



# Strategic Plan

Long-Term Agroecosystem Research Network



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## Executive Summary

The Long-Term Agroecosystem Research network (LTAR) was formed in 2012 to create a platform for research, education, and outreach to improve the current and future capacity of farmers and ranchers to provide agricultural commodities and other agroecosystem goods and services. The LTAR network is organized and led by the USDA Agricultural Research Service (ARS) using appropriated funding from Congress. The network currently comprises 18 sites; 16 sites are managed by ARS, 1 is managed by a university and a nonprofit organization, and 1 is managed exclusively by a university. Sites were selected based on their long-term research histories and capacities and their representation of a diversity of agroecosystem and production enterprises across the United States. While many ARS and other sites conduct long-term agricultural research, LTAR sites conduct research that is coordinated among sites and partnering institutions and provides a broad array of scientific information with national-level impacts.

Coordinated, long-term research develops and tests agricultural innovations applicable to broad regions. Multiple indicators appropriate to regions are measured so that LTAR can report on agricultural production, environmental impacts, and societal outcomes to support decision making. Multisite working groups standardize, integrate, and publish data across sites and produce new technologies and information products addressing specific problems. Network research supports producers, processors, and rural communities across the United States as well as the goals and priorities of USDA and two of its component mission areas, Research, Education, and Economics (REE) and Farm Production and Conservation (FPAC).

The LTAR Shared Research Strategy, completed in 2015, provided early guidance to the network. Since 2015, more than 20 coordinated site experiments and more than 60 multisite projects have been established to develop and test strategies that increase agricultural productivity and profitability, reduce negative environmental impacts, and promote human well-being. During the past decade, new concepts, capabilities, and priorities have emerged, necessitating a fresh look at the network's strategic directions. In 2024, agroecosystem science is being asked to chart a path for U.S. agriculture that is:

Sustainable and balances the costs and benefits of production, environmental quality, and human well-being for current and future generations;

Resilient to forces that can disrupt agricultural production and supply chains, such as extreme droughts and the COVID-19 pandemic;

Climate-smart and helps mitigate greenhouse gas emissions and adapts production to climate change;

Equitable in ensuring the distribution of costs and benefits are equivalent for all producers; and

Transformational if adaptations of business-as-usual strategies cannot achieve desired outcomes.

All these goals are captured in this strategic plan. Our stakeholders include those that interact with the food system, including farmers, farm laborers, ranchers, landowners, crop and ranch advisers, agency personnel, agricultural retailers and manufacturers,

consumer retailers, commodity groups, nonprofit interest groups, policymakers, other researchers, and interested consumers.

The LTAR network supports the key priorities of the Secretary of Agriculture as outlined in the recently published USDA Strategic Plan, Fiscal Years 2022 - 2026. Specifically, the LTAR seeks to (1) promote climate-smart, resilient production systems; (2) increase the economic viability and sustainability of our food, feed, fiber, and renewable fuel supply chains; (3) ensure that our agricultural lands provide abundant environmental services and societal benefits; (4) reflect the production challenges and needs of all producer communities; and (5) extend a research environment that is inclusive, collaborative, and highly engaged. The work of the LTAR network aligns with goals and vision for other efforts across the Department, including REE and FPAC mission areas, USDA Climate Hubs, and the broader ARS research portfolio. The LTAR vision nests squarely within the USDA vision of "an equitable and climate-smart food and agriculture economy that protects and improves the health, nutrition, and quality of life of all Americans; yields healthy land, forests, and clean water; helps rural America thrive; and feeds the world." Our vision also aligns with the ARS mission to: "... deliver scientific solutions to national and global agricultural challenges."

In this strategic plan, we describe the current state of the LTAR network and how it aims to meet the growing needs and expectations of U.S. agriculture. In Part I, we build on the network's past planning efforts to provide new vision and mission statements, strategic

network goals, and a rationale for a science network dedicated to long-term agroecosystem research to achieve these goals. This is followed by an outline of the network's broad steps to link needs, research, solutions, and outreach. Research co-production is emphasized throughout this plan, in which researchers and stakeholders share in problem formulation, research implementation, and interpreting the results. Part I concludes with an analysis of strengths and challenges to the network based on feedback from network participants and stakeholders. Part II describes seven strategic initiatives that build on the network's strengths and address core challenges and opportunities. The initiatives include both broad network research directions and organizational improvements to increase research and outreach efficacy. Considering the urgency of climate change adaptation and mitigation communicated to the network by a variety of stakeholders, these topics figure prominently in planned research initiatives. Parts III and IV summarize expected short- and long-term outcomes of LTAR network research and a near-term implementation plan, respectively. Finally, it is important to note that this plan is intended to be a living document. We expect that elements will be revisited on at least a 5-year cycle.

# PART I:

## Strategic Framework

### Rationale for the Network

Long-term research is critical for understanding how agroecosystems adapt and respond to management practices under a variety of stressors and a changing climate. But systems-level agricultural challenges are too complex to be solved by a particular discipline in a particular region over short time periods. Thus, long-term transdisciplinary networked science is essential to advance goals for U.S. agriculture. A transdisciplinary, networked science approach accelerates scientific progress and discovery and enables shared ideas, resources, data, expertise, and perspectives. In addition, working across a network of sites and institutions enables researchers to develop agroecosystem management approaches and innovations that are matched to different enterprise types and social and environmental conditions. The LTAR network is uniquely positioned to address key challenges facing

agriculture. Its diverse research sites have decades of prior research and data across the United States. Integrating the work at these diverse sites into a larger network creates synergies and promotes insights that advance agricultural sustainability.

LTAR network scientists collaborate to conduct research that is long-term, transdisciplinary, and cross-scale; integrates information from a variety of landscapes, production systems, and data sources from across the network and beyond; and is informed by diverse stakeholders.

### LTAR network scientists:

Conduct research with an expanded reach that cannot be achieved by any one institution or site;

Gather and integrate data from across the network as a singular, open-access public resource and engage with a community of scholars, stakeholders, students, and private and public entities through a diverse, inclusive, and cohesive network or "community of practitioners";

Leverage shared resources, long research histories, and data from multiple sites nationwide, and coordinate data collection and analysis to develop new knowledge and solutions from local to regional to national scales;

Obtain feedback from and develop relationships with diverse stakeholder partners to recognize innovations and consider practical needs and adoption on the ground; and

Work to ensure scientist and site contributions provide actionable solutions for increasing the delivery of ecosystem services and adapting to and mitigating climate change, and empower diverse individuals and communities of practitioners to influence the direction of agricultural research.



## Vision

A vibrant, inclusive, adaptable, and resilient agricultural community achieving production, environmental, and societal goals sustainably.

## Mission

To conduct long-term, transdisciplinary, networked research to create innovative tools and practices and regionally tailored, evidence-based knowledge supporting adaptable, resilient and sustainable agriculture.

## Strategic Goals

The strategic goals of the LTAR network are to engage with diverse stakeholders to:

Improve scientific understanding of agroecosystem function and responses to management and external drivers.

Develop and test new tools, technologies, and management practices that promote the agricultural goals of sustainability, resilience, and climate adaptation and mitigation.

Enhance equitable access to science information leading to the adoption of locally tailored tools and practices.

