USDA
U.S. DEPARTMENT OF AGRICULTURE

2020

Agriculture Innovation Agenda: Year One Status Report

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INTRODUCTION

The Agriculture Innovation Agenda (AIA) is the United States Department of Agriculture's (USDA) commitment to the continued success of American farmers, ranchers, producers, and foresters in the face of future global challenges. World population is expected to grow to more than 9.7 billion by 2050, and demand for food and fiber is expected to increase by 40 percent. Meanwhile, the planet faces a changing climate that will increase uncertainty within agricultural systems. The United States can respond to these challenges by helping to provide food security for a growing population in a way that is sustainable for the planet. The objectives of the AIA are to stimulate innovation and to work toward the shared goal of increasing U.S. agricultural production by 40 percent while cutting the environmental footprint of U.S. agriculture in half by 2050.

The AIA aligns USDA's resources, programs, and research to provide farmers with the tools they need to position American agriculture as a leader in the effort to meet the food, fiber, fuel, feed, and climate demands of the future. As part of the AIA, USDA is working to modernize its approach to innovation and technology so America's producers will continue to advance and have access to the latest resource conserving and productivity enhancing technologies and practices.

AIA Goals

The AIA sets meaningful targets that can be tracked over time to assess progress in the following areas:

- **Agricultural productivity**: Increase agricultural production by 40 percent by 2050 to ensure that the U.S. helps to meet estimated future demand for food, fuel, feed, and fiber.

- **Food loss and waste**: Advance our work toward the U.S. goal to reduce food loss and waste by 50 percent in the United States by the year 2030, from the 2010 baseline.

- **Carbon Sequestration and Greenhouse Gases**: Enhance carbon sequestration through soil health and forestry, leverage the agricultural sector's renewable energy benefits for the economy, and capitalize on innovative technologies and practices to achieve a net reduction of the agricultural sector's current carbon footprint by 2050.

- **Water Quality**: Reduce nutrient loss from agriculture by 30 percent nationally by 2050.

- **Renewable Energy**: Support renewable fuels, including ethanol, biodiesel, and biomass, to achieve market-driven blend rates of E15 in 2030 and E30 in 2050.

Three Pillars of the AIA

To accomplish the AIA goals, the Department focused its efforts into three pillars: research, programs, and metrics. These pillars are described below.

Pillar 1: Align public and private research efforts. The AIA research team will establish a set of Discovery Goals to focus public sector research opportunities and inform private sector efforts with a goal of aligning them to target innovative solutions.

Pillar 2: Integrate innovative technologies into programs. There have been dramatic advances in efficiency and conservation performance over the past two decades. USDA can assist producers in accessing and adopting new technologies and practices to help them meet productivity and environmental goals. The Department will focus on USDA program delivery to encourage rapid adoption of cutting-edge technologies and practices. USDA will champion commercialization of innovative technologies in the private sector.

Pillar 3: Improve data, metrics and reporting for tracking progress towards AIA goals. USDA currently collects a wealth of data on commodity production, but information on how our food is produced and the conservation practices being employed is harder to come by. USDA intends to increase our understanding of the adoption of conservation practices and improve the timeliness and access to conservation information, delivering a powerful new tool to measure and track progress. Through improved reporting and access to conservation data, USDA and the public will be able to understand and monitor conservation and productivity trends and progress. Access to this information will also serve as a catalyst for innovation and improved conservation decision-making.

Purpose of the Status Report

The AIA Status Report is an annual report that describes activities and progress of the USDA Agencies towards meeting the AIA objectives. The Status Report will report out on activities that have helped advance research, technology and improvement of data and metrics. The Status Report is a companion to the Scoreboard report which tracks progress of the agricultural sector towards the five AIA goals using the established metrics and benchmarks.

AIA ROADMAP

Internal teams representing each pillar were asked to undertake the activities necessary for achieving the goals of the AIA. These teams worked to identify barriers and gaps in research, technology implementation, and metrics and opportunities to address them to maximize our ability to facilitate increased productivity while improving environmental outcomes.

