Statement by
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Chairman Roberts, Ranking Member Stabenow, and distinguished members of the Senate Agriculture, Nutrition, and Forestry Committee, I am pleased to appear before you to provide an overview of the activities of the Research, Education, and Economics (REE) mission area of the United States Department of Agriculture (USDA), highlight some of our recent successes, and share information on the priorities and challenges facing the future of agricultural research.

I am Dr. Ann Bartuska, the Acting Under Secretary for the REE mission area. I am a career Senior Executive Service employee of USDA and have served as the Deputy Under Secretary for REE since 2010. I previously worked in the U.S. Forest Service as the Deputy Chief for Research and Development and also served as the Acting Under Secretary for the Natural Resources and Environment mission area in 2009.

The REE mission area has four agencies: the Agricultural Research Service, the Economics Research Service, the National Agricultural Statistics Service, and the National Institute of Food and Agriculture. I am accompanied by the leaders from two of the four agencies in the Research, Education and Economics Mission Area: Dr. Chavonda Jacobs-Young, Administrator of the Agricultural Research Service (ARS), and Dr. Sonny Ramaswamy, Director of the National Institute of Food and Agriculture (NIFA). The other two agencies in the mission area are the Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS). I also serve as the Acting Chief Scientist for USDA and oversee the Office of the Chief Scientist, which was mandated in the 2008 Farm Bill. The Office of the Chief Scientist provides strategic coordination of the science that informs USDA's and the Federal government's

decisions, policies and regulations that impact all aspects of U.S. food and agriculture and related landscapes and communities.

The United States and the world are facing critical problems and opportunities. Global population is expected to reach 9.7 billion people by 2050, almost two and half billion more people than today. At the same time, we are seeing the impacts of extreme weather conditions, impacts that will likely only get worse. These are among the challenges that all of us face. Investments in research are a critical factor in meeting these and other challenges and opportunities, and it is the REE mission area agencies that support the critical research our country needs to ensure farm profitability and strengthen our communities; improve nutrition and food safety for lifelong health; and safeguard sustainable use of natural resources, including an abundant and safe water supply. For instance, ARS' network of 2,000 Ph.D. scientists at nearly 90 laboratories across the country work to enhance and protect agriculture as well as transfer research results to the marketplace where they serve the needs of a wide range of users. By funding research at land-grant universities, as well as other universities and organizations, NIFA integrates research, education, and extension to ensure that groundbreaking discoveries go beyond the laboratory and make their way to the farms, ranches, classrooms, and communities where Americans can put this knowledge into practice and improve lives. The research and analytical work of ERS provides vital statistical information to policymakers, consumers, other researchers, and the marketplace. NASS conducts numerous surveys and issues over 400 reports that provide accurate, timely, and useful official statistical data on national, state, and county agricultural estimates covering production, supply, price, and other aspects of the U.S. agricultural economy. Farmers and ranchers, governments, commodity markets, businesses, and researchers are among those who depend on these statistics to make informed decisions.

We have a rich history of the agricultural sciences in the United States and I would like to provide you some context for the ongoing work within the mission area.

The agricultural research and education system of the United States started in 1862 with President Abraham Lincoln signing into law the creation of a new Department of Agriculture with the mission to promote scientific agriculture and the propagation and distribution of seeds. The passage of the Morrill Act in 1862 established the Land Grant University (LGU) system. In creating the Land Grant system, a whole new generation was allowed to gain access to post-secondary education in the United States, ensuring that higher education would forevermore be accessible to everyone. Congress expanded this family of Land Grants in 1890 through the Morrill Act of 1890 to serve the educational needs of the African American communities and, in 1994, to serve Native Americans in welcoming Tribal universities and colleges through The Equity in Educational Land-Grant Status Act of 1994.

Congress passed the Hatch Act of 1887, which created the State Agricultural Experiment Stations. These experiment stations contributed many key discoveries in agricultural science. In 1914, the Smith-Lever Act was signed into law, which created the Cooperative Extension Service as a unique federal, state, and local partnership to translate knowledge into innovations and solutions that advanced economic and social progress in American agriculture and rural America.

