniquely positioned to be a critical part of the solution. We applaud you for recognizing the severity of the problem, and we look forward to working with you to ensure farmers and ranchers have the tools they need to be leaders in nationwide efforts to significantly mitigate and adapt to the pressures of a changing climate.

NSAC Position on Climate Change and Agriculture

The National Sustainable Agriculture Coalition (NSAC) is a national alliance of family farm, food, rural, and conservation organizations that together take common positions on federal agriculture and food policies to advance sustainable agriculture. Our member organizations, and the farmers and ranchers they work with across the country, believe that climate change presents a severe and immediate threat to the agriculture sector and to rural communities across the country. We also believe that farmers and ranchers can, and must, be part of the solution as we work to support and advance climate change mitigation and adaptation.

Not only are farmers and ranchers at the frontlines when it comes to the effects of climate change, including droughts, floods, extreme temperatures, severe storms, and shifting pest and disease pressures, but they are also uniquely positioned to be part of the solution and significantly contribute to climate change mitigation. Through soil health management practices that sequester and store carbon in the soil, as well as through the adoption of agricultural systems that reduce greenhouse gas emissions, farmers and ranchers absolutely must be part of climate change solutions, and they must have a seat at the table as we work to develop policy solutions to address this pressing issue.

Farm Bill Opportunities

NSAC worked across a wide range of issues included in the 2018 Farm Bill to protect and improve natural resources, expand opportunities for the next generation of farmers, invest in local and regional economies, and scale up agricultural research efforts to build a more sustainable food and

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farming system. We thank you for your leadership and tireless efforts to pass a strong, bipartisan farm bill, and we look forward to continuing to work with you on farm bill implementation in the months and years ahead. As you know, the 2018 Farm Bill included several important provisions to help advance climate change mitigation and adaptation, including, but not limited to, the following:

- Increased payment rates for conservation activities that build soil health, including cover crops, resource conserving crop rotations, and advanced grazing management;
- Priority for conservation activities and systems that build soil health and address weather volatility;
- Establishment of on-farm soil health demonstration trials for innovative practices;
- Increased funding to protect agricultural land from development and to restore and protect wetlands;
- Strengthened protection of native grasslands that provide enormous carbon storage benefits;
- Addition of new soil health priorities within agricultural research programs and increased funding for organic research;
- Inclusion of public plant breeding provisions to increase farmers' access to the most productive and well-adapted seeds for their operations, geographies, and a changing climate;
- Clarification of the definition of cover crop termination in order to reduce farmers' fears that cover cropping could risk their crop insurance coverage; and
- Requirement for USDA to identify available data relevant to conservation practices and the effects of conservation adoption on crop yields, farm and ranch profitability, and soil health.

The implementation of these important provisions will be critical to supporting farmers and ranchers in their efforts to mitigate and adapt to climate change. We look forward to working with you and with USDA to ensure successful implementation of these provisions, as well as working with our member organizations across the country on outreach to promote these opportunities and ensure farmers and ranchers can utilize and benefit from these important provisions.

Addressing the Severity of the Crisis

Given the severity of climate crisis, as well as the need for incentives and support for farmers and ranchers on the frontlines of climate change, we also believe it is critical to scale up the resources and tools available for climate change mitigation and adaption. In order to reduce the risk to producers in shifting to new climate-friendly agricultural systems, we need to invest in relevant financial incentives, technical assistance, and research.

It is essential that any national climate policy recognize the role that agriculture can and must play in avoiding the worst impacts of climate change, increasing soil health and carbon sequestration, and reducing greenhouse gas emissions. Climate change threatens agricultural productivity, as well as the viability and profitability of farmers and ranchers across the country. We need policy solutions that not only support farmers and ranchers in adapting to these pressures and building resilient agricultural systems, but that also provide them with the tools and resources to play a leading role in mitigating the effects of climate change through carbon sequestration and greenhouse gas emission reductions.

Conclusion

We thank you for holding the hearing today to further examine climate change and agriculture, and we look forward to working with you to support innovative policies that bring farmers and ranchers to the table as a critical part of the solution.

Sincerely,

Alyssa Charney
Senior Policy Specialist

Juli Obudzinski
Interim Policy Director

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Testimony of Abby Youngblood, Executive Director of the
National Organic Coalition

submitted to the

U.S. Senate Committee on Agriculture, Nutrition and Forestry

for the hearing on

"Climate Change and the Agriculture Sector"

May 21, 2019

Chairman Roberts, Ranking Member Stabenow and Members of the Committee-

I am Abby Youngblood, Executive Director for the National Organic Coalition. The National Organic Coalition is a national alliance of organizations representing the full spectrum of stakeholders with an interest in organic agriculture, including farmers, ranchers, conservationists, consumers, retailers, certifying agents, and organic industry members. NOC seeks to advance organic agriculture and ensure a united voice for organic integrity, which means strong, enforceable, and continuously improved standards to maximize the multiple health, environmental, and economic benefits that organic agriculture provides.

Thank you for the opportunity to provide testimony on the important topic of climate change and the agriculture sector. In the organic agriculture sector, we are very excited and engaged in this topic because there is strong science showing that, in general, organic practices are climate-friendly practices. I welcome this opportunity to summarize what we have learned from the evolving science on this topic.

Important Role of Organic Agriculture in Addressing Climate Change

Organic agriculture has led innovations in farming for decades, particularly in the development of climate-friendly soil building techniques and farm inputs. Healthy soil is the cornerstone of organic agriculture and a critical solution for addressing climate challenges. Organic farming practices help mitigate climate change by keeping roots in the soil, preventing soil erosion, and sequestering soil carbon. Nutrient-rich, biodiverse soils foster the ability of crops to withstand

and adapt to extreme weather-induced events such as droughts, floods, fire, and high winds. Accelerating the adoption of organic agricultural practices in the U.S. and abroad will go a long way toward solving the global climate crisis.

ORGANIC ELIMINATES A SIGNIFICANT SOURCE OF NITROUS OXIDE EMISSIONS

EPA estimates that U.S. agriculture contributes 8.6% to the country's anthropogenic greenhouse gas (GHG) emissions, releasing the equivalent of 574 million metric tons of carbon dioxide annually into the environment, mostly from fossil fuel production and use. Nitrous oxide emissions from soils comprise 50.4% of all domestic agricultural emissions.[i] The chemical is a long-lived GHG and ozone depleter, with 310 times the global warming potential of carbon dioxide.[ii]

- Organic regulations (§205.105) prohibit the use of synthetic substances in crop production.

- Prohibiting synthetic fertilizers in organic eliminates a significant agricultural source of N_2O emissions. Since nitrogen is an essential plant nutrient, many organic farmers apply soil amendments such as manure and compost, and grow leguminous cover crops, to fix nitrogen in the soil.

- Efficient nitrogen use is key to reducing GHG emissions; aerated organic soils have low mobile nitrogen, which reduces N_2O emissions from agricultural fields.[iii]

- The use of synthetic pesticides is prohibited in organic agriculture. Synthetic pesticides disrupt nitrogen fixation and inhibit soil life. The absence of pesticides in the soil allows diverse organisms and beneficial insects to decompose plant residues and help sequester carbon.

ORGANIC PRACTICES CAN MITIGATE CLIMATE CHANGE

Healthy, biodiverse soils are integral to thriving organic farming systems and they also impact climate change. As biologically active soils break down crop residues, they release carbon dioxide and nutrients. Stabilized soil organic carbon that adheres to clay and silt particles or resists decomposition is sequestered and can remain in soils for decades or even millennia.

- Organic regulations (§205.203) require the implementation of soil fertility and crop nutrient management practices to maintain or improve soil such as crop rotations, cover cropping, and the application of plant and animal manures.

- Research has shown that if the standard practices used by organic farmers to maintain and improve soils were implemented globally, it would increase soil organic carbon pools by an estimated 2 billion tons per year – the equivalent of 12% of the total annual GHG emissions, worldwide.[iv]

• Cover crops, routinely planted by organic farmers after harvesting cash crops, rebuild soil nitrogen and improve carbon sequestration by adding soil organic matter. Planting deep-rooted cover crops like forage radish or cereal rye further aid in the long-term sequestration of carbon.

• Compost is an important organic farming soil amendment and, when used judiciously and in combination with cover crops, it accrues more soil organic carbon than when used alone.

• Adding compost to rangeland and intensively managing and rotating livestock can increase plant productivity and heighten carbon sequestration.

• Diverse crop rotations, using plants with deep, extensive root systems, play an important role in sequestering carbon. Research has shown that although most soil biological activity occurs near the earth's surface to take advantage of the sun, 53% of the global soil organic carbon is found at depths 12-39 inches below the surface.[v]

• Prudent green and animal manure applications, crop rotations, intercropping, and cover cropping improve farm soils and help prevent soil erosion, which depletes the amount of carbon the soil is able to store.

ORGANIC AGRICULTURE INCREASES RESILIENCE TO CLIMATE CHANGE

By design, organic agriculture builds resilience into the system of food production. Growing strong crops and livestock on healthy soils with bountiful biodiversity above and below ground facilitates the ability of organic systems to tolerate, adapt to, and recover from extreme weather conditions.

• High levels of organic matter in organic farm soils increase soil water retention, porosity, infiltration, and prevent nutrient loss and soil erosion. These soil properties make agriculture more resistant to flooding, drought, high winds, and the loss of soil organic carbon.

• Diverse cropping and intercropping on organic farms keep pest and predator relationships in check, decreasing crop susceptibility to insect pests and disease and increasing crop resiliency and adaptability to the extreme variabilities of climate change.

• "Given its potential for reducing carbon emissions, enhancing soil fertility and improving climate resilience, Organic Agriculture should form the basis of comprehensive policy tools for addressing the future of global nutrition and addressing climate change."[vi]

As Congress debates effective strategies to address the threat of global climate change, we believe the science shows that organic agriculture can be part of the solution to this challenge.

Thank you for the opportunity to provide this testimony on behalf of the National Organic Coalition member organizations:

Beyond Pesticides
Center for Food Safety
Consumer Reports
Equal Exchange
Food & Water Watch
Maine Organic Farmers and Gardeners Association
Midwest Organic and Sustainable Education Service
National Co+op Grocers
Northeast Organic Dairy Producers Alliance
Northeast Organic Farming Association
Ohio Ecological Food and Farm Association
Organic Seed Alliance
PCC Community Markets
Rural Advancement Foundation International – USA

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[i] Environmental Protection Agency (EPA). (2018) *Sources of Greenhouse Gas Emissions*. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

[ii] Schonbeck, M. et al. (2018) *Soil Health and Organic Farming, Organic Practices for Climate Mitigation, Adaptation, and Carbon Sequestration,* Organic Farming Research Foundation, p. 2. https://ofrf.org/soil-health-and-organic-farming-ecological-approach

[iii] UNCTAD/WTO, FiBL. (2007) *Organic Farming and Climate Change*, Doc. No. MDS-08-152.E. Geneva, Switzerland. http://orgprints.org/13414/3/niggli-etal-2008-itc-climate-change.pdf

[iv] *Ibid*, p. 42.

[v] Schonbeck, M. et al. (2018) p. 12.

[vi] International Federation of Organic Agriculture Movements (IFOAM). https://www.ifoam.bio/en/advocacy/climate-change

National Farmers Union

STATEMENT FOR THE RECORD

Submitted to the U.S. Senate
Committee of Agriculture, Nutrition, & Forestry

"Climate Change and the Agriculture Sector"
May 21, 2019
Room 328A Russell Senate Office Building
Washington, DC

Chairman Roberts, Ranking Member Stabenow, and members of the committee:

Thank you for holding a hearing to examine climate change and the effects on farmers. National Farmers Union (NFU) represents about 200,000 family farmers, ranchers and rural residents. NFU works to protect and enhance the economic well-being and quality of life for family farmers and ranchers and rural communities across the country.

Climate change is already having a significant impact on family farmers and ranchers. Changing growing seasons, precipitation patterns, and increasingly frequent and severe extreme weather events have all taken their toll. This spring, flooding left farm fields across the Midwest underwater. Meanwhile, growers across the Southeast are still working to recover from Hurricane Michael, which is one of only four category 5 hurricanes to make landfall in the United States. And wildfires in California, brought on by increasingly warm and dry weather, have caused more damage than ever before.

NFU has long been concerned with the ongoing and future impacts of climate change on agriculture and food security. In light of these concerns, NFU members at our 117th Annual Convention this spring passed a Special Order of Business supporting "policies, collaborations with consumers, and efforts throughout the agricultural value chain" that would help farmers adapt to and mitigate climate changes impact.[1]

NFU supports a comprehensive federal approach that would encourage and assist farmers in implementing climate friendly practices on their operations. Core elements of this approach include funding and promotion of the U.S. Department of Agriculture's (USDA) existing voluntary incentive-based conservation programs; initiatives to expand on-farm energy production and biofuels; and measures to incentivize new markets and supply chains to help farmers diversify their operations. A strong investment in research must underlie these efforts. All of these initiatives are core to our principles of ensuring domestic and global food security and competitive markets. We urge you to consider policies that provide family farmers and ranchers the tools they need to curb future effects of climate change, increase their resiliency, and help make America's family farms more economically viable.

Agriculture's role in climate change

U.S. farmers and ranchers are both contributors to and victims of climate change. While the sector accounts for less than 5 percent of the U.S. economy, it accounted for about 9 percent of total greenhouse gas emissions in 2017.[2] Many of these emissions are due to the nature of agricultural production: livestock emit methane; burning crop residues and tilling soil to prepare

[1] See appendix.
[2] U.S. EPA. "Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2017." April 11, 2019. Retrieved May 20, 2019. https://www.epa.gov/sites/production/files/2019-04/documents/us-ghg-inventory-2019-main-text.pdf

for planting releases carbon and other gases; and the application of certain fertilizer can release nitrogen and other greenhouse gases.

USDA has found that climate change will affect everything from what farmers can grow to where they can grow it. A 2015 report from USDA found that "U.S. agriculture faces significant changes in local patterns of precipitation and temperature over the next century, with implications for regional water cycling and water availability." How bad things will get will depend on the severity of changes in local weather patterns, the availability of water for irrigation, and the ability of the sector to adapt.[3]

Should current weather conditions and changes persist, by 2080 crop production in some of the most productive parts of the country—particularly the Midwest and Northern Plains—will decline, while Mountain and Pacific Coast states will see a marked increase in dryland production, according to USDA. But those increases are unlikely to compensate for the production that is lost. The Corn Belt and Northern Plains account for about half of agricultural production in the United States, and projected declines in these regions account for 2.1 percent of their combined acreage.[4] Even as farmers undertake broadscale shifts in how and what they produce, USDA's climate projections suggest they will have to make those potential decisions amid increasingly frequent and severe storms and droughts.

Unlike many other sectors, agriculture cannot only reduce its emissions but capture emissions from other sectors. Plants take up carbon from the atmosphere and deposit it in soil, making agriculture a key player in carbon sequestration. Practices like no-till, cover cropping, crop rotations and precision farming techniques will help unlock agriculture's potential as a carbon sink. USDA and other players in the sector are working with growers to adopt these and other climate-smart practices, which can improve yields and encourage the storage of carbon in soil. We need to build upon these efforts to expand farmers' access to the tools and information they need to mitigate and adapt to climate change.

The USDA's Natural Resources Conservation Service is using money provided in the farm bill to work with farmers to implement a host of practices aimed at leaving soil undisturbed and increasing plant biodiversity—key requirements for carbon sequestration in soil. And their efforts are working. Through these voluntary, incentive-based programs, the use of cover crops, a key tool in protecting soils, increased from 10.3 million acres in 2014 to 15.4 million in 2017, according to USDA.[5] Meanwhile, about half of corn, cotton, soybean, and wheat producers have

[3] USDA Economic Research Service. "Climate Change, Water Scarcity, and Adaptation in the U.S. Fieldcrop Sector." November 2015. Retrieved May 20, 2019. https://www.ers.usda.gov/webdocs/publications/45492/err-201.pdf?v=0

[4] *Ibid.*

[5] USDA, National Agricultural Statistics Service. (2019) 2017 Census of Agriculture.

adopted limited or no-till practices on their farms.[6] These practices not only protect the soil, storing carbon instead of releasing it, but also curb runoff from fields that harms waterways.

Technology is helping farmers to mitigate and adapt to climate change. Farmers are using more efficient irrigation systems to increase yields while using less water. They are also deploying precision agriculture systems to limit the application of fertilizers and pesticides, which can both contribute to greenhouse gas emissions and potentially cause environmental harm.

Further, farmers are also increasingly interested in on-farm energy production, including wind and solar production, as well as producing crops for ethanol and other renewable fuels, which can play a key role in reducing American dependence on foreign fossil fuels and provide a new market for U.S. agricultural goods.

Building on Current Policy to Address Climate Change

While the work U.S. farmers and ranchers are doing is important to reduce emissions, provide energy alternatives, and make farms more resilient, it needs to be done on a larger scale. To achieve broader adoption of mitigation practices and greater carbon sequestration by farmland, NFU recommends that Congress and the administration expand USDA's existing incentive-based conservation programs, promote and incentivize biofuels and on-farm energy production, and encourage market-based incentives for farmers to adopt climate friendly practices.

Conservation programs

USDA and farmers and ranchers know what practices work to sequester carbon and promote agricultural resilience, but they are neither easy nor inexpensive to implement. For example, cover crops help to capture and keep carbon in the soil, and increase resiliancy to drought and flood. However, planting them comes at a cost to farmers in the form of seed, time, energy use, and short-term impacts on yields. Increased funding and staff for USDA conservation programs will be key in any effort that aims to address agriculture and climate change.

The Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP) are USDA's main tools for providing funding and assistance to farmers to implement conservation practices on agricultural lands. NFU believes that both programs have a key role to play in the battle against climate change. We applaud Congress for leveraging each program to help farmers adapt to and mitigate weather volatility, a key product of climate change, in the 2018 farm bill.

The 2018 farm bill established Conservation Incentive Contracts within EQIP, targeting the program for longer-term, management-focused conservation. It also allows for higher reimbursement rates for state-designated high-priority practices. Going forward, we encourage

[6] Clesson, Roger, "No-till and Strip-till Are Widely Adopted but Often Used in Rotation with Other Tillage Practices." USDA ERS. March 13, 2019. Accessed May 20, 2019.

Congress to examine ways to specifically prioritize EQIP for conservation practices that are most effective at sequestering carbon.

NFU is also grateful that the farm bill calls for better coordination between EQIP and CSP. It is critical that we encourage farmers to install and maintain comprehensive conservation systems. This change allows farmers to seamlessly take advantage of both programs' benefits. We are also glad the CSP was further leveraged for climate-smart production with the establishment of a bonus payment for cover crops and a supplemental payment for advanced grazing management.

Further, we were pleased to see the increases in the Conservation Reserve Program (CRP) acreage and funding for the Agricultural Conservation Easement Program in the 2018 farm bill. Programs such as these protect land from development and take highly erodible land out of production. Together, they play an important role in climate change adaptation and mitigation.

On-Farm energy

On-farm renewable energy generation and energy-efficient systems can help farmers access new revenue streams and reduce their carbon footprint and input costs. USDA's Rural Energy for America Program (REAP) has supported more than 15,000 renewable energy system installations and energy efficiency improvements nationwide. However, the program remains heavily oversubscribed. NFU supports increasing REAP funding to meet demand and to target the program to projects with the largest climate benefits.

NFU supports "expanding the utilization of anaerobic digesters."[7] However, in most cases, our members lack the quantity of waste necessary to serve as adequate feedstock for large-scale digesters. We believe the Carbon Utilization and Biogas Education Program established in the 2018 farm bill, will provide an effective tool to promote the development of biogas systems that aggregate organic waste from multiple sources. We also encourage the committee to identify ways to encourage the proliferation of small-scale digester systems.

NFU also supports the Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program; and the Biomass Crop Assistance Program. Each of these programs can play critical roles in promoting the development of the bioeconomy, providing farmers with additional marketing opportunities.

Renewable fuels

NFU supports growth in the use of renewable fuels, including ethanol, and any climate programs should work hand-in-hand with the Renewable Fuels Standard (RFS) program.

Ethanol, a renewable fuel produced largely from corn, has broad benefits for the environment. As a renewable, domestically produced resource, it reduces U.S. dependence on fossil fuels, and creates a cleaner burning fuel when mixed with gasoline. Real-world evidence shows use of

[7] P. 137 of NFU 2018 Policy Book

ethanol blends reduces emissions of carbon monoxide, particulate matter, air toxic chemicals, and greenhouse gases compared to burning petroleum gasoline. As we move to even higher-level blends of ethanol such as E20 + we see even more benefit as a higher-octane fuel, and the motor fuel can burn even more efficiently. This results in better overall air quality than when vehicles burn conventional gasoline, significantly improving public health.

The Energy Independence and Security Act of 2007 required EPA to conduct lifecycle GHG emissions analysis to identify the renewable fuels eligible to meet the various categories under the RFS program. EPA conducted this analysis for corn-based ethanol as part of the 2010 RFS rulemaking. Since that time, published studies and more recent data have improved the understanding of corn ethanol's lifecycle GHG impacts.[8] U.S. farmers have responded to demand and concerns by moving toward sustainable practices and intensification, not land expansion.[9]

Market-based incentives

Finally, Congress and the administration should take steps to incentivize and ease the way for new domestic markets and supply chains so that farmers can have more control over what they produce and have the freedom to make climate friendly choices on their land. More diversified crop rotations have soil health and environmental benefits that in the long run can make land more resilient to extreme weather and help soil capture carbon.

Due to consolidation, farmers and ranchers face few choices in the markets they buy from or sell to. Many of our members have argued that this consolidation has limited their opportunities to diversify their operations. Because farmers have limited access to diverse input options, they are often locked into a small selection of commodities. This has implications both for farmers' environmental and economic sustainability. To see lasting, market-based climate benefits from

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[8] *See, e.g.*, ICF, *A Life-Cycle Analysis of the Greenhouse Gas Emissions of Corn-Based Ethanol*, Report prepared for USDA (Jan. 2017), *available at* https://www.usda.gov/oce/climate_change/mitigation_technologies/USDAEthanolReport_20170107.pdf.

[9] *See, e.g.*, Bruce A. Babcock and Zabid Iqbal, *Using Recent Land Use Changes to Validate Land Use Change Models*, Iowa State University Center for Agricultural and Rural Development, Executive Summary (2014), *available at* http://www.card.iastate.edu/products/publications/pdf/14sr109.pdf ("The contribution of this study is to confirm that the primary land use change response of the world's farmers from 2004 to 2012 has been to use available land resources more efficiently rather than to expand the amount of land brought into production. ... Our conclusion that intensification of agricultural production has dominated supply response in most of the world does not rely on higher yields in terms of production per hectare harvested. Any increase in yields in response to higher prices would be an additional intensive response."); *see also* Renewable Fuels Association, *USDA Data Show Cropland Reductions in Counties with Ethanol Plants from 1997-2012*, April 3, 2017, *available at* http://www.ethanolrfa.org/wp-content/uploads/2017/04/USDA-Data-Show-Cropland-Reductions-in-Counties-with-Ethanol-Plants-from-1997-2012-1.pdf.

agriculture, the government needs to examine ways to curb consolidation in the agriculture industry and encourage markets that help farmers and ranchers improve their environmental stewardship. Doing so could also create more space for other market-based incentives for climate friendly production.

To be sure, there have been market-based carbon sequestration systems for farmers that have worked. From 2006 through 2010, North Dakota Farmers Union (NDFU) and NFU partnered to create a program that traded carbon credits on the Chicago Climate Exchange (CCX), which was a voluntary cap-and-trade program similar to the mandatory system enacted internationally under the Kyoto Protocol. NDFU served as the program's fiscal agent, selling carbon credits that were earned on a per-acre basis with land management practices such as no-till and reduced-till cropping, long-term grass seeding, intensive rangeland management, and afforestation. Along with storing carbon in the soil, the conservation methods implemented provided substantial fuel savings, improved soil tilth, water storage and water efficiency, and reduced soil erosion. At the program's conclusion when the CCX ceased in 2010, NDFU had distributed more than $7.4 million to 3,900 farmers who sequestered carbon on over five million acres.

Conclusion

Government efforts fund and promote on-farm conservation, expand on-farm energy production and biofuels, and assist farmers in diversifying their operations would be a boon to producers who are currently struggling in a depressed farm economy. Climate change mitigation and resilience could help to rebuild rural areas and ensure the longevity of America's family farms and ranches.

Thank you for the opportunity to submit a statement for the record on climate change and agriculture. We look forward to working with you to identify policies and solutions to this pressing issue in ways that strengthen our family farms and rural communities.

Sincerely,

Roger Johnson
President, National Farmers Union

National Farmers Union

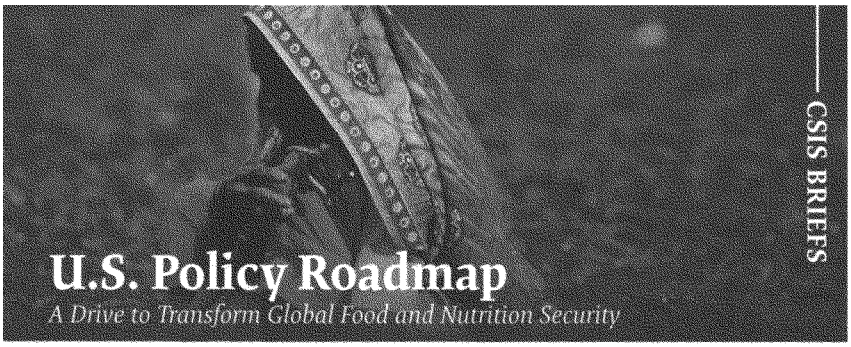
FAMILY FARMING AND CLIMATE CHANGE
2019 SPECIAL ORDER OF BUSINESS

Climate change jeopardizes the livelihoods of U.S. family farmers, ranchers, and rural residents. Without immediate and decisive action, climate change will disrupt all sectors of the national and global economy and pose risks to the food supply and human health and well-being. Farmers need to have a seat at the table as the new political frameworks to address climate change are being developed.

Family farmers and ranchers have been significantly impacted by the changing climate, which has caused shifts in growing seasons, altered precipitation patterns, and increasingly severe and frequent national disasters. At the same time, family farms are uniquely positioned to mitigate climate as healthy soils and vegetation remove existing greenhouse gases from the earth's atmosphere.

In order to empower family farmers to lessen the negative impacts of climate change, NFU supports policies, collaborations with consumers, and efforts throughout the agricultural value chain that:

- Support research, cost-share and other incentives to help family farmers install and manage practices and infrastructure that mitigate climate change and sequester carbon;
- Encourage USDA Climate Hubs to coordinate climate information, agronomic and risk management support, and programs that enhance marketing options to allow family farmers to effectively utilize opportunities to enhance profits while mitigating climate change;
- Encourage energy efficiency, renewable energy production, and further development of the bioeconomy on family farms and in rural communities;
- Encourage cooperation and collaboration among family farmers to build and expand market infrastructure that will allow consumers to choose agricultural products that create climate benefits;
- Provide new opportunities for family farmers to articulate their climate mitigation efforts with consumers through food processors and retailers;
- Protect family farmland from carbon intensive suburban sprawl development; and
- Protect competition in the markets that family farmers buy from and sell into, allowing for more opportunities to make decisions that benefit soil and the landscape rather than farming within the narrow prescriptive demands of excessively consolidated markets.



CSIS BRIEFS

U.S. Policy Roadmap

A Drive to Transform Global Food and Nutrition Security

By Kimberly Flowers

JANUARY 2019

THE ISSUE

There has been strong bipartisan support for the United States to be a worldwide leader in addressing global food and nutrition security. Congressional champions are still needed, particularly under the Trump administration. Policymakers should elevate the issue within diplomatic and national security discussions, invest more in nutrition, better link humanitarian and agricultural development strategies, renew commitments to agricultural science, and scale up agricultural technologies.

Over 90 newly-elected members of Congress will arrive in Washington this month, bringing with them new perspectives and fresh thinking on an array of issues important to their constituents. They will be soon inundated with information and facing a rising tide of requests for immediate policy attention and legislative action. This policy brief suggests that there are few issues more urgent and more important both at home and abroad than food security and improved nutrition.

WHY FOOD SECURITY AND IMPROVED NUTRITION MATTER

More than 800 million people today go to bed hungry, and billions more have diets deficient in essential vitamins and minerals or are overweight or obese.[1] Malnutrition in all its forms is now the major contributor to the global burden of disease. And rises in hunger and food insecurity over the last few years indicate the presence of rising social and economic tensions and conflicts that threaten global stability.

The legislative framework for U.S. initiatives to address food and nutrition security is in place. A Farm Bill guiding national action on these issues over the next four years passed during the lame duck session last month;[2] the Global Food Security Act was recently reauthorized until 2023 as the framework for U.S. support for food security in key countries around the world.[3] The challenge for the 116th Congress will be to ensure effective implementation of these key pieces of legislation. Through bipartisan policy oversight and timely funding decisions, congressional support matters. It impacts the daily well-being of billions of people.

While sustained U.S. investments in international development ultimately advance our country's economic development and national security interests, it is not (nor should it be) about indiscriminately putting U.S. interests first. Some pockets of the world depend on the United States as a leader and partner to address complex global development challenges. Our track record speaks for itself: from 2010 to 2017, U.S. targeted strategies and investments in inclusive agricultural growth and nutrition programming decreased poverty by 23 percent and stunting by 32 percent in areas where Feed the Future operated.[4]

There are few issues more urgent and more important both at home and abroad than food security and improved nutrition.

Numerous leaders and factors should be credited for Feed the Future's success, from interagency coordination under the U.S. Global Food Security Strategy to the unflagging work of U.S.-based and international partners who implement programs on the ground. Progress hasn't come easily or quickly. Robust results monitoring has proven that agricultural development tools can work, particularly when combined with effective enabling environments and country-led approaches.

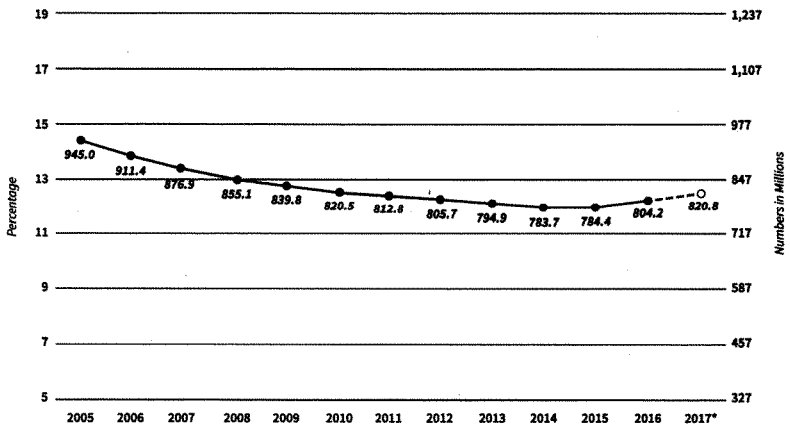
But now is not the time to just sit back and applaud our inspiring progress, collaborative leadership, or legislative victories. Despite targeted achievements, for three years in a row global hunger has risen.[5] Progress to reach the UN Sustainable Development Goals are not currently on track to reverse the climbing trend of undernourishment, much less to eradicate hunger by 2020.[6] Despite admirable global efforts like Scaling Up Nutrition and the New Alliance for Food Security and Nutrition, why does it feel like we are being pushed slowly backward down a mountain of progress? Protracted conflicts, climate change, and mass migration—which are inexorably linked—are primary drivers. And these trends are getting worse, not better.

WHY DOES THE UNITED STATES NEED TO LEAD?

The United States has a long, proud history as a leader in food security from a research, humanitarian, and development perspective: a U.S. scientist, later coined the "Father of the Green Revolution," saved one billion lives from starvation in the 1960s through agricultural research and technology development; U.S. tax dollars provided a record-setting $8 billion in humanitarian assistance in fiscal year 2017, making the United States by far the largest single donor responding to natural and man-made crises;[7] and Feed the Future estimates that it has lifted 23.4 million people out of poverty since 2010.[89]

When the United States leads, other nations follow. President George W. Bush recognized the scourge of growing levels of HIV/AIDS infection and, with congressional support, launched PEPFAR in 2003 as a pathbreaking bilateral commitment to HIV/AIDS prevention and treatment. President Obama's decision at the 2009 G8 Summit in L'Aquila to commit $3.5 billion in U.S. support for agricultural development mobilized resources more than

UNDERNOURISHED PEOPLE IN THE WORLD SINCE 2005



Source: UN Food and Agriculture Organization via UNFAO, IFAD, UNICEF, WFP, and WHO, The State of Food Security and Nutrition in the World 2018: Building Climate Resilience for Food Security and Nutrition

**Projected values, illustrated by dotted lines and empty circle*

six times the U.S. commitment.[10] There hasn't been the same level of political action on agriculture or nutrition for nearly a decade, despite strong evidence that investments in agriculture and nutrition have a high return on investment and is an effective tool for poverty reduction.[11][12] Sustainable food systems made the cut as a top agenda item for the G20 meeting held in Argentina in early December, but the United States has clearly stepped back from a global leadership role. The world needs a L'Aquila-level moment in 2019.

Even though improving global food security aligns with the economic and national security interests of the Trump administration, there is no sign that the White House plans to emulate the kind of development leadership of the Bush and Obama administrations. At last year's G20 summit, President Trump did announce $639 million in humanitarian aid to help four countries facing potential famines. In addition, the BUILD Act, a trailblazing piece of development finance legislation, was strongly supported by President Trump's National Security Council.[13] On the other hand, overall funding for diplomatic and development objectives have been subject to draconian cuts in the budgets submitted by the president in 2017 and 2018. Bipartisan congressional leadership has been effective in protecting the foreign assistance accounts to date, but the signals for continued U.S. leadership on key issues—economic growth and poverty reduction, food security, and improved nutrition and health—are not positive.

Congressional oversight and guidance are more important than ever to maintain the development leadership that the United States is known for. Foreign assistance is part of our moral fabric. The instrumental benefits, including economic returns and global stability, are understood and appreciated by both political parties. President Trump's signature reauthorizing the Global Food Security Act for the 2018-2023 period confirms the importance of these issues and the U.S. role in addressing them.

WHY IS THE GLOBAL FOOD SECURITY ACT POLITICALLY SIGNIFICANT?

The groundbreaking Global Food Security Act of 2016 not only demonstrated sincere bipartisan U.S. leadership, with both sides of the aisle co-sponsoring and advocating for the legislation, but also transformed a presidential initiative into a national strategy.[14][15] Signed months before the 2016 presidential election, the timing of the authorization was more crucial than most could have predicted at the time. It placed enduring congressional commitment behind a global food security strategy that was otherwise tied to the parting Obama administration.