Roadmap for Research

The Research team was charged with drafting an innovation research strategy to align public and private research efforts around discovery goals. To ensure that the needs of the stakeholders were understood, the research team sought input from the agricultural community on what innovative technologies and practices are needed to meet their demands.

Develop a U.S. Agriculture Innovation Strategy: A Directional Vision for Research. On January 12, 2021, the Department released a first iteration strategy[1], summarizing feedback received to our 2020 Request for Information (RFI), that identifies opportunities, challenges, and key technologies that are needed to advance the agricultural sector over the next 10- to 30-years. Additional input from sectors who did not provide input to this RFI is needed to develop a comprehensive strategy, and future iterations will seek to fill those gaps. Components of the strategy include:

- **Organizing research using Innovation Clusters.** To organize our work, USDA adopted a set of four innovation clusters from a 2019 report from the National Academy of Sciences entitled "Science Breakthroughs to Advance Food and Agricultural Research by 2030[2]". These innovation clusters include Genome Design, Digital and Automation, Prescriptive Intervention, and Systems Based Farm Management.

- **Collecting and incorporating feedback from stakeholders and the public.** The research strategy also aimed to collect input from stakeholders and end-users of technologies, including farmers, foresters, and ranchers. The Research team collected input through a request for information (RFI) in the Federal Register, and by encouraging stakeholder groups to hold workshops or listening sessions. Stakeholder input was designed to identify perspectives on the major opportunity areas in support of the AIA and create a vision for outcome-oriented solutions, or discovery goals, for each of the four innovation cluster areas. Findings from this input are summarized in the report, "U.S. Agriculture Innovation Strategy: A Directional Vision for Research."

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[1] See https://www.usda.gov/media/press-releases/2021/01/12/usda-releases-agriculture-innovation-research-strategy-summary-and

[2] National Academies of Sciences, Engineering, and Medicine. 2019. *Science Breakthroughs to Advance Food and Agricultural Research by 203*0. Washington, DC: The National Academies Press. doi: https://doi.org/10.17226/25059.

Align research across the Department to support AIA goals: Aligning research across the Department to help achieve AIA goals is critical for ensuring coordination and meaningful progress. The Research team is identifying research gaps and priorities for achieving the AIA goals. These will be used to align research priorities across the Department. Steps for aligning research within the Department include:

- Working with USDA science agencies to develop research priorities that support the AIA goals.

- Integrating the discovery goals across USDA science agencies and supporting the continued definition, clarification, and utilization of AIA discovery goals in research forums such as the Foundation for Food and Agriculture Research (FFAR) and any future research mechanisms (e.g., the Agriculture Advanced Research Development Authority (AgARDA)).

- Aligning research funding opportunities within the Department to support AIA goals.

Communicate research priorities to outside stakeholders: USDA will communicate its research priorities to outside stakeholders to facilitate alignment and synergies with AIA discovery goals.

Roadmap for Integrating Innovation into Programs

A key component of the AIA is harnessing innovative technologies that have the potential to improve productivity and/or conservation outcomes and applying them at scale. The Programs team was asked to identify, coordinate and deliver new approaches to the agricultural community through USDA programs, specifically those technologies that contribute to meeting the AIA objectives. The recommendations and accomplishments of the Programs team, while ongoing, have been used to create an initial roadmap for integrating innovation into programs, summarized below.

Identify new and emerging innovative technologies: Without a clear understanding of all the technologies and initiatives that are out there, USDA cannot successfully communicate and coordinate adoption of innovative technologies within the agricultural sector. The Programs team has begun the process of identifying and inventorying innovative technologies with the following activities:

- **Survey and identify ready-to-implement innovative agricultural technologies.** USDA agencies were asked to provide information on existing, innovative agricultural technologies or efforts. Members of the Programs team identified which of these were both on the cusp of implementation and had the greatest potential to improve productivity and conservation outcomes. The resulting short list of innovations are the "low-hanging fruit" where agencies should focus immediate efforts for technology delivery.

- **Identify agricultural innovations from partners and collaborators.** To identify new and emerging innovations from the private sector, the Programs team published a Request for Information (RFI) in the Federal Register (FR). The FR request ran from September 10 to November 8, 2020 and resulted in over 100 responses. Promising technologies will be further evaluated for how they can be integrated into USDA program delivery.