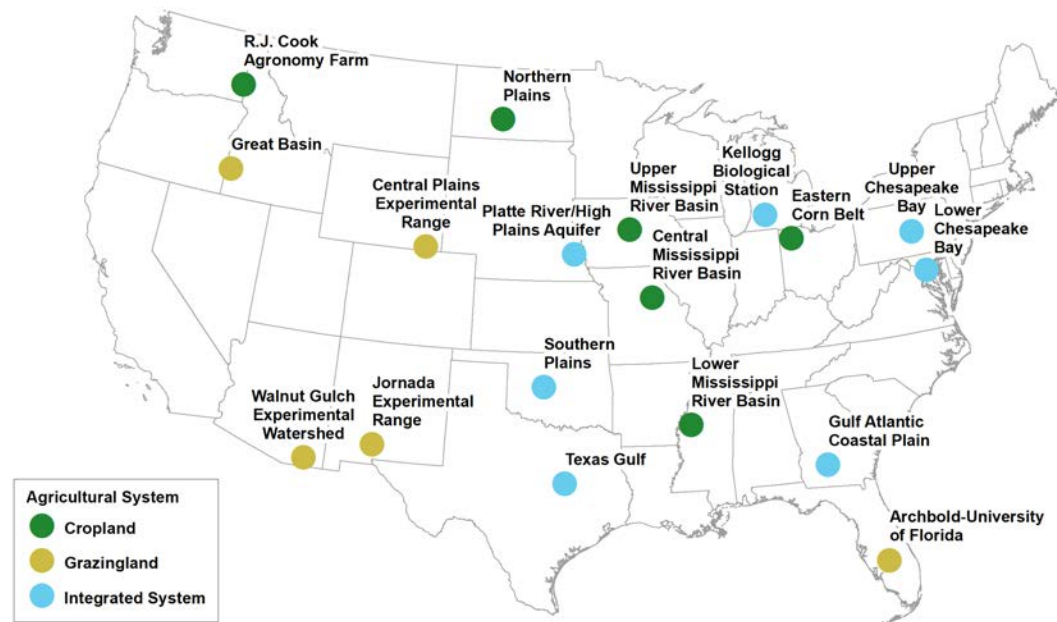


Figure 1: The 18 LTAR network sites located in the continental United States span cropland, grazingland, and integrated agricultural systems.

## Current Organization of the Network

The LTAR network currently comprises 18 sites across the continental United States (Figure 1). Ten LTAR locations were initially selected in 2012 and an additional eight locations were selected in 2014. Site activities commenced in 2014 for most sites, depending on available funding. Sites were selected based on their long-term research infrastructure and capacities and to represent a diversity of agroecosystem and production enterprises across the United States.

Each site conducts five coordinated research activities. The first is to collect core meteorological measurements as well as measurements representing production, environmental, and socio-economic variables that reflect stakeholder interests in regional agroecosystems. These measurements should be standardizable such that data can be integrated across LTAR sites. Second, sites conduct a long-term “common experiment” that contrasts agricultural production systems or technologies within a region, including a prevailing “business-as-usual” system and an alternative or “aspirational” system hypothesized to yield improved outcomes compared to the business-as-usual system. Experimental measurements should include multiple indicators appropriate to the

production system such that tradeoffs or synergies among indicators can be quantified and reported (Figure 2). Third, sites engage directly with stakeholders in the design and conduct of the common experiment and in technology development. Fourth, sites participate in multisite working groups that standardize and integrate data across sites, contribute to shared data management and communication functions, and produce technologies and publications addressing specific problems (Appendix). Finally, sites create and publish publicly available, high-quality datasets with appropriate metadata following LTAR, ARS, and USDA guidelines.

Network governance and site evaluation is carried out by a Leadership Team consisting of the National Program Leader for LTAR and 9 elected members from the LTAR community who each serve 3-year terms. The Leadership Team guides network vision, programmatic leadership, site coordination, and internal and external engagement. The team also evaluates site and working progress annually.



Figure 2: The LTAR Network uses 20 coordinated site experiments and more than 60 network projects to develop and test strategies that increase agricultural productivity and profitability, reduce negative environmental impacts, and promote human well-being. In these studies, we evaluate six attributes that together reflect agricultural sustainability (inner circles) using a variety of indicator measurements (outer circle). The indicators allow stakeholders to evaluate tradeoffs among strategies based on local contexts and differing values.

## Evaluating the Network

Surveys and feedback sessions involving network participants and key stakeholders were used to catalog network strengths and challenges and elicited many responses from network participants and stakeholders. The responses are summarized below; they include strengths to enhance and challenges that will require new network efforts and additional support.

### Strengths to Enhance

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Clear articulation of three research pillars (food production, ecosystem services, prosperous communities) and vision for the future of U.S. agriculture.

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Common understanding of why long-term agroecosystem research is important.

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A culture of collegiality and collaboration.

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Positive view of the current LTAR governance and leadership.

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Appreciation for USDA funding for the network.

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Leveraging across disciplines and sites.

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A foundation of credible, peer-reviewed science.

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## Challenges to Address

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**Organizational Development: From Startup to Maturity**

- Articulating the value of a networked approach to agroecosystem research.
- Guidelines for cross-site working groups, including their creation, support, resourcing, expectations, and impact.
- Identification and support for the most effective network structure, support system, leadership, and means of governance.
- Accountability for sites, including clear expectations matched to funding levels.
- Opportunities and support for bottom-up idea generation.

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**Solidification of a Growing Network**

- Clear priorities and transparent processes for adding new sites to the network.
- Strategies to engage satellite, affiliated, or liaison sites and researchers that may bring greater resources, personnel, or ideas into the network.
- Enhancing site capabilities, including the assessment of each site's distinctive competencies and unique challenges, to deliver on core priorities.

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**Articulating a Shared Science Focus**

- Shared questions and hypotheses that are updated periodically.
- Common indicators and metrics for evaluating and communicating about innovations and alternative agricultural production systems.
- Balancing network efforts among hypothesis-driven research, long-term observational monitoring of core attributes, and compilation and analyses of datasets.
- Balancing network efforts in engagement and information delivery tailored to local stakeholders, regional stakeholders that may be distant from existing sites, and national-level stakeholders.

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**Meeting the Data Management Challenge**

- Development of data sharing and integration platforms that all sites use.
- Clear expectations and workflows for the management of diverse data alongside accountability and incentive mechanisms to invest in open data.
- Data management support at site and network levels that is regularly reprioritized and adjusted to meet stakeholder, site, and network needs.

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**Enhancing Stakeholder Engagement and Communication**

- Improving internal communication to address the needs of a growing network.
- Formalizing and enhancing external communication efforts with full-time efforts.
- Expertise and strategies for two-way engagement with stakeholders and co-production of knowledge.
- Evaluation of communication activities to improve learning and sharing of best practices.

