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FARM BILL 2023: RESEARCH PROGRAMS

HEARING

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COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY

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C O N T E N T S

Tuesday, December 6, 2022

FARM BILL 2023: RESEARCH PROGRAMS

Tuesday, December 6, 2022

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

The Committee met, pursuant to notice, at 10 a.m., in room 328A, Russell Senate Office Building, Hon. Debbie Stabenow, Chairwoman of the Committee, presiding.

Present: Senators Stabenow, Brown, Bennet, Smith, Booker, Luján, Boozman, Hoeven, Ernst, Hyde-Smith, Marshall, Tuberville, Grassley, Thune, Fischer, and Braun.

STATEMENT OF HON. DEBBIE STABENOW, U.S. SENATOR FROM THE STATE OF MICHIGAN, CHAIRWOMAN, U.S. COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY

Chairwoman STABENOW. Well, good morning. I call this hearing to order. I want to welcome Under Secretary Jacobs-Young and our panel of expert witnesses. Wonderful to see you again and have you in front of us.

I appreciate you all being here today as we review the U.S. Department of Agriculture's research, extension, and related programs ahead of the 2023 Farm Bill. Before the Thanksgiving holiday, Ranking Member Boozman and I held the first in a series of hearings here in D.C. focused on our shared goal: passing another bipartisan farm bill. With respect to the Research title, I look forward to working with Senator Booker and Senator Braun, who are the Chair and Ranking Member of the Subcommittee, and with every member of this Committee.

On our agenda today is a topic of great importance—agriculture research, extension, and education. We cannot have a thriving economy if we do not make things and grow things, and agriculture research helps us do exactly that. Just last month, the United Nations estimated that the world population surpassed eight billion people. That is eight billion people who need access to safe, nutritious, and affordable food. Innovation through agriculture research is central to global food security. Thanks to the progress achieved through research, we can boost the profitability and resiliency of our farms while adapting to and mitigating the climate crisis. It is our incredible extension and education systems that deliver valuable research findings into the hands of farmers, as well as consumers, and communities.

Through the support of this Committee, USDA's research agencies are advancing cutting-edge science and rigorous economic analysis on behalf of our farmers and ranchers. In the 2018 Farm Bill,

members of this Committee secured much-needed investments in USDA's agricultural research programs. That includes $185 million for the Foundation for Food and Agriculture Research, which leverages public investments with private funds to address real-world issues facing our farmers and ranchers. We secured investments for our organic farmers, as well as reauthorized the Specialty Crop Research Initiative, benefiting Michigan's many cherry, blueberry, and asparagus growers, as well as, of course, others across the country. For the first time, we authorized the Urban, Indoor, and Emerging Agriculture Initiative.

The 2018 Farm Bill also benefited our land-grant universities, like my alma mater, Michigan State University, and the University of Arkansas. Land-grant universities are vital partners in conducting agriculture research, delivering cooperative extension, and training the next generation of leaders in the food and agriculture sector. Investments in research and extension are absolutely essential. Demand for these Farm Bill programs continues to outpace the available resources, and yet, in recent years, funding for public agriculture research here in the U.S. has declined, which is concerning.

Meanwhile, China has quintupled its investment in public agriculture research since 2000, and now invests twice as much as the U.S. does. As our farmers work to tackle the climate crisis, navigate constantly changing markets, and feed a growing global population, investments in agriculture research and trustworthy economic data will only become more important. I look forward to hearing testimony from Under Secretary Jacobs-Young and our panel of stakeholders.

Let me now turn to my friend and our Ranking Member, Senator Boozman.

STATEMENT OF HON. JOHN BOOZMAN, U.S. SENATOR FROM THE STATE OF ARKANSAS

Senator BOOZMAN. Thank you, Madam Chair. I would like to also thank our witnesses for taking the time to join us today. Whether you are visiting us from the farm, from campus, or from the Whitten Building, you provide an important perspective on how the farm bill enhances agricultural research, and for that, we are very grateful.

As Senator Stabenow just said, last month, the world population reached eight billion people, and according to most projections, we will add our next billion people in less than 15 years. Our growing population will need access to affordable and high-quality grains, oils, and proteins, and the American farmer is well positioned to meet this demand due to our continued investments in our academic institutions and agricultural research.

As we begin drafting the new farm bill, our priorities must take into consideration what is happening on the international stage. The world has been teetering on the brink of a massive food crisis for some time now. The Russian conflict in Ukraine, two grain exporting countries whose products feed some of the most vulnerable people in the world, has added fuel to that fire. The misguided government policies by some global leaders are only making matters worse.

What happened in Sri Lanka is a perfect example. Sri Lanka was self-sufficient for most dietary staples, until its leadership instituted a ban on synthetic fertilizer and mandated an organics-only approach. A third of Sri Lanka's farmable land went fallow, food prices soared, and a man-made hunger crisis was created as a result.

While Sri Lanka's plight was largely brought about by its own leadership's shortsighted decisions, it is important that we learn the right lessons from that catastrophe. This is what makes the research title of the farm bill so very, very important.

Innovation is the answer to the challenge of feeding our growing population, as well as giving our farmers and ranchers the ability to help meet the needs of an ever-changing global dynamic.

According to USDA's Economic Research Service, U.S. farmers produce three times as much agricultural output today as they did in 1950, while total inputs have remained virtually unchanged. It is our job to continue these advancements by providing the American agricultural research enterprise with the resources and infrastructure that they need to do it.

The farm bill is the most important and consistent opportunity to invest in agricultural research and extension. From programs that build capacity at our Nation's land-grant institutions to world renowned competitive grant programs such as the Agriculture and Food Research Initiative, this important title of the farm bill provides a broad array of authority and investment in agricultural research.

Congress first recognized the need for agricultural research in 1862 and 1890, with the passage of the First and Second Morrill Act. At the time, a novel concept to further agricultural research, extension and education. In fact, each of our witnesses today, as well as both myself and the Chairwoman, are products of distinguished land-grant institutions.

The success of the land-grant system is a major priority. In my view, this Federal, State and local partnership is the most capable vehicle to conduct and deliver research outcomes to farmers, ranchers, and consumers. The value of the land-grant system cannot be overstated, and I look forward to working together to strengthen this system in the next farm bill.

Additionally, it is my goal to deliver a farm bill that provides focus and clarity to USDA's research enterprise. American agriculture is best served when we target our efforts and have focused, well-funded, and flexible research programs that can have widespread impact and find broad stakeholder support.

Again, I would like to thank each of the witnesses for their testimony today, and I thank the Chairwoman for continuing our preparations for the next farm bill, which will be here before you know it.

With that I yield back.

Chairwoman STABENOW. Thank you very much, and also just let me say, on a personal note, that I think that our Ranking Member has a birthday on Saturday. In advance, happy birthday. We will not ask you how old you will be.

Senator BOOZMAN. Well, when the candles are lit it looks like a forest fire.

[Laughter.]

Chairwoman STABENOW. All right. We will have the Forest Service there to help handle that.

I am going to Senator Hyde-Smith, who I know is not going to be available for the second panel but has a special witnesses from her State.

Senator HYDE-SMITH. Thank you so much, Chairwoman and Ranking Member, and I am going to ask Dr. Felecia Nave to stand right now. It is truly my pleasure to introduce this lady. She is the President of Alcorn State University in Lorman, Mississippi. Alcorn is the oldest public land-grant HBCU in the entire country, serving 3,000 students from 37 States and 22 countries.

Since arriving at Alcorn three years ago, Dr. Nave has expanded university strategic partnerships, overseen record contributions to the school, and led important upgrades to facilities and infrastructure. She has really done a great job.

Dr. Nave is a member of the Executive Committee of the 1890 Council of Presidents and oversees Alcorn's Socially Disadvantaged Farmers and Ranchers Policy Center. She earned a bachelor's degree in chemistry from Alcorn and a master's in chemical and environmental engineering, and a Ph.D. in engineering from the University of Toledo.

I just want to welcome you, Mr. James Hill would be so proud, and so would his children. Thank you for being here.

Chairwoman STABENOW. Thank you, Senator, and Dr. Nave, we look forward to hearing you as a part of our second panel.

We will now turn to our Under Secretary. We want to welcome back to the Committee Under Secretary Chavonda Jacobs-Young. It is always wonderful to see you. Dr. Jacobs-Young was confirmed by the U.S. Senate to serve as the Under Secretary for Research, Education, and Economics on June 7, 2022. She also serves as USDA's chief scientist.

In her role, Under Secretary Jacobs-Young supports our farmers and ranchers and communities by advancing critical agricultural research and economic data at the USDA. As a dedicated public servant she has served in various roles at the Department, including as the former Administrator of the Agricultural Research Service.

We are so pleased to have you in your position, and we welcome you today.

STATEMENT OF THE HONORABLE CHAVONDA JACOBS-YOUNG, UNDER SECRETARY FOR RESEARCH, EDUCATION, AND ECONOMICS, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, DC

Dr. JACOBS-YOUNG. Thank you. Chairwoman Stabenow, Ranking Member Boozman, and members of the Committee, thank you for the opportunity to come before you today to discuss the state of USDA's Research, Education, and Economics (REE) mission area, which includes The National Institute of Food and Agriculture (NIFA), Agricultural Research Service (ARS), Economic Research Service (ERS), National Agricultural Statistics Service (NASS), and the Office of the Chief Scientist.

The success of the REE mission area is rooted in partnerships, partnerships with technical assistance providers that give producers the tools they need to adapt as they feed the world, partnerships with institutions to advance agricultural innovation and cultivate the next generation of agricultural leaders, and partnerships with Congress, to assure that decisionmakers have the tools they need to support farmers and ranchers across the country.

Agriculture research often has a less-told story, but we live and reap the benefit of it every single day. The impacts of this research shape the way we eat, clothe ourselves, and adapt to a changing climate. For example, in Kansas, NASS collects winter wheat data, data that is so important to our producers. ARS conducts research on grain quality and also breeds crops for genetic solutions to damaging stresses like leaf and stem rust and Fusarium head blight. This research helps producers make informed decisions for their operations.

Production agriculture requires constant innovation and adaptation, as farmers and ranchers pursue climate-smart solutions to extreme weather, as rural businesses seek new markets, and as underserved communities seek trusted partners to tackle systemic issues.

Access to information and new technologies underpins each of these objectives, and when appropriately resourced, REE is well-positioned to be a partner in providing timely research, data, training, extension services, and economic analysis to support informed decisionmaking.

The U.S. has a long track record of making investments in research that pays off for farmers and our economy. Between 1948 and 2019, total agriculture output in the United States grew by 142 percent. This rise cannot be attributed to increase in agricultural land or labor—both inputs declined over this period—but stem instead from the adoption of a whole suite of publicly funded innovations, in crop and livestock breeding, nutrient use, pest management, and farm and field management. These new practices have yielded significant dividends. ERS found that public agriculture research and development investments from 1900 to 2011 generated, on average, $20 in benefits to the U.S. economy for every $1 of spending.

Yet Federal investments in agricultural research have declined by a third in the past two decades, falling far behind our international partners. Once the world's leader, the United States now trails far behind other major nations in public agricultural research investments. This decline in investments means we are missing critical opportunities to capitalize on the powerful potential of our world-class scientists to conduct the type of high-risk, high-reward research necessary to meet the overlapping and rapidly emerging challenges our farmers face.

The United States, through USDA, can once again lead in discovering and circulating solutions to global agriculture and natural resource challenges through highly responsive, transdisciplinary, and convergent research. That is why I am pleased that President Biden and Secretary Vilsack are strongly committed to supporting Federal agricultural research, development, and deployment, which will define innovation for decades to come.

I believe a few things are critical to ensuring REE's mission stays on track: supporting work force development efforts, deepening our existing partnerships to bridge the gap between researchers and producers, and increasing equity in research funding and program focus. The power of information and research is undeniable, and REE is well positioned to support farmers, ranchers, scientists, and academics alike in tackling some of the most pressing issues facing our country.

In my time leading REE and in my 20 years of Federal service I have had the opportunity to travel across the country and meet with many of the people you serve. I have visited States in every region of the country and many of your districts, meeting with the people you represent. They are optimistic about the future of agriculture, and so am I. President Biden, Secretary Vilsack, and REE are poised to catalyze food systems transformations, and we can meet and expand our commitment to farmers and ranchers as they work to feed the world, and I look forward to working with the Committee to support this mission. Thank you.

[The prepared statement of Dr. Jacobs-Young can be found on page 46 in the appendix.]

Chairwoman STABENOW. Thank you so very much.

First of all, let me just say we all know that our farmers are facing unprecedented challenges. We have the climate crisis right in our face. We have market volatility. We have emerging diseases that you were talking about, supply chain disruptions. I mean, there is so much coming at our farmers and ranchers. The research that is done at USDA and the data that is collected is really critical.

When we look at the next farm bill, how can we strengthen the USDA's research extension education programs to better meet the challenges that farmers and ranchers are facing? Let me just say, when you talk about the numbers and how our investments have gone down and other countries are going up, that is something we should all be very concerned about as we look at our future.

Talk more specifically about what we should be doing to strengthen these efforts.

Dr. JACOBS-YOUNG. Thank you, Chairwoman Stabenow, for that question. We have talked about investments in ag research, and we know that there are some countries, like Brazil, who are competitors, global competitors. We lose an opportunity to be competitive if we continue in this trajectory.

The second topic I would like to focus on is ag infrastructure. When we think about the work force that we have across the country, both internal to USDA and the Agriculture Research Service and with our land-grant university partners, we know that many of the scientists that support our industry are working in crumbling facilities. In USDA's Agriculture Research Service, which I have the most latest experience with, the average age of our buildings is 47 years old.

In order to attract the best and the brightest, which is my third point, our next generation of agriculture professionals is critical. Today, in REE, 20 percent of our work force are eligible to retire. In three years, that becomes 33 percent. That is one-third of our work force is eligible to retire. It has been very helpful to have un-

precedented investments in the next generation of agricultural professionals.

President Biden and Secretary Vilsack recently announced a NEXTGEN program, From Learning to Leading, which is an unprecedented, $250 million investment in encouraging and attracting students from underrepresented communities to the agriculture profession. The flexibility that that gives us, the infrastructure that we need for our best and the brightest, and investments in ag research are things that I know that this Committee also believes in very strongly.

Chairwoman STABENOW. Great. Thank you very much. I mentioned in my opening that we have secured $185 million in the last farm bill for the Foundation for Food and Agricultural Research, or FFAR, as we call it. This is actually something that Senator Roberts and I originally created in the 2014 Farm Bill as a public-private effort, as we do public-private research in health care. We have not done that in the past on agriculture. This foundation has been doing that, and I appreciate 341 grants to date, including a really important one that Michigan State did on pest management for our cherry growers.

Could you talk a little bit more about how FFAR's unique model of leveraging public and private funds is something that is helpful in this arena?

Dr. JACOBS-YOUNG. Yes. I have been a part of FFAR. I have been an ex officio board member since the inception. I was fortunate enough to call some of the original members who served on the board. I remember the spreadsheet with all the names that had been suggested for the board. I have been working very closely with the organization over the past couple of years, and as Under Secretary, working to partner with FFAR whenever possible to benefit on their convening power, their opportunities to bridge the gap between public and private organizations. Working with the new director, Dr. Saharah Moon, and just really continuing to bring strength to strength from my two organizations.

Chairwoman STABENOW. Thank you. Just quickly in closing, we now have been reemphasizing, or strengthening the focus on urban agriculture, which is creating jobs in our urban areas, and it is really a wonderful bridge between urban and rural. We have a new office, as you know, set up, and so on.

I wonder if you might speak a little bit about how we could improve the ability to support our urban producers and develop innovative technology for local food systems.

Dr. JACOBS-YOUNG. Yes. Absolutely. One of the things that I am very excited about is our recent announcement about Beginning Farmer and Rancher Development Program, and looking at the array of the 45 projects, they span the spectrum. Because urban agriculture is agriculture, and so really trying to encourage more people to enter into that profession. There is a project that encourages farmers in aquaculture, for example. Using our community technical assistance partners to really reach out to some of those communities to help them enter into areas like urban agriculture.

Chairwoman STABENOW. Thank you very much. Senator Boozman.

Senator BOOZMAN. Thank you, Madam Chair, and Dr. Jacobs-Young, thank you again for being here. I continue to hear really good things about the work that you are doing, and we are grateful, grateful for your service.

I understand you recently met with a group of rice researchers from Arkansas. I appreciate you taking that meeting, and I think that they felt like it was very productive, and we appreciate you listening to their concerns.

The 2018 Farm Bill established the Agriculture Advanced Research and Development Authority. Though the authority itself will be revisited in farm bill discussions, the program has vast support across the stakeholder community. The last appropriations bill provided startup funding for staff hires and a mandate to complete a strategic plan. Can you tell us the status of how that is going and talk about when you plan to submit the strategic plan to Congress?

Dr. JACOBS-YOUNG. Senator Boozman, thank you for that question. This is a very complex topic, and just to be clear, the opportunity to fund high-risk, transformative research is something that we are all very, very excited about. In fact, as ARS administrator for eight years, we have been trying to integrate innovation into the DNA of who we are. We are very excited about this concept, to follow in the footsteps of some of our Federal partners like the DARPA organization.

On the other hand, we recognize that DARPA has a budget of $3.85 billion, and so to be truly impactful we recognize we need the resources to scale the types of projects that we all envisioned would happen with AGARDA.

With the $1 million, we have partnered with FFAR, and we are engaging in a series of formal conversations. We have received a lot of feedback from stakeholders. We are going to engage in formal conversations to get their feedback on the direction for AGARDA when properly resourced.

We have a plan in clearance. I just want to be transparent. It is an implementation plan on what was possible if AGARDA is funded at the authorized $50 million level, and we expect to release that plan to you all and publicly in the first quarter of next year.

Senator BOOZMAN. Good. Certainly that would be very helpful. You have to have a plan before you can get implemented. You need to be nice to this guy, the Ranking Member on Ag Appropriations, as we go forward.

Following today's hearing, myself and the Chairwoman are eager to begin our work to develop the research title for the next farm bill. Dr. Jacobs-Young, in your role as Under Secretary will you commit to provide the Committee with the technical assistance when asked, and to prioritize the effective implementation of programs authorized by the next farm bill?

Dr. JACOBS-YOUNG. We would be so happy to do so. We are on standby and ready for your call.

Senator BOOZMAN. Very good. Cannot ask for anything more than that. That is great.

Can you just speak again, very quickly, about the importance of the USDA research in developing new tools and how are you, as the Under Secretary, furthering the goals of trying to get more tools in the toolbox?

Dr. JACOBS-YOUNG. Right. Absolutely. When we think about what we heard when we engage with stakeholders, they need more technical assistance, they need more boots on the ground, and they need more data. What we found is that when we partner with technical cooperators, when we partner with extension service, those people who are on the ground every day, the point of our research is not to stay in the file cabinets. It is to get it out into the hands of the people that need it.

We have been partnering with a number of the programs that have been put in place at USDA to disseminate the information. For example, the Climate Hubs, which were created to take the thousands of peer-reviewed papers we do a year on climate science—that is just in USDA-but a producer here, she cannot stand in their field and read our papers, you know, as grand as they are. We implemented the Climate Hubs to take that information, to translate it into nuggets that producers can use, and more importantly, bringing producers in at the beginning of some of our research projects.

I think it is just very, very important that we continue to up our game in terms of working hand-in-hand with the producers and meeting them where they are.

Senator BOOZMAN. Okay. Thank you, Madam Chair.

Chairwoman STABENOW. Thank you very much. Senator Smith.

Senator SMITH. Thank you, Madam Chair, Ranking Member, and thank you very much, Under Secretary, for joining us today.

I want to talk a little bit about research into food. The USDA research into food for humans centers on safety but also on strategies for increasing productivity and sustainability and quality, and that is really important. The USDA has also started to advance some educational programs and resources promoting indigenous food sovereignty, which I think is very important, and I appreciate your attention to that issue as well.

One area of research that is very important, but I think gets less attention, is NIFA's support for research and education to help Americans make informed food choices. On NIFA's website there are a variety of initiatives, including programs to help folks make good choices about food, resources to help individuals living with diabetes make good nutritional choices, those kinds of strategies.

These initiatives go directly to the relationship between food and health, and touch on how improved nutrition is one of the most powerful tools we have to improve health outcomes, especially for chronic health conditions that are so harmful to people and also cost the United States billions of dollars in health care costs.

Could you talk about what more we need to do in the farm bill to support USDA's research and education into healthy food and that connection between food and health?

Dr. JACOBS-YOUNG. Senator Smith, this is one of my passionate priorities as Under Secretary. I am very, very committed to this topic. Yesterday, Secretary Vilsack and I both announced ASCEND, which is the Agricultural Scientific Center of Excellence for Nutrition and Diet, in support of President Biden's Cancer Moonshot 2.0, in response to the White House Conference on Hunger and the strategies that we are working to meet.

We recognize that in the United States almost 60 percent of us deal with at least one chronic condition. I could probably raise my hand three or four times when we ask those questions. We know that there are a lot of things outside of our control, especially when we deal with cancer, but food is not one of them.

We have the power to bring together the right people at the right time to talk about what needs to happen in order to translate, once again, the research and the data into usable information for Americans, to improve the quality of life, and reduce their risk of chronic disease and cancer.

We have initiatives called Precision Nutrition. Each one of us in this room belongs to a subpopulation, and one size does not fit all of us. We want to be more targeted in the guidance we provide to Americans on how to eat for a healthy, high-quality life.

I shared, and Secretary Vilsack shared yesterday, that many of our family members have died before age 60, mine between 50 and 55, my sister, just last year, at age 50. We can do better. The pandemic elucidated for us how vulnerable we are when we carry these obesity-related, chronic diseases like diabetes, hypertension, kidney disease, cardiovascular disease.

Yes, my answer is yes. We are all over it. We currently invest about $180 million in nutrition, and how do we bring that power with the American Heart Association, the Cancer Associations, with our producers. You know, so how can we use our convening power to bring people together to solve some of these problems.

Senator SMITH. Thank you. I can hear the strength of your passion for this and I believe that this is such an important area for us, an area where there is a lot more work to do. As my good friend, Senator Booker, says, this is a civil rights issue, and it is also an issue of how you save billions of dollars in health care cost, while you are also simultaneously improving people's lives. I think this is a big opportunity for us as we think about resource allocation and prioritizing in the farm bill.

I just have a minute left and I want to ask you a similar question about the role the USDA can play in research understanding the impacts of market consolidation and concentration, another area that I think affects the lives of farmers and research and also consumers, as we see increased consolidation. This Committee has talked a lot about that. Do you see this as an area where we would benefit from additional research?

Dr. JACOBS-YOUNG. Absolutely. Currently the Economic Research Service is right in the middle of all of these conversations about the impact of consolidation on American agriculture. It is the impetus behind a number of our initiatives that are trying to build local and regional approaches to many of the challenges that we face, because we recognize how vulnerable we are when we do not have a resilient food system.

The consolidation is an issue and we are working toward making sure that we, for example, increase meat and poultry processing at local and regional levels, being able to help those producers have economic opportunities and have a little bit more control over their vitality.

Yes, absolutely, Economic Research Service is right in the middle of those conversations.

Senator SMITH. Thank you very much. Thank you, Madam Chair.

Chairwoman STABENOW. Thank you very much. Important questions. Senator Hoeven.

Senator HOEVEN. Thank you. Thank you, Under Secretary, for being here today, and thanks to both the Chairman and Ranking Member for holding this hearing. Ag research is so incredibly important. Growing up in western North Dakota I can remember there were just a few crops we could grow very well on dry land farming, and now the diversity in terms of the crop out there is amazing and is a credit to ARS and to NIFA and the great research done not only at USDA but at our land-grant universities. It is just unbelievable in terms of productivity and disease resistance, and it continues.

This is such an important area, and one of the things that we are really pushing for now is precision agriculture. We have started a concept at North Dakota State University called Grand Farm, and it is actually a public-private partnership where they have actually set up a cooperative agreement with USDA, with ARS specifically, to do research on precision ag, and they have acquired land. The theory, actually, is that they are going to have a fully automated farm, you know, self-propelled vehicles and the whole nine yards. Now it will not be, just like unmanned aircraft are not unmanned, right. There is a pilot. He is just on the ground, not in the aircraft. It involves all these things.

First I want to invite you to come out and see it. As Senator Smith will tell you, we have lovely winters in North Dakota and Minnesota, great Christmas time, white Christmas, you know, but certainly you could come in the summer or spring if you would, but we would love to invite you to come see it.

Dr. JACOBS-YOUNG. Well, I will share with you that I have been to North Dakota in the summer and it was 104 degrees.

[Laughter.]

Dr. JACOBS-YOUNG. I am not sure what is the best time of year to go to North Dakota, Senator Hoeven.

Absolutely. You know, ag is high tech. When you talk to most Americans they have no idea how high tech agriculture is. Once again talking about infrastructure, those things are only possible if you have broadband access, if you have smart young people. I am not saying us old folks cannot do it, but a lot of young people who understand biology and computers systems and informatics, who can come in and help us build AI systems, machine learning. Then we need traditional breeders who can breed plants that can be mechanically harvested. It is a full spectrum of needs.

Precision agriculture, once again, relies on data. We cannot do it without data. Where do we store that data? How do we analyze it? We also need high-tech IT infrastructure, looking at high-performance computing, looking at cloud storage, and once again, a cadre of people who know how to use those systems to be able to give us the answers we need.

I would be more than happy to come and tour the site. I would love to be able to visit, to see it in action, especially since you are partnering with ARS.

Senator HOEVEN. Well, I appreciate it, and these cooperative agreements are a great way to do more of what you just described, and I think you are right on there.

The only thing I would not agree with, with you said "us old people," if you are talking about me and Boozman, us old people would apply. In your case, that does not apply at all.

Then the other thing is, just in the remaining time here, touch on, in terms of ARS and NIFA, how you see the two working together, coordinating. As we go into this next farm bill, what are your priorities both for ARS and NIFA, and what do you see as the most effective thing we can do to enhance? I mean, I think they're already great programs, but how do we improve them in this next farm bill?

Dr. JACOBS-YOUNG. I think the opportunity to have those conversations about like how are things working, whether there are some technical fixes, all those things that we are poised to comment on. Then there is this opportunity—I think I am one of the few people who have had an opportunity to work in both ARS and NIFA, and actually head both agencies. There are only two agencies in REE that I have not been a member of so I may do an internship in either NASS or ERS.

I have the benefit of seeing the high-level opportunities to connect more of the dots. I think what you have done in terms of your support for us is very important, and we need to work with you as we capitalize on those investments—infrastructure, increased agricultural research investment, and the next generation of agriculture professionals.

Senator HOEVEN. Great. Again, thanks for your work. I really appreciate it, and for being here today.

Chairwoman STABENOW. Thanks very much. Senator Booker, who chairs our subcommittee who oversees research as well as nutrition.

Senator BOOKER. Thank you, and I am happy to speak for the young people on this Committee.

[Laughter.]

Senator BOOKER. Senator Grassley and I are the youngest of spirit here, I think. I just want that for the record.

Dr. JACOBS-YOUNG. I am not going to live that down.

Senator BOOKER. Under Secretary, I have one judgment real quickly. You clearly went to the second-best North Carolina school, not North Carolina Central, which is my dad's university. I assume you just could not get into North Carolina Central.

Dr. JACOBS-YOUNG. Yes. You got me there.

Senator BOOKER. Okay. Good. Good.

We have a crisis in American farming. It is really stunning. The number of small farmers that are losing their farms is dramatic. My colleagues mentioned about the corporate concentration. I visited farmers in the Midwest, saw their deeds to the land from like four generations ago in the Homestead Act, and yet the economics just do not work for them like it did for those four generations previously. You are seeing these big market forces that are causing corporate concentration, causing a level of pain in the Midwest, in farm countries, rural areas. I mean, the suicide rate for independent family farmers is three times higher than Americans. This

should be a national crisis, yet we are doing things that are aiding and abetting the massive concentration of farms.

I am just wondering, from a research challenge, to begin to lay plain this generational shifting from independent family farmers to massive, multinational corporations and what the real effect is on our culture, on our society, and even for farm workers, consumers, and more. Is there something you can give me of hope that we are trying to do things that could lay plain the true cost of all this?

Dr. JACOBS-YOUNG. Most of our focus is on small to midsized farms. Most of our research, most of our programs are focused on small to midsized farms. Really the Beginning Farmers and Ranchers Development Program that I mentioned, we just announced $24 million in a grant to technical operators on the ground, going to those farms, going to try to help them with technical assistance around land access, market planning, entrepreneurship, and how do we support those farmers?

Taking about four steps back, if those producers cannot make a living on those farms, if they cannot have rural communities where they can raise a family, where they can thrive, we are going to be in a world of hurt, because I think it is about two percent or less of Americans are involved in growing the food that we eat. If we cannot find a way to make those farmers successful and be vital, let us just say it is a high priority for us. We are investing a lot of research and really trying to be able to respond to how do we reduce inputs, how do we increase the economic advantages, how do we do things like value-added products?

Senator BOOKER. I agree, and so as we look to the next farm bill I hope we can really invest in research to provide those farmers with scale-appropriate innovations and the tools they need.

On a related issue to this to me is the fact that we are not aligning our subsidies with the best return for the consumer because we are not taking into effect all the negative externalities toward what we are doing. For example, only two percent of our ag subsidies are going to the foods that other parts of government tell us we should eat the most of—fruits and vegetables. These are actually called specialty products but yet most of our nutritionists are telling us that should be the core of our diets.

More than that, the kind of farming we are investing in has a tremendous amount of these negative or externalities. This is not a reflection of true market forces because we are, as a government, interrupting. So these negatives are substantial greenhouse gas emissions, pollutions of lakes and rivers and oceans as these chemicals are flowing into them, the depletion of our soil health, which is tragic in and of itself but also fails to deal with flooding and this contributes to the flooding we see in a lot of our communities as well as failure to sequester carbon, a massive loss of biodiversity around our country.

These are the true costs that are not being incorporated into what we are doing, not to mention the fact that we are making incredibly cheap the foods that we are telling people not to eat. My kids in Newark walk into a corner grocery store and a Twinkie product is so much cheaper than an apple because all of our billions of dollars of subsidies go to everything in the Twinkie product and nothing to healthy food. Then our taxpayers pay twice by pay-

ing for the Medicaid-Medicare cost explosion of diet-related diseases because we, as a country, have decided we are going to make cheap and easy, available foods, empty nutrition, and the like.

I just think there should be research into the massive explosion of costs that are true costs to the foods we are eating and subsidizing, to the point now, in America, that 1 out of 3 of our government dollars is going to health care, and almost 1 out of 5 of our dollars in our entire economy is going to health care, and 80 percent of it is preventable diseases, most of which is related to the foods that we are subsidizing. That is the insanity that I think we are in. We are a frog in boiling water right now as a country. If diabetes, strokes, heart disease, even what people call Type 3 diabetes, which is Alzheimer's, keeps going up at the same rate, in the next 25 years it will not be 1 out of 3 government dollars going to health care. It will be one out of two government dollars.

You could be the canary in the coal mine by screaming right now with the right research to expose, I think, more of the truth of how we are digging our own grave. I am not being metaphorical here with the number of people that are dying based upon the way we have designed our food system.

Could you comment on that, and I am out of time, but if you would just give me a quick note.

Dr. JACOBS-YOUNG. Senator Booker, you dropped a lot there, and is it possible for me and my team to followup with you, maybe sit down——

Senator BOOKER. Yes, please, and with that I will surrender the time.

Chairwoman STABENOW. Thank you very much. Important questions. Senator Ernst.

Senator ERNST. Thank you, Madam Chair, and as a proud Cyclone alum, I am going to attest that the best land-grant university actually comes from Ames, Iowa. I think all of us have competing interests, but all working together in that same wonderful system.

Certainly the research title of the farm bill enables a lot of really important relationships and partnerships with our land-grant universities to dig into that ag research extension and education. There are a number of programs that I have supported here from the Senate. The Farm and Ranch Stress Assistance Network, Agriculture Advanced Research and Development Authority, and as you have mentioned many times, the Beginning Farmer and Rancher Development Program. I really appreciate those programs and what they are doing for our Iowans and others across the country. Again, thank you, Dr. Jacobs-Young, for being here with us today and sharing your expertise.

The ag sector has come under a lot of increasing cyberattacks, and this is threatening the livelihood of our farmers and then, in turn, of course, is threatening our Nation's food chain. Of course, there are a number of us, we work to combat the increasing cybersecurity threats and we do that especially as we look at our adversaries around the globe.

What role would you see for the university agricultural systems in this particular effort, and of course, thereby embedding research, education, and outreach activities into this? Again, a very important topic and one that we have not spent as much time on.

Dr. JACOBS-YOUNG. Thank you, Senator. First, raising the awareness about the need for ag cybersecurity. You know, in the Agricultural Research Service we do a lot of IP-related research—vaccine development, et cetera, et cetera. We are constantly protecting our systems from intrusion. Which is interesting because ultimately our goal is to make all of it public, but when we are ready to make it public.

I think that the need to raise awareness about the need for the cybersecurity and then training a generation of professionals who can help us in this space, I think that is going to be critically important. We are partnering with Iowa State University, with their High-Performance Computing Network. Our first was built right there at the NADC on the Iowa State University Campus, so we are already partnering with Iowa State.

Once again, training people who can help us. I will add that we also retrain some of our existing employees. We offer trainings all year to try to get people up to speed in areas like high-performance computing, AI, cybersecurity.

I look forward to working with you, Senator Ernst. If there is something that we can do in partnership with your office, we are just happy to do that.

Senator ERNST. That is wonderful. Then are there other agencies that you work with as well in this area that could be good partners and relationships that we should be developing?

Dr. JACOBS-YOUNG. In agriculture we have something called the Five I's, which is the five international countries working with our intelligence communities. I am happy to share more about that.

Senator ERNST. Wonderful. Thank you. I appreciate that. Then, as well, when you look at the research title and addressing the important issue of data-driven research around carbon—and that is something that a few members have already brought up—what can be done to help our farmers and producers make the best decisions for their operations around the issue of carbon? Because I travel across the State of Iowa doing what is known as the Full Grassley. We visit all 99 counties every single year. A lot of our farmers have expressed interest and want to be engaged in, whether it is carbon capture or other. How can we get that information out to them?

Dr. JACOBS-YOUNG. Stressing the importance of having the producers engaged, right, from the beginning, early and often, communicating. I do not know if I want to do the whole Grassley tour, but I think it is critically important to get out there—I have been on farms—as well as talking to our producers about what is it they need, and how can we deliver it in a way that it will be receptive, because adoption is part of the issue that we have. We have developed wonderful technologies and innovations and tools and then we struggle with adoption.

I am thinking about tools like GRACEnet. You know, it is one of the tools that a farmer can use to really look at their emissions from their crops and grazed soils under current and future management practices. We have tools like COMET that we can look at reductions and sequestration and conservation. Then we have like Dairy JAM.

We are taking a lot of this science and data, and what we want to be able to do, I want to pull out one or two of my cellphones,

we want to produce a him or her to be able to stand with their cellphone and be able to access the tools. They do not need to know what is working behind it. They just need to know how to put the proper variables in or get the answers that they seek.

A full-time job is translating the science into digestible nuggets in a way that people can receive it.

Senator ERNST. Yes, absolutely. It is just so important that we take all of this incredible information, get it right out there to that end user. Thanks so much. We really appreciate it. Thank you, Chair.

Chairwoman STABENOW. Thank you very much. Senator Bennet.

Senator BENNET. Thank you, Madam Chair. Thank you for holding this hearing. Madam Secretary, thank you very much for being here.

In the 2018 Farm Bill this Committee authorized the Agriculture Advanced Research and Development Authority (AGARDA). I was happy to hear the Ranking Member ask about this. There is bipartisan support for this pilot program which was modeled after the success of ARPA-E at the Department of Energy and DARPA at the Department of Defense, meant to address the greatest threats to American agriculture through high-risk, high-reward research that drives innovation.

You mentioned in your conversation with the Ranking Member that you are working on a strategic implementation plan, which is an important step, but I hope we can see that released as soon as possible.

I was curious whether you had made progress on hiring a director or staff to help launch the program itself. Aside from funding what are the biggest challenges to implementing the program? Are there changes we need to think about in the upcoming farm bill to make it more effective or easier to implement or more relevant to the issues facing producers today?

Dr. JACOBS-YOUNG. With the $1 million investment that we received in Fiscal Year 2022, it is complicated to be able to support a Federal employee with short-term funding. We looked over at DARPA, ARPA-E, ARPA-H, and they were somewhere between GS–15s and senior executives. We are talking about $165,000 to $200,000 base salary without benefits. It would be difficult to make that type of commitment to a Federal employee without long-term committed resources.

We partner with the Foundation for Food and Ag Research so that we did not have to use the resources that we could use working with stakeholders and engagement to try to create a position inside of USDA. Working with the foundation that was created to support the Department. That is the strategy that we have taken thus far, and once we have an opportunity to talk with the stakeholders about what they would love to see, then I think we have an opportunity to be able to see what is possible internal to the Federal Government.

Senator BENNET. Do you have a timeline for when you are trying to bring somebody aboard?

Dr. JACOBS-YOUNG. Currently there are no plans to bring a permanent Federal employee aboard.

Senator BENNET. Okay.

Dr. JACOBS-YOUNG. We do not have the committed resources.

Senator BENNET. Okay. I would like to followup with your staff if that is okay, to understand that better and make sure that what we were trying to achieve here is actually being carried out by the Administration. If we could work with you I would appreciate that.

Dr. JACOBS-YOUNG. Senator Bennet, as I shared before, it is a matter of scale, and the scale is when you look at what the program was authorized, at $50 million. Being able to plan for a $50 million program is something that we are excited about. However, we have to have the resources.

Senator BENNET. Okay. I will followup, if that is okay.

Dr. JACOBS-YOUNG. Okay. Thank you.

Senator BENNET. I know you know that Colorado, and the American West for that matter, is being ravaged by wildfires. We have been able, with the leadership here, to create an unprecedented commitment of billions of dollars both in the Infrastructure Law and in the Inflation Reduction Act, to begin to address the forests that have been neglected so badly by our Federal Government over years. The effects of climate change have just been staggering.

I wonder whether you have some examples of ongoing research to support wildfire prevention and mitigation, and what role research can play in advancing our understanding of our ecosystem's vulnerability to fires, to extreme weather, and to other similar threats.

Dr. JACOBS-YOUNG. Thank you for your question, Senator Bennet. This is an example of where we play a supportive role to our Federal partners, and that is the Forest Service research entity and our Forest Service colleagues. I know that in ARS we have done a lot of studies around things like sage grass and some of the other things that might be an issue. We have looked at what do we do with, for example, smoke-tainted grapes. How do we not lose that agricultural production? You know, what are the options?

Really working with our Forest Service colleagues is an example of where we can come together there.

Senator BENNET. Okay. Thank you, Madam Chair.

Chairwoman STABENOW. Thank you very much. Senator Hyde-Smith.

Senator HYDE-SMITH. Thank you, Madam Chairman, and thank you for being here today. You have really presented yourself extremely well. Very impressive.

I want to talk about rural veterinary medicine. In Mississippi, we have a tremendous shortage, and across the country, that threatens the long-term viability of our livestock industries. We have counties in Mississippi that do not even have a large-animal veterinarian, and that is really what we are hearing across the entire country. As you well know, our food security and economic security are put at risk without sufficient veterinary oversight to ensure the health of animals in the food supply chain, and the proper Federal inspection of meat, poultry, and catfish processing.

The USDA National Institute of Food and Agriculture, NIFA, currently administers the Veterinary Medicine Loan Repayment Program to alleviate rural veterinary shortages by providing money toward educational loans to veterinarians who agree to serve in rural shortage areas. There is just so much money to be made in

small animals that it is difficult to lure them into large animals. While many of these rural veterinarians serve in private practice, some undertake Federal roles such as USDA Food Safety and Inspection Service inspectors.

Despite the successes of this program there are still critical shortages across rural America. One of the reasons for this, that I think has been identified, is that these awards from NIFA are subject to a Federal withholding tax, meaning that 37 percent of the dollars appropriated to this program go right back to the Treasury, instead of the educational debt for the rural veterinarians. Without this tax we could better address these shortage issues by helping more veterinarians practice where it is desperately needed.

What are your views on the veterinary shortages and how open are you to additional conversations on how we can get more veterinarians into rural America, and how will you ensure NIFA continues to successfully administer this program, and what do you think about alleviating those taxes?

Dr. JACOBS-YOUNG. Senator Hyde-Smith, it is interesting because every young person I talk to is interested in animal science. I beg them. I literally beg and plead with them to look at large animals. What I notice when I toured the veterinary school at Mississippi State University, primarily female.

Senator HYDE-SMITH. Yes.

Dr. JACOBS-YOUNG. Primarily female vet students.

Senator HYDE-SMITH. I have got one on my staff right here who just graduated.

Dr. JACOBS-YOUNG. The systems are great. Programs like the NIFA-led program are great. We have also recognized an imperative to diversify our veterinary programs. I talked with some of the students at President Nave's university, at Alcorn. The students are interested in animal science and veterinary science. How do we encourage them and bridge a way for them to go into vet programs?