Improve delivery of innovative technologies through programs: USDA conservation programs can be a barrier to deploying new solutions in the field, especially when these innovations do not fit within established NRCS practice standards for eligible practices. To address this, the team is focusing on opportunities to streamline and speed the process by which new technologies are evaluated and integrated into established conservation programs.

Incentivize agricultural innovation from the private sector: The private sector is an essential source of agricultural innovation. USDA can help incentivize innovation from the private sector through funding opportunities and prize competitions.

- **Establish prize competitions to encourage innovation**. Prize competitions have the potential to spur innovation from the private sector. The Programs team is embarking on an Innovation Prize competition. An Innovation Prize will be awarded to promising projects that strive for new solutions in nutrient management, carbon management and precision agriculture. The Next generation Fertilizer Challenge is an example of a recent prize competition launched jointly by USDA and EPA which is focused on identifying and recognizing innovative fertilizers that have the potential to reduce environmental impacts. The Team identified partners and young persons (e.g. 4H, FFA, etc.) as the target for future prize competitions.

- **Align USDA funding and grant opportunities to help incentivize innovative technologies and approaches**. The Department has existing funding opportunities, for example, the Conservation Innovation Grant (CIG) program, that are currently focused on incentivizing and funding innovative approaches to agricultural production and resource conservation. The Department will continue to support existing grant programs and other funding opportunities and ensure alignment of these with objectives of the AIA.

Communicate, deploy, and demonstrate agricultural innovation on the landscape: Demonstrating and communicating the effectiveness of new and innovative technologies is important for their adoption by the larger agricultural community. USDA will seek to utilize established infrastructure such as the National Technology Support Centers, Rural Innovation Centers and Climate Hubs to communicate to the agricultural sector about promising new innovations. In addition, USDA will establish "Conservation Technology Innovation Laboratory Watersheds" to demonstrate and showcase innovations and emerging technology. The short-term implementation of these watershed labs emphasizes existing work in line with the AIA. The longer-term implementation will provide a method to accelerate development and adoption of innovative technology.

- **Identify and establish Conservation Technology Innovation Laboratory watersheds.** Each State will be invited to identify one watershed or area to use as a focal point to demonstrate the latest technology and agriculture innovations. These Conservation Technology Innovation Laboratory Watersheds (CTIL) will be the proving grounds for USDA-led technology from ARS, NRCS, and Forest Service, as well as farmer-led advancements in partnership with industry and universities. Watershed selection criteria used by the Programs team will include addressing nutrient loss from agricultural land, and have one or more of the following characteristics:

- Novel approaches to watershed identification

- Use of innovative tools for watershed planning

- Implementation of innovative conservation practices

- Advanced monitoring and outcome reporting

- Coordination with CEAP for validation and correlation

- New approaches to partnerships

- **Coordinate with National Technology Support Centers to implement innovation.** NRCS Technical Support Centers, located around the country, can act as "lightning rods" for innovation. These centers can be a collection point for information and a venue to connect partners. One of the important feedback systems will be ensuring innovation information is available to our Conservation Environmental Affects Program (CEAP) team.

- **Leverage USDA Climate Hubs and Rural Development Innovation Centers to identify and implement innovative carbon management opportunities.** The AIA recognizes the importance of reducing greenhouse gas emissions and increasing soil carbon sequestration within the agricultural sector. By using existing USDA programs which are designed to facilitate outreach and education opportunities for producers, such as Rural Innovation Centers and the USDA Climate Hubs, the Department can facilitate identification and implementation of innovative carbon management opportunities.

Roadmap for Improving Data, Metrics and Reporting

A key component of the AIA is keeping score. The AIA Metrics Working Group (Metrics team) was formed to assess USDA's ability to track and report on progress towards meeting AIA goals over time. The Metrics team was asked to prepare recommendations to improve the data, statistics, and reporting of key metrics needed to track progress towards the AIA goals. The Metrics team consisted of members from ARS, ERS, FPAC, NASS, NRCS, OCE, and OCS and was divided into four teams: productivity, food loss and waste, renewable energy, and water quality and greenhouse gasses. The recommendations of the metrics group were compiled into a Metrics Report and have served as the basis for the Data and Metrics roadmap summarized below.

