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Good morning, Chairman Roberts, Ranking Member Stabenow, and Members of the Committee, I am honored to have this opportunity to speak about USDA's Agricultural Research Service.

The Agricultural Research Service (ARS) in partnership with the National Institute of Food and Agriculture exemplify the mandate expressed in President Abraham Lincoln's 1862 executive order establishing the USDA, in which the Department was charged with conducting "practical and scientific experiments" to improve the quality and security of agriculture in the United States.

As U.S. Department of Agriculture's chief scientific in-house research agency for the past 64 years, the Agricultural Research Service, with its 1,800 scientists at 90 laboratories throughout the United States, carries on that mission today and represents an important component of USDA's science infrastructure. ARS has world-class research units from Maine to Hawaii, and we maintain research facilities in France, China, Argentina, and Australia that serve as bases for our insect pest and weed biocontrol collection efforts. We manage tens of thousands of acres of pasture, rangeland, and crop land for our research; more than 3,000 buildings housing our laboratories; and 8,000 employees developing cutting-edge science at our locations. They provide us with the infrastructure to pursue the science to make American agriculture stronger and more resilient to environmental changes and the demands of feeding a growing world population.

We have 19 genebanks that manage the U.S. National Plant Germplasm System's collections and provide scientists all over the world with the genetic materials to develop new varieties that improve the quantity, quality, and production efficiency of our food, feed, bioenergy, fiber, and ornamental crops. The genebanks hold 578,000 accessions representing more than 15,000 plant species, making it the largest collection of plant germplasm in the world.

This resource is very much in demand by scientists everywhere. In the most recent fiscal year, these genebanks facilitated the distribution of more than 240,000 plant germplasm samples domestically and internationally. The GRIN-Global database of the details about the accessions held in our genebanks [https://npgsweb.ars-grin.gov/gringlobal/search.aspx?] received more than 1.5 million page visits during that time. ARS also maintains genebanks for animal and bee germplasm for research and breeding purposes, and collections of insects, microbes, nematodes, and plant pathogens that are used for reference by USDA action and regulatory agencies and as resources for researchers.

We have organized 18 of our experimental watersheds, ranges, and research farms into a coordinated national information-gathering network for creating an infrastructure for research on agricultural processes at a variety of scales. These locations have been collecting data on agricultural production, natural resources, and conservation in their specific areas – some for as long as 100 years – but had not shared that information amongst themselves.

The concept of the Long-Term Agro-Ecosystem Research Network, or LTAR, is to put data into a format that will provide the capacity to address large-scale environmental questions through shared research protocols across locations, and even to a continent gradient. Our scientists are using the data to develop more refined and accurate modeling systems for estimating the effects of climate variability on agricultural production. Recent LTAR findings include a 10-year study identifying a link between extreme precipitation patterns and decreased vegetation productivity across 11 sites in the continental United States; validation of satellite-based rainfall estimates made by NASA's Tropical Rainfall Measurement Mission satellite; a global analysis of plant community water demand; and publication of 50+ years of data records for watersheds in Oklahoma and Missouri.

I would also like to highlight ARS support for the National Agricultural Library that is located in Beltsville, Maryland, just outside Washington, D.C. While not a research facility per se, it is the world's largest agricultural library, and one of four congressional national libraries. The Library is an important component of the ARS research infrastructure, and we are rapidly increasing the ways in which the information in this repository can be shared with our scientific colleagues. As a public institution, ARS maintains an open access policy for the data and research results our scientists generate, and the National Agricultural Library is instrumental in assisting ARS in meeting that demand. The Library now provides access to nearly 50,000 peer-

reviewed journal articles authored by USDA researchers through the PubAg public archive system, and is adding more publications every year. It has turned out to be a very popular and active resource. In 2016 alone, the Library reported its users had downloaded more than 13.5 million full-text items. This free flow of information is an important stimulus for the entrepreneurs who will be developing valuable decision support options for farmers based on site-specific crop, soil, and weather data.

ARS is also looking to the future, and developing two state-of-the-art animal disease research facilities — one in Athens, Georgia and another in Manhattan, Kansas.

In Athens, ARS is modernizing the biocontainment facilities and expanding the capabilities of the Southeast Poultry Research Laboratory, ARS' preeminent location for poultry related disease, toxicology, and food safety research.

The new National Bio- and Agro-Defense Facility (NBAF) in Manhattan will allow ARS and the USDA Animal and Plant Health Inspection Service to safely study foreign animal and zoonotic diseases, such as foot-and-mouth disease of cattle, classical swine fever, and African swine fever, that are not yet in the United States. When completed in 2023, NBAF will replace an aging facility at Plum Island, New York, which is currently the primary USDA laboratory responsible for research on high-consequence foreign zoonotic diseases, but which lacks the infrastructure to work with the highest level BSL-4 biosafety agents.

The most irreplaceable component of our infrastructure, however, is our employees. ARS has internationally recognized scientists working on every issue affecting American agriculture today. ARS scientists are engaged in the agricultural, biological, chemical, engineering, veterinary medicine, human nutrition, food technology, and physical science disciplines on 690 research projects that fall under four broad research areas:

- Nutrition, Food Safety, and Quality;
- Animal Production and Protection;
- Natural Resources and Sustainable Agricultural Systems; and
- Crop Production and Protection.

It is this science that provides help in controlling plant and animal diseases; finding ways to ease the effects of drought and soil depletion; increasing yields and sustainable production of plant crops; determining nutritious dietary food choices; and developing new products from our Nation's agricultural production.