Something that we talk about a lot in terms of planning are how we can use some of these unprecedented investments in the next generation of ag professionals to train targeted areas, like veterinarians, for rural communities, for large animal science. I think you are right. This is an important issue. I would love to have an opportunity to talk more, maybe hear some of your thoughts on what you have learned in your State.

I have always been excited about the repayment program, the loan incentive program that NIFA led. I tried to get my daughter to go into veterinary services but she fought against me, because I thought, hey, we can send you to a rural area and you can get some of that paid back.

Yes, this is very important. ARS hires a lot of veterinarians, a lot of veterinarians. What I will tell you, where we have seen the most glaring shortage is as we move into our BSL–3 and BSL–4 facilities, where we are dealing with diseases like African swine fever, classical swine fever, avian influenza, we need trained veterinarians, Ph.D.s, DVM Ph.D.s who can help us in those spaces. We have a shortage of those people. Then we have to compete with everybody else for the same students. I would love to have an opportunity to talk with you about that.

Now in terms of the withholding, I would need a whole lot more information on that piece, but I am happy to talk with your office to see what is possible.

Senator HYDE-SMITH. Thank you for your interest because it is a critical shortage and we are losing animals because we just have no one to come to the farm in time to save them.

Thank you, Madam Chairman.

Chairwoman STABENOW. Thank you very much. I appreciate it. I believe Senator Tuberville is next.

Senator TUBERVILLE. Thank you, Madam Chair. Thank you for having this discussion today. My former employee was one of the big land-grant universities, earliest ever, Auburn University, and also in Alabama we have Tuskegee University and Alabama A&M. Thank you for your hard work and looking out for our land-grant universities.

The farm bill is very, very important to my State, and really all the States, and for all the people that live in this country. I am real concerned about our family farms, as Senator Booker was talking about earlier. It is important we understand what they go through and the problems that they are having. You know, the average U.S. farmer is 58 years old. We have very few young people getting into it. Why would they do it when they cannot make any money doing it? We have got problems from fuel prices, and the EPA looking over their shoulder, and making it tougher every day. Things are getting tougher, you know, doing away with fossil fuels. There is so much unknown that our farmers are getting ready to face.

One thing I wanted to ask you about is the research. What are we doing through your department in the ownership of our land to foreign countries? China, for instance, in the last 12 years, has gone from 10,000 acres to 360,000 acres of farmland in our country that they are purchasing. I can understand why a lot of our farmers are selling out. In the South, we are selling out—some of the farmers are selling out because of people moving to the South, you know, housing areas, home building, all those things, and they can make money doing it. We have to save our family farms, but for some reason we are selling more and more land to foreign entities. Are we doing any research into that?

Dr. JACOBS-YOUNG. That is a good question, sir, and I would love to followup with the Economic Research Service and Office of the Chief Economist to determine if we do have some research in that space.

I would share with you that we are doing everything in our power to be able to help those farmers and producers be successful on their land, and so that has been a huge focus area for us in the research areas. We talked about the Beginning Farmer and Rancher Development Program. You know, a large portion of our military come from rural communities. A number of them come back to the country and they are interested in farming and returning to the land. How do we help those people integrate back into the land, and what services can we provide to help them be successful? Investments in rural communities—how can we create communities where people want to live, where they can educate their children, where they can make a living?

The Economic Research Service has shared with us that over 85 percent of farmers do not make their primary living on the farm. I cannot imagine that. We have a lot of work to do in this space to help those producers be economically viable.

Senator TUBERVILLE. Yes. I know being at an ag school at Auburn we are having a lot of interest in it, but we have interest in more things like vet school, other than actually getting into the farming business, and we have to do something about it. We are not going to need a farm bill if we do not. Again, we have foreign entities coming in. Bill Gates is the largest farmland owner in the country, hundreds of thousands of acres. He owns most of the warehousing seeds in the country. For one person to do that there has got to be some kind of reason for that happening.

I just hope that we would keep our farmers in our prayers. Some of my best friends are in farming and they are just about to get out of it. If we do not come up with some answers for the cost and the availability of being able to do things easier, finding people to work on our farms, which right now is tough. I know people that own dealerships in terms of selling farm equipment. The supply chain is bad and getting worse.

You have got your hands full, and we are going to have our hands full putting this farm bill together to make sure our farmers are able to make it through the next few years, because I think the next few years are going to be telling of where are farmers go and where our farming ends up, whether it is going to be foreign land or whether it is going to be domestic farmers.

Thanks for your help. Thanks for your work.

Dr. JACOBS-YOUNG. I just want to quickly share. This is where innovation comes in. We have to be able to automate some of the processes. We have to do things like mechanical harvesting. We have to be able to reduce the inputs by finding alternatives.

We just recently broke ground on a brand-new facility on Auburn University campus, for the ARS scientists. We are just very excited about some of the help we are making in this space. We know how important research is to the region, and so we are just happy to be in partnership with Auburn and look forward to working with you.

Senator TUBERVILLE. Well, thank you. The one thing that I am very concerned about in that area of innovation is our farmers are wondering about the equipment they are going to be using. Is it going to be EV equipment? Right now they burn diesel. They burn gas. In the future is it going to be—I mean, everything is up in the air. The cost is going to even get higher. We cannot have our costs going up for our farmers. Their margins are very small as they are.

We have a lot of decisions to make for our family farms. Corporations will make it but the family farms are not going to make it unless we go out on a limb for them in the future, to make it easier and more profitable for them.

Thank you. Thank you, Madam Chair.

Chairwoman STABENOW. Thank you very much. A lot of important, serious issues for us coming together to support farmers and ranchers and families. Senator Brown.

Senator BROWN. Thank you, Madam Chair, and Madam Under Secretary, nice to see you. I concur with my friend from Alabama,

though I would amend that. The threat of foreign land ownership is real. The threat of consolidation and corporate ownership is every bit as real or greater, what has happened to farms in Ohio and Alabama and Indiana and Nebraska and Michigan and Arkansas. I think we all know that.

I appreciate what you said about innovation and that discussion back and forth. When you think about innovation in agriculture you think from Henry Wallace to researchers at our land-grant universities have made American farmers the most productive in the world, and you know these numbers, Dr. Jacobs-Young. Every dollar invested in ag research has a $20 return. Food security is national security, and agricultural research is foundational to that.

China understands it. They have quintupled their public investment in research, investing roughly double what the U.S. does. In the U.S., as you know, public investment in ag research has remained flat for five years. The Trump administration showed no real interest in doing the kind of research we should be doing.

A couple of questions about that. I assume you are concerned about the U.S. lagging behind China, and now, as well, Brazil when it comes to public investment in ag research?

Dr. JACOBS-YOUNG. I am. I probably have said it ad nauseum this morning. You know, I am concerned about the level of investment, when we look at being on par with our scientific colleagues here domestically and globally. When we look at some of the investments in ag research, if we were on par—so we share what you already shared and what I shared. If we could do that with what we have, imagine what we could accomplish if we were on par with our scientific colleagues, both here in the U.S. and around the world.

Senator BROWN. It means, Dr. Jacobs-Young, providing more multiyear, mandatory funding. Correct?

Dr. JACOBS-YOUNG. I will leave that to the decision of Congress, but happy to help with technical assistance and support.

Senator BROWN. I get it. Well said.

Let me shift to the 1890s land-grant system of historically Black universities. Nineteen universities, as you know, including Central State University in my State, one of the first and one of the best. The last farm bill established a scholarship program for students at 1890 institutions who are pursuing careers in agriculture and food sciences. What impact has that had on the 1890s network's ability to attracts students interested in careers in food and ag sciences? What does it mean for work force development and diversity in agriculture? If we are going to make the case that I know the Chair wants to make and I want to make, and I think several around this table I think in both parties want to make, we need to know how you assess so far the success we have had there from the last effort.

Dr. JACOBS-YOUNG. I know that you are going to have a witness on the next panel, Dr. Nave, who is right there where the rubber meets the road and working with the students at the 1890 institutions.

I will tell you, from my perspective as Under Secretary and as past administrator, how important it is for those types of programs to help us get a diversity of students into our halls, into our labora-

tories. When they have that type of support it takes the stress off, to be able to encourage them.

It is one thing to attract students to the programs. It is a whole different topic to retain. I think that those scholarships, both the 1890s scholars, we look at the Thurgood Marshall scholars, the HACU scholars, our 1994 scholars, all those programs are critically important to support those students to be able to know what is possible.

I will just share real quickly, I was with Dr. Nave and her colleagues on the Council of 1890 Presidents when my confirmation vote came in. It was not how I had planned it. I had planned to be at home with my family, with the bubbly, just waiting. I was in a hotel lobby——

Senator BROWN. You pay attention to these confirmation votes?

Dr. JACOBS-YOUNG. I do. I watch them all.

Senator BROWN. You could tell me the names of any, as all nominees, anybody that voted no, you could tell me their names?

Dr. JACOBS-YOUNG. Yes, I can. Yes, I can.

Senator BROWN. Never mind.

[Laughter.]

Dr. JACOBS-YOUNG. I was with Dr. Nave and her colleagues at the 1890 Council of Presidents, and we talked about what needs to happen for us to make sure that we can provide a successful trajectory for these students. I was on her campus talking to her 1890s scholars. I have been to Prairie View A&M. I have been to the FALCON conference, that is the First American Land-grant Consortium, for our 1994s with our Native American students. They need to see what is possible.

When I was at that hotel with Dr. Nave and her colleagues there was a young man that walked up to me, and he said, "I heard you speak many years ago, several years ago, and I went on to get a Ph.D. because I saw you." You know——

Senator BROWN. Because he knows you have one.

Dr. JACOBS-YOUNG. Because I talked to them about what is possible, the same thing I am doing at each one of these campuses and in the caucuses I speak. Now to be honest, I do not where I met him before. I do not know what talk it was, what engagement it was. We do not often know what type of impact we are having on people.

The 1890's scholars program and all the different scholars programs are important because they provide an entry into exposure. When we can get those students into our laboratories, we provide them opportunities to get exposure to people doing things that they did not even know was possible, then we will have success. How do we measure that in totality I think is your question, and that is something that we will have to sit down and talk about.

Senator BROWN. Because my time has expired I will be really quick here, Madam Chair.

Retention is always harder than recruitment. Correct?

Dr. JACOBS-YOUNG. Yes.

Senator BROWN. Okay. We need to get serious about what we can do, what this Committee can do in the farm bill and beyond on retention. We will come back to you with more about that.

Dr. JACOBS-YOUNG. Okay. Thank you.

Senator BROWN. Thank you, Madam Chair.

Dr. JACOBS-YOUNG. I could talk about this all day.

Chairwoman STABENOW. No, this is so important, so important. Senator Fischer.

Senator FISCHER. Thank you, Madam Chairman, and thank you, Secretary, for being here today. I appreciate it. I love your comments. I love your enthusiasm.

Madam Chair, the University of Nebraska-Lincoln's Vice Chancellor for the Institute of Agriculture and Natural Resources recently delivered testimony as part of USDA NIFA's listening session on updating scientific priorities. I ask that Vice Chancellor Mike Boehm's testimony be given consideration and be included as part of the official hearing record.

Without objection, Madam Chair?

Chairwoman STABENOW. I am so sorry. Senator Brown is going on about how great our witness is.

Senator FISCHER. I know. We all are.

Chairwoman STABENOW. He was echoing what you were just saying. Yes, without objection.

Senator FISCHER. Thank you so much.

[The testimony can be found on page 79 in the appendix.]

Senator FISCHER. Madam Secretary, a priority that we have previously discussed is my support for USDA's co-located ARS National Center for Resilience and Regenerative Precision Agriculture, the National Center at the University of Nebraska-Lincoln. I, along with Nebraska congressional delegation, recently sent you a letter underscoring the delegation's support for the National Center and our strong commitment to secure Federal funding for this essential ARS research facility.

Can you provide the Committee with an update and thoughts on how the new National Center will serve as a critical regional hub for collaboration and to identify and address relevant scientific and research gaps across the USDA ARS landscape, please?

Dr. JACOBS-YOUNG. What has been very exciting is as we have really emphasized the need for investments in infrastructure, Congress has been very generous to us. We have received over $1 billion in investments for ARS facilities. The beauty of that is we have been able to address seven facilities, co-located facilities, on land-grant university campuses. We are in early conversations—well, not so early—with the University of Nebraska, and we have plans for what we will do when properly resourced.

I support that co-location. My scientists are excited about it. Ronnie Green, who is an alumni of the Agricultural Research Service is excited about it. We just look forward to continuing to work with our colleagues there in Nebraska to make it a reality.

Senator FISCHER. Thank you. I look forward to working with you on that. Nebraska has a unique position just with our water resources that we have and the possibility there with innovation. I think the research would be extremely important for food and our water resources, so thank you.

Our community colleges also play an important and increasingly growing role in agriculture education and work force training. For example, at Northeast Community College in Norfolk, they have an associate's degree in precision agriculture to train students on how

to use, interpret, and utilize precision agriculture technologies to improve production. Northeast is also part of a multistate coalition of community colleges that provide education, training, and demonstrations to future farm producers. As part of this group of community colleges, Northeast also has an MOU with USDA's Natural Resource Conservation Service to provide training and education on conservation.

Can you discuss the ways that USDA could better partner with community colleges? Specifically, do you see a role for community colleges like Northeast to help translate research into technical training to help implement in that field?

Dr. JACOBS-YOUNG. I do. I see a huge role for community colleges.

I recently attended the FFA convention for the first time ever. I do not know if anybody in this room has ever been to an FFA conference.

Senator FISCHER. Yes, ma'am.

Dr. JACOBS-YOUNG. Sixty-seven thousand kids and a lot of blue corduroy jackets.

[Laughter.]

Dr. JACOBS-YOUNG. What I noticed when I walked through the exhibits is the prevalence of community and technical colleges, and it was the first time I had seen such a huge presence. You know, focusing on technical skills like welding. In fact, the first vice president, the second vice president for FFA is a welding student, and his goal is to open a welding business.

I recognize the importance of community colleges. We are partnering with community and technical schools for meat and poultry processing, for example. If we want to build local and regional systems we need to have local and regional trained employees. It has been a right partnership for the community and technical colleges.

Every profession in agriculture does not require a four-year degree, so we really want to make sure that we are capitalizing on the strengths of all of the institutions that serve us.

Senator FISCHER. I would love to host you at the University of Nebraska, but I would also like to get you a couple of hours away from Lincoln to Northeast Community College and see the really fabulous things they are doing there with precision agriculture. It is a very exciting time, and it is a growing program for them that reaches out into rural areas of the State and the students they are able to connect with there, and keep agriculture strong.

Dr. JACOBS-YOUNG. I would love to do that. Remember, not in the winter.

[Laughter.]

Senator FISCHER. No. I am well aware of the charms of our State, and I want you to have an enjoyable time. Thank you.

Chairwoman STABENOW. Thank you very much, Senator. I should also tell you, as someone who has been to multiple FFA State conferences, I love FFA and 4-H, and I have lobbied for years that in the summer the young people need to have t-shirts, not navy blue corduroy jackets. Just another word for that.

Dr. JACOBS-YOUNG. Yes, it is hot.

Chairwoman STABENOW. Yes, exactly. Senator Braun.

Senator BRAUN. Thank you, Madam Chair, and good morning, Madam Secretary. By the way, that FFA get-together happens in the great city of Indianapolis each year.

Dr. JACOBS-YOUNG. Yes, it does.

Senator BRAUN. When those kids come to town, it is the most peaceful get-together of a lot of folks in one place, and those blue jackets are all over the place. I was there this summer.

When I came here four years ago I always try to look ahead. I ran a company for 37 years, and if you did not have a good business plan for the future you were always going to end up in a cul-de-sac sooner or later.

I sit on the Budget and Appropriations Committees, and everything we are talking about here today is in peril in the long run if we do not get back to budgeting and appropriations that are done the old-fashioned way, where you go through regular order, where you actually use a budget committee. That should be the most important committee in the U.S. Senate. It is almost kind of attenuating into a useless appendage. I think that puts it in peril. I am on Health, Education, Labor, and Pensions. All the people that come there, to make sure there is going to be R&D there for whatever you are interested in. You do not do that by running down trillion-and-a-half-dollar deficits. We have just kind of woven that into the landscape of how this place works.

I do not want to depress the discussion here, but it is a reality we have got to confront, and until we get that back into place, which is not that difficult—a little bit of political will, a little bit of discipline—some of the things we are talking about here today, for farmers, or for all the folks that are wrestling with hard-to-cure diseases are in that same peril. Because the Federal Government should be the place where you could always go. We should be investing more in that stuff. To do that we have got to be spending less on some of the things that create these chronic now annual deficits.

Earlier it was mentioned the difficulty of the hardest occupation that I think God created—farming. It is the ultimate small business—most are still small business enterprises—fraught with financial risk. I got started back when the farm crisis hit us nearly 40 years ago, and I remember what that was about. That was about the biggest change in farming that we had ever seen in modern times—160-acre farmers had to all of a sudden become 1,000-acre farmers. Now that is a small enterprise. The profit margin, in an absolute sense, has not changed much from what it was then, and you have got all that financial risk.

Really what we do in terms of making it easier for farmers is so important, and Senator Tuberville drilled in on that.

I come from a State that has got one of the heaviest concentrations in the poultry industry, and I think we lead in ducks. We are really large in the turkey grow-out business. I am from one of the two counties in the southern part of the State where there is a lot of activity, and they have recently had to contend with that added uncertainty, the highly pathogenic avian influenza. When that hits, it is basically very few options. You are depopulating farms. You sometimes have to keep them depopulated for a long time. I work closely with APHIS and our other State agencies to ensure that

Hoosier producers are receiving that kind of support, but I can tell you, there is a lot of uncertainty on what is happening.

I want to just hear it from you, that not only for poultry—I think the hog industry has got other issues. We have the chronic wasting disease on our borders that impact the recreational side of things. What is the USDA doing? How high a priority is it? Can I tell Hoosier poultry farmers back home that we are going to be putting more resources into something that, when it hits us, it is devastating?

Dr. JACOBS-YOUNG. Emergency preparedness is something that is always top of mind, and as we look at farm animal diseases, when we look at high-path avian influenza, our partnership with APHIS is top notch. Surveillance is important, diagnostics. ARS is often brought in to do the diagnostics and to help put whatever mitigation program in place.

Avian influenza vaccines are being developed in Athens, Georgia. We just cut the ribbon on a brand-new, $158-million facility, BSL–3 facility, where we do all of our avian research.

We can only be prepared because we have that capacity. Working with APHIS and working with our State and local leaders, we want to be able to come in and be very, very responsive in terms of mitigating the impact. We cannot control the pests and diseases, unfortunately, because they do not respect boundaries, but we can be prepared when we are faced with these.

Senator BRAUN. I think as we become more global in nature it is going to be important that we pour more resources to it, and again, do it in the context of trying to reform some things on a broader scale. Thank you.

Dr. JACOBS-YOUNG. Thank you.

Chairwoman STABENOW. Thank you very much. I believe we have concluded our first panel. Thank you so much. We very much appreciate all of your wonderful work and look forward to continuing to work with you as we move forward on this important title and others as well. Thank you so much.

Dr. JACOBS-YOUNG. Thank you for having me.

Chairwoman STABENOW. We will now move to our second panel, and we will ask our witnesses to come forward as Under Secretary Jacobs-Young is leaving. Thank you again. We will ask all of our witnesses to come forward and begin the second panel.

[Pause.]

Chairwoman STABENOW. We appreciate all of you coming. As usual, members are trying to be multiple places at once, so we expect members to come back and join us during our second panel. Welcome. Good to have you.

Terrific. Well, let me welcome everyone and I want to start by introducing Dr. Rowntree. Dr. Jason Rowntree is a Professor of Animal Science at Michigan State University where he holds the Charles Stewart Mott Distinguished Professorship for Sustainable Agriculture. Dr. Rowntree has led or been a co-investigator on almost $28 million in funding, conducting much of his work at Lake City AgBio Research Center and the Upper Peninsula Research and Extension Center. In his work, Dr. Rowntree engages directly with farmers to support ecological improvements in grazing systems.

I want to thank you, Dr. Rowntree, for being here, and as a twice alum from Michigan State I would say "Go Green."

Dr. ROWNTREE. Go White.

Chairwoman STABENOW. All right. There we go. We got it down. That is great.

Our next witness is Dr. Felecia Nave, who has already been introduced by Senator Hyde-Smith. Just as a reminder, Dr. Nave serves as the President of Alcorn State University in Lorman, Mississippi, and the Nation's oldest public historically Black land-grant university. We are so pleased to have you with us.

I will next recognize Senator Braun, who will introduce our third witness.

Senator BRAUN. Thank you, Madam Chair. The next witness is Dr. Katy Martin Rainey, an Associate Professor of Agronomy at Purdue University's College of Agriculture in West Lafayette, Indiana. Dr. Rainey earned her bachelor's degree from the University of Georgia and her doctorate from Cornell University. She has been a soybean breeder since 2006, starting at Virginia Tech before moving to Purdue.

Dr. Rainey is the recipient of the Purdue Faculty Scholar Award and Director of the Purdue Soybean Center, and a co-founder of Progeny Drone, Inc. She serves as the National Genetic Resources and Advisory Council, the Foundation for Food and Agriculture Research Crops of the Future Advisory Council, and is involved with the leadership of the National Association of Plant Breeders.

Dr. Rainey has received millions of dollars in funding from soybean farmers and has taught plant breeding and genetics to over 850 students.

Chairwoman STABENOW. Thank you very much. Welcome. I will turn now to Senator Bennet for our next introduction.

Senator BENNET. Thank you, Madam Chair and Ranking Member Boozman. It is a great, great privilege to introduce a fellow Coloradan, Steve Ela, as one of our witnesses this morning. Mr. Ela is a fourth-generation grower. He manages Ela Family Farms, extremely well, by the way, and Silver Spruce Orchards as well, a 100-acre organic family farm in Hotchkiss, Colorado, that grows cherries, peaches, plums, pears, apples, and tomatoes.

In 1994, Steve began the transition to organic and today his farm is 100 percent certified organic.

Steve not only brings the Committee his experience as a farmer and as a businessperson but is a leader in agriculture policy. Steve graduated with a degree in biology and environmental geology from Beloit College and a master's in soil science with a minor in water resources from the University of Minnesota. He served on the National Organic Standards Board, including as president. He served with the Organic Farming Research Foundation, the Orchard Pest and Disease Management Conference, the Western Colorado Horticultural Society, and the Colorado Agricultural Commission.

His family's farm also partners with Colorado State University to conduct on-farm research projects. Mr. Ela commands a firm understanding of organic standards and the organic food industry, rooted in years of experience running a farm and working in farm policy.

I am extremely grateful to him for making the trip to Washington to share his experience with the Committee as we consider the 2023 Farm Bill, and thank you again, Mr. Ela, for your testimony. I think I could speak for Steve to say to you, Madam Chair, and the Ranking Member, that you are invited to the North Fork Valley any time to see an incredible, thriving, entrepreneurial, agricultural culture that has built a diverse and strong economy over the last 20 years. Steve Ela has been a huge part of that, so thank you.

Chairwoman STABENOW. Wonderful. We will take you up on it. When you were listing everything that grows I was getting hungry. Thank you so much. Welcome.

Last but certainly not least, I will turn to Senator Boozman for our final witness.

Senator BOOZMAN. Thank you, Madam Chair, and our final witness is Dr. Deacue Fields. Dr. Fields is Vice President for Agriculture at the University of Arkansas, a position he was appointed to in July of this year. Dr. Fields has provided extraordinary leadership for Arkansas agriculture. As Vice President, he is responsible for leading the university system's coordinated agriculture program including the Cooperative Extension Service and the Agriculture Experiment Station.

Dr. Fields has vast experience at several universities which gives him unique insight on how to support research, teaching, and extension work. Prior to his current role, Dr. Fields served as Dean for the Dale Bumpers College of Agricultural, Food, and Life Sciences at the University of Arkansas. For several years he was a faculty member at Auburn University.

He received his bachelor's degree from Southern University in Baton Rouge, Louisiana, his master's from the University of Missouri at Columbia, and a Ph.D. from Louisiana State University, all in agricultural economics. He is married to Dana Fields and they have three sons.

Dr. Fields, thank you for your time and for being here today, and the excellent job that you are doing, not only at the University of Arkansas but throughout the entire educational system.

I yield back.

Chairwoman STABENOW. Thank you very much. Well, we have a distinguished panel and I will ask each of you for five minutes of testimony. We welcome any other written materials that you would like to give to the Committee.

We will start with Dr. Rowntree.

STATEMENT OF JASON ROWNTREE, Ph.D., CS MOTT CHAIR OF SUSTAINABLE AGRICULTURE; DIRECTOR, MSU CENTER FOR REGENERATIVE AGRICULTURE; PROFESSOR, MICHIGAN STATE UNIVERSITY, EAST LANSING, MI

Dr. ROWNTREE. Chairwoman Stabenow, Ranking Member Boozman, and distinguished members of the Committee, thank you for your work and the opportunity to testify about the importance of cooperative extension and agriculture research funding. My name is Jason Rowntree, and I serve as the CS Mott Chair of Sustainable Agriculture and the Co-Director for the Center of Regenerative Agriculture at Michigan State University.

My research relies heavily on Federal agriculture research funding. In fact, I have led or been a co-investigator on research encompassing more than $27 million from the USDA Sustainable Agriculture Research and Extension Program (SARE), USDA National Institute of Food and Agriculture (NIFA), and the Foundation for the Future of Agriculture (FFAR). Most recently, I pioneered a $19.2 million FFAR soil health grant entitled, "Metrics, Management and Monitoring. An Investigation of Pasture and Rangeland Soil Health and Its Drivers."

The United States has the most efficient agricultural system globally. Technological advancements and intensification have enabled greater crop yields and improved animal productivity. However, these intensive practices have come with environmental costs such as greenhouse gas emissions, water contamination, and the erosion of our most prized agricultural resource—soil. Soil losses endanger agricultural resilience by increasing drought vulnerability, reducing productivity, and releasing carbon dioxide into the atmosphere. These challenges, coupled with global unrest and a growing population, places immense pressure on our agriculture resilience. Today, now more than ever before, domestic food security is inseparable from national security, and our national security hinges on our long-term climate security.

Investing in extension and agriculture research is a powerful and straightforward way to ensure we develop innovative solutions to these challenges. Further, we must envision holistic solutions that are well-suited to address the complexity of agriculture. In my experience, the philosophy of regenerative agriculture is well-suited to this challenge.

At the MSU Center for Regenerative Agriculture, we define regenerative agriculture along NRCS's five soil health principles: keeping soils continuously covered, minimizing soil disturbance, increasing biological diversity, keeping living roots in the soil, and integrating livestock. While implementation varies by farm, practices aligned with these principles are associated with promising soil health and carbon sequestration outcomes, and they are doing this while reducing inputs and not sacrificing profitability.

Importantly, this movement is farmer and rancher led. Just this week I watched a YouTube video of a farmer who is growing 200-bushel corn in western Kansas with no nitrogen or phosphorus application. To me, this is the growing "culture" of agriculture. As these producers experiment and learn from one another, there is a need for Extension to help troubleshoot, educate, empower, and facilitate. Supporting and expanding Extension in this way is crucial to the success of regenerative agriculture as a climate solution.

Experimental and on-farm research is equally important to this mission. Participatory research, where academics connect with on-the-ground producers, is essential. The USDA SARE Program is well-suited to this mission. However, there is a large gap between the demand for these projects and available funding. In my experience, only about 10 percent of farmer-and academic-led sustainability grants are successfully funded, while half the submissions were worthy of funding. Expanding participatory research impact is also feasible for USDA NIFA and FFAR.

Last, with the advent of natural capital markets, such as soil carbon offsets, research is desperately needed to facilitate the accurate and efficient quantification of ecosystem services. The Natural Capital Project at Stanford University indicate that the first law of a successful natural capital market is that the transaction must yield the desired effect. Essentially when a company purchases a CO2 offset, there must be proof that the offset is grounded in real soil carbon sequestration. A handshake does not count. This requires rigor, accuracy, and robust accounting protocols that help us do things like avoid double-counting.

In the landmark document, "A National Strategic Narrative," three core components were emphasized for future national security: Land, Energy, and Water. In the face of a changing climate, nothing could be truer today. With the known challenges to agriculture's future, the question that must be posed, and especially thinking of our younger generations, is what level of food security risk do we assume by not acting? The easy bet is that continued and increased investment in Extension and Research will work to ensure we regenerate our food production system, mitigate climate risk and enhance national security for future generations.

Thank you again for the opportunity to address the committee and I look forward to any questions.

[The prepared statement of Dr. Rowntree can be found on page 51 in the appendix.]

Chairwoman STABENOW. Thank you so much. Dr. Nave, welcome.

STATEMENT OF FELECIA NAVE, Ph.D., PRESIDENT, ALCORN STATE UNIVERSITY, LORMAN, MS

Dr. NAVE. Thank you. Good morning, Chairwoman Stabenow, Ranking Member Boozman, and members of the Committee for inviting me to participate in today's hearing. I am Felecia M. Nave, and I have the privilege of serving as the 20th President of Alcorn State University, which is located in Lorman, Mississippi. I also serve on the Executive Committee of the 1890 Council of Presidents, and I am honored to speak to you today representing the 1890 University community.

On behalf of the 1890 Council, which is comprised of the 19 presidents and chancellors, I thank you for your past support and for your future commitment to the growth and expansion of the 1890 land-grant system, a commitment that furthers the educational attainment, economic prosperity, and health of the families, businesses and communities that our institutions serve. The impacts of our universities are significant and the positive outcomes for the communities we serve, and the Nation, are even greater.

As a point of personal privilege, I want to share a little background about Alcorn State University. Founded in 1871, Alcorn traces it heritage back to both the 1862 and 1890 Morrill Acts. Alcorn is unique among the 1890 institutions because it is the only HBCU founded with a land-grant purpose after the first Morrill Act, making it America's oldest public historically Black land-grand institution.

The 2023 Farm Bill presents an excellent opportunity to build on key gains for the 1890's that were included the 2018 Farm Bill. It

is also an opportunity to increase the financial support in critical growth areas, scale initiatives that have proven to be effective and successful and address other areas of significance to the 1890 community. In my written testimony I submitted for the record I outlined several key areas that we would like to work with Congress and the members of the Committee on in the reauthorization of the 2023 Farm Bill.

Our work at the Socially Disadvantaged Farmers and Ranchers Policy Center, which was authorized in the 2014 Farm Bill, is an example of the important work of taking a policy idea and turning it into actionable items for the success of socially disadvantages ranchers and farmers.

As you know the 2018 Farm Bill included key investments in student scholarships and centers of excellence at the 1890's. Our universities are very grateful for the funding provided to support scholarships with students interested in pursuing careers in agriculture and agriculture-related fields. The new scholarship program is working. We are recruiting and preparing a diverse and talented new generation of agricuralists and food scientists. Your continued support for the permanent expansion of this scholarship program will have a significant impact for our students, their families and the long-term benefit of the country.

The funding that was provided in the 2018 Farm Bill to establish the six centers of excellence support innovative research and programming at our institutions. However, it is imperative that funding included in the 2023 Farm Bill to stand up a center at each university as it drives our ability to remain competitive and contribute to the research vital to the communities that we serve.

Congress also included in the 2018 Farm Bill a reporting requirement that States share with USDA the one-to-one funding match requirement for research and extension they are supposed to meet. Although Mississippi meets its match, unfortunately several States are still falling short of this requirement and the resulting nearly $30 million of underfunding in just the last three years continues to undermine the Federal investment that Congress is making available to our institutions.

There is a great need for an increased investment to grow the footprint and outreach of the extension agents at the 1890's. The agents are embedded in our communities and serve as the boots on the ground. With more resources, our agents would be able to serve more in our communities. As you know, our 19 universities are mainly in the rural areas of our States. We train our students for jobs and careers and many of them have to leave our communities to secure employment in their respective field.

As we look to the 2023 Farm Bill, the 1890 universities would like to work with Congress and this Committee to find ways through the USDA Rural Development Agencies to bring economic development opportunities to the surrounding areas of our school. The goal would be to create meaningful jobs prospects for our students to consider working and living in the communities that we serve.

Last, for our institutions to remain competitive in emerging areas, increased funding is required to support the modernization and expansion of our research and technology infrastructure and to

build capacity. Congress has realized this critical importance with the recent passage of the CHIPS Act. We want to partner in these efforts and the work of this Committee, and the resources provided in the farm bill can help make that a reality.

I am grateful for this opportunity to address the Committee. On behalf of the dedicated faculty, staff, and students at Alcorn State University and throughout the 1890 university system, I thank you for your continuous support of our institutions and agriculture.

[The prepared statement of Dr. Nave can be found on page 55 in the appendix.]

Chairwoman STABENOW. Thank you so much, Dr. Nave.

Dr. Rainey.

STATEMENT OF KATY RAINEY, Ph.D., ASSOCIATE PROFESSOR; DIRECTOR, PURDUE SOYBEAN CENTER, PURDUE UNIVERSITY, WEST LAFAYETTE, IN

Dr. RAINEY. Good morning, Chairwoman Stabenow, Ranking Member Boozman, and members of the Committee. I am Dr. Katy Martin Rainey, Associate Professor of Agronomy at Purdue University. I am pleased to offer testimony on behalf of the American Seed Trade Association.

Breeding and distributing the best seeds and other stocks is integral to U.S. farm productivity and food security, and requires substantial investments in R&D. A critical element of crop improvement research is public-private partnerships. Thank you for shining a light on the importance of agriculture research.

Now more than ever, U.S. agricultural production is faced with an array of emerging threats like extreme weather and new pests, combined with needs to provide enhanced ecosystem services such as improving water quality. U.S. seed companies, public and private scientists, and U.S. producers will continue to innovate to improve crops and production practices thanks to cutting-edge research.

Strong investments in research means better outcomes for our farmers, our consumers, our land, and our environment. I would like to offer a few examples highlighting the value of public-led plant research.

I leverage economically valuable crop breeding research to also advance digital agriculture capacity for remote crop growth estimation, known as phenomics, and I launched a successful software company in this space. Because of my federally funded training in entrepreneurism, I am seeking to extend my technology to facilitate effective on-farm research.

A USDA geneticist at the Plant Genetics Research Unit in Columbia, Missouri, discovered soybean mutants that produce healthier oil, and then collaborated with the University of Missouri soybean breeder to develop new varieties with funding from commodity organizations, the USDA, and the university.

Lettuce is one of the most widely consumed vegetables in the U.S. Scientists at UC Davis and ARS are collaborating to develop and release varies and breeding lines for the private sector, with critical resistance to diseases.

It is the truth that every bite of lettuce contains USDA genetics, and thanks to private and public sector R&D investments over

time, gene editing is one of the most promising areas of crop improvement research. For instance, non-grounding varieties of fruits and vegetables like potatoes, avocados, lettuce, and apples could significantly reduce food waste.

We rely on support of the farm bill funding and programs to ensure continued U.S. leadership as the provider of the best seed to the world. ASTA worked closely with Congress to mandate the development of a strategic germplasm and cultivar collections assessment and utilization plan for the National Plant Germplasm System. We look forward to its publication which establishes a roadmap for the sustainability of NPGS for years to come.

ARS capitalizes on long-term investments for high-impact payoffs. Its management of vast collections of genetic resources cannot be done by an individual university or company. The Germplasm Enhancement of Maize project is a great example of utilization of the NPGS. That project identifies useful genetic diversity in exotic germplasm for commercial use in developing U.S. corn hybrids.

Another key initiative is land-grant capacity funds through the farm bill, which allow land-grant universities like Purdue to invest in infrastructure and people for cutting-edge research and extension that directly impacts farmers. Consider as well that land-grants are critical to agriculture through our role in STEM education. About 59,000 U.S. graduates with agricultural expertise are needed per year, and land-grant universities educate this work force.

Nonetheless, we face unprecedented infrastructure challenges. U.S. scientists and educators are asked to perform 21st century science in facilities constructed in the 1950's and 1960's, and this negatively impacts recruitment of the best and most diverse talent to study critical topics in food security. Robust support is needed via the Research Facilities Act in this farm bill.

The National Institute of Food and Agriculture's competitive grants program funds extramural research, education, and Extension projects. We are encouraged that AFRI received funding increases in recent congressional appropriations cycles, but it continues to be funded significantly below its authorized level.

Similarly, the Foundation for Food and Agriculture Research is the primary entity promoting public-private partnerships in this space by leveraging Federal funding to bring private sector investments and knowledge to public scientists. With an average matching rate of $1.40, FFAR is on track to invest nearly $1 billion.

There is a misconception that the private sector has the basic and applied research needs for row crops covered. Private investments in row crops deserve corresponding investments in public investments, because these crops, such as soybean, are so economically valuable and critical to national security.

The Economic Research Service and the National Agricultural Statistics Service provide foundational data in socioeconomics and statistical insights that are critical for stakeholders. The tools and services provided by these agencies inform the decisions of seed companies and the rest of the private sector, as well as scientists, producers, and policymakers.

For instance, providers across the country seek to adopt conservation practices such as using cover crops to improve soil health.

Information on acres and types of cover crops planted would help producers and the seed industry ensure the availability of high-quality cover crop varieties at the right place, in the right time.

The Agriculture Advanced Research and Development Authority, or AGARDA, was established in the last farm bill to support transformative advances the industry by itself is not likely to undertake because of financial uncertainty. One great area of potential within AGARDA is to promote agricultural resiliency with data. A reauthorized and robustly funded AGARDA would position USDA to lead agricultural data stakeholders in the implementation of badly needed data infrastructure.

As we deal with ever-increasing challenges facing the future of our planet, all of these programs have unique roles, creating solutions for more secure and sustainable future while keeping the U.S. competitive globally. Breeding high-quality, state-of-the-art seed will bolster practices for climate adaptation and mitigation and habitat restoration while also benefiting farm productivity.

In summary, strong Federal investments in agriculture research, leveraged through public-private partnerships, ensure the success of U.S. farmers in a sustainable global food production system.

Thank you for the opportunity to provide remarks today, and thank you for your continued support for agriculture research programs.

[The prepared statement of Dr. Rainey can be found on page 61 in the appendix.]

Chairwoman STABENOW. Thank you very much.

Mr. Ela, welcome.

STATEMENT OF STEVE ELA, PARTNER AND MANAGER, ELA FAMILY FARMS, HOTCHKISS, CO

Mr. ELA. Thank you. Thank you for the privilege of being here. It is a true pleasure to be able to speak.

I am going to start with the question my grandfather would have asked in 1945: Do you substitute DDT for lead arsenate to control worms in apples? That was the question of those days.

In four generations we have grown fruit in pretty much every which way possible, using many different techniques. We have marketed every different way in 115 years. I am going to return to that research question of what do we choose.

Every day when I walk out of my door to my farm I have to make choices—crop load management, fertility, irrigation management, thinning, labor, economics. I can make those choices based on research and knowledge on research and data, or I can guess, or I can put my finger in the wind, or I can use my experience or my intuition. The more I can base that information and that knowledge on research and use that to make those decisions, the better grower I am going to be.

Coming back, lead arsenate or DDT? That is the question my granddad had to answer, and the problem with that is we are talking about a substitution. We are talking about this or that. As an organic grower—I have been conventional; I am now organic—I have learned to get away from those single questions and get into systems. I want to ask, if I am going to integrate into a system, how am I going to make decisions? Rather than saying DDT or lead

arsenate, why would I not ask, what cover crop would I plant? What cover crop would I plant that would enhance the biodiversity of my farm, that would enhance the beneficial insects that will help control the aphids and the mites and the worms? At the same time that cover crop could be providing fertility that I do not have to buy from off-farm, because it could be fixing nitrogen from the air, so fertility is not a supply chain issue. At the same time that cover crop could be providing soil organic matter which will enhance the water-holding capacity of my soil, which will make my irrigation management easier. At the same time, that cover crop could also be sequestering carbon and helping with our climate change.

I am going to challenge you today, as we talk about research, to change the paradigm of how we think, from single endpoint inputs to multiple systems thinking. This is the new way we have to go, and it goes with regenerative agriculture, it goes with organic, it goes with conventional agriculture. I am going to say that that systems approach is going to help solve multiple problems at once. We no longer have the time or the money to be able to solve each problem one by one. We need to think globally and we need to think in terms of ecosystems, and that is the paradigm we need to go toward.

I am also going to say that when we invest in that, and those organic systems, and how the farm system works, we are not just benefiting organic growers, we are going to benefit all agricultural growers, conventional growers as well. Some of the projects that have been done, say in the 1990's, with codling moth and worms, with pheromone mating disruption, they were pioneered on organic farms, and they are now used by nearly 80 percent of the conventional industry.

If we want to talk about cover crops, which NRCS is pushing now, if we want to talk about regenerative agriculture, those are the mainstays that have always formed the foundations of organic agriculture. Those things are benefiting all of us, conventional, organic growers as well.

The final thing is that we need to have organic research as part of all of our organic research programs. As a grower, we have conducted on-farm research with a number of universities. We have worked with Michigan. We have worked with Arkansas. We have worked with Colorado. We have worked with California, Oregon, and Washington. We have worked with programs like OREI. We have worked with SARE. We have worked with SCRI. We have worked with ARS, and we have worked with Regional Seeds and Breeds Programs. Each of those, having an organic component and increasing the organic specific funding will help us change the paradigm of how we can work forward and use biological systems that will make us stronger.