The Global Food Security Act is a reminder that enacting policy change takes serious attention over an extended period, even when both Republicans and Democrats support the cause. The act was more than a decade in the making, propelled by a community of policymakers, advocacy organizations, and thought leaders pushing for the United States to step up. Among these stakeholders was a 2008 Center for Strategic and International Studies (CSIS) task force co-chaired by champions like Senator Bob Casey (D-PA) and now former Senator Richard Lugar (R-IN). The task force crafted a bold, bipartisan vision arguing, among other policy points, for the United States to create a strategic approach to global food security that connects relief, development, energy, and trade.[16]

Congressional oversight and guidance are more important than ever to maintain the development leadership that the United States is known for.

WHAT IS THE CURRENT U.S. STRATEGY?

That U.S. Global Food Security Strategy was submitted to Congress in September 2016 as mandated by the Global Food Security Act. It provides a comprehensive framework to achieve its vision of a "world free from hunger, malnutrition, and extreme poverty," replete with thriving economies, nutritious diets, and resilient households.[17] The strategy aptly details emerging global trends, from instability and conflict, to urbanization and gender inequalities. It meticulously outlines how to develop an efficient and inclusive agricultural growth program at the global level, covering everything from building market systems and trade linkages to integrating water and sanitation investments.

From a technical perspective, very little is missing. And that may be precisely the problem: the strategy is so comprehensive and broad that it lacks strategic focus. From the results framework to the monitoring, evaluation, and learning approach, the plan on paper is solid. Translating these strategies into activities on the ground, however, is much more complex. At the country-level, how do you prioritize target commodities and communities when funding is stagnant, but expectations have risen? How do you effectively partner with a national government that may have a well-written country strategy, but remarkably low tax revenues, limited capacity, or inadequate political will to invest in its own people? How

do you integrate market-led development programs with traditional humanitarian aid in areas plagued by political instability and violence? What is the best way for diverse U.S. agencies to collaborate and combine efforts at the country level when they have numerous competing priorities and potentially conflicting missions?

LESSONS LEARNED FROM CSIS RESEARCH

Between 2015 and 2017, the CSIS Global Food Security Project traveled to three unique Feed the Future focus countries that represented the largest U.S. investments in their respective regions at the time: Tanzania, Bangladesh, and Guatemala. During these research trips, the CSIS team met with food and agriculture experts, donors, implementing partners, smallholder farmers, and representatives from the public and private sectors to explore the effectiveness of the Feed the Future strategy. Each country case study furnished distinct insights that CSIS translated into the *Tracking Promises* series, which includes analytical reports, short videos, private roundtables, public panel events, and congressional briefings.

In addition, the CSIS Global Food Security Project led bipartisan, bicameral congressional staff delegations to Senegal in 2016 and Ghana in 2018.[18][19] The goal was to better understand how Feed the Future principles are applied, how the initiative's programs relate to other U.S. development investments, and how partners and beneficiaries perceive the impacts of those programs.

The intention of both the CSIS *Tracking Promises* series and the congressional delegations was neither to provide a technical assessment of individual programs nor a comprehensive evaluation of Feed the Future. Still, salient trends that policymakers should know about the initiative emerged from these research efforts and can inform sustained U.S. leadership moving forward. While there were many key observations made over the course of our research, the following four are worth highlighting:

- **Development goals are futile without country commitment.** Both the 19 Feed the Future focus countries, as well as the current 12 selected last year under Feed the Future 2.0, met specific criteria considered preconditions for success by the interagency team. One of these is the political will of partnering governments to take ownership of the initiative. This critical criterion is hard to measure and certainly doesn't play out equally in all countries. For instance, Bangladesh is often hailed as a model of government leadership. Rightfully so, as it has allocated substantial resources—$5.6 billion or 64 percent of the total budget—to its country investment plan and crafted robust national policies to tackle hunger, poverty, and malnutrition.[20] The UN's Food and Agriculture Organization (FAO) found Bangladesh's strategic plans so successful that it replicated them in nearly 50 other countries. In comparison, a lack of government ownership can make it difficult for donors or implementing partners to implement new ideas or projects sustainably. In Guatemala, minimal domestic resource mobilization and an inadequate provision of agriculture, health, and nutrition services underscore the government's inability to hold up its end of the bargain.[21] Focus countries will often face capacity constraints at the national and local levels of government; however, experiences confirm that the *commitment* of government leadership to Feed the Future objectives is essential to success. Our experience raised an important question: if a focus country government fails to fulfill its responsibility in this regard, should the U.S. consider suspending or reducing its engagement in that country?
- **Strategic collaboration between U.S. agencies and initiatives matters.** Designing a whole-of-government structure to lead U.S. global food security efforts is necessary to achieve ambitious development goals and leverage the full power of the U.S. government. It makes sense and is the right thing to do. But the complexity of multiple agencies implementing a singular strategy cannot be overstated. Functional interagency coordination in Washington, D.C. does not automatically trickle down to the operational level (and vice versa). Divergent priorities or processes among agencies can be complementary at best and contradictory at worst. The presence—never mind proficiency—of the 11 U.S. agencies within target countries varies.[22] The one constant being that the U.S. Agency for International Development (USAID) is the lead agency, the dominant strategist, and the primary funder for most of the programs. Senegal is a powerful example of how to capitalize on synergies across U.S. agencies and assistance programs; infrastructure projects led by the Millennium Challenge Corporation were vital to the success of USAID's Feed the Future agricultural growth programs there.[23] Overall, Feed the Future's coordination with other U.S. government food security programs—including food aid through USAID's Food for Peace and the U.S. Department of Agriculture (USDA)'s McGovern-Dole school-feeding

program—remains weak despite improvements. The elevation of resilience as a development priority and the current reorganization of USAID has the potential to further strengthen coordination and better bridge the humanitarian and development divide.[24]

- **Nutrition interventions are not receiving the priority they deserve.** Despite the dual Feed the Future objectives of inclusive agricultural growth *and* improved nutrition, the allocation of funding to projects meant to achieve these shared goals does not often reflect equal prioritization. Compared to agricultural interventions, investments that specifically target nutrition have been meager and potentially insufficient to achieve ambitious stunting reduction targets. In Bangladesh, nutrition programming in 2016 constituted less than 20 percent of the portfolio's total investment, with most of these funds drawn from the USAID Global Health funding tranche, not Feed the Future.[25] Income growth and greater agricultural yields alone cannot combat malnutrition; indeed, economic growth does not inherently lead to improved nutrition or health outcomes. The balance of resource allocation across the Feed the Future portfolio should be realigned so that greater investments are made in robust and integrated nutrition-specific and nutrition-sensitive programming. Feed the Future strategies should consider fruits and vegetables as priority crops. Country strategies should also engage the private sector in biofortification efforts, particularly in countries where target populations derive most of their calories from staple foods that offer little nutritional value.
- **Access to finance can build resilience and change the lives of smallholders.** Smallholder farmer livelihoods are increasingly exposed to external shocks, including market volatility, climate change, and natural disasters. Building resiliency requires providing risk management tools, such as promoting off-farm livelihood diversification and strengthening national disaster preparedness and response mechanisms. Often overlooked in this equation is facilitating access to financial services. Microfinance institutions in Feed the Future target countries routinely see agriculture as risky, and fail to offer financial products suitable for low-income customers, farmers, or owners of small- and medium-sized enterprises. When services do exist, potential customers often lack access to the information they need to take advantage of them. In Ghana, only 5 percent of commercial lending goes to agriculture, and interest rates have risen as high as 42 percent in recent years.[26] Feed the Future-funded programs in Ghana are addressing this at the local level through village savings and loans associations and at the national level by working directly with financial institutions. Access to affordable financial services, paired with adequate financial education, can support productive investments, drive rural economic growth, and mitigate the risk of shocks. Plausible approaches to achieve this objective could include private- or public-sector insurance products, weather-indexed lines of credit, or producer collectivization and risk-pooling.

WHERE DO WE TURN NEXT?

There are five new "roads" that U.S. policymakers should take to maximize our investments and sustain the drive to transform global food and nutrition security:

1. **Raise the profile of global food security within U.S. diplomatic and national security strategies.** Linkages between global food security, political stability, and economic prosperity have been well established, from the urban food price riots in 2007 to the connections today between protracted conflicts and potential famines.[27] The intelligence community has recognized the threat that global food insecurity places on U.S. national security interests. U.S. military and political leaders have been vocal about the role that foreign assistance plays in the cost-effective prevention of further chaos, especially as it relates to the nexus between food insecurity and instability. Yet, food and nutrition security are far from a central pillar in U.S. national security, diplomatic, or military engagements.

   The current U.S. National Security Strategy should be lightly applauded for its emphasis on leadership in humanitarian assistance. It gives support for "food security and health programs that save lives and address the root cause of hunger and disease" but is weak in terms of its understanding and prioritization for long-term international development programs.[28] Investments in food and nutrition security protect U.S. national security and create new markets for U.S. goods in emerging economics—two core priorities of the Trump administration. Yet, the White House has failed to strengthen global food security efforts within the State Department, make significant commitments at global summits, or prioritize discussions within the National Security Council.

Hunger and malnutrition contribute to key threats such as civil unrest and violence. Global food security deserves greater prominence within foreign policy debates and demands better coordination between development, diplomacy, and defense sectors. Whole-of-government initiatives like Feed the Future have proven both the effectiveness and challenges of integrating and leveraging resources across the U.S. government—from trade policies to Peace Corps volunteers—but it is past time to elevate efforts across diplomatic and defense departments and agencies.

Global food security deserves greater prominence within foreign policy debates and demands better coordination between development, diplomacy, and defense sectors.

2. **Double down on nutrition.** We need to nourish, not just feed, a growing population. Malnutrition is a universal, costly problem. As the winners of this year's World Food Prize reminded us, every country in the world is dealing with at least one form of malnutrition. Eighty-eight percent of countries suffer from more than one form: childhood stunting, anemia, and/or overweight or obesity.[29] The burden of malnutrition robs the global economy of $3.5 trillion yearly in lost productivity and health care costs. One in three people globally is overweight or obese, and the rate is rising faster than undernutrition is decreasing.

   Nutrition interventions can be the catalyst for tackling all the UN Sustainable Development Goals, from environmental sustainability to equity and inclusion. With a $16 return on every $1 invested, nutrition has also proven to be one of the most cost-effective development interventions. Despite this high return on investment and powerful multiplier effect, nutrition investments by global donors are nothing short of abysmal at less than 1 percent. It is no wonder that the world is not on track to meet internationally agreed-upon nutrition targets.[30]

   Agricultural growth programs that focus solely on traditional staple crops, which by and large provide limited nutritional value, need to be rebalanced with investments in biofortification, horticultural productivity, and behavior change and nutrition education. There is a dramatic discrepancy between the amount of fruits and vegetables the world needs, and the amount produced.[31]

   It is not enough for agriculture and food supply chain policies to be nutrition-sensitive; they must be nutrition-*driven*.[32] Nutrition investments and indicators should continue to be woven into U.S.-funded development programming and remain a top priority within the global food and nutrition strategy. Policymakers should support and expand global efforts like the Scaling Up Nutrition Movement and Nutrition for Growth and elevate nutrition commitments through sustained diplomatic engagement at global gatherings such as the G7 and G20 meetings in 2019.

3. **Better link humanitarian responses with development strategies.** The surge in global hunger levels over the past three years has been driven by political instability in conflict-afflicted regions and compounded by the impacts of climate change. More than half of the hungriest people in the world (nearly 500 out of 820 million) live in countries marred by man-made conflict.[33] Most of the countries facing pre-famine conditions in 2018, like Yemen, South Sudan, or Somalia, don't have the economic or political stability required to meet the thoughtful criteria to become a Feed the Future target country. Linkages between political instability and food insecurity are often touted as one of the primary reasons for sustained U.S investments in agricultural development. Yet, long-term food security programming can only function in stable environments.

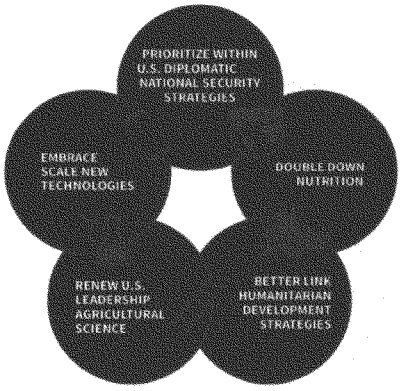
   If the United States wants to address the root causes of hunger and poverty, its strategy must include investing in and linking up its strategies on governance and peace and reconciliation, as well as recoupling humanitarian assistance with long-term agricultural and nutrition programs. USAID has robust and effective humanitarian programs, from Food for Peace to those within the office of U.S. Foreign Disaster Assistance, that targets the world's most vulnerable populations. But the nexus between emergency life-saving assistance and inclusive market growth opportunities needs to be further analyzed and better operationalized. The recent addition of Nigeria and Niger in Feed the Future's refreshed strategy presents a unique opportunity for USAID to align traditional food security programming with U.S security interests, though it is too early in the strategy implementation to assert success or failure.

The good news is that Feed the Future 2.0's new strategic objective, "strengthening the resilience of communities to shocks that can lead to famine and political unrest," not only lifts up resilience programming but also pushes for more strategic collaboration between humanitarian and development aid.[34] Furthermore, the transformation of USAID includes adding "resilience" to the name of the bureau leading the global food security strategy, and the agency has a strong center focused on resilience.

4. **Renew U.S. leadership in agricultural science.** While the U.S. government has been cutting funding for agricultural research and development (R&D) for nearly a decade, rapidly-growing economies—like China, India, and Brazil—have been doing the opposite. China ramped up spending almost eightfold between 1990 and 2013, overtaking the United States as the biggest investor in public agricultural R&D in 2008.[35]

   The dwindling U.S. commitment to agricultural science has both domestic and international consequences. The competitive agricultural productivity enjoyed by U.S. farmers is directly tied to a flood of breakthrough technologies and innovations resulting from R&D investments. Current levels of public research are needed just to sustain current productivity levels, let alone boost yields.

5 GLOBAL FOOD AND NUTRITION SECURITY RECOMMENDATIONS FOR U.S. POLICY MAKERS



Partnerships between U.S. scientists and international researchers can address pest and diseases not bound by national borders (e.g., wheat stem rust and fall armyworm), simultaneously safeguarding domestic agriculture against future threats and bolstering resilience and productivity around the world. This is especially important in today's global agricultural challenges: climate change, unfamiliar pests and diseases, and rising production costs, to name a few.

Good news is that Feed the Future Innovation Labs harness U.S. expertise by supporting collaboration between 70 top U.S. colleges and universities and focus country research institutions.[36] Investing in research partnerships like these not only advances cutting-edge technology to address some of the most pressing issues facing agriculture—like water scarcity or pest and disease control—but also builds local capacity, fosters good will, and supports the next generation of agricultural scientists and researchers in partner countries. One such example is U.S. engagement in Ghana, in which the University of Illinois is working with partners to boost consumption of soy products to improve protein uptake among consumers and the University of California, Davis is helping the University of Ghana to develop chicken breeds that are resistant to a highly infectious virus called Newcastle disease.[37]

5. **Embrace and scale new technologies.** Climate change will continue to test the capabilities of the global food system, from irregular rainfall that affects smallholder productivity (and migration movements) to warming temperatures that create the perfect breeding ground for emerging pests. Supporting researchers and entrepreneurs to advance innovative technologies that allow farmers to do more with less natural resources is a requirement to adapt to the new environmental norms.

   Scaling innovations is only possible if governments foster an enabling environment that attracts private sector investment and if smallholders are provided access to affordable and practical technologies.[38] Community-level agro-dealers need to be equipped with training and finance tools to ensure that quality agricultural products like drip irrigation kits or deep placement fertilizers get into the hands of the farmers that most need them.

   Gene-editing techniques like CRISPR, which could be used to modify staple crop plants like cassava

and sweet potato to increase resistance to common diseases, have the potential to transform agricultural production radically. With the right investors and market environment, digital technologies like the Hello Tractor app in Nigeria, which empowers farmers through mechanization, could grow exponentially. If embraced by emerging markets, innovations like cold chain storage or safe chemical sprays could revolutionize supply chains and reduce postharvest loss.

USAID administrator Mark Green's bold vision to end the need for aid begins with spurring innovation outside of the traditional development model. Creative initiatives like the USAID Grand Challenge on Powering Agriculture that supports clean energy ideas, or programs like Feed the Future Partnering for Innovation that helps businesses reach hard-to-access markets, are good models to follow. ■

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QUESTIONS AND ANSWERS

MAY 21, 2019

Senate Committee on Agriculture, Nutrition, & Forestry
Climate Change and the Agriculture Sector
May 21, 2019
Questions for the Record
Mrs. Debbie Lyons-Blythe

Chairman Pat Roberts

1) In your written testimony, you provide an excellent example of the importance of research and technology to your operation. You explain how using DNA sampling technology to select for desirable genetic traits, such as feed efficiency and growth, reduces your cattle's impact on the environment. Can you describe other technologies that have been key for your industry in improving efficiencies and thus improving environmental sustainability?

DNA sampling is just one factor in the herd management equation. While our industry continues to make significant strides in understanding cattle genetics, our knowledge is most useful when effectively implemented through artificial insemination. Artificial insemination provides me a world of freedom when it comes to breeding; I am no longer limited to passing on genes from the best bulls in my herd but can instead pass on genes from the best bulls from around the globe.

