ESCOP Science & Technology: http://escop.info/committee/scitech/

2/24/2020
4 pm ET, via Zoom (https://zoom.us/j/7318779678 or 1 669 900 9128 Meeting ID: 731 877 9678)

Committee Members:

Chair: *Jody Jellison (NERA)* **Past Chair:** Laura Lavine (WAAESD) **Delegates:** Alton Thompson (ARD) *John Yang (ARD)* *Joe Colletti (NCRA)* *Bill Barker (NCRA)* *Indrajeet Chaubey (NERA)* *Mark Hutton (NERA)* *Susan Duncan (SAAESD)* Nathan McKinney (SAAESD) *Gene Kelly (WAAESD)* *Chris Davies (WAAESD)* **Executive Vice Chair:** *Bret Hess (WAAESD ED)* *Saige Zespy (WAAESD Recorder)*	**Liaisons:** Wendy Powers (ECOP) Danesha Carley (NIPMCC) *Kristina Hains & Tim Killian* (SSCC) Parag Chitnis and/or *Tim Conner* (NIFA) Robert Matteri (USDA ARS)

Attendees:
Bill Barker, Indrajeet Chaubey, Joe Colletti, Tim Conner, Chris Davies, Susan Duncan, Kristina Hains, Mark Hutton, Jody Jellison, Tim Killian, Travis Park, Richard Rhodes, John Yang, Bret Hess (WAAESD ED) and Saige Zespy (WAAESD Recorder)

Agenda & Minutes:

1. Welcome and roll call – Jellison and Hess
    a. See attendees list above.
2. Approval of meeting notes from 01/27/2020 – Jellison
    a. Jody particularly thanked those folks for following up on the list of action items from the meeting.
    b. Indrajeet Chaubey moved to approve the minutes. Susan Duncan seconded the motion, and the motion was approved without dissent.
3. Liaison Updates, as needed
    a. ECOP
        i. Wendy Powers was unable to join the meeting.
    b. NIFA
        i. Tim Conner joined the meeting for the first time, noting that NIFA's biggest focus has been on re-staffing and rebuilding internal networks within the agency. While he doesn't have actual numbers, Tim estimated that staffing numbers are down approximately 75 percent. Not all hired staffers are on-boarded yet, but the

process is continuing across the agency. He will bring more firm numbers to the next meeting.

ii. NIFA is also working diligently to utilize the feedback from APLU and other stakeholders from the Re-Imagining surveys sent out late last year.

c. ARS
   i. Bob Matteri was unable to join the meeting
d. NIPMCC
   i. Ann Hazelrigg and Danesha Carley were unable to join the meeting.
e. SSSC
   i. Tim Killian spoke first, noting he has been a liaison for less than a week. He looks forward to being a part of the group moving forward.
   ii. Kris Haines was elected president-elect six days ago. Tim is the new liaison. Their recent Zoom meeting was several hours, and they were focused on the relocation of individuals in NIFA in Kansas City. Generally, they meet in February to meet with other groups and lobbyists in Washington, DC.
      1. They are working to set up a meeting plan with individuals in Kansas City to build relationship.
      2. Several Social Science Committee members will meet in DC in May to continue to maintain and develop the relationships.

4. Report discussions – Jellison
   a. National Academy Sciences Science Breakthroughs 2030: A Strategy for Food and Agricultural Research
      i. What are NIFA's impressions of the report? – Chitnis/Conner
         1. Tim noted that the 2030 report aligns completely with NIFA's focus areas, and the data pieces are largely included in AFRI budgets. Further NIFA will continue looking at trans-disciplinary, cross-integrated research.
         2. He further clarified that the presidential budgets help to determine their direction going forward. NIFA will also look at USDA's latest blueprint to help guide discussions moving forward.
      ii. Does NIFA intend to broaden their scope in areas emphasized in the Breakthroughs 2030 report to be more inclusive of other disciplines working in areas such as the microbiome – Chitnis/Conner
         1. Tim explained it can be difficult to expand project areas where funding isn't available.
         2. In an effort to ease some challenges, NIFA through AFRI are assessing the opportunity to do more and smaller awards (such as $2-3 million, rather than $10 million). He noted that a branch-out into predictive sciences may provide opportunities in the future, to determine areas that there might be more research needed.
         3. Some areas, such as sustainable agriculture systems, were not emphasized as much in the 2020 budget. However, they are looking at the budgetary explanatory notes to see where solutions for challenges like ag labor can be found.
   a. USDA Science Blueprint: A Roadmap for USDA Science from 2020 to 2025
      i. How does the release of USDA's roadmap impact the relevance of STC addressing the Breakthroughs 2030 report – Jellison/Chitnis/Conner

1. Areas that are deemed important from USDA's Blueprint, the 2030 report or other such reports are used as the basis for increasing budgets, but whether those increases are realized or not is up to Congress and the President. NIFA tries to be aggressive in those areas that are deemed most important.

5. Challenges due to the NIFA relocation and staff loss relevant to ESCOP STC – Jellison
    a. Is there a way ESCOP STC could better partner with NIFA? – Chitnis/Conner
        1. STC members asked what the best way for the committee and Experiment Station Directors was to submit comments to NIFA. Tim said that listening sessions were not held last year and would likely not be held this year. They are working on a solution for the best way to identify a point of contact. Tim agreed that the processes used in soliciting comments for the Re-Imagining NIFA document were helpful and concise. However, it is overly cumbersome if everyone directly reaches out to the agency with advice. He agreed with STC members that developing a process for Executive Directors to provide feedback might be helpful for future input.
        2. Executive Directors might be a valuable tool in providing concise, constructive comments to NIFA on a variety of process-oriented, as well as programming efforts.
6. Status of a one-page, double-side "leave behind" – Jellison/Hess/Rhodes
    a. A team of professional communicators was enlisted to develop a one-page double-sided leave behind document that is short and easily digestible. Overall, STC members liked the document, but provided a slate of changes. (See summary of changes in the attached document. They utilized resources from previous STC efforts to compile the document.
    b. Committee members were encouraged to read the document again and find additional changes or comments they thought were necessary. Comments should be sent to Bret and/or Rick by Feb. 27.
    c. Susan asked about the specific audience of the one-pager, and Jody noted it was likely different for everyone. She sees it as useful for federal and state representatives, to help when making funding decisions; and within the university to explain the importance and role of AES. Susan thought it might be helpful to emphasize the importance of partnerships between states and the necessity of a partnership network.
7. Other business, as needed
    a. Next Zoom meeting, March 23 4-5 pm ET with Paul Wester, National Ag Library
        1. Susan commented that, looking forward, the May meeting may need to be re-scheduled, since it falls on Memorial Day. Bret further noted that is an important meeting where the national winner of the Multi-State Regional Excellence Award is selected.

Action Items:

- Send changes on one-pager to Bret with comments, corrections and suggestions within one week (by February 27, 2020) (All)
- Summarize comments from ESCOP SCITECH meeting on one-pager (Saige Z.)
- Develop a process for gathering input from Directors to NIFA on RFAs (possibly similar to NIFA's comment-seeking process for their Re-Imagining survey).
- Look at options for re-scheduling the May meeting.

ESCOP Science & Technology: http://escop.info/committee/scitech/

2/24/2020
4 pm ET, via Zoom (https://zoom.us/j/7318779678 or 1 669 900 9128 Meeting ID: 731 877 9678)

Committee Members:

Chair: Jody Jellison (NERA) **Past Chair:** Laura Lavine (WAAESD) **Delegates:** Alton Thompson (ARD) John Yang (ARD) Joe Colletti (NCRA) Bill Barker (NCRA) Indrajeet Chaubey (NERA) Mark Hutton (NERA) Susan Duncan (SAAESD) Nathan McKinney (SAAESD) Gene Kelly (WAAESD) Chris Davies (WAAESD) **Executive Vice Chair:** Bret Hess (WAAESD ED) Saige Zespy (WAAESD Recorder)	**Liaisons:** Wendy Powers (ECOP) Danesha Carley (NIPMCC) Kristina Hains (SSCC) Parag Chitnis and/or Tim Conner (NIFA) Robert Matteri (USDA ARS)

Agenda:

1. Welcome and roll call – Jellison and Hess
2. Approval of meeting notes from 01/27/2020 – Jellison
3. Liaison Updates, as needed
    a. ECOP
    b. NIFA
    c. ARS
    d. NIPMCC
    e. SSSC
4. Report discussions – Jellison
    a. National Academy Sciences Science Breakthroughs 2030: A Strategy for Food and Agricultural Research
        i. What are NIFA's impressions of the report? – Chitnis/Conner
        ii. Does NIFA intend to broaden their scope in areas emphasized in the Breakthroughs 2030 report to be more inclusive of other disciplines working in areas such as the microbiome – Chitnis/Conner
    a. USDA Science Blueprint: A Roadmap for USDA Science from 2020 to 2025
        i. How does the release of USDA's roadmap impact the relevance of STC addressing the Breakthroughs 2030 report – Jellison/Chitnis/Conner
5. Challenges due to the NIFA relocation and staff loss relevant to ESCOP STC – Jellison
    a. Is there a way ESCOP STC could better partner with NIFA? – Chitnis/Conner
6. Status of a one-page, double-side "leave behind" – Jellison/Hess/Rhodes
7. Other business, as needed
    a. Next Zoom meeting, March 23 4-5 pm ET with Paul Wester, National Ag Library

ESCOP Science and Technology Committee
Comments on one-pager

From the Zoom meeting

- More emphasis on infrastructural investments that need to be made (under *Gaps and Needs*). Some places have state-of-the-art facilities, but not all.
- Emphasis on the importance of base capacity funding (under *Gaps and Needs*) to allow states to compete for competitive funding.
- Include a section titled *Power of Partnerships*
- Emphasize state synergy created by multi-state research projects (under *Power of Partnerships*)
- Emphasize the value of the system as a whole (under *Power of Partnerships*)
- Emphasize the leverage provided by multi-state research efforts (under *Power of Partnerships*)
- Make sure *Power of Partnerships* combats the idea that "if there are 49 other experiment stations, why do we need ours?"
- Emphasize increasing productivity and reducing the environmental impact of farming, echoing Sec. Perdue's Ag Innovations Initiative

From follow-up emails

- My only concern is that this does not as explicitly link the continuing success of the SAES system with the continued support from the Hatch and other capacity funds. We all understand this linkage but this one pager should be able to be used to help people who are less familiar with how the system works, understand the importance of this funding. In the introductory paragraph perhaps expand the “As part of the land-grant system AND WITH SUPPORT OF USDA CAPACITY FUNDING …” Also at the end where we identify Gaps and Needs we need to also identify our continuing need for the capacity grant funding, either as a bullet or part of the opening sentence. Without this funding the smaller stations would not be able to meet their core agricultural commitments. I mention this because as important as the other items such as infrastructure, big data etc. are, the foundational capacity support is central to our survival.
- The capacity funds are critical to our survival as Land Grant institutions.
- The NIFA capacity funding should be acknowledged.
- Use of the term “state-of-the-art” in reference to labs, greenhouses, computational centers and tools undercuts the serious message that substantial investments in outdated, poorly maintained, or in some cases failing infrastructure are critically needed. Can we please highlight the issue? Otherwise this is a really nice piece of work!
- The 1890s must review and comment, so that it is not just the 1862s driving the ship. Potentially use the language in the ESCOP Guidelines instead of State Agricultural Experiment Stations.

STATE AGRICULTURAL EXPERIMENT STATIONS

Addressing Grand Challenges in Food and Agriculture Through Research

Over the years, public investment in research has been key to increased agricultural productivity, food safety and security, community resilience, and economic growth. As the physical environment changes and human societies grow and evolve, our food and agricultural systems face increasingly complex and pervasive challenges—or Grand Challenges. As part of the Land-grant University system, State Agricultural Experiment Stations (AES) are uniquely positioned to address these challenges and improve food and agricultural systems regionally, nationally, and globally.

CAPACITY & RESOURCES

- Institutions in all 50 states and many U.S. territories with research sites representing diverse ecosystems, communities, and food production systems
- State-of-the-art laboratories, greenhouses, computational centers, and tools
- Skilled scientists, educators, students, and staff working in a wide variety of basic and applied research fields
- Impartial, peer-reviewed science, technology, and recommendations
- Far-reaching Extension networks to work with and inform communities across the U.S.
- Strong relationships with government agencies, farm and commodity groups, and the private sector

State Agricultural Experiment Stations (SAES) were officially borne out of the Hatch Act of 1887 and the Evans-Allen Act of 1977. The State Agricultural Experiment Stations are supported by USDA NIFA and collaborations across federal, regional, state, nonprofit, and private institutions. The Experiment Station Committee on Organization and Policy (ESCOP), a unit of the Association of Public and Land-grant Universities, governs the research activities of SAES. The Grand Challenges are part of ESCOP's Science Roadmap for Food and Agriculture: escop.info/roadmaptext

- escop.info
- aplu.org
- umes.edu/ard
- ncra-saes.org
- nerasaes.org
- saaesd.org
- waaesd.org

Experiment Station Committee on Organization and Policy (ESCOP)

IMPACTS ON GRAND CHALLENGES

Sustainability, competitiveness, and profitability

Onion growers applied ***75%*** less insecticide and saved ***$300 per acre*** using pest management programs developed by researchers.

Researchers ***quadrupled*** the length of the strawberry growing season, increasing production ***80%***.

Research-based recommendations saved ***10,500*** honey bee colonies, enough to provide crop pollination worth ***$6 million each year***.

Cutting-edge research has minimized the impacts of cattle diseases, which cause ***billions of dollars*** in losses.

The fishing and aquaculture industries have adopted research-based production and marketing practices that enhance producer profits and consumer satisfaction.

Adapt to and mitigate the impacts of climate

Researchers have developed crop varieties that grow well on marginal land and bred animals that can tolerate heat.

Researchers found that changes in temperature and precipitation caused soybean yields to be ***30%*** lower over the last 20 years, resulting in losses of ***$11 billion.***

Support energy security and the bioeconomy

Growers using recommended lighting and heating sensors and strategies have reduced energy use ***up to 30%***.

Researchers increased the oil content of sugarcane tissues ***80-fold*** and genetically modified cell walls, improving ethanol production efficiency by ***more than 60%***.

Scientists developed bio-based textiles that add value to agricultural byproducts, reduce waste, and provide alternatives to synthetic, petroleum-based textiles.

Ensure a safe, secure, and abundant food supply

Researchers designed antimicrobial sprays, high pressure processing, and other technology that ensures food safety without damaging quality.

24 peanut varieties worth ***$200 million per year*** were bred from a single peanut sample collected by researchers in 1952.

Improve human health, nutrition, and wellness

Pioneering research on bioactive compounds is guiding diet-based interventions, new food products, and accurate food labels, helping people make healthy choices, stave off illness, and reduce healthcare costs.

75 colleges are using a research-based program to create healthier campuses and encourage healthy diet, exercise, and stress management choices among their students.

Heighten environmental stewardship

Information about the economic value of ecosystem services has helped land managers and policymakers weigh the costs and benefits of management options, estimate losses under certain land use and climate scenarios, and predict how mitigation strategies might reduce losses.

Researchers helped install prairie strips on ***35 farms*** in ***9 states***, reducing soil, nitrogen, and phosphorus runoff from these farms by ***up to 95%***.

80% of commercial egg producers have adopted new feeding strategies that reduce ammonia emissions.

Individual, family, and community resilience

Research on rural areas is guiding programs and policies, increasing the likelihood they successfully meet needs.

Nationwide, residents, businesses, and government agencies use research to guide disaster preparedness and recovery and to adapt to climate change impacts.

Research has shown that diversity and tolerance can lead to richer stores of social capital and economic prosperity.

GAPS & NEEDS

With continued support, SAES can continue to address grand challenges in food and agriculture. Filling current gaps and needs will require investment in:

- Resources to improve campus infrastructure
- Interdisciplinary, systems-level research
- Broader focus on sustainability and wellness
- Models and decision-making tools that account for interlinked variables and uncertainty
- Harnessing advances in big data, genetics, nanotechnology, and other emerging fields
- Strategies for communicating information and sharing technology

Science Breakthroughs to Advance Food and Agricultural Research by 2030	*The potential of microbiomes—in the animal gut, in soil, and everywhere in between—to increase efficiency and overcome obstacles in production.*
NIFA 2020 RFA b. Agricultural Microbiomes Program Area Priority Code: A1402	**Research supported by this program area priority will help fill major knowledge gaps in characterizing agricultural microbiomes and microbiome functions across agricultural production systems, and natural resources through crosscutting projects.** **This research will capitalize on the convergence of low-cost sequencing and "omics" technologies, manipulation of microbiome composition and of phage and microbial genes (transposons, integrons), genome editing tools, and other novel tools for studying microbiota's structure and function.**