We are going to face unprecedented changes. We are facing climatic changes. We are facing more freezes, more rainfalls. We are facing invasive insects. We are facing higher input costs. Looking at these as a system where we can solve multiple problems with a system and not just one by one, will make us a much stronger agricultural system.

Thank you for having me here today.

[The prepared statement of Mr. Ela can be found on page 67 in the appendix.]

Chairwoman STABENOW. Thank you so much. Really important insights.

Dr. Fields, welcome.

STATEMENT OF DEACUE FIELDS, Ph.D., VICE PRESIDENT FOR AGRICULTURE, UNIVERSITY OF ARKANSAS SYSTEM DIVISION OF AGRICULTURE, LITTLE ROCK, AR

Dr. FIELDS. Thank you. Chairwoman Stabenow, Ranking Member Boozman, and members of the Committee, I am grateful for the opportunity to testify on behalf of the entire land-grant system. I am also grateful for the significance this Committee has placed on the research title of the next farm bill, as evidenced by this hearing.

As Senator Boozman mentioned, I have either been a student or a faculty member at three of the Nation's premier 1862 land-grant institutions, and two premier 1890 land-grants before coming to the University of Arkansas. I consider myself a walking billboard for the power of the Nation's land-grant system to connect a young man from a small agrarian town in northern Louisiana with the world.

Through my various roles I have witnessed the transformative strength of the land-grant system which marries vision with relevance. It is the foundational stone that undergirds public and private advances in research and innovation, trains our future, allows us robust resiliency in the face of continual and mounting challenges, and is the nucleus of the world's food security.

Federal support for teaching, research, and extension has been critical for over a century and a half. Building on this noble legacy, I want to share some additional recommendations.

Earlier this year, we talked about the Economic Research Service and the decline in public support for agricultural research. Seventy percent of agricultural R&D is performed at land-grant universities and other non-Federal entities. The global competitiveness of U.S. agricultural research is challenged as public investment declines disproportionately.

Land-grants have successfully leveraged Federal resources, provided and informed collaborative partnerships with other land-grants, industry, State, and county government. Using Arkansas as an example, in 2022, the State appropriated funds accounting for 56.5 percent and Federal capacity funds accounted for 6.3 percent of the total University of Arkansas Division of Ag budget.

From 2017 to 2022, the share of the Federal capacity funding decreased by 2.8 percent while extramural funding from grants increased by 2.1 percent, and county extension program funding increased by 1 percent. Industry grants account for about 45 percent of all extramural grant funding at the University of Arkansas.

In Arkansas, USDA Ag Research Service units are either housed in or co-located with or supported by the UA system entities. This was seen as a necessary way to leverage ARS investment while benefiting the scope and reach of the UA system research. Over a 20-year period, beginning in 1990, the Division of Agriculture met

regularly with national and regional ARS administrators to help ensure complementarity of our research activities.

At every land-grant institution in the country, our research infrastructure is degrading and literally crumbling in many instances. We cannot try to do 21st century research in mid–20th century facilities, which was the last time a major investment was done in our research infrastructure.

The University of Arkansas Division of Agriculture estimated deferred maintenance costs of nearly $100 million. Within the last five years, we have managed to bring two new facilities online. We have saved 13 years to be able to begin construction on one facility, forcing us to abandon sorely needed maintenance and renovation on existing facilities. On the other, we were forced to remain a substandard facility 15 years beyond its time to be razed before we could cobble together enough resources to replace it.

Land-grants are expected to be able to evaluate and showcase the latest technology, but in many cases our agricultural producers have more modern technology than we do. One of the most impactful things our Federal partners can do is invest in the infrastructure necessary for us to continue to do cutting-edge research, extension, and teaching programs. Reauthorizing funding for the Research Facilities Act will allow land-grant institutions to modernize our research facilities and begin to address the $11.5 billion backlog of deferred maintenance nationally.

Land-grant universities have proven their ability to bring world-class solutions to grassroots problems throughout the country. Our research discoveries have resulted in U.S. being able to have the safest, most efficient food system in the world. We must make bold moves to have infrastructure and technology necessary to improve efficiency, profitability, and health while protecting the environment in rural and urban communities.

It is critical that agricultural research funding increase to remain a global leader and produce the technological advances necessary to meet the challenge of feeding the growing global population. Supporting agricultural research and infrastructure development is not a donation, but an investment in the future of national and international food security.

Thank you.

[The prepared statement of Dr. Fields can be found on page 73 in the appendix.]

Chairwoman STABENOW. Well, thank you so much, and thank you to each of you for really important testimony. Let me start with Dr. Rowntree, and thank you again for being here. It is always great to see a fellow Spartan here at the table.

Much of your career has focused on using extension to help farmers implement research on the ground to really improve resiliency of farms, as you talked about. In the next farm bill, how can we strengthen ag research and extension to help our farmers become more resilient to the impacts of the climate crisis?

Dr. ROWNTREE. Thank you, Senator Stabenow. Great question. I look back to when I first started in my career, and at Michigan I believe we had like six to seven beef specialists out in the state that were extension folks, and over time that has dropped significantly. I can say the same about dairy and other things. I think

having boots on the ground regionally is going to be highly important.

I think simultaneously as we do get more folks into the regions and out away from East Lansing and into the State, I think simultaneously education of those folks is key. I believe that we have the knowledge to mitigate climate. We have the knowledge to impact resilience. We always need more, obviously. I think through the investment in these typically younger folks going out into these areas and investing in their education or understanding of ecology, their understanding of technology will be highly vital.

I think finally, just thinking through this, from the standpoint of encouragement of funding that has been historic of merging extension and research, I think should absolutely continue. In fact, most of the researchers I work with today are getting more and more good with extension, and I think the auspice of even considering our extension folks as applied, on-farm researchers that can be the hands and feet of said land-grant are going to be important as well.

Chairwoman STABENOW. Great. Thank you very much.

Dr. Nave, I appreciate you joining us as well and for educating the next generation of our food and agricultural professionals, and the 1890 land-grant institutions are absolutely vital to improving our diversity and also uplifting rural communities. Thank you for being here.

How have the investments provided by Congress in the 2018 Farm Bill strengthened your ability to reach more students and recruit qualified faculty members at Alcorn State?

Dr. NAVE. Thank you, Chairwoman Stabenow. Great question. The support that we receive through the scholarship program has been absolutely impactful to our ability to recruit talented students, to increase the interest in the agriculture field, agriculture-related fields, and being able to come in and to be successful. It lowers the financial burden for those students, so they are able to concentrate on making sure that they are being prepared, trained, and ready to go out into the work force. The scholarships have been monumental in supporting the work that we do in being able to serve the communities that we serve.

As mentioned by my colleagues here, although there have been great gains, because of the significant infrastructure challenges that we face in delivering a more modern experience and being able to address some of our modern challenges nationwide, being able to improve our facilities is monumental. I cannot stress enough the impact or the need to be able to provide first-class facilities in attracting students and faculty and staff so they can continue the innovative research that will be needed in order to address many of the challenges that we have.

Although the support has continued to be there, when you look at the communities that we serve, the need are great, and they can be greater because in our areas, particularly in our rural communities, we lack so much. The investments need to be even greater in order to reach an additional level of parity for our communities.

Thank you for the question.

Chairwoman STABENOW. Thank you very much.

Mr. Ela, first of all, thank you again for being here. I know it is hard when you are operating a farm to be able to get away and be here. Your perspective is really important.

How are the research needs of the organic sector unique, and what are the ways we can better support organic farmers when we are looking particularly at the research and extension programs?

Mr. ELA. I think the research needs are unique in several ways. One is because we are learning about systems—and I have said that over and over—but it really was a change of thinking for me as a grower from what can I do with solving one problem at a time, I am going to change one thing, for one reason, then I am going to change something else, to thinking of my whole farm as a unique entity and as a whole system.

Long-term projects that allow the system to become a system and to set testing different ideas, looking at multiple answers. If we are talking about beneficial insects, I want to support multiple beneficial insects, not just one. If the climate changes in one year or another, then one or the other insect is going to help. We are going to have to look at larger perspectives.

The other thing, I think, is that we just need to really look at natural systems and learn from them, because the natural systems themselves, when I watch and let the system do the work for me, I always learn something. I am a lazy person. I do not want to have to go out and work. If I can let my farm do the work for me, and then I intervene when I absolutely need to, there is more power to it. I would rather go to lunch. I would rather have coffee. I would rather do other things. Having a system on my farm and researching those systems I think is very unique, but it also will benefit all growers.

Chairwoman STABENOW. Thank you very much. I am sure you are not lazy. My guess is you are just very smart, so thank you for your testimony.

I am going to turn it over to Senator Boozman and apologize that we have a vote just started on a Michigan judge on the floor, and I need to be on the floor. To my Ranking Member I am going to turn over the gavel. Very good. Thank you so much.

Senator Boozman.

[Presiding.] A little responsibility here.

Chairwoman STABENOW. That is right.

Senator BOOZMAN. Dr. Fields, welcome again to the Senate Agriculture Committee, and we are so proud of the work that you are doing in Arkansas, and really throughout the system. In your testimony you highlight, and as others have highlighted also, the considerable need for infrastructure, even in a system such as the University of Arkansas, where private and State resources are vast. Can you walk us through your specific needs? What research outcomes are we potentially losing by not investing in infrastructure across the land-grant institutions?

Dr. FIELDS. Certainly. Thank you for that question, Senator Boozman. As I mentioned, you know, just at the University of Arkansas, our needs in terms of deferred maintenance total about $100 million. Our immediate needs there, we have buildings that we are trying to conduct 21st century research in, such as our Food Science Building, where we have the Arkansas Food Innovation

Center that is there. Places like that, where we try to do what is innovative, we are doing in substandard facilities, and I think that is the case nationally.

When we talk about what we have missed, I can say that almost every university has missed opportunities to hire top faculty as a result of the infrastructure that exists. We personally had two faculty members for an endowed position that we lost as a result of substandard facilities.

We are trying to conduct low-moisture research in a facility where we cannot get the relative humidity below 80 percent.

We are doing things to try make this work, but there are several opportunities that we are missing. When we look at our opportunities to be competitive for extramural funding, the folks funding that research anticipate that we will have the facilities necessary to conduct the research and to conduct that research at a high level, and at that point we are missing a big opportunity based on where our facilities are.

Have kind of tried to put together a strategy at the University of Arkansas, but I think nationally our land-grant partners have looked at ranking priorities for facilities that give them an opportunity to be aggressive at taking advantage of things that are current issues, and being able to address high technology and issues that exist throughout our Nation.

Senator BOOZMAN. Very good. Dr. Rainey, thank you for our work and for you highlighting several important programs. In my view, you demonstrate the ideal partnership between publicly and privately funded research and what is possible when this enterprise is working at its best.

I guess the question that I have is, in addition to funding these key programs what else can Congress do to unleash innovation in biotechnology and seed production?

Dr. RAINEY. Great question. Thank you. Primarily what we need is regulatory alignment between USDA, FDA, and EPA, and that is absolutely necessary to fully realize the potential for innovation in agriculture and to maintain America's position in agriculture leadership, and to ensure that our farmers have access to the latest tools, technologies, and plant varieties.

We are here asking for investments in research, in a range of areas and a range of topics, but we need to make sure that the regulatory environment and policies are in place that allow innovation to reach farmers' fields and the consumers' plate. For example, gene editing technology has a lot of promise to impact nutrition, as we were talking about when Dr. Jacobs-Young was here. Gene editing can make foods more palatable and last longer, but we need to have policies in place for those products to reach the market. Regulatory alignment between USDA, EPA, and FDA. Thank you.

Senator BOOZMAN. Very good. Thank you. As I mentioned in my opening statement, I continue to be concerned by our global food security situation. Talking to people like David Beasley, head of the World Food Programme, we have a significant problem, especially in the next few years. Sri Lanka is not alone in pushing misguided policies that will have devastating impacts on food production. The Netherlands is currently forcing farmers to comply with ever-increasing environmental mandates or face a compulsory land buyout

situation which it is estimated will lose thousands of family farms there as a result of that.

Countless nations continue to enact biotechnology bans, and if the European Union continues down its road, they risk having only marginal agricultural production left. The list goes on and on. Inefficient production practices and misguided government mandates will negatively impact world hunger.

I guess, again, anyone can jump in that would like to, but in your view how can innovation help us continue producing food and fiber efficiently? What does Congress need to do to help you continue with the trajectory that we have on the chart? I agree with you, Mr. Ela. Your grandfather had the choices. The good news is that if you look at this chart, back in his year the trajectory has gone up here, with the inputs staying fairly the same.

The other thing, too, and I agree with you totally in looking at systems, okay. The problem that we face so often here is we try and put the same system in every situation. In other words—and you know better than this and you are an expert, all of you all are—but the system that works on your farm, with your moisture content, with your soil, is different than the system that works where Dr. Fields grew up, in Louisiana.

If anybody would comment very quickly, or I am going to have to gavel myself down.

Mr. ELA. Well, if I could quickly respond, I think you have actually pegged it. Yes, the systems are different. The tenets of the system, the basis—so how do nutrients transform in soils—there are some consistencies. As we face that our climate is changing, we are going to have to look to those other systems to see what we can do on our farm to change things to make them more resilient.

The system itself, I want to stress it is redundant, it is resilient, and that is going to be the important part. We are not going to do it overnight, and they are going to be different, and they are going to be regionally adapted, and that is the point. One size does not fit all in this changing world at this point. We are going to have to learn and adapt.

Senator BOOZMAN. Senator Braun. Thank you, and again, thank you bringing that up. That really was my point.

Senator BRAUN. Thank you, Mr. Chairman.

Dr. Rainey, we had a nice conversation earlier today and focused on a couple of things. One was the increasing anxiety among farmers going through a year like 2022, where most indicated to me—I visited all 92 counties, the last one was riding in a combine in Spencer County, just south of where I live—that they just made it through all that uncertainty. He and others have expressed they are worried about 2023. I think that is even going to be a tougher scenario to get the crop out and all the inputs you actually need.

Tell me what you think we need to do better that can approach, through the R&D side, both revenue enhancement, to do all the things that technology has maybe kind of weighed in on for agriculture, and then cost savings. Because that elusive bottom line, which seems to go higher and higher in terms of the altitude of your revenues, and the profit margin absolutely stays the same, I think farmers could really be interested to seeing how it is not so thin each year, trying to craft a bottom line.

Dr. RAINEY. Okay. You are asking how to increase revenues for farmers? Well, they are taking the chart away that showed we have exponential increases in output with the same input.

Senator BRAUN. What are a few of the things that we need to either spend more money on? What are the breakthrough areas, because that is the next thing I am going to ask you. What are the two or three kind of most optimistic areas of research that would help craft a better profit, either through revenue enhancement or cost reductions?

Dr. RAINEY. Right, and this goes back to what Senator Boozman was talking about, his concern for global food security. There are a number of technologies. I mean, I am very hopeful about the outlook for global food security. There are a number of technologies that are yet to be explored or are yet to be deployed. Some promising technologies that need both investment and a favorable regulatory and policy environment, include gene editing, as we have been talking about, or I mentioned earlier. Another promising area is so-called predictive analytics in the seed industry. That is a huge area of investment and cost savings, and will also bring more productive seed to farmers.

You mentioned that farmers need to save money on inputs, and really, I am so excited about the see-and-spray technology, which is where we use sensors to detect weeds and then deliver herbicides, in this case, in a very concentrated and effective way. I think that the sensor-based technologies, in general, will really help farmers with their bottom line, though they are expensive to invest in, of course.

Then I think the fourth promising area for the outlook of global food security—I am not sure about saving the farmers' bottom line—but it is the sort of information-sharing and just national coordination around conservation practices. You know, we have been talking about how, in the future, we are going to move toward even more sort regional or localized solutions, but I think we need national coordination, discussion, communication, and education where information flows both ways. I think AGARDA is really important to that.

Going back to the farmers' bottom line, I think the land-grants have a role in that, with Extension, and that we need an independent, unbiased source of information for our farmers to make decisions. Like you were saying, you need data for decisions, and it helps to have a third-party voice in that.

Senator BRAUN. When you are talking about discussion, I was asked in the Senate Climate Caucus, as a freshman Senator, when no one else would do it on my side of the aisle. We have come a long way. We actually passed a bill that went through the Senate, 92–8, Growing Climate Solutions Act, which would have matched up good stewardship with preexisting markets. Senator Boozman was very important in getting that across the finish line.

Well, alas, it is sitting over in the House, and has for a year, and every farm group was for it. You still run into political snags, and that is a place where I can tell you, in the three years since I have been there, not only agriculture, electric generation, industrial emitters, steel and concrete, transportation, all the CEOs, all the thought leaders in this country are recognizing it. Agriculture,

since we met, I think only 10 percent through agriculture in the greenhouse gasses, 25 percent across the world, we got a lot to show others. I hope that is going to be something on display for an issue that is important.

Dr. RAINEY. Yes, you mentioned conservation, and we have been talking about research and farmers, and an area to invest in, I think is nationally coordinated on-farm research for conservation practices. I think that is where we are going to get the critical mass of data in place and analytics to start making, I guess, evidence-based decisions, policies, management decisions around conservation and climate mitigation.

Senator BRAUN. Thank you.

Senator BOOZMAN. Thank you, Senator Braun, and thank you for your leadership on the Growing Climate Solutions bill. We appreciate it.

Again, I thank the panel for being here. You all did a great job. We learned a lot. You had really significant participation from lots of members of the Senate. We appreciate you pushing your message out, and it really will help us as we try and get things in the future with the farm bill, and look forward to continuing to ask you for your advice.

With that the hearing is adjourned.

[Whereupon, at 12:23 p.m., the hearing was adjourned.]

A P P E N D I X

DECEMBER 6, 2022

Statement by
Dr. Chavonda Jacobs-Young
Under Secretary for Research, Education and Economics
Before the Senate Committee on Agriculture, Nutrition & Forestry
December 6, 2022

Chair Stabenow, Ranking Member Boozman, and Members of the Committee, thank you for the opportunity to come before you today to discuss the state of the United States Department of Agriculture's Research, Education and Economics (REE) mission area, which includes the National Institute of Food and Agriculture (NIFA), Agricultural Research Service (ARS), Economic Research Service (ERS), National Agricultural Statistical Service (NASS), and Office of the Chief Scientist (OCS). The success of the REE mission area is rooted in partnerships—partnerships with technical assistance providers, including the Cooperative Extension System, that give producers the tools they need to adapt as they feed the world, with institutions to advance agricultural innovation and cultivate the next generation of agricultural leaders, and with Congress to ensure that decision-makers have the tools they need to support farmers and ranchers across the country.

Production agriculture requires constant innovation and adaptation as farmers and ranchers pursue climate-smart solutions to extreme weather, rural businesses seek new markets, and underserved communities seek trusted partners to tackle systemic issues. Access to information and new technologies underpins each of these objectives, and when appropriately resourced, REE is well-positioned to be a partner in providing timely research, data, training, Extension services, and economic analysis to support informed decision-making.

For example, ARS and Forest Service through USDA's ten domestic Climate Hubs deliver science-based, region-specific information and technologies to agricultural and natural resource managers. These Hubs link USDA research and program agencies to deliver the timely and tailored support agricultural producers and professionals need to make climate-informed decisions on the ground. This model of providing science-based climate tools and strategies through coordinated technical assistance has proven especially effective at reaching underserved and vulnerable communities and tribes.

The U.S. has a long track record of making investments in research that pays off for farmers and our economy. Between 1948 and 2019, total agricultural output in the United States grew by 142 percent[1]. This rise cannot be attributed to increases in agricultural land or labor—both inputs declined over the period—but stem instead from the adoption of a whole suite of publicly-funded innovations in crop and livestock breeding, nutrient use, pest management, and farm and field management. These new practices have yielded significant dividends; ERS found that public agricultural research and development investments from 1900 to 2011 generated, on average, $20 in benefits to the U.S. economy for every $1 of spending.[2]

[1] https://www.ers.usda.gov/data-products/agricultural-productivity-in-the-u-s/agricultural-productivity-in-the-u-s/#National%20Tables

[2] https://www.ers.usda.gov/amber-waves/2022/june/investment-in-u-s-public-agricultural-research-and-development-has-fallen-by-a-third-over-past-two-decades-lags-major-trade-competitors/

Yet, federal investments in agricultural research have declined by a third in the past two decades, falling far behind our international partners.[3] Once the world's leader, the United States now trails far behind other major nations in public agricultural research investments. This declining investment means that we are missing critical opportunities to capitalize on the powerful potential of our world-class scientists to conduct the type of high-risk, high-reward research necessary to meet the overlapping and rapidly emerging challenges our farmers face. The United States, through USDA, can once again lead the world in discovering and disseminating solutions to global agriculture and natural resource challenges through highly responsive, transdisciplinary and convergent research.

Alarmingly, another impact of these declining investments is that there are not enough college graduates available to meet private and public sector employer needs across the food, agriculture, renewable natural resources and the environment (FARNRE) disciplines. According to NIFA-supported research published by Purdue University in the 2022-2025 Employment Outlook Report Summary, employer demand for college graduates with degrees and expertise in FARNRE will continue to exceed the number of available graduates. Of the 59,400 annual job opportunities expected within this period, 31% (or 18,400) are projected to be for graduates from science and engineering fields.

This employment gap comes at a time when extreme weather is leading to large crop and livestock losses for farmers and ranchers, resulting in greater liabilities for producers. Innovative research in climate science has never been so critical nor had such a positive impact on the U.S. economy.

That's why I am pleased that President Biden and Secretary Vilsack are strongly committed to supporting federal agricultural research, development, and deployment, which will define innovation for decades to come. I believe a few things are critical to ensuring REE's mission stays on track—supporting workforce development efforts, deepening our existing partnerships to bridge the gap between researchers and producers, and increasing equity in research funding and program focus. The power of information and research is undeniable, and REE is well positioned to support farmers, ranchers, scientists, and academics alike in tackling some of the most pressing issues facing this country.

Workforce & Partnerships

The challenges facing agriculture, human and animal health, food supply and conservation are immense and growing under the pressures of a changing climate and swelling global population. Our farmers are on the front lines facing each situation as it arises, while planning for the best possible next season, next year, and future generation. The average age of American farmers, according to NASS's most recent Census of Agriculture, is 58 years old. I know the USDA research, education, and extension mission must support those producers' decisions every day, meeting them where they are with what they need. At the same time, we must also help attract

[3] https://www.ers.usda.gov/amber-waves/2022/june/investment-in-u-s-public-agricultural-research-and-development-has-fallen-by-a-third-over-past-two-decades-lags-major-trade-competitors/

and prepare a robust and diverse agricultural workforce to meet the challenges of the next generation.

First this means ensuring that the REE workforce—USDA's scientific enterprise—feels supported and able to carry out their mission. REE faced significant staff losses over the past five years and rebuilding that capacity has been a top priority for the mission area. ERS and NIFA have demonstrated outstanding resilience during this time, working hard to ensure their ability to deliver on their agency missions did not falter. Our continued efforts to support these rebuilt agencies will in turn improve our ability to support the nation's farmers, producers, and consumers from our research labs to the farm to the table. It's never been more critical to restore our employees' voices, respond to their needs, cultivate their talents, and champion their efforts to advance our research and extension mission.

The President and Secretary have both been very clear – this new workforce must look like America. Investing in inclusion, diversity, and inspiring future generations through formal and informal learning is critical for the future. As an agricultural scientist myself, I know that talent must be inspired, nurtured, and advanced across the country if the United States is to maintain its global leadership in science and technology. That's why Secretary Vilsack recently announced $250 million to enable Minority-Serving Institutions to create career development opportunities in agriculture for next gen scholars. This competitive funding, made possible through funding provided in the American Rescue Plan Act (ARPA) Section 1006, as amended by Section 22007 of the Inflation Reduction Act, is a necessary down payment for attracting, inspiring, and retaining diverse and talented students for careers in food and agriculture, and careers at USDA. It's also a foundation and model on which, in partnership with Congress, we can make changes that enable USDA internship, fellowship, and other professional development opportunities at to become career opportunities for next gen scholars and professionals in food and agriculture.

USDA is especially dedicated to enhancing equity across its programs and policies through the development of a more diverse workforce that properly reflects America's rich and diverse characteristics.

Building a future-proof agricultural workforce requires leveraging existing partnerships with institutions to support programs that expand skilled agricultural employment opportunities. Earlier this year Secretary Vilsack announced resources through American Rescue Plan funding to support the expansion of meat and poultry processing options, including $40 million for NIFA for workforce development and training to build a pipeline of well-trained workers to meet the demand for both current processors and increased independent processing capacity. The primary investment will be through competitive grants to support workforce training at community, junior and technical colleges with programs specifically for meat and poultry processing.

Local and regional food systems will benefit from shortened or branched supply chains that impart some redundancy and diversity. And the availability of a trained workforce, both domestic and migrant, with the right skills at the right location and at the right time is critical to ensuring reliable food and agricultural supply chains. This is particularly important as the agricultural enterprise in the U.S. is redesigned to become climate-smart, robust, culturally responsive, equitable, and resilient.

NIFA's broad array of workforce training programs and strong partnerships with educational institutions, including community colleges and Land-grant Universities (LGUs), can provide an effective way to implement additional workforce development initiatives.

Research

To best support producers and communities as they face new and evolving challenges, we must ensure that USDA's research arm is flexible, nimble, and working on timely and relevant research and data collection.

In response to the immediate need for research, data, and analysis, ERS developed the COVID-19 Working Paper Series as a "rapid response" vehicle for publishing non-academically reviewed research and analyses on the impacts of COVID-19 for policymakers, other researchers, and the public. ERS researchers are also actively contributing to USDA efforts around tracking supply chain challenges and food prices.

REE agencies conduct essential research on climate mitigation and adaptation and translate that research to inform our farmers as they work to feed the world. In 2021, NASS and ERS released the first results from 2019 Survey of Irrigation Organizations (SIO). ERS's analysis of the data in the report Irrigation Organizations: Water Storage and Delivery Infrastructure, suggest that, in many cases, water delivery organizations may not be able to supply all water demands, even under normal water supply conditions. ERS is also evaluating the impacts of climate change on U.S. field crop farm productivity using farm level data.

NASS collects a broad range of information from U.S. farmers and ranchers, and produces data on land use and production practices, specifically found in the Census of Agriculture, the Agricultural Resource Management Surveys, and geospatial products. While many of these statistics can be used in the evaluation of climate adaptation science and results, NASS does not yet have any programs directly related to climate adaption but looks forward to coordinating with USDA agencies to develop new survey tools.

REE research also plays a critical role in advancing nutrition security by defining the role of food and its components in optimizing health throughout the lifecycle for all Americans. ARS seeks to expand its human nutrition research to more precisely understand the nutritional needs of diverse communities, such as American Indians and children, and is eager to utilize machine learning and AI approaches to better predict interactions between food and nutrition-related data and health outcomes. NIFA, through critical programs like the Gus Schumacher Nutrition Incentive Program (GusNIP), enables income-eligible consumers to increase their purchase of fruits and vegetables. REE and the Office of the Chief Scientist are also proud to help advance the President's goal of cutting the death rate from cancer by at least 50 percent over the next twenty-five years. We are working across government to accelerate the preventative science and research necessary to improve nutrition in support of better health outcomes for all Americans. USDA's enhanced focus on precision nutrition will allow us to better understand the specific needs of underserved communities – particularly those most impacted by diet-related diseases including cancer.

We also work swiftly to provide quality science to help the global community understand and respond to zoonotic diseases and other challenges. For example, REE has been a leader in making progress on the fight against African Swine Fever (ASF), a high-mortality disease impacting global hog populations and is considered the biggest threat to pork production worldwide, including here in the United States. No commercial vaccine for ASF is currently available in the United States, but significant progress has been made.

In 2020, ARS scientists published findings about a new ASFV vaccine candidate, the most promising, safe and efficacious vaccine tested to date. Our scientists were invited by the Vietnamese government to help establish a Material Transfer Research Agreement with the Vietnamese company NAVETCO to further research and develop the vaccine. ARS scientists provided NAVETCO technical support to rapidly advance the development of the vaccine.

The Vietnamese Department of Animal Health is further evaluating the vaccine under field conditions in a two-phased approach for integrating the use of the vaccine in their national ASF control program. ARS is working closely with APHIS to determine the steps necessary to develop an ASF vaccine that would provide control and management options for the United States.

This is a perfect example of the impact that collaboration and quickly executed research can have on agriculture. Because we maintain excellent in-house expertise, we have the power to react quickly and partner with producers to carry them into the future of farming.

Conclusion

In my time leading REE and in my 20 years of federal service, I have had the opportunity to travel across the country and meet with many of the people we serve. I have visited states in every region of the country—in many of your districts meeting with the people you represent. They are optimistic about the future of agriculture, and so am I. President Biden, Secretary Vilsack and REE are poised to catalyze food systems transformation —we can meet and expand our commitment to farmers and ranchers as they work to feed the world, and I look forward to working with the Committee to support this mission.

Testimony before the United States Senate Committee on Agriculture, Nutrition and Forestry

Farm Bill 2023: Research Programs

Dr. Jason Rowntree
C.S Mott Chair of Sustainable Agriculture
Co-Director, MSU Center for Regenerative Agriculture
Professor, Department of Animal Science

December 6th, 2022

Chairwoman Stabenow, Ranking Member Boozman, and distinguished members of the committee. Thank you for your work and for the opportunity to testify about the importance of Cooperative Extension and Agriculture Research Funding. My name is Jason Rowntree and I serve as the CS Mott Chair of Sustainable Agriculture and co-director of the Center for Regenerative Agriculture at Michigan State University. My research relies heavily on federal agricultural research funding – in fact, I've led or been a co-investigator on research encompassing more than $27M from the USDA Sustainable Agriculture Research and Education Program (SARE), USDA National Institute of Food and Agriculture (NIFA) and the Foundation for the Future of Agriculture (FFAR). Most recently, I pioneered a $19.2M FFAR soil health grant entitled, "Metrics, Management and Monitoring. An Investigation of Pasture and Rangeland Soil Health and its Drivers".

The United States has the most efficient agricultural system globally. Technological advancements and intensification have enabled greater crop yields and improved animal productivity. However, these intensive practices have come with environmental costs such as greenhouse gas emissions, water contamination, and the erosion of our most prized agricultural resource: soil. Soil losses endanger agricultural resilience by increasing drought vulnerability, reducing productivity, and releasing CO_2 into the atmosphere. These challenges coupled with global unrest and a growing population places immense pressure on our agriculture resilience. Today, now more than ever before, domestic food security is inseparable from national security. And our national security hinges on our long-term climate security.

Investing in extension and agriculture research is a powerful and straightforward way to ensure we develop innovative solutions to these challenges. Further, we must envision holistic solutions well suited to address the complexity of agriculture. In my experience, the philosophy of regenerative agriculture is well suited to this challenge.

At the MSU Center for Regenerative Agriculture, we define regenerative agriculture along NRCS's 5 soil health principles: keeping soils continuously covered, minimizing soil disturbance, increasing biological diversity, keeping living roots in the soil, and integrating livestock. While implementation varies by farm, practices aligned with these principles are associated with promising soil health and carbon sequestration outcomes while reducing inputs and not sacrificing profitability.

Importantly, this movement is farmer and rancher led. Just this week I watched a YouTube video of a farmer who is growing 200-bushel corn in western KS with no nitrogen or phosphorus application. This is the growing 'culture' in Agriculture. As these producers

experiment and learn from one another, there is a need for Extension to help troubleshoot, educate, empower, and facilitate. Supporting and expanding Extension in this way is crucial to the success of regenerative agriculture as a climate solution.

Experimental *and* on-farm research is equally important to this mission. Participatory research – where academics connect with on-the-ground producers – is essential. The USDA SARE Program is well suited to this mission, however, there is a large gap between the demand for these projects and available funding. In my experience, only ~10% of farmer and academic led sustainability grants are successfully funded, while half the submissions were worthy of funding. Expanding participatory research impact is also feasible for USDA NIFA and FFAR.

Lastly, with the advent of natural capital markets (such as soil C offsets), research is desperately needed to facilitate the accurate and efficient quantification of ecosystem services. The Natural Capital Project at Stanford University indicate that the first law of a successful natural capital market is that the transaction must yield the desired effect. Essentially when a company purchases a CO_2 offset, there must be proof that the offset is grounded in real soil carbon sequestration. A handshake doesn't count. This requires rigor, accuracy, and robust accounting protocols that help us do things like avoid double-counting.

In the landmark document, "A National Strategic Narrative", three core components were emphasized for future national security: Land, Energy, and Water. In the face of a changing climate, nothing could be truer today. With the known challenges to agriculture's future, the question that must be posed, and especially thinking of our younger generations, is what level of food security risk do we assume by not acting? The easy bet is that continued and increased investment in Extension and Research will work to ensure we regenerate our food

production system, mitigate climate risk and enhance national security for future generations.

Thank you again for the opportunity to address the committee and I look forward to any questions.

December 6, 2022

Testimony of

Dr. Felecia M. Nave, President Alcorn State University

Before the

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

Farm Bill 2023: Research Programs

Introduction

Thank you, Chairwoman Stabenow, Ranking Member Boozman and members of the Committee for inviting me to participate in today's hearing. I am Felecia M. Nave, and I have the privilege of serving as the 20th and the first woman President of Alcorn State University, which is located in Lorman, Mississippi. I also serve on the Executive Committee of the 1890 Council of Presidents, and I am honored to speak to you today representing the 1890 University community.

On behalf of the 1890 Council, which is comprised of the 19 presidents and chancellors, I thank you for your past support and for your future commitment to the growth and expansion of the 1890 land-grant system, a commitment that furthers the educational attainment, economic prosperity and health of the families, businesses and communities that our institutions serve. The impacts are significant and the positive outcomes for the communities we serve, and the nation, are even greater.

Founded in 1871, Alcorn State University traces its heritage back to both the 1862 and 1890 Morrill Acts. Alcorn is unique among the 1890 institutions because it is the only HBCU founded with a land-grant purpose after the first Morrill Act, making it America's oldest public historically black land-grant institution. Alcorn is also Mississippi's second oldest state-supported university.

For 151 years, Alcorn has demonstrated its resilience and commitment to providing affordable and equitable educational opportunities to students and underserved communities that have limited access to education, healthcare, and economic mobility. It is because of the long

tradition of success of 1890s, such as Alcorn, that we continue to provide the talented diverse agriculture workforce that the nation needs now and in the future.

HBCUs were founded on principles of access, opportunity, inclusive excellence and persistence. 1890s are unique because our mission extends teaching beyond the campus to the communities we serve—especially to minorities and the socio-economically disadvantaged—so that these communities can also prosper and grow. As such, the future of agriculture is intrinsically intertwined with the future of the 1890 land-grant institutions.

The 2023 Farm Bill presents an excellent opportunity to build on key gains for the 1890s that were included in the 2018 Farm Bill. It is also an opportunity to increase the financial support in critical growth areas, scale initiatives that have proven to be effective and successful and address other areas of significance to the 1890 community, like the impacts of climate change and its impact on communities of color. Through the collaborative efforts of the *19 Strong*, utilizing a "systems-approach" has proven to be key to addressing the challenges that so many of our communities face in food insecurity, health disparities, and technology desserts. Research is being conducted on our campuses that quantify the needs of our community, provides technical assistance to socially disadvantaged ranchers and farmers, as well as informs and drives public policy decision-making.

The Work of the Policy Research Center and Disadvantaged Farmers and Ranchers

Through the leadership of members of this Committee and your colleagues in the House, specifically U.S. Representative Bennie Thompson, Alcorn State University serves as the lead institution for the federally funded *Socially Disadvantaged Farmers and Ranchers Policy Research Center*, which was authorized in the 2014 Farm Bill. The Center collaborates with other 1862 and 1890 land-grant universities as well as private, non-governmental organizations on research proposals, policy development, and funding to implement actionable items for the success of socially disadvantaged farmers and ranchers.

With recent funding from USDA, our impact in rural and underserved communities has been immediate and far-reaching. Recently, we collaborated with Centers at the University of Arkansas and Mississippi State University to identify best practices and then worked to develop training materials for land-grant extension staff and other agriculture professionals to use when

providing technical assistance to minority farmers related to asset preservation and to help clear title and to prevent the loss of additional heirs' property. The pilot train-the-trainer programs were attended by over 100 university agricultural professionals.

Our heirs' property research identified from a conservative estimate that there are 579,000 heirs' properties with a combined total acreage of 6.8 million, valued at $47.3 billion, across 14 southern states. Texas and Mississippi report the greatest number of acres while the highest total market value can be found in North Carolina and Virginia.

Over the past 100 years, discrimination against Black farmers, in particular discrimination by the USDA in federal farm assistance and lending, has caused Black farmers to lose millions of acres of land, robbing these farmers and their families of billions of dollars of generational wealth. In 1920, there were nearly 1 million Black farmers in the United States. Today, due to this history of discrimination, it is estimated that there are less than 50,000 remaining Black farmers. Without some intervention, Black farmers will become extinct. We provided recommendations to USDA on implementing important provisions of the Inflation Reduction Act earlier this year to help address this problem and our universities look forward to working with Congress and the Administration on next steps.

Additionally, the Policy Research Center co-hosted a strategy meeting between USDA and 1890 land-grant universities leadership to discuss how the 1890 universities could support USDA's priorities and to identify resources needed to provide that support. All nineteen 1890 universities were represented, and participants heard from key leaders, including U.S. Department of Agriculture Secretary Tom Vilsack and USDA Deputy Secretary Jewel Bronaugh.

We have collected input from over 5,000 socially disadvantaged farmers and ranchers across the country to understand their challenges and concerns and developed policy recommendations for the 2023 Farm Bill to address those concerns. We plan to share policy recommendations within the next month with the Committee and stakeholders. Your continued support ensures that the great work of the Policy Research Center is continued.

Successes from the 2018 Farm Bill and next steps.

The 1890s are very grateful for the funding provided to support scholarships for students interested in pursuing careers in agriculture and agriculture-related fields that was included in the

2018 Farm Bill. For example, Alcorn State University has received approximately $750,000 annually for the program. This scholarship program supports 75 high-achieving scholars, including a 2020 Gates Scholar. My colleagues at the other 18 Universities have also implemented their scholarship programs and even with the challenges that the COVID-19 pandemic presented, they were able to successfully attract hundreds of new and future agriculture and food scientists to their programs. This new funding helps address access barriers that many of our students face in attending college. We share best practice strategies that support the recruitment, retention, and development of well-rounded scholars among the 19 institutions. Your continued support for and the permanent expansion of the scholarship program will have a significant impact for our students, their families and for the long-term benefit of the country.

Additionally, the funding that was provided in the 2018 Farm Bill to establish the six Centers of Excellence, of which Alcorn partners in two of the Centers, supports innovative research and programming at our institutions. Again, COVID-19 presented challenges with standing up these Centers but I am pleased to report that all six Centers in: (1) Student Success and Workforce Development; (2) Health Wellness and Quality of Life; (3) Farming System Rural Prosperity and Economic Sustainability; (4) Global Food Security & Defense; (5) Natural Resources, Energy and Environment and (6) Emerging Internet of Things (IOT) Technologies for Smart Agriculture are up and running and researchers across our 19 Universities are partnering to further our work. One institution is the lead on each Center, and it is our hope to increase the total number of Centers of Excellences in the 2023 Farm Bill and that at some point, have each of the 19 Universities lead a Center of Excellence.

Congress also included in the 2018 Farm Bill a reporting requirement that states share with USDA the one-to-one match requirement they are supposed to meet. Unfortunately, several states are still falling short of this requirement and the resulting underfunding continues to undermine the federal investments that Congress is making available to our universities. In FY 2020, the 1890 Universities were not matched by states by approximately $10 million. In FY 2019, the gap was approximately $8.5 million. And, in FY 2018, it was roughly $8.7 million. So, that is close to $30 million in underfunding from the states in just those 3 fiscal years.

We would like to work with the Committee to strengthen the reporting requirement and perhaps have the states, not the Universities, apply to USDA for a non-matching waiver request

and have the state certify why they are unable to meet the one-to-one matching requirement. Additionally, the requirement could also have the state attest whether they are able to make any other matching requirement for federal funding for any state supported universities.

Our Extension Efforts, Rural Development and Infrastructure Needs

There is a great need for increased investment to grow the footprint and outreach of the extension agents at the 1890s. These agents are embedded in our communities and serve as boots on the ground. With more resources, our agents would be able to serve more communities. Alcorn State University's Extension Program is working to improve the quality of life for Mississippi's small and limited resource farmers, ranchers, rural communities, and underserved audiences through education and extension outreach during an unparalleled health crisis and economic distress. Now, more than ever, the Extension Program is needed to translate research into action and provide innovative solutions from research laboratories to local rural communities. We must develop much-needed pipeline programs and projects, which will be useful in ensuring that the work of 1890 land-grant institutions remain viable.

As you know, our 19 Universities are mainly in the rural areas of our states and the country. We train our students for jobs and careers and many of them have to leave our communities to find them. As we look to the 2023 farm bill, the 1890 Universities would like to work with Congress and this committee to find ways, through the USDA Rural Development Agency, to bring economic development opportunities to the surrounding areas of our schools. The goal would be to create meaningful job prospects for our students to consider working and living in the communities we serve.