Strong genes provide a solid foundation for the nation's cattle herd, benefits that only multiply with combined with our industry's advances in cattle nutrition. Over the years, we have significantly increased our ability to efficiently raise healthy, well-finished cattle. By feeding rations specifically designed for an animal's development stage, in addition to maintaining herd health with judicious use of antibiotics when necessary, we insure that our animals grow at a healthy rate. By feeding exactly what each animal needs, we ensure that we are not spending money unnecessarily on rations that will provide little nutritional benefit.

Beyond my ranch, feedyards across the country implement manure management practices in the form of a nutrient management plan to conserve and protect water, land, and air resources. Manure management practices consist of carefully engineered infrastructure designed to store, convey, and apply animal waste in a manner that's beneficial to the environment. Livestock producers work with engineers to implement nutrient management plans. Additionally, feeders use hormones to optimize cattle performance, in turn reducing methane emissions. According to the USRSB Beef Industry Sustainability Framework, "Growth-promoting technologies such as ionophores, hormone implants, and β-adrenergic agonists can reduce GHG emissions not only through decreasing methane emissions by improving the rumen environment for digestion, but also through decreasing feed requirements and overall natural resources needed to produce a unit of beef."

According to the U.N. Food and Agriculture Organization, trends in methane emissions per unit of beef show that the U.S. beef supply chain not only produces significantly less methane than the rest of the world but also becomes increasingly more efficient with each passing decade. Enteric methane emissions from beef cattle have decreased by 34% in the U.S. over the last three decades. This is due to increasing yields that have decreased the number of beef cattle needed to produce the same amount of beef.

2) Advancements in research have allowed farmers and ranchers to better adapt and respond to environmental challenges, while at the same time providing the ability for increased yields and higher quality products. Examples like seed technology, precise fertilizer application, and innovative conservation practices benefit not only producers but also the environment and consumers. What specific **research opportunities** exist for the beef sector that would most directly impact the ability for U.S. agriculture to continue growing the food the world needs, in a way that will ensure healthy land and environment for future generations?

Research is a necessary tool for improving management practices, both on pasture and in feeding environments. As an example, on open range, land grant universities and private entities study the benefit of dung beetles in a rangeland ecosystem. Dung beetles consume cow patties before they break down naturally or wash away. Not only does this reduce methane emissions from the manure's breakdown but can eliminate nutrient runoff as well. For feeders, feed efficiency is an area in which our industry sees daily progress thanks to public and private research. The FDA is presently considering multiple feed additives that would reduce methane and ammonia emissions from cattle. These additives often provide numerous benefits: both reducing emissions and optimizing cattle growth.

Beyond research that provides tools to improve our practices, many land grant universities publish studies to show the value of grazing pasture and rangelands. Continuing this research is integral in demonstrating the importance of maintaining America's cattle herd. Additionally, as our industry strives better understand and improve our practices every day, we depend on private and public research to advance, support, and communicate the continuous improvement of our producers throughout the supply chain. The USRSB supports a number of pilot projects including assessment tools, genetics, and even a seaweed supplement with the potential to reduce emissions.

3) Your testimony provides a compelling story about the technology and voluntary conservation practices that you and farmers across the country install on your operations. Your testimony also highlights that many producers like yourself implement sustainable conservation practices on their operations – not only through government assistance, but willingly out of their own pocket. Can you expand upon the conservation work and

practices that producers, like yourself, voluntarily incorporate without compensation by the Federal government? How do these efforts generate both a return on investment and an environmental benefit?

On my ranch, we utilize no-till and low-till farming to reduce soil erosion and sediment runoff. Fields managed using no-till for multiple years generally have a higher water holding capacity. This is particularly valuable in drought-prone areas, where lack of water is a major concern tied to crop loss. No-till adoption also reduces soil erosion, increases soil biological activity and increases soil organic matter. These benefits can lead to additional economic gains over time. Likewise, cover crops provide a protective canopy for soil, rather than leaving it exposed to wind, rain, and snowmelt. Cover crops, planted between commodity crops, trap and retain vital nutrients, increasing commodity crop yield and durability over time. Additionally, cover crops can improve the ability of soils to store carbon by increasing soil aggregation. My family also employs rotational grazing to increase forage production, reduce forage waste, and extend our grazing season.

While my family originally implemented these practices through NRCS, we quickly saw their financial benefit, even without cost-share assistance. Our cover crop serves as forage for cattle while building soil health and leading to higher crop yields in later years. Increased soil health not only sequesters carbon but provides an added layer of drought protection (healthy soil holds necessary nutrients, sustaining the ranch through long periods without precipitation) and erosion protection (healthy soils hold water rather than allowing it to run off).

Senator Debbie Stabenow

1) Thanks to our researchers and land grant institutions, the U.S. has made tremendous productivity gains in animal agriculture and our cattle ranchers are producing the same amount of beef today as we did in 1970, only this time with 33% fewer animals. What will it take for the U.S. to continue to our beef production efficiency to feed almost 10 Billion people by 2050, while doing so in a sustainable manner?

While we know that feeding the world's growing population is a significant challenge, America's cattle producers are well-equipped to feed the world, and do so sustainably. The key to ensuring that we have enough food to feed 10 billion people in 2050 is to ensure that America's agriculturalists are still able to do what they love. My children are the fifth generation to manage our family ranch and must be able to pass the ranch on to the next generation if we hope to feed a growing population. My family works every day to ensure that the ranch can be passed on – we keep the soil healthy, the water clean, and the air clear. But every day, another family hangs a "for sale" sign because they simply cannot afford to

keep up with the increasing regulatory burden. These come in many forms – from environmental regulation to undue transportation limitations.

As Congress looks to how it can be an ally of farmers and ranchers, rather than an adversary, the key is focusing on voluntary practices. Farmers and ranchers strive to implement practices to maintain and improve our natural resources, but often don't know where to begin. Technical assistance, whether it be from the private sector, land grant research and extension, or NRCS is key to ensuring that producers have the tools necessary to develop specialized conservation plans. The natural resource concerns are different in Kansas than in Arizona, and different in Arizona than in Indiana. Unique natural resource concerns have unique solutions, and technical assistance is vital to ensure that agricultural producers are maximizing the practices available at their disposal.

Many cattle operations have some feeding component. Even ranches across the country are required to feed cattle in the winter when snow covers otherwise grazeable rangeland. During these seasons, it is imperative that all producers have access to sufficient feedstuffs to make it through the feeding season. Genetically modified corn and other crops makes this possible without sacrificing environmental sustainability. For example, because of technology improvements like genetically modified corn, today's American farmers are producing up to 175 bushels/acre, compared to a nationwide average of 33 bushels/acre in 1945. Without improved technology, including GMO technology, it would take nearly six times the acreage to produce the same amount of food! This means that farmers can use less land to grow significantly more food – both for animal and human consumption. The use of GMOs will be necessary as our population continues to grow, especially if we hope to maintain America's remaining forests and prairies.

2) The U.S. Roundtable for Sustainable Beef (USRSB) has been successful in engaging stakeholders across the beef supply chain. I commend the USRSB on the creation of the Framework for Sustainable Beef that identified six key areas in sustainability.

   a. Has or will the USRSB be publicly releasing any of the findings of the measurements for each step in the supply chain?

      Thank you for recognizing what USRSB is trying to accomplish and support it. USRSB does intend to benchmark against its metrics and is in the process of determining how exactly to do just that. We hope to show progress against our own metrics, which we believe will then show through as improved environmental outcomes across the whole industry in the Beef Industry Lifecycle Assessment (LCA) which is regularly updated. Previous versions of the LCA can be found at www.beefresearch.org.

b. Did the USRSB set any beef supply chain sustainability measurement goals? If so, what are they?

Our ultimate goal is espoused in our mission to advance, support and communicate continuous improvement in U.S. beef production. We also have a strategic goal of achieving uptake of the U.S. Beef Industry Sustainability Framework by having 20 percent of the beef in the U.S. produced utilizing it. The goal of the USRSB has always been to improve sustainability throughout the entire beef value chain, in a precompetitive way. In other words, through outreach and education, we can assist in improving sustainability of the entire American beef supply. As we turn the corner from Framework development to Framework implementation/uptake, our focus will be on outreach to every segment of the supply chain through education as well as through existing industry programs.

c. How many supply chain members took part in voluntarily measuring their individual impact?

Our Framework was developed by more than 250 individuals from our more than 116 members. These individuals cover every supply chain sector as well as our non-governmental organizations, allied industry companies, academic institutions, and other research institutions. We are finalizing a self-assessment tool that will allow anyone (it will be publicly available) to assessment and measure improvements of their own operation or company against the Framework criteria.

Frankly, as a member of the USRSB, Blythe Family Farms, LLC. has tried to be a representative of the American beef producer and assisted in making sure the indicators and metrics identified are appropriate and applicable on farms and ranches across the country. In addition, I want to reiterate, we are working for the good of all American farmers and ranchers. The goals and accomplishments we have attained will benefit every beef producer, whether they have been involved in the USRSB or not. For more information about the USRSB and the Framework, please look at USRSB.org and BeefSustainability.us.

Senate Committee on Agriculture, Nutrition, & Forestry
Climate Change and the Agriculture Sector
May 21, 2019
Questions for the Record
Dr. Frank Mitloehner

Chairman Pat Roberts

1) In recent years, a number of states have adopted initiatives that would limit certain animal housing systems used in animal agriculture. Industry groups have expressed concern that the elimination of these technologies will result in higher rates of animal mortality and hamper productivity. Please share your analysis of the impacts of any of these initiatives, such as California's propositions 2 and 12, and the effect those measures would have on productivity and the livestock sector's environmental footprint.

Answer: California propositions 2 and 12 were issued to change housing and husbandry of confined livestock and poultry, with the ultimate goal of improving animal welfare.

As you point out, Chairman Roberts, California is not alone; other states have adopted similar legislation, often circling around anima welfare issues. However, animal welfare is just one of several sustainability areas in agriculture, and modifications of existing livestock/poultry housing systems to improve welfare can have various intended and unintended consequences in other areas.

For example, I served as one of the principal investigators of a major hen-housing study, titled "Coalition of Sustainable Egg Supply," which was a significant effort to assess the sustainability impacts of replacing caged housing with cage-free housing systems for laying hens (a study summary can be found here: https://www.hfhl.umn.edu/sites/hfhl.umn.edu/files/assessing_effects_of_the_food_system.pdf pages 353-360).

Three hen housing types were compared in the CSES study mentioned above: 1) conventional cages, 2) enriched cages, and 3) cage free. Five sustainability areas were assessed, namely animal welfare and health; worker health and safety; food safety; environmental quality; and financial viability.
The overall principal investigator of the study, Prof. Joy Mench, summarized some of the study's main findings as follows:

> *"Each hen housing system showed inherent limitations in terms of the extent to which particular sustainability risks can be mitigated. And while developing quantitative sustainability "metrics" to rank housing systems would be useful, all attempts to do so will involve making value judgments as to which aspects of*

sustainability, both within and across the five sustainability areas, are considered more important when they are in conflict. For example, in addressing hen welfare considerations, when hen health and behavior measures are in conflict which should be weighted more heavily? When environmental impacts and animal welfare are in conflict, which should be weighted more heavily? These kinds of conflicts will ultimately be addressed by stakeholders of egg production via public policy and purchasing patterns. An important priority for the future will therefore be to gain a better understanding of the opinions of stakeholders regarding sustainability issues and how those opinions are influenced by scientific information about the sustainability of egg production." (Mench and Rodenburg, 2019.)

In summary, agricultural/food initiatives such as California Proposition 2 and 12 cannot solely be addressed or guided through science, because many aspects involve emotional value judgements. Research might accompany these initiative processes, and here it is imperative to proceed with cross disciplinary teams consisting of STEM and social scientists.

2) Although the focus of this hearing is not on particular policy proposals or solutions regarding climate change, when considering choices in the future, what guidance would you offer to ensure that U.S. farmers and ranchers remain competitive in a world market?

Answer: U.S. farmers and ranchers are among the most productive in the world, and I believe all Americans should take pride in that fact.

An often unknown key principle is that production efficiencies and environmental emission intensities are inversely related, which means that efficient animals and plants produce relatively less pollution per unit of production. Higher yields in U.S. animal agriculture have led to a situation in which we have record low livestock inventories but still meet demands. It is paramount that farmers and ranchers continue to have access to existing and future technologies that have allowed them and will continue to enable them to maintain their global leadership status.

All that being said, intensive production has unintended consequences and externalities associated with it. For example, intensive livestock and poultry facilities are designed to optimize efficiencies, which can lead to high animal density per unit of space. These high densities can affect animal health/welfare and the ability of the animals to perform natural behaviors. Additionally, high stocking densities pose challenges to manure management, potentially causing increased emissions and nuisances. Public investment is needed to allow us to optimize production while minimizing environmental pressures.

3) Advancements in research have allowed farmers and ranchers to better adapt and respond to environmental challenges, while at the same time providing the ability for increased yields and higher quality products. Examples like seed technology, precise fertilizer application, and innovative conservation practices benefit not only producers but also the environment and consumers. What specific research opportunities exist for U.S. agriculture that would most directly impact the ability to continue growing the food the world needs, in a way that will ensure healthy land and environment for future generations?

Answer: *The question above was recently posed to a National Academies of Sciences committee (http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=25059), which made the following five recommendations:*

A. ***A systems approach to understand the nature of interactions among the different elements of the food and agricultural system can be leveraged to increase overall system efficiency, resilience, and sustainability.*** *Progress is only able to occur when the scientific community begins to more methodically integrate science, technology, human behavior, economics, policy, and regulations into biophysical and empirical models. Transdisciplinary science and systems approaches should be prioritized to solve agriculture's most vexing problems, the report says. Enticing and enabling researchers from disparate disciplines to work effectively together on food and agricultural issues will require incentives in support of the collaboration.*

B. ***The development and validation of highly sensitive, field-deployable sensors and biosensors will enable rapid detection and monitoring capabilities across various food and agricultural disciplines.*** *Sensing technology has been used widely in food and agriculture to provide point measurements for a characteristic of interest, such as temperature, but the ability to continuously monitor several characteristics at once is the key to understanding both what is happening in the target system and how it is occurring. An initiative should be created to more effectively develop and employ sensing technologies across all areas of food and agriculture. For example, soil and crop sensors could provide a continuous data feed and alert a farmer when moisture content falls below a critical level to initiate site-specific irrigation to a group of plants, eliminating the need to irrigate an entire field.*

C. ***The application and integration of data sciences, software tools, and systems models will enable advanced analytics for managing the food and agricultural system.*** *The food and agricultural system collects an enormous amount of data, but has not had the right tools to use it effectively, as data generated in research laboratories and in the field have been maintained in an unconnected manner, the report says. The ability to more quickly collect, analyze, store, share, and integrate heterogeneous datasets will vastly improve understanding of the complex problems, and ultimately, lead to the widespread use of near-real-time, data-driven management approaches.*

D. ***The ability to carry out routine gene editing of agriculturally important organisms will allow for precise and rapid improvement of traits important for productivity and quality.*** *Gene editing is poised to accelerate breeding to generate traits in plants, microbes, and animals that improve efficiency, resilience, and sustainability, the report says. This capability opens the door to domesticating new crops and soil microbes, developing disease-resistant plants and livestock, controlling organisms' response to stress, and mining biodiversity for useful genes. Furthermore, crops could be effectively modified for enhanced taste and nutritional value.*

E. ***Understanding the relevance of the microbiome to agriculture and harnessing this knowledge will improve crop production, transform feed efficiency, and increase resilience to stress and disease.*** *Research on the human microbiome demonstrates the effect of resident microbes on the body's health; however, a detailed understanding of the microbiomes in agriculture is markedly more rudimentary. A transdisciplinary research effort focused on the various agriculturally relevant microbiomes and the complex interactions between them would help modify and improve numerous aspects of the food and agricultural continuum. For example, understanding the microbiome in animals could help to more precisely tailor nutrient rations and increase feed efficiency.*

4) The agriculture sector is often eager to access new technologies that could be useful in improving efficiencies, and also have the positive effect of lessening the environmental impact of the agriculture sector. However, we often hear the regulatory burden for approving such technologies is so great that U.S. agriculture stands to suffer as such approvals languish. Is this a concern you share? If so, could you describe instances where this scenario has occurred?

Answer: Societal concerns pertaining to the use of technologies in agriculture and food production seem much greater than in other sectors, such as human health. Some examples of useful agricultural technologies that are often criticized are: GMOs, glyphosate and the use of production-efficiency promotors such as rBST. Although proven safe and effective by most relevant agencies, all of the technologies mentioned above have been continuously scrutinized, and those who wish to use them face ongoing challenges in obtaining or retaining the "social license" to do so.

Technology providers in the agricultural sector are cautious about investing in R&D and inventing new products that even though effective, will likely meet massive societal resistance. For example, there are several feed additives in development that can effectively reduce enteric methane from ruminant livestock and thus, have a positive effect on greenhouse gas emissions. However, it has yet to be seen if the public will tolerate the use of methane inhibitors to be fed to cattle to achieve lower methane emissions.

5) The EAT-Lancet Commission recently released a report and campaign arguing that human diets worldwide must be drastically altered and include virtually no animal-sourced foods in order to promote planetary health. Have you reviewed the analysis presented in the EAT-Lancet report, and if so, does the data support the conclusion presented in the report?

Answer: The recent report from the EAT-Lancet Commission is a complex study with the overarching goal of changing global dietary patterns from animal- to plant-based diets. The authors claim that this dietary shift would drastically improve both human health and planet health.