Applications must address one of the following:	**Multistate Research Projects**
Characterize molecular mechanisms and signal exchange involved in microbiome assembly and interactions in various environments or physiological states such as stress, diseases or growth stages.	**NE1602: Explorations in the Turfgrass Phytobiome: Understanding Microbial Associations and Developing Tools for Management W4147: Managing Plant Microbe Interactions in Soil to Promote Sustainable Agriculture S1083: Ecological and genetic diversity of soilborne pathogens and indigenous microflora NE1833: Biological Improvement of Chestnut through Technologies that Address Management of the Species and its Pathogens and Pests**
Functionally characterize microbiomes and microbiome metabolites in conferring specific host phenotypes (such as disease resistance or drought tolerance), optimization of environmental processes (such as water uptake, nutrient cycling or carbon sequestration), and/or host-microbiome interactions (such as host influences on microbiome composition).	**NE1602: Explorations in the Turfgrass Phytobiome: Understanding Microbial Associations and Developing Tools for Management W4147: Managing Plant Microbe Interactions in Soil to Promote Sustainable Agriculture S1083: Ecological and genetic diversity of soilborne pathogens and indigenous microflora NE1833: Biological Improvement of Chestnut through Technologies that Address Management of the Species and its Pathogens and Pests**

Define genomic elements that shape functional diversity, virulence and resistance to sanitation and/or antimicrobial treatment of plant and foodborne pathogens.	**NE1602: Explorations in the Turfgrass Phytobiome: Understanding Microbial Associations and Developing Tools for Management W4147: Managing Plant Microbe Interactions in Soil to Promote Sustainable Agriculture S1083: Ecological and genetic diversity of soilborne pathogens and indigenous microflora NC1208: Biology, Etiology, and Management of Dollar Spot in Turfgrasses NE1833: Biological Improvement of Chestnut through Technologies that Address Management of the Species and its Pathogens and Pests**

Projects focusing on microbiomes associated with livestock or model animals are beyond the scope of this program area priority.	**W4002: Nutrient Bioavailability--Phytonutrients and Beyond W4122: Beneficial and Adverse Effects of Natural Chemicals on Human Health and Food Safety NC1202: Enteric Diseases of Food Animals: Enhanced Prevention, Control and Food Safety NC1206: Antimicrobial Resistance NC1180: Control of Endemic, Emerging and Re-emerging Poultry Respiratory Diseases in the United States NE1834: Genetic Bases for Resistance and Immunity to Avian Diseases NC1182: Management and Environmental Factors Affecting Nitrogen Cycling and Use Efficiency in Forage-Based Livestock Production Systems NE1942: Enhancing Poultry Production Systems through Emerging Technologies and Husbandry Practices NC1192: An integrated approach to control of bovine respiratory diseases (NC-1027) NC2042: Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises NC2040: Metabolic Relationships in Supply of Nutrients for Lactating Cows NE1748: Mastitis Resistance to Enhance Dairy Food Safety W3150: Breeding Common Bean (Phaseolus vulgaris L.) for Resistance to Abiotic and Biotic Stresses, Sustainable Production, and Enhanced Nutritional**

Other Multistate Research Projects
NE1640: Plant-Parasitic Nematode Management as a Component of Sustainable Soil Health Programs in Horticultural and Field Crop Production Systems NE1943: Biology, Ecology & Management of Emerging Disease Vectors

Science Breakthroughs to Advance Food and Agricultural Research by 2030 released by the National Academies of Sciences, Engineering, and Medicine (NASEM) identified the following five most important initiatives that need to be addressed by food and agriculture research.

1. The potential of microbiomes—in the animal gut, in soil, and everywhere in between—to increase efficiency and overcome obstacles in production

2. Advancements in genetic evaluation and editing, including making the most of CRISPR and other technologies to accelerate the evolution of food production

3. Expanding and analyzing the many pools of data involved in growing and producing food

4. Developing and improving sensors and biosensors across all agricultural sectors to increase productivity and better target interventions

5. Examining, through transdisciplinary collaborations, entire systems in food production and finding the keys to adapting and transforming them to overcome challenges and increase production

Experiment Station
Committee on Organization
and Policy (ESCOP)

Science & Technology Committee

USDA Science Blueprint: A Roadmap for USDA Science from 2020 to 2025 released by USDA identifies five overarching themes for research, education, and economics with objectives, strategies, and evidence-building measures for each theme. The themes are:

- Sustainable agriculture intensification
- Agriculture climate adaptation
- Food and nutrition translation
- Value-added innovations
- Agriculture science policy leadership

United States Department of Agriculture

USDA SCIENCE BLUEPRINT

A ROADMAP FOR USDA SCIENCE FROM 2020 TO 2025

United States Department of Agriculture

USDA SCIENCE BLUEPRINT

A ROADMAP FOR USDA SCIENCE FROM 2020 TO 2025

Contents

Introductory Message

Continued investment into agriculture science is essential as the world population grows concomitant demand for the goods and services provided by America's farm and forest lands. As the world's largest exporter of food, U.S. agricultural land and the people who steward it will need to intensify production to meet demand. At the same time, we must conserve and renew natural resources for generations to come.

The U.S. Department of Agriculture is focusing on collaborative science which aligns our work in fundamental research with projects funded through our extramural and intramural research programs, as well as the knowledge and information delivered by our statistical survey and economic analytics programs. This suite of programs, funding, and partnerships enable USDA to conduct critical, long-term, broad-scale science and spur innovation throughout the agriculture, natural resource, and food systems.

Secretary Sonny Perdue has directed all of USDA to prioritize customer service. Accordingly, almost every day USDA consults formally or informally with external stakeholders, partners, landowners, policy experts, and industry and consumer groups. For USDA scientists, that equates to ensuring our discoveries, technology developments, data, information, and knowledge are valuable tools for farmers, ranchers, foresters, industry, producers, and consumers. It means using internal systems to be relevant and accountable to our customers, and it means doing what we can to move science into practice.

Fortunately, USDA has a long and distinguished history of moving science into practice. We are committed to strengthening our technology transfer efforts, partnerships with our Nation's colleges and universities, cooperative extension and outreach efforts, as well as youth development, Science Technology Engineering Math education initiatives and mentorship for developing the next generation of agricultural, forest, and food researchers. These are core, foundational success stories to promote innovation and entrepreneurship and are the backbone of American global leadership in applied science.

Scientific integrity is paramount at USDA. Our federally recognized Scientific Integrity Policy is in action across the Department, promoting and protecting scientific integrity, both in the performance of scientific research and discovery and in the use of that research. We take this responsibility seriously, and we look forward to informing and engaging on the accomplishments of USDA's entire food and agricultural research, data, and statistics portfolio.

This Science Blueprint guides USDA's science priorities for the next 5 years, building from past success. It is not, however, a catalog of every science activity or focus within the Department. Indeed, departing from past blueprints, it is intentionally concise in order to provide focused leadership and direction to the use of resources. It is also an invitation to partners throughout our Nation to propose innovative ideas to strengthen the themes provided here, which are essential to continuing U.S. leadership in the production of food, wood, and other agricultural products.

As we are entrusted with public taxpayer investments, we want to ensure our scientific discoveries transition into deliverables "that matter" and provide a return on investment to taxpayers through tools that benefit commercial agricultural and food and nutrition systems. Agriculture today is a highly diversified and complex industry; our focus is to use science to reduce complexity for both the producer and consumer. The stakes are high with a growing population and a changing environment, but the USDA team, with our many partners, is confident that this blueprint will pave the pathway to meet these challenges.

Our leaders and scientists must be good listeners and use a rigorous process to prioritize identified needs, invest resources in the most critical needs, and be accountable with those investments through program metrics, performance indicators, and scientific excellence across the OneUSDA family. The Department will also champion and collaborate through innovative, public-private partnerships and work with like-minded organizations such as the Foundation for Food and Agriculture Research.

So, the innovation, diversity, and integrity of U.S. agriculture and the science foundational to its productivity will ensure that American agriculture and food and nutrition systems continue to provide customer service to both producers and consumers in order to ***"Do Right and Feed Everyone."***

Scott H. Hutchins, Ph.D.
Deputy Under Secretary, Research, Education, and Economics
United States Department of Agriculture

Background

Secretary Sonny Perdue issued the *U.S. Department of Agriculture (USDA) Strategic Plan for FY 2018-2022* in May 2018 to articulate a customer-first agenda outlined in seven strategic goals that guide the work of USDA to ensure our efforts best serve the American people.