Similarly, on our main campuses and at our extension facilities, we need resources to upgrade and repair our facilities. In October, I joined over 80 of my fellow HBCU Presidents and Chancellors in sending a letter to House and Senate leadership asking them to prioritize Senator Chris Coons' and Senator Tim Scott's IGNITE infrastructure legislation. For many decades, the infrastructure at our universities has been underfunded by billions of dollars. This bipartisan and bicameral bill would help provide students with state-of-the-art research laboratories, reliable high-speed internet access, and adequate housing. We are pleased that infrastructure investments at our universities were included in the President's fiscal year 2023 budget request and hope that Congress will find a way to complement the work that this Committee will do with the Farm Bill

on infrastructure. These much-needed investments in our agriculture, and other, facilities and in expanding our capacity equips our faculty and staff with the necessary tools to attract new students as well as to expand our outreach and educational programming to effectively train the current and future generations of agricultural leaders. The added resources also support in attracting faculty, staff, and researchers who contribute to innovation and the advancement of agriculture science. The funding is particularly critical for smaller land-grant institutions charged with the unique mission of addressing the needs of underrepresented communities, as well as of producers and landowners with limited access to technology and resources.

Additionally, strengthening our facilities, technical, and research capabilities also positions our programs to leverage and secure more industry partners. For example, several of our universities have been able to leverage the new funding that was provided in the 2018 Farm Bill to attract funding from major corporations to help further our work. There is much more to be done in expanding public-private partnerships, but better infrastructure investments are a key component.

Lastly, artificial intelligence, drone technology and vertical farming are a few of the emerging fields in sustainable agriculture that 1890 students and researchers are capable and prepared to contribute to the advancement of science in strengthening the nation's agricultural landscape. However, for our institutions to remain competitive in these emerging areas, increased funding is required in order to support the modernization and expansion of our research and technology infrastructure and to build capacity. Congress has realized this critical importance with the recent passage of the CHIPS Act. We want to be a partner in those efforts and the work of this Committee, and the resources provided in the Farm Bill can help make that a reality.

Conclusion

I am grateful for this opportunity to address the Committee. On behalf of the dedicated faculty, staff, and students at Alcorn State University and throughout the 1890 University system, I thank you for your continuous support of our institutions and agriculture. I look forward to answering any questions you may have for me today. Thank you.

Testimony of Dr. Katy Martin Rainey
Associate Professor of Agronomy, Purdue University
Director, Purdue Soybean Center
On behalf of the American Seed Trade Association

Hearing of the U.S. Senate Committee on Agriculture, Nutrition, and Forestry
FARM BILL 2023: RESEARCH PROGRAMS
December 6, 2022

Good morning, Chairwoman Stabenow, Ranking Member Boozman and Members of the Committee. I am Dr. Katy Martin Rainey, Associate Professor of Agronomy at Purdue University, where I conduct research on plant breeding and genetics. I am pleased to be here today to offer testimony on behalf of the American Seed Trade Association (ASTA), which represents nearly 700 member companies involved in seed production and distribution, plant breeding, seed treatment and related industries in North America.

Breeding and distributing the best seeds and other stocks is integral to U.S. farm productivity and food security, requiring substantial investments in R&D. Agriculture research through public-private partnerships, including seed companies, universities, and federal research entities, is foundational to crop improvement, and to U.S. farmers' access to the best varieties and hybrids. Many of ASTA's member companies work closely with public sector research programs like mine, for the public benefit.

Thank you for holding this hearing today to shine a light on the importance of agriculture research as the foundation of the Farm Bill, and ultimately of ensuring a safe and secure agricultural production and food system. Because of robust public and private investments in research over time, today's U.S. farmers produce increasingly more on the same acres using fewer resources, and U.S. farmers play an outsized role in global food security. Now, farmers and others engaged in agriculture strive to improve the sustainability of U.S. agricultural practices. But, now more than ever, U.S. agricultural production is faced with a complex array of emerging threats like extreme weather and new pests, combined with simultaneous needs to provide enhanced ecosystem services such as improving water quality. More is expected of the crops themselves, which increasingly provide not just food, but also renewable fuels and meat alternatives, while also sequestering carbon and using less fertilizer.

BENEFITS OF AG RESEARCH

U.S. seed companies, public and private scientists, and U.S. producers will continue to innovate to improve crops and production practices, thanks to ongoing and future cutting-edge research. Efficient and productive agriculture systems all start with seed. Strong investments in research from discovery through development lead to better seed, which means better outcomes for our farmers, our consumers, our land, and our environment, in the short and long-term.

These are not just platitudes, but are backed up with real data, including USDA based yield data per acre over many decades. The seed sector has a track record of return-on-investment to show for it.

I'd like to offer just a few examples highlighting the real and measurable value of public-led plant research:

- I leverage economically-valuable crop breeding research to also advance digital agriculture capacity for remote crop growth estimation, known as phenomics, and I launched a successful software company in this space. Because of my federally-funded training in entrepreneurism, I am currently seeking to extend my technology to facilitate effective on-farm research.
- My colleagues working on soybeans provide a perfect example of public-private cooperation on federally funded outputs to benefit consumers. A USDA geneticist at the Plant Genetics Research Unit in Columbia, MO discovered soybean mutants that produce healthier oil, and then collaborated with the University of Missouri soybean breeder to develop new varieties with funding from commodity organizations, the university, and the USDA. Today, the ag tech company Benson Hill has a vertically integrated program working with farmers to produce and sell the healthier oil, known as VERI oil, which is offsetting global deficits in the availability of sunflower oil due to the war in Ukraine.
- The Tasti-Lee tomato is the best-selling field round tomato in the U.S., and it is a hybrid produced by a private seed company from parents bred at the University of Florida with funding from growers.
- Lettuce is one of the most widely-consumed vegetables in the U.S., and is produced year-round in California and Arizona. Scientists at the University of California Davis (UC Davis) and the ARS Crop Improvement and Protection Research Unit are collaborating to develop and release varieties and breeding lines for the private sector, with critical resistance to diseases.
- Through a partnership with USDA, several leading academic institutions and Plant Sciences, Inc. (PSI), an agricultural research company, will study *Rubus*, or caneberry crops, and identify natural variation for future breeding and gene editing opportunities. Scientists and researchers from Pairwise, PSI, the University of Arkansas, the USDA Agricultural Research Service (ARS) in Corvallis, Oregon, Cornell University and North Carolina State University, will collaborate to identify and characterize the genetic diversity in blackberries, red raspberries and black raspberries as well as multiple wild caneberry species such as salmon and thimble berries.

CONGRESSIONAL SUPPORT

While there are many competing needs in the Farm Bill, we must prioritize a robust investment in ag research. Over the past decade, other countries have rapidly expanded investment in public agriculture research, threatening U.S. competitiveness. I want to thank the Committee for recognizing this through your historically strong support for research programs, including recent efforts to increase investment by:

- Strengthening and establishing authorities to bolster the role of the U.S. in agriculture research, including the Agriculture Advanced Research and Development Authority (AGARDA), and the Research Facilities Act in 2018;

- Preserving the baseline funding for key programs, including the Specialty Crop Research Initiative and Organic Research and Extension Initiative in 2018;
- The creation of the Foundation for Food and Agriculture Research in 2014.

RESEARCH PRIORITIES

We rely on the support of Farm Bill funding and programs to ensure continued U.S. leadership as the provider of the best seed to the world. ASTA worked closely with Congress to mandate that the USDA Agricultural Research Service (ARS) develop and implement a national strategic germplasm and cultivar collections assessment and utilization plan for the **National Plant Germplasm System.** As a key priority for ASTA, we look forward to the publication of this plan, which will be instrumental in establishing a roadmap for the sustainability of NPGS for years to come, allowing scientists access to critical plant germplasm, and enabling the development of new varieties and hybrids that resist pests, diseases, and environmental stresses. A strong and healthy national germplasm collection is valuable to the public and private sectors, especially with new technologies, such as genomic prediction, that enable us to fully utilize these collections.

USDA's Agricultural Research Service (ARS) leverages long-term investments for high- impact payoffs. Its management and utilization of vast collections of genetic resources is the type of research that can't be done by an individual university or company. A great example of utilization of the National Plant Germplasm System (NPGS) is the **Germplasm Enhancement of Maize (GEM)** project at ARS, which focuses on identifying useful genetic diversity in exotic germplasm for commercial use in developing new hybrids in the U.S. Over 300 lines have been released by GEM and made available to commercial breeders. The continued success of American agriculture is intimately linked to corn production, with USDA estimating 14.2 billion bushels were harvested in 2020. It's important to note, however, that U.S. corn production is still based predominantly on just two races of maize, when over 250 exist to be exploited. ASTA is encouraged by Congress' continued investment in ARS; however, additional funding is necessary to address the broad range of long- and short-term research needs of the entire agriculture sector.

Another key initiative, and one I'm passionate about given my role with Purdue University, is land-grant capacity funds, and funding for non-land grant colleges of agriculture. Capacity funds through the Farm Bill allow land-grant universities, like Purdue, to invest in infrastructure and people for cutting-edge research that has a direct impact on farmers in our states and beyond, and these capacity funds allow us to respond quickly to emerging issues. Consider tar spot in corn: Purdue uses Hatch Act funding to fund an Extension Plant Pathology scientist and the Purdue Plant and Pest Diagnostic Lab. Both were critical in 2018 when the lab identified the first instance of tar spot in Indiana. With resources already in place when tar spot hit Indiana fields, Purdue researchers and Extension specialists could quickly identify the new disease and start working on management options.

Consider as well that land grants are critical to agriculture research through our role in STEM education, indeed agricultural technology is a critical application of the STEM disciplines. Purdue estimates that approximately 59,000 new U.S. graduates with agricultural expertise are needed per year, and land grant universities educate this workforce. Nonetheless, the land-grant system is facing unprecedented infrastructure challenges. U.S. scientists and educators are asked to perform

21st century science in facilities constructed in the 1950s and 1960s, and this situation negatively impacts recruitment of the best and most diverse talent to study critical topics in food security. According to the Association of Public and Land-grant Universities (APLU), more than 69% of research and education facilities at land-grant universities colleges of agriculture are at the end of their life cycles. To remedy this, robust support is needed via the Research Facilities Act in the 2023 Farm Bill.

The National Institute of Food and Agriculture (NIFA) leads and funds extramural research, education, and extension programs in partnership with leading scientists and educators around the country. As you know, under its flagship competitive grants program, the **Agriculture and Food Research Initiative (AFRI)**, the agency funds research in several priority areas, including plant health and production and plant products. We are encouraged that AFRI has received critical increases in recent congressional appropriations cycles, but it continues to be funded significantly below its authorized level of $700 million. We thank the Committee for its continued support in the authorization of AFRI, and we strongly support its full funding through congressional appropriations. Similarly, as the primary entity funding public-private partnerships for food and agriculture research, the Foundation for Food & Agriculture Research, or FFAR, leverages federal funding to bring private-sector investments and knowledge to public scientists. To date, FFAR has awarded over 290 grants with more than 550 funding partners, and spanning 45 states and 17 countries. With an average matching rate of $1.40 FFAR is on track to invest nearly a billion dollars in food and agriculture research.

The Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS) provide foundational research and data in socioeconomics, and statistical insights that are critical for all agricultural stakeholders. The tools and services provided through these agencies inform the decisions of seed companies and the rest of the private sector, as well as scientists, producers, and policy makers.

For instance, producers across the country have been seeking to adopt conservation practices, such as using cover crops to improve soil health. Data related to acres and types of cover crops planted would help producers and the seed industry plan ahead to ensure the availability of high-quality cover crop varieties at the right place and the right time. As Members of this Committee seek to assess programs and policies that support conservation, the work of ERS and NASS will continue to grow in importance as the agriculture industry continues to work to overcome challenges and meet food security needs with a reduced carbon footprint.

The **Agriculture Advanced Research and Development Authority (AGARDA)** was established in the last Farm Bill to allow USDA to drive high-risk and long-term research to address challenges that threaten the stability and economic viability of agriculture in the U.S. Modeled from the success of other advanced research and development authorities such as the Defense Advanced Research Projects Agency (DARPA), and the Advanced Research Projects Agency – Energy (ARPA-E), AGARDA was established to support transformative advances that industry by itself is not likely to undertake because of technological or financial uncertainty.

One area of great potential within AGARDA is to support the role of data in agricultural resiliency. The AGARDA authority provides the ability to facilitate the sharing of publicly-funded ag research

data. A reauthorized and robustly funded AGARDA would position USDA to lead a partnership of agricultural data stakeholders in the development and implementation of badly-needed data infrastructure that is currently lacking in public agriculture research.

In the seed sector, we are challenged to respond quickly to new production challenges with new seed of hybrids and varieties. The **Ag Genome to Phenome Initiative (AG2PI)**, enhanced in the last Farm Bill, is generating knowledge that bridges genomics, phenotype, and the environment to support more responsive, and predictive plant and animal breeding programs. This initiative strengthens interdisciplinary collaboration among public and private research communities, which will enhance U.S. producers' access to improved crops and livestock in future scenarios. ASTA supports full funding of the AG2PI through congressional appropriation.

As we deal with ever-increasing challenges facing the future of our planet, all of these programs play unique and important roles in driving the solutions for a more secure and sustainable future, while keeping the U.S. competitive at the global level. It's important that these solutions are founded on measurable, data-driven metrics, emphasizing the critical role of research arms like USDA's Research, Education, and Economics (REE) in supporting NRCS, FSA and other agencies as they work to achieve large-scale conservation outcomes.

CONSERVATION PROGRAMS

In the area of conservation, as we look to increase conservation and cover crops practices, advancements in breeding will bolster their vast benefits – for climate adaptation and mitigation, soil health and habitat restoration – while at the same time boosting farmer productivity. In fact, the significant use of cover crops in production agriculture is one of the most promising practices to address the stewardship of our soils and nutrient reduction in our environment. A report from the Farm Bill-supported **Sustainable Agriculture Research and Education** (SARE) program showed that cover crops have the potential to sequester approximately 60 million metric tons of CO2 equivalent per year when planted across 20 million acres. **SARE** also qualifies the benefits of the use of cover crops to include:

- On average, cover crops reduced sediment losses from erosion by 20.8 tons per acre on conventional-till fields, 6.5 tons per acre on reduced-till fields and 1.2 tons per acre on no-till fields.
- Cover crops have been shown to reduce nitrogen losses by an average of 48% and as much as 89%.
- Cover crops have the ability to reduce average total phosphorus loads to waterways by 15% to 92%, but additional research is still needed

Additionally, environmental and conservation seed helps to restore lands devastated by wildfires, natural disasters, and invasive weeds. It serves as the foundation of healthy landscapes, contributing to stable ecosystems and economies, all while providing critical erosion-control and biodiversity. Whether it's farmers enrolling acres in the Conservation Reserve Program, signing up for the Environmental Quality Incentives Program to promote wildlife habitat or other environmental benefits, or strengthening efforts on working lands by implementing management activities through the Conservation Stewardship Program, farmers and landowners need high-quality, innovative seed. And that innovation starts with research in plant breeding.

PLANT BREEDING INNOVATION

One especially exciting focus of breeding as of late is the exploration of new and emerging tools like gene editing. These innovative methods have the potential to unlock new capabilities in plants thanks to robust private and public sector R&D investments over time. Gene editing is being used to help drive potential solutions to climate change, food and nutritional security, and sustainability. Here are just a few examples:

- Non-browning varieties of fruits and vegetable like potatoes, avocados, lettuce, and apples could significantly cut down on food waste – a problem that has serious consequences for people and for the planet. FAO estimates that worldwide, the amount of food wasted is enough to feed 2 billion people — more than double the number of people struggling with hunger. And food waste contributes to climate change, causing about seven percent of all greenhouse gas emissions.
- Drought tolerant and water-efficient varieties of crops, from lettuce to wheat and rice can reduce agriculture use of water for irrigation and help crops withstand a changing climate.
- Wheat with higher protein and fiber content; and berries that are more flavorful and higher in key nutrients can lead to healthier diets
- Multiple plant disease resistance genes can be leveraged for maintaining production levels despite the emergence of new diseases threatening crop production.

In order for the tremendous benefits of these innovations and others like them to become widely available, the U.S. must create an innovation-enabling environment that includes sustained and substantial investment in public-sector agriculture research; fair, strong, and enforceable protection for intellectual property rights to incentivize private investment and business development; and scienced-based, predictable and transparent regulatory policy in the U.S. and influencing regulatory policy alignment around the world. While the Farm Bill and the Research title are key, the industry will be limited without effective regulatory systems in place to allow for and foster continuing innovations such as these.

CONCLUSION

Before I close, I want to dispel the notion that commodity organizations, private companies, and a few other investors have the basic and applied research needs for row crops covered. While considering competitive granting programs, private sector investments in row crops deserve corresponding investment of public funds, because these crops, such as soybean, are so economically valuable, and critical to national security.

In summary, a strong federal investment in agriculture research—leveraged through strong public-private partnerships-- is vital to ensuring the success of U.S. farmers and a sustainable and secure global food production system. It begins with seed, which is founded on innovation. Thank you for allowing me the opportunity to provide remarks today on behalf of ASTA and their many partners in the public and private research community, and thank for your continued support for critical agriculture research programs. I am happy to answer any questions.

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Testimony of Steve Ela
Colorado Organic Tree Fruit Grower
before the
Senate Committee on Agriculture, Nutrition, and Forestry
for a hearing on

Farm Bill 2023: Research Programs
December 6, 2022

Chairwoman Stabenow, Ranking Member Boozman, and distinguished members of the Committee.

I would first like to thank you for hosting a hearing on agricultural research, and for providing me an opportunity to share my experiences.

I. My Background and Introduction

I am Steve Ela, a fourth-generation tree fruit grower in western Colorado. We grow certified organic peaches, apples, pears, plums, sweet cherries and heirloom tomatoes on a 100-acre farm.[1] We pack and sell everything we grow and also have a commercial kitchen on the farm to process off-grade fruit into artisanal fruit jams, fruit butters, apple sauces, and dried fruits. We began transitioning to organic production in 1994 and became 100% certified in 2004; our commercial kitchen is also USDA certified organic—we actually just completed our annual organic inspection last week. Our marketing channels include 7 farmers markets, wholesale to smaller, individual specialty food stores, restaurants and through Community Supported Agriculture shares. We also work with Whole Foods Markets in the Rocky Mountain Region. While we are a small size farm, we have the capacity to raise over 1 million pounds of fruit in a season.

We have had our farm reviewed for our carbon footprint, and we are very close to carbon neutral, including the fuel it takes to attend our farmers markets. We have also achieved zero food waste by either selling fresh or processing all the fruit that we harvest. The fruit that is unusable for human consumption as well as the scraps from our kitchen are given to a local pig farmer for use on their farm. We are certified at the Gold Level in the Environmental Leadership Program of the Colorado State Department of Health and Environment.

I am here today to urge you to continue to fund public agricultural research programs to help us and other growers innovate and develop additional environmentally sound, climate friendly, and economically practical growing practices. I have been both a consumer of and a participant in this research, and it has and will continue to impact how our farm operates. This research isn't only important to organic growers like me, but also to conventional growers looking for smart, economical, systems-based management. Even though these programs have resulted in impactful research, they are still not meeting the needs of the growing market for organic and other sustainable products.

I ask you to increase funding for organic research to at least be equal with its market share. The systems-based research programs like the Organic Research and Extension Initiative (OREI) and the Sustainable Agriculture Research and Education (SARE) program help growers implement systems of management on their farms, but needs more support to meet the growing demand of farmers. We are facing multiple

[1] About Ela Family Farms, https://elafamilyfarms.com/about-us/ (last visited Dec. 1, 2022)

issues at once – new invasive insects, fluctuating and extreme climates, rising input costs, and an ever-growing demand for healthy, nutritious foods. If we try to solve and research each of these problems one by one, we will never have the time or resources to keep up with the challenges ahead. Instead, we need research programs to invest in looking at these issues through an ecosystem lens. Rather than researching a single spray, fertilizer, or crop genetic trait, these programs study how we solve problems using an ecosystem-based response.

II. Our farm has participated in publicly funded agricultural research to great success

We have been involved with insect control studies, fruit thinning trials, fertility and weed control investigations, as well as economic analyses. This research has been funded by you, through SARE, through the Agricultural Research Service (ARS), via the Specialty Crops Block Funds, and through OREI. We have also utilized research funds from the EPA, NGOs, and private companies.

When I first returned to our family farm in 1990, we participated in a number of trials of pheromone disruption for codling moth, the insect that causes worms in apples. Those trials helped us replace many of our broad spectrum spray applications with a program that specifically controlled the moths through their own biological communication systems without impacting beneficial insects.[2] As we transitioned to organic and removed herbicides from our system, we looked at the impacts of different types of organic mulches on fertility and weed control in our trees.[3] The lessons from those projects demonstrated the value of our cover crops in both providing fertility and out competing problematic weeds. I changed from trying to physically eliminate weeds to using cover crops to fill the niche those weeds might otherwise occupy. The research helped reformulate how I approach weed control and I now watch and learn every year about how we can better use our cover crops for weed suppression.

Another side of research that has benefitted us is the efficient use of labor. Fruit trees set much more fruit than they can successfully feed to obtain good size and quality. The way to reduce fruit load is to thin and that often involves skilled labor, something that is increasingly expensive and difficult to come by. The use of organic materials to reduce fruit set has helped us to save labor and given us better fruit quality.[4] I should also point out that all research isn't biologically related. Economic impact studies have helped us analyze the differences between planting systems, how to best use our off-grade fruit, and the relative value of different marketing strategies.

Ultimately, all these research projects have changed the way I farm. In some cases, we may be using similar materials or cover crops as we were before, but we are using them differently and managing them differently so that they work together as a system.

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[2] *See* L. M. McDonough et al., *Efficacy of nonpheromone communication disruptants of codling moth (Cydia Pomonella): Effect of pheromone isomers and of distance between calling females and dispensers*, 22 JOURNAL OF CHEMICAL ECOLOGY 415–423 (1996).

[3] *See* Alan J. Franzluebbers et al., *Adjusting the N fertilizer factor based on soil health as indicated by soil-test biological activity*, 7 AGRICULTURAL & ENVIRONMENTAL LETTERS (2022).

[4] See R. Pokharel et al., *Efficacy of plant and mineral oils, and Tergitol on peach thinning.* Colorado State University Agricultural Experiment Station Technical Report TR09-12, 67-72 (2009)

III. Our farm, like all farms, depend on robust research and extension systems to make decisions and plan for the future

As you can imagine, we have raised fruit using many different methods over the 115 years of our farm's history. My grandfather used lead arsenate to control worms in apples before the advent of DDT – I can well imagine the excitement over having DDT. That "new" material gave excellent control of worms. As we now know, that "new" material also came with a number of environmental drawbacks. As times changed, my family used and participated in research to continue to grow top quality fruit using the best-known techniques.

When I returned to the farm in 1990, we were already working to "soften" our control programs to use methods that utilized more biological controls and created fewer problems with secondary pests due to the use of sprays that killed those biological predators. While we didn't start out with the intention of becoming certified organic, by 1994 we had changed our control programs so much that it only took a few changes to make the move to certified organic production on peaches and pears and receive a higher price premium. We continued to experiment and became 100% USDA certified organic in 2004. While the research projects we have participated in and consumed have changed my farm and helped me become a better organic grower, there is still a long way to go.

As a grower, I make decisions every day about how to best produce a high-quality crop of organic fruit. These decisions range from irrigation applications, managing cover crops for insect and disease control and fertility, tree pruning and replacement, to marketing choices. If I do my job well, I have found that by focusing on growing a variety of cover crops, building soil, and not applying materials that disrupt the ecosystem of my farm, there are only a handful of insects or diseases that I have to step in to help control. Using organic research to make those decisions makes my job easier because I don't have to guess. If that research is not available, I still have to do something and at that point I have to rely on my experience and best guesses as to how to proceed. The more I can use research to inform my choices, the more confident I am of moving forward in the right direction. For example, if I am trying to maximize nitrogen release from my perennial cover crops, at what stage do I mow those cover crops? If I am also trying to use those cover crops to encourage beneficial insects, how does mowing them for nitrogen release affect those beneficial insects? How do my irrigation applications change the way my cover crops and trees interact and do I have different results if I apply water via sprinklers or drip systems? In many cases, economic thresholds developed for when to treat insect pests assume that a single spray can be applied for control.[5] In my organic system, I use an approach of trying to build up beneficial insect populations that will gradually decrease a pest population. That means the economic thresholds used by conventional growers may not work for me. Likewise, I am not only mowing a cover crop for ease of access to the trees as a conventional grower might do, I am also mowing it at certain stages to affect the rate of nitrogen release into my orchard system, its effect on beneficial insects, and to maximize weed control.

One of the wonderful aspects of organic farming systems is that they are adapted to their specific areas. Research conducted across multiple environments helps me understand what might be appropriate for my area. I choose alfalfa as a primary legume cover crop in my area due to its taproot that penetrates my heavy clay soils. Since I am growing the alfalfa as a perennial cover crop/mulch I am interested in a variety that is long lived rather than a short-lived maximum biomass producer. A grower with a different

[5] An "economic threshold" is a decision-making tool; generally speaking, it is a number of insects present that indicates a pest problem that will likely result in economic injury or the value of the lost crop is worth as much as the cost of controlling the pest. *Reviewing Decision Thresholds for Pest Insect Control*, https://crops.extension.iastate.edu/cropnews/2008/07/reviewing-decision-thresholds-pest-insect-control#:~:text=The%20economic%20threshold%20(ET)%20is,population%20from%20reaching%20the%20EIL (last visited Dec. 1, 2022).

soil type and/or cropping system might choose a legume with different characteristics. Having organic farming system trials across the country with multiple crops helps us to develop cropping systems that are best adapted to the many regional growing conditions. They will also help us to be able to look to other areas for experience and ideas as climate conditions change in our own areas.

An ecosystem approach strengthens my resiliency in the face of climate-related changes in my pest programs. It is simultaneously helping me with fertility and preventing soil erosion if we have extreme weather events. By approaching our problem solving from a systems perspective we are getting multiple benefits at once, rather than solving problems one by one. Ultimately, I don't care which beneficial insect controls a certain pest - I only care that I have multiple beneficial insects in my system. Each beneficial insect may react differently to changing climatic variables, but in my experience, at least one of them will suppress the pest species. I don't care which cover crop species I plant suppresses a problematic weed, I just care that pests, weeds, and diseases are suppressed.

Directly related to research is how farmers get access to the information in that research; support through outreach and extension has been critical to allowing us to adopt these systems of management. We live in a relatively isolated area where producers grow tree fruits, wine grapes, vegetables, corn, wheat, and graze livestock. It is impossible for our few local extension agents or technical service providers to be experts in all these crop systems. We have worked closely with our extension agents to make information sharing a two-way street. They pay attention to information they see that might be of interest to me and we help them learn about organic production methods they can then pass onto others. In many cases, we are educating the educators, which reflects the need for significant investment into these services to increase their accessibility. It costs money and time, but increasing the capacity of these services is the best way to increase the knowledge base of farmers on these systems. Facilitating organic knowledge transfer among growers would help to increase my, and every grower's, productivity.

Ultimately, Organic systems research helps me to develop systems that respond to a multitude of needs. Organic extension and outreach help me both pass along lessons I have learned and learn from the experiences of others. I am rarely trying to solve one problem with one solution. Instead, I am trying to solve problems with multiple solutions so that I have the greatest chance of success. The more research that is done, the greater the pool of knowledge I have in making farm decisions. However, that is only true if I can learn about what research has been done and the experiences of others in similar situations. Dissemination of organic research findings are critical to helping growers like me take that knowledge and use it to improve our own systems. In travel to conferences, I try to sift the organic information from the conventional information since that may be the only way I will learn about cutting edge research. Having more people steeped in organic systems disseminating information that directly relates to organic production would be of great benefit. The more I can learn about beneficial insect dynamics, the better chance I have of encouraging robust, diverse beneficial populations. The more I learn about how nitrogen moves within soil systems, the better chance I have of managing my system to move nitrogen to my trees when it is most needed.

IV. To ensure these needs are met for all farmers, invest in organic research and technical assistance

It has been important to have pools of money that allow growers and researchers of all sizes to participate. A number of our research projects were quite small and were perfect for private funding, grower SARE grants, or small Specialty Crop grants. Other projects that were multi-year needed larger funding pools. In general, organic, systems-based research must be multi-year and long-term. Systems don't normally

change overnight. Results seen in the first few years may be different than results seen in later years as the agricultural ecosystem balances and responds. For example, the use of landscape fabric for weed control under our trees gave better weed control than mulches, especially since we have some very difficult perennial weeds such as quackgrass. However, those same mulches increased tree girdling from mice since predator species could not attack those mice under the fabric. The fabric also prevented organic matter from being continually deposited in the soil from our cover crops and as a result we lost soil tilth. The short-term benefit of the weed control was lost to the long-term loss of degraded soil health and tree loss. Instead, we are now managing our quack grass issues through a diverse strategy that uses other cover crops that outcompete the quack grass and through targeted irrigation management.

Most importantly, much of the investment in organic research projects also benefits conventional growers. The use of mating disruption for the control of codling moth (worms) in apples was primarily developed on organic farms and is now used by much of the conventional industry.[6] The research into the use of cover crops for fertility and beneficial insect management is increasingly being used by conventional growers.[7] The use of certain cover crops instead of soil fumigants is being followed by the conventional industry.[8] Soil health and regenerative agriculture are the new buzzwords being used by many, but these concepts have always been the basis of organic agriculture management. Investing in ecosystem management research programs, like SARE, OREI, and the Organic Transitions Program (ORG), benefits all growers.

I also ask that more research be conducted on certified organic ground. As I mentioned above, it takes time for agricultural ecosystems to reestablish themselves. Simply doing a study on conventionally managed ground, using organic techniques, may not give the same results as that same study on long-time organically managed land. For example, "economic optimum nitrogen rates" may be significantly lower on organic as compared to conventional farms due to the capacity of the soil to continually provide nitrogen to the crop through biological processes.[9] The longer I farm, the more I realize how complex the ecosystem is that I am working with. It is imperative that rather than heavily investing into basic, single issue agricultural research, like specific chemicals or gene transfers, we embrace systems management and action-oriented research that not only enhances our understanding of complex ecosystems but helps farmers work with rather than against natural systems.

Even while current research projects have been invaluable, the research needs are ongoing and critical.[10] For example, we have not even begun to understand soil ecosystems. We talk about soil health, but we have only a rudimentary understanding of what that even means in terms of soil nutrient transformations and availability. If we are really going to be discussing regenerative agriculture, and climate resiliency, investment in organic systems research is critical to our understanding of our food production systems.

Research is key to tackling the many challenges facing organic farmers. As was true in the last Farm Bill, a high priority should be placed on increased funding for organic research, to keep pace with the growing organic sector. This should include organic research priorities across USDA research and data agencies,

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[6] *See* Utah State University Cooperative Extension, *Codling Moth Mating Disruption*, April 2010, https://extension.usu.edu/pests/uppdl/files/factsheet/codling-moth-MD10.pdf.

[7] USDA Economic Research Service, *Cover Crop Trends, Programs, and Practices in the United States*, Economic Information Bulletin 222, February 2021.

[8] Chuck Gill, COVER CROPS MORE EFFECTIVE THAN INSECTICIDES FOR MANAGING PESTS, STUDY SUGGESTS PENN STATE UNIVERSITY, https://www.psu.edu/news/agricultural-sciences/story/cover-crops-more-effective-insecticides-managing-pests-study-suggests/ (last visited Dec 1, 2022).

[9] Alan J. Franzluebbers et al., *Adjusting the N fertilizer factor based on soil health as indicated by soil-test biological activity*, 7 AGRICULTURAL & ENVIRONMENTAL LETTERS (2022).

[10] *See Generally*, Snyder et al., *2022 National Organic Research Agenda*, Organic Farming Research Foundation

including the National Institute for Food and Agriculture, Agricultural Research Service, National Agricultural Statistics Service, Agricultural Marketing Service, and the Economic Research Service. To that end, I urge these following programs to be included and robustly funded in the upcoming Farm Bill. These programs will help organic and conventional growers respond and adapt to the multi-layered challenges we are facing:

- **Increase funding for the Organic Agriculture Research and Extension Initiative (OREI) to $100 million by end of the 2023 Farm Bill;**

- **Formally authorize the existing NIFA Organic Transition Program at $20 million by the end of the 2023 Farm Bill, with a name change and program mission updates to avoid confusion and improve program operation;**

- **Continue to support the work of other NIFA programs that should expand their organic portfolio, like SARE, SCRI, and AFRI-SAS;**

- **Require USDA to direct ARS to increase investments into organic agriculture research, both through coordinating the ongoing and planned research while also increasing the amount of organically certified acreage ARS is operating;**

- **Reauthorize the Organic Data Initiative (ODI) to expand segregated organic data collection and analysis by the National Agricultural Statistics Service, Agricultural Marketing Service, and the Economic Research Service and require an economic impact analysis of the organic agriculture market on rural communities;**

- **Require USDA to dedicate funds annually to fund the development of cultivars and animal breeds that are regionally adapted using conventional breeding methods to address farmers' unique soils, farming systems, market needs, and changing climates; and**

- **Require USDA to appoint a Public Cultivar and Breed Research Coordinator reporting to the Under Secretary of Research, Education, and Economics to oversee collaboration between existing USDA competitive grant research programs regarding regionally adapted cultivar and breed development activities.**

As an organic grower, making daily decisions, the more information and tools I have at my disposal the better grower I can be. These programs and investments are critical for research into the agricultural systems we depend on for food and fiber production. I am amazed at the gains in organic systems understanding we have achieved with relatively little funding. That being said, increased funding will accelerate and punctuate those gains and will give me, as a grower, better tools to produce food in an environmentally friendly fashion. One of the mantras of organic growers is "continuous improvement" - the way to do that is to invest in research and extension that allows us to test, try, and investigate the way systems work.

Testimony of Dr. Deacue Fields, III
Vice President for Agriculture, University of Arkansas System
"Farm Bill 2023: Research Programs"
U.S. Senate Committee on Agriculture, Nutrition, and Forestry
December 6, 2022

Chairwoman Stabenow, Ranking Member Boozman, and members of the Committee, my name is Deacue Fields, the University of Arkansas System Vice President for Agriculture, and I am grateful to the Committee for the courtesy of allowing me to testify today on behalf of the entire land-grant system. I am also grateful for the significance this Committee has placed on the Research Title of the next Farm Bill as demonstrated by today's hearing.

By way of quick introduction, I oversee the University of Arkansas System Division of Agriculture which is a separate institution comprised of the Arkansas Agricultural Experiment Station and the Arkansas Cooperative Extension Service. Prior to my becoming Vice President, I was Dean of the Dale Bumpers College of Agricultural, Food and Life Sciences at the University of Arkansas, the agricultural teaching program at our 1862 land-grant campus. In fact, I have degrees from two of the nation's premier 1862 land-grant programs and another from a premier 1890 land-grant. I have also worked at two other 1862 and 1890 land-grants before coming to the University of Arkansas System. I am a walking billboard of the power of the nation's land-grant system to connect a young man from a small town in northern Louisiana with the world.

In my current and previous roles, I have seen the interconnectivity of the land-grant model and am an enormous advocate of its transformative strength that marries vision with relevance. It is the fuel that that helps drive the agricultural, food, and rural development engine that is the envy of the world. Most importantly, it is the foundational stone that undergirds public and private advances in research and innovation, trains our future, allows us robust resiliency in the face of continual and mounting challenges, and is the nucleus of the world's food security.

The federal role in the triad of teaching, research, and extension started with the initial vision and continues with over a century and a half of critical policy and funding support. Building on this noble legacy, may I be so bold as to share some additional recommendations?

Earlier this year, the Economic Research Service published data that shows the US public investment in agricultural research has declined by one-third over the past two decades. During this period public investment by China has increased by over 150% and European Union investment has increased by 33%. About 70% of public agricultural research and development is performed at land-grant universities and other non-Federal entities. These researchers investigate major challenges such as food security, water conservation, animal and plant diseases, nutrition and health, consumer demand and more. Agricultural research and Extension investments result in $10-$20 in benefits for every $1 spent (or a

20-60% internal rate of return). (OECD, 2016). The global competitiveness of US agricultural research is challenged as the public investment declines disproportionately. Too much is on the line, and we must make critical investments now.

Capacity funding (Hatch, McIntire-Stennis, and Smith-Lever/ Evans-Allen and 1890s Extension/and 1994 programs) serves as the foundation of all of U.S. food and agricultural innovation through the colleges of agriculture. Experiment stations conduct vital research tailored to the needs of each state but often with national and international impacts. Land-grant extension programs provide essential technical assistance, education and resources that reach every county and parish in America. No other entity can boast this type of national linkage and engagement with rural and urban communities. Unfortunately, the U.S. has lost considerable capacity for these programs in real dollar terms over the past 20 years.

There is often a misperception that funding is distributed at land-grant campuses. In most cases the central campus budget only covers the teaching function for faculty with experiment station and/or cooperative extension appointments, and funds allocated to the central campus budget do not typically funnel down to support research for faculty with agricultural experiment station and cooperative extension. As a general rule, the budgets for the agricultural experiment station and cooperative extension are mutually exclusive from the central campus budget. When the University of Arkansas receives budget increases from tuition, increased student numbers or other sources, the agricultural experiment station must increase state, federal or extramural funds to maintain competitive salaries while still conducting quality research and extension programs. Although 78% of faculty in the Bumpers College of Agricultural, Food and Life Sciences have a joint appointment in the University of Arkansas System Division of Agriculture, the agricultural experiment station provides all funding to support the research these faculty conduct

Land-grants have successfully leveraged federal resources provided. Using Arkansas as an example, in 2022, state appropriated funds accounted for 56.5% of the total University of Arkansas System Division of Agriculture budget. In addition, since 2017, extramural grant funding has increased 2.1% and county funding of extension programs has increased 1%. Unfortunately, over this same five-year period, the share of our budget represented by federal capacity funding has fallen from 9.1% to 6.3%, a nearly 31% decrease.

In Arkansas, USDA Agriculture Research Service units are either housed in, co-located with, or supported by UA System entities. This was seen as a necessary way to leverage ARS investment while benefitting the scope and reach of UA System research. Over a twenty-year period beginning in 1990, the Division of Agriculture met regularly with national and regional ARS administrators to help ensure complementarity of our research activities, a practice that we would very much like to resume. Making this a nationwide practice where it is not currently engaged would serve the nation well. Joint research activity with ARS through an increasing number of cooperative agreements will help reduce research silos, increase research relevance, and avoid costly and unnecessary redundancy.

We cannot do 21st century agriculture in mid-20th century facilities, the last major investment period. At every land-grant institution in the country, our research infrastructure is degrading, and literally crumbling in many instances. In the University of Arkansas System Division of Agriculture our estimated deferred maintenance costs are $92 million. Within the last five years, we have managed to bring two new facilities online. We saved thirteen years to be able to begin construction on one facility, forcing us to abandon sorely needed maintenance and renovation on existing facilities. On the other, we were forced to remain in a substandard facility fifteen years beyond its time to be razed before we could cobble together enough resources to replace it.

Our states provide much of the support to recruit and maintain our faculty personnel – and these faculty carry their own weight through their extramural funding efforts. But that human capital component can only function effectively within an increasingly complex physical infrastructure. From smart classrooms to state-of-the art laboratories and field technology, a sophisticated – and expensive – infrastructure is necessary both to attract good talent and to equip that talent to address current and challenges. Land-grants are expected to be able to evaluate and showcase the latest technology, but in many cases our agricultural producers have more modern technology than we do. One of the most impactful things our federal partners can do is to help us with the kind of large, up-front capital investments that are required to develop the infrastructure necessary to support cutting edge research, extension and teaching programs. We do a good job building human capital. We could use help building the physical capital to support it.

Our researchers are addressing critical national needs and challenges, and we must make core investments in research infrastructure if we are going to compete globally and enhance national and international food security. Reauthorizing and funding the Research Facilities Act would allow our land-grant institutions to modernize our research facilities and begin to address an $11.5 billion backlog of deferred maintenance. Not only would this funding allow us to improve our current facilities, it would also allow for the development of plans for new facilities as well—and perhaps most importantly, act as a catalyst to attract the next generation of agriculture innovation leaders.

Partnerships are essential to what we do. Land-grants have worked in partnership with one another, with federal, state, and local governments, and with community and industry stakeholders since our founding. These partnerships are most effective when they develop organically in response to common problems. Land-grant universities have excelled not only in performing production agriculture research, but also policy, consumer, health and nutrition research to improve quality of life in urban and rural communities. By providing the land-grant system with adequate resources for our programs, Congress empowers the development of effective and efficient local, state, regional and even national collaborative efforts to address even the most challenging stakeholder concerns. This approach brings world class solutions to grass roots problems throughout the country.