The nutrition and health portion is largely based on nutritional epidemiology, a tool not suitable in proving causality to predict chronic disease. Claims that the EAT reference diet is "healthy" – and thus superior to other diets – has been met with significant opposition from the nutrition science community.

As an environmental expert, I have kept my focus on the environmental claims of the commission's report. When comparing environmental impacts across various diets, namely the business-as-usual diet versus the EAT reference, pescatarian, vegetarian and vegan diets, the EAT team showed no meaningful difference. In other words, the data provided by EAT do not show that their reference diet provides advantages in land use, water use or nutrient pollution. In fact, diets higher in plant-based ingredients were shown by EAT to have a more detrimental impact on biodiversity.

The only meaningful environmental difference across diets was in the area of greenhouse gas emissions (GHGs). Unfortunately, inconsistencies in the report regarding how GHGs were measured (i.e. Global Warming Potential, GWP100 vs 20) bring the validity of this measure into question.

After asking the authors about the lack of differences across diets, which seemed contradictory to all their major outreach on the environmental side, I was informed that the report's meat consumption limits were not set due to environmental considerations, but were solely in light of health recommendations. I was told that "...this is not the diet to reduce climate change, but the diet to reduce the risk of premature mortality due to dietary related health causes...." (Fabrice DeClerc, EAT Science Director).

In summary, the report of EAT-Lancet was a start toward defining a healthy and sustainable diet but seemingly with a strong vegetarian/vegan bias, which has led to significant opposition. In my opinion, the environmental data presented in the EAT report do not support the planetary health claims.

Senator Debbie Stabenow

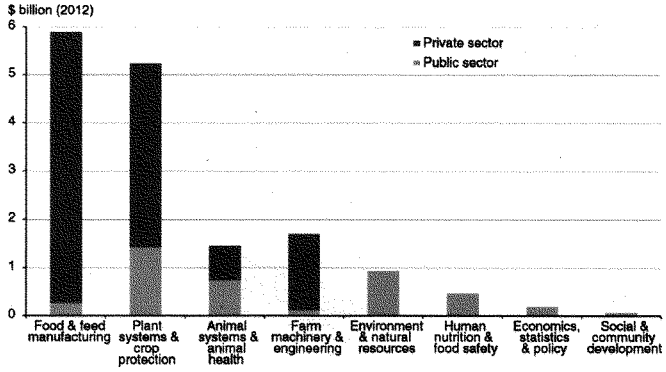
1) In Michigan, our researchers are focused on climate change solutions that will result in higher yields with less water inputs, as well as crops that are more resistant to stresses including drought, high temperature, flooding, disease, weeds and insect pests. MSU's Plant Resilience Institute is leading national efforts to enhance plant resilience to environmental challenges including extremes in weather and climate change, providing foundational and translational plant research aimed at increasing the productivity and quality of food and energy crops. **Dr. Mitloehner, you know firsthand the role research and extension plays in helping producers adapt to climate change, while also helping them implement practices that can sequester carbon and cut down on harmful emissions.**

    a. **Do you have any suggestions for how we can improve or strengthen the role research and extension plays in addressing climate concerns?**

    Answer: Agricultural research provides a strong societal rate of return to the public. Each $1 spent on agricultural research gives $10 back to the economy. Cooperative extension is critical to extending our knowledge to the farmers and ranchers who need it. In addition, it allows us to learn directly from the stakeholders about their challenges and pressing needs. An estimated 7.3 percent of the annual agricultural productivity growth from 1949 to 2002 was due to extension activities aimed at enhancing on-farm production efficiency.

    For a pressing challenge like climate change that sits squarely in the public domain, public investment in research and extension on this topic area are of paramount importance. Private funding of research has filled some of the gap in recent declines in public funding for agricultural research; however, private funding tends to focus on marketable outcomes. Climate change is a cross-cutting issue, requiring both mitigation research and adaptability/resiliency research that will largely need to be addressed via public funding.

Composition of public and private food and agricultural R&D by subsector in 2014



Note: Data are adjusted for inflation and expressed in 2012 dollars.
Source: USDA, Economic Research Service using data from USDA, National Institute of Food and Agriculture (NIFA), Research, Education, and Economics Information System; and Fuglie (2016).

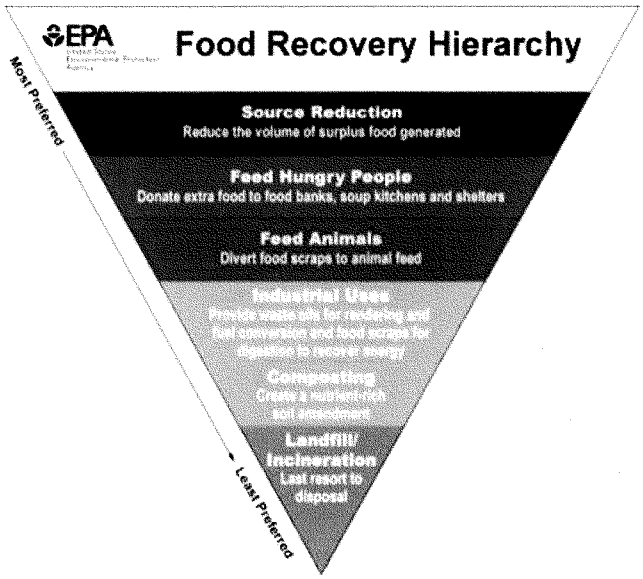
b. How can we improve collaboration and share best practices about climate change across the land grant and cooperative extension system?

Answer: See answer 1a.

2) In your testimony you mentioned that forty percent of food purchased in the U.S. is wasted and is a major contributor to agriculture's carbon foot print.

a. Can you describe some actions that can be taken at the federal level to reduce food waste?

Answer: It should be noted realistically that food waste cannot – nor should it be – reduced to zero. A food supply that provides abundance and affordable food to the public will generate waste. However, we can strive to reduce waste and divert waste from landfills to higher-value uses, such as feeding hungry people, using food waste as animal feed or generating bioenergy. These strategies are outlined in the Food Recovery Hierarchy:



In October 2018, the USDA, FDA and EPA signed a joint agreement to address food waste and losses.

b. How can industry, farmers, and the public sector work together to reduce food waste?

Answer: There are unique opportunities to "close the loop" with food waste by using wasted food as a livestock feed source, a feedstock for anaerobic digesters that co-digest food waste and animal manure to produce biogas and fertilizer, and/or composting food waste for use as a soil amendment in crop production.

c. What kind of public research is needed to address food waste issues?

Answer: Public research is needed to help identify strategies to "close the loop" in feasible ways. Food waste recovery systems have multiple steps from food service or food retailer establishment to the recovery phase. Research of the kind required will need to be cross disciplines.

Senate Committee on Agriculture, Nutrition, & Forestry
Climate Change and the Agriculture Sector
May 21, 2019
Questions for the Record
Mr. Matthew Rezac

Chairman Pat Roberts

1) Advancements in research have allowed farmers and ranchers to better adapt and respond to environmental challenges, while at the same time providing the ability for increased yields and higher quality products. Examples like seed technology, precise fertilizer application, and innovative conservation practices benefit not only producers but also the environment and consumers. What specific research opportunities exist for the soybean industry that would most directly impact the ability for U.S. agriculture to continue growing the food the world needs, in a way that will ensure healthy land and environment for future generations?

   Any research that focuses on the economic opportunities for producers is key. Research that continues to advance increased yields, whether through new biotech traits or advances in seed technology, is important because it increases the efficiency and potential profitability of farmers. At the same time, precision conservation tools (such as the Truterra Insights Engine from Land O'Lakes SUSTAIN, which I mentioned in my testimony to the Committee, hold tremendous promise to help farmers target their in-field conservation efforts, helping them focus both on safeguarding the environment and optimizing their business. Advances that have both an economic benefit to the farmer and an environmental one will have more uptake by farmers because farmers are always seeking the latest tools that could help them be both more efficient and more profitable.

2) How has biotechnology enabled you to address environmental sustainability issues on your operation

   As I noted in my testimony, technology and innovation is key to not only environmental sustainability but also for economic opportunity. For me, adoption of all kinds of technology has been critical for the environmental and economic health of my farm. Most farmers have fully adopted biotechnology, and of course those biotech traits have resulted in higher yields which means more food can be grown on the same number of acres, making us more efficient. In addition, we are able to optimize our use of fertilizers and pesticides because of biotech seeds, which again in turn provides environmental and economic benefits.

3) In your testimony, you discuss the importance of precision agriculture and how this kind of technology allows you to control and limit input waste. What types of precision agriculture do you use for application of crop protection tools? Recently, there has been significant

attention on certain chemistries and pending litigation from environmental non-governmental organizations threatening continued use of certain types of crop protection tools. How would the potential loss of crop protection tools impact your farm's productivity and your business's bottom line?

One of the most frustrating false narratives is that farmers are wasteful with crop protection tools and inputs. In this farm economy, we can't afford to be inefficient and be wasteful. While farmers are always adapting, taking away crop protection tools would be devastating to farmers in this tenuous time.

4) Across the country, farmers and ranchers continue to share with me the concern of regulatory burdens impacting their farming operations. During these tough economic times, certainty is in the mind of all producers especially with the thought of unforeseen regulatory costs. What Federal regulatory challenges from agencies like U.S. Environmental Protection Agency (EPA) or the U.S. Fish and Wildlife Service do you think are looming that might impact your farm's profitability or long term viability?

Fortunately, my operation has not been faced with huge regulatory burdens but I understand that is a concern in heavily regulated areas like the Chesapeake Bay. Our policymakers in Washington need to understand how close we are farming on the economic edge in today's economy. As I mentioned in my testimony, we are not farming to rake in profits – we're farming to lose as little as possible and we're focusing every day on making sure our farm remains strong into future years. Every new regulation and requirement has a potential impact on our bottom line, but producers can also do their part by proactively adopting conservation practices and technology to be as efficient and sustainable as possible.

Senator Debbie Stabenow

1) In your testimony, you emphasized the importance of Public-Private Partnerships. The 2018 Farm Bill increased the mandatory investment in the Regional Conservation Partnership Program (RCPP). How can increased coordination between the public and private sector, particularly in the case of RCPP, lead to increased adoption of sustainable agriculture practices?

As I noted in my testimony, not one farmer, industry or sector has all the answers to the sustainability question. My stewardship journey has been one of relationships and collaboration and that is what RCPP does best, bringing a diverse coalition together to solve natural resource concerns. One of the best opportunities for RCPP is to bring to the table farmers who might not be the early adopters. The outreach from trusted sources such as an ag retailer would be invaluable to increased adoption.

2) As you mentioned at the end of the hearing, you see a lot of potential to increase farmers' revenue through carbon markets. What potential barriers to entry or other pitfalls might prevent you or other producers from participating in a carbon market in the future?

For a carbon market to work, the economic incentive must be there to incentivize producers to join. For a lot of farmers in these tough economic times, any revenue stream would be an added bonus, but the market must not be too onerous or time consuming for a producer to participate. As I said in my testimony, farmers are often stubborn and have a mindset of "that's how we've always done it," so you can't expect a farmer to make massive shifts in production practices to participate. So in conclusion, the market must provide enough incentive to participate, it can't expect massive shifts in production practices and it must be easy to understand.

Senate Committee on Agriculture, Nutrition, & Forestry
Climate Change and the Agriculture Sector
May 21, 2019
Questions for the Record
The Honorable Thomas J. Vilsack

Chairman Pat Roberts

1) Advancements in research have allowed farmers and ranchers to better adapt and respond to environmental challenges, while at the same time providing the ability for increased yields and higher quality products. Examples like seed technology, precise fertilizer application, and innovative conservation practices benefit not only producers but also the environment and consumers. What specific research opportunities exist for the dairy industry that would most directly impact the ability for U.S. agriculture to continue growing the food the world needs, in a way that will ensure healthy land and environment for future generations?

   Mr. Chairman- the research needs are many and varied. I might say at the outset that investment in agriculture and food research ought to be significantly increased as a matter of economic, environmental and national security. Public investment in agricultural and food research has not kept pace with research investments in other important societal areas. As for specifics I offer the following which is not intended to be an inclusive list:

   1. Seed technology - work at the Salt Institute on crops that could sequester more carbon at their roots should be accelerated.

   2. Measurements - work needs to be increased in the area of measuring the effectiveness of land conservation and soil health activities in order to better facilitate the development of efficient eco-system markets and services.

   3. Feed Additives - continued research should help to identify ways in which feed could reduce the production of methane in livestock without harming the efficiency of the feed in building protein.

   4. Manure Conversion - there is a real need to fully understand the chemical and material components of manure and how they might be separated without great expense to produce marketable chemicals, materials, fibers, fuels and energy feedstocks.

   5. Equipment - in all of the above opportunity exists to produce new equipment to more efficiently and less expensively produce the items suggested listed in 1-4 above.

I would strongly suggest to the Chairman and Ranking Member they place a call to key land grant universities to determine the current inventory of research underway now and where holes may exist in key areas.

Senator Debbie Stabenow

1) Your testimony talked about the USDA Building Blocks for Climate Smart Agriculture and Forestry. Can you describe what types of coordination was required during your tenure at USDA to ensure that the Department was using all of the available authorities to pursue climate smart ag and forestry practices? During the exercise of writing the Building Blocks reports, did you find that there were any programs that, with modest changes from Congress, could deliver markedly greater climate benefits? If so, which programs and what were the changes needed?

   Senator Stabenow - a key to coordination is a clear signal from the President and the Secretary of Agriculture that Climate Smart Agriculture practices are an administration priority and coordination within the department and within sister agencies and departments is expected. In the Obama- Biden Administration officials within the department had that clear signal. A key to any existing program or future programs is for Congress to set a clear result expected from the effort while providing the flexibility within the program to enable the department's experts to determine what steps will best accomplish the required results. This is especially true in the Conservation Innovation Program which ought to be geared towards the innovations best supporting Climate Smart Agriculture practices. It is equally true in the structuring of the REAP, EQIP, CSP, and RCCP programs. Congress creates programs without clearly laying out what specific result should be achieved by the investment. This gives each administration the chance to set its own priorities that may or may not advance Climate Smart Agriculture practices.

U.S. DAIRY SUSTAINABILITY COMMITMENT | INNOVATION CENTER FOR U.S. DAIRY

About This Report

The *2018 U.S. Dairy Sustainability Report* is the seventh progress report published by the Innovation Center for U.S. Dairy® (Innovation Center). The reporting period covers calendar years 2017 and 2018, except where clearly noted. The principles in the GRI Sustainability Reporting Standards informed report development. Future reporting is expected to occur biennially. This report and past ones are available at **USDairy.com/Report**. We welcome your feedback on this report and the U.S. dairy industry's sustainability efforts. Please contact us at InnovationCenter@USDairy.com.

Welcome

2018 saw the launch of the U.S. Dairy Stewardship Commitment, a fitting milestone for the first decade of the Innovation Center for U.S. Dairy and a clear signal of dairy's ongoing shared progress.

We are conducting business in unprecedented times. The pace and scale of change and the interconnected economic, political, societal and technological forces at play are impacting the everyday practices of our farmers and manufacturers, like all others. Amid these dynamics, conversations and expectations about food choices continue to evolve and deepen as people try to understand what is good for them and good for the planet.

The U.S. dairy community is committed to providing the world with responsibly produced, nutritious dairy foods that nourish people, strengthen communities and foster a sustainable future. This deep-rooted dedication led to the creation of the Innovation Center and the inaugural U.S. Dairy Sustainability Summit in 2008.

To a passerby, the gathering might have looked like any other conference, with people at round tables and flip charts and markers at the ready. **Leaders from across the dairy community met to create a new way of working together pre-competitively to advance dairy's sustainability.** They charted a bold path forward.

For an industry as large and diverse as ours, that was no small undertaking. However, dairy farmers and companies recognized that certain areas are better addressed through cooperation and collaboration – priorities like food safety, animal care and environmental stewardship that the dairy community, our customers and consumers all care about. Only together can we meet the challenge of nourishing a growing population within a resource-constrained world in need of strong climate action.

Ten years in, we've elevated our ability to act as a unified industry. For example, 98% of U.S. milk production comes from dairy farms participating in the National Dairy Farmers Assuring Responsible Management™ (FARM) Animal Care Program, demonstrating to customers and consumers that the dairy community holds itself to the highest standards. Over the years, the National Dairy FARM Program, administered by the National Milk Producers Federation (NMPF), has added program areas for Environmental Stewardship, Antibiotic Stewardship and, most recently, Workforce Development.

Through the Innovation Center, we have built an exceptional food safety program in which top dairy plant professionals train their peers to ensure the safety of all dairy products. Processors representing more than 80% of U.S. milk production have voluntarily implemented best practices outlined in the U.S. Dairy Traceability Guidelines.

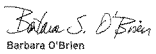
Industry-wide, stakeholder-informed initiatives like these fueled the development of the U.S. Dairy Stewardship Commitment, dairy's social responsibility pledge to consumers, customers and other stakeholders. **The Stewardship Commitment is the platform from which we will demonstrate our collective progress over the next decade.** Within the short period from the launch in November 2018 to the end of the year, dairy cooperatives and companies representing approximately 60% of U.S. milk production formally signed on. This inspires confidence in our joint efforts and in the strides we will take to accelerate and increase adoption and positive impact.

People are more interested than ever to learn about where their food comes from and to get to know the farmers and producers who supply the food they eat. **Dairy farmers and companies are bringing U.S. dairy's story to life**, engaging with consumers in a proud, unified voice to communicate authentically and transparently about who we are, what we stand for and how we work.