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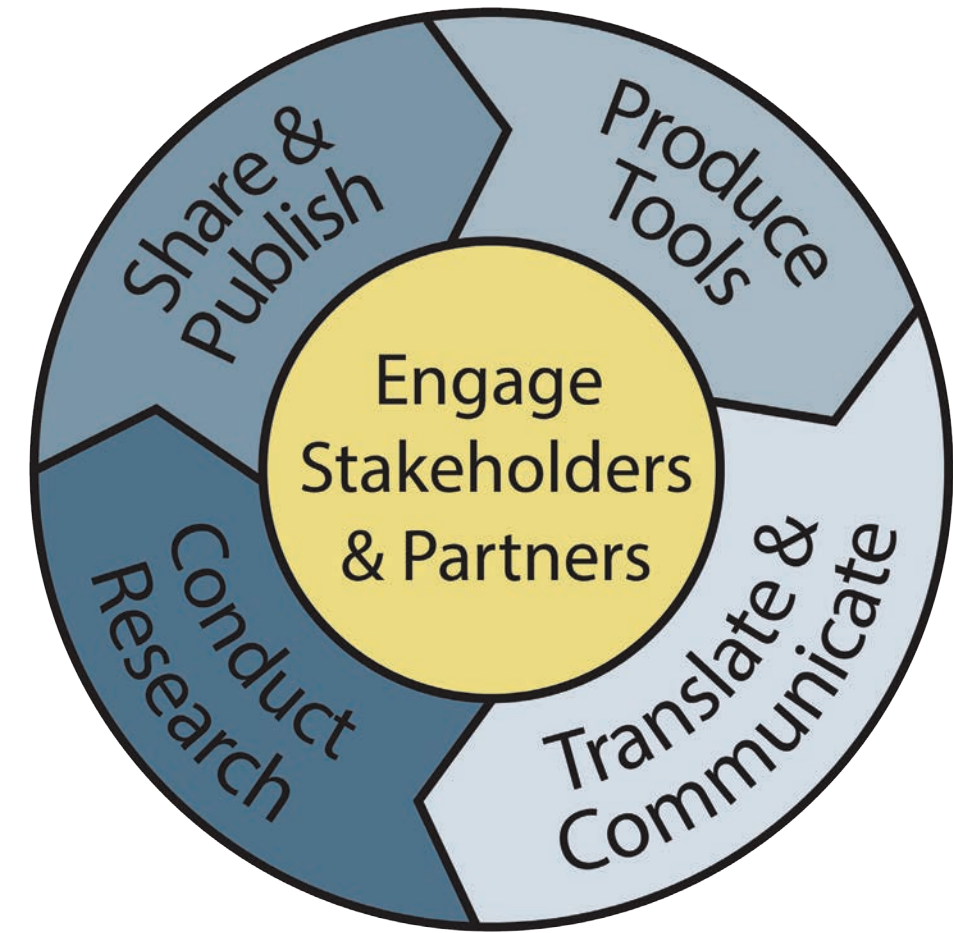


Figure 3: The network approach to science: 1) Engage partners and build relationships; 2) Conduct relevant network research; 3) share and publish data and research findings; 4) produce tools that are useful, usable, and used; and 5) translate and communicate findings.

## Network Approach to Science and Stakeholder Engagement

Science that directly involves stakeholders is more likely to benefit decision making at all levels. The LTAR network will achieve its strategic goals by linking societally relevant questions with long-term networked research that is co-produced with stakeholders. Research findings, innovations, tools, and solutions will then be delivered and communicated to stakeholders. Developing research collaborations with stakeholders and partners is known as co-production and is the core of the LTAR

network approach to science. Early and ongoing engagement with producer communities and other stakeholders and partners is required. Time and resources are being allocated to both framing and designing research that is relevant to users as well as packaging and disseminating science in formats that are accessible, useful, adoptable, and ultimately influential. Below, we describe five interlinked activities that encapsulate the LTAR network's science and engagement approach (Figure 3).

## 1. Engage Partners and Build Relationships

LTAR asserts that if partners in the agricultural value chain, especially producers and other stakeholders, are engaged in the cocreation of research priorities and are involved throughout the research and implementation process, then the research conducted will more likely have usable, practical applications and will be adopted. To operationalize this concept, LTAR will:

Engage diverse producers and stakeholders in framing research questions and interpreting, evaluating, and sharing results.

Engage with relevant USDA agencies in defining research priorities and strategies and their potential impacts.

Work with and engage intermediaries such as technical service providers, private enterprises, and nongovernmental organizations who in turn advise and influence producers and stakeholders.

Strengthen and foster existing and new relationships with early career, underrepresented, and smallholder farmers/ranchers, and those potentially on the vanguard of on farm innovation and changes.

## 2. Conduct Relevant Network Research

LTAR asserts that if research and data are connected across multiple sites, both within and across regions representing a diversity of landscapes and agricultural production systems, then high impact technologies and practices can be identified, tested, and scaled up more rapidly. To operationalize this concept, LTAR will:

Use stakeholder input from across the network to inform research questions and priorities to ensure the science is relevant to users' needs.

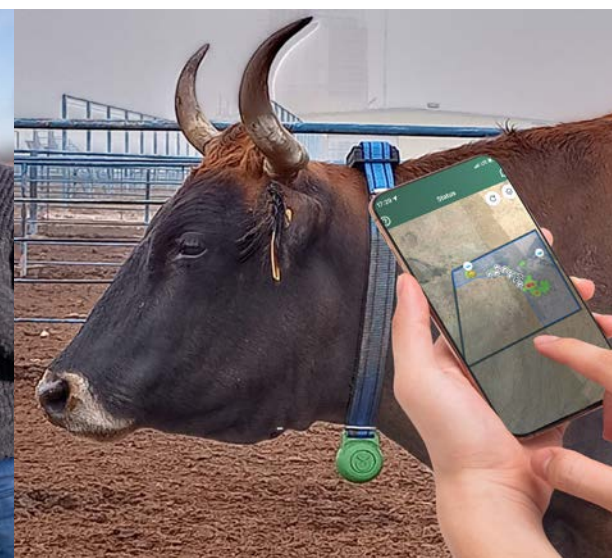
Conduct coordinated site-based research on aspirational management strategies and assess effects compared to business-as-usual approaches.

Conduct novel research and implement outreach strategies via cross-site working groups that allow new ideas to emerge from multiple sites and then test those ideas across wider geographies.

Partner with research organizations and sites from outside the LTAR network, including U.S. Long-Term Ecological Research (LTER), National Ecological Observatory Network (NEON), and Critical Zone Observatory (CZO) sites in cross-site research when appropriate, as well as research co-production collaborations with the USDA Climate Hubs.



Photo courtesy of USDA, ARS



## 3. Share and Publish Data and Research Findings

LTAR asserts that if data and research findings are shared widely in a host of forums, across both the research and practice communities, then innovations, products, tools, and solutions will be adopted more rapidly. To operationalize this concept, LTAR will:

Manage, standardize, and integrate data to have greater impact through broad scale analysis, synthesis, and production of site-specific information.

Make high-quality data and derived information and tools freely accessible to stakeholders.

Publish data and findings in peer-reviewed publications to ensure scientific credibility.

## 4. Produce Tools that are Useful, Usable, and Used

LTAR asserts that in addition to sharing data and research findings widely, LTAR must produce practical and innovative tools and methods that can be used by a host of diverse technical providers, producers, and others in the agricultural value chain to ensure research translates to action. To operationalize this concept, LTAR will:

Engage stakeholders in tool design and in all phases of development.

Consider upfront how tools can be used, and through what means, by diverse stakeholders.

Develop solutions applicable to stakeholders at different points along agricultural value chains to maximize positive impacts at the level of entire agricultural systems.