Land-grant research discoveries have resulted in the U.S. having the safest, most efficient food system in the world. It is critical that agricultural research funding increase to remain a global leader and produce the technological advances necessary to meet the challenge of

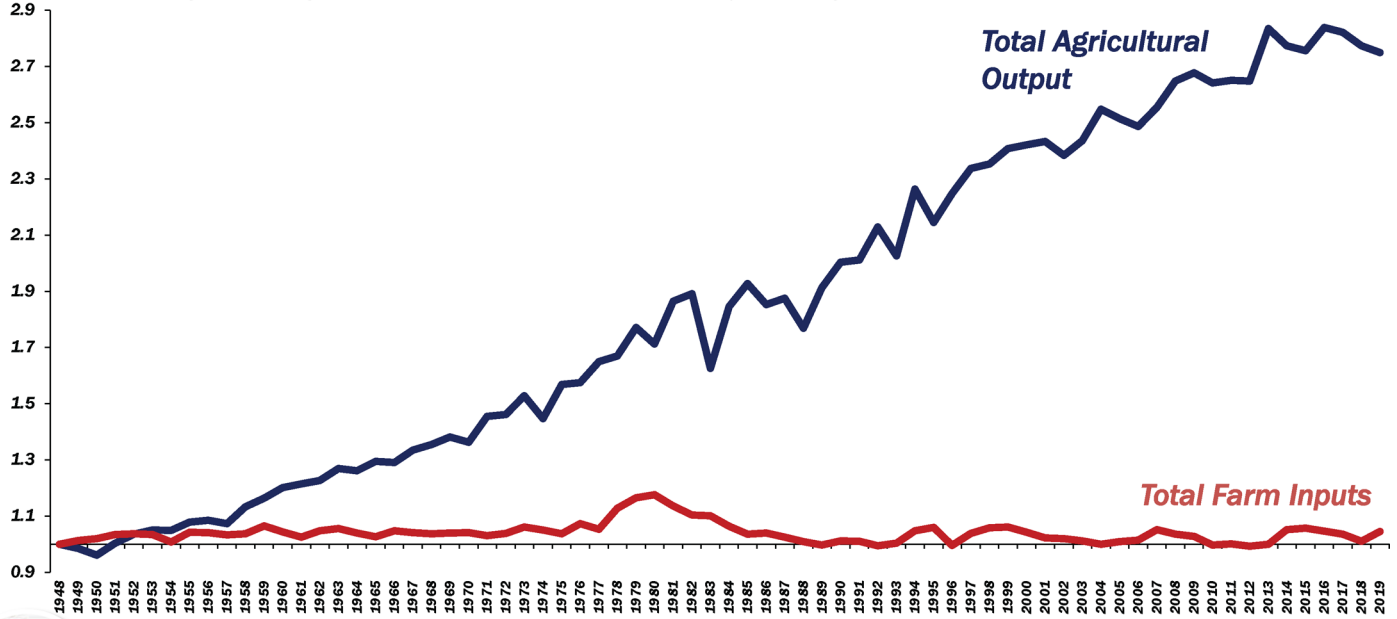
feeding the growing global population. Supporting agricultural research and infrastructure development is not a donation, but an investment in the future national and international food security.

DOCUMENTS SUBMITTED FOR THE RECORD

DECEMBER 6, 2022

U.S. Farm Productivity

Indices of farm outputs and inputs for the United States, 1948-2019, (1948 = 1)



Senate Ag Committee Republicans

Senate Ag GOP Analysis, USDA ERS

University of Nebraska Lincoln

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
OFFICE OF THE NU VICE PRESIDENT AND IANR HARLAN VICE CHANCELLOR

November 2, 2022

Dionne Toombs, Acting Director
National Institute of Food and Agriculture
U.S. Department of Agriculture
1400 Independence Avenue, SW
Washington, D.C. 20250

Dear Acting Director Toombs,

My name is Mike Boehm and I am the Harlan Vice Chancellor for the Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln and Vice President for Agriculture and Natural Resources at the University of Nebraska system. Thank you to the National Institute of Food and Agriculture for hosting this listening session. I welcome the opportunity to provide Nebraska's input as the agency develops its education and science priorities.

The University of Nebraska-Lincoln is our state's flagship land-grant institution. A proud member of the Big 10 Conference, the Big 10 Academic Alliance, and the Association of Public and Land-grant Universities, Nebraska is a R1 research institution with annual research expenditures of $320 million or more. IANR scientists and engineers account for roughly 46% of this annual expenditure, and externally sponsored research within the IANR accounts for nearly $71 million of that total in FY2022.

In the Institute, we are all about people and the food, water and natural resources that sustain them. IANR has embraced the current challenges facing the U.S. agricultural industry to ensure a safe, nutritious, and abundant food supply to an expanding global population while protecting the environment and profitability for our farmers and ranchers. Nebraska is only second to California in agricultural production and farmgate revenue at $27 billion is a natural research hub with seven climatic zones where a mix of agricultural crops, forage and livestock are produced. UNL innovation in research and advanced technology, teaching, and extension education places Nebraska on the leading edge of food production, environmental stewardship, human nutrition, business development, and youth engagement. Our researchers are perfectly positioned and are working hand in hand with Nebraska's 46,332 farms and ranches. As such, UNL is recommending several key suggestions to NIFA, which reflect what we're hearing directly from Nebraska's key agricultural stakeholders:

Research priorities that complement the vision of the National Center for Resilient and Regenerative Precision Agriculture.

As USDA looks forward to developing updated science priorities, advancing targeted and strategic investments centering on all things precision ag is long overdue. We are at a critical juncture in advancing precision agriculture technology and related artificial intelligence and commend USDA's efforts to establish a co-located, national center for resilient and regenerative precision agriculture in Lincoln at Nebraska Innovation Campus. This facility will serve as the anchor of a national network comprised of USDA and land-grant universities committed to addressing the most critical science gaps required to ensure the United States remains the leader in feeding and fueling a growing world sustainably. As such, NIFA should pursue priorities that complement this vision and help transition producers to a new world where digital ag drives most on-farm decision-making.

Continued support for the National Agricultural Producers Data Cooperative.

Given that precision agriculture heavily relies on on-farm data to enhance producer efficiency and profitability, NIFA should continue its investment in the National Agricultural Producers Data Cooperative. This project is currently developing a blueprint for a national framework to create a neutral and secure data repository cooperative where producers, small businesses, land-grant universities, and not-for-profit organizations can store and share data and develop powerful tools that enable producers to make more informed enterprise-level management decisions. NIFA should continue its investment in creating this repository, which will be a key component as the nation transitions from mechanized to digital agriculture.

How to safeguard the nation's food supply as farming practices become highly digitalized.

While the transition to digital and precision agriculture will provide many opportunities that producers can leverage, it will also pose significant challenges. For example, in the next 15 to 20 years, U.S. agriculture will likely transition from large diesel-powered tractors and implements to a collection of highly networked smaller, lightweight autonomous robots, drones and sensors. Communications between these machines will not only be required, but large quantities of data generated will likely require tremendous computer power, possibly off farm supercomputing facilities. Various challenges will be presented with equipment compatibility, security of data, and protection against bad actors interested in targeted violence and terrorism against America's farms, ranches, and processors. NIFA should consider how to safeguard the nation's food supply as these disruptive technical changes significantly alter current farming practices.

Solutions that account for the impacts of a changing climate, such as drought.

In addition to advancing regenerative and precision agriculture, NIFA should also prioritize solutions that account for and possibly help mitigate the impacts of a changing climate with more frequent extreme weather events. According to the National Drought Mitigation Center, which is located at UNL, 63 percent of the lower 48 states are currently experiencing drought conditions This is affecting approximately 393 million acres of cropland and 135 million people. While the drought is undoubtedly straining the agricultural community, its long-term impact on global food security is unknown. Similarly, NIFA should continue its three-pronged approach for climate smart ag priorities: filling in knowledge gaps around modeling, carbon capture and carbon markets; fostering grassroots climate change innovations in farming and forest management; and

ensuring a strong connection between USDA's regional climate hubs and university cooperative extension services.

Critical nutrition research to develop new foods/crops with proven health benefits, particularly those that affect the human gut microbiome.

Finally, as food biotechnology and biomedical research continues to advance, we will soon be able to develop hybrid crops to improve the quality of life by those affected by critical diseases. We encourage NIFA to continue critical nutrition research to develop new foods/crops with proven health benefits, particularly those that affect the human gut microbiome. This is a key area of focus at the University of Nebraska's Food for Health Center where researchers are determining how the collection of all beneficial and potentially harmful micro-organisms in the digestive system can affect health and well-being and prevent health disorders, including heart disease, diabetes, obesity, cancers, inflammatory bowel disease and mental disorders.

Other science and education priorities for NIFA to consider include the future of robotics, particularly as it can mitigate labor issues in meatpacking; meat and poultry expansion and workforce development; and value-add for U.S. agriculture and the U.S. economy through advanced bioproducts and biomaterials.

Thank you very much for your time today and the opportunity to comment on NIFA's science priorities. We greatly appreciate NIFA's leadership and support for initiatives that ensure the long-term viability of American agriculture.

Sincerely,

Michael J. Boehm, Ph.D.
NU Vice President and
IANR Harlan Vice Chancellor

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QUESTIONS AND ANSWERS

DECEMBER 6, 2022

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
Farm Bill 2023: Research Programs
December 6, 2022
Questions for the Record
The Honorable Chavonda Jacobs-Young

Ranking Member John Boozman

1. You mentioned in your testimony the need for more college graduates in agriculture, food, and natural resources. How does USDA's Research, Education, and Economics (REE) mission area work with youth in agriculture to promote studies and careers in agriculture, particularly, youth agricultural organizations who prioritize agriculture, leadership, and careers in the agriculture, food, and natural resources sectors?

   Response: There are several programs within USDA's National Institute of Food and Agriculture (NIFA) that enable colleges and universities to provide the quality of education necessary to produce baccalaureate or higher degree level graduates capable of strengthening the nation's food and agricultural scientific and professional workforce. Such programs include grant programs within NIFA's Agriculture and Food Research Initiative (AFRI).

   AFRI's Education and Workforce Development program areas support:
   1. professional development opportunities for K-14 educational professionals;
   2. non-formal education that cultivates youth interest in food and agriculture;
   3. workforce training at community, junior, and technical colleges;
   4. training of undergraduate students in research and extension;
   5. fellowships for predoctoral candidates and postdoctoral scholars; and
   6. special workforce development topics.

   The 4-H Program (also known as 4-H Youth Development Program) is a federal program of the USDA that is administered through the Cooperative Extension System (CES) in partnership with NIFA and a community of over 100 universities to provide experiential learning in school programs, community clubs, and 4-H camps. Its purpose is to offer hands-on learning for youth aged K-12 to build agricultural literacy, leadership, resiliency, and life skills. The organization offers youth development programs covering areas of science, technology, engineering, and math (STEM), agriculture, healthy living, and civic engagement.

   The Youth Farm Safety Education and Certification (YFSEC) programs supports national efforts to deliver timely, pertinent, and appropriate farm safety education to youth seeking employment or already employed in agricultural production. YFSEC is authorized under 3(d) of the Smith-Lever Act of 1914 [7 U.S.C 343(d)] as amended, as such funding is to support Extension projects. The Safety in Agriculture for Youth National Steering Committee funded by the YFSEC program includes representatives from youth agriculture organizations and other national stakeholders focused on

agriculture and agricultural education to help identify curriculum and testing gaps, certification needs, and industry recognized credentials, as well inform a national outreach strategy.

The Food and Agricultural Non-Formal Education Program of AFRI's Education and Workforce Development (EWD) supports content development and activities for non-formal education to foster development of technology-savvy youth. Projects must develop activities that cultivate interest and competencies in STEM and in food and agricultural sciences supported by the six Farm Bill Priority areas of AFRI.

The Youth Innovators Empowering Agriculture Across America Program of the AFRI EWD requires applicants for the Coordination Network (CN) to collaborate with other youth-serving partners for joint initiatives aimed at building the capacity and educational and workforce pipelines for young people in underserved communities, among other requirements. The CN also supports regional projects aimed at enhancing positive youth development efforts focused on education and workforce development aligned with the AFRI Farm Bill and USDA priorities to inspire the next generation of food and agriculture professionals.

Grants Promoting K-12 Education: These grants target teachers from primary grades to high school. They help educators give students a foundation in math and science relating to agriculture.
- Ag In the Classroom: Promotes science literacy state-by-state
- Secondary Education, Two-Year Postsecondary Education, and Agriculture in the K-12 Classroom Challenge Grants Program (SPECA): Contains special funding options for K-12 teachers.
- National Awards Program for Excellence in College and University Teaching in the Food and Agricultural Sciences: Recognizes talented educators who inspire students in agriculture.

Grants Promoting University Education: These grants allow faculty members to give their students the best education possible in Agri-science.
- Higher Education Challenge (HEC) Grants Program: Grants for faculty to develop a creative or non-traditional approach towards addressing that need that can serve as a model to others.
- Capacity Building Grants for Non-Land-Grant Colleges of Agriculture Program: Supports non-Land-Grant colleges in their efforts to carry out educational, research, and outreach activities that address priority concerns of national, regional, State, and local interest.
- Scholarships for Students at 1890 Institutions (1890 Scholarships): The scholarships are intended to encourage outstanding students at 1890 institutions to pursue and complete baccalaureate degrees in the food and agricultural sciences and related fields that would lead to a highly skilled food and agricultural systems workforce.
- Special Projects: Data Research Programs: NIFA also funds projects to track trends in agricultural workforce and graduate degrees in agriculture.

Additionally, USDA's Economic Research Service (ERS) has recently entered into an agreement with the Agricultural and Applied Economics Association to help increase diversity in the field of agricultural economics. This agreement focuses on attracting students from high school through advanced degrees and beyond to the field of agricultural economics. By expanding the number of students from underrepresented groups pursuing advanced degrees and careers in agricultural economics, both organizations aim to diversify, support and retain a new generation of skilled professionals that are more representative of today's society.

Finally, NIFA's new $250 million NEXTGEN program funded through the American Rescue Plan Act (ARPA) will enable Minority-Serving Institutions to create career development opportunities in agriculture for next gen scholars. This program addresses a critical need to attract, inspire, and retain diverse and talented youth for careers in food and agriculture. It is also a foundation and model on which, in partnership with Congress, we can make changes that enable USDA internship, fellowship, and other professional development opportunities to translate into career opportunities for next gen scholars and professionals in food and agriculture.

2. As you noted in your testimony, the average age of farmers is 58 years old. How are you supporting not only the next generation of graduates in agriculture, but the next generation of farmers and ranchers? What role does the Cooperative Extension Service have in developing the next generation of farmers and ranchers?

Response: U.S. farmers have been on their current farm an average of 21 years. Beginning farmers have ten or fewer years of farming experience and in 2017 made up about 27% of the U.S. producer population. While the average age of the U.S. farmer is 58 years, the average age of the beginning farmer is 46 years. The average age of all farmers and ranchers continues to rise.

NIFA supports the next generation of graduates in agriculture by:
- Increasing exposure to job opportunities in agriculture in the public and private sectors for recent graduates. Recent graduates can join USDA as employees through the OneUSDA Internship program, or through specific job opportunities accessible via www.USAjobs.gov.
- Providing scholarships for students at 1890 Institutions.
- Promoting access to career paths in agriculture and leadership opportunities.
- Providing adequate technical and training assistance for new entrants into the agriculture discipline both in one-on-one and group settings.
- Offering strategies and insights for conducting agriculture businesses.
- Encouraging graduates to join Agriculture networks for future prosperity as well as for upward mobility.
- Ensuring access to information about organizations, services, and opportunities to build knowledge base and skill sets.

NIFA supports the next generation of farmers and ranchers by:

- Educating, mentoring and training individuals including youth (16 years and older) to become farmers and ranchers through NIFA's Beginning Farmer and Rancher Development Program.
- Providing education, mentoring and technical assistance to enhance access to land, capital, marketing, and production.
- Training individuals to become farmers and establish farming enterprises.
- Providing knowledge, skills and support services needed to launch or strengthen farm businesses.
- Promoting access to USDA programs and services.
- Offering connections with USDA Service Centers where customers can access services provided by the Farm Service Agency, Natural Resources Conservation Service, and Rural Development agencies.
- Offering connections with County Extension Offices so producers can connect directly with County Extension Agents at the County and Parish levels.
- Encouraging producers to subscribe to Farmers.gov to get more done with web-based tools and view important and ongoing National USDA program deadlines.

Cooperative Extension Service supports the development of the next generation of farmers and ranchers by:
- Promoting access to USDA programs and services and translating research into action in all counties and parishes nationwide.
- Empowering farmers and ranchers to meet the challenges they face as well as adapt to changing technology.
- Providing training and technical assistance to farmers and ranchers in linking landowners with farmers seeking to sell or rent farmland.
- Enhancing access to farmland for production and linking farmers with market access.
- Provides training and technical assistance to include heir's property, estate planning, farm financial management, better access to capital, credit, and operating loans that are critical for farm start-ups.
- Expanding opportunities for underserved farmers, women and veteran farmers and ranchers.
- Working with 4-H Youth, Vocational Agriculture and Future Farmers of America K-12 in promoting agriculture.
- Working with farmers and ranchers in establishing cooperatives.
- Assisting farmers and ranchers build capacity to create risk management strategies for quick and immediate recovery after an emergency disaster .
- Preparing for and responding to emergencies during disasters through the Extension Disaster Education Network, an effort of the Cooperative Extension Service.
- Conducting conferences, workshops, on-farm demonstrations, field days, farm tours, one-on-one mentoring.
- Working with farmers and ranchers to address climate change with climate smart agriculture, food and forestry solutions and to mitigate challenges arising from COVID-19 Pandemic.
- Distributing newsletters and translating publications into other languages as needed to provide tailored customer service.
- Developing farm business plans to maximize income to increase net farm income.

- Providing legal assistance to resolve challenges with heirs property and estate planning to preserve and maintain land ownership and generational transfer of farmland.

3. The 2018 Farm Bill directed the Agricultural Research Service (ARS) to develop, implement, and make publicly available an assessment and plan for the National Plant Germplasm System (NPGS). Once implemented, the NPGS will allow access to critical plant germplasm necessary to address immediate agricultural production problems, and safeguard plant genetic diversity for the future.

    a. What is the current status of the development and implementation of this plan?

        Response: The Agricultural Research Service (ARS) is excited about this plan and appreciates the opportunity to consult, analyze, develop, and make it publicly available. At present, the plan is fully developed and incorporates recommendations from the National Genetic Resources Advisory Council. ARS understands the plan's importance and is now working on its clearance through the Department so that it can be made public and implemented.

    b. Please provide a timeline for expected public availability of the plan.

        Response: While USDA does not have a specific timeline, I am committed to ensuring that the plan is made publicly available as soon as it is cleared through the Department.

4. Please describe how ARS data and research regarding biotechnology is utilized by activities in other mission areas, such as the Biotechnology Regulatory Services, to promote innovation and advanced technologies for U.S. agriculture.

    Response: The Agricultural Research Service' (ARS) data and research regarding biotechnology promotes innovation and advanced technologies for U.S. agriculture, promotes science-based regulatory policy through research, and sustains effective science-based leadership by U.S. agencies, including the Animal and Plant Health Inspection Service (APHIS) through its Biotechnology Regulatory Service (BRS) program, Agricultural Marketing Service (AMS), Foreign Agricultural Service (FAS), Environment Protection Agency (EPA), Food and Drug Administration (FDA), National Aeronautics and Space Administration (NASA), and Department of Energy (DOE). Specifically:
    - ARS data informs U.S. biotech regulators (BRS, EPA, FDA) of the scope, scale and importance of natural DNA sequence diversity used by breeders for conventional crop breeding.
    - ARS data supports EPA and industry efforts to preserve insecticide efficacy.
    - ARS supports BRS biotech forensics, thus preserving trade.
    - ARS pollinator-mediated geneflow research informs BRS and industry stakeholders to foster coexistence of biotech and conventional crops.

- ARS supports the National Institute of Food and Agriculture's BRAG (Biotechnology Risk Assessment Grants) program that serves U.S. biotech regulators at BRS, EPA, and FDA.
- ARS supports FAS biotech outreach.
- ARS, DOE, and BMGF support RIPE (Realizing Increased Photosynthetic Efficiency) through biotechnology.

a. The Office of the Chief Scientist is designed to serve a coordination role over all USDA scientific functions. How does biotechnology and other advanced technologies fit into this mission?

Response: Agricultural biotechnology research plays a crucial role in developing and advancing solutions to challenges faced by U.S. farmers. USDA subject matter experts in the Office of the Chief Scientist (OCS) work closely with Research, Education, and Economics (REE) agencies and with the USDA Biotechnology Coordinator to advance biotechnology research solutions so that farmers and consumers benefit from these innovations. OCS also works with other USDA and Federal agencies and partners in other countries to advance risk-proportionate regulatory policies that encourage development and use of innovations needed to strengthen U.S. agriculture and help make global agricultural systems more resilient.

Examples of how REE research and data are coordinated with and utilized in other mission areas include:

- APHIS greatly benefits from the USDA Biotechnology Risk Assessment Grants (BRAG) Program, which supports research designed to identify and develop appropriate management practices to minimize potential physical and biological risks associated with animals, plants, and microorganisms developed using genetic engineering, as well as research that generates information and data that informs risk assessments and regulatory decision-making. On a case-by-case basis, APHIS works closely with ARS scientists to address specific regulatory matters.

- USDA's Foreign Agricultural Service (FAS) also makes extensive use of ARS research and expertise to advance agricultural biotechnology globally. ARS innovations in plant breeding—particularly with genome editing—have been very helpful in discussions with the European Commission and Member States regarding genome editing reform in the EU. FAS is currently planning a high-level engagement in the EU concerning wine grape climate adaptation utilizing gene editing that will feature ARS conducted & supported research.

- The objective of the ARS vaccine biotechnology research is to develop innovative veterinary medical countermeasures that animal health officials can stockpile to prepare and respond to potential disease outbreaks. For example, in 2015, ARS transferred a vaccine technology for Highly Pathogenic Avian

Influenza (HPAI) to a commercial partner that developed the vaccine which APHIS acquired for the stockpile. There are several new vaccine biotechnologies currently under development that APHIS could eventually be stockpile in the future to help protect U.S. animal agriculture.

5. Does REE have any current plans to leverage agricultural biotechnology innovation research, including synthetic biology, in effort to strengthen U.S. food and agriculture?

Response: The REE agencies are conducting agricultural biotechnology in many areas that strengthen U.S. food and agriculture, for example:
- Agricultural Genome to Phenome Initiative which focuses on collaborative science engagement that brings together a community of researchers across both crops and animals to lay the foundation for expanding knowledge concerning genomes and phenomes of importance to the agriculture sector of the United States. The initiative has positioned the United States as the worldwide leader for crop and animal breeding and selection.
- Breeding Insight program that supports specialty crops and animal breeders by developing genomics, phenomics, and data management tools for higher genetic gains outputs.
- Biotechnology and bioinformatics have also provided opportunities to investigate safe gene editing strategies to facilitate disease resistance and resilience in crops and animals, enhance crop and animal production efficiency, and improve animal welfare. Enhanced characterization of plant, animal and microorganism genomes through development and application of advanced biotechnology have facilitated knowledge of host-organism associations that will improve nutritional, physiological, and genetic responses in plants and animals.
- USDA soil microbiology research focusing on crop management strategies that impact the native soil microbial communities and the influence cropping systems have on the nitrogen and carbon dynamics which contribute to nutrient cycling and nitrogen availability in agricultural soils.
- Crop improvement and genetic research to identify molecular genetic tools to advance biotechnology application for crop improvement including introducing multiple disease defense genes into citrus and potato to combat citrus greening and Zebra Chip diseases.
- Biotechnology is at the core of innovative veterinary medical countermeasures discoveries such as rapid diagnostics for the early detection of diseases and vaccines for preventing the incursion and spread of especially dangerous pathogens. In addition, sequencing of tick and fly genomes have contributed to improved animal health as this research has been used to control these pests with new vaccines and RNAi.
- USDA supports foundational research and development in nanotechnology through programs at NIFA and the Forest Service. NIFA supports foundational research in advancing cutting-edge nanoscale science and engineering for solving significant agricultural and food system challenges. The scope of investigation includes discovery and characterization of novel nanoscale phenomena, processes, and properties that are relevant to agriculture and food; development of new platforms leading to novel applications; novel utilization and valorization of nanobiomaterials; exploitation of bio-

nano interfaces; and exploration of nanotechnology-related aspects of synthetic biology and additive manufacturing technologies.

How can the mission area incorporate public-private partnerships into such agricultural biotechnology research?

Response: REE research regarding biotechnology promotes innovation and advanced technologies for U.S. agriculture, promotes science-based regulatory policy through research, and sustains effective science-based leadership by U.S. agencies. REE agencies develop research initiatives that are designed to work with industry, universities, and communities to transfer important technology to producers and consumers. One area when REE successfully leverages public-private partnerships is in the development of vaccines to prevent disease in food and agriculture. In 2015, ARS transferred vaccine technology to prevent Highly Pathogenic Avian Influenza (HPAI) to a commercial partner for development. As a part of the Presidents Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy, REE has been further engaged with private biotechnology companies to better understand where synergies between public agriculture research and development and the private sector lay.

6. As you know, there is a tremendous need for more veterinarians in rural America. What is REE doing to attract students to veterinary medicine, recruit them to rural areas, and retain their talent for the agriculture and food industry?

Response: USDA, through the National Institute of Food and Agriculture (NIFA), has several ways to attract students to veterinary medicine, recruit them to rural areas, and retain talent. NIFA's two Veterinary Services Programs, the Veterinary Medicine Loan Repayment Program (VMLRP) and the Veterinary Services Grant Program (VSGP) conduct outreach to students in undergraduate and professional (DVM) programs to provide opportunities and support for funding and experience in food animal veterinary medicine and veterinary practice. NIFA staff work with veterinary college leaders and faculty to ensure students and faculty have information on NIFA's programs and to provide support for students as they enter the food animal workforce.

In addition, cross collaboration with State Animal Health Officials, veterinary practitioners, deans of veterinary medical Colleges, student veterinary medical associations, federal agencies (i.e., APHIS, FSIS) and other stakeholders has maintained consistent communication annually to improve incentives to attract, recruit, or retain veterinarians in rural areas of need across the US. These discussions have prompted program staff to evaluate the veterinary programs processes and objectives to better align with the changing workforce in agriculture and veterinary medicine. The VMLRP incentivizes current and future veterinarians to fill serious veterinary shortage situations in the US to enhance the probability the recipient will achieve professional success and satisfaction during their agreement that they will continue in their area to serve beyond the term of their agreement. The VSGP complements the VMLRP by developing,

implementing, and sustaining food animal veterinary services and relieve veterinarian shortage situations. This grant can expose students in 11th and 12th grades to education and career opportunities in food animal medicine, expand or enhance private practices capabilities, services, and resources, as well as establish or expand training or educational opportunities.

The VMLRP provides educational debt loan repayments for food animal veterinarians who provide veterinary services in designated veterinary shortage areas throughout the U.S. for a three-year service period, to ensure these services are available to producers. VMLRP encourages State Animal Health Officials who are writing annual shortage area nominations to describe the positive aspects of the rural lifestyle that will attract students and veterinarians to their areas. In FY2021, the VMLRP designated 221 veterinary shortage areas throughout the US and received 144 applications from food animal veterinarians to fill these shortages. Of these, 78 (55%) were awarded service agreements for an award rate of 54%. VMLRP's funding in FY21 was $7.5M.

The VSGP Rural Practice Enhancement program provides grants to food animal veterinary practices that provide services in designated shortage rural areas. Grant funding allows clinics to retain services in rural areas. Funds can be used for a range of needs such as hiring staff and purchasing equipment and vehicles. The VSGP Education, Teaching and Training (ETT) program also funds education, extension and training opportunities for students, interns, and residents in qualified programs in food animal veterinary medicine, including veterinary technician training programs. In FY2021, VSGP made 17 total awards, 10 in Rural Practice Enhancement and 7 in Education, Extension and Training, with funding totaling $3M.

An example for how NIFA is attracting students to food animal veterinary medicine:
- In 2021, through the VSGP-EET program, NIFA awarded $248,000 to the College of Veterinary Medicine at The Ohio State University for a 3-year project titled "Moving from Meows to Moos; Recruiting Teens to Food Animal Veterinary Medicine Through Education, Experience, and Engagement. A comprehensive first year's report can be found in USDA CRIS (Current Research Information System) under Accession No. 1027110.

An example of how NIFA is funding mentorship to veterinary students to serve rural areas and food animal producers:
- In 2022, through the VSGP-EET program, NIFA awarded $249,930 to the Mississippi State University for a 3-year project titled "Enhancing Rural Practice by Preparing Student, Residents, and Practicing Veterinarians for Service in Veterinarian Shortage Situations."

7. As you are aware, African Swine Fever (ASF) is a significant threat to our domestic pork industry as well as the global pork trade. I am aware that most of ARS's attention in this area has been focused on vaccine development. Can you please provide an update on the status of ASF vaccine research including:

Response: The Agricultural Research Service's (ARS) African Swine Fever (ASF) research program on veterinary countermeasures is primarily focused on vaccine development and critical to the success of this program are 1) basic research on the functional genomics of ASF viruses, 2) viral pathogenesis, and 3) viral ecology in ASF endemic settings, all of which provide critical information to inform our ASF vaccine discovery and development.

a. Studies evaluating the potential for reversion to virulence *(required to ensure that the vaccine's weakened form of the ASF virus does not revert to its original state).*

b. The prospects of developing a DIVA (differentiable between infected and vaccinated animals) capable vaccine.

Response to a. and b.: Reversion to virulence studies are pivotal safety studies that are conducted by pharmaceutical companies according to codified international standards during the implementation of a full vaccine development program. To date, ARS has transferred ASF vaccine candidates to several companies but has research agreements with only two of these companies. As such, ARS is providing full support to these two companies during the execution of pivotal studies, including reversion to virulence studies. One of these reversion to virulence studies has been published in a peer-reviewed scientific journal for the I177L gene deleted ASF vaccine currently being deployed in Vietnam. The results of this study showed the I177L vaccine virus is genetically stable during several passages in pigs and does not revert to virulence. The other company with which ARS has a research agreement is not as advanced and has not yet conducted reversion to virulence studies with their vaccine candidate.

8. As you may be aware, the Food Safety Inspection Service (FSIS) recently announced a Proposed Framework to Reduce Salmonella Illness from Poultry. I have heart that, while industry and academia strongly support the goal of reducing salmonella illness, evaluating and commenting on the proposed framework is difficult due to gaps in available data. Can you provide an update on the state of scientific understanding as well as ongoing research at ARS in the following areas:

a. Attribution/risk assessment indicating what foods and what types of salmonella are most closely and frequently associated with Salmonella illness;

Response: According to the 2020 Interagency Food Safety Analytics Collaboration multi-year outbreak data report, Salmonella illnesses came from a wide variety of foods including Poultry (23.3%), Produce (20.6%), Fruits (14.9%), Pork (12.8%), Beef (6%) and Turkey (5.9%). Although serotypes vary over time and by geographic region, Salmonella Typhimurium and Enteritidis are consistently the most commonly reported serotypes found in association with clinical human illness. Other top Salmonella serotypes in the United States include Newport, Javiana, and monophasic Typhimurium 4,[5],12:i:−. Salmonella

serotypes are constantly emerging and/or developing through molecular changes and environmental selection. Information is lacking on the genetic factors and environmental conditions that lead to the emergence and spread of new Salmonella serotypes. Increased focus on research to fill gaps to identify high risk serotypes and conditions that lead to their emergence and on data analytics to address causes and improve forecasting of the emergence of new serotypes are of critical importance.

b. Efficacy of various intervention strategies used by industry relative to the various specific Salmonella serotypes responsible from causing disease in human;

Response: Due to the diversity of food animal production, including differences in geography, environmental conditions, cost and management types, there are many approaches used by farmers, integrators and processors to reduce Salmonella. Multi-hurdle approaches are used to address needs across the production and processing chain. Interventions include vaccination of animals against specific Salmonella serotypes, biosafety and biosecurity protocols on-farm and various commodity-specific physical and chemical interventions to decrease bacterial contamination of meat during processing.

Vaccines are often effective for targeting specific Serotypes and processing interventions have significantly reduced the prevalence of Salmonella on meat products over the last 20 years.

However, continued high prevalence of this foodborne pathogens has heightened the regulatory and industry focus on Salmonella and prompted the Agricultural Research Service's (ARS) Food Safety National Program to form a multi-disciplinary, cross-programmatic research group focused on integrated food safety systems approaches to address Salmonella. Leveraging resources across expertise in food safety, food animal production and processing, environmental and climate programs, economic assessments and communication tools, the project aims to develop decision support tools and communication frameworks to enable producers and processors to make food safety decisions fit for their needs.

Regulatory agencies and industry need ARS to continue to develop programmatic expertise to model and forecast outbreaks associated with highly pathogenic Salmonella serotypes, including those with multi-drug resistance. The computational and statistical tools and expertise need to be strengthened to continue to make progress on Salmonella illness using state of the art approaches for data interpretation and development of targeted interventions.

c. The development and validation of commercially available and rapid quantitative testing methods to determine if and how testing and processing scheduling can reduce the likelihood that carcasses and parts with higher levels of Salmonella that are most capable of causing illness are released into commerce.

Response: Over the past 2 years, ARS scientists have been working to develop and validate rapid methods for detecting meat products that are contaminated with abnormally high levels of Salmonella. More highly contaminated products are more readily identified with little-to-no enrichment (added time) because of the greater number of Salmonella cells present. Commercially available methods evaluated include the Hygiena Sal-Quant system and the BioMerieux GeneUP Quant Salmonella system, that is currently being used by FSIS for quantifying Salmonella contamination in breaded stuffed raw chicken products. Reducing the entry of products contaminated with higher levels of Salmonella into commerce, will decrease human exposure to Salmonella, and the concomitant risk to human health.

d. Any research being done for commercially available and rapid methods for serotypes of human health concern or specific virulence genes that are associated with illness.

Response: USDA Agricultural Research Service (ARS) Scientists have developed and validated a rapid molecular detection method for identifying Salmonella strains of greater concern for human health, referred to as Highly Pathogenic Salmonella (HPS). The test targets 8 Salmonella specific virulence genes, and the identification of 5 or more of these targets indicates the presence of a HPS strain. ARS and the Food Safety and Inspection Service have worked together to validate the method, and the test was found to be 99% specific and 96% sensitive for identifying Salmonella strains that are the leading contributors to human illnesses. ARS is currently working with partners in the microbial detection industry to develop this test into a commercial test kit for use in regulatory and industry food testing laboratories. ARS has also developed assays to detect critically important antimicrobial and biocide resistance and to target S. Infantis a multi-drug resistant serotype which has been increasing in prevalence in poultry products.

9. This year we have witnessed a virtually unprecedented persistence of Highly-Pathogenic Avian Influenza (HPAI) in both commercial and backyard flocks throughout the country. In past years, we would expect outbreaks to recede during warmer months. Further, this strain seems to be prevalent in many species of wild birds rather than primarily in migratory waterfowl as we have come to expect.

a. How does the relatively novel behavior of the virus this year affect the direction of research going forward?

Response: As mentioned, the current HPAI panzootic is unprecedented and reflects the fact that, unlike the 2014-2015 outbreak, the virus continues to circulate in the wild bird population without the usual seasonal decrease. The majority of detections in this outbreak are not from traditional farm-to-farm spread, but rather due to wild birds that are spreading the virus widely. The amount of virus circulating in wild birds is challenging conventional on farm

biosecurity measures and producers, and USDA needs to adapt methods and identify new countermeasures and strategies. ARS is collaborating with APHIS and the poultry industry to develop veterinary medical countermeasures that could be used as part of a comprehensive response or control strategy. First, it is critical that we monitor and characterize the evolution of these viruses as they continue to adapt to survive longer in wild bird populations. Second, research to support on-farm biosecurity measures will continue to be a key priority for our research programs. Third, ARS continues the research, development, and evaluation of new veterinary countermeasures, such as vaccines, should they be needed in the future.

b. Are we conducting sufficient research seeking to ascertain why the current outbreak is behaving differently than in previous years?

Response: Yes. USDA, through the Agricultural Research Service and the Animal and Plant Health Inspection Service, are working closely with our Federal and State action and regulatory agencies to monitor and characterize the evolution of the HPAI viruses that are at the core of the disease outbreaks in the United States.

c. Is research in progress on the characteristics of this year's strain of the virus and what characteristics may have contributed to the increased prevalence and persistence we are experiencing?

Response: Yes. USDA, through the Agricultural Research Service and the Animal and Plant Health Inspection Service, are working closely with our Federal and State action and regulatory agencies to monitor and characterize the evolution of the HPAI viruses that are at the core of the disease outbreaks in the United States.

d. What is the state of research pertaining to our ability to predict and respond to future variations of the virus?

Response: Although great strides have been made in understanding the molecular mechanisms that enables avian influenza viruses to emerge, there is still a great deal that has yet to be deciphered. Predictive biology research to better predict and forecast new and emerging avian and mammalian influenza viruses is a priority for USDA, and the Agricultural Research Service will continue to allocate existing resources to advance this field of research.

e. Is further research required with respect to biosecurity measures applicable to this new environment given the bulk of infection is vector born rather than the product of farm-to-farm transmission?

Response: Yes. Research to support on-farm biosecurity measures will continue to be a key priority for USDA's influenza viruses (avian and swine) research programs at the Agricultural Research Service and analysis within the Animal and Plant Health Inspection Service. Existing biosecurity measures have largely

limited farm-to-farm lateral spread and USDA continues to urge all producers to be vigilant to eliminate the possibility of this type of spread.

f. Is research underway on developing a commercially viable method to differentiate between the presence of the virus due to actual infection versus vaccination? If so, can you give us an update on that research? If not, would you recommend resources being dedicated to this space?

Response: Yes. One of the major impediments of vaccination is the likely negative impact on trade. However, trading partners may be more amenable to trade negotiations for vaccinated poultry if it is possible to prove with reasonable assurance that vaccinated animals have not been infected with HPAI. All of the vaccine technologies currently being evaluated by USDA's Agricultural Research Service (ARS) have been engineered to differentiate infected from vaccinated birds (DIVA). Most DIVA strategies have historically used serologic antibody tests to evaluate infection. ARS is currently evaluating DIVA strategies after vaccination to determine if the serologic response is consistent and can be clearly defined. This usually requires an inexpensive companion diagnostic test kit that will allow samples to be processed and tested in large numbers. The development of such a companion diagnostic test kit will be paramount to effectively implement a DIVA vaccination strategy and to minimize negative economic consequences for producers.

10. Research from the Universities of California-Davis and Georgia found that the nutritional value of frozen fruits and vegetables is equal to, and in some cases better than, fresh-stored produce. In a study by USDA last year, it found 61% of SNAP recipients identified the cost of healthy food as a barrier, 30% lacked the necessary time to prepare meals from scratch, and more than 10% lacked cooking skills. Frozen foods are affordable, often costing less than their restaurant or home delivery equivalents. Frozen foods have easy to follow on-packaging instructions so consumers can prepare meals with minimum equipment, cooking skills or time.

Knowing that it takes all types of food to achieve a balanced and healthy diet, how can we ensure research and consumer education amplify this sentiment so that families understand that frozen foods are also healthy, and that people utilizing government feeding programs are best served?

Response: USDA's Nutrition.gov website provides resources on many topics related to healthy eating. There is a section devoted to nutrition on a budget (https://www.nutrition.gov/topics/food-security-and-access/nutrition-budget) which specifically provides the following information under fruits and vegetables – Find fruits and vegetables in the produce section, frozen foods, and in the canned and pantry food aisles. Compare prices to find the best buys.

- Buy "in season" produce which often costs less and is at peak flavor. Buy only what you can use before it spoils. For more info check out the Seasonal Produce Guide from SNAP-Ed Connection.
- Choose fruits canned in 100% fruit juice and vegetables with "low-sodium" or "no salt added" on the label. These products are just as nutritious and fresh, and often cost less.
- If you have the freezer space, stock up on frozen vegetables without added sauces or butter. Frozen vegetables are as good for you as fresh and may cost less.
- Canned and frozen fruits and vegetables last much longer then fresh. They can be a quick way to add fruits and vegetables to your meal.

USDA's Agricultural Research Service (ARS) continues to conduct high impact research on frozen foods at the Western Regional Research Center (WRRC) in Albany, CA. The WRRC has been designated a National Historic Chemical Landmark in 2002 by the American Chemical Society for developing the Time-Temperature Tolerance studies, which made possible the production of stable, safe and high quality frozen food, revolutionizing the industry in the 1950s.

Additionally, USDA, through the National Institute of Food and Agriculture (NIFA), addresses this question directly. The Expanded Food and Nutrition Education Program (EFNEP) reaches families and youth with limited financial resources nationwide through nutrition education. EFNEP stresses the importance of eating healthy foods, whether they are fresh, frozen, or canned. Further, EFNEP provides education on food resource management, including preparing healthy foods, and food safety, including keeping foods at a proper temperature which may be an increased risk factor for vulnerable populations that have old appliances. In FY 2022, 40% of adults increased their consumption of fruits and 43% increased their consumption of vegetables after participating in EFNEP. EFNEP is a Federal Extension (community outreach) program that currently operates through the 1862 and 1890 Land-Grant Universities (LGUs) in every state, the District of Columbia, and the six U.S. territories – American Samoa, Guam, Micronesia, Northern Marianas, Puerto Rico, and the Virgin Islands. EFNEP uses education to support participants' efforts toward self-sufficiency, nutritional health, and well-being, and combines hands-on learning, applied science, and program data to ensure program effectiveness, efficiency, and accountability.