1. Ensure USDA Programs Are Delivered Efficiently, Effectively, With Integrity and a Focus on Customer Service
2. Maximize the Ability of American Agricultural Producers to Prosper by Feeding and Clothing the World
3. Promote American Agricultural Products and Exports
4. Facilitate Rural Prosperity and Economic Development
5. Strengthen the Stewardship of Private Lands Through Technology and Research
6. Ensure Productive and Sustainable Use of Our National Forest System Lands
7. Provide All Americans Access to a Safe, Nutritious, and Secure Food Supply

Secretary Perdue's aspiration is to make USDA the most effective, the most efficient, the most customer-focused, and the best managed Federal Department. To make that vision a reality, the Department has increased the interconnectedness of mission areas, agencies, and offices through the OneUSDA effort. This call to action is a reminder to all USDA employees that we are part of one team, working together to provide the best service to our customers and U.S. producers and consumers.

The Research, Education, and Economics (REE) mission area of the U. S. Department of Agriculture has Federal leadership responsibility for advancing scientific knowledge related to agriculture through research, extension, and education. The work of the REE mission area stretches across all seven USDA strategic goals and applies across the diverse and extensive agricultural sector.

The agencies of the REE mission area serve our customers throughout the country and inside the Department by delivering foundational and applied research, timely and relevant data, and information, as well as the creation and dissemination of knowledge that benefits the entire Nation. Accomplishing this ambitious agenda for a safe, sustainable, competitive U.S. food and fiber system, as well as strong communities, families, and youth requires a focused approach to science, education, and analysis in critical core areas.

USDA's mission area leadership compiled an update to the REE Action Plan from 2014 to set forth a blueprint for USDA's science initiatives for 2020-2025. This update began under the leadership of then Acting Deputy Under Secretary of the REE mission area Dr. Chavonda Jacobs-Young, integrated the goals from the *USDA Strategic Plan FY 2018-2022* developed under the leadership of Secretary of Agriculture Sonny Perdue, and is published under the leadership of REE Deputy Under Secretary Dr. Scott Hutchins.

We have a vision to provide economic opportunity through innovation, helping rural America to thrive; to promote agriculture production that better nourishes Americans while also helping feed others throughout the world; and to preserve our Nation's natural resources through conservation, restored forests, improved watersheds, and healthy private working lands.

This Blueprint lays out overarching themes that provide a framework for our vision for the USDA's science initiatives. The goal of setting forth this framework is to provide organizational clarity, speed, and agility to meet the needs of today's and tomorrow's agricultural enterprise. This Blueprint is intentionally concise and customer-focused so that we can build on the trust USDA science holds with stakeholders in the United States and around the world as well as be assertive as leaders in agricultural science and innovation.

This document outlines the implementation of this mission with a blueprint that outlines five overarching Program Themes. This structure will allow organizational clarity, speed, and agility. These Program Themes are:

1. Sustainable Ag Intensification
2. Ag Climate Adaptation
3. Food and Nutrition Translation
4. Value-Added Innovations
5. Ag Science Policy Leadership

Each theme is briefly summarized and then objectives, strategies, and evidence-building measures are discussed.

In the Research, Education, and Economics mission area, there are four agencies and a staff office. The Science Blueprint also includes the science arm of the USDA Forest Service.

The **Agricultural Research Service (ARS)** is USDA's chief scientific in-house research agency. ARS has a workforce of approximately 8,000 employees, including 2,000 scientists and post docs in 90+ research locations. ARS's research mission is to find solutions to agricultural problems that affect Americans every day from field to table and includes about 690 research projects within 16 national programs.

The **National Institute of Food and Agriculture (NIFA)** is USDA's primary extramural research, education, and extension funding agency, providing leadership and funding for programs that advance agriculture-related sciences. NIFA invests in and supports initiatives that ensure the long-term viability of agriculture. NIFA applies an integrated approach to ensure that groundbreaking discoveries in agriculture-related sciences and technologies reach the people who can put them into practice. Through partnerships with the Land-Grant University System and government, private, and non-profit organizations, NIFA programs can provide solutions to those who need them.

The **Economic Research Service (ERS)** anticipates trends and emerging issues in agriculture, food, the environment, and rural America and conducts economic research to inform public and private decision making. Together with the National Agricultural Statistics Service (NASS), ERS is one of USDA's two principal Federal statistical agencies responsible for ensuring the quality, objectivity, and transparency of the statistical information and analysis it provides. ERS provides the Nation's statistics for food security, farm income, and agricultural productivity, and contributes to the work of USDA's World Agricultural Outlook Board.

USDA has additional research authorities in divisions of the Food Safety and Inspection Service, Natural Resources Conservation Service, Food and Nutrition Service, and Animal and Plant Health Inspection Service as well as the others in the Marketing and Regulatory Programs mission area. These scientists and researchers contribute funding, human capital, and collaborative expertise to USDA science efforts.

The **National Agricultural Statistics Service (NASS)**, USDA's chief statistical agency, is committed to providing timely, accurate, and useful statistics in service to U.S. agriculture. NASS conducts hundreds of surveys every year and prepares reports covering virtually every aspect of U.S. agriculture. Production and supplies of food and fiber, prices paid and received by farmers, farm labor and wages, farm finances, chemical use, and changes in the demographics of U.S. producers are only a few examples.

The research and development arm of the **Forest Service (FS R&D)**, a component of USDA, works at the forefront of science to improve the health and use of our Nation's forests and grasslands and innovative use of wood products. The work has a steady focus on informing policy and land-management decisions, whether it addresses invasive insects, degraded river ecosystems, or sustainable ways to harvest forest products. The researchers work independently and with a range of partners, including other agencies, academia, nonprofit groups, and industry. The information and technology produced through basic and applied science programs is available to the public for its benefit and use.

The **Office of the Chief Scientist (OCS)** was established in accordance with the Food, Conservation, and Energy Act of 2008 to provide strategic coordination of the science that informs the Department'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.

Movements in Science and Agriculture

There are cross-cutting, macro movements in science with regard to agricultural production, food and nutrition systems, and natural resource stewardship and the applied research, data, and information analysis that support those systems. These considerations require coordination across the Department and Federal Government and include:

Open Data

USDA promotes the proactive sharing of data to make information and research results about agriculture and nutrition available, accessible, and usable worldwide. As a founding partner of the Global Open Data for Agriculture and Nutrition (GODAN) initiative, USDA empowered open data conversations about agriculture and nutrition data all over the world. USDA's open data vision is to provide public access to all the products of USDA-funded research while protecting the confidentiality of individual and proprietary data. We are also committed to ensuring that USDA's public data is easy to access, interpret, and use, accelerating further scientific and public policy research. In support of this vision, USDA is developing an integrated, cloud-based platform that houses USDA's scientific models and decision support tools.

Big Data

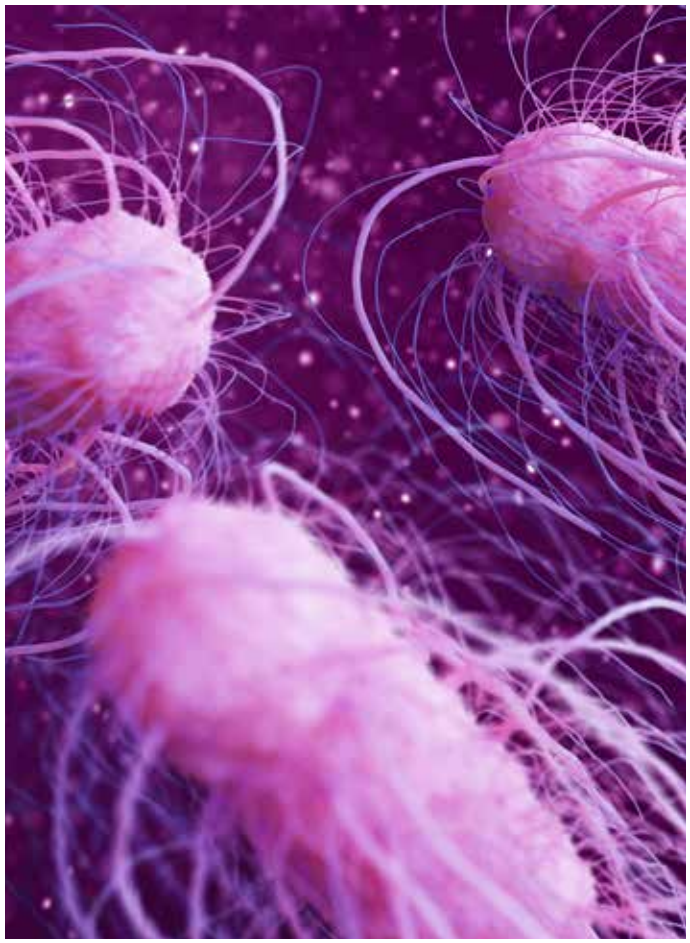
Large volumes of information are being generated and collected rapidly, which offers great challenge in stewardship and utilization. The agricultural community uses big data to help farmers and the whole food system make decisions that will increase yields and deliver safe, nutritious food to communities around the world. Predictive modeling requires comprehensive datasets with numerous measurements and corresponding performance assessments that are multiplied across various management regimes over multiple years. To maximize the impact of these critical datasets, USDA conducts and invests in data science, data infrastructure, and cross disciplinary, data-driven decision making for the agricultural sector.