## 5. Translate and Communicate Findings

LTAR asserts that translation of research results to readily available and understandable information is essential to knowledge development, adoption, and up-scaling. To operationalize this concept, LTAR will:

Engage and retain science communication expertise across the network.

Bring experts in science impact, human dimensions, theories of change, and human behavior into the network to identify barriers and incentives for adoption.

Use research findings to design effective, tailored communication through diverse means, including social media, to reach diverse stakeholders and elevate awareness of LTAR products.

# Part II:

## Strategic Initiatives

Through a generative process of workshops and breakout groups, LTAR network members and collaborators developed ideas for building on the network's strengths and addressing core challenges and opportunities. The following seven strategic initiatives resulted from this process. Research initiatives 1–3 identify and link primary network-level research activities to deliver information, solutions, and innovations to stakeholders using the network approach. To improve network function and the robustness of the research initiatives, four organizational (4–7) initiatives will be implemented. Organizational initiatives will improve network capabilities to deliver positive societal outcomes from LTAR research.

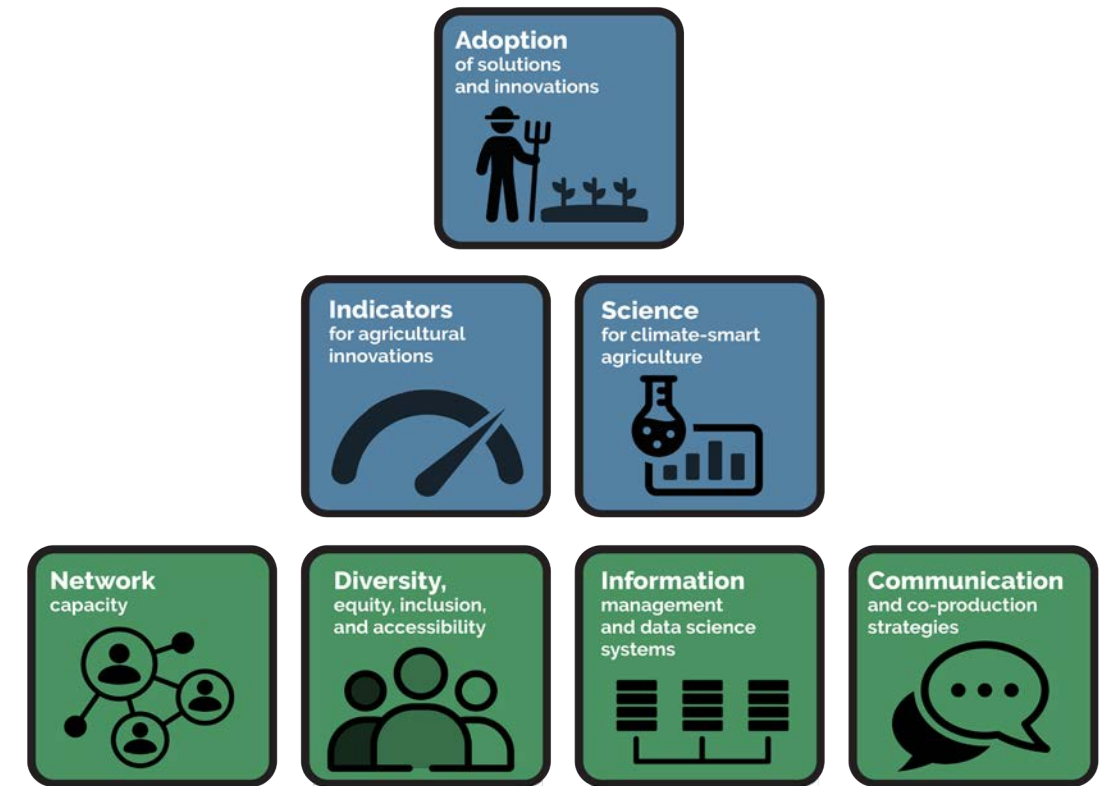


Figure 4: The 3 Research Initiatives focus on: adoption of solutions and innovations; indicators for agricultural innovation; and science for climate-smart agriculture. The 4 Organizational Initiatives focus on: network capacity; diversity, equity, inclusion, and accessibility; and communications and co-production strategies.

### Research Initiatives: Creating a Shared Science Focus

- Initiative 1: Core Performance Indicators for Agricultural Innovation

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- Initiative 2: Science for Climate-Smart Agriculture

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- Initiative 3: Science to Action - Understanding Adoption of Climate-Smart Solutions and Agricultural Innovations

### Organizational Initiatives: Building a Path to Impact

- Initiative 4: Building LTAR Network Capacity

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- Initiative 5: Developing Network Information Management and Data Science Solutions

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- Initiative 6: Advancing Diversity, Equity, Inclusion, and Accessibility

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- Initiative 7: Expanding Communication and Co-Production

# Research Initiatives

## Initiative 1: Core Performance Indicators for Agricultural Innovations

### Summary

Develop indicators of agroecosystem function to quantify the performance of agricultural innovations relating to production, environmental, economic, and societal concerns.

### Rationale

Agricultural stakeholders lack standardized methods to quantify how multiple disciplines affect agroecosystems and to assess whether agricultural practices support or detract from diverse agricultural goals. In this initiative we focus on developing a comprehensive system of indicators to understand agroecosystem function and quantify how agricultural innovations affect a wide range of production, environmental, economic, and societal/human condition objectives. These indicators will allow diverse stakeholders to assess multiple aspects of sustainability innovations to improve decision-making processes and serve as the foundation for developing and evaluating LTAR's data-driven products, tools, and solutions.

### Objectives

Develop an indicator framework for multifactor outcomes that addresses varying goals at multiple temporal and spatial scales.

Engage with diverse stakeholders to co-generate and quantify tradeoffs and synergies among a suite of indicators to improve decision making and achieve desired outcomes when adopting management practices.

Assess how innovations implemented at one scale impact outcomes at other scales.

Create an accessible, interoperable, and user-friendly web-based knowledge and decision-support system for scientists, practitioners, stakeholders, and policymakers.

Establish LTAR as a trusted source for assessing and communicating the performance of agricultural innovations with respect to multiple goals.

### Strategic Actions

Systematically engage with stakeholders to identify socioeconomic and environmental attributes related to agricultural goals.

Systematically engage with stakeholders to quantify synergies, tradeoffs, and thresholds or benchmarks in indicators to improve decision making about innovations designed to improve agricultural outcomes.

Build a modeling framework to scale up the effects of fine-scale management to landscape and regional scales.

Coordinate research on factors that affect decision making around LTAR innovations.

Assess stakeholder participation and adoption, identify knowledge gaps, and adapt indicators and knowledge systems based on this learning.

Use measurement of multifactor indicators as a basis for quantifying agroecosystem sustainability and resilience.

### Outputs

A common multifactor indicator framework for the LTAR network and partners.

More LTAR decision support tools with a web-based knowledge and decision-support system based on tradeoffs, indicators, and benchmarks.

Best practices for stakeholder co-production of the indicator framework and related tools.

### Metrics of Success

The indicator-based knowledge/decision-support system is widely used.

Findings based on indicators are routinely disseminated to the stakeholder community through peer reviewed journals, conferences and invited talks, engagement with stakeholders, and popular media.

Innovations are adopted by producers based in part on indicator information.