The key to our success has been our strong partnerships and collaborations. We work closely with Land-Grant university researchers; scientists from other Federal agencies; international organizations; and many industry scientists and producers. As an example of that cooperation, the development of ARS' LTAR network involves the collaborative efforts of 60 universities, 15 Federal agencies, 29 international organizations, 25 non-governmental organizations (NGOs), 19 private industry firms, and 12 State government agencies.

ARS scientists also continue to play an important role in providing the objective science that action and regulatory agencies in USDA and other Federal departments need and use as the basis for developing their policies. For instance, under the IR-4 program, ARS scientists evaluate the safety and residue of pesticides on specialty crops grown in fields using established application protocols. The data generated is used by the U.S. Environmental Protection Agency to inform its decision on pesticide labeling and use.

ARS scientists also provide critical support to the USDA Animal and Plant Health Inspection Service (APHIS) on numerous fronts, such as during the 2015 outbreak of highly pathogenic avian influenza that started in Washington State and soon spread across the Midwest, resulting in the loss of 49 million chickens and turkeys from approximately 200 farms. ARS scientists quickly implemented a rapid response research program to determine the virulence, host range, and transmission capabilities of the emerging viruses. Within weeks, ARS scientists had developed a rapid molecular test to detect the H5N8 and H5N2 viruses causing the disease. They then transferred the test to the APHIS National Veterinary Services Laboratory to help APHIS track and react to the spread of the viruses.

ARS' institutional capacity, wide-ranging expertise, and geographic reach allows it to conduct coordinated and integrated research targeting national and regional agricultural priorities of importance to our many stakeholders. One such example is the national coordination involving ARS, APHIS, and NIFA to focus efforts to control and eradicate Huanglongbing, or citrus greening, which also involved private industry from Florida, California, and Texas, State departments of agriculture, and university researchers. The collaboration was essential to identifying research gaps, establishing priorities, and developing a coordinated research plan to manage the citrus greening disease and its insect vector across a variety of interests. ARS' in-house expertise and NIFA's financial support for increased research were brought to bear on this

most serious threat the U.S. citrus industry has ever encountered. While the disease continues to impact the production of citrus in Florida, it has only been found in limited instances in other citrus-producing states to date.

Meanwhile, ARS and its collaborators have made significant strides in preparing industry to better cope with its presence. We have developed new citrus tree rootstocks more resilient to the disease; techniques for preventing or mitigating the disease from infecting trees; and strategies to reduce the population of the insect vector.

Recently, ARS' decades-long expertise was also called upon to address an outbreak of New World screwworms in Florida Key deer on Big Pine Key, the first U.S. infestation reported in 30 years. The screwworm is devastating for cattle ranchers and caused tens of millions of dollars in loses each year before it was eradicated from the United States in 1966 using a technique developed by ARS scientists. ARS researchers in the 1950s developed the sterile fly technique that involved releasing sterilized (infertile) screwworms into infested areas, where they would mate with wild screwworms without producing any progeny. ARS and APHIS continue to collaborate on a sterile fly rearing facility in Panama that is supplying flies today to create a barrier in Central America to prevent the spread north of screwworm populations still persistent in South America. In Florida, ARS scientists, working with APHIS and the Florida Department of Agriculture and Consumer Services, brought in nearly 154 million sterile flies from the Panama facility and released them in the Keys and southern Florida. By April 2017, 5 months after the infestation was discovered, APHIS announced the screwworm had been successfully eradicated from Florida.

Since its inception, USDA has recognized the importance of maintaining a research infrastructure of both intramural and extramural research. This includes NIFA, which as USDA's extramural agricultural research agency provides research funding to scientists who work at universities and other public organizations, including Federal agencies. To avoid duplication of effort and enhance coordinated research goals, ARS and NIFA have established agency mechanisms for identifying overlap/duplication of research projects in related topic areas.

This involves checking the CRIS database for duplicative current research projects; vetting proposed projects through an external peer-review process; joint agency meetings with stakeholders; and active communication between national program leaders at both agencies and

with other members of the scientific community. However, the strength of having intramural programs provides ARS and USDA with unique capabilities, capacities, and responsibilities:

- Conduct inherently governmental, or for "the public good", research;
- Support action and regulatory agencies, such as APHIS, FSIS, and the EPA;
- Maintain essential germplasm collections;
- Conduct long-term nutritional studies and maintain databases;
- Operate long-term experimental watershed facilities;
- Respond to emergent national priorities; and
- Engage in long-term research to meet national goals;

This infrastructure, expertise, and nationwide network of partnerships is needed to respond quickly to a national agricultural emergency like the H1N1 swine flu virus or soybean rust, and to prepare for those emerging diseases – such as the Ug99 stem rust disease of wheat or the foot-and-mouth disease of cattle – that are not yet in our country.

In a 2011 study on returns to investment from USDA intramural agricultural research, the USDA Economic Research Service estimated that for every dollar spent on research, the country received approximately $17 in economic benefit. These returns include benefits not only to the farm sector, but also to the food industry and consumers. Over the years, our public investment, and the cooperation in agricultural research among the private sector, universities, and government, has given Americans the safest, most nutritious, and most abundant food supply anywhere.

Agriculture has formed the foundation of our national economy for the past 200-plus years, and agricultural research has given strength to that foundation. And that is the mandate President Lincoln gave the USDA at its founding. As we face the challenges to U.S. agriculture in the coming decades, ARS will continue to place a premium on expanding our scientific cooperation where we can and with whom we can, and on sharing our information and technology as freely as possible to help the American farmer.

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