Gene Editing

The latest developments in plant and animal breeding methods offer important tools for addressing disease resistance, drought tolerance, and nutrient content, among other challenges. However, these technological advances may raise important questions about consumer acceptance, risk, and safety assessments. As a result, our science agencies fund and engage in research into the social and economic implications of emerging technologies to understand producer, stakeholder, and public engagement with gene editing techniques for agricultural use. This research allows for data-driven decision making for policy makers, domestically and internationally.

Science of the Microbiome

The collective genomes of all the microbes (bacteria, fungi, viruses, et al.) in a human, plant, animal, or environmental community have tremendous potential. The microbiome for plants affects productivity as well as stress and disease resistance. A cow's microbiome can influence the amount of methane produced by the animal. A soil's microbiome can be enhanced for more nutritious crops, to sequester more carbon, to capture more water, or to prevent erosion. Microbiomes maintain the healthy function of these diverse ecosystems and influence human health, climate resiliency, food security, and other important and critical phenomena.



Artificial Intelligence (AI)

USDA science agencies work together to deliver new approaches to produce data-driven results using AI and machine learning. Partnering with public and private organizations, we develop tools and practices, including robots for agriculture, instruments for crop and soil monitoring and input application, and predictive analytics. We also provide funding for research, education, and extension using AI to ensure the safety and quality of agricultural products.

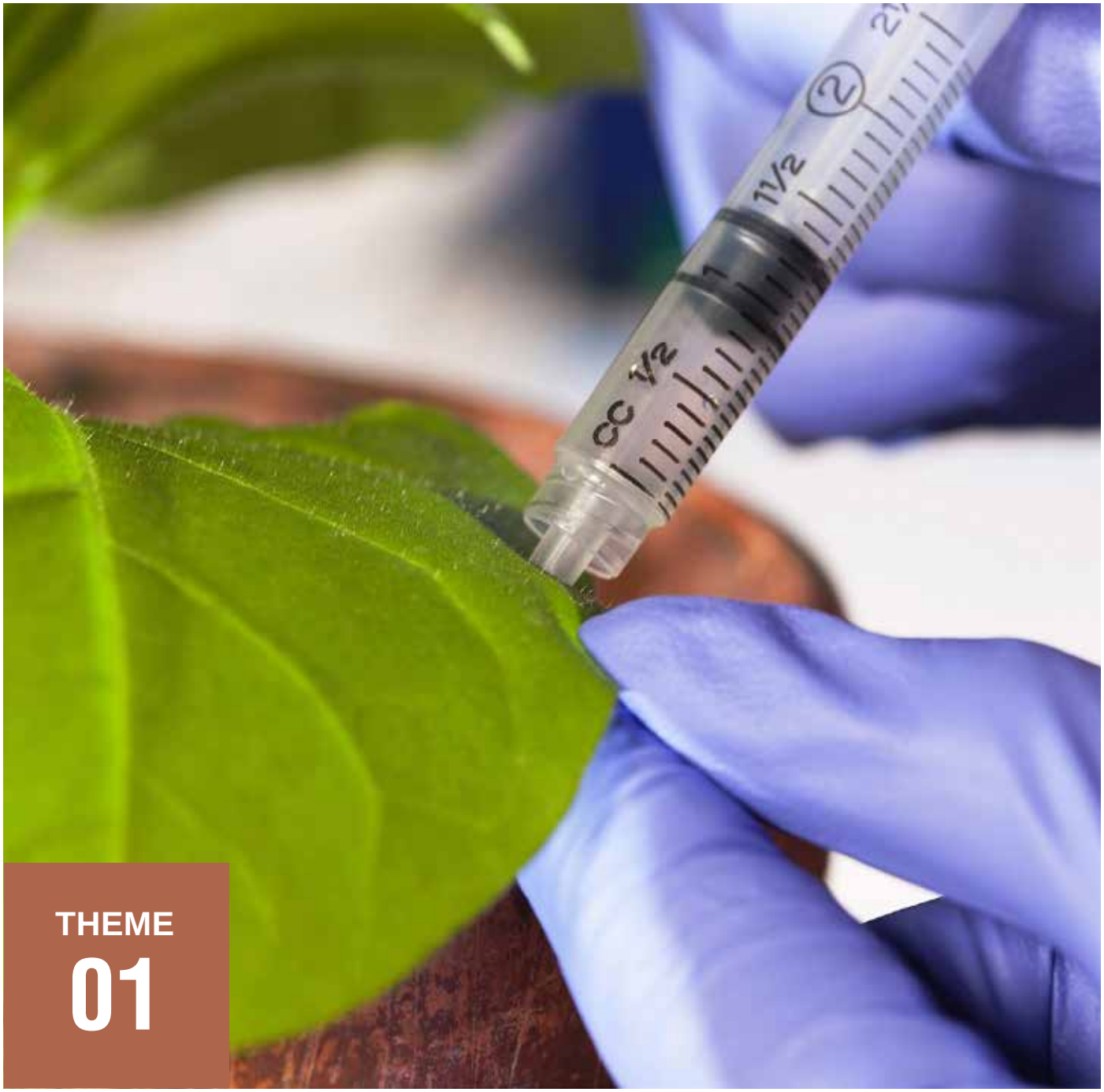
Technology, Automation, and Remote Sensing

With new technologies such as automation and remote sensing, agriculture is on the forefront of an exponential leap in productivity. Technologies such as remote sensing, automation, and digital scouting are allowing a new renaissance in every fundamental agriculture and natural resource stewardship task while enabling more responsiveness to market forces. These new technologies, along with increasing accessibility of reliable, high-speed internet connectivity in rural America, farm management will be transformed, intensifying the need for communicating best practices and choosing the most effective tools to improve agricultural productivity sustainably.


N
K
P

Public Perception of Science

In these times of unprecedented scientific and information progress, there is an increasing distrust of science and politicization of scientific discoveries. This may be because of diminished understanding of science by the general public, failure of scientists to communicate effectively, and increasing confirmation bias of information systems. Under Secretary Perdue's leadership, USDA will champion science through expanding science literacy through outreach and education, backing USDA scientists in public forums in order to build consensus and trust in science, and actively seeking leadership roles in decision-making bodies to ensure that agricultural perspectives are included in other federal agencies.



THEME
01

Sustainable Ag Intensification

The future of U.S. agriculture, which includes plant and animal agriculture, forestry, and aquaculture, depends on continued improvements in production capacity, technological progress, production efficiencies, and environmental stewardship, with a focus on domestic economic growth. World population will likely grow by 20 percent to 9.7 billion people over the next 30 years, and demand for the goods and services provided by farm and forest lands will increase by about 40 percent. Agricultural and forest lands will need to be more productive to meet this demand. Discovering, fostering, and implementing advances in production, technology, and management will allow agriculture to primarily intensify productivity while enhancing sustainability.

Plant Production, Health, and Genetics

Objectives:

- Develop crop production systems and alternative strategies to intensify plant and forest production with continuous improvements and adoption of new technology and innovative practices while reducing environmental impacts.

- Provide credible, objective, and accurate data products, statistics and analysis on U.S. plant production, economics, land, water, energy and environmental management, as well as farmer and rancher demographic and rural statistics to promote efficient production and marketing systems.

- Advance science-based approaches to combat outbreaks of emerging pests and diseases of row and fruit crops, horticultural and landscape production, and others agricultural investments.

- Enhance plant product quality by enhancing traits such as shelf life and taste/flavor, and optimize nutrition, health and food safety components.

- Evaluate the adoption and use of enhanced technologies and technology transfer for sensors, data analytics, and precision agriculture.

Strategies:

- Tap into genetic diversity and use genomic technology to accelerate breeding progress, decrease susceptibility to climate variability, pests, diseases, and weeds, and increase yield potential.

- Use precision agriculture technologies, innovative input technologies and stand improvement to optimize resource use and reduce the gap between actual yield and yield potential.

- Improve surveillance, early detection, rapid response, and recovery for transboundary, vector-borne, emerging/reemerging, and costly endemic crop diseases, insects, and weeds through research, education, and extension.

- Enhance the utility and value of nutrient, metabolites, and other constituents of plant products.

- Improve methods and identify strategies to reduce plant-borne pathogens and toxins.