REE's work in the food and agricultural sciences is based on the premise that the federal government has a role in advancing scientific knowledge to promote our Nation's social and economic well-being. REE does this by investing in areas in which for-profit industry does not invest, such as basic research. It also collaborates with the public sector, academia, and the private sector to amplify research outcomes and impacts. We know that the return on investment

in agricultural research is $20 for every $1 spent. Underinvestment or the absence of investments in food and agricultural sciences diminishes the needed foundational knowledge-base and impacts our Nation's global preeminence and economic well-being. It is with these goals in mind, that the REE mission area agencies establish their priorities and conduct their work.

These priorities are determined through a rigorous and extensive process that incorporates the direction provided by this Committee, and the House of Representatives counterpart, through five-year authorizing farm bills, the annual appropriations bills, and related governance statutes set in place by Congress and guidance provided by the President. REE agencies have five year strategic plans, which are aligned with the Department's plans. Input is also solicited from many different types of stakeholders throughout the planning process. These stakeholders conduct or use agricultural research, education, and economics services provided by or for the agencies and include representatives from commodity groups, industry, interagency federal working groups, scientific societies, and university partners. Stakeholders also include the Congressionally-established REE external advisory committee, the National Agricultural Research, Extension, Education, and Economics Advisory Board (NAREEEAB).

Additionally, Congress, in the 2008 Farm Bill, directed the REE mission area to prepare a roadmap for USDA agricultural research, education, and extension. The *Roadmap* stated that solutions to many of modern society's most intractable problems demanded change that USDA would bring about by, for example, (1) better coordinating its science planning among and between REE science agencies and with other Federal science agencies; (2) listening to the needs of stakeholders; and (3) institutionalizing outcome-driven scientific program planning and implementation. Building upon this, REE developed an Action Plan organized around the leading priority areas for USDA science that contains long-term goals and short and immediate

steps to: enhance crop and animal health and production; develop positive responses to changes in weather and climate; develop new energy resources; develop knowledge about sustainability of our natural resources; develop more knowledge about childhood obesity and nutritional needs; enhance food safety as new challenges emerge; and increase science literacy and education.

REE ensures the highest level of integrity in all aspects of the Department's engagement in these scientific and technological activities and through the use of scientific information in policymaking. REE has developed and provided continuous improvements to a Department-wide scientific integrity policy intended to provide guidance to leadership and employees to ensure public policy is informed by science that is unbiased and unaltered as well as developed under stringent scientific standards. This policy also is intended to instill public confidence in USDA research and science-based policy.

You will hear more on the work and accomplishments of ARS and NIFA in their respective remarks. I would like to take a moment to highlight the important work of our statistical agencies – ERS and NASS. ERS shapes its research program and statistical products to serve those who routinely make or influence public policy and program decisions and their work reaches far beyond the borders of USDA. The mission of ERS is to inform and enhance public and private decision making on economic and policy issues related to agriculture, food, the environment, and rural development. Although ERS statistical research is aimed at the information needs of policymakers, its statistical products are also used by the media, trade associations, public interest groups, and the general public. ERS statistical products are widely recognized in the research community for its credibility, timeliness, and use of cutting edge data, models, and methods.

Rather than make recommendations, ERS designs its statistical research to examine alternative programmatic or policy pathways. In fact, in recognition of this 'arms-length' role, along with NASS, ERS is one of the 13 OMB officially designated Federal statistical agencies. As principal Federal statistical agencies, both NASS and ERS provide data that are relevant to policy issues, maintain credibility among data users, maintain the trust and confidentiality of data providers, and the independence from political and other external influence.

As I mentioned earlier, NASS's mission is to provide timely, accurate, and useful official statistics in service to U.S. agriculture. NASS achieves this through two separate appropriated program areas: the Agricultural Estimates program, and the Census of Agriculture and its follow-on studies. The Agricultural Estimates program provides critical supply, production, and price data that is the foundation of the commodities market and critical to the coordination of damage and loss assessment of the crop insurance program and disaster assistance. The Agricultural Estimates program issues over 400 reports annually, providing U.S., regional and State estimates on a wide range of crop and livestock commodities, in addition to estimates of environmental issues, economics, and demographics. The Census of Agriculture serves as the benchmark of the structure of agriculture in the U.S and is critical to formulation of agriculture policy. The quinquennial census, which is being done this year, provides very detailed statistics at the county, watershed, and Congressional district level. Additionally under this program, NASS conducts in-depth studies on topics like irrigation, horticulture, organic farming, and aquaculture.