Senator Sherrod Brown

1. Agricultural research infrastructure across the U.S. is generally characterized as outdated and unconducive to the scientific innovation required for the U.S. to maintain its global leadership in food and agricultural production.

    a. How can the next Farm Bill address the systemic limitations of agricultural research facilities across our nation's land-grant universities?

Modern agricultural research and education facilities serve as the backbone of science solutions. The U.S. can cultivate a new era for agricultural research and innovation, but risks losing the

ability to compete internationally if we ask our researchers and educators to conduct and deliver 21st century results in aging facilities that are end the end of their useful life. According to Gordian, 69% of the infrastructure at colleges and schools of agriculture are >25 years old, and strategic federal investment in facilities at 1862, 1890, 1994, and insular land-grant and non-land-grant schools of agriculture would create 200,000 new jobs nationwide. The jobs and growth created by bridging the infrastructure gap would provide a boost to communities suffering from COVID-19's economic impact while simultaneously securing our strategic position as a global leader in agricultural science.

2. Climate-smart agriculture practices deliver many environmental benefits – including increased carbon sequestration, better water infiltration and retention, and improved wildlife habitat.

   However, many research gaps remain when it comes to measuring environmental impacts accurately, particularly for soil carbon sequestration. We know that soil carbon is a very good proxy for overall soil health, *and* we know there is a lot of interest in paying farmers for sequestering carbon.

   USDA's Research, Education, and Economics mission area should play a leading role in coordinating soil carbon research projects across the Department, as well as centralizing and collecting data on soil carbon and other environmental outcomes.

   a. Can you speak to the role that REE is currently playing to coordinate and advance soil carbon research and monitoring efforts?

      Response: USDA's Research, Education, and Economics (REE) Mission Area continues to support research, education, and extension on soil carbon sequestration and monitoring. REE coordinates efforts across the department related to high priority soil carbon measurement and monitoring research. Examples include:
      - Leading efforts, through the Office of the Chief Scientist, to outline high priority climate change research areas, including related to soil carbon storage, measurement and monitoring, as part of the Department's ongoing strategic planning efforts for science and research.
      - REE helps ensure that data, modeling and information from all REE agencies are integrated into the National GHG Inventory reporting process.
      - Working across the REE agencies to help develop standardized soil carbon sampling and measurement protocols for a pilot project assessing soil carbon under CRP contracted acres.
      - Continuing to support the Greenhouse gas Reduction through Agricultural Enhancement Network (GRACEnet), which generates information needed by agro-ecosystem modelers, producers, program managers and policy makers to compare GHG emissions and carbon sequestration, among other outcomes, of different management systems.

   b. What additional resources does REE need to fill this role?

Response: When appropriately resourced, Research, Education, and Economics Mission Area, in consultation with USDA's producer-facing agencies and stakeholders, can work to identify different options for developing research to support soil carbon monitoring.

3. Farmers want to be part of the solution to climate change including through sustainable agricultural practices that store carbon, improve crop yields, and build resilience.

   However, current methods to measure and monitor soil carbon outcomes, are arduous, expensive, and low quality — making it difficult for farmers to make decisions.

   a. Historically, ARS's Long Term Agroecosystem Research Network sites (like those located in Ohio), USDA Climate Hubs and Land-Grant Universities like the Ohio State University, have played a pivotal role in advancing research and supporting farmers in adopting cutting-edge practices and technologies.

   b. From your perspective, what role can these entities play in advancing related research, especially the monitoring, reporting, and verification (MRV) of soil carbon?

      Response: USDA's Agricultural Research Service (ARS) and its collaborators are key to advancing the research and data that support soil carbon storage, measurement, monitoring and verification. ARS has been a global leader in this area over the past two decades, with the GRACEnet research network establishing sample and data standards that have been widely adopted. Adoption of these standards for soil carbon measurement has resulted in vastly improved modeling, prediction, verification and decision support related to soil carbon fluxes and dynamics. In the past couple years, ARS researchers and collaborators from the Department of Energy and land-grant universities (LGU's) have completed work on and transferred to industry a novel new technology for measuring and mapping soil carbon across a field. The Mobile Inelastic Neutron Scattering (MINS) system will accurately measure and map soil carbon across a field in real time without taking and processing soil samples. It can also provide data on soil health and crop nutrient management. This is a huge breakthrough and the commercial partner is gearing up to deploy the field device in support of carbon market transactions. This new technology is a potential "game-changer" for soil carbon measurement, monitoring and verification. Current collaborative efforts of ARS and the industry partner are exploring ways to scale up the technology in order to improve the aerial coverage and reduce per acre costs of use.

      This past year, the ARS Partnerships for Data Innovations (PDI) has been working with USDA's Farm Service Agency on developing standardized data collection and management tools to help standardize the data needed to quantify the soil carbon changes under fields enrolled in the Conservation Reserve Program. Standardizing data capture and handling will enhance data quality, interoperability and accuracy,

improving our ability to model and predict soil carbon changes more accurately. Building on this history of success in this area, ARS is poised to collaborate with others across USDA and the LGU's to drive the next generation of soil carbon dynamics, quantification and inventory.

c. Looking beyond MRV, are there existing USDA research and extension programs that have already shown their practical soil health and climate research impacts that we should consider expanding and improving in the next farm bill?

Response: USDA, through the National Institute of Food and Agriculture (NIFA), has several existing competitive grant programs that have demonstrated practical soil health and climate research impacts. Some are listed below.
- Soil Health program: this program supports research projects that will contribute to improvements in soil health and productivity while improving environmental health (e.g., minimizing greenhouse gas emissions and carbon losses from the soils) and sustainability of our natural resource base.
- Agricultural Microbiomes in Plant Systems and Natural Resources: this program supports research projects those help fill major knowledge gaps in characterizing agricultural microbiomes and microbiome functions across agricultural production systems, and natural resources through crosscutting projects. Projects supported through this program address microbiome research, which is critical for improving agricultural productivity, sustainability of agricultural ecosystems, safety of the food supply, carbon sequestration in agricultural systems, and meeting the challenge of feeding a rapidly growing world population.
- Critical Agricultural Research and Extension: this program area addresses critical challenges and opportunities that research and extension, together, can address to improve our nation's agricultural and food systems. This program addresses stakeholder-identified need or problem for agriculture for enhancing soil health (C) and nutrient management etc.
- Water quantity and quality: this program area priority is designed to support research projects to advance the scientific understanding of the improved efficiency of agricultural water use to protect water quality and increase water and food security.
- Climate Hub Partnerships: this program addresses climate change through improved practices, managing emissions and soil C, and others through regional partnerships including USDA Climate Hubs and Extension.
- Sustainable Agroecosystems: Health, Functions, Processes and Management: this program area priority calls for research projects that focus on improvement of ecosystem health and productivity in managed systems (croplands, forests, grasslands and rangelands) that are currently under stress and at risk from climate change, pests, pathogens, invasive plants, and increased environmental pressures.
- Small Business Innovation Research (SBIR) and Small Business Technology Transfer 8.4 (Conservation of Natural Resources) Program: this program supports projects those develop innovative technologies that are developed with the purpose to conserve, monitor, improve and/or protect the quality and/or quantity of natural resources, e.g., soil C, air, water and nutrient management.

- Sustainable Agriculture Research and Education (SARE): this regional program with four host Institutions has each institution running several grant programs to: Maintain and enhance the quality and productivity of the soil; Conserve soil, water, energy, natural resources, and fish and wildlife habitat; Maintain and enhance the quality of surface and ground water; Protect the health and safety of persons involved in the food and farm system; Promote the well-being of animals; and Increase employment opportunities in agriculture.
- Sustainable Agriculture Systems (SAS): this program promotes the sustainable supply of abundant, affordable, safe, nutritious, and accessible food and other agricultural products, while enhancing employment and economic opportunities and improving the long-term health and well-being of Americans. This program support projects that significantly advance foundational and applied sciences for the following USDA priority outcomes: (1) Climate-Smart Agriculture and Forestry (CSAF): Improve mitigation, adaptation, and resiliency of agricultural and forestry production systems to climate change. (2). Strengthening the Bioeconomy: Develop sources of clean energy and other high-value biobased products from agricultural feedstocks to foster economic development and prosperity, especially in underserved communities. (3). Nutrition Security: Enhance the contribution of food and agriculture to improve health of the nation through resilient local and regional food systems, adoption, and application of new or existing technologies, tools, education, and other resources to ensure access to adequate, safe, nutritious, and affordable food.
- Organic Transitions Program: this program prioritizes environmental services provided by organic farming systems in the area of soil conservation, pollinator health, and climate change mitigation, including greenhouse gases (GHG), as well as the development of educational tools for Cooperative Extension personnel and other agricultural professionals who advise producers on organic practices.
- Organic Agriculture Research and Extension Initiative (OREI): this program invites projects that solve critical organic agricultural issues, priorities, or problems through the integration of research, education, and extension activities. OREI supports integrated projects that will enhance the ability of producers and processors who have already adopted organic standards to grow and market high quality organic agricultural products and to help mitigate the impacts of climate change, build resilience of the organic farming system, and protect water and other resources.

4. I am a cosponsor of a bill with Senators Grassley and Thune, the Biochar Research Network Act.

   This bill is partially based on a paper co-authored by OSU professor and world food prize winner, Dr. Rattan Lal.

   A comprehensive strategic approach to researching biochar and its promise for carbon sequestration and soil health is the kind of long-term research at our land-grant universities and ARS sites we need to be investing in to address climate change.

a. Is this something that USDA can run with, using the capacities within ARS for long term multi-site research in concert with NIFA for competitive grants?

Response: USDA's Agricultural Research Service (ARS) has considerable expertise in biochar research and many ARS research locations have studied biochar composition, feedstock pyrolysis, and the potential uses and benefits of biochars for carbon sequestration and improving soil health, ecosystem restoration, water quality and other benefits. ARS researchers have partnered with land-grant universities (LGUs) in these studies. Recently, ARS researchers and leadership partnered with the Foundation for Food and Agriculture Research (FFAR) and industry partners to co-develop a biochar research strategic vision that will enable strategic long term research approaches to develop regionally relevant and science-based characterizations of biochar feedstocks, conversion, application and uses, including improved means of collecting standardized data to evaluate carbon sequestration, improvements in soil health and other benefits resulting from biochar use. Specifically, the development of this vision led to the recognition that additional resources could lead to new cross-site, fundamental research (e.g., by creating biochar efforts at long term multi-site research sites and by expansion of ARS historical biochar study sites). ARS is ideally positioned to provide the long-term, multi-site strategic innovation of biochar use and quantification of associated benefits. ARS is also well positioned to collaborate with university partners, FFAR, and industry partners on site-specific biochar research. ARS has existing relationships with many LGUs, and has identified opportunities for strategic collaborations on biochar research with The Ohio State University, Iowa State University, Cornell University, Washington State University and many others. ARS is also interested in identifying strategic 1890 and 1994 LGU's as key collaborators on biochar research.

Additionally, NIFA's grant programs provide a mechanism that facilitates comprehensive, strategic, and long-term research on biochar's role in carbon sequestration and soil health, by 1) developing research priorities for federal funding opportunities (including competitive and capacity programs) that consider the state of carbon sequestration and soil health science and technology, including the latest research conducted by ARS and land-grant universities; 2) encouraging grant applicants to integrate the latest, scientific and research findings and establish appropriate partnerships in their proposals, some of which can be funded for up to 5 years, and 3) making the results of research projects funded by NIFA publicly available , for ARS, applicants, land-grant universities and the public.

Continued coordination with USDA's National Institute of Food and Agriculture (NIFA) and FFAR around agreed upon priorities is critical to advancing biochar technologies and realizing the production, economic and environmental benefits.

b. Is this something you would support?

Response: REE is eager to continue research on biochar.

5. We know harmful PFAS chemicals commonly known as "forever chemicals," pose a threat to human health, the environment, and our agricultural economy.

   They've been discovered in soils, crops, livestock, feed, and other farm inputs like pesticides. That's what we do know. But there's much more that we don't know about the impact of PFAS on food and agriculture – PFAS uptake in plants, its movement in soil and water, potential remediation methods, and safe levels in soil and crops.

   As we look to the next farm bill, we need to know the scale of this challenge, and the level of assistance needed to support farm families in Ohio and across the country.

   a. Do current farm bill research programs provide you with sufficient authorities to expand PFAS research, and if not, what additional support do you require?

      Response: USDA is currently expanding and investing in PFAS research. USDA's Agricultural Research Service (ARS) is researching the effects of cattle consumption of PFAS contaminated forage. The data have shown that while cattle rapidly excrete certain types of PFAS, other types remain and are likely to accumulate in edible tissues. PFAS uptake in plants has also been observed by ARS scientists working with FSIS to evaluate its presence in livestock diet to address dairy cattle exposure.

      ARS has also been assessing food packaging as a potential source of contamination, both from direct migration into food during product use and from re-entry into the food system after food packaging is thrown away. Further, ARS scientists are studying the distribution and transportation of PFAS through agricultural operations and identifying best management practices for reducing risk if municipal wastewater is used for irrigation, especially in semi-arid regions of the country.

      USDA's National Institute of Food and Agriculture (NIFA) invested approximately $3 million in the last two years to support several projects aimed at better understanding PFAS in agricultural systems. These projects have supported investigations in the occurrence, transport, and transformation of PFAS in soil, water, and plant systems, and to develop strategies for minimizing environmental and human health risks.

      NIFA is also supporting 32 active projects focused on PFAS at land-grant universities through Hatch Act funding. Examples of these include projects for: (i) characterizing the potential of PFAS to affect the actions of hormones during development, reproduction, and metabolism, with relevance to livestock, wildlife, and humans, (ii) development of new water treatment methods that will destroy and convert PFAS from waste streams and water treatment plants into nontoxic chemicals, and (iii) exploring human dietary interventions that may disrupt diseases (e.g., liver, and cardiovascular diseases) that may be initiated by exposure to PFAS.

Language in the House FY2022 Agriculture Appropriations report provided $1M for the "Secretary to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to conduct an analysis of current scientific findings to determine the links between human health and soil health by reviewing existing research on the connections between the human microbiome and soil microbiome and the direct interaction of humans with soils, identifying linkages between soil management practices and the nutrient density of foods for human consumption, determining how to best leverage healthy soil management practices to maximize benefits and minimize adverse impacts on human health, and exploring areas for future research." The report is due no later than 18 months after the date of enactment of the Consolidated Appropriations Act, 2022 (September 15, 2023). NIFA is the lead agency, and has been in discussions with NAS, who is expected to include PFAS in their overall review. NIFA disbursed the funds to NAS via a directed Request For Applications.

b. What actions is USDA taking to coordinate this research across agencies?

Response: On November 1, 2022, USDA brought leadership together from across the Department to find a collaborative path forward to coordinate all PFAS related activities.

6. As you know, controlled environment and urban agriculture were included in the Miscellaneous Title of the last Farm Bill.

a. Are existing research programs properly equipped to provide the research and extension capacity necessary to help us answer related emerging scientific questions and conduct the community outreach needed to see these two areas of agriculture thrive in the next five years?

Response: Controlled Environment Agriculture (CEA) and the expansion of urban agriculture are issues that are receiving increased attention by the science community. USDA, through two programs within the National Institute of Food and Agriculture, fund CEA and urban agriculture related projects. The Specialty Crop Research Initiative (SCRI) has provided funding for these type of projects since 2008 and continues to receive applications in these areas annually. Additionally, the new 2018 Farm Bill authorized and funded Urban, Indoor and Emerging Agriculture program will add important resources, as soon as USDA officially announces those awardees, to help the science community improve production practices in these high-tech areas. As more funding becomes available, universities are responding by hiring faculty to work on these topics, thus increasing the capacity of the system to respond to stakeholder needs. Both SCRI and Urban, Indoor and Emerging Agriculture programs require that Extension is an integral part of any funded project. This ensures that new technology developed with funding from these programs is delivered to end-users in a timely manner.

Senator Amy Klobuchar

1. One of the emerging challenges for agriculture is the balance between productivity and sustainability. The *Agriculture Innovation Act*, legislation I introduced with Senator Thune, aims to improve the use of conservation data so that farmers are able to make better choices about conservation practices that benefit both their yields and the environment.

    a. How can long-term research projects help us better understand the effects of implementing multiple conservation practices at one time?

    Response: USDA's Agricultural Research Service (ARS) has many long-term research experiments investigating the effects of multiple conservation practices on productivity and environmental services such as water quality, soil health, and carbon sequestration. Some of the practices that have been combined in these experiments include conservation tillage, cover cropping, crop rotations, forested or grassy riparian buffers, grassed waterways, and edge-of-field practices including saturated buffers and filter systems to remove excess phosphorus from tile drainage water. It is important to investigate these practices over the long term (at least 5 years and up to 70 years in some experiments) because it takes time for the full benefits of the conservation practices to be realized. Improvements in soil health, including increased organic matter, improved soil structure, improved water filtering, and improved productivity take many years to build. Most conservation practices have an associated cost to implement, and the return on that investment may not be seen the first few years. ARS has long-term experiments, both within and outside of the Long-Term Agroecosystem Research (LTAR) network, that explore and optimize the benefits of both individual and combined conservation practices across many types of agricultural systems in the U.S., from intensive row cropping to extensive rangeland systems and many complex diversified systems.

    USDA's National Institute of Food and Agriculture can facilitate discussions among the state experiment stations to further develop use of public and producer-owned data for the public good. There is a long history to such an approach. A century ago, production of wheat and other crops relied on landraces and other under-developed genetics bases. Farmers partnered with their state experiment stations and with USDA to develop public plant breeding programs that are still very effective today. The wheat industry relies on public breeding programs, as well as other crops. A similar state-based approach could be explored with data. Much like public breeding programs are guided by farmer-led commodity and crop improvement groups, similar structures could be developed for public data. This research and extension funding improves our national capacity to provide actionable advice to farmers and ranchers in our US food, forestry and agriculture system. For example, NIFA funds the Artificial Intelligence (AI) institutes, Sustainable Agricultural Systems (SAS), the Agriculture and Food Research Initiative (AFRI) Economics, Markets and Trade and the Data Science for Food and Agriculture Systems programs. In addition, the Open Data Framework program provides coordination and standards for data

analysis. Together these programs provide prediction of optimal practices and measurement support to all U.S. regions and the full range of producers and consumers, from beginning farmers to large-scale regional best practices implementations.

2. Recent outbreaks of Avian Influenza, African Swine Fever, and other emerging diseases continue to pose significant threats to animal agriculture.

    a. How can the National Animal Health Laboratory Network prevent and mitigate animal disease outbreaks?

    Response: Since 2002, the U.S. livestock and food sectors have been protected in part by the National Animal Health Laboratory Network (NAHLN), led and funded cooperatively by USDA's Animal and Plant Health Inspection Service (APHIS) and National Institute of Food and Agriculture (NIFA).

    NAHLN is a network of Federal, State and university – associated veterinary diagnostic laboratories that provides ongoing disease surveillance, responds quickly to disease events, communicates diagnostic outcomes to decision makers, and has the capability and capacity to meet diagnostic needs during animal disease outbreaks. These activities support efforts to prevent the spread or introduction and mitigate the impact of transboundary and emerging animal diseases.

    Originally composed of 12 laboratories, the NAHLN has grown to include 60 animal health laboratories distributed across 42 states within the U.S. with the capability of testing large numbers of samples for specific disease agents.

    As of December 15, 2022, Highly Pathogenic Avian Influenza (HPAI) has been found in more than 5000 wild birds and more than 690 domestic flocks in forty-seven states. The total number of domestic birds affected has topped 53 million, making the 2022 HPAI outbreak the largest outbreak in US history. Fifty-two NAHLN laboratories have been activated within 39 states and performed more than 147,000 PCR tests for HPAI.

    African Swine Fever, or ASF, is a devastating, highly infectious animal disease that, if found in the United States, threatens our multibillion-dollar pork industry. While ASF poses no threat to human health, its impact on U.S. pig populations — and the domestic and foreign markets that depend on them — would be severe. Preliminary estimates suggest that losses to the pork industry can be as high as $50 billion if we are unable to contain and eliminate ASF in a 10-year scenario.

    Since the first known outbreak in 1907, ASF has infected swine in Africa, Europe, and Asia. The virus was recently discovered on the Caribbean Island of Hispaniola—first in the Dominican Republic and, since September, in Haiti. Previous outbreaks in other countries have resulted in devastating losses for swine populations and pork

producers through both high mortality and significant culling to control the spread of the disease. On June 1, 2019, APHIS implemented an active ASF Surveillance Program within the NAHLN that supplemented an already existing CSF surveillance program. This program tests diagnostic lab submissions for the presence/absence of ASF and CSF via a real-time polymerase chain reaction (PCR).

To that end, the 2018 Farm Bill's animal health programs included mandatory funding for the network, which has been a significant help to the network and greatly enhanced our capacity to detect foreign animal diseases.

In response to the global pandemic of SARS-CoV-2, or COVID-19, the NAHLN network entered unchartered territory by heeding a call for help from human diagnostic laboratories to increase human testing capacity within the United States. Many NAHLN labs utilize high throughput PCR testing for various animal pathogens, which is not a common practice among their human counterparts.

To make this happen, each laboratory independently obtained Clinical Laboratory Improvement Amendments approval, and many took on all human testing for their states. Some also performed next generation sequencing, aiding in identification, and tracking of viral mutation including detection of the Delta variant as it spread across the country.

By October of 2021, 33 NAHLN laboratories were conducing SARS-CoV-2 testing; 22 of those for human samples, and 26 testing for the virus in animals. The National Veterinary Services Laboratories in Ames, IA, also served as the reference laboratory for animal testing. More than 5.6 million human samples were tested in veterinary diagnostic labs across the NAHLN.

Antimicrobial resistance (AMR) of bacterial pathogens is an emerging public health threat to people and animals because it compromises the ability to treat infections. Traditionally, antimicrobial resistance surveillance programs in the United States, such as the National Antimicrobial Resistance Monitoring System (NARMS), have focused on collecting data from healthy food animals, retail foods and people.

NAHLN initiated the NAHLN AMR pilot project in January 2018, which is on track to be converted to a permanent program in early 2023. The project monitors data from four livestock species (cattle, swine, poultry, and horses), and two companion animal species (dogs and cats).

Establishing a surveillance program within the NAHLN to monitor AMR profiles in animal pathogens will enhance the nation's early detection of, response to, and recovery from animal health emergencies. It will also help identify new or emerging AMR profiles and help monitor continued usefulness of antimicrobials over time.

b. Would providing additional federal resources to the Network increase its abilities to further protect animal agriculture?

Response: The funds provided through the Food and Agriculture Defense Initiative (FADI) appropriations are used by NIFA to support three networks critical for ensuring security of the agricultural production system and mitigation of disaster situations: the National Animal Health Laboratory Network (NAHLN), the National Plant Diagnostic Network (NPDN) and the Extension Disaster Education Network (EDEN). Approximately $4.25 million of the $8 million in FADI funds is allocated to the NAHLN each year. NIFA works collaboratively with USDA APHIS to fund the infrastructure needs of the NAHLN laboratories with funding that includes NIFA annual appropriations, APHIS annual appropriations, and APHIS Farm Bill funding.

The National Security Memorandum on Strengthening the Security and Resilience of United States Food and Agriculture (NSM 16) signed on November 10, 2022, specifically directs the USDA to develop, maintain, assess, and enhance a comprehensive and fully coordinated surveillance and monitoring system for animal disease, as well as a nationwide laboratory network that integrates and interconnects existing Federal and State laboratory resources and utilizes standardized diagnostic protocols, procedures, and mechanisms; and timely information and analysis sharing.

3. According to land grant universities, serious infrastructure improvements and upgrades are needed in order to recruit and retain students and maintain excellence in research, extension, and education. At the University of Minnesota Saint Paul Campus, where the majority of the University's agricultural and natural resources classes and research are hosted, it is estimated that 42 percent of the buildings are in critical condition.

a. How is the administration planning to work with universities like the University of Minnesota to ensure they can maintain their competitiveness internationally and recruit the best and brightest into the field?

Response: Once the world's leader, the United States now trails far behind other major nations in public agricultural research investments. The U.S. is missing critical opportunities to capitalize on the powerful potential of our world-class scientists to conduct the type of high-risk, high-reward research necessary to meet the overlapping and rapidly emerging challenges our farmers face.

Through existing programs, USDA is committed to helping institutions of higher education to maintain their competitiveness internationally and recruit the best and brightest into the field. USDA's National Institute of Food and Agriculture has many programs, including the Agriculture and Food Research Initiative's Education and Workforce Development program, that support formal and non-formal education programs for training or retraining of current and future workforce at technical schools, community colleges, and land-grant universities.

Senator Michael Bennet

1. Thank you for your testimony at the Research hearing. As I referenced during the hearing, I believe it is critical that we support high-risk, high-reward agricultural innovation research at USDA through the Agriculture Advanced Research and Development Authority (AgARDA) pilot program. As climate change fuels a hotter, drier future, we must do more to ensure producers have the tools to continue producing the safest and most abundant food supply in the world. Echoing the Ranking Member's question as well as my own, I would urge the agency to ensure swift completion and publication of the strategic implementation plan.

    a. Understanding that the level of funding Congress appropriated in Fiscal Year 2022 may not have been sufficient to hire and retain staff at a level commensurate with Directors at existing ARPA agencies, what is the level of funding necessary in coming fiscal years to hire a Director to oversee AgARDA?

    Response: The Agriculture Advanced Research and Development Authority (AGARDA) implementation strategy will include a sufficient funding projection to hire and retain an AGARDA director and necessary staff to implement a successful and properly resourced high risk, high reward research program. It is anticipated that once funding becomes the new appropriation baseline for the USDA AgARDA program, staff retention can be ensured.

    b. How quickly can USDA hire a Director should the necessary funding be made available through the appropriations process?

    Response: USDA will begin the recruitment process for an AgARDA director and necessary staff once the properly-resourced, baseline appropriation has been provided to ensure ongoing, multi-year retention of essential employees.

    c. What is the status of the $1 million appropriated in FY 2022 for AgARDA? To what extent has it been spent, and on what activities specifically? If it has not been spent, what is your plan for doing so?

    Response: USDA's Office of the Chief Scientist (OCS) conducted an initial internal stakeholder scan in FY 2022. Additionally, OCS has completed a strategic implementation plan that is currently in clearance at USDA. This implementation plan proposes strategic next steps at various requested funding levels and will be made publicly available once clearance is complete. Additionally, OCS has solidified partnerships to hold stakeholder listening and engagement sessions in FY 2023 toward establishing AGARDA priorities and building the program once properly resourced. OCS is also working with its partners to conduct a landscape analysis of existing advanced research projects agency organizations across the government to harvest tools, best practices and lessons learned for application of AGARDA implementation.

d. Does USDA currently have authority to move non-Commodity Credit Corporation funds into the AgARDA fund to conduct research? If so, is that something the agency has or is considering?

Response: AGARDA provides no general authority to transfer other USDA funds into the Agriculture Advanced Research and Development Fund (AGARDA), USDA has no other authority that would allow for transfer of funding to the AGARDA Fund.

2. As you know, USDA operates 10 regional climate hubs across the country. Can you expand on how we can leverage the research opportunities climate hubs present to help our farmers and ranchers tackle climate change? What role do you foresee the climate hubs playing in terms of adapting to climate change across the country, and the West in particular? Are there ways the agency and/or Congress can better support and advance the work of the climate hubs?

Response: The ten Climate Hubs were established to provide a strategic and responsive infrastructure that brings USDA science and service to U.S. producers, stakeholders, and other customers - by providing a focal point for regionally relevant science and technical information, incorporating the newest information from USDA researchers, and moving it to field application through USDA action agencies. Climate Hubs address regional climate impacts such as wildfires, invasive pests, devastating floods, and crippling droughts by translating science and research into usable information to build landscape-level resilience. The regional structure of the Climate Hubs allows for the development of locally relevant tools and resources to help build climate change adaptation capacity across the country.

The efforts of the hubs occur across all regions of the United States, but the Southwest, Northern Plains, California, and Northwest Hubs are all addressing the unique challenges of the western states, including but not limited to the development and deployment several tools and engagements, such as the FireCLIME Vulnerability Assessment Tool (a tool designed to help producers address the combine challenges of climate change and wild fires in the southwest), GrassCast (a tool to help ranchers assess and manage available forage for grazing), and establishment and leadership of the Southwest Drought Learning Network.

The Climate Hubs provide an effective regional framework that, if expanded, could provide even more regionally relevant information, tools and solutions in support of crop, livestock and forest production systems, enabling producers and land managers to make strategic decisions in consideration of regional weather and climate challenges.

The USDA National Institute of Food and Agriculture's Agriculture and Food Research Initiative's Extension, Education & USDA Climate Hubs Partnerships request for applications solicits proposals that provide effective, translatable, and scalable approaches for addressing climate change through USDA Climate Hubs and extension entities. The RFA encourages applicants to establish partnerships in both the private and public sectors that result in the development and delivery of science-based, region specific information and

technologies to agricultural and natural resource managers that enable climate informed decision-making and provide access to assistance to implement those decisions. To date, NIFA has funded 6 projects for a total of $9 million. Continued support of this funding program would provide critical resources to agriculture and forestry producers, natural resource managers, and communities dealing with the reality of climate change.

Senator Kirsten Gillibrand

1. Per- and polyfluoroalkyl substance (PFAS) are man-made "forever" chemicals that are used in industry and consumer products and can lead to serious health effects. PFAS primarily come from biosolids from wastewater utilities that can be spread over farmland as fertilizers; however, these biosolids can contain many toxic chemicals such as PFAS. Contamination in soil and water has prevented some farms from selling their products, creating financial hardship for affect family farmers.

    a. What is USDA REE doing to help farmers in these situations?

    Response: USDA's Research, Education, and Economics Mission Area does not have the authority to provide direct payments to farmers, however there are several programs at USDA's Farm Service Agency that may be applicable: the Dairy Indemnity Payment Program and the Conservation Reserve Program.

    USDA is currently expanding and investing in PFAS research. USDA's Agricultural Research Service (ARS) is researching the effects of cattle consumption of PFAS contaminated forage. The data have shown that while cattle rapidly excrete certain types of PFAS, other types remain and are likely to accumulate in edible tissues. PFAS uptake in plants has also been observed by ARS scientists working with FSIS to evaluate its presence in livestock diet to address dairy cattle exposure.

    ARS has also been assessing food packaging as a potential source of contamination, both from direct migration into food during product use and from re-entry into the food system after food packaging is thrown away. Further, ARS scientists are studying the distribution and transportation of PFAS through agricultural operations and identifying best management practices for reducing risk if municipal wastewater is used for irrigation, especially in semi-arid regions of the country.

    USDA's National Institute of Food and Agriculture (NIFA) invested approximately $3 million in the last two years to support several projects aimed at better understanding PFAS in agricultural systems. These projects have supported investigations in the occurrence, transport, and transformation of PFAS in soil, water, and plant systems, and to develop strategies for minimizing environmental and human health risks.

    NIFA is also supporting 32 active projects focused on PFAS at land-grant

universities through Hatch Act funding. Examples of these include projects for: (i) characterizing the potential of PFAS to affect the actions of hormones during development, reproduction, and metabolism, with relevance to livestock, wildlife, and humans, (ii) development of new water treatment methods that will destroy and convert PFAS from waste streams and water treatment plants into nontoxic chemicals, and (iii) exploring human dietary interventions that may disrupt diseases (e.g., liver, and cardiovascular diseases) that may be initiated by exposure to PFAS.

Language in the House FY2022 Agriculture Appropriations report provided $1 million for the "Secretary to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to conduct an analysis of current scientific findings to determine the links between human health and soil health by reviewing existing research on the connections between the human microbiome and soil microbiome and the direct interaction of humans with soils, identifying linkages between soil management practices and the nutrient density of foods for human consumption, determining how to best leverage healthy soil management practices to maximize benefits and minimize adverse impacts on human health, and exploring areas for future research." The report is due no later than 18 months after the date of enactment of the Consolidated Appropriations Act, 2022 (September 15, 2023). NIFA is the lead agency, and has been in discussions with NAS, who is expected to include PFAS in their overall review. NIFA disbursed the funds to NAS via a directed Request For Applications.

b. What can we do in the next Farm Bill to help you?

Response: Additional investments in agriculture research and development are needed to turn the tide and bring the United States back to the top of major nations' investments in public agricultural research. The U.S. is missing critical opportunities to capitalize on the powerful potential of our world-class scientists to conduct the type of high-risk, high-reward research necessary to meet the overlapping and rapidly emerging challenges our farmers face.

2. New York State is proud to have Cornell University as its land-grant university. Cornell Cooperative Extension in Tompkins County ran a solar campaign in 2017 helping to educate over 100 people who were on track to install nearly a total of 1 megawatt of solar in the county, and now continues to educate the public on community solar.

a. Can you please discuss the work land-grant universities, extension agents, and NIFA are doing to support community-wide rural energy initiatives or other rural initiatives such as broadband?

Response: Through the National Institute of Food and Agriculture's Regional Rural Development Centers (RRDCs), USDA is working on several issues regarding rural broadband. In Fall of 2022, they conducted listening sessions with rural stakeholders in the Southern region to understand greatest barriers to connectivity, which in addition to physical infrastructure also include digital literacy. In Winter 2022,

Southern Regional Rural Development Center hosted a series of three Broadband and Digital Access webinars to share results from the listening session and articulate a need for Extension's role as a leader in building digital literacy competencies through a "Digital Volunteers" training program, which would be similarly modeled after Master Gardener Program (e.g., Certifications, community led trainings and volunteer service).

As of December 2022, RRDCs are putting together a plan to develop the Digital Literacy Volunteer program, including organizing details for a first pilot cohort training set to start in early 2023. This work is still contingent on additional funding, to launch and sustain this effort. RRDCs are actively looking for partners to help invest in this new initiative.

In addition, Southern Regional Rural Development Center is leading efforts to elevate Extension's voice in the FCC map updates, as this map will determine how funding for rural broadband is allocated. Finally, RRDCs have launched a new list of Broadband Points of Contact for every Land Grant University. So far, this list is at 40 representatives, and growing. These points of contact are the early phase of a new network of Extension leaders nationally who are poised to lead new future programming in digital literacy.

b. Has USDA assessed extension's capacity to do this type of work? What are the benefits and barriers?

Response: NIFA's Regional Rural Development Centers are currently leading efforts to coordinate a new national network of Extension-based "Broadband Points of Contact" who will help to develop Broadband and Digital Literacy resources and services for each LGU. With the county-level service structure, Extension offices are geographically well-poised to fill this important digital technical assistance role for rural stakeholders. RRDCs already have a pilot plan ready to launch that would begin training Extension staff in Digital Literacy but are looking for funding to lift the pilot off the ground in select states. If the pilot proves successful, Extension will need dedicated funding to scale up training Extension staff in Digital Literacy and Broadband assistance to all LGU's across the country.

3. Cornell University is home to NOAA's Northeast Regional Climate Center, which collects climate and weather data often important to agricultural research and extension. USDA Climate Hubs also connect science and research to producers.

   a. Can you elaborate on USDA's partnership with other federal agencies, such as NOAA, and what data sharing practices exist?

   b. How can USDA strengthen these relationships, for example, between USDA's Climate Hubs and NOAA's Regional Climate Centers?

Response for a. and b.: Through the National Institute of Food and Agriculture's (NIFA) Agriculture and Food Research Initiative's Extension, Education & USDA Climate Hubs Partnerships request for applications, USDA specifically identifies partnerships with NOAA's Regional Integrated Sciences and Assessment (RISA) Teams. The name change of the RISA program to "Climate Adaptation Partnerships" (CAP) with an emphasis on "partnerships" further provides a means for strengthening partnerships between USDA Climate Hubs and NOAA. These partnerships include data sharing. Applicants are also required to provide letters of support from partners, as well as management plans, delineating the roles and responsibilities of partners to ensure that partners will be fully and effectively integrated in the implementation of successful proposals. Apart from NOAA serving as a partner, data, and results of NIFA's investments in all Climate Hubs Partnerships are made available to the public and other Federal agencies by NIFA through an online portal. In addition, Climate Hubs provide Quarterly Reports on their top accomplishments. Applicants and USDA Climate Hubs also have access to environmental data, products, and information produced and delivered to NOAA's Regional Climate Centers (RCCs) in NOAA's effort to translate climate change impact data into usable products and services for decision makers. RCCs also focus on the seamless integration and storage of non-NOAA climate data with NOAA data sources. Therefore, the mechanism exists for both strong and lasting partnerships and data sharing between NOAA (CAP and RCC) and USDA Climate Hub Partnerships.

4. NIFA often encourages and prioritizes collaboration in its competitive grants.

    a. What is USDA doing to assist LGUs in collaboration with each other? And what can be done to strengthen collaboration amongst LGUs in research, education, and extension?

    Response: There are multiple mechanisms that USDA, through the National Institute of Food and Agriculture (NIFA), uses to encourage land-grant universities (LGUs) to collaborate. Hatch Multi-state committees bring scientists from across the U.S. together around common research objectives. NIFA National Program Leaders provide leadership and guidance to these multi-state committees. This active engagement has resulted in scientists from Hatch Multi-state committees successfully collaborating to obtain competitive funding to augment the Hatch capacity funds available for these projects.

    In fiscal year 2021 and again in fiscal year 2022, through appropriations, NIFA provided funding to the National Academies of Science to convene a Blue-ribbon panel to investigate how collaboration amongst all 112 land-grant partners could be improved. A detailed report describing the results from fiscal year 2021 was released in November of 2022. A synopsis of that report can be found at this link: https://www.nationalacademies.org/news/2022/11/to-improve-research-collaboration-among-land-grant-universities-congress-should-facilitate-participation-of-historically-black-and-tribal-colleges-and-universities-says-new-report.

NIFA program staff continuously work with land-grant scientists to promote collaboration through one-on-one contacts and through the use of workshops. One such workshop is planned at the Plant Animal Genome (PAG) meeting January 2023, in which member of LGU's and federal representatives will meet to discuss "Lessons learned when integrating new technologies into breeding." An additional workshop planned at PAG, "Beyond the National Plant Genome Initiative: New frontiers and grand challenges in plant genomics," will bring together multiple Federal agencies and external scientists focused on discussions of emerging issues in plant genomics. Through participation in workshops and direct communications, NIFA staff can help scientists from divergent disciplines understand how they can team across biological, physical, and social sciences to address the needs of stakeholders.

Several AFRI and non-AFRI competitive grant programs provide funding for Research Coordination Networks (RCN). The RCN grants do not fund research directly but provide support for broad coordination of ongoing research efforts already funded. Examples of activities supported by RCN grants include funding for development of standards and methods for data collection and integration of datasets; long-term data management, data storage, data curation, and data sharing; leverage additional funds or resources, including collaborations with the private sector; identify research needs, priorities and plans to fill critical gaps in scientific knowledge; engage stakeholders; and train the next generation of agricultural workers.

b. How can extension agents in one state benefit from the research and learn best practices from extension in another state?

Response: Through the National Institute of Food and Agriculture (NIFA), USDA staff serve as a liaison to the Extension Foundation which works with extension professionals from all over the country and the land grant institutions. Through joint meetings between research and extension, extension agents from one state can benefit from and learn best practices. As an example, the 1890 land-grant universities organize joint extension and research meetings that allows this interaction of extension/research professionals from various states.

New Technologies in Agricultural Extension (NTAE) provides through its small grant program, the opportunity to Incubate, Accelerate and Expand new ideas and projects nationally across Extension through seed funding and coaching support. In FY23, there are over 40 projects that are receiving funding support through this program nationally. In FY22, over 20 NTAE projects were funded, and their final results featured at an annual National Showcase that was presented virtually and open to the public. The Regional Rural Development Centers (RRDCS) offer regionally based small grants that dedicate funding to incentivize Extension staff and LGU faculty to work on research and outreach across state lines, often requiring a minimum of 2-3 states' participation to receive funding, and an outreach or publication output to share learnings for colleagues nationally.

The Extension Collaboration for Immunization, Teaching, and Engagement (EXCITE) program was created to address COVID-19 vaccine hesitancy, especially in rural communities. EXCITE is a nationwide local response by the U.S. Cooperative Extension and is funded ($7.5 million) through an interagency agreement between USDA-NIFA and the Center for Disease Control and Prevention (CDC) and a cooperative agreement with the Extension Foundation. To date, Extension staff from over 80 land-grant universities across the United States have been engaged in EXCITE pilot and programming efforts. The Extension Foundation hosts frequent virtual meetings to facilitate the sharing of best practices and lessons learned across all States. The EXCITE website also includes several resources for Extension staff, including a summary of State projects and tools/publications developed by various State Extension staff.

c. What is USDA currently doing to support collaboration and communication between LGUs and ARS research?