Given the challenges the world faces and growing global competition, the pressure to act has never been stronger. But neither has our commitment to positive impact been so united, that is – along with the dairy community's spirit and grit – will make all the difference.

We will continue on this path together, providing the nutrient-rich, responsibly produced dairy foods people love and strengthening trust that we are caring for the land, our animals and communities.

Thank you for your interest in this report; we welcome your feedback.



Barbara O'Brien
President, Innovation Center for U.S. Dairy, and Dairy Management Inc.

Mike Haddad
Chair, Innovation Center for U.S. Dairy Board of Directors, and President/CEO, Schreiber Foods

About the Innovation Center for U.S. Dairy

VISION | People trust dairy as essential to their lives.

As a leadership organization that leverages the collective strengths of the dairy community, the Innovation Center for U.S. Dairy is focused on ensuring an economically viable and socially responsible U.S. dairy community.

Initiated in 2008 by America's dairy farmers through the dairy checkoff, the Innovation Center brings together dairy farmers, companies and organizations as well as other key stakeholders to work pre-competitively on important efforts.

Through the Innovation Center, the dairy community initiates and supports programs and best-in-class practices from farm to table that build trust and promote the current and future health and well-being of consumers, communities, our cows, employees, businesses and the planet.

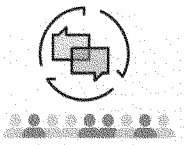
Dairy-Led Governance Bodies: Board of Directors and Committees

CEOs and chairs of leading dairy cooperatives, farmer organizations, processors and retailers serve on the Innovation Center's Board of Directors. The board sets priorities and serves as the organization's highest governing body. The Executive Operating Committee, a subgroup of the board, oversees the efforts of seven operating committees that correspond to the core areas of focus for the Innovation Center: Food Safety, Environmental Stewardship, Animal Care, Sustainable Nutrition, People & Community, Global Insights & Innovation, and Communications.

Committee members concentrate on priority topics within their areas of focus (pg. 7) and align efforts on best and next practices to promote industry-wide improvement. The work of the first five operating committees is covered in the Progress on Our Priorities section starting on pg. 8. The Global Insights & Innovation Committee and the Communications Committee (pg. 19) play integrative roles to inform and support efforts in each area. The Global Insights & Innovation Committee provides insights and early indicators that help the U.S. dairy community address emerging issues and opportunities.

WORKING TOGETHER: GOVERNANCE AND COLLABORATION

Operating Committees
Food Safety | Environmental Stewardship | Animal Care
Sustainable Nutrition | People & Community
Global Insights & Innovation | Communications



The **Dairy Sustainability Alliance®** brings together **370+ professionals from 100+ member organizations** from the dairy community and beyond to share knowledge, provide input and stimulate action.

Multi-Stakeholder Involvement: Dairy Sustainability Alliance®

The Dairy Sustainability Alliance® (Sustainability Alliance) is a collaborative forum that leverages diverse experience and perspectives along the dairy value chain and beyond. Members include 40 dairy farmer representatives from across the country, along with industry suppliers, cooperatives, processors, brands and retailers, and representatives from the dairy checkoff program, academia, government and advocacy groups – each with a stake in advancing dairy sustainability.

The Sustainability Alliance provides a pre-competitive environment in which members can share knowledge and collaborate on issues affecting the industry at large. Through involvement in the Sustainability Alliance, the dairy community gains regular and ongoing opportunities to engage with customers, nonprofits and other key stakeholders to advance shared social responsibility priorities, including the U.S. Dairy Stewardship Commitment (pg. 5). All efforts and outcomes of the Innovation Center and the Dairy Sustainability Alliance's work are voluntary, technology-neutral and made available to the entire industry.

LEARN MORE at USDairy.com.

A Decade of Progress

For 10 years, the Innovation Center for U.S. Dairy has been harnessing the power of many to advance mutual priorities. This timeline highlights some of the collaborative and pre-competitive initiatives across and within the Innovation Center's areas of focus that have advanced U.S. dairy's journey of progress.

America's dairy farmers and leading dairy companies form the INNOVATION CENTER FOR U.S. DAIRY. HEALTHY PEOPLE • HEALTHY PRODUCTS • HEALTHY PLANET

Setting the vision: **U.S. Dairy Sustainability Summit** 250 participants

Undeniably Dairy Campaign 300 organizations involved between 2017 and 2018

Innovation Center becomes U.S. Aggregating Member for the global **Dairy Sustainability Framework**

Sustainability Measurement and Reporting Framework is developed and evolves into the **U.S. Dairy Stewardship Commitment** | From the launch in Nov. 2018 to year-end, adoption by 60% of U.S. milk production

U.S. Dairy Sustainability Awards program launches | 54 award winners from 2011 to 2018

The Sustainability Council (initially named the Carbon Council) forms and evolves into the **Dairy Sustainability Alliance®** in 2015 | ~100 organizations and 370+ professionals

Impact of Globalization on U.S. Dairy report published | U.S. dairy advances strategies to help U.S. dairy become a consistent supplier in the global market

Life cycle assessment research studies conducted 2008 to 2011, with publication of results beginning in 2010

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019

National Dairy Council® (NDC) continues to fund research on dairy's role in **health, nutrition and sustainable food systems**

Industry-wide voluntary **greenhouse gas (GHG) reduction goal** is set, followed by the launch of GHG reduction projects | 650+ stakeholders involved

Fuel Up to Play 60 endorsed as an industry-wide youth initiative | Nearly 73,000 schools involved

FARM Animal Care training program in 2011, with updated versions in 2014 and 2017 | Enrolled farms represent 95% of milk supply by 2020

FARM Antibiotic Stewardship evolves from the annual publication of the Milk and Dairy Beef Residue Avoidance manual started around 1990

Innovation Center-led **food safety training** begins | 3,500+ training participants from 2011 to 2018

U.S. Dairy Traceability Guidelines | Voluntary adoption grows from 25% of milk production at 2013 launch to more than 80%

First-of-its-kind ***Listeria* Control Guide** for U.S. dairy published

Newtrient LLC forms to create environmental and economic value through manure management technologies

Dairy Nourishes America | From 2016 to 2018, close to 750 million pounds of dairy distributed in the Feeding America network

FARM Environmental Stewardship | Participants from launch to 2018 represent ~60% of the U.S. milk supply

FARM Workforce Development launches

Leveraging the Power of Partnerships

Collaboration is a foundational element of the Innovation Center's work. Partnerships with organizations within and outside the dairy community accelerate the discovery, development and adoption of shared solutions that deliver environmental, social and economic benefits. The following list highlights partnerships with which the Innovation Center has formal agreements and those that contributed to efforts mentioned in this report:

Environmental Defense Fund, Feeding America, Field to Market: The Alliance for Sustainable Agriculture, GENYOUth Foundation, U.S. Department of Agriculture (USDA) and USDA's Agricultural Research Service and Natural Resources Conservation Service, World Wildlife Fund, and numerous academic institutions and scientific organizations.

Areas of Focus

- Food Safety
- Environmental Stewardship
- Animal Care
- Sustainable Nutrition
- People & Community


DAIRY'S SOCIAL RESPONSIBILITY:
OUR PLEDGE AND PRIORITIES
U.S. dairy's social responsibility vision to consumers, customers and other stakeholders, is embodied in the U.S. Dairy Stewardship Commitment. It affirms and demonstrates U.S. dairy's long-standing values of responsible production, nourishing communities and progress across a range of shared environmental, social and economic priorities.

U.S. Dairy Stewardship Commitment

The U.S. Dairy Stewardship Commitment unites the U.S. dairy industry and demonstrates its positive impact from farm to table.

The Innovation Center for U.S. Dairy developed the Stewardship Commitment as a voluntary, stakeholder-informed platform to bring together the dairy industry and to support dairy farmers, cooperatives and processors who voluntarily choose to participate in industry initiatives and report progress.

The Stewardship Commitment aligns and quantifies industry action on important areas like the environment and animal care to affirm and illustrate U.S. dairy's long-standing values of responsible production and nourishing communities. It defines indicators (what is measured) and metrics (how they are measured) that enable the dairy community to set baselines, document progress and demonstrate impact (see Priority Summary table at far right).

Dairy Cooperative and Processor Adoption

Adoption of the Stewardship Commitment, which occurs at the dairy cooperative and processor levels, helps earn the trust of dairy's stakeholders. Adopting companies agree to the specific terms of adoption and to work collaboratively with diverse stakeholders through the Dairy Sustainability Alliance to demonstrate positive impact. Retailers, food service and other dairy customers can use the Stewardship Commitment to demonstrate their suppliers' sustainability efforts and to share dairy's story with consumers.

On a broader scale, companies that adopt the Stewardship Commitment contribute to U.S. dairy's ability to track, aggregate and report on national progress. This collective reporting builds credibility and support in the global marketplace, adding value to the entire U.S. dairy industry. It also provides a baseline for setting meaningful shared goals.

The Stewardship Commitment is an ongoing pledge to:

WORK COLLECTIVELY
- Pre-competitive collaboration across the U.S. dairy industry
- Customer and third-party engagement and support
- Partnerships with peer initiatives and key thought leaders

CONTINUOUSLY IMPROVE
- Measurement through trusted tools and resources
- Incorporation of latest science and insights
- Reflection of dairy's long-standing values

TRANSPARENTLY REPORT PROGRESS
- Credible and consistent metrics
- Company and national reporting
- Demonstrated impact

LEARN MORE at commitment.usdairy.com

From the November 2018 launch to year-end, 15 dairy cooperatives and companies, representing 80% of U.S. milk production, adopted the Stewardship Commitment.

Involvement and Governance

The strength of the Stewardship Commitment depends on the active participation of dairy farmers, cooperatives and processors, along with key stakeholders within and beyond the dairy value chain, such as industry suppliers, dairy brands, food service, retailers, nonprofits and scientific experts.

Through an open and transparent process, the Innovation Center's operating committees (pg. 2) guide the ongoing development of the Stewardship Commitment and its priorities and metrics. The Dairy Sustainability Alliance participates in the overall process, with members providing feedback to ensure credible, meaningful metrics.

The Executive Operating Committee of the Innovation Center Board of Directors provides oversight and final approval on metrics and decides which are mandatory for adoption. It also oversees a Stewardship Commitment Task Force of 16 cross-sector leaders – including three CEOs on the Innovation Center Board – charged with advancing the adoption, reporting and credibility of the Stewardship Commitment.

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

The Progress on Our Priorities section starting on pg. 8 features a summary table for each priority and its components within the Stewardship Commitment.

Priority Summary

INDICATORS AND METRICS (LEVEL)

The heading indicates the level at which the indicator applies (Field, Dairy Farm and/or Processor).

Indicator: Each priority has one or more indicators.
- Metric: Each indicator has one or more associated metrics.

TERMS OF ADOPTION

When applicable, terms of adoption related to the priority or its associated metric(s) are described.

Assessing Dairy's Social Responsibility Priorities

For the past decade, the Innovation Center has led efforts to help the dairy community understand its most significant social, environmental and economic impacts. In 2018, the Innovation Center conducted a materiality assessment to confirm and prioritize the sustainability areas where the U.S. dairy industry should focus its efforts and resources. The results show where the dairy community has the greatest potential to amplify positive impacts and demonstrate improvements over time.

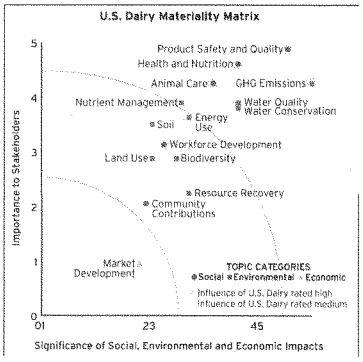
The scope of the materiality assessment was limited to dairy production and processing within the United States. The process was informed by the Global Reporting Initiative's GRI Sustainability Reporting Standards, the most widely used framework for sustainability reporting worldwide. The Stewardship Commitment priorities were mapped to the 11 Global Criteria of the Dairy Sustainability Framework (DSF) with health and nutrition, energy use and land use also included as relevant topics for U.S. dairy.

The Innovation Center defines materiality according to two dimensions: (1) significance of social, environmental and economic impacts and (2) importance to stakeholders. Each topic was reviewed and rated along these two aspects, with the resulting coordinates plotted on a materiality matrix, as shown. A third dimension, influence of U.S. dairy, was also included.

The assessment's iterative development and vetting process considered a range of input and involved internal and external stakeholders. A targeted, third-party review of a draft version included representatives from Environmental Defense Fund, GRI Global Sustainability Standards Board, The Nature Conservancy, SAI Platform and World Wildlife Fund. Subsequent internal reviews validated the updated matrix before final review and approval by the Executive Operating Committee and Board of Directors.

U.S. Dairy 2018 Materiality Matrix

The materiality matrix presents relevant topics based on significance of economic, environmental and social impact and importance to stakeholders. While the main objective of the materiality assessment was to prioritize topics for strategic purposes, the results also guide the content in this report.



THRESHOLDS FOR MATERIALITY

The Innovation Center set two thresholds for materiality (the curves on the matrix):

- The first is at 2.5; topics beyond this curve are material for reporting.
- Topics beyond the upper threshold, which is set at 4.5, represent the highest-rated priorities: Product Safety and Quality, Health and Nutrition, GHG Emissions, Animal Care, Water Quality, Water Conservation and Nutrient Management.

INFLUENCE OF U.S. DAIRY

This additional dimension highlights topics for which the operational control or influence that dairy farmers, cooperatives and processors have was rated medium or high.

The assessment reinforced the work that the Innovation Center has been doing over the years, including the priorities within the Stewardship Commitment (discussed next), and will inform future strategic planning. The Innovation Center plans to reassess materiality every three years or as needed to consider changes relevant to the industry, marketplace and/or consumer, to respond to shifts in stakeholder interests, and to maintain alignment with the latest available science, standards and expert opinions.

LEARN MORE in the *U.S. Dairy Stewardship Commitment Materiality Assessment and Progress* report available at USDairy.com.

Shared Priorities for Collective Action

The U.S. Dairy Stewardship Commitment aligns and quantifies industry action and shared progress on key priorities. The materiality assessment (pg. 6) prioritized the Dairy Sustainability Framework Global Criteria along with health and nutrition, energy use and land use as additional relevant topics for U.S. dairy. Of those, all but market development were deemed material for reporting and represent the current priorities within the Stewardship Commitment. Each priority falls within one of the Innovation Center areas of focus, as shown in the table below.

Innovation Center Areas of Focus	Dairy Sustainability Framework Criteria	Topics in the Materiality Assessment	Priorities in the U.S. Dairy Stewardship Commitment
FOOD SAFETY	Product Safety and Quality	Product Safety and Quality	Product Safety and Quality Ensuring the safety, quality and traceability of dairy products from grass to glass
ENVIRONMENTAL STEWARDSHIP	Greenhouse Gas Emissions	GHG Emissions	**GHG Emissions** Reducing dairy's footprint to mitigate climate change
	–	Energy Use	**Energy Use** Conserving energy and lowering production costs
	Water	Water Conservation	**Water Conservation** Optimizing water use
		Water Quality	**Water Quality** Protecting water quality
	Soil Nutrients	Nutrient Management	**Nutrient Management** Managing nutrients to maximize growth and safeguard ecosystems
	Waste	Resource Recovery	**Resource Recovery** Maximizing benefits from products and minimizing waste
	Soil	Soil	**Feed Impact** Minimizing crop production impacts on water, soil, biodiversity, land use, GHG emissions and energy
	Biodiversity	Biodiversity	
	Land Use	Land Use	
ANIMAL CARE	Animal Care	Animal Care	Animal Care Ensuring the well-being of the animals in our care
SUSTAINABLE NUTRITION	–	Health and Nutrition	**Health and Nutrition** Promoting dairy's contribution to health and nutrition within sustainable food systems
PEOPLE & COMMUNITY	Rural Economies	Workforce Development	**Workforce Development** Creating positive and safe work environments
	Working Conditions	Community Contributions	**Community Contributions** Supporting healthy, vibrant communities
	Market Development	Market Development	*Relevant topic below threshold for reporting (pg. 6)*

Alignment with Leading Standards

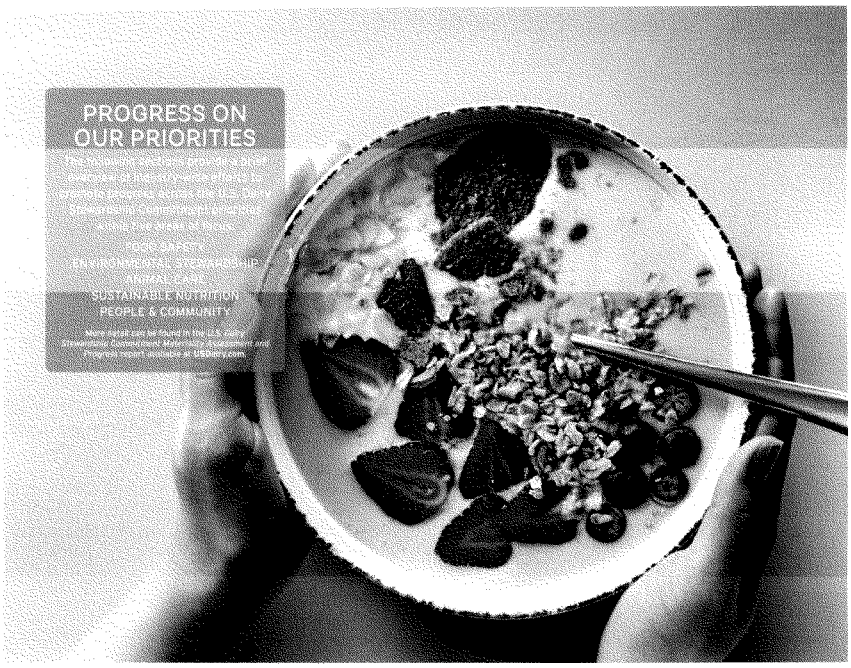
The Stewardship Commitment draws upon globally recognized best practices and guidance in sustainability standards and report development, including those issued by the **Global Reporting Initiative (GRI)**, the **Greenhouse Gas Protocol**, CDP and ISO (**International Organization for Standardization**).