In keeping with the efforts to break down silos, REE agencies are actively encouraged to seek efficiencies, collaborations, and partnerships with other agencies in the REE mission area and the Department. For example, ERS relies on NASS data for its Farm Income Estimate research; ERS provides ARS with social science research and analysis that guides some aspects

of ARS' priority setting; and ARS and NIFA routinely work together on research projects that have both intramural and extramural components. The REE mission area works broadly across the Department and with other Federal agencies on agricultural literacy, food safety, pests and diseases, bioenergy, natural resources, and nutrition programs in order to ensure REE programs provide the science backbone to support budget and program policy decision makers.

Mr. Chairman, up to this point, I have presented some information on the mission of REE agencies and provided some background on how priorities are coordinated in the mission area. I would like to look forward at agricultural science in coming years and the unique challenges we face.

Expected gains in agricultural yield and production are unlikely to sustainably provide feed, fiber, and fuel to the burgeoning population projected to be 9.7 billion people worldwide by 2050 without additional resources for research. The U.S. is losing its global scientific dominance and research leadership to emerging countries in addressing agricultural productivity and profitability challenges. China has surpassed the United States and continues to increase their investment in agricultural research.

New discoveries, new technologies, and new skill sets (e.g. precision agriculture, artificial intelligence, machine learning, robotics, photonics, remote sensing, computational biology, etc.) applied to agriculture and forestry, are needed to greatly increase agricultural productivity and profitability sustainably in order to provide for a population expected to expand to 9.7 billion people worldwide by 2050. U.S. agricultural research currently has limited flexibility and resources to apply to these high-risk opportunities, and perhaps an even bigger recurring challenge is attracting the brightest minds to sustainably increase food and fiber production and to solve tough problems. Despite these challenges, REE is looking towards the

future to meet the demands of providing feed, fiber, and fuel to an exponentially growing population. This will require focus on the growth and development of the physical infrastructure, human capital, and big science capabilities within USDA and the agricultural research enterprise.

As I mentioned earlier, ARS operates an extensive network of over 90 research facilities for which adequate, up-to-date and safe structures, as well as laboratories, are critical to produce research results that will help the U.S. continue to lead the world in agricultural innovation.

Concurrently, infrastructure for agricultural research at land grant (including 1862's, 1890's, 1994's, and HSI's) and non-land grant universities includes deteriorating 19th and 20th century facilities unsuitable and unsafe for quality modern research. A recent Association of Public and Land-Grant Universities audit estimated $8.9 billion in deferred maintenance of mission-critical buildings, including classrooms and laboratories, animal and plants research houses/farms, greenhouses, and pilot facilities with a $29 billion replacement value. Investments in academic research infrastructure would immediately create local jobs, conserve energy, and realize savings over time, in addition to improving research and education outcomes. Most universities already have documented capital infrastructure 'shovel-ready' projects.

Agriculture will need to produce more food, fiber, and fuel in the next 30 years in order to provide for a population expected to expand to 9.7 billion people worldwide in that time – more than mankind has produced over its entire history; yet land area available for cultivation decreases, so production increases must be made through efficiency. Recent discoveries, new technologies, new sources of data, and holistic approaches allow breakthrough technologies and management practices to meet the production challenges facing U.S. agriculture. Transformative innovations to ensure nutritional security and safety will require substantial additional investments, which can be leveraged by significant private sector investments and, often more

critically, create new industries and technological efficiencies for the U.S. private sector to market. This would significantly boost U.S. agricultural production, increase farm incomes and profitability, benefiting the entire agricultural sector, consumers, and their rural communities. Both development as well as effective monitoring of these systems regionally are needed, for example, as provided by the USDA-ARS Long Term Agroecosystem Research (LTAR) network, which addresses water resource issues through holistic approaches such as drought tolerant germplasm and non-traditional water management research.