Response: USDA's Agricultural Research Service (ARS) scientists routinely collaborate with land-grant universities (LGU's). In FY2022, ARS had 916 research agreements with LGU's, including 889 agreements with 1862 LGU's, 25 agreements with 1890 LGU's, and 2 agreements with 1994 LGU's. More than 30 ARS laboratories are co-located on LGU campuses and ARS hosts faculty and students in our laboratories, while ARS Associate Area Directors attend regional Experiment Station Directors meeting to share research priorities. Through the ARS 1890 Faculty Research Sabbatical Program, ARS builds 1890 LGU research capacity and fosters mutually beneficial research partnerships. ARS and USDA's National Institute of Food and Agriculture hold joint research planning meetings and jointly meet with stakeholder groups to obtain input on the highest priority research needs.

5. NIFA Regional Aquaculture Centers support aquaculture research, development, demonstration, and extension education to advance U.S. aquaculture production. NOAA also has aquaculture research through several programs. As the U.S. offshore and onshore aquaculture industry grows, we need more research on the effects, particularly from offshore aquaculture, on our ecosystems and other stakeholders.

   a. What is the status of USDA's research on offshore aquaculture? And what can be done to strengthen the relationship between USDA and NOAA research?

   Response: USDA's Agricultural Research Service (ARS) conducts research on marine fish and shellfish species that could be farmed in offshore environments, specifically salmonids, pompano, red drum, striped bass, and oysters, with limited focus on seaweeds. Research aims to increase yield, production efficiency, and minimize impacts of pests and pathogens. Although ARS sees the value in offshore aquaculture and is prepared to support these producers, our domestic offshore aquaculture industry is largely non-existent. Establishing a research program with co-

located ARS and NOAA scientists and having access to offshore demonstration facilities would strengthen the relationship between USDA and NOAA and support the development of this promising industry. NOAA scientists are needed to identify ideal siting of operations and evaluate ecosystem interactions, while USDA scientists are needed for genetic improvement and developing profitable aquatic plant and animal production systems.

Over the past five years, USDA's National Institute of Food and Agriculture (NIFA) has solicited, and supported projects focused on enabling offshore development in economically and environmentally sustainable ways. This includes the development of production long-lines made from recycled carbon-fiber that are better than traditional monofilament technologies for producers and the environment, the development of offshore robots and autonomous vehicles to enable effective offshore production and proper offshore facility maintenance, and the integration of robots and other sensing techniques for continuous aquaculture monitoring. Likewise, NIFA consistently supports research that enables culture of both traditional and novel aquaculture species (from nutrition and development to reproductive and genetic studies that facilitate breeding programs), including those species that may be targets for offshore production.

Over the past two years, staff and programs from NIFA, ARS, and NOAA have worked closely on the creation of the National Strategic Plan for Federal Aquaculture Research and the forthcoming National Aquaculture Development Plan, both of which are coordinated through the National Science and Technology Council's Joint Subcommittee on Aquaculture. These engagements have spurred further collaboration, recently culminating in the funding of the Aquaculture Information Exchange (an information repository and virtual community for the development of U.S. aquaculture) supported jointly by USDA and NOAA SeaGrant. A continued focus on these types of joint agency interactions and funding opportunities that leverage limited funding in ways that provide synergy in addressing critical issues for U.S. producers and consumers serves to both strengthen our ties and better support our varied stakeholders.

b. Has USDA assessed the impacts of the different livestock from offshore aquaculture such as shellfish and finfish?

Response: Through the Agricultural Research Service, USDA conducts research work on shellfish and finfish, but does not have access to offshore aquaculture facilities. Additionally, due to the present nature of permitting and siting of offshore aquaculture the ability to evaluate production in the offshore space and any potential impacts in terms of environment and economics is limited. USDA's National Institute of Food and Agriculture (NIFA) has supported much extramural research on finfish and shellfish in freshwater, coastal, and on-land production systems that directly translates in many ways to the offshore environment. The lack of opportunity for producers and researchers to engage in, assess, and improve offshore production

currently hinders the ability to develop solutions to issues that may be encountered by the future offshore industry. In this way, dedicated "test beds" or research and development hubs for offshore aquaculture and funding leveraged in ways that enable public-private partnership would provide a springboard for advancement.

6. Farmers and ranchers are looking for more ways to diversify and one solution is agrovoltaics, using the land for both agriculture and solar energy at the same time.

   a. What research and extension work are USDA and LGUs doing on this issue?

      Response: Agrovoltaics is a growing area of research for USDA. In the new NP216 Sustainable Agricultural Systems research action plan for USDA's Agricultural Research Service (ARS), several research units are gearing up to undertake this timely research topic. There are many questions to be answered in ensuring successful integration of solar energy production into integrated production systems. And there are considerable opportunities for agrovoltaics to be an important part of profitable and sustainable food and energy systems. This is a new area of research for ARS, and we have highly productive collaborative research relationship with numerous land-grant universities that are also considering this type of research. ARS is eager to grow our research portfolio to answer question about water, light, shade, cooling, and other potential impacts of deploying an integrated crop/livestock/energy landscape.

      Additionally, USDA's National Institute of Food and Agriculture supports agrovoltaics through the Sustainable Agricultural Systems program of the Agriculture and Food Research Initiative and the Small Business Innovation Research (SBIR) Program. The land-grant universities have begun forming regional groups to study and support agrovoltaics.

   b. What can we do in the next Farm Bill to advance this work?

      Response: For USDA's ARS, the main need is for appropriated resources to allow for agrovoltaic installation at scale to undertake field research. Additional research expertise (including agricultural engineers and perhaps economists and data scientists) will also be needed. ARS will work in close coordination with National Institute of Food and Agriculture (NIFA) colleagues and land-grant universities' collaborators to ensure the impact of the research and the extension of the research findings.

      Additionally, through NIFA, USDA is working closely with the Department of Energy's Solar Technologies Office (SETO) and held two interagency workshops, with a third being planned for 2023. Resourcing ARS and NIFA through appropriate measures would provide a sustained and long-term opportunity to properly study the opportunities and impacts that agrovoltaic systems will have on crops and livestock.

There are currently few research studies that have been ongoing more than a few years and there is significant pressure from developers to place solar into agricultural systems. Regional studies are needed to optimize the benefits of agrovoltaics on livestock, pollinators, and specialty crops and to evaluate long term impacts on crop and pasturelands and to understand business models, and liability for producers and developers.

Senator Ben Ray Luján

1. Under Secretary Jacobs-Young, our agriculture research network is an invaluable national asset for developing innovative and transformative ways to feed our world, combat climate change and protect our natural resources. In New Mexico we are proud of our Land Grant University, Tribal Colleges and other Minority Serving Institutions that not only educate tomorrow's leaders and innovators but also execute cutting edge research.

    a. All of New Mexico's Land Grant Colleges and Universities are Minority Serving Institutions (MSI). As we look to the next Farm Bill how can we remove real or perceived barriers to collaboration between USDA and our Land Grant Colleges and Universities?

    Response: New Mexico land-grant universities include New Mexico State University (NMSU), Institute of American Indian Arts (IAIA), and Southwestern Indian Polytechnic Institute (SIPI), which are all minority serving institutions. Barriers to collaboration between USDA and Land Grant Colleges and Universities are important to address regardless of their reality or perception. NIFA has historically funded the NM land-grant universities and currently has 68, 5, and 5 active awards at NMSU, IAIA, and SIPI, respectively. NIFA engages in extensive virtual and in-person outreach opportunities aimed at demystifying the grant application and awards process. NIFA maintains an Upcoming Events webpage that lists webinar offerings and application deadlines and there are additional trainings offered at MSI conferences such as the First American Land Grant Consortium Conference (FALCON), Hispanic Association of Colleges and Universities (HACU), and the Historically Black Colleges and Universities Conference (HBCU).

    In addition, New Mexico State University has been a key collaborator on the $15 M NIFA's Agriculture and Food Research Initiative (AFRI) Climate Adaptation Partnerships (CAP) Sustainable Bioeconomies of Arid Regions (SBAR) working to enable a domestic natural rubber industry using the drought tolerant southwest native desert shrub guayule. The SBAR project which also included U Arizona and Bridgestone Americas recently was awarded $35 M through the USDA Partnership for Climate-Smart Commodities program to work with disadvantaged communities in the region to cultivate guayule at scale, including several NM/AZ tribal nations. Bridgestone has committed to build a commercial tire

manufacturing plant based on guayule by 2030. In addition to natural rubber latex (a Critical Agricultural Material), guayule produces a valuable resin for coproducts, and a lignocellulosic residue, which at scale could be used as a feedstock for sustainable aviation fuel. Guayule uses 1/3 to ½ of the irrigation needed for traditional southwest crops.

b. How can the next farm bill better serve our existing MSI students and develop a wider pipeline for these students to enter careers in agriculture research?

Response: Strategies focused on making education and training affordable and supporting more MSI students through financial aid sources have important roles to play in closing this gap and must be addressed not only in 2- and 4-year institutions, but also in certification programs offered to the general public.

Assisting with the financial burden of summer research internship costs, tuition costs, professional organization membership costs, research materials costs, travel costs to present research, and stipend support for costs-of-living is also a necessary factor for increasing MSI student entry to agriculture research careers. Identification and propagation of best practices for teachers, professors and research mentors through training, provision of research materials, and facilitating collaborative efforts are also essential for engaging minority students and fomenting an identity with agriculture research that motivates success.

The National Institute of Food and Agriculture's (NIFA) Agriculture and Food Research Initiative - Education and Workforce Development (AFRI-EWD) grant program focuses on developing the next generation of research, education, and extension professionals in the food and agricultural sciences and supports professional development opportunities for K-14 educational professionals; non-formal education that cultivates food and agricultural interest in youth; workforce training at community, junior, and technical colleges; training of undergraduate students in research and extension; fellowships for predoctoral candidates and postdoctoral scholars; and special workforce development topics. In addition, the Higher Education Multicultural Scholars Program (MSP), National Needs Fellows (NNF), Higher Education Challenge (HEC) and Non-land Grant Colleges of Agriculture (NLGCA) grants programs provide funds to strengthen education and research in the food and agricultural sciences. Finally, NIFA's new $250 million NEXTGEN program funded through the American Rescue Plan Act (ARPA) will enable Minority-Serving Institutions to design career development opportunities in agriculture for next gen scholars. This program addresses a critical need to attract, inspire, and retain diverse and talented youth for careers in food and agriculture.

Additional resources for competitive grant programs like those mentioned above are needed to better serve our existing MSI students and widen the pipeline for them to enter careers in agriculture research.

2. Our country's diversity is not only reflected by our citizens, geography, and climate, but also by the crops and livestock we cultivate. That diversity also needs to be reflected by our agricultural research network, and this is why our regional research system is so valuable to states like New Mexico, where our climate and terrain present unique challenges. A recent Economic Research Service report indicates that more than half of publicly-funded agricultural research is conducted by State Agricultural Experiment Stations.

    a. Does the Farm Bill need to better support our nation's research powerhouses so they can continue to meet the needs of their host states? What are some of your recommendations for the enhancement of these Stations?

    Response: The Hatch Act of 1887 was enacted to support research that is practical and relevant to the host states. Today, capacity funds (such as Hatch and Evans Allen) are provided to states with the requirement that the resulting research addresses state-determined priorities. Large and small land-grant universities (LGUs) have unique strengths to address problems and opportunities for their stakeholders. The LGU portfolio of multi-state research committees are intended to further leverage knowledge and assets across state lines in order to achieve synergies. Additionally, NIFA's competitive programs (such as the Agriculture and Food Research Initiative and the Small Business Innovation Research grant program) are mechanisms to support LGU involvement in addressing national problems and opportunities. Previous Farm Bills determined the priority areas that AFRI and SBIR must address. Most recently, state LGU leaders and agricultural stakeholders have indicated that their most urgent limitation is the condition of their aging facilities. This is an issue at remote field stations as well as research facilities on the campuses. Modern agricultural research and education facilities at 1862, 1890, and 1994 land-grant universities serve as the backbone for innovative research and applied science solutions to current agricultural and societal challenges. However, the LGU system faces unprecedented infrastructure challenges. More than 69% of research and education facilities at LGU colleges of agriculture are at the end of their life cycles. Scientists and educators at U.S. LGU's are being asked to perform 21st century science in facilities constructed in the 1950s and 1960s.

3. Public funding for USDA's agricultural research activities has been relatively flat for nearly two decades, including formula funds provided to land-grant universities. Thanks to the leadership of this committee, one bright spot has been the ability of the Foundation for Food and Agricultural Research (FFAR) to attract non-federal funds to match the resources that they've been given as part of the last two farm bills. Since it was first established in 2014, FFAR has been able to exceed the Farm Bill matching requirement, bringing $1.40 for every federal dollar spent from non-federal partners for funded projects.

a. Do you think that the FFAR model is a good approach for bringing more private sector money into public research efforts? How do we expand this approach to other USDA programs?

Response: As an ex-officio board member of FFAR since its inception, I, as Under Secretary, will continue to partner with FFAR whenever possible. I can't speak for USDA programs outside of the Research, Education, and Economics Mission Area, but we need to focus on ensuring USDA and FFAR continue to work closely together through open dialogue and open lines of communication at all levels, so we can bring strength to strength.

Additionally, the USDA National Institute of Food and Agriculture's (NIFA) Agriculture and Food Research Initiative's (AFRI) Sustainable Agricultural Systems (SAS) Climate Adaptation Partnerships (CAP) projects are public-private partnerships. In many cases, the leveraged private in-kind and direct funding far eclipses the $10 million NIFA CAP funding. This is a highly competitive program, where the number of projects funded versus the number of applications received are disproportionately small.

b. What are some areas where this public-private partnership model can be improved? What benefits may be gained through these changes?

Response: The way this model works, like all partnerships, is through open dialogue and open lines of communication at all levels. USDA will continue to lead by example to ensure this public-private partnership continues to succeed.

4. As you look at the post-COVID research, Extension and educational needs for our youth, how can we work together to expand online services that encourage community across the diversity of the country, develop STEM programming for the future of our workforce, and promote personal healthy habits – from nutrition to mental health?

Response: 4-H at Home is a project that was funded via the USDA National Institute of Food and Agriculture's (NIFA) Agriculture and Food Research Initiative SARS-COV-2 Digital Learning Resources program in 2020. As a digital positive youth development platform of the Cooperative Extension System, it is intended to level the playing field and address the widening opportunity gap growing as a result of the pandemic by providing universal access to supplemental at-home curriculum, engaging learning projects and supplies, and a virtual community of peers and positive adult mentors. Virtual educational resources have reached 1.4 million youth with content populated by Land-grant Universities. Digital learning resources are focused on building positive outcomes in workforce development and life skills-driven STEM, Ag, Healthy Living and Civic Engagement/Community learning, while supporting 4-H's Positive Youth Development outcomes like connection and engagement.

Prior to the global pandemic, a few states had begun combining new technologies with in-person learning as part of a national initiative to improve program reach among NIFA's Expanded Food and Nutrition Education Program (EFNEP)'s historically underserved population. Closures and limited access to community and school programs during the pandemic resulted in university partners nationwide pivoting to adopt online learning methods. Universities shared new programming practices freely with each other to help the entire EFNEP community. NIFA held multiple webinars to support such sharing of best practices and lessons learned. With input from program partners, NIFA's EFNEP leadership established new procedures nationwide to support; 1) synchronous learning – in-person or live online lessons; and 2) hybrid learning that also allows for asynchronous approaches – interactive digital or recorded lessons. Additionally, program evaluation measures were established to track developments and success in using new learning strategies. These new strategies do not negate the need for more traditional approaches since such is needed to ensure equity in program delivery where access to technology continues to be a challenge. Additionally, EFNEP continues to apply a paraprofessional or peer educator teaching model, as per legislative intent.

Senator Reverent Raphael Warnock

1. One of the biggest challenges that farmers in Georgia are facing right now is stress. For older and younger farmers alike, resources provided through the Farm and Ranch Stress Assistance Network (FRSAN) Program have been integral to help folks get through tough times and destigmatize conversations around mental health in rural communities. I am proud to support funding for this program, and I hope to continue working with members of this Committee to provide additional stress resources for our farmers in the next Farm Bill.

    a. How can we strengthen the Farm and Ranch Stress Assistance Network (FRSAN) Program to help our farmers they experience high levels of stress?

    Response: USDA, through the National Institute of Food and Agriculture (NIFA), manages the funding to support Farmer Rancher Stress Assistance in every state, territory, and region. The work that the four regional networks have done to build capacity, outreach, direct service for farm stress mitigation has led to much greater awareness that the concerns for farmers and shown that farm stress is not diminishing, but rather increasing.

    Additionally, there is a notable gap in research about the interaction of factors (e.g. behavior health, social, economic, and environmental) that create farm stress and suicide risk. Specific funding for national research to investigate the root causes and interaction so of these factors is critical. In particular, data is lacking on the geographic dimensions (i.e. there is little to no comparable state level data) to show which regions and populations of farmers and ranchers are most at risk. Funding national research on the factors of farm stress, would help to direct current assistance and prioritize future funding to those most in need.

Farmer health and well-being is a fundamental issues not only for our society, but for our agricultural and food security. The FRSAN regional program would benefit from annual dedicated funding to build on the research, outreach and resources provided to farmers, ranchers and other service providers who support them. Stable funding would allow support to flow to farmers in a time when intersecting challenges are still present and affecting agricultural producers (e.g. severe and unpredictable weather, rising costs of inputs, unstable markets, ongoing public health crises, etc.). Long-term funding would also allow for the establishment of larger and more mature networks of service providers who need to work together to provide comprehensive support for producers.

2. In the 118th Congress, I am looking forward to remaining on the committee and working with my colleagues to support our 1890 land-grant Institutions. I strongly believe in the value that the 1890 scholarship program and the 1890 Centers of Excellence bring to the 1890 system.

    a. How would further expansion of the 1890 scholarship program or the Centers of Excellence increase opportunities for both students and disadvantaged communities serviced by the 1890 land-grant system?

    Response: The 1890 scholarships program is intended to encourage outstanding students at 1890 land-grant universities (LGU's) to pursue and complete baccalaureate degrees in food and agricultural sciences and related fields to increase the talent pipeline for the agricultural innovation workforce and the next generation of agricultural scientists. This program provides scholarships to support recruitment, engagement, retention, mentoring, and training of undergraduate students at 1890 Land-grant Institutions that are partners in the U.S. Land-grant University System. In FY 2022, each 1890 Institution received $1 million (both mandatory and discretionary) funding for scholarships. The funding has resulted in increased enrollment of students in food and agricultural sciences and related fields at 1890 Institutions. Increasing the funding investment and long-term funding support of this program will benefit more students and signify our continuing partnership with the 1890 Land-grant Institutions to ensure the sustainability of our country's agricultural future.

    The 1890 Centers of Excellence awards are an effort to increase rural prosperity and economic sustainability of food systems in underserved farming communities. There are six Centers currently funded supporting projects that enhance academic and career activities for students pursuing careers in food and agricultural sciences; increase profitability, natural resource conservation, and market demand for small farmers, including /underserved farmers, ranchers and forest landowners; address vital needs in nutrition and health to improve the quality of life of underserved populations; address critical needs for developing global food

security and defense; and develop/apply emerging technologies to increase agricultural productivity. Each of these Centers received $1 - 2 million each year.

Senator Joni Ernst

1. Under Secretary Chavonda Jacobs-Young, the National Institute for Antimicrobial Resistance Research and Education (NIAMRRE), is hosted by Iowa State University and is working to address knowledge gaps to ensure the agricultural sector and food supply remain safe and plentiful.

    a. What can the Department do to help address the growing threat of antimicrobial resistance and ensure our researchers have the tools they need?

    Response: USDA, through the National Institute of Food and Agriculture's Agriculture and Food Research Initiative, funds investments that include fostering research on strategies to mitigate antimicrobial resistance and providing opportunities for new investigators to support the next generation of scientists and educators to ensure America's food security, as well as its preeminence in the agricultural and food sciences.

2. Under Secretary Chavonda Jacobs-Young, biochar is an emerging soil amendment, that when applied in a production agricultural setting, can lead to several potential benefits. Recently, Iowa State University researchers found that biochar can reduce manure-related odors and emissions, and it is widely accepted that biochar has long-term carbon storage benefits in the soil. Optimizing the processes that create biochar and identifying the soils where its application can also improve nutrient and water efficiencies in crop production are critical for bringing this technology to the forefront for U.S. agriculture.

    a. As we work on the 2023 Farm Bill, how can we help U.S. farmers realize the potential of biochar to provide value to farmers, mitigate climate change, and more?

    Response: USDA's Agricultural Research Service (ARS) conducts impactful agricultural research, including research on biochar. ARS furthermore recognizes that scientific and technical agricultural research outcomes need contextualization for farmer and producer communities to facilitate their consideration and then adoption of important discovery outcomes. For biochar, two complimentary strategies will accelerate farmer consideration and adoption of biochar.
    - The first is additional research support that will lead to biochar studies conducted at a greater number of sites and under relevant conditions, which will be of high value to particular agricultural regions that have different cropping/animal systems and that vary in climate and soil conditions. The outcomes of such additional biochar research will lead to the optimization of what and how much biochar to use for which systems and under which conditions.

- The second is support that will lead to better tools for farmers to realize the benefits of those research outcomes. In this aspect, ARS envisions providing needed contextualization services via additional support for the impactful USDA Regional Climate Hubs. These entities have considerable capability and expertise for science translation and tool development for their regions. Many have professional agricultural economists and agricultural sociologists as part of their teams who can further assist in the important "realization" aspects of what farmers need to consider biochar.

ARS research locations have studied biochar composition, feedstocks, pyrolysis, and the potential uses and benefits of biochar for carbon sequestration, improving soil health, ecosystem restoration, water quality and others. ARS researchers have partnered with land grant institutions in these studies. Recently, ARS researchers and leadership partnered with the Foundation for Food and Agriculture Research and industry partners to co-develop a biochar research strategic vision that will enable strategic long term research approaches to develop regionally relevant and science-based characterizations of biochar feedstocks, conversion, application and uses, including improved means of collecting standardized data to evaluate C sequestration, improvements in soil health and other benefits resulting from biochar use. Specifically, these conversations and the resultant vision recognized that additional resources could empower ARS to lead new cross-site, fundamental research (e.g., by creating biochar efforts at Long-Term Agroecosystem Research sites and by expansion of ARS historical biochar study sites). Innovating the development, use and benefits of biochar is a critical component of expanding their use and impact by producers and industry.

Senator Roger Marshall, M.D.

1. A decade ago, DHS began plans on building NBAF in Manhattan, Kansas. This facility is designed to host every zoonotic disease in the world and be a premiere international leader on disease research. It seems to me that the grand opening of the facility has been pushed several times and there is a lot of uncertainty around when it will be up and running.

    a. Can you lay out a timeline of when we can expect NBAF to be at full service?

    Response: The Department of Homeland Security (DHS) has just completed construction commissioning of the National Bio and Agro-Defense Facility (NBAF) and reached Substantial Completion on December 20, 2022. After facility commissioning, USDA must still test and validate NBAF work processes in accordance with the building systems. Scientists will confirm laboratory set-up, evaluate workflows, and confirm equipment is functioning appropriately to ensure research and diagnostics will be accomplished safely and effectively.

Before any work with biological select agents and pathogens can begin, the facility and personnel must undergo a series of inspections and reviews by the Federal Select Agent Program. Even after commissioning is complete and USDA takes official ownership of the facility from DHS, it will still take at least a couple of years to transfer the full science mission from the Plum Island Animal Disease Center (PIADC) in New York to NBAF in Kansas. We expect full mission transfer from PIADC to occur in late 2024, and full stand-up of the Zoonotic and Emerging Disease Research Unit and BSL4 research and diagnostic capability to be in 2025. This will mark the attainment of full service.

b. We see some interesting synergies between NBAF and AgARDA especially given the language in the 2018 farm bill that directs AgARDA to prioritize research on zoonotic diseases. Can you give us an update on AgARDA, including the status of the $1 million in appropriated funds that was directed for the strategic plan and to hire staff?

Response: USDA's Office of the Chief Scientist (OCS) conducted an initial internal stakeholder scan in FY 2022 and has completed an Agriculture Advanced Research and Development Authority (AGARDA) strategic implementation plan that is currently in clearance at USDA. This implementation plan proposes strategic next steps at various requested funding levels and will be made publicly available once internal clearance is complete. Additionally, OCS has solidified partnerships to hold stakeholder listening and engagement sessions in FY 2023 toward establishing AGARDA priorities and building the program once properly resourced. OCS is also working with its partners to conduct a landscape analysis of existing advanced research projects agency organizations across the government to harvest tools, best practices and lessons learned for application of AGARDA implementation.

The 2018 Farm Bill directs AGARDA to fund targeted acceleration of novel, early-stage innovative agricultural research and development of qualified products and projects which might include addressing zoonotic diseases. A fully funded AGARDA may have synergies with other initiatives, such as NBAF, in that AGARDA is designed to fund high risk, high reward research across agriculture, forestry, and food science that current agricultural research and development investments are not designed to fund.

c. How can we leverage this farm bill title to ensure NBAF becomes the premiere international leader on disease research?

Response: USDA's Agricultural Research Service has all the authorities needed for NBAF to become the premiere international leader in foreign and emerging animal diseases. Continued support for the animal health research programs throughout USDA will be critical to support this goal.

2. While I think we all agree there is significant potential in carbon markets to reward farmers for their good land stewardship, I'm concerned about the lack of unified standards around measuring, monitoring, reporting and verifying for soil carbon. We don't want to build these markets and then find out that they were just as volatile as crypto. I'm concerned that Democrats pushed roughly $20 billion dollars in the Inflation Reduction Act to transform our agricultural system for "climate purposes" before we even had the research to back it.

    a. Can you talk about the research gaps in soil carbon measuring and what USDA is doing to address those gaps?

    Response: USDA's Agricultural Research Service (ARS) and its collaborators are key to advancing the research and data that support soil carbon storage, measurement, monitoring and verification. ARS has been a global leader in this area over the past two decades, with the GRACEnet research network establishing sample and data standards that have been widely adopted. Adoption of these standards for soil carbon measurement has resulted in vastly improved modeling, prediction, verification and decision support related to soil carbon fluxes and dynamics. The gaps in soil carbon research are primarily in three areas: (1) innovative practices, strategies and new crops that increase carbon inputs to the soil; (2) improved understanding and ability to model soil carbon dynamics across hundreds of soil types under thousands of different management and cropping variations; and (3) data standardization that drives improved accuracy of measurement and reduced uncertainty (or potential error) in the measurements, predictions or model results. ARS and collaborators are currently conducting research in all three of these areas, and there are strategic opportunities to accelerate these efforts to rapidly bring innovation to producers and the marketplace.

    Over the past few years, ARS researchers and collaborators from the Department of Energy and land-grant universities (LGU's) have completed work on and transferred to industry a novel new technology for measuring and mapping soil carbon across a field. The Mobile Inelastic Neutron Scattering (MINS) system will accurately measure and map soil carbon across a field in real time without taking and processing soil samples. It can also provide data on soil health and crop nutrient management. This is a huge breakthrough and the commercial partner is gearing up to deploy the field device in support of carbon market transactions. This new technology is a potential "game-changer" for soil carbon measurement, monitoring and verification.

    This past year, the ARS Partnerships for Data Innovations (PDI) has been working with USDA's Farm Service Agency on developing standardized data collection and management tools to help standardize the data needed to quantify the soil carbon changes under fields enrolled in the Conservation Reserve Program. Standardizing data capture and handling will enhance data quality, interoperability and accuracy, improving our ability to model and predict soil

carbon changes more accurately. Building on this history of success in this area, ARS is poised to collaborate with others across USDA and the LGU's to drive the next generation of soil carbon dynamics, quantification and inventory.

Additionally, USDA's National Institute of Food and Agriculture is supporting a Small Business Innovation Research (SBIR) grant to measure soil organic carbon up to one meter depth. To date, tools for measurement of soil C stock to the degree of accuracy necessary for a functioning C credit market do not exist or very limited, and lack of such tools is a barrier to the establishment of such a market. This SBIR grant proposed a unit (the Subterra Green Model P) which enables land managers to rapidly and accurately map the soil organic carbon content in three dimensions to depth of one meter. This unit employs a visible/near-infrared spectroscopic probe that is pushed into the soil at intervals and is small and maneuverable enough to be operated by one person in many different vegetative conditions.

b. Do you think a program like AgARDA could be a method to fund transformational research that could really take this field to the next level?

Response: USDA Science is committed to supporting high-risk, innovative research that can help to address major challenges in agriculture and forestry systems. The Agriculture Advanced Research and Development Authority (AgARDA) provides a valuable opportunity for the USDA to advance innovation in agriculture, food, and forestry science. A properly funded AgARDA program could follow the same model of other advanced research projects agency programs to fund high risk, high reward research to develop transformative technologies to benefit the future of agriculture, food, and forestry science.

3. We've asked several times the hiring information for this administration regarding the move to ERS and NIFA and still have not received that information.

a. Can you tell me what percentage of staff is in the Greater Kansas City area?

Response: ERS - 29%, NIFA - 15%

b. What percentage is "remote work" and outside of Kansas City?

Response: ERS - 55%, NIFA - 85%.

c. Do you support keeping ERS and NIFA permanent duty stations in Kansas City?

Response: USDA supports having a permanent duty station in the Greater Kansas City area. It has proven to be a successful location for hiring and attracting qualified personnel. Both ERS and NIFA have been successful in carrying out their agency's respective mission from Washington, DC and Kansas City, MO.

d. Is the USDA NIFA and ERS telework policy different from other agencies? If so, why?

Response: The policy is consistent with Departmental policy.

Senator John Thune

1. As you know, USDA currently manages and stores valuable producer data. The data could be better utilized to bolster producers' understanding of which conservation practices help reduce risk and increase profitability.

   To address this, Senator Klobuchar and I have introduced the Agriculture Innovation Act, which would improve USDA's secure and confidential data collection procedures for assessing how conservation and production practices increase crop yield, bolster soil health, and ultimately improve profitability. We will be working to secure our proposal in the 2023 farm bill.

   a. Can you talk about the role that USDA and its trusted research partners – like land-grant universities – can play in analyzing data related to the impacts of conservation and other agriculture production to better support farmers and ranchers?

      Response: USDA's Economic Research Service (ERS) has significant expertise in understanding the role of role of soil health in affecting crop yields and has a long history of research and analysis on conservation programs and agricultural productivity. For example, in 2021, ERS released a report, Cover Crop Trends, Programs, and Practices in the United States, showing cover crop adoption rates across different crops. Currently, ERS is working with external collaborators on two reports that were directed to ERS in the FY2022 Appropriations. One report examines programs that incentivize carbon sequestration in soil through soil management practices. The second report examines the environmental benefits of participating in voluntary conservation practices. ERS continues to apply its expertise, supplemented with work alongside external research partners, to address important policy issues related to crop yields, soil health, and farmer well-being.

      Through the National Institute of Food and Agriculture (NIFA), USDA supports research and extension funding that improves our national capacity to provide actionable advice to farmers and ranchers in our U.S. food, forestry, and agriculture system. For example, NIFA funds the Artificial Intelligence (AI) institutes, Sustainable Agricultural Systems (SAS), the AFRI Economics, Markets and Trade and the Data Science for Food and Agriculture Systems programs. In addition, the Open Data Framework program provides coordination and standards for data analysis. Together these programs provide prediction of optimal practices and measurement support to all U.S. regions and the full range of producers and

consumers, from beginning farmers to large-scale regional best practices implementations.

Some specific examples of land-grant university partner funding though NIFA include:
- AFRI AI Institute: Agricultural AI For Transforming Workforce and Decision Support (AgAID), lead institution Washington State. The AgAID Institute builds tools and workflows to help mitigate the effects of labor costs and shortages, and better manage regional resources such as water, despite climate uncertainties.

- AFRI Data Science for Food and Agricultural Systems (DSFAS)-AI: Leveraging Data Science, Remote Sensing, And Open-Source Tools to Inform Grassland Management Decisions for Livestock Producers, South Dakota. This project will develop a web application using real-time data to inform livestock producer decision making, which will greatly improve environmental quality, build climate resiliency, and increase ranch income and sustainability across millions of acres of agricultural lands in the U.S.

- AFRI DSFAS Developing Data-To-Decision Pipelines for Agroecosystem Management Through High-Performance Computing and Big Data Analytics, North Carolina. This project addresses the analytical bottleneck though the development of an open-access and readily useable package of novel computational tools ("cultivatr") that will enable users to "cultivate" their agroecological data to generate predictive data-driven decision support tools.

- AFRI Markets, Economics and Trade Crop Insurance Policy Design and Program Participation. This project aims to better understand farmer insurance choices the project will work with farmers to assess the impacts of policy design and incentives on farmer's crop insurance participation through evaluating competing decision theories.

- AFRI Environmental and Natural Resource Economics Aligning Food Production, Solar Development and Ecosystem Services. The project will develop a full cost-benefit accounting framework to examine the technical feasibility of co-location of solar and agriculture, the economic viability of investment and opportunity costs, the ecosystem service co-benefits, the life cycle environmental impact implications of investment decisions on key agricultural production systems, and the implications for food and energy production.

- AFRI SAS Promoting Economic Resilience and Sustainability of The Eastern U.S. Forests (Perseus), Indiana. Working with stakeholders, PERSEUS will provide user-friendly tools and programs to better measure and monitor forests; sustainable forest management practices; and a platform to optimize regional efforts in building environmentally and economically sustainable forests, especially on private lands in rural America.

- Sustainable Agriculture Research and Education program (SARE): Incentivizing Land Access for Small, Beginning and Socially Disadvantaged Farmers and Ranchers: Research, Extension and Community of Practice, Indiana. The project will increase knowledge of the impacts and reach of Land Access Policy Incentives and build capacity to advance their use, to facilitate access to land for a new generation of farmers and ranchers, through policy, survey, and interview data analyses, and translation of findings to extension.

2. The 2018 farm bill authorized the New Beginning for Tribal Students Program, which allows USDA to match land-grant colleges and universities' funding used to provide support specifically for Native American students. The program helps land-grants with recruiting, tuition assistance, and student services like tutoring, counseling, and academic advising.

    a. Can you provide an update on implementation of the program?

    Response: The New Beginning for Tribal Students (NBTS) makes competitive grants to land-grant colleges and universities to provide identifiable support specifically targeted for Tribal Students. A land-grant college or university that receives this grant will use funds for, but not limited to, support of Tribal students for articulation agreements with 1994's; dual credit programs; recruiting; tuition and related fees; experiential learning; student services; including tutoring; counseling, academic advising; and other student services that would increase the retention and graduation rate of Tribal students enrolled at the land-grant college or university, as determined by the Secretary. The maximum one state can receive is $500,000 per year.

    In 2020, the number of proposals submitted for the New Beginning for Tribal Students program was 22 with 20 proposals recommended for funding. In 2021 14 proposals were submitted for funding and 13 were recommended for funding. In 2022, 6 proposals were submitted and 6 proposals were recommended for funding. The decrease in the number of proposals submitted annually is thought to be due to the saturation of land-grant universities' ability to meet the match requirement and states not being able to apply for NBTS due to meeting the maximum of $500,000 per state per year requirement. States that have either met or are close to meeting the $500,000 per state per year maximum are South Dakota, Wisconsin, and Montana.

    b. Do you have any ideas for improving this program as we consider farm bill reauthorization?

    Response: The New Beginning for Tribal Students is a dynamic program that is creating changes at land-grant universities (LGUs) by helping Tribal students graduate with degrees for land-grant institutions. Some barriers to this program that could help to increase the reach would be to remove the restriction that one state can receive a maximum of $500,000 per year. The location of the 1994s

(tribal LGUs) is not scattered evenly by state. Unlike 1862 land-grant universities, of which there are typically only in each state, there might be five 1994s in just one state . This creates an inequity in the ability to apply for this program.

The 1994 LGUs often struggle to meet the match requirement which prevents them from applying for this program. There would also be more 1862s who would apply for this program if the match requirement was removed or USDA was given the authority to waive.

3. In the past, South Dakota producers have raised concerns with the accuracy of National Agricultural Statistics Service, or NASS, crop reports.

    a. What can be done to strengthen the integrity and accuracy of NASS reports that are vitally important to producers?

    Response: The National Agricultural Statistics Service (NASS) continues to be transparent with our procedures and has responded to and reached out to many organizations and individuals who have expressed concerns similar to these. To better communicate our procedures, staff have been doing the following:
    - synchronizing announcements of re-survey plans with the Acreage report release (and others as relevant);
    - adding text to the report(s) describing the follow-up survey work;
    - reviewing all survey forms, instruments, and instructions for potential improvements to address weather situations;
    - and expanding outreach explaining NASS procedures.

    Additionally, NASS is also continuing to research using new technologies such as precision agriculture and expanding on existing usage of remote sensing to support survey information. Finally, in March of 2022, NASS started livestreaming agricultural data briefings to enhances public access to valuable information and increase transparency.

    Increasing producer response to NASS surveys would have the most significant impact on improving the accuracy of reports.

4. The Sun Grant program overseen by USDA provides students and university researchers an opportunity to collaborate on advancements in the energy sector.

    South Dakota State University serves as the North Central Regional Sun Grant center and has been at the forefront of biomass feedstock and renewable fuel research.

    a. Can you speak to the importance of land-grant university-based research activities in rural states for advancing USDA's agriculture, environmental stewardship, and rural development goals?

Response: Through the National Institute of Food and Agriculture (NIFA), USDA supports a wide range of land-grant university-based research that advances USDA's goals across agriculture, environmental stewardship, and rural development. This support includes competitive and capacity programs. The Sun Grant program is a unique program where regional centers (and one sub-regional center) are funded to administer their own competitive programs for regionally appropriate research on bioenergy, bioproducts, and the bioeconomy. The Sun Grant program has a track record of supporting large, national-scale interagency research efforts as well as regional small business commercialization. For example, previous accomplishments have included research efforts that played an important role in providing critical data underpinning bioenergy feedstock assumptions in the DOE-led interagency Billion Ton Report. Research funded by NIFA through the Sun Grant program also led to commercially meaningful advances at South Dakota-based Prairie Aquatech, a provider of sustainable aquafeeds and recirculating aquaculture technology. NIFA also has other models for funding coordinated, regionally appropriate research beyond Sun Grant, such as the Agriculture and Food Research Initiative's Sustainable Agricultural Systems program. Both approaches play important roles in ensuring research at land grant universities is advancing goals that will have positive impacts in the communities that they serve.

5. Bio-based products represent a growing segment of the consumer market. Products derived from commodities like corn and soybeans offer consumers a greener alternative to petroleum-based products and provide our farmers with an additional market for their commodities.

   South Dakota State University has been at the forefront of bio-based research and development. SDSU serves as the North Central Regional Sun Grant center and has been able to turn federal research investment into tangible results.

   a. Can you speak to the importance of university-based research activities in advancing USDA's rural development goals and how they directly impact stakeholders?

      Response: Similar to the previous question, USDA, through the National Institute of Food and Agriculture (NIFA), supports a wide range of land-grant university-based research that advances USDA's goals across agriculture, environmental stewardship, and rural development. This support includes competitive and capacity programs. The Sun Grant program is a unique program where regional centers (and one sub-regional center) are funded to administer their own competitive programs for regionally appropriate research on bioenergy, bioproducts, and the bioeconomy. The Sun Grant program has a track record of supporting large, national-scale interagency research efforts as well as regional small business commercialization. For example, previous accomplishments have

included research efforts that played an important role in providing critical data underpinning bioenergy feedstock assumptions in the DOE-led interagency Billion Ton Report. Research funded by NIFA through the Sun Grant program also led to commercially meaningful advances at South Dakota-based Prairie Aquatech, a provider of sustainable aquafeeds and recirculating aquaculture technology. NIFA also has other models for funding coordinated, regionally appropriate research beyond Sun Grant, such as the Agriculture and Food Research Initiative's Sustainable Agricultural Systems program. Both approaches play important roles in ensuring research at land grant universities is advancing goals that will have positive impacts in the communities that they serve.

b. Do you believe continued, robust investment in rural land-grant university research activities is essential to USDA's rural development goals, and why do you believe so?

Response: Absolutely. The rural –land-grant university system is one of our most critical assets for rural stakeholders in America. The geographical infrastructure of offices and staffing that represent the state and county level is fundamental to providing targeted assistance and is founded on decades of critical trust and relationships built upon the land-grant universities (LGUs) as a trusted source for cutting edge research and supportive technical assistance. Extension continues to evolve with the times, thinking of creative ways to expand research, outreach, education and technical support to address changing needs for rural stakeholders including nutrition, health, youth, entrepreneurship, broadband and digital literacy and more. Supporting the LGU System and Extension's ability to be a leader in providing support to rural America is fundamental to the surviving and thriving future of rural communities.

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
Farm Bill 2023: Research Programs
December 6, 2022
Questions for the Record
Dr. Jason Rowntree

Senator Kirsten Gillibrand

1. NIFA often encourages and prioritizes collaboration in its competitive grants.

    a. What is USDA doing to assist LGUs in collaboration with each other? And what can be done to strengthen collaboration amongst LGUs in research, education, and extension?