### Roles and Responsibilities

Engagement of the USDA ARS Office of National Programs (ONP) and LTAR Site Leads

Leadership by the Indicators Working Group.

Participation of other appropriate working groups in LTAR, and direct involvement of the Data Management and Communication working group.

## Initiative 2: Science for Climate-Smart Agriculture

### Summary

Conduct research on new and existing agricultural practices and synthesize results to quantify the effectiveness of practices for climate change mitigation and adaptation, including adaptation to extreme weather events.

### Rationale

U.S. agriculture faces a variety of stressors, but none more pervasive than those associated with climate change. The increasing frequency of extreme weather events, coupled with slow but persistent temperature increases, necessitate climate adaptation to enable producers and other stakeholders to attain and sustain agricultural goals. Some adaptations may be simple, but all interventions must be designed and evaluated in a systems context to avoid situations where a solution applied to one part of a system creates a new problem in another. Moreover, solutions for adaptation can also be used to mitigate climate change. Soil carbon storage, innovative nitrogen management, site specific precision technologies, and bioenergy crops all have the potential to contribute significantly to climate mitigation, and with the advent of carbon markets, to farm profitability. This initiative focuses on identifying and verifying practices that can, in a whole-system context, contribute to climate resilience and mitigation.

### Objectives

Identify agronomic innovations that have potential to make cropland and grazing land ecosystems resilient to climate change effects, including extreme events and more gradual changes, and test their potential in whole system contexts.

Identify and test climate change mitigation strategies that store carbon and at the same time enhance resilience and the provision of other co-benefits.

Facilitate the development of quantitative models that incorporate innovations to predict agroecosystem responses in future climates.

Establish the LTAR network as a trusted source for assessing and communicating the ability of various agronomic interventions to promote resilience and mitigation.

### Strategic Actions

Together with stakeholders, identify innovations likely to confer climate resilience and incorporate them into production systems research.

Employ LTAR and collaborator expertise to quantify all significant sources and sinks of greenhouse gasses (CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub>), including agronomic inputs as well as emissions and sinks such as soil carbon storage.

Engage with diverse stakeholders to evaluate the effectiveness and practicality of different resilience and mitigation interventions.

Identify best management strategies that optimize adaptation and mitigation and related co-benefits.

Engage with modelers to incorporate innovations into successful cropland and grazingland system models for research and decision-support purposes and to validate model predictions.

Provide a long-term incubator testbed for assessing how site- and time-specific factors interact with management for climate mitigation and adaptation.

### Outputs

Science-based practices that can be used by producers for climate adaptation and mitigation.

More LTAR decision-support tools that include near real-time decision making and long-term planning and that are supported by new network databases.

Verifiable measurements that can be used by producers and land managers to evaluate mitigation opportunities.

### Metrics of Success

LTAR results are fully accessible and salient to users.

Data, models, and tools, including Application Programming Interfaces (APIs) and web-based applications, are used in decision making.

Useful innovations developed or tested by LTAR become increasingly adopted.

### Roles and Responsibilities

This initiative will be led by a new Climate-Smart Innovations Working Group receiving input from several existing working groups to focus on climate implications of LTAR research (including Cropland and Grazinglands Common Experiment groups, Weather and Climate, Non-CO<sub>2</sub> Emissions, Soils, and Eddy Flux and Climate Hubs).

Direct involvement of the Data Management and Communication working groups.

# Initiative 3: Science to Action - Understanding Adoption of Climate-Smart Solutions and Agricultural Innovations

## Summary

Investigate incentives and barriers to stakeholder adoption of research innovations, including site-specific environmental conditions and traditions, agroecosystem capacity, and economic realities, in various U.S. regions.

## Rationale

Achieving sustainable and resilient agriculture requires that producers and other stakeholders (1) identify productivity, environmental quality, and social and economic goals for land areas; (2) build resilience to external drivers of change to attain and sustain goals; and (3) where possible, mitigate those drivers. Climate-smart agriculture circumscribes efforts to enhance the adoption of practices and technologies that enable adaptation to climate variability and change and simultaneously to reduce greenhouse gas emissions and enhance carbon sequestration. To be successful in promoting adoption of climate-smart practices and technologies, we must improve our understanding of the incentives and barriers to adoption of innovations through transdisciplinary research that reflects site-specific environmental conditions and traditions, agroecosystem capacity, economic realities, and political landscapes of different regions of the United States.

## Objectives

Develop and implement transdisciplinary research programs on incentives for and barriers to adoption of innovations from individual producers to government and local to national scales.

Use economic, social, cultural, and logistical knowledge with scientific results to assist diverse users in incorporating locally appropriate technologies to achieve agricultural goals.

Establish LTAR as a trusted information source in considering innovation adoption.

## Strategic Actions

Strengthen existing and foster new collaborations with social scientists from within and outside LTAR and engage with our diverse stakeholders to identify research needs.

Engage with Federal and State agencies responsible for agricultural and natural resources regulation and/or incentivization programs to prioritize research needs.

Expand partnership opportunities, particularly via the USDA Climate Hubs, to develop place-based planning tools and logistical support for at-risk producers, agribusinesses, and producer networks.

Develop a network priority plan for implementing pilot/demonstration sites.

Host stakeholder listening sessions and workshops to build relationships, receive feedback, and cogenerate research questions that could be addressed with existing and new data and information.

Work with engagement, outreach, and communication strategies and DEIA teams to ensure that LTAR efforts reach user communities equitably.

## Outputs

A process to assess and monitor adoption and use of innovations.

Information on socioeconomic factors that mediate adoption of innovations.

Improvements in LTAR decision support tools based on new knowledge from multidisciplinary research that enable scientists, practitioners, stakeholders and policy makers to advance research, improve the decision-making process, and inform policy design.

Science-based educational materials and websites.

## Metrics of Success

Efforts to understand adoption lead to co-production and outreach strategies that enhance adoption of locally appropriate innovations.

Policy design and implementation are based on LTAR research.

Research products are widely regarded as advancing the science of innovation adoption in agriculture.

## Roles and Responsibilities

The Human Dimensions Working Group will take the lead in addressing this initiative in coordination with other groups as appropriate, particularly the Climate-Smart Innovations Working Group.

The Cropland Common Experiment and Grazingland Common Experiment Working Groups and individual sites will support local partnerships and efforts around particular practices/technologies.

Coordination among ONP, Site Leads, Climate Hubs, stakeholders, and working groups are needed for successful implementation of this initiative.

# Organizational Initiatives

## Initiative 4: Building LTAR Network Capacity

### Summary

Improve network function through centralized support, growing stakeholder engagement capacity, and expanding collaboration with diverse agricultural researchers, sites, and networks.

### Rationale

The LTAR network must continue to grow to fully achieve the objectives described above. The LTAR network presently comprises 18 sites and 20 working groups carrying out more than 80 site-level and network-level agroecosystem research projects. Research products from these efforts are intended to yield benefits within all U.S. agroecosystems, but several factors are limiting the network's reach. First, the network lacks sufficient coordination among sites and working groups for engaging with national stakeholders, identifying research priorities, and delivering research products to diverse users. Second, the geographic footprint of primary research sites and associated stakeholder engagement is limited, necessitating creative solutions for scaling up research activities and data collection that cannot reasonably be accomplished by simply adding new LTAR sites. Finally, the fiscal resources available to the network have not kept pace with demands for new research, improved coordination, science-based tools, and expanded stakeholder engagement, which is impeding the development of strategies to optimize resource allocation to various network activities.