On behalf of the U.S. market, the Innovation Center is an Aggregating Member of the Dairy Sustainability Framework, a widely adopted global platform for sustainable dairy.

Contributions to the UN SDGs

The United Nations (UN) Sustainable Development Goals (SDGs) are a powerful call to action to all actors in society to achieve a more just, peaceful, prosperous and sustainable future. While the dairy community directly or indirectly connects to all 17 goals, the U.S. dairy community is uniquely qualified to contribute to the achievement of the following SDGs:

2. Zero Hunger
3. Good Health and Well-Being
6. Clean Water and Sanitation
8. Decent Work and Economic Growth
12. Responsible Consumption and Production
13. Climate Action
17. Partnerships for Goals


PROGRESS ON
OUR PRIORITIES
SUSTAINABLE NUTRITION
PEOPLE & COMMUNITY

FOOD SAFETY

PRODUCT SAFETY AND QUALITY

Ensuring the quality and safety of dairy products from grass to glass is an unwavering priority for the entire dairy community.

Milk and other dairy foods, which are highly regulated at the state and federal levels, have been a safe, healthy and important part of the American diet for generations. Through the Innovation Center's Food Safety Committee, the dairy community promotes research, develops science-based food safety tools, designs and coordinates food safety training, and develops guidance, assessment materials and metrics for dairy processors. Efforts across all aspects of milk production and processing aim to diminish food safety risks and help ensure that dairy products are safe.

80 active volunteers from over 30 dairy cooperatives and companies contribute to Innovation Center-led food safety efforts.

More than 80% of U.S. milk production is covered by the U.S. Dairy Traceability Guidelines.
Traceability is the ability to track a product through all stages of production, processing and distribution.

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Priority Summary: Product Safety and Quality

INDICATORS AND METRICS (PROCESSOR)

Food safety
- Do you have validated, verifiable food safety programs and management systems in place?
- Do you frequently reassess your food safety programs to ensure efficacy and to reflect new food safety tools/practices and ensure continuous improvement?

Traceability
- Commitment to voluntary U.S. Dairy Traceability Guidelines

TERMS OF ADOPTION

Dairy cooperatives and processors adopt and apply the U.S. Dairy Traceability Guidelines.

2017-2018 Progress

Education: The Innovation Center helps strengthen manufacturing practices in dairy processing facilities – from large processors to small farmstead and artisan cheese facilities.

- More than 3,500 dairy industry employees have completed Innovation Center-led food safety training from 2011 to 2018.
- In 2017 and 2018, 857 individuals participated in in-person and online courses, including Dairy Plant Food Safety and Supplier Food Safety Management workshops and a new online Food Safety Basics for Artisan Cheesemakers.
- In 2017, the National Institute of Food and Agriculture (NIFA) awarded the Innovation Center and its university partners a three-year, $400,000 grant to help artisan and farmstead cheesemakers write their own food safety plans.

Resources: The committee shares guidance and best practices through food safety materials.

- Launched in 2017 by the American Cheese Society, the Safe Cheesemaking Hub provides a searchable collection of food safety materials in English and Spanish, co-developed with the Innovation Center.
- A Spanish version of the 2015 publication Control of *Listeria monocytogenes*: Guidance for the U.S. Dairy Industry was published in 2017.
- Development of a broader pathogen control guidance document began in 2018.

Research: A priority for food safety research is the control of *Listeria monocytogenes*. In 2015, the Innovation Center initiated an industry-funded Listeria Research Consortium to advance scientific knowledge and support the development of new tools for use in dairy plants.

- At the end of 2018, 10 consortium-funded research projects were underway.

Antibiotic Stewardship: The dairy community is committed to the prudent and responsible use of antibiotics in dairy animals. Each year, the U.S. dairy community conducts nearly 4 million tests on all milk that enters dairy plants to ensure that antibiotics are kept out of the nation's milk supply. FARM Antibiotic Stewardship, a program area within the National Dairy Farmers Assuring Responsible Management (FARM) Program, provides ongoing education on the responsible use of antibiotics to keep cows healthy and our milk supply safe. FARM's Milk and Dairy Beef Drug Residue Prevention Reference Manual, published annually for the past 30 years, is the primary educational tool for dairy farms throughout the country.

- Since 1995, there has been a 90% decrease in bulk milk tanker antibiotic residues, with the lowest ever incidence in 2018: 99.99% of the nearly 3.6 million bulk milk tankers tested free of antibiotics.[1]
- In 2017, no antibiotic residues were found in more than 33,511 random samples of post-pasteurized fluid milk and milk products tested before leaving the processing plant, as has been the case since 2011. In 2018, 4 positive samples were identified in a total of 32,847 samples.[2] Dairy's goal is zero incidence, and the dairy community continually works to strengthen the system to reach and maintain this goal.
- Any milk that tests positive for antibiotic residues is destroyed and cannot be sold for human consumption.

ENVIRONMENTAL STEWARDSHIP

OUR PRIORITIES TO PROTECT THE PLANET

The dairy community is committed to preserving natural resources and reducing the environmental footprint of dairy products.

Dairy farmers and companies rely on science, innovation and efficiency to help nourish the world's growing global population while protecting the environment. Environmental stewardship encompasses a wide range of topics, from the soil that grows crops for animal feed to greenhouse gas (GHG) emissions and resource recovery.

Overview

The life cycle assessment (LCA) research for milk and cheese conducted in 2008-2011 for the U.S. dairy industry was unprecedented in size and scope, and the peer-review process ensured credible results to establish baselines and identify areas for improvement across the dairy value chain. While the dairy community supports advances from grass to glass, the Stewardship Commitment concentrates on topics at the field, dairy farm and processor levels. The following table highlights where impacts associated with each priority occur (○) and where metrics are also currently in place (●).

Priorities	Farm	Processor
Feed Impact	○	
GHG Emissions	●	●
Energy Use	●	●
Water Conservation	●	●
Water Quality	○	●
Nutrient Management	●	
Resource Recovery	○	●

KEY:
○ Impacts occur at this step of the value chain.
● Impacts occur and metrics are in place.

2017-2018 Progress

Industry-wide efforts coordinated through the Innovation Center and its Environmental Stewardship Committee follow a deliberate, inclusive approach: start with scientific research to measure and understand a topic, then engage a broad group of stakeholders to develop guidance, resources, metrics and tools to improve performance and increase business value.

The launch of FARM Environmental Stewardship (FARM ES) in 2017 exemplifies this approach. Administered and managed by the National Milk Producers Federation (NMPF) under the National Dairy Farmers Assuring Responsible Management (FARM) Program, FARM ES provides dairy producers, cooperatives and companies with a streamlined, single source for voluntary assessment and reporting of GHG emissions and energy use on dairy farms.

Researchers regularly review the model that powers FARM ES to ensure that it remains robust and relevant. Updates in 2018 incorporated the latest available crop production data and manure management technologies.

- 20 cooperatives and processors, representing approximately 60% of the U.S. milk supply, are participating in FARM ES.
- From the 2017 launch through 2018, more than 750 FARM ES evaluations were conducted by participating organizations.

FEED IMPACT

Dairy's environmental stewardship begins in the fields that grow feed crops.

The Feed Impact priority covers multiple topics: water, soil, land use, biodiversity, and energy and GHG emissions intensity.

On average, 35% of feed is produced by U.S. dairy farmers. The remaining 65% is sourced from feed suppliers.[3]

2017-2018 Progress

Field to Market

To help understand and promote reductions in the field-level environmental impact of feed production, the Innovation Center works in partnership with Field to Market: The Alliance for Sustainable Agriculture. Field to Market is a diverse collaboration working to advance the sustainability of U.S. commodity crop production.

The Innovation Center participates in all of Field to Market's standing committees and provided financial support to enable the addition of two key dairy feed crops into version 3.0 of the Fieldprint® Platform, which launched in 2018. Field to Market's assessment framework empowers brands, retailers, suppliers and farmers to measure the environmental impacts of commodity crop production and identify opportunities for improvement. The updates for corn silage and alfalfa will provide more relevant metrics for farmers and cooperatives to track sustainable production of these crops.

LEARN MORE at fieldtomarket.org.

GREENHOUSE GAS EMISSIONS

Reducing GHG emissions to mitigate climate change is a global priority.

The agricultural sector can play an important role in mitigating GHG emissions. In 2009, the U.S. dairy industry set a voluntary goal to reduce GHG emissions for fluid milk by 25% by 2020 from a 2007-2008 baseline. Since then, the dairy community has been tracking progress using an intensity metric calculated as GHG emissions per unit of production.

2017-2018 Progress

U.S. dairy's collective efforts focus on enhancing resources to help individual dairy companies measure, report and improve their GHG emissions performance.

- The GHG Protocol Corporate Accounting and Reporting Standard is the most widely accepted and adopted GHG standard in the world. Comprehensive guidance to prepare a GHG Protocol-aligned inventory and quantify emissions was completed in 2018 for FARM ES and the *Dairy Processor Handbook*.
- NMPF and the Innovation Center are collaborating with EDF Climate Corps, (Environmental Defense Fund's fellowship program), to ensure that FARM ES and accompanying resources align with CDP (formerly Carbon Disclosure Project) Scope 3 reporting to credibly track progress toward science-based targets and other GHG reduction goals.

In 2018, researchers began to assess progress toward achieving the industry's 2020 GHG emissions reduction goal. This process has entailed independent, expert, third-party review of both the underlying LCA model and the analysis of progress. A status report is expected to be released in 2019.

North America has the lowest dairy-related GHG emissions intensity globally.[3]

U.S. GHG Emissions Intensity for Fluid Milk
17.6 lbs. of carbon dioxide equivalents (CO_2e) **per gallon of milk consumed.[4]**

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Priority Summary: GHG Emissions

INDICATOR AND METRICS (DAIRY FARM AND PROCESSOR)

GHG intensity
- DAIRY FARM: Total GHG emissions (lb. CO_2e)/lb. of milk (fat and protein corrected milk [FPCM])
- PROCESSOR: Total GHG emissions (lb. CO_2e, Scope 1 and 2)/lb. of production output

TERMS OF ADOPTION

Dairy cooperatives use or plan to use the FARM ES Sampling Protocol to enroll farms in FARM ES to measure the on-farm GHG metric (or they enroll 100% of farms).

Processors use the GHG Protocol for reporting.

Priority Summary: Energy Use

INDICATOR AND METRICS (DAIRY FARM AND PROCESSOR)

Energy intensity
- DAIRY FARM: Total energy use (converted to million British thermal units (MMBTU)/lb. of milk (FPCM)
- PROCESSOR: Total energy use (converted to MMBTU)/lb. of production output

TERMS OF ADOPTION

Dairy cooperatives use or plan to use the FARM ES Sampling Protocol to enroll farms in FARM ES to measure the on-farm energy metric (or they enroll 100% of farms).

Processors report using methodologies outlined in the *Dairy Processor Handbook*.

~2% of the total U.S. GHG emissions is attributed to the U.S. dairy industry.[5]

36% of U.S. dairy's total GHG emissions **is from energy use across the dairy value chain - from feed production to the end consumer.[6]**

ENERGY USE

Opportunities to reduce energy use, associated emissions and costs occur at every step from farm to fridge.

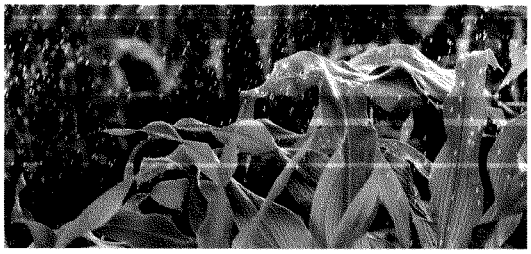
Energy efficiency and conservation often serve as entry points to other sustainable practices and can provide an immediate cost benefit to quantify return on investments.

2017-2018 Progress

- The 2017 launch of FARM ES (pg. 10) supports dairy producers, cooperatives and companies with on-farm energy use reporting and reduction efforts.
- The National Dairy FARM Program worked with World Wildlife Fund to assemble an independent technical review panel of academics, farmers, NGOs and industry specialists to create and review the *Environmental Stewardship Continuous Improvement Reference Manual*. This guide provides a comprehensive suite of on-farm management practices, including energy efficiency strategies, to reduce a farm's environmental footprint and improve its profitability.

WATER CONSERVATION AND QUALITY

Conserving water and ensuring water quality form the basis of the dairy community's water stewardship commitment.



Water is a finite resource that is under increasing pressure from human activities and is directly linked to local, regional and national sustainability concerns. It is also a local issue with varying considerations based on regional water supply and watershed characteristics.

While management approaches are tailored to individual operations and locations throughout the U.S., practices such as water reuse and recycling are common on dairy farms and in processing plants.

On dairy farms, nutrient management, including manure management, contributes to water quality. Dairy plants concentrate on ensuring the quality of water discharged for beneficial reuse.

2017-2018 Progress

- In 2018, the Innovation Center Environmental Stewardship Committee formed a Water Task Force to examine water use and water quality on the dairy farm more closely. It also collaborates with Newtrient, LLC (pg. 13) and NMPF to address on-farm practices related to water quality.
- The partnership with Field to Market (pg. 10) supports efforts related to on-field water use for growing feed, which accounts for 93.5% of dairy's water use.[7]

Dairy-related water use represents 5.1% of total U.S. water withdrawal.[6]

93.5% of dairy's water use is for crop irrigation for dairy feed.[7]

Most dairy farmers recycle water an average of 3 to 5 times.

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Priority Summary: Water Conservation

INDICATORS AND METRICS (DAIRY FARM AND PROCESSOR)

Water use
- FIELD: Reporting through Field to Market
- DAIRY FARM: Gallons of water consumed (for lactating cows)/lb. of milk (FPCM)
- PROCESSOR: Percentage of total water withdrawn and consumed by source

Water efficiency
- PROCESSOR: Gallons of water consumed/lb. of production output

Water recycling and reuse
- PROCESSOR: Percentage and total volume of water (gal.) that is recycled and reused

Priority Summary: Water Quality

INDICATOR AND METRICS (PROCESSOR)

Water discharge and quality
- DAIRY FARM: Refer to the metric for Nutrient Management on pg. 13.
- PROCESSOR: Do you have a policy, program or monitoring system that ensures routine compliance with industrial or storm water permit parameters?

NUTRIENT MANAGEMENT

The efficient use of the proper nutrients helps maximize crop growth, while safeguarding ecosystems.

The nutrients in fertilizer, manure and compost are used to enrich the soil and increase crop productivity. Responsible approaches to nutrient management contribute to efforts to ensure water quality.

The Innovation Center supports advances in nutrient management and encourages the use of a nutrient management plan, which helps guide management decisions to ensure nutrients are applied in an efficient and environmentally sound manner.

2017-2018 Progress

- In 2018, the Stewardship Commitment's nutrient management plan metric was strengthened to specify documentation, implementation and maintenance. This metric will be added to FARM ES in 2019.
- Newtrient, a company founded in 2015 by 14 companies representing nearly 20,000 dairy farmers, focuses on discovering innovative, economically viable ways to reduce dairy's environmental footprint. Through Dairy Management Inc.™, the Innovation Center is a Newtrient board member. The Newtrient Technology Catalog, released in 2017, provides a comprehensive review of manure management and resource recovery technologies.

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Priority Summary: Nutrient Management

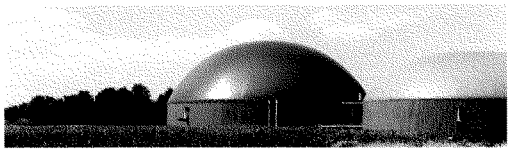
INDICATOR AND METRIC (DAIRY FARM)

Nutrient management plan

- Do you implement and maintain a written nutrient management plan?

RESOURCE RECOVERY

The dairy community recognizes the need to do more with less and minimize waste.



The aim of resource recovery is to extract the maximum practical benefits from products, delay the consumption of virgin natural resources and generate the least amount of waste. Food waste, in particular, is of interest to the food and agriculture sectors.

Efforts aim to strengthen dairy processors' resource recovery practices through research, guidance materials and investments in food waste reduction initiatives. The Stewardship Commitment merges the Waste Management and Food Recovery Hierarchies from the U.S. Environmental Protection Agency (EPA) to provide the basis for the resource recovery metrics.

2017-2018 Progress

In 2017, the Further with Food website launched as part of a broad public-private partnership to find solutions to food loss and waste. This online hub provides comprehensive content on food loss and waste in the U.S. and highlights ways to help achieve the national goal to cut food waste in half by 2030.