Improve data across the Department: Timely data are critical to ensuring that USDA can track its progress towards meeting AIA goals for productivity, food loss and waste, renewable energy, and water quality and greenhouse gases. USDA currently collects significant amounts of data that can be used to develop metrics and track progress towards these goals. However, the Metrics team identified several priorities for improving the data necessary for tracking progress, described below.

- **Address data gaps within USDA surveys.** The Metrics team identified several gaps in USDA's current survey data, especially data necessary to accurately evaluate the greenhouse gas emissions and soil carbon sequestration from agriculture, as well as data related to on-farm energy generation capacity and sources of renewable energy. Relevant USDA agencies will work to fill these gaps by collecting data through existing survey instruments, new survey instruments, or other means.

- **Address time series gaps within the data.** Time series gaps were consistently identified by the Metrics team as a barrier to timely and accurate tracking towards AIA goals. For example, the CEAP cropland survey, which is highly detailed and useful for establishing water quality and greenhouse gas metrics, is completed only once every ten years. Filling time series gaps in USDA survey data can be done several ways, including through better linking and interoperability of existing survey data; increasing use of USDA administrative data on technical and financial assistance for conservation practice adoption; a new survey instrument; and/or increased use of satellite imagery or remote sensing to help improve time series data for certain conservation practices. Relevant USDA agencies will work together to identify the best path forward for identifying and filling critical time series gaps while weighing these against Department priorities and resources.

- **Improve interoperability of data.** Improving interoperability of data, especially environmental and economic data, is important to help fill time series gaps as well as to inform on drivers of environmental outcomes. Linking existing survey data through geo-referencing and links to the NASS list frame will greatly increase the functionality of USDA data and our ability to use these data in analyses. Relevant agencies will examine and outline opportunities for improving linkages between existing USDA survey data moving forward.

- **Improve timing and release of statistical data**. Timely data analyses are critical to reporting outcomes and measuring progress. Timely data and analyses are not only useful in tracking progress towards AIA goals, but can help provide critical feedback to the effectiveness of programs and policies and promote adaptive management. Delays of up to five years in collecting and analyzing survey data can impact the relevance of the data and accompanying metrics to assess progress on the ground. USDA agencies will work to streamline timing and release of statistical data in order to increase the power of these data to effect change on the ground.

- **Explore new technologies for data collection.** The Metrics team identified several areas where new and emerging technologies might be used to gather necessary data. For example, satellite imagery might be used to provide annual estimates of crop type, tillage, cover crops, and some structural practices in the field. Similarly, the Food Loss and Waste group identified potential for AI and remote sensing technologies to be able to better estimate farm, retail and consumer level losses. USDA will explore ways in which these new and emerging technologies can be useful for improving data collection frequency and/or accuracy.

- **Leverage data from other sources/agencies.** In many cases the private sector, academic institutions or other federal agencies may already be collecting data that is critical to AIA efforts or may have access

to a group of producers or industry leaders that can provide data valuable for metrics concerning water quality, carbon and GHG, food loss and waste, ethanol production, and on-farm renewable energy generation. For instance, ethanol blend rate data from the Energy Information Agency (EIA) has been identified by the Metrics team as the primary source of ethanol blend rate data that will be used to track towards AIA goals. The Metrics team also identified some prospective partnerships. For example, several private organizations are already looking at implementing satellite technologies to track conservation practices. USDA plans to begin assessing partnership opportunities with groups like these.