### Objectives

Improve network coordination via new governance strategies, staffing, and network activities.

Develop strategies to expand the reach of the LTAR network and create maximum opportunities for stakeholder engagement.

Develop shared priorities for allocation of effort and funding.

### Strategic Actions

#### Network coordination

Create a centralized LTAR network office that is funded independently of site contributions and includes dedicated staff for research coordination and data management (Initiative 5) and communication and engagement (Initiative 7).

Produce concepts and workflows for aggregating, synthesizing, and disseminating network research progress toward network goals aimed at national-level stakeholders, media, USDA leadership, and congressional staff. This must be accomplished as part of a new communications strategy (Initiative 7) but additionally requires a framework for matching research progress to broad network goals.

Develop a framework to identify priorities for the initiation of network projects and formation of working groups, including:

Consultation with regional and national stakeholders to identify research priorities that account for ideas generated bottom-up from stakeholder collaborations as well as top-down from USDA leadership.

Promoting linkages and complementarities among projects and working groups and how they collectively make progress toward agricultural sustainability goals. Coordination will include cross-working group workshops and publications.

Best practices, clear scopes, and desired outcomes for projects and working groups to increase effectiveness, minimize redundant activities, and increase efficiency in staff participation.

Strategies to incentivize researchers and site leadership to lead and participate in network-level projects and working groups based on evolving national priorities.

### Geographic footprint

Prioritize potential sites for addition to the LTAR network using a transparent and data-driven approach.

Encourage involvement of long-term "satellite" partner research sites to capture variability within regions and extend reach to additional stakeholders.

Encourage public-private partnerships with businesses and nongovernmental organizations involved in agroecosystem research via network- and site-level collaborations and formalized via cooperative agreements.

Encourage collaboration between LTAR and other science networks (including, but not limited to, the Long-Term Ecological Research Network, National Ecological Observatory Network, Critical Zone Observatory, and the National Phenology Network) and seek extramural funding for these collaborations.

In conjunction with USDA Climate Hubs, design and initiate site- and network-level research projects that include collaboration and data collection within a wide range of farms and ranches, leveraging remote-sensing-based data products, sensor networks linked to site or national computer systems via broadband or cellular connectivity, and field data collection using mobile or web-based applications.

### Outputs

A centralized LTAR network coordination office.

A detailed, transparent operational work plan for the LTAR network that links site- and network-level funding, research, and outreach activities to agricultural outcomes and their metrics via a logic model that is updated as the network improves its strategies.

A suite of productive, well-supported working groups that are addressing critical research gaps identified by scientists and stakeholders.

## Metrics of Success

Progress in the network workplan is reflected in LTAR site annual project reports and milestones.

Working groups involve participation from many or all sites and report high impact products.

The network features an increasing number of collaborations with businesses, nongovernmental organizations, science networks, and research sites.

The network features an increasing number of science co-production activities with farmers and ranchers, especially those in areas distant from core LTAR sites.

There are demonstrable linkages between LTAR research/outreach and Climate Hub synthesis, co-production, and outreach activities.

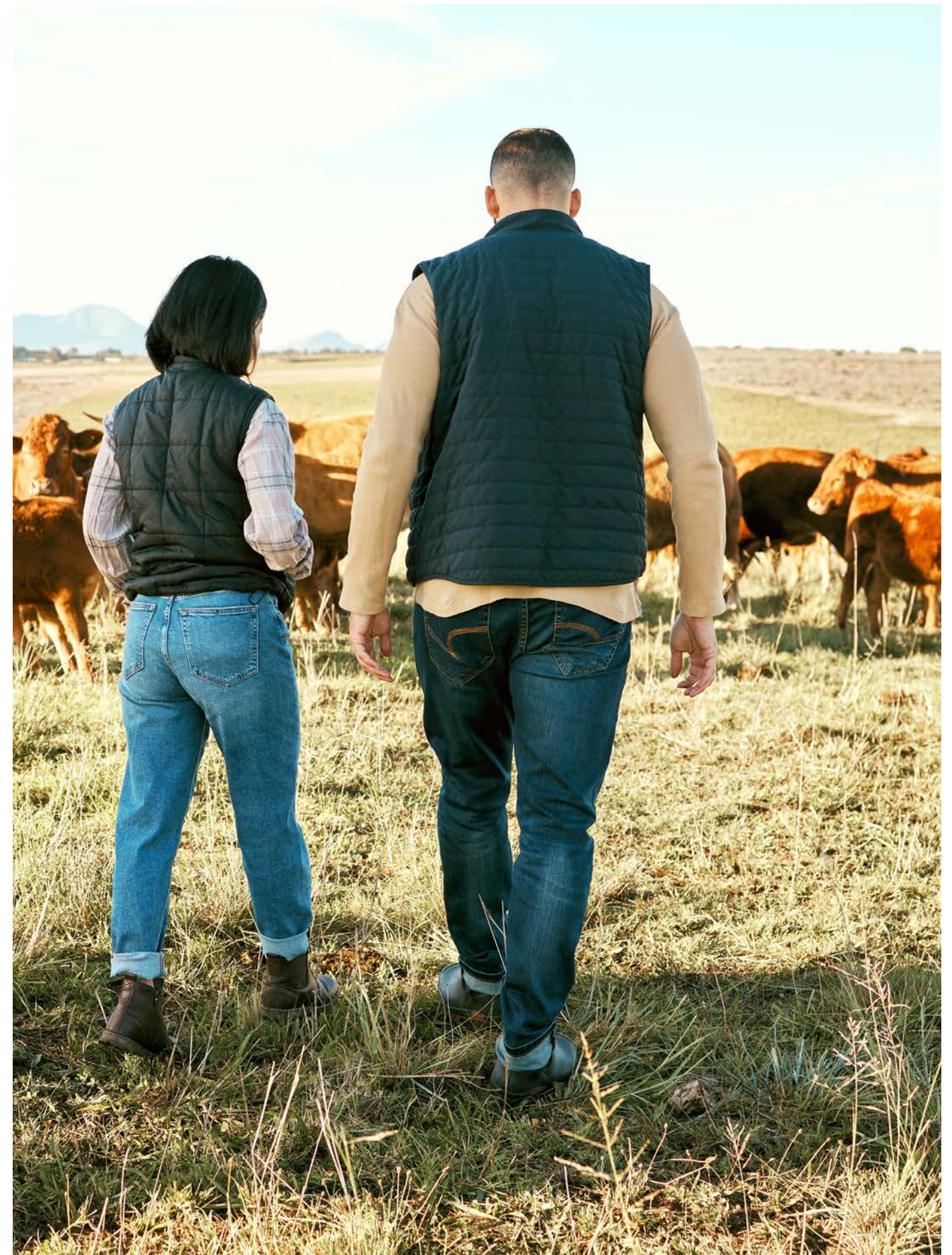
Network projects are increasingly supported by competitive extramural funds.

## Roles and Responsibilities

ARS leadership and the Executive Team, in consultation with Site Leads, will be responsible for initiating the proposed actions, identifying network priorities, and developing strategies for integrating and expanding site and working group research.