- Identify key factors in producer behavior change and technology adoption models emphasizing the critical decisions and thresholds.

Evidence Building:

- Evaluate current genetic diversity of crops and crop gene banks, rangelands, and natural and planted forest stands and develop means to use natural diversity and new breeding technologies to increase resilience.

- Characterize the sources of yield variance including genetics, environment, management practices, and socioeconomic factors and develop plans to modulate their influence.

- Develop food crops that have optimal levels of nutrients and confirmation of reduced foodborne illness outbreaks.

- Accelerate breeding progress to bring more superior performing varieties (disease, pest, drought resistant, etc.) to the market.

- Compare the relative benefits of competing technologies to determine the optimal strategic paths forward.

- Identify bottlenecks and develop technological solutions to break through them.

- Examine the role of regulation on timber production and harvest decisions to create more streamlined processes for permitting and contracting.

- Improve forest stand and timber forecasting tools to enable more efficient timber planning, planting, and harvest.

- Evaluate current data collections and gaps to assess opportunities to improve the timeliness and scope of data collection efforts.

- Continue to support and further develop metrics that assess changes in behaviors and/or practices.

Animal Production, Health, and Genetics

Objectives:

- Develop animal production systems and alternative strategies to maximize animal, human, environmental, and economic health to include continuous improvements, adoption of new technology and innovative practices while maintaining sustainability.

- Provide credible, objective, and accurate data products, statistics and analysis on U.S. animal production, economics, land, water, energy and environmental management, and farmer and rancher demographic and rural statistics to promote efficient production and marketing systems.

- Capitalize on emerging opportunities such as automation, deep learning, precision management, genetic engineering, and biotechnological innovation in animal production, welfare and health; managing risk as appropriate, to continue to advance animal research programs and sustain effective technology transfer.

Strategies:

- Generate fundamental knowledge and tools that can later be applied to improve food animal production and protection systems, including One Health research such as antimicrobial resistance.

- Expand partnerships to integrate U.S. research discoveries (government, other academic, non-governmental organizations, and commercial research capabilities) into a fluid, highly effective research network, maximizing use of core competencies and public and private resources.

- Tap into genetic diversity and use genomic technology to accelerate breeding progress, decrease susceptibility to climate variability, pests, and diseases, to improve animal welfare, and to increase productivity potential.

- Use new technologies and improvements to optimize resource use and reduce the gap between actual production and the production potential.

- Improve surveillance, early detection, rapid response, and recovery for transboundary, vector-borne, zoonotic, emerging/reemerging, and costly endemic animal diseases through research, education, and extension; including the development of specialized high containment laboratories needed to support research with certain pathogens.

- Identify successful models of animal husbandry behavior change and technology adoption emphasizing the critical decision drivers and thresholds.

- Evaluate the adoption and use of enhanced technologies and technology transfer for sensors, data analytics, and precision agriculture.

- Analyze the performance of domestic or international markets for impacts of technology, industry structural change, and/or public and private initiatives on animal agriculture productivity and profitability.

Evidence Building:

- Solicit stakeholder feedback on research, education, and extension needs related to animal health; including opportunities to discuss and quantify new and emerging threats, opportunities, and challenges related to existing program strategies.

- Enhance animal genetic, reproductive, nutritional, health, well-being, and marketability knowledge; deploy that knowledge through new or improved resources, products, and best practices, to increase farmers' productivity and competitiveness.

- Accelerate breeding progress to bring more superior performing genetics (disease, pest, heat tolerance, etc.) to the market.

- Develop automation and decision support tools to help producers manage livestock efficiently and optimally; enhance animal production and protection; and benefit the biomedical research communities.

- Continue to support and further develop metrics that assess changes in animal husbandry behaviors and/or practices.

- Examine the economic impacts and develop targeted solutions to problems incurred by the threat of domestic and transboundary animal diseases to livestock, poultry, and aquaculture production.

- Develop estimates indicating the impacts of changing technology and market structure in animal agriculture on the agricultural economy.

- Assess impacts of research, education, and extension on resulting interventions on sustainable animal production and protection outcomes.

THEME

02

Ag Climate Adaptation

Ensuring that agricultural lands, national forests, and private working lands are conserved and restored makes agriculture production more resilient to climate change and other disturbances such as drought, invasive species, and wildfire. Further, based on the best available science, new strategies and management practices must be developed to allow unmanaged and managed systems to be fully leveraged to mitigate and address climate change. While mitigation is a priority, agricultural systems must nonetheless adapt to the changing weather patterns and temperature regimes to ensure food security.

Landscape-Scale Conservation and Management

Objectives:

- Develop interdisciplinary integrative systems approaches to address environmental and management challenges that positively impact productivity and resilience.

- Consider abiotic factors such as nutrient and water cycles and all biotic trophic levels, including microbiomes, invertebrates, and roots as elements of a healthy ecosystem.

- Better understand the effects of management choices and climate change on soil and air quality, and water cycles at landscape scales to inform land managers and policymakers.

- Develop methodologies for the combined use and evaluation of novel sensing technologies and land management practices to increase resilience, input-use efficiency, and productivity.

- Work with communities and stakeholders to understand needs, identify barriers, quantify ecosystem services, and promote technology transfer and innovation.

Strategies:

- Generate mission-driven initiatives and interdisciplinary research that incorporates stakeholder inputs to increase the use of best management practices, innovative technologies and tools to promote resilient farms, forests, and rangelands, and improve ecosystem services.

- Develop avenues for open data access to facilitate trans-disciplinary research, stakeholder engagement, and the co-development of research and management recommendations.

- Invest in research and development, education, and extension activities to better understand whole ecosystem responses to environmental challenges following agricultural activities.

Evidence Building:

- Assess the communication, adoption, and implementation of best management practices for the stewardship of productive, resilient, and sustainable agricultural lands, forests, and rangelands.

- Make cross-disciplinary data visible and accessible to stakeholders for enhanced decision making through integrated storage, computational resources, and analytics support.

- Conduct interdisciplinary assessments of whole ecosystem function, services, and resilience that support product development and inform land stewards, government officials, and consumers.

- Working in partnership with conservation colleagues, develop and maintain metrics for landscape-scale data and knowledge for data-driven management of working lands.

Climate Research and Resiliency

Objectives:

- Synthesize climate research data and scientific information to inform data-driven and science-driven decision making and planning for agriculture, food, forestry, and fuel production systems.

- Understand and convey knowledge about the influences of climate change and weather variability on agricultural, forest, and rangelands; stewardship systems and the communities built around them; as well as the products and societal benefits from our natural resources.

- Develop knowledge and tools to enable adaptation to climate change and weather variability, to improve the resilience of unmanaged and managed ecosystems and optimize the sustainability of agricultural management systems.

- Leverage economic analysis of land use and management, technology adoption and environmental program design to inform data-driven and science-driven decision making and planning.

Strategies:

- Create and contribute to research that addresses the resiliency and vulnerability of agricultural production, natural resource stewardship, and socioeconomic systems to climate change and weather variability.

- Generate peer-reviewed, science-based research and tools supporting data-driven decisions for agriculture, water resources, land, and forest management.

- Identify mechanisms to increase resilience of food and forest product systems after extreme events.

- Evaluate the environmental effects (benefits/limitations) of conservation practices selected for adaptation for climate change and weather variability or greenhouse gas mitigation. Use this evaluation for a spatially explicit analysis of the economic costs and benefits from conservation practice implementation.

- Develop deeper knowledge of the human dimensions of climate change and weather variability, including perceptions and effective framing of risk, adaptation and mitigation incentives, and the impact of climate change and weather variability on nutritional characteristics of food products.

- Examine the economic effects of climate change and weather variability on communities and agricultural producers to enable the development of appropriate/effective technologies.

Evidence Building:

- Enhance soil-health metrics, with a focus not only on land for crop and animal production but also forests, grasslands, and rangelands.

- Improve metrics from earth observations for identifying, measuring, and monitoring the effects of climate change and weather variability.

- Identify gaps in USDA observational networks (GRACEnet, LTAR, FIA, EFRs) in which USDA is missing data and identify opportunities to use existing external datasets to fill these gaps.

- Assess the likely influences of climate change and weather variability on regional and global food, fuel, and forest security.

THEME
03

Food and Nutrition Translation

USDA plays a pivotal role in providing Americans with safe, nutritious, and wholesome foods. This means supplying foods, both fresh and processed, that are of the highest quality and that provide adequate nutrition supporting the entire population life span. This task must address challenges to reduce foodborne illnesses; understand the drivers of poor diets and nutritional choices; provide better access to nutritious foods in low-income households; and reduce the overall cost of foods through more efficient processing, packaging, and repurposing to minimize food waste.