Improve metrics for each of the AIA goals: Metrics are measures used to track success towards the AIA 2050 goals, for example, pounds of nitrogen and phosphorus runoff reduced from agriculture, tons of carbon sequestered in agricultural soils, and agricultural productivity. Metrics are derived using data from USDA and other sources and are often coupled with models and/or emissions/loss factors. The metrics selected to track progress towards AIA are described in more detail in the Scoreboard report. The Metrics team identified areas where AIA metrics can be improved, either through improvements to the underlying data (as outlined above), or improvements to the methods or factors used to derive the metrics themselves. Undertaking activities to improve these metrics will result in more accurate tracking towards AIA goals. The Metrics team identified the following priorities:

- **Update critical data/factors used in metrics to track AIA progress.** The metrics team identified several areas where metrics could be improved. There are currently efforts underway to update methods and factors used to estimate greenhouse gas emissions. On average, updates to GHG estimation methodologies occur about every five years. In addition to ongoing improvements to GHG methods and emissions factors, the Metrics team identified several opportunities for improving the Loss-Adjusted Food Availability (LAFA) estimates for food loss and waste by incorporating additional data from the Census of Agriculture as well as updating commodity-specific food loss estimates (currently underway at ERS), developing estimates for foodservice and restaurant retail level food loss, and incorporating multi-ingredient products into the LAFA estimates. The Metrics team also recommended ongoing, regular updates to the retail and consumer food loss conversion factors currently used in the LAFA estimates.

- **Develop additional metrics and/or proxies where appropriate.** The metrics team identified areas where current metrics should be supplemented. For example, the water quality metric relies on the CEAP cropland estimates which are updated only every 10 years. Developing metrics that can track progress in the interim years will be important for providing more regular feedback on progress towards AIA goals. The CEAP team is currently developing several tools derived from CEAP efforts that, when paired with program data, could help provide interim measures of progress towards water quality goals. In the case of agricultural productivity, the metrics team identified opportunities for disaggregating the national productivity metric to the state level. In this case, being able to provide sub-national

productivity metrics could help identify regional or state trends in agricultural productivity that could be important for targeting USDA resources.

- **Provide updates to metrics every 1-3 years.** Regularly updated and accurate metrics will not only help track progress towards AIA goals, but will allow USDA to respond to policy needs and program priorities. To be useful in guiding policy and directing resources, these metrics would ideally be updated and made available every 1-3 years. Publishing some metrics, such as water quality metrics, more regularly may require more frequent data collection, updated estimation factors, and/or alternate or proxy metrics. Improving timeliness of metrics will, in some cases, mean improving time series data for conservation activities which may include a new survey, improved links between existing USDA survey data, and use of satellite data. Reporting comprehensively on the AIA metrics on a regular schedule will allow USDA to consistently benchmark progress towards AIA goals and will allow the public a trusted source of information on these metrics.

- **Continue to support/improve established metrics.** The metrics selected to track progress towards the AIA are already established within the USDA agencies. Support for these metrics should be ongoing in order to ensure continuity of tracking efforts.

- **Establish regular reporting of progress towards AIA goals:** Standard and consistent reporting on progress towards AIA goals would create transparency and facilitate distribution of metrics data and associated data products and reports.

- **Provide an annual Scorecard report.** USDA should produce an AIA Scorecard report annually. The report should include a "scoreboard" to document progress towards AIA goals, as well as a description of annual progress and next steps.

- **Centralize metrics reporting online.** The Soil and Water Resources Conservation Act (RCA) website may provide an option for housing the AIA metrics data on water quality and carbon. RCA currently offers a range of NRCS data and links to other data across USDA agencies. The scope of the website could be expanded to offer a rich data platform that could feature additional data products. While the USDA GHG Inventory and EPA GHG Inventory report are housed on their own pages, these reports can also be linked through the RCA. As already noted, the RCA Data Viewer could host data products featuring conservation practice adoption data from CEAP Cropland and, potentially, other sources. The Agricultural Collaborative Research Outcomes System (AgCROS) may provide a way to link conservation and production data through interactive queries. The Partnerships for Data Innovation[3] team could expand the data products offered through the National Agriculture Library. ERS currently publishes productivity metrics online and may be linked to a centralized website as well. Energy metrics would need to begin centralized reporting as they are not currently collected and reported through a single source or website.

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[3] https://usdaars.maps.arcgis.com/apps/MapSeries/index.html?appid=546b9ef818be49689b974e47687416fc

PROGRESS AND ACCOMPLISHMENTS

Listed below are 2020 Accomplishments across the Department that have contributed to achieving AIA goals within each of the three pillars.