Site Leads will encourage working group participation, foster collaborations, and pursue extramural funding opportunities.

The Executive Team will coordinate with working group leads in developing a set of best practices.





# Initiative 5: Developing Network Information Management and Data Science Solutions

## Summary

Organize information and data to facilitate scientific innovation and new initiatives and develop comprehensive data management and sharing guidelines and protocols for publishing LTAR data in national repositories.

## Rationale

The purpose of the data management initiative is to organize information and data to help spur innovation by the scientific community within and outside of LTAR, as well as to deliver on research initiatives. Creation of harmonized, interoperable, and well-documented data that are available to LTAR and its stakeholders provides the foundation for LTAR research, including cross-site analysis of management outcomes, decision-support applications for stakeholders, and models to extrapolate findings to regional and national scales. To achieve success, LTAR must overcome four key data management challenges: (1) implementing LTAR's shared data vision in support of USDA's Data Vision (<https://www.usda.gov/topics/data>); (2) harmonizing management of different data types—leveraging site, network, USDA, and other data management resources; (3) ensuring the availability, interoperability, and appropriate use of data within LTAR and external science networks; and (4) ensuring site participation and accountability across the network in producing datasets required for network efforts. These challenges are addressed below according to the topics Education, Implementation, Expansion and Adaptation, and Accountability.

## Objectives

### Education

Cultivate a collective vision for network data management as a fundamental element of our network science.

Train and educate the LTAR community (scientists, data managers, and collaborators) on data management techniques and practices.

Create opportunities for the LTAR community to share in developing and refining data management activities.

### Implementation

Make data from network sites findable, available, interoperable, and re-useable (FAIR).

Create a shared inventory structure for the data required to achieve network science goals.

Develop a framework managing different categories of data representing the diversity of data produced by the network. These categories could include legacy data, data that are generated as part of LTAR collaborative initiatives (common experiment, workgroups), large datasets (remote sensing), small/unusual data, and modeled/value added data.

Facilitate harmonization and use of data with established and emerging tools available from USDA and third-party partners.

Coordinate data management with network science, including use of tools, scripts, and workflows for collecting, formatting, harmonizing, integrating, and sharing data; metadata collection protocols; and procedures for managing confidential data (e.g., social science data).

Coordinate staff contributions across sites toward network-level goals.

### Expansion and Adaptation

Prioritize LTAR site data of greatest potential for re-use by the network and its stakeholders to bring into the network's data management system.

Develop a common data language to facilitate data discovery and harmonization across users and disciplines.

Work with ARS Partnerships in Data Innovation and approved data repositories to build the necessary infrastructure to operationalize FAIR data sharing.

Invest in technological and procedural innovations to improve data management and sharing processes.

### Accountability

The LTAR Executive Team will communicate timelines and expectations for data management and sharing responsibilities.

Improve recognition and credit for site data products and cross-site data papers to provide incentives for scientists to publish data.

Cultivate a collective approach to data management so that scientists and working groups will be engaged with data managers.

Ensure that all LTAR sites contribute fully to the LTAR network's data management implementation.

## Strategic Actions

Establish a network-level LTAR Data Scientist position to facilitate creation of innovative data management approaches and data products and coordinate expectations of and contributions from site-level data management staff.

Enact USDA-ARS data policies (P&P 630.0) and LTAR Data Sharing Principles and Guidelines (<https://ltar.ars.usda.gov/data/data-guidance>) at all sites.

Work with ARS and LTAR leadership in creating standardized data management and data sharing workflows via the Research Data Advisory Team (RDAT), that includes the following:

Identify the data type, end repository, and workflow appropriate for the data.

Provide and/or identify storage suited to the data type.

Provide tools (scripts, apps, etc.) and training to remove barriers within site-specific data pipelines.

Finalize ingestion of legacy data.

Provide Digital Object Identifiers (DOIs) for all contributed datasets.

RDAT will work with LTAR site leadership and working groups to identify key network-level datasets, minimum metadata documentation, and a minimum set of data quality specifications and processes to sustain data quality in long-term studies.

Work with ARS and LTAR leadership to incentivize creating, sharing, and publishing cross-site data.

Engage with Partnerships in Data Innovation to automate workflows; assist with protocols for collecting, formatting, harmonizing, integrating, and sharing data; and create data hosting infrastructure (including the LTAR website).

Develop and adopt a strategy for publishing LTAR data that acknowledges the roles and opportunities provided by multiple data repositories, including AgCROS, Ag Data Commons, DataONE, PhenoCam Network, Ameriflux, and Environmental Data Initiative Data Portal.

Work to make suitable data types harmonized and interoperable (i.e., machine-readable and via APIs) to facilitate cross-site and cross-network research.

## Outputs

Updated and finalized comprehensive data management and sharing guidelines.

A set of working protocols for publishing LTAR data into national repositories (minimum data and metadata requirements) following ISO (International Organization for Standardization) and FAIR standards.

Designation of authoritative LTAR repositories and accepted external data repositories, data catalogs, and datasets (current list available here: <https://airtable.com/shrld8xLGwuiq00M5/tblMZm7WEaV8h1VND>)

Core LTAR network data and metadata reside in approved repositories.

Cross-site and cross-network research and data products included within repositories.

## Metrics of Success

The number of LTAR datasets and metadata in open access repositories acknowledging LTAR.

The number of times these datasets are accessed and downloaded.

The number of papers published with DOIs pointing to the LTAR network data catalogs containing citable data products.

## Roles and Responsibilities

RDAT will be responsible for coordinating efforts across the network to accomplish objectives.

LTAR site leadership will support site data management activities and network-level contributions.



# Initiative 6: Advancing Diversity, Equity, Inclusion, and Accessibility (DEIA)

## Summary

Expand DEIA opportunities within the LTAR network and with network stakeholders by creating awareness, developing formal protocols and training sessions, and conducting surveys to document progress.

## Rationale

Diversity, equity, inclusion, and accessibility (DEIA) are integral to fulfilling the network's commitment towards creating sustainable and resilient agricultural systems. Explicit attention to DEIA is imperative because the network is diverse given its geographic extent and the potential set of communities that each site may interact with and serve—each having different needs, expectations, and interests with respect to agricultural research and facing different barriers to engagement (e.g., access to information, participation in research efforts). This initiative addresses DEIA from two perspectives—internal-facing and external-facing. The internal perspective addresses DEIA issues from a workforce or LTAR community perspective. The external perspective addresses DEIA issues as they relate to LTAR network engagement with stakeholders, including individuals, organizations, and institutions outside of the network community. For this initiative, the two perspectives are addressed separately with actions the network can take in the near-term to enhance DEIA within the network and support more inclusive engagement with network stakeholders. We note these actions are consistent with Federal policies and that a USDA-ARS DEIA strategic plan currently in development will provide specific guidance to LTAR efforts.

## Objectives

### Internal: Network Workforce

Diverse, inclusive workforces as reflected in the recruitment, hiring, and retention for LTAR-related positions.

LTAR working environments that are equitable, inclusive, safe, and free from discrimination.

LTAR network members are equipped to address DEIA issues and enhance DEIA within their specific research contexts.

DEIA expertise is expanded within the network.

### External: Network Stakeholders and Partners

Research directions reflect the diversity of partner/stakeholder needs, perspectives, and interests across the United States.