The primary way I see USDA encouraging collaboration across the three components of the LGU: research, education and extension (REE) is by way of incentivization through funding opportunities. Often these funds come through USDA NIFA and USDA SARE and generally encourage at least two components of REE for successful funding. Additional funding opportunities with a regional to national scope would be one way of encouraging greater collaboration across LGU and REE. Importantly, participatory (on-farm) research that encourages involvement across REE is an excellent way to see the LGU as the 'hands and feet' of agriculture and natural resource discovery and education.

    b. How can extension agents in one state benefit from the research and learn best practices from extension in another state?

Generally, I see multistate interaction in face-to-face conferences and various webinars. The best ones are producer/farmer led conferences that extension contributes to as important facilitators and educators. As one example I have worked with the Grassfed Exchange. This is a producer led group that works to promote regenerative grazing and ecological improvement of grazing lands by working to increase pasture-based livestock production. Each year we go to a different location in the United States and embark on considerable farm and ranch tours. These experiential learning opportunities that focus on exchanges of information are highly effective. Each year, Extension is very involved with the conference and this has created a national network of colleagues working in the same area.

    c. What is USDA currently doing to support collaboration and communication between LGUs and ARS research?

From a programmatic perspective, I think the LGU-ARS interaction is fairly limited outside of general conferences and educational activities. One example of successful interaction is the LTAR (Long Term Agroecosystem Research) program. For instance, the Kellogg Biological

Station at MSU houses a newly formed crop-livestock interaction LTAR. The LTAR program is facilitated through ARS but is hosted at a LGU. Other examples are having ARS infrastructure and scientists housed at universities. Finally allowing ARS scientists to compete for federally funded grants has incentivized collaboration. I currently lead a large FFAR funded grant that has several ARS faculty participating.

2. Extension agents are an important source of unbiased, scientifically backed information that farmers rely on. They understand local issues and are trusted.

    a. What is your institution doing to attract and hire the extension agents?

MSU Extension has an on-going internship program for undergraduates to help expose students at Michigan State University to a possible career in extension. This has been expanded to include students from North Carolina A&T University to improve our ability to recruit a more diverse workforce. In addition, MSU Extension completes a national search for our Extension Educator/Agent open positions. This includes marketing positions through regional and national professional/technical societies in addition to well-known position marketing organizations (e.g., Indeed, LinkedIn). We also market our positions through organizations/groups that represent underrepresented groups and minorities (e.g., Native American tribal associations, Minorities in Agriculture, Natural Resources and Relates Sciences (MANNRS), etc.). Furthermore, we notify students within academic departments at MSU about these opportunities and provide our position information to industry groups and organizations to alert people within their networks of opportunities for employment within extension. Within the interview process we include industry representatives to help broaden our perspective on candidate strengths and weaknesses, giving candidates a chance to learn about the local community during the interview process.

    b. In your experience, how long does it take for extension agents to build trust with local farmers and their communities? What is the turnover of these agents? Have you assessed turnover?

MSU Extension's Extension Educators have either an M.S. or Ph.D. degree in their field of expertise. Our educators typically have an appointment that covers specific content statewide or regionally. This content specialization helps improve a new staff person's credibility at state and local levels with stakeholders. Their command of specific content information helps improve their response time and accuracy to inquiries. They also have responsibilities to integrate programming efforts, across topic areas, in their local communities. In our experience, we believe that it takes 2-3 years for new extension educators/agents to build support and trust with local communities. Though in many cases there are advocates in these communities that work with a new person to help them acclimate and integrate into the community and work with key stakeholders.

MSU Extension has developed an extensive onboarding program for its new staff to help them learn how to build relationships and understand needs within communities as well as better master their role to improve their ability to be successful. Within agricultural extension our retention rate is near 75% over the last 5 years, and we are working to improve that.

c. What can we do in the next Farm Bill to improve your efforts to hire a diverse and representative extension workforce and prevent turnover?

Conservation related programs for agriculture and rural communities are key components of the Farm Bill. A critical component of adoption of agricultural conservation practices is having on-going educational efforts to help farmers and their advisors understand both the public and private good of these conservation practices. Education is also necessary regarding how these practices should be implemented and sustained over time. Extension plays a significant role in providing sustained educational messaging of these programs due to extension staff being imbedded in communities. Providing identified funding for extension education within Farm Bill conservation programs will have a greater and long-term benefit to sustain agricultural conservation practices. This is accomplished by working with governmental and non-governmental agencies working on the state and local level to help the agricultural community implement and sustain essential conservation practices.

To further improve recruiting and retaining a more diversified work force, increased funding of Smith Lever funds is needed. Smith-Lever funds are a critical base for extension programs and are greatly appreciated. Yet, there has not been a significant change in Smith-Lever funding for many years. Increases in Smith-Lever funding would help improve salary competitiveness to attract and retain a more diverse work force to complete the necessary work in sustaining the agriculture community for the current and next generation of farmers.

Additionally, increased funding for USDA competitive grant programs of integrated projects, that require research and extension components in project execution, will help expose additional graduate students to opportunities and experiences related to extension career opportunities. This will help in recruiting a talented and diverse workforce for extension.

Senator John Thune

1. Dr. Rowntree, can you talk about the role that USDA and its trusted research partners – like land-grant universities – can play in analyzing data related to the impacts of conservation and other agriculture production to better support farmers and ranchers?

This question speaks directly to the work we conduct at the MSU Center of Regenerative Agriculture. Importantly conservation should be tied to land and the metrics (ecological such as water and carbon, or emissions such as nitrous oxide and methane) that are derived from land.

Land Grant Universities (LGU) working with partners such as ARS and others have a tremendous opportunity to scale agriculture and grazing land metrics to inform agriculture producers, policy makers and the value chain. Importantly these metrics should not only be accounted for on research sites but also across ranches and farms throughout the United States. I believe public: private and public: NGO collaborations will be important. The LGU has the expertise in measuring and instrumentation and can work to scale data to validate and calibrate new and existing models. Gradients of production practices (those using Climate Smart Practices

to Status Quo) can work to inform these models. These approaches will allow for greater education on management impacts on land and water among others. Importantly protecting data and creating regional to national GHG, water use, and carbon storage databases will be crucial in this effort. Data storage and protection is a question that must be addressed. I maintain that any data harvested from the farm or ranch should be owned by the land owner/manager and ultimately data in of itself should be an important enterprise to farms and ranches. I do not want to see our rural communities manipulated like this story in the WSJ, "The Middlemen Snag Carbon-Credit Cash Aimed at Peruvian Amazon" .

Once data is purchased, protected scaled and analyzed, I see a baton passing to the private industry. This could be in the form of Applied Program Interfaces that can inform the value chain of a Climate Smart Commodities impact on agriculture's emission footprint. It can also inform farmers and ranchers in terms of how management is influencing land-based ecosystem services. There are endless opportunities. These data streams can also inform on ecosystem service trades over time as well.

In conclusion, I envision the LGU and partners working to instrument and scale data and subsequent models. This creates educational opportunity. Second the data streams will enter into some sort of a protected database (where to be determined) that can be used by private industry and to inform the landowner, value chain and greater public on strides made towards meeting emission reduction targets and also in the improvement of ecosystem services at landscape level.

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
Farm Bill 2023: Research Programs
December 6, 2022
Questions for the Record
Dr. Felecia Nave

Senator Kirsten Gillibrand

1. NIFA often encourages and prioritizes collaboration in its competitive grants.

    a. What is USDA doing to assist LGUs in collaboration with each other? And what can be done to strengthen collaboration amongst LGUs in research, education, and extension?

    Our primary interaction with USDA is through the National Institute of Food and Agriculture (NIFA) and the Secretary and Deputy Secretary's offices. The Secretary recently announced in December 2022 the reestablishment of the USDA/1890 Universities Task Force. That task force should be an important forum for better engagement across the entire Department.

    In addition, NIFA holds quarterly conference calls with the 1890 community on issues important to the tripartite mission areas (teaching, research and extension).

    NIFA hosts webinars with the 1890 community when appropriate and/or as needed to clarify or elaborate more fully on program requirements/expectations (i.e., the 1890 scholarship program, Centers of Excellence, etc.)

    NIFA has an 1890 Region Liaison (Deputy Director) and an 1890 National Program Leader (both former 1890 administrators) to work with the 1890s on collaborating with other 1890s and other land grant universities on competitive large-scale projects (i.e., NEXTGEN RFA and the Climate Smart Agriculture RFA).

    The NIFA 1890 Region Liaison and National Program Leaders have regular conference calls (at least monthly) with the 1890 Research Executive Director and the 1890 Executive Extension Administrator on issues of partnering and collaboration among the 1890s as well as issues pertaining to response to RFAs, plans of work, capacity grants, the scholarship program, Centers of Excellence, the 1890 programs portfolio, etc.

    NIFA issued a sub-contract to the Extension Foundation to work with the 1890s on the NEXTGEN RFA to find partners and collaborators to support proposal development prior to submission.

NIFA participates and supports financially the 1890 Research Symposium and the 1890 Extension System-wide Conference. NIFA constitutes panels at each conference to discuss funding opportunities, developing quality and integrative proposals and strategic partnering.

b. How can extension agents in one state benefit from the research and learn best practices from extension in another state?

Universities engage in research and teaching, but land-grant colleges and universities have a third, critical mission — Extension. Through Extension, land-grant colleges and universities bring vital, practical information to farmers, small business owners, consumers, families, and young people. Multistate collaboration enhances the capacity of Extension educators to respond to the needs of the stakeholders, share ideas and learn from other Extension programming activities. Therefore, multistate collaboration and good coordination reduces duplication of efforts, enhances transfer of Extension best practices, and supports long-lasting synergistic outcomes. Research and Extension activities from a multistate perspective can influence public policy that support regional and local food systems, as well as develop and secure the next generation of agricultural scientists and professionals.

Moreover, there are only 18 states with 1890 institutions. Those states without 1890s could benefit from the best practices and strategies utilized successfully to reach unserved and underserved audiences. New collaborations with 1890s can help with integration in other communities.

c. What is USDA currently doing to support collaboration and communication between LGUs and ARS research?

Agricultural Research Service (ARS) has a research lab on only two 1890 campuses: Delaware State University and Florida A&M University.

ARS developed and implements the 1890 Faculty Research Sabbatical Program that provides faculty at 1890s with the opportunity to participate in a residency at an ARS laboratory to conduct cooperative research of mutual interest with ARS scientists. Tenure-track and research-track faculty who have been employed for a minimum of 3 years at their current 1890 LGU are eligible to participate in the program. Each year, pending annual appropriations, ARS invests up to $500,000 in the program to support expenses such as salary, housing, personal living expenses, travel, and research costs. In 2022, faculty members from Fort Valley State, Tennessee State, Tuskegee, University of Arkansas at Pine Bluff, and Virginia State availed of this opportunity. ARS is currently accepting applications for 2023. The due date is May 20, 2023.

Scientists at Fort Valley State University have collaborative projects with scientists at the ARS lab in Charleston, SC on "whitefly infestation in vegetable crops;" "aflafoxins in peanuts" at the ARS lab in Dawson, GA; "postharvest pecan safety and quality" at the ARS lab in Bryan, GA; and the "integrated pecan-small ruminant production systems" at the ARS lab at Bryan, GA.

Scientists at Kentucky State University have collaborative projects with ARS scientists at the Forage-Animal Production Research Unit located at the University of Kentucky; and ARS scientists at the Food Animal Environmental Systems Research Unit located in Bowling Green, KY.

In November, the ARS Director in Florence SC visited the University Farm at South Carolina State and has scheduled a follow up discussion on collaboration.

The 2023 Farm Bill and the FY 2024 appropriation process present a new opportunity to increase collaboration between ARS and the 1890s. ARS can initiate new research facilities on all of our campuses to support research and recruit students for their internships and jobs. Most 1862s have ARS labs or/and connections with other federal labs and such initiatives will strongly increase the collaboration between ARS and the 1890 community.

Similarly, a reconvening of top USDA science officials and 1890 University leaders to plan for the next decade of agricultural research and science at 1890s institutions would be useful. A major pillar would focus on agriculture infrastructure enhancements.

2. Extension agents are an important source of unbiased, scientifically backed information that farmers rely on. They understand local issues and are trusted.

    a. What is your institution doing to attract and hire the extension agents?

    Recruiting and developing the next generation of extension professionals is paramount for changing industry and community needs. Recruiting qualified candidates should be deliberate and strategic, including providing experiential learning (volunteer, internship, student employment, etc.,) for students to develop skills in Extension delivery and operations. Through work-study, students employed in the department are being introduced to Extension programs. Academic and work experiences influence agents' decisions to seek Extension positions.

    Institutions publish job announcements in local papers, on University websites and other major educational media recruitment sites, as well as work closely with other LGU colleagues to develop recruitment strategies. Institutions are also allocating annual budget funds to support the hiring of new agents and sustaining existing county extension agents. There are offerings of special employment packages,

including increased and competitive salaries, competitive insurance benefits, and discounts for enrolling in college courses and career ladder promotions, to attract new agents. Increases in salaries are also offered for advanced degree attainment for existing agents.

Some non-traditional approaches involve working with stakeholders to determine the best approach to take in hiring new agents that can best be used to meet the needs of farmers, homeowners, communities and youth.

b. In your experience, how long does it take for extension agents to build trust with local farmers and their communities?

Trust is something even the most scrupulous communicator can lose if they do not perform their job well. An Extension agent's trust is built on knowledge and skills in their job responsibilities. Therefore, Extension agents build trust not just when they do a job, but when they prove they can do their job well.

Trust is important for effective delivery and adoption of new ideas, and the agent is the purveyor of these new ideas. Building trust is directly related to building relationships and is a continual process. There have been some challenges in building trust in minority and underserved communities due to past experiences of discrimination and relationships with public and government agencies. It is more important that extension agents build trust with constituents and communities through their positive work ethic, dependability, excellent communication skills, honesty, and delivery of exquisite customer services. An Extension Agent's demonstration of impact is based on consistency, competency and addressing relevant local needs of constituents. Extension agents are also liaisons for USDA and other governmental agencies in addressing access for limited resource audiences.

What is the turnover of these agents?

Turnover typically occurs within 1-3 years due to exploration of new careers with higher salaries, less demanding responsibilities and guaranteed weekly schedules. Agents are typically located in local rural areas, and finding housing or jobs for spouses can be a challenge for retaining new agents. Agents are also located in urban areas where the cost of living and other urban challenges can affect turnover. Other turnover has resulted from retirements or untimely death. The Extension job is not a typical 9 to 5 occupation. It takes dedication and commitment to being a change agent in the lives of people and communities.

Have you assessed turnover?

Some anecdotal assessment has been done, mostly through exit interviews. Extension professionals tend to stay in Extension, while those who leave do so early on in their career.

What can we do in the next Farm Bill to improve your efforts to hire a diverse and representative extension workforce and prevent turnover?

Maintaining Land-Grant funding lines and increasing levels of Capacity funds would allow for the hiring of additional agents needed to expand program offerings and enhance reach to underserved and unserved audiences based on community and clientele needs. Increased funding would also allow for salary equity in commensurate industries, as well as accommodate consistent cost of living increases. Increased resources will allow for additional training and professional development to enhance competency and confidence of Extension agents. Diversity is especially important in Extension. Extension is a "boots on the ground" workforce in diverse communities. Therefore, the Extension workforce should reflect the communities we serve. Increased resources will allow for hiring the diversity needed for communities.

Senator Reverend Raphael Warnock

1. I believe that 1890 land-grant institutions, like Fort Valley State University in Georgia, can provide educational opportunities in agriculture to underserved students and can uplift disadvantaged communities through cooperative extension. I hope to work with you and members of this Committee to further support our 1890 land-grants.

    a. How would permanent scholarship funding in the next Farm Bill create more opportunities for institutions like Fort Valley State University and Alcorn State University to support students who are interested in careers in agriculture?

    Permanent scholarship funding would allow our 1890 Universities to continue producing the talent necessary to meet the challenges of the 21st century.

    The 1890 institutions are playing a significant role in addressing challenges such as global food security and climate change through high-quality research and outreach programs. In addition, the 1890 system has the historic mission of addressing the needs of the underrepresented producers and communities. In addition to building capacity and infrastructure, an excellent pool of qualified and skilled researchers is crucial in continuing and expanding this work. If the 1890s do not produce enough agriculture graduates, we may have to fill the research positions at these institutions

and jobs across the agriculture ecosystem with individuals who may not understand the important mission of the 1890s. Even with the creation of the 1890 scholarship program, we are still not producing nearly enough graduates. We have more work to do to expand the scholarship opportunity, but permanent funding is critical to those efforts.

Also, including a provision in the 1890 scholarship program that funds can be used to hire a dedicated student recruiter for each 1890 institution will be helpful.

b. What unmet needs are you seeing at your 1890 institution that this Committee needs to be aware of as we consider the upcoming Farm Bill?

There are several key areas we hope to work with the Committee in the 2023 Farm Bill.

These include expanding the funding and number of Centers of Excellences at 1890 Universities. We currently have six Centers of Excellence authorized and believe that every 1890 University deserves and should lead a Center of Excellence.

We also need significant investments for new 1890 agriculture facilities. Our infrastructure and deferred maintenance efforts have been severely underfunded for decades. Allocating sufficient resources at one time, instead of allocating over a period of 5 years, could also speed up construction projects on our campuses.

The matching requirements for USDA grants continue to not be met by states. We believe that some requirement that States, instead of the Universities, have to apply for the waiver and/or have to match what they are doing for other land grants in their states needs to be seriously considered. Our Universities are losing millions of dollars in investments each year due to these actions.

Increase USDA ARS summer research internship opportunities for 1890 students.

The teams that decide USDA program priorities impacting small and minority farmers must include these constituents.

Our priorities also include a couple of areas that Chairwoman Stabenow and Senator Hyde-Smith raised at the December hearing.

Chairwoman Stabenow – resources for faculty development

Chairwoman Stabenow raised the critical point about support for students and faculty at 1890 institutions. While most of the discussion focused on students, there is also a critical need for providing resources for faculty development at 1890 institutions.

Making this investment will go a long way in not only recruiting the best research minds to teach and mentor our students but also help in the retention of faculty to create institutional knowledge and experience that can help the 1890s system grow and thrive.

Senator Hyde-Smith – Veterinary needs at 1890 institutions

Sen. Hyde-Smith mentioned during the hearing the challenges of communities that are facing a shortage of veterinarians. This is an important point. In fact, Tuskegee University in Tuskegee, AL is the only 1890 institution that has a veterinarian school. Several of our Universities, including the University of Maryland Eastern Shore and Alcorn State University, are interested in developing a veterinary medicine program. The 2023 Farm Bill presents a new opportunity to establish and increase the number of veterinary education programs at 1890s and help ease the veterinary doctor shortage.

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
Farm Bill 2023: Research Programs
December 6, 2022
Questions for the Record
Dr. Katy Rainey

Senator Kirsten Gillibrand

1. NIFA often encourages and prioritizes collaboration in its competitive grants.

    a. What is USDA doing to assist LGUs in collaboration with each other? And what can be done to strengthen collaboration amongst LGUs in research, education, and extension?
        i. USDA has requirements for multi-state activity. Requests for proposals (RFP's) that have requirements for multi-state submissions or preference for multi-state submissions are one mechanism. A focus on integrated types of grants would build collaborations across research, education, and extension. I am not aware of the comprehensive strategies that USDA might be employing to strengthen collaboration amongst LGUs. The testimony from this hearing of Dr. Shavonda Jacobs-Young addresses this question.

            Even though many collaborative projects already exist, the problems facing agriculture today are more complex than in the past and require "convergent" solutions that integrate knowledge from life and health sciences, physical, mathematical, and computational sciences and engineering disciplines to create tools that enable systems research. The National Academies recently completed an initial study on how to enhance collaboration among land-grants which addresses this question. Primarily, we need support and incentives for large-scale collaborative projects, that include farmers and the private sector, with data infrastructure playing a key role through AGARDA. AGARDA can develop uniform, shared data management systems that enable seamless access to emerging information. We also see an urgent need to invest in Outreach in the form of educating and, employing and funding more social scientists focused on all aspects of agriculture and food systems.

    b. How can Extension agents in one state benefit from the research and learn best practices from Extension agents in another state?
        i. Research must be conducted across environments to ensure best practices are applicable beyond the research area. Additionally, because farmers value research conducted 'close to the farm' prioritizing multi-state collaborations that utilize on-farm trials is a good way to help farmers see and experience best practices in a low-risk way. There also needs to be higher prioritization for multi-state work that includes genuine Extension outcomes. Currently, Extension components/inclusion are nearly an

afterthought and rarely have funding attached to make them worthwhile or possible.

Concurrently, federal programs should fund multi-state educational/professional development programs for Extension educators; for example, the North Central region has an ANR Extension Academy that brings educators from multi-state together for workshops/training/professional development. Extension educators often share best practices and programs across state boundaries and frequently multiple states will adopt the same curriculum. There are also regional meetings based on research areas or for Extension educators that allow individuals to interact and adopt best practices.

c. What is USDA currently doing to support collaboration and communication between LGUs and ARS research?
    i. USDA-ARS sites are located at universities all over the US. I can't speak for how this works on the national level, but at Purdue University we have three on-site ARS research units that focus on: livestock behavior and welfare; soil erosion; and crop disease resistance and soybean oil composition. The ARS scientists in many cases have adjunct status at the University and co-advise graduate students and state of the art equipment that is available to students and faculty. ARS scientists also engage in many collaborative projects that they fund through cooperative agreements and add significant research capacity for Purdue Ag Science.

    The Northern Uniform Soybean Trial (NUST), and the Southern counterpart, are ARS projects that I am personally familiar with and have relied on throughout my career as a soybean breeder. The NUST makes it possible for all the public (university) soybean breeders to cooperatively test their experimental breeding lines at over 50 different locations throughout the Northern US. The trial accepts over 500 lines from the public breeders and distributes them to be grown at the diverse locations, rate their performance, collate, analyze, and share the data. This information has great value for breeders as they develop their soybean lines for optimal performance in different environments, and is consulted by the private sector for potential parents and licensing opportunities. Increasingly, crop scientists are using the 80 years of compiled data from this experiment for modeling purposes. This is an example of a complex endeavor executed with USDA-ARS support and cooperation among dozens of labs.

    As valuable as the NUST is, I would like to say from personal experience collaborating with ARS geneticists, technology transfer is much too restrictive, with many requests denied for, say, seed samples to be

transferred from an ARS lab to a university lab. The fundamental approach or attitude of tech transfer as it relates to genetics must change.

2. Extension agents are an important source of unbiased, scientifically backed information that farmers rely on. They understand local issues and are trusted.

    a. What is your institution doing to attract and hire the extension agents?
        i. We are working to recruit a more diverse workforce to meet the diverse needs of our audiences and to make sure Extension is relevant to a broader stakeholder base. Purdue University has engaged in many different types of marketing activities reaching out to college students across the state and nearby states, primarily promoting positions over social media.

            Currently, hiring Extension specialists is a challenge due to a lack of funding. More funding is needed for LGUs to hire and support new Extension specialists. It would also be valuable if federal grant funding could support funding for Extension agent salaries at a higher level beyond simply covering the non-salary costs of Extension program development, such as with the summer salary support in research funding for faculty with nine-month appointments.

    b. In your experience, how long does it take for extension agents to build trust with local farmers and their communities? What is the turnover of these agents? Have you assessed turnover?
        i. In order for Extension agents to provide successful and consistent delivery of programs, it takes 2-5 years to build trust, and become a trusted source of information, for local farmers and communities. Because of the competitive nature of the crop production industry, and insufficient numbers of students studying agricultural sciences, it is currently challenging to hire and retain Extension agents with current salary disparities. Purdue University College of Agriculture has been studying turnover among agents. Our wages are not able to keep pace with the industry and other public service sector wages. Educator departure rate is 33% over the past year, which is down. High ag profits, increased salaries for PK-12 teachers, and funding for public health professionals compete with Extension positions for hiring.

    c. What can we do in the next Farm Bill to improve your efforts to hire a diverse and representative Extension workforce and prevent turnover?
        i. A diverse Extension workforce starts with education and outreach to high schools in order to sustain a pipeline of students into Ag Education programs. It's important system-wide to generally raise awareness of possible careers in agriculture and food systems now and in the future. In her oral testimony during part one of this hearing, Dr. Chavonda Jacobs-Young referenced many strategies to impact students.

A critical part of attracting and retaining a diverse Extension workforce is to provide funds to decrease salary disparities for similar experience levels with industry professionals. We should also increase training opportunities to help new professionals develop both technical and soft skills which would increase the ability of extension agents to develop trusting relationships more rapidly.

Senator John Thune

1. Dr. Rainey, USDA currently manages and stores valuable producer data, but the data could be better utilized to bolster producers' understanding of which conservation practices help reduce risk and increase profitability.

   To address this, Senator Klobuchar and I have introduced the Agriculture Innovation Act, which would improve USDA's secure and confidential data collection procedures for assessing how conservation and production practices increase crop yield, bolster soil health, and ultimately improve profitability.

   We will be working to secure our proposal in the 2023 farm bill.

   a. For the adoption of cover crops, do you feel that having more information on practices and benefits would be beneficial to farmers and ranchers and seed producers?

      Yes, having more information on the demand for cover crops would help the seed industry meet the need and prepare for different cover crop seed varieties based on regional needs. Additionally, research on different cover crop varieties is needed to understand effectiveness in certain regions and to ensure that growers continue to have positive results from the use of cover crops.

      To achieve this, the highest priority need is to have USDA include questions about cover crop use in their surveys to farmers. Also, as I mentioned in my oral testimony, we need national coordination of on-farm research, which would be best achieved through competitive granting programs and cooperation with commodity groups.

2. Dr. Rainey, I appreciate the comments in your written testimony on cover crop research.

   I have worked to remove barriers to adoption of cover crops on prevent plant acres, and we are seeing the adoption of cover crops increase.

   a. What types of research are needed when it comes to assessing the benefits of conservation practices such as cover crops?

> As growers continue to expand adoption of cover crops, we are seeing different seed mixtures providing multiple benefits that include improving soil health, sequestering carbon, and enhancing pollinator and wildlife habitat. The seed industry wants to ensure that growers have positive results and experiences when utilizing cover crops. Additional research on the impact of the different mixtures and the regional appropriateness of different varieties will help ensure that growers are getting the results they are seeking.

Farmers regularly cite challenges in the adoption of cover crops. The use of cover crops also requires additional labor for establishment and termination when other field activities take priority (e.g. case crop planting and harvesting). For these reasons, it's important that we invest in research showing the economic gain that can be used to offset the additional cost and time of cover crop use. We simply cannot be asking farmers to increase their cost of production with practices that need to occur while dealing with increased costs and environmental pressures. We need to better understand how cover crops can reduce weed control, increase soil water holding capacity, build soil health… and quantify how these things help farmers increase profitability in both the short and long term.

In summary, we need to address carbon intensity, return on investment, weed control capabilities, and other complex issues in cover crop usage with long-term field studies that are statistically balanced and well-orchestrated, in collaboration with incentivized farmers. An unexplored opportunity that will require research and cooperation across value chains is linking the use of cover crops and other sustainable production practices with specific market opportunities, such as the European Union sustainability requirements for aquaculture feedstocks.

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
Farm Bill 2023: Research Programs
December 6, 2022
Questions for the Record
Mr. Steve Ela

Senator John Thune

1. Mr. Ela, in your testimony, you talked about the value of cover crops for your operation.

    a. When working to incorporate cover crops and other soil health practices, what challenges have you faced?

We have learned a great deal from research on carbon/nitrogen cycles, but we have also just scratched the surface of having an understanding of the complexity of these cycles. I know that cover crops can provide both organic matter and nitrogen, but a more thorough knowledge of the dynamics of how we manage the cover crops to best suit our tree needs is elusive. For example, what mix of cover crops might be best for us? When we mow a cover crop, what are the variables that determine where the nutrients in those cover crops go and how do they cycle through the soil from cover crops to trees? How do different species assemblages in our cover crops impact pests and beneficial insects?

I know that the best mix for me depends on my soils and climate – thus I want to be able to adapt a cover crop mix to my own specific region. We have relatively thin topsoil, but very deep subsoils. Our subsoil is a very heavy clay and our tree roots do not penetrate into the subsoil. Even large tree roots grow down, hit the subsoil layer, and then turn sideways. In all the trenches we have dug for irrigation improvements, I have only seen two species of plants that put roots into the subsoil. One is a field mallow and the other is alfalfa. For that reason, my legume of choice is going to be alfalfa since it will both fix nitrogen, exploit a subsoil resource that my trees do not, bring nutrients from the subsoil to the surface layers, and build "topsoil" in the subsoil by incorporating organic matter and water pathways through the roots and root channels. Since we have heavier, alkaline, soils I am also going to look for alkaline tolerant cover crop species and species that have a significant amount of organic matter to help build soil tilth. For another grower with different soils and climate, they might choose a different legume with a different root structure or species that are shorter and are easier to mow.

I also know that the stage of growth at which I mow my cover crops alters the release rate of the nitrogen from those cover crops. Mowing a green, lush cover crop will most likely result in a quicker release of nitrogen than mowing a late stage, senescent cover crop. This is important since my trees need lots of nitrogen in the spring when they are blooming and forming fruits. In the fall they require less nitrogen since high nitrogen levels can cause reduced fruit quality. Therefore, I will mow more often in the spring to try to get a more rapid nitrogen release and then let the cover crops grow up and senesce before I mow them in the fall so that they release nitrogen more slowly. But, this is based on general research and I don't have data to actually double check if what I am doing accomplishes my goals.

More research into nutrient dynamics in organic perennial systems is critically needed. I know from soil tests that I have increased organic matter content in our soils as compared to native soils or soils with little cover cropping. But, what does that mean in terms of my fertility program? Likewise, according to data in cover crop books, my cover crop should be producing plenty of nitrogen for my trees, yet the trees don't show that in their growth. They still require some supplemental, off farm, organic nitrogen to achieve adequate growth. What is the limiting factor that keeps the nitrogen that "should" be being produced from being utilized by my trees?

Soil dynamics are not the only factors that play into our choice of cover crops. Several beneficial insects have life cycle stages that utilize flower nectar as a food source. We intentionally try to have flowering plants in our cover crop as much as possible in order to benefit these beneficial insects. We also know that cover crops foster multiple species on which predatory insects might feed. These food sources keep those beneficial predatory insects alive and with robust populations that are able to respond to other pest outbreaks. What we don't know is how insects move between the cover crops and trees. Thus, in what ways can we better manage our cover crops for additional insect and disease control? Since cover crops are part of our overall orchard system, we need much more research into how they integrate with our disease and pest control programs.

Research into organic systems would help me to make better decisions and utilize my cover crops more thoroughly.

b. Is it difficult to determine the value of these practices for farm and ranch operations? Do you have ideas to help improve access to this important information?

Determining the value of these practices is both straightforward and difficult. The straightforward part is that we can document increased organic matter levels in our orchard soils, increased soil tilth and structure, and the utilization of our subsoils through our cover crop root systems. We can also document the presence of both pest and beneficial insects in our cover crops. Valuing those attributes can be done using traditional soil science and insect monitoring techniques.

The more difficult parts to value are the additional benefits. We only have a very rudimentary knowledge of how increased organic matter levels benefit our trees, other than through better soil structure. We only have a very rudimentary knowledge of the cycles of crop micronutrients. I know that we receive considerable nitrogen input into our system from our nitrogen fixing cover crops. But, I don't know how much and when. As a conventional grower I applied highly soluble nitrogen fertilizers and struggled to get adequate tree growth, even at high nitrogen levels. I tried many things, but never solved the puzzle of what was limiting our tree growth. That frustration of not being able to figure out what my trees needed and when led me to trying a different approach.

Instead of applying fast acting, simple, fertilizers to my trees, I decided to try fostering an active soil system that increases complex nutrient cycling. Cover crops are mowed, they break down, and release nutrients. If the trees need those nutrients, they can feed on them. If not, those nutrients are absorbed by other species. As those species die and release nutrients there are continuous opportunities for my trees to feed on whatever they need. A soil system that is always cycling nutrients, in and out of living and dying things, gives my trees a nutrient smorgasbord that allows them to feed when needed, as needed, without me having to employ guesswork. But, documenting and valuing that cycling and nutrient availability needs much more research, especially in organic perennial systems.

It is also exceeding difficult to document the value of our beneficial insects – we don't know what sprays we did not have to apply because our beneficial insects controlled pests. If you never see the problem, it is hard to know what was taken care of without our intervention and place value on that.

Once we move beyond evaluating the value of our cover crops by single means (soil structure, absolute nutrient content, water holding capacity, insect counts) and move towards evaluating the value of our cover crops in a systems capacity, it becomes more complex and difficult to ascertain value. In many cases, there is exceptional value in what we didn't have to do because the system interactions took care of a problem for us. We may not realize what we did not have to do because we never knew there was a problem!

No one system will fit all places. Our system works for us, in our climate. It may not work for a grower in another area. By its very definition, a system is adapted to the soils and climate it is in. Regionally appropriate organic cover crop varieties/mixes, and the timings of planting/mowing associated, are an area of research in need of investment to facilitate wider adoption. Quantifying the ecological system benefits of these cover crops needs much more research. We already know our organic cover crops have value. Without additional research we just don't know how much more value there is. This is why increased farm bill funding and congressional appropriations for long-term, organic farming systems trials and long-term agroecosystem network research is so critical to helping me, as a grower, make better decisions.

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
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December 6, 2022
Questions for the Record
Dr. Deacue Fields

Senator Kirsten Gillibrand

1. NIFA often encourages and prioritizes collaboration in its competitive grants.

    a. What is USDA doing to assist LGUs in collaboration with each other? And what can be done to strengthen collaboration amongst LGUs in research, education, and extension?

Collaboration is often a challenge because LGUs consistently compete for the same limited pool of funds. LGUs are evaluated based on successful efforts that they lead, and limited credit is given to collaborators. USDA NIFA strongly encourages integrated, multistate grant applications for many of their programs. The RFAs also encourage collaboration between 1890 and 1862 LGUs. The preference given to multistate and 1890 collaboration fosters communication for LGUs to capitalize on each other's strengths.

USDA also funds multi-state regional research committees that address major research topics and key agricultural issues. These committees are typically comprised of scientists across the nation who have a similar or symbiotic research focus. An example would be the USDA Multistate Committee S1088: Specialty Crops and Food Systems: Exploring Markets, Supply Chains and Policy Dimensions. This committee combines research, extension and teaching faculty from more than 20 states who set priorities and select teams to address the priorities. Although these efforts exist, more could be done to convene faculty around themes or grand challenges. Multistate projects could greatly be enhanced by encouraging more multidisciplinary collaboration to solve complex issues facing agriculture.

I want to acknowledge that my observation on USDA initiatives to foster collaboration is limited to my experience and not all encompassing.

    a. How can extension agents in one state benefit from the research and learn best practices from extension in another state?

Extension agents currently communicate with extension specialists and agents across the nation. Most agents are extremely skilled at finding the best source of information to serve their clientele. Regional and national extension meetings create an excellent opportunity for networking and information sharing. Although opportunities for information sharing exists, duplication of effort is still prevalent because agents are evaluated on the quantity of information they develop for their state. Providing travel grant opportunities for agents to meet and coordinate the development of pertinent

publications would help expand the body of information nationally. This would allow an agent to be responsible for developing the main content for a publication on a subject such as evaluating input costs. Once the main content is developed, it can be shared with other agents who can add state-specific information. This would provide an opportunity to strategically expand the number of topics being addressed nationally.

b. What is USDA currently doing to support collaboration and communication between LGUs and ARS research?

This is an excellent question. While I have no doubt that there are areas and regions in the country where ARS and LGU collaboration and communication are exemplary, in our area I must be truthful by saying it could be better. In Arkansas, we are somewhat unique. Five of the six ARS units in the state are wholly embedded in either university facilities, within other nonfederal, non-state institutions, or on state property. Coordination and collaborations are essential, but there is not a systemic approach to such. The University of Arkansas is pursuing a strategy of better communications with the ARS Area office.

With federal agricultural/food/nutrition/health promotion/disease prevention research dollars being relatively scarce when compared to defense and disease management/therapy research funding, it is incumbent upon us all of us in the broader agricultural research leadership to leverage these federal dollars wisely by co-investing, avoiding duplication, and commonly strategizing for both near-term and long-term discoveries. Likewise, with the USDA lacking a federal Extension service, applied research discoveries by ARS researchers depend upon others for dissemination to stakeholder users. The genius of the American system is the existence of an extensive national Extension service within the LGU system. A better plan to utilize this system is critical. Truly, a dedicated framework to foster organized collaboration and communication is in the nation's interest. Joint research activity with ARS through an increasing number of cooperative agreements will help reduce research silos, increase research relevance, and avoid costly and unnecessary redundancy.

2. Extension agents are an important source of unbiased, scientifically backed information that farmers rely on. They understand local issues and are trusted.

a. What is your institution doing to attract and hire the extension agents?

The extension agent system for information dissemination provides a comparative advantage for LGUs. Attracting top talent for extension agent positions is a consistent challenge, given the low salaries we currently offer. State Cooperative Extension services do not have an income stream that allows them to keep up with inflation, increasing salaries in other industries, and/or tuition-based salary increases at the universities they are affiliated with. Despite no state or federal funding increase, in FY23 we increased starting salaries from $36,000 to $42,000 for agents with a bachelors degrees and $40,000 to $46,000 for agents with a masters degree. In addition, we are

launching a new plan that will allow agents to be considered for up to 5% salary increases every four years even after they have reached the highest position tier. As a result, top agents don't reach a salary ceiling after eight to ten years on the job.

Two years ago, University of Arkansas Division of Agriculture (UADA) implemented an internship program to identify college students who might be interested in a career in Extension. We have already hired full-time agents from the first class of interns. Despite our recent efforts, attracting and retaining top agents is a constant battle. Others in the agricultural industry recognize the technical skills and valuable relationships extension agents have, and they are able to offer higher salaries and more flexible work schedules.

b. In your experience, how long does it take for extension agents to build trust with local farmers and their communities? What is the turnover of these agents? Have you assessed turnover?

Based on my personal experience and professional observations, I conclude that the amount of time required to build trust varies significantly. New agents typically require at least one year for stakeholders to determine if the information being provided is consistent and reliable. Competence, communication and consistency are the major factors that determine value to stakeholders and time to build trust.

Turnover rates are highest among new agents and agents with five to ten years of experience. Higher starting salaries and better onboarding will have a significant impact on decreasing new agent turnover. New agents are often evaluating the best career path, and they are consistently recruited by other LGUs and industry stakeholders who can offer a higher salary. In Arkansas, we have hired Agent Instructors to serve as mentors for new agents, which will flatten the learning curve and improve new agent retention. Agent Instructors help new agents more rapidly gain trust and be more effective.

Agents with five to ten years of experience have the second highest turnover rate. These have built a strong network and gained valuable experience which makes them attractive to other agencies and private industry. More competitive salaries will be required to retain agents with this rank. Most strong agents have reached the highest promotion level by year ten, and they have only been eligible for cost-of-living adjustments in subsequent years. University of Arkansas Division of Agriculture has developed a salary program that will allow agents to apply for a performance-based salary increase every four years to prevent them from reaching a salary ceiling so early in their career.

c. What can we do in the next Farm Bill to improve your efforts to hire a diverse and representative extension workforce and prevent turnover?

At every land-grant institution in the country, our research infrastructure is deteriorating. Our states provide much of the support to recruit and maintain our faculty personnel, and these faculty carry their own weight through their extramural funding efforts. To attract and retain a diverse workforce a sophisticated, increasingly complex physical infrastructure. The most talented

faculty from diverse background will require state-of-the art infrastructure to address current and future challenges. One of the most impactful things our federal partners can do is help us with the kind of large, up-front capital investments required to develop the infrastructure necessary to support cutting edge research, extension and teaching programs. Reauthorizing and funding the Research Facilities Act would allow our land-grant institutions to modernize our research facilities and begin to address an $11.5 billion backlog of deferred maintenance. This investment would serve as a catalyst to attract the next generation of agriculture innovation leaders.

Senator John Thune

1. Dr. Fields, in your testimony, you talked about the importance of partnerships for the University of Arkansas System's ag research efforts.

    a. How can we further strengthen USDA's partnership and collaboration with land grant universities in the farm bill?

The federal government should be more than a funder, it should be a partner with a mindset of fostering collaboration. The relationship should be mutually supportive. This requires the LGU community to also think more globally. Currently, the bulk of agricultural/food/nutrition research is nonfederal. In my state of Arkansas, the state investment in our research is 4:1 when compared to the federal investment. The state is doing the heavy lifting, in part due to the awareness that the federal investment in research and extension is not robust. In recognition that state LGU partners bring most of the research and extension resources to the table, a true framework to foster common decision making that isn't totally reliant upon lobbying to influence federal/USDA strategies would be a good start.

In Arkansas, we have ARS laboratories collocated in many of our facilities; however, collaboration is still limited. Despite the proximity, research continues to be conducted in silos. Research strengths can be leveraged by incentivizing strategic research partnerships to enhance collaboration between ARS and LGUs. Scientist at ARS and LGUs have complimentary skills and a there is a huge missed opportunity without strategic collaboration.

One very important area where the federal investment could punch above its weight is assisting the states in dealing with the menacing backlog of deferred infrastructure maintenance on the physical plant upon which the future of American agriculture will rely. This is as important to our national security as roads, bridges, airports, and seaports.

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