Research

- Released the U.S. Agriculture Innovation Strategy Directional Vision for Research to generate an initial vision for the future that aligns public and private research efforts with AIA goals. The process to compile this report included:

  - Publishing a Request for Information (RFI) in the Federal Register to collect input on the greatest opportunities, challenges, and key technologies that need to be developed over the next 10 to 30 years to meet the goals of increasing agricultural production by 40 percent while reducing agriculture's environmental footprint by half by 2050.

  - Conducting meetings with 31 different stakeholder groups from across the agricultural production system, as well as scientific societies, science organizations, university extension leaders, and the National Association of State Departments of Agriculture, and encouraged them to hold workshops to collect inputs on future research opportunities.

  - Analyzing all inputs and synthesized a summary report identifying major aspirational goals and supporting discovery goals for agricultural segments for which input was provided, including crops, forestry, beef and range, and dairy.

- Developed an online dashboard for exploring the discovery goal data and generating customized reports based on topics of interest.

- Initiated integration of the discovery goals into the fabric and framework of USDA science agencies.

Programs

- The Programs team solicited input from across USDA including: ARS, FS, NRCS, FSA, RD, OCS, OCE and others to identify innovative agricultural technologies.

- In September, USDA announced a solicitation for public and private-sector input on the most innovative technologies and practices that can be readily deployed across U.S. agriculture. This request was published in the Federal Register with comments due November 9, 2020. Over 100 submissions were received, and a USDA team led out of the Chief Scientist's Office is assessing these contributions.

- The Agriculture Conservation Innovation Team held a series of Stakeholder Forums that USDA Leadership, including the Under Secretary for Farm Production and Conservation and the Chief of NRCS, hosted both to communicate the AIA objectives and provide a forum to listen to partners and their innovative ideas.

- Established Conservation Technology Innovation Labs to provide the testing grounds and focus emerging innovation on fields/watersheds/landscapes. The Conservation Technology Innovation Labs will provide a venue to highlight new agriculture advances from the private sector, universities, partner organizations, USDA and producers. Conservation efforts in Wisconsin's Lower Fox River watershed demonstrates NRCS working with agricultural producers and partners to help develop sustainable working landscapes. A critical focus in this watershed is supporting the AIA goal to reduce phosphorus and sediment losses from agricultural fields.

- NRCS reviewed all 172 Conservation Practice Standards to assess new science and innovation that may be relevant and appropriate to incorporate.

- USDA and the U.S. Environmental Protection Agency co-sponsored the Next generation Fertilizer Challenge. This competition strives to engage agricultural partners to develop and deploy advanced fertilizer formulations and release technology to improve yields while also improving environmental outcomes.

Data and Metrics

- Completed initial review and analysis of data and metrics within the agency. USDA assembled a team of experts across the agencies to evaluate data and metrics currently being used within the department. The charge of the group was to identify the appropriate data and metrics to track towards AIA goals, but also to recommend improvements to data, metrics and reporting. The Metrics team drafted the Agriculture Innovation Agenda Metrics Report: Data, Challenges and Recommendations report. This report accomplished the following:

  - Identified metrics for tracking each AIA goal

  - Identified reporting mechanisms for each AIA goal

  - Identified specific data challenges to be addressed

  - Put forth recommendations for addressing data challenges

- Compiled a report on implementation priorities across the agencies for improving data, metrics and reporting, based on recommendations laid out in the Metrics report.

- Initiated updates to the GHG Entity-Scale Methods report which will be used to update models and methods for estimating GHG and soil carbon for the U.S. GHG Inventory.

- Completed updates to manure storage methods for major animal types. These updates have led to revised intensity metrics for animal methane emissions which in turn have been used to update the U.S. GHG Inventory.

- Issued the 2017 Indicators for the Biobased Economy. This report furthers the understanding of the impact that the biobased economy has in the American economy. The report collects and analyzes measures of bioindicators in four categories: field crops, bioenergy, bioproducts, and policy.

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