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Priority Summary: Resource Recovery

INDICATORS AND METRICS (PROCESSOR)

Waste diversion

- Percentage by weight (lbs.) of total waste stream diverted from landfill or incineration without recapturing energy

Throughput efficiency

- Total waste stream/lb. of production output

Water recycling and reuse

- Percentage and total volume of water (gal.) that is recycled and reused

Resource utilization

- Food donated or repurposed as animal feed and non-food recycled or composted (lbs.)/total waste stream (lbs.)
- Food repurposed for industrial uses or compost and non-food repurposed for energy recovery (lbs.)/total waste stream (lbs.)
- Waste sent to landfill or incineration without recapturing energy (lbs.)/total waste stream (lbs.)

TERMS OF ADOPTION

Processors use the EPA hierarchies as the basis for resource recovery and waste reduction reporting.

ANIMAL CARE

U.S. dairy farmers are committed to ensuring the well-being of the animals in their care by meeting the highest standards

Responsible animal care is not only an ethical obligation, it is essential for a productive herd and critical to a farm's profitability and success. In consultation with veterinarians and recognized experts, the U.S. dairy industry developed a leading animal care program to establish guidelines and standards for cow care and create a culture of continuous improvement. This unified approach helps strengthen evidence-based practices on all dairy farms and helps build public confidence.

2017-2018 Progress

To demonstrate its commitment to animal care, the dairy community has worked with stakeholders since 2009 to develop and evolve FARM Animal Care, a program area within the National Dairy Farmers Assuring Responsible Management (FARM) Program. Administered by National Milk Producers Federation (NMPF), FARM Animal Care promotes responsible operating procedures and practices and encourages continuous improvement to assure the public that dairy farmers raise and care for their animals in a humane and ethical manner.

On-farm evaluations and third-party verification of the program help the FARM Program's integrity. At its core, the program relies on scientific evidence and findings to develop standards. The program's standards are then reviewed and updated every three years with significant stakeholder involvement.

- In 2018, FARM Animal Care became the first livestock animal care program in the world to comply with ISO (International Organization for Standardization) requirements and guidance, providing assurance that U.S. dairy foods come from animals treated under internationally recognized standards.
- Over 450 trained and certified second-party evaluators have conducted more than 50,000 on-farm evaluations since the program's inception.

Read the 2018 National Dairy FARM Program Year in Review for more program highlights.

LEARN MORE at nationaldairyfarm.com.

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Animal care
- Do you participate in the FARM Animal Care program?

Dairy cooperatives participate in FARM Animal Care. Dairy processors source 100% of purchased milk from FARM-enrolled farms.

SUSTAINABLE NUTRITION

HEALTH AND NUTRITION

The dairy community is committed to helping ensure dairy foods contribute to health and sustainable food systems.

Dairy's role as a nutritious source of enjoyable, affordable, accessible food is foundational to dairy's contribution to health and sustainable food systems. Through National Dairy Council (NDC) and the Innovation Center's Sustainable Nutrition Committee, the dairy community's health and sustainable nutrition initiatives combine research, education, guidance and outreach to raise awareness about how responsibly produced dairy foods contribute to nutrition and health.

Dairy foods, like milk, cheese and yogurt, provide nutrients important to good health – including calcium, phosphorus, vitamin B12 and high-quality proteins.[10]

Within the context of healthy eating patterns, dairy foods are associated with reduced risk of cardiovascular disease, type 2 diabetes and high blood pressure among adults.[11] Dairy foods are also linked to bone health, especially in children and adolescents.[12]

Sustainable Nutrition

Sustainable nutrition considers dairy's nutrition and health contributions within the context of its interconnected environmental, social and economic dimensions. It is the ongoing, science-based pursuit of solutions that provide affordable, accessible, nutrient-rich foods that can nourish the world's growing global population, while also protecting environmental resources.

The Dairy Community's Contributions to Sustainable Nutrition, published in 2018 by NDC and the Innovation Center, provides an overview of the global context and the U.S. dairy community's role and vision for sustainable nutrition.

2017-2018 Progress

Research: NDC's research program includes nutrition, product and environmental research. Specific to nutrition research, registered dietitians, academics, scientists and other key stakeholders are exploring dairy's contribution to public health and consumer-focused benefits. Primary areas of interest are inflammation/cardiovascular disease, type 2 diabetes, milk fat, childhood nutrition, protein and gut health.

A number of farmer-funded NDC studies published in 2017 and 2018 highlight the role of milk and dairy foods in child and adult nutrition and health:

- Three studies continue to show the essentiality of milk and dairy foods for young children. Dairy is the top source of calcium, vitamin D and potassium, three of the four nutrients of public health concern for children, as identified by the *2015-2020 Dietary Guidelines for Americans*.[13]
- More closely following the Healthy U.S.-Style or Healthy Mediterranean-Style eating patterns, which both include low-fat and fat-free dairy, was projected to save over $15 billion in healthcare costs.[14]
- An NDC-funded clinical study showed eating low-fat yogurt (1.5 servings per day) reduced chronic inflammation and improved gut integrity in healthy women, regardless of weight.[15]

Education and Outreach: NDC engages national partners and key health and wellness professionals – physicians, dietitians, fitness and culinary experts, school nutrition specialists, and food security professionals – to communicate dairy science, promote dairy's Stewardship Commitment and build trust in dairy's contribution to health and sustainable food systems. NDC offers a variety of sustainable nutrition educational resources, including presentations, webinars, blogs, infographics and handouts.

Nourishing Communities: The Sustainable Nutrition Committee and the People & Community Committee collaborate with the broader dairy community and local organizations to facilitate partnerships and initiatives aimed at alleviating hunger and increasing access to nutrient-rich milk and dairy foods. See the following section for more information.

LEARN MORE at nationaldairycouncil.org.

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Priority: Summary: Health and Nutrition

The development of indicators and metrics for this priority is underway.

PEOPLE & COMMUNITY

COMMUNITY CONTRIBUTIONS

U.S. dairy's direct economic impact is paired with a deep dedication to supporting healthy, vibrant communities.

The U.S. dairy industry's overall economic impact is valued at $628 billion, which represents more than 3% of U.S. GDP.[14]

In the U.S., the dairy industry directly employs nearly 1 million people and indirectly supports almost 3 million additional jobs.[15]

The U.S. dairy community has a significant impact on thousands of communities and millions of people across the country.

To strengthen dairy's positive impact on communities, the Innovation Center brings the broader dairy community together with local organizations to facilitate partnerships and programs that address hunger and increase access to nutrient-rich milk and dairy foods (see sidebar).

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

Priority Summary: Community Contributions

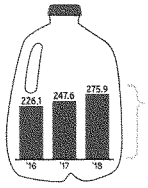
INDICATORS AND METRICS (PROCESSOR)
Community volunteering • Volunteer activities performed by employees
Monetary and product donations • Monetary and product donation activities
Educational opportunities • Describe community educational events per year and the total number of participants
TERMS OF ADOPTION
Dairy cooperatives and processors communicate community contributions using at least one of the metrics.

2017-2018 Progress

The Innovation Center and NDC strive to feed hungry people by increasing the availability of nutritious dairy foods, such as milk, cheese and yogurt, in the Feeding America network of food banks.

In partnership with Feeding America, the Dairy Nourishes America (DNA) initiative increases the distribution of milk and dairy to the 41 million clients of 200 food banks in over 60,000 agencies. In the period from 2016 to 2018, nearly 750 million pounds of dairy were distributed in the Feeding America network.

MILLION POUNDS OF DAIRY DISTRIBUTED IN THE FEEDING AMERICA NETWORK (2016-2018)



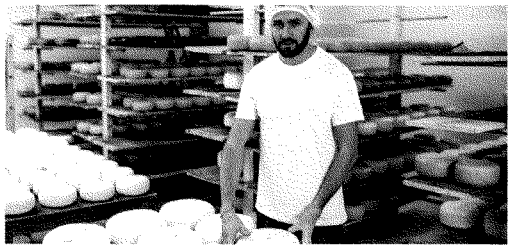
From 2016 to 2018, pounds of dairy **increased nearly 22%.**

The 2018 value translates into **686 million servings** of nutritious milk, cheese and yogurt, which are highly desired by food banks and the people they serve.

PEOPLE & COMMUNITY

WORKFORCE DEVELOPMENT

The U.S. dairy community is committed to creating positive and safe work environments.



Hiring and retaining quality employees and ensuring their safety and well-being are essential to the success of the dairy community. Employment conditions and safety are highly regulated at the state and federal levels. The dairy industry concentrates on efforts that provide guidance materials to help farmers, cooperatives and processors understand their compliance requirements as well as go above and beyond for their employees.

2017 EMPLOYMENT AND WAGES[18]

MILK PRODUCTION
106,500 **jobs with** $3.7 billion **in wages.**

DAIRY PRODUCT MANUFACTURING
144,779 **jobs with** $8.4 billion **in wages.**

DEMONSTRATING OUR STEWARDSHIP COMMITMENT

While the Workforce Development topic applies all across the dairy value chain, the current version of the Stewardship Commitment has metrics in place at the processor level.

Priority Summary: Workforce Development

INDICATORS AND METRICS (PROCESSOR)

Human resources
- Total number of jobs supplied (includes full- and part-time employees and consultants)
- Indirect and non-monetary benefits available to employees
- Total number employed during the past year and percentage of employees who have been employed for 5, 10 and 20 years

Worker safety
- Number of opportunities for workers to participate in, and percentage of employees who participated in developing, implementing and managing health and safety initiatives; also, the levels in the corporation at which these programs operate
- Days of restricted work activity or job transfer (DART) rate

2017-2018 Progress

In 2018, the National Milk Producers Federation (NMPF) launched FARM Workforce Development, the fourth program area within the National Dairy FARM Program, to provide dairies across the country with guidance and best management practices around human resources (hiring, training and supervising workers) and worker health and safety. FARM Workforce Development supports safe, exceptional work environments.

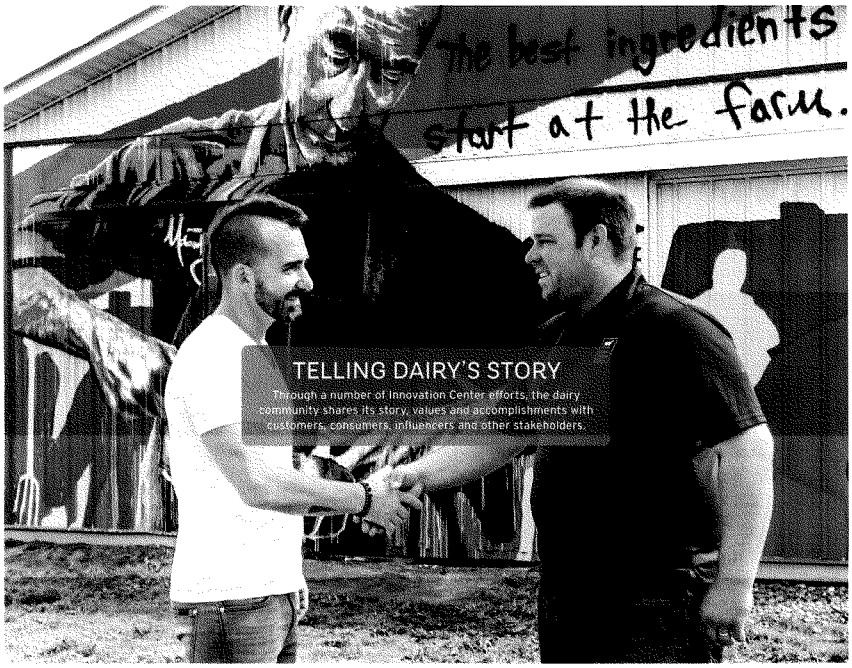
A Workforce Development Task Force made up of cross-sector representatives provides overall strategic guidance and input on developing program resources. The suite of educational materials and tools includes federal and state legal fact sheets and reference manuals on human resources and safety management. The resources are designed to help dairy farm owners and managers increase worker engagement and safety, reduce employee turnover, and manage safety risks.

Recognizing Exemplary Safety Performance

The International Dairy Foods Association (IDFA) Dairy Industry Safety Recognition Awards and Achievement Certificates program highlights outstanding worker safety records of U.S. dairy companies in both processing facilities and trucking operations.

The program presented awards and achievement certificates for exemplary safety records to 80 dairy processing facilities and trucking operations in 2017 and 50 in 2018.

For a full list of recipients, visit idfa.org.


the best ingredients
start at the farm.
TELLING DAIRY'S STORY
Through a number of Innovation Center efforts, the dairy community shares its story, values and accomplishments with customers, consumers, influencers and other stakeholders.

Undeniably Dairy

National campaign builds a bold platform for the entire dairy community to engage with consumers.

As an increasingly urban population becomes further removed from the farm, people want to know more about where their food comes from and the people and practices behind the foods they love. That's dairy's call to action: to authentically and transparently let consumers know who the dairy community is, what it stands for and how it operates.

In 2017, the Innovation Center launched Undeniably Dairy, a national, multiyear campaign to grow trust and relevance in dairy and provide a platform through which the whole dairy community can engage and speak with one voice. The Undeniably Dairy campaign brings U.S. dairy's story to life, engaging consumers to showcase the nutrient-rich profile of their favorite dairy foods, along with a farm-to-table look at the commitments U.S. dairy has to responsible production and positive local community impact.

2017-2018 Progress

The campaign started strong with a wide range of engaging content, partnerships and experiences, which rallied the entire dairy community around culturally relevant moments at times when consumers are open to hearing about dairy. Below are key highlights:

300+ dairy community partners
engaged with the Undeniably Dairy platform.

Content and Partnerships

- **Videos on Food Network** invited viewers onto a dairy farm to hear directly from farmers about where their food comes from and the commitments farmers have to responsible production.
- Stories of Dairy Devotion articles and podcasts highlight people throughout the dairy community who are devoted to bringing delicious dairy products to consumers' tables in the best possible way. Featured devotees include food scientists, cheesemakers, chefs and restaurateur, and dairy farmers from across the country.

More than 40% of people
are more likely to trust the dairy industry after listening to sponsored podcasts. Campaign video content has earned 76 million views.

Direct Experiences

- Hundreds of on-farm events and farm-to-table dinners brought together consumers, health and wellness experts, and others.
- To celebrate National Farmers Day and connect people to where their food comes from, **21 dairy farmers from across the U.S. took to the streets at two food festivals in New York City in October 2018.** Over the course of two days, they reminded thousands of consumers about the joy of dairy, shared their stories of devotion and answered people's questions over grilled cheese and chocolate milk samples.

Passed out a grilled cheese sandwich and chocolate milk sample every three seconds.

- **Discovery Education partnership** introduces fifth- to eighth-grade classes to modern farming and innovations that are helping to care for cows and communities through virtual field trips, a 360-degree video experience and educator guides.

In 2017 and 2018, nearly 200 million students reached.

Undeniably Dairy helps remind consumers of all the good that is dairy, from the farm to the table, through four key pillars:

NUTRIENT RICH: Fresh, real foods are easy to find - right down the dairy aisle.

RESPONSIBLY PRODUCED: Innovation and technology have dramatically transformed our lives for the better, helping the dairy community deliver exceptional animal care, sustainable nutrition and a better, fresher product.

LOCALLY DRIVEN: There are dairy farms in all 50 states, and dairy farmers and the people who make dairy foods and beverages are telling their stories to those who have questions. Dairy farmers, companies and brands have come together to bring these narratives to life, reaching interested people where they are by using influencers and media they deem credible and relevant.

REAL ENJOYMENT: Dairy is the milk in your morning cereal and the cheese on your pizza. It's part of all the things people love to eat and is present at some of the most special moments in life.

U.S. Dairy Sustainability Awards

The U.S. Dairy Sustainability Awards program recognizes excellence in sustainability across the dairy value chain.

2017 AWARD WINNERS pictured (from left): Louie Kazemier of Rickreall Dairy, Ken Nobis of Michigan Milk Producers Association, Dick Edwards of Oakland View Farms, Tim Rosen of Mishore Riverkeeper Conservancy, Anne Link of SwissLane Farms, Robert Hagevoort of U. S. Dairy Education & Training Consortium, Mark Keller of Kellercrest Registered Holsteins, Inc., Lucas Fuess of Glanbia Nutritionals, Lee Kinnard of Kinnard Farms, Matt Nuckols (emcee) of Eastview Farm, Inc., and Barbara O'Brien of the Innovation Center for U.S. Dairy. Not pictured: Mercer Vu Farms.

2018 AWARD WINNERS pictured (from left): Austin Allred of Royal Dairy, Sarah Beaubien of Tillamook County Creamery Association, Brent Reinford of Reinford Farms, Ted Sniegocki and Bob Jablin of Magic Dirt, Mike and Tate McMahon of F-Z Acres, and Evie Zwack and Erin Sharp of The Kroger Co.

Through 2018, 54 honorees have been recognized **for their achievements in sustainable dairy.**

The dairy farms, companies and partnerships honored each year have demonstrated innovative and replicable dairy practices that benefit the environment, their businesses and the communities in which they work and live. An independent panel of judges evaluates nominations based on measurable results and the potential for other dairy farms and businesses to adopt the approaches. From 2011 to 2018, more than 50 dairy farms and companies were selected from hundreds of nominations across the country. Their stories have been featured in video, social media, print and in-person communications.

LEARN MORE about the awards program and past winners at USDairy.com/Awards.

APPRECIATION FOR OUR GENEROUS SPONSORS IN 2017-2018

Each year, program sponsors help make it possible for the Innovation Center to continue recognizing those who go above and beyond to improve their communities, the environment and their bottom line.

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Acknowledgments

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Report Feedback

We welcome your feedback on this report and U.S. dairy's sustainability efforts. Please contact us at InnovationCenter@USDairy.com.

Download the report at **USDairy.com/Report**.


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