Food Safety and Health

Objectives:

- Generate fundamental knowledge and tools that can later be applied to improve food safety and food security, including One Health research such as antimicrobial resistance.
- Identify food safety programs that are the most effective at reducing contaminants/hazards with the lowest costs.
- Identify incentives for food safety investment in food processing/ manufacturing plants.
- Improve technologies to associate environmental and external factors in food production systems that differentiate natural from intentional contaminations of foods.
- Foster innovative methods to distinguish highly virulent pathogens from non-virulent pathogens within food systems and develop better risk assessments.
- Understand the role of market forces that encourage higher food safety standards in food production and processing.
- Understand the outcomes from foodborne illness, including severity and impacts such as medical costs, lost work productivity, and loss of life, and long-term consequence of previous disease or injury.

Strategies:

- Conduct research, gather and analyze data on the effectiveness and costs of various food safety interventions in reducing the contamination from pathogens, antimicrobial resistance, toxins and chemical contaminants.
- Fund and otherwise promote peer-reviewed studies on predictive microbiology and intervention technologies to identify mitigation steps to reduce contamination during food production and processing.
- Solicit stakeholder feedback on research, education, and extension needs related to food safety; including opportunities to discuss and quantify new and emerging threats to food safety and security.
- Derive and analyze data from whole genome sequencing of pathogens to assist public health agencies with their regulatory and attribution roles.
- Develop technologies that contribute to the detection and intervention to reduce pathogen populations and chemical contaminants in foods.
- Develop multi-media public communication materials to inform and promote food safety and safe food practices.
- Conduct research to understand how foodborne pathogens emerge and spread through production and processing environments and devise strategies to reduce their impact.

Evidence Building:

- Gather data from appropriate USDA agencies for use in models that illustrate how competitive market forces can encourage better food safety.
- Compile data from other agencies to update and extend economic burden estimates.
- Collect data to examine how regulatory and other actions affect incentives for improving food safety.
- Track changes in consumer food safety knowledge and behavior following outreach activities.
- Summarize USDA agency reports on cost and effectiveness of programs aimed at reducing contamination in the food supply.
- Collect and analyze survey data on consumer food-safety knowledge and practices.
- Analyze Whole Genome Sequencing pathogen data to help in decision making on recalls, outbreak tracking, and epidemiological investigations.
- Gather survey and predictive microbiological data that can be used to develop risk assessments for public health regulatory use.

Nutrition & Health Promotion

Objectives:

- Develop and update the current evidence base to promote proper macro- and micro-nutrient intake among critical age or state groups like pregnant women, infants, children, adolescents, working-age adults, Tribal members and seniors.
- Provide guidance and incentives to promote healthier diets so that the U.S. can reduce incidence of, and morbidity from, obesity and diet-related, chronic diseases.
- Promote food systems that reduce the prevalence and severity of food insecurity.
- Expand understanding about the impacts of USDA food assistance programs on human health, communities, and the economy.

Strategies:

- Establish evidence-based recommendations, remove barriers, and enhance facilitators to choosing a healthy diet.
- Increase food accessibility for all low-income households, including those in Tribal areas.
- Evaluate the effectiveness of Federal agencies, State, community, and non-profit organizations on reducing childhood obesity.

- Improve nutritional quality of existing products with useful biologically active food compounds to enhance human health.

- Identify and partner with community-based feeding programs that leverage Federal partnerships to reach out to low-income and Tribal areas to reduce childhood obesity via better nutrition and physical activities.

- Identify and promote biological and behavioral factors that can decrease obesity and chronic diseases.

Evidence Building:

- Enhance the scientific basis for dietary guidance.

- Evaluate changes to the National School Lunch Program and the Supplemental Nutrition Assistance Program (SNAP).

- Evaluate the impact of the Summer Electronic Benefits Transfer for Children (SEBTC) on food security and diet quality among households with children.

- Evaluate the efficacy of new technologies to reduce food waste and increase nutritional content/availability in packaged foods.

- Analyze data from feeding programs' strengths and weaknesses to generate priorities and actions.

- Examine the links between food access and food security with purchasing patterns, SNAP participation, and self-reported challenges to obtaining a nutritious diet.

- Measure and track the number and locations of vendors for local foods throughout the United States, especially in low-income and rural areas.

THEME
04

Value-Added Innovations

Agricultural and rural areas offer both challenges and opportunities with respect to infrastructure, adding value to products and innovation throughout the agricultural system and bioeconomy, including biofuels and bioenergy as well as emerging supplemental and alternative crops. New technologies and system designs are needed for producing higher value end products from agricultural products, emerging crops, and livestock, and forest feedstocks, which will enable new markets, establish new domestic supply chains, and create more jobs and economic opportunities.

Infrastructure, Innovation, and Well-Being

Objectives:

- Strengthen food, agricultural, and forest production, processing, manufacturing, utilization, and marketing through new technologies, innovation, and data analysis to create jobs and economic opportunities in rural areas.

- Foster sustainable non-food, feed and other high-value chemical and biophysical applications of plants (pharmaceutical, nutraceutical, industrial products, and feedstock ingredients).

- Develop and evaluate methods to increase access to low-cost and nutritious food as well as sustain efficient agriculture and bioeconomy systems in rural communities.

- Evaluate alternative systems that may improve the quality, resiliency, and sustainability of food, fiber, forest, and fuel supplies.

Strategies:

- Develop and transfer technologies through partnerships with universities, colleges, private and Federal laboratories to produce innovative and high-value products.

- Identify successful models of producer behavior change and technology adoption emphasizing the critical decision drivers and thresholds.

- Develop methods and models to encourage the coexistence of multiple crop and forestry technologies.

- Help small businesses establish criteria, methods, and instrumentation to assess raw and in-process food and non-food product quality during handling, storage, and transportation.

- Identify and improve coordination between successful local and regional food and forest product systems to optimize access to food, fiber, fuel and forest products and minimize waste.

- Utilize the local and regional resources throughout USDA, including the National Agricultural Library (NAL) Rural Information Center and the Cooperative Extension system, to facilitate adoption of transformational behaviors throughout the country.

- Engage stakeholders to develop inclusive collaborative partnerships that foster innovation and adoption of novel technologies.

Evidence Building:

- Evaluate and predict food and non-food processing efficiencies and product quality/performance for economic returns to producers, processors, and rural communities.
- Report on expanded and new technology development partnerships between research institutions and small businesses.
- Monitor changes in access to nutritious foods among low-income households based on price and proximity utilizing retail scanner data.
- Utilize existing data, evaluate peer-reviewed publications, and optimize survey capabilities to study the impacts of food assistance programs in rural areas.
- Track and measure success in knowledge sharing about organic farming, higher value end products from agricultural products, emerging crops and forest feedstocks.

Bioeconomy

Objectives:

- Promote the development of enabling technologies for the sustainable, efficient, and profitable production of biobased products from renewable agricultural and bioeconomic crops, including emerging supplemental and alternative crops.
- Develop a bioeconomy research roadmap that sets near-, mid-, and long-term goals and highlight progress towards those goals annually.
- Develop knowledge and tools to design and optimize biorefining and processing systems that leverage economies of scale to promote biobased product competition and market access.
- Generate, gather, and synthesize relevant data and scientific information to quantify and inform the valuation of bioeconomic ecosystem as well as societal and environmental costs, benefits, and services.

Strategies:

- Coordinate the development of new initiatives and interdisciplinary research to promote new feedstock development, conversion, and intermediate upgrading technologies.
- Generate science and tools supporting data-driven decisions in agriculture and forest management for the bioeconomy.
- Develop bioeconomy supply-chain models to enhance decision making with geographical region, product price, and market size relevant to feedstock and bioproduct selection.

- Recognize and share feedstock utilization best practices, biomass conversion strategies, biorefinery design and operation, and pathway specific approaches.

- Assess biomass and carbon resources with lifecycle, technical and economic modeling to characterize and quantify costs and benefits for relevant feedstock and product pathways.

Evidence Building:

- Increase the use of research outcomes as evidenced by technology transfer through licensing of processes or products and research publications and citations.

- Identify and communicate research success stories and continue to highlight biobased products through USDA's BioPreferred labeling program.

- Improve natural resources co-products, such as water quality improvements and nontimber forest products, associated with crop, animal, and forest products production systems.

THEME
05

Ag Science Policy Leadership

USDA was founded on the need for emerging sound science to create food security and economic prosperity for the United States. Continuing capability to address growing needs for domestic and international food security and forest productive capacity is predicated on a strong and vital U.S. agriculture sector that is increasingly able to compete as a global leader in the production of food, wood, fuel, and other agricultural products. U.S. agriculture requires a vibrant, innovative community of leaders who set forth an aggressive ag science agenda to support science-based policy decision making.