Decisions and products for U.S. agricultural and nutritional security and global competitiveness will continue to dramatically improve if cyberinfrastructure enables the necessary big data to be readily accessible and the information to be properly analyzed, validated, used, and disseminated. USDA and other federal research organizations generate enormous quantities of valuable big data, as well as integrated models, on agricultural production and markets, natural resource utilization, agricultural production systems, genetics of agricultural species, and field data on crops, soils, climate, and water. Data collected on-farm is rapidly growing from tractors and other machines, Unmanned Aerial Systems (UAS or drones), and the Internet of Things. New software, algorithms, and analytical models using this wealth of digital untapped information would reduce burdens, decrease operational cost and time, increase efficiency, and provide new products for the private sector. Underserved needs for big data infrastructure by USDA uniquely encompass all aspects of the REE mission area – ARS, ERS, NASS, and NIFA. A few data-enabled science goals would include more accurate and timely crop forecasts, accelerated breeding of crops and animals, enabling robotics and smart systems, improved market and supply chain efficiencies, and gaining better health outcomes to sustainably provide food, fiber, and fuel to 9.7 billion people worldwide by 2050. Investments in

our future must also include trained staff, data storage, high performance state-of-the-art computing clusters, partnerships with university researchers, a high-speed network backbone to link locations, agricultural data hubs, digital data spokes, and modern cybersecurity mechanisms. USDA needs to expand its big data platform, Ag Data Commons, to handle USDA-funded scientific data in open computable forms. USDA also needs a virtual research support core to provide the advanced informatics, statistical, data management, programming, modeling, and other analytical capabilities.

A highly focused, but nimble, effort that can support high-risk opportunities and attract expert researchers from within and outside of agriculture to work on applied problems in agriculture and forestry is also urgently needed. A research effort focused on data and technology advancement would provide this novel approach, yielding the ability to bridge the innovation "valley of death," attract new talent in agriculture, and improve data-driven decisions. Such an effort would expand USDA's ability to accelerate cutting edge technology adoption to provide solutions to U.S. producers, consumers and other end users.

Agriculture critically needs a steady supply of individuals with modern agricultural and scientific knowledge and training to support the agricultural industry and R&D enterprise. This requires an ability to translate complex technical knowledge to end-users, particularly farmers and livestock producers, while recognizing local needs and constraints. A Purdue University study suggests an acute shortage and immediate need for significantly more agricultural graduates than currently being produced; this is an emerging threat to our food and national security, especially in the context to provide for an expanding population. A USDA-NIFA "systems approach," including development of transformative models in agricultural education, spanning the "K through 20" pipeline, would result in students competent in leadership, critical

thinking, problem solving, communication skills, digital competencies, professionalism and ethics. This would create the workforce needed for future U.S. agriculture. A specific training need for national security is modernizing the workforce at the USDA-ARS Plum Island Foreign Animal Disease facility in New York in advance of the move to the $1.2 billion National Bio- and Agro-defense Facility, known as NBAF, in Kansas in 2021.

In addition to the infrastructure needs of USDA, the future of farming extends beyond our rural communities and into our urban spaces. Small community gardens, urban farms that span several city blocks, and intensive indoor aquaponics facilities are all examples of urban agriculture. The fast-growing phenomenon has the potential to nourish the health and social fabric of communities and create economic opportunities for farmers and neighborhoods. Urban agriculture can provide many benefits to a community, including closer neighborhood ties, reduced crime, education and job training opportunities, and healthy food access for low-income residents. USDA's urban agriculture research provides leading science and decision tools to inform urban natural resources stewardship and improve environmental health and community well-being in urban areas. Our research helps communities transition to a more sustainable future. Key urban research areas include: forestry inventory and management; ecosystem services; human health and well-being; urban sustainability; green infrastructure; water and watersheds; and urban long-term research, which works across and within disciplines to identify a holistic approaches to sustaining urban agriculture and improving the communities served.

Mr. Chairman, despite significant efforts by recent Farm Bills and annual spending bills to enhance agricultural science in the United States, we are at a crossroads. Although REE has made significant strides, there is still much to be accomplished. Our storied legacy of discovery, innovation, and international leadership in agricultural research, education, and economics is in

jeopardy by insufficient investments in both money and minds. This is a challenge we must all rise to meet and REE looks forward to rising to the challenge. Thank you.