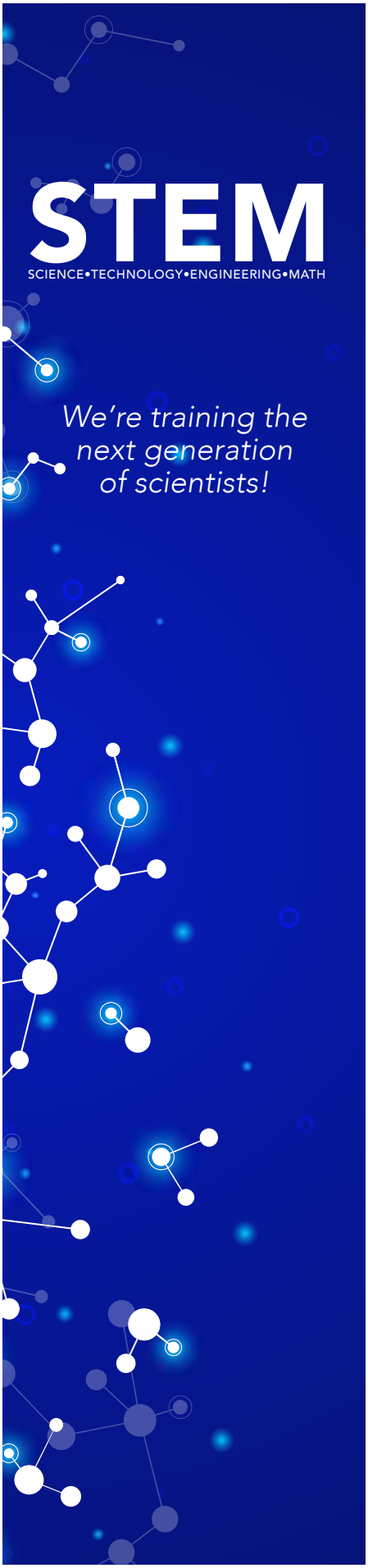
Beacon for Science

Objectives:

- Encourage a global conversation and facilitate such discussion within decision-making bodies about literacy in agriculture, food, forestry, health and science.
- Advocate globally for the development of science-based, international and domestic standards, regulatory approaches, and policies, including those guiding the development of new and emerging technologies.
- Develop an effective and diverse U.S. agriculture workforce that contributes to safer, healthier, vibrant, sustainable, and innovative communities.
- Enhance the capacities of USDA and other institutions in workforce development, with attention towards developing scientists and practitioners familiar with developing technologies and innovative practices.
- Develop and expand degree, certificate, curriculum, and youth programs that integrate science, technology, engineering, and mathematics (STEM) into instruction, considering real world challenges relevant to agricultural and food science.

Strategies:

- Identify core principles to reinforce with world decision-making bodies and incorporate them into a strategic communications strategy at influential international and national conferences.
- Develop innovative approaches for measuring scientific effort, outputs, and impacts using innovative data sources and methods for effective quantitative research evaluation.
- Build transdisciplinary teams to work on agricultural, food and forestry science problems and train the next generation.
- Evaluate the social and economic impacts of discovery, development, regulation and adoption of new technologies.
- Make agriculture and forest research outcomes readily accessible to the public (consumers), producers, and processors through improved delivery approaches.
- Develop, enhance, and support workforce training and retraining programs for life-long learning and extension of innovation into practice.
- Enhance experiential learning opportunities leading to and advancing diverse food, agriculture, and natural resource careers.



- Identify and remove barriers to assist socially disadvantaged and limited-resource producers, beginning farmers, women producers, and veterans, in joining the workforce for farming, natural resource and related industries.

- Foster greater information sharing about food, agriculture, natural resource and forestry careers to ensure that prospective workers are aware of opportunities.

Evidence Building:

- Foster effective methods for evaluating quantitative information generated by USDA science and research programs.

- Expand the analysis and reports documenting adoption, deployment, and better and effective technology.

- Increase the use of research outcomes as evidenced by technology transfer through licensing of processes or products and research publications and citations.

- Evaluate how regulatory and policy options impact sustainable agricultural production systems.

- Examine career outcomes of participants in expanded degree, certificate, curriculum, and youth programs that integrate STEM into instruction to inform successful development of future USDA activities and programs.

- Evaluate participation rates over time in educational programs to provide insight into the value placed on these interventions.

- Conduct regional workforce research to accurately and scientifically inform training, re-training and extension program development.

Trade and Commerce

Objectives:

- Develop and maintain vital market information, both domestically and internationally, that affects producer and marketing decisions in agriculture food, fiber, forest products, and energy sectors.

- Deliver high-quality, objective, relevant, timely and accurate research, education, statistics, and economic analysis that enables producers, policy makers, and other data users to make sound, informed production, risk management and marketing decisions.

- Invest in innovative methods to collect, develop, analyze, and disseminate data to improve the efficiency and fairness of agricultural markets, domestic and foreign trade policies, and other factors that impact food and forest product systems.

Strategies:

- Continue to obtain information on a broad range of issues about the farm sector, including financial condition and agricultural resource use through the annual Agricultural Resource Management Survey (ARMS).

- Address global technical barriers to trade with science-based evidence and tools.

- Assess, modernize, and restructure programs to provide services that meet customer needs and capitalize on opportunities to achieve greater efficiencies through streamlined process and cross-leveraged Department resources.

- Develop systems and portals that provide customers with greater access and flexibility with market data, statistics, and economic analysis.

- Continue to partner with international, national, regional, State, and community-based organizations and Tribes to ensure all populations and segments of the industry are accounted for and that published reports meet needs.

Evidence Building:

- Evaluate data collection and data use in developing information delivery systems, portals, and agency reports that provide customers with market data, statistics and economic analysis for accuracy, timeliness, and efficiency.

- Provide data and analysis to enable productive, sustainable agriculture, food and forest production, support effective stewardship of our natural resources, and facilitate international trade while maintaining a safe, nutritious, and secure food supply.

Program Metrics and Performance Indicators

Impact-driven agricultural science is critical to the future of agricultural and related industries. The evidence building goals defined under the objectives and strategies outlined in this Science Blueprint will help USDA make science-based, data-driven decisions and communicate the impacts of those decisions to our stakeholders. The first step toward success has already occurred—goal teams that cut across USDA science agencies developed the actions contained herein. These teams also identified evidence that will be used to determine progress towards meeting the science goals.

Science agencies will develop enterprise key performance indicators (KPIs) that convey the combined impact of science agencies towards meeting the USDA strategic goals through these Blueprint objectives. These KPIs will demonstrate that outcomes of USDA science are relevant and useful to industry and further improve agriculture and advance adoption of technology. The indicators will also demonstrate the need for, and USDA's contribution to, developing an agriculture sciences workforce capable of overcoming existing and future challenges through science and innovation.

USDA's actions demonstrate that careful planning and stewardship of appropriated taxpayer funds aids in securing the future of U.S. agriculture as a leader in the world for science-based decision making. USDA is determined to avoid unnecessary duplication of effort and to enhance coordinated science advancement. We utilize coordinating committees, advisory boards, a robust science strategic planning process that is further outlined below, and mandatory database searches and coordinating meetings between intramural-extramural science activities to do so.

One Science Blueprint for OneUSDA Scientific Excellence

The USDA science planning process is a two-step process that integrates into one unified plan for operational excellence. First, each science agency has its own strategic planning and review process that conducts formal program reviews to share knowledge gained internally and from stakeholder groups, prioritizes science, identifies gaps, and ensures relevance and adequacy of science programs. All the agencies contributing to this Science Blueprint solicit stakeholder input during their strategic planning cycles. These stakeholders include representatives of commodity groups, industry, interagency Federal working groups, scientific societies, and university partners. Secondly, the Department provides guidance to the agencies through its strategic planning process. This USDA Science Blueprint then allows unification of the agency plans into the Department's plan.

Stakeholders engaged in this process include the REE external advisory committee, the National Agricultural Research, Extension, Education, and Economics Advisory Board (NAREEEAB). This board is comprised of 15 members representing a specific stakeholder category, such as a national science society or a national farm organization. NAREEEAB has specific responsibilities to advise the Secretary and Under Secretary for REE about the relevancy of research portfolios including a mandated review of the relevancy of USDA's agricultural research programs and activities to the established research priorities and the adequacy of funding for those programs and activities.


ANALYSIS
SEARCH
SCANNING

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

December 2019

@USDAScience

www.usda.gov