Partner/stakeholder engagement processes are equitable, inclusive, and transparent.

There is equal and open access to LTAR network information, tools, and other products.

## Strategic Actions

### Internal: Network Workforce

Distribute job/internship announcements via a variety of outlets (including nontraditional outlets) to ensure diverse pools of potential applicants are reached.

Foster an inclusive environment of mutual respect and where diverse perspectives are sought and valued, and individuals have a sense of belonging irrespective of their background.

Create opportunities for internships for underrepresented groups and from minority-serving institutions.

Encourage individuals from underrepresented groups to participate in LTAR leadership activities.

Reinforce training opportunities in strategies to enhance the network's DEIA.

### External: Network Partners and Stakeholders

Develop strategies to quantify the level of current network interactions and increase interactions with underrepresented and historically underserved groups.

Strengthen research partnerships with minority-serving institutions, including Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), and Asian American and Pacific Islander Serving Institutions (AAPISIs).

Work with the National Institute of Food and Agriculture (NIFA) to leverage its 1890 Land-Grant Institutions Programs as means of strengthening and/or establishing partnerships with HBCUs and to strengthen and/or establish partnerships with HSIs.

Work with the USDA Office of Tribal Relations and NIFA to strengthen and/or establish partnerships with 1994 Tribal Land-Grant Colleges and other tribal entities.

Seek opportunities to collaborate with academics and/or practitioners already engaging with underrepresented and/or historically underserved groups.

Develop, as needed, communication approaches and materials that are inclusive, such as Spanish language materials and presentations.

## Outputs

Create an LTAR DEIA statement that confirms the network's commitment to DEIA and addresses how LTAR's mission will contribute to enhancing DEIA.

Annual survey of LTAR leadership for participation of underrepresented groups.

Annual survey of LTAR early career positions for participation of underrepresented groups.

Conduct a network survey to document successes and barriers to enhancing DEIA internally and externally.

Written materials on partner/stakeholder engagement best practices to guide LTAR community members in their engagement efforts.

Creation of an annual award for DEIA progress.

## Metrics of Success

Increased participation of individuals from underrepresented groups in LTAR leadership positions.

Increased representation and retention of individuals from underrepresented groups in early career scientist and new hire positions.

Increased number of partnerships with minority-serving institutions, including activities such as grant proposals, internships, co-authorship on publications, and joint workshops.

Increased engagement with new partners/stakeholders, including those from underrepresented and historically underserved groups, in research and advisory activities.

## Roles and Responsibilities

LTAR leadership will seek to establish a DEIA working group that will have responsibility to initiate crafting of a network statement, develop an assessment and tracking strategy to augment LTAR annual reporting, and develop engagement/recruiting strategies with support of LTAR Site Leads.

# Initiative 7: Designing Strategies for Communication and Co-Production

## Summary

Develop protocols and procedures, in collaboration with communication specialists and human dimensions experts, to disseminate research results effectively and to engage stakeholders in research co-production.

## Rationale

To be successful, the LTAR network must regularly articulate the value of long-term research distinguishing LTAR from other agricultural research investments; communicate LTAR innovations with the broader community; and engage with diverse stakeholders to co-produce research and innovations. In addition, strong internal communication is critical to fostering collaborations across sites and disciplines and to ensure that research opportunities, information, and updates are equally accessible to all participants. To meet these needs, network communication efforts will be guided by a comprehensive communication plan with activities and messages tailored to specific audiences. For example, members of the media and the general public have an increasing interest in understanding the relationships among food production, environmental concerns, and human well-being that require translational communication materials with relatable stories showing why LTAR science matters to people's lives. USDA scientists, producers and landowners, industry stakeholders, extension staff, agency personnel, and environmental and conservation organizations, should engage frequently with one another. A successful communication effort should ultimately increase the uptake and application of LTAR network science across diverse agricultural systems.

## Objectives

Define the targeted audiences and the appropriate communication tools for respective stakeholders and partners.

Expand capacity for science communication and stakeholder engagement at site and network levels and make a shift from a largely volunteer effort led by scientists to a full-time science engagement and communication program.

Enhance internal network communication to support network-wide collaboration, ensure equitable access to network information and opportunities, and efficiently share lessons and best practices across the network.

Strengthen external communication to target audiences in compelling formats that meet their needs and ensure access to research products by historically marginalized groups.

Build understanding of stakeholder engagement, two-way exchange, and knowledge co-production as well as its applicability to the network.

## Strategic Actions

### Expand capacity

Establish centralized network support by communications professionals with experience in social science and stakeholder engagement to implement the communication plan and facilitate engagement between scientists, customers, and ARS, USDA, and partner communication teams. This team will have continuous interaction with LTAR network leadership and scientists and knowledge of current research objectives and outcomes.

Develop an LTAR communications plan that includes clear communication goals for each non-LTAR audience and supporting messages, tactics, and dissemination channels. The plan should address the identified targeted audiences, methods of communications, recommendations for training, and specific staff workflows. The plan should be guided by a logic model and a clear theory of change for achieving impact with LTAR science.

## Internal Communications

Initiate an LTAR Network e-newsletter.

Sustain annual meetings and workgroup meetings related to the shared science focus projects. Seek to develop a pool of workshop funds that working groups can apply for.

Conduct annual internal surveys to assess LTAR needs and evaluate use of communication tools like Basecamp and the proposed e-newsletter.

## External Communications

Develop communication products based on the new communications plan and align messages, products, and tactics with well-defined communication goals. Products could include videos, social media posts, highlights, digital teasers, as well as usable tools, practices, and products.

Develop an operational plan for how the website is administered, how web content is authored and vetted, and approval processes. This should include a plan and guidelines for social media.

Convene quarterly meetings with the communications offices in ARS, USDA partners, and members of the LTAR Executive Team and Communication Strategies and Human Dimensions working groups to strengthen collaboration and target LTAR communications for distribution to customer agency communications teams and professionals.

Hold an annual symposium in Washington D.C., to highlight research advances and discuss research priorities with Federal agency partner. Couple the event with an educational event for members of Congress.

Develop and share tip sheets with sites for how to host annual field tours and site visits for members of Congress and other stakeholder tours.

## Two-Way Engagement and Knowledge Co-production

Catalog and understand the purpose of stakeholder groups and stakeholder engagement that already exist across the network.

Explore the role of a national stakeholder group to advise on relevant questions and research uptake.

Provide a "toolkit" for sites on how to organize local stakeholder workshops, high-quality presentation materials, and practices to encourage two-way exchange.

Convene workshops/projects on the theory and practice of science communication, stakeholder engagement, and knowledge co-production for LTAR scientists; this could include collaboration with outside organizations.

Develop metrics and undertake tracking and assessment to evaluate engagement and communication strategies and adapt them over time as needed to achieve communication goals.

## Outputs

Communications staff in a central LTAR network office to augment efforts of the Communications Strategies working group as well as investment in site-level communications.

New training workshops and communication products based on a communication plan.

A set of metrics to test, track, and evaluate communication efforts that assesses:

Who is accessing LTAR research, tools, and products, how are users accessing these resources, and what type of engagement is the network receiving (e.g. more inquiries, more web traffic, new partnership)?

Which topics were most popular with our customers and how was information used?

A system for tracking and assessment to adapt engagement and communication strategies over time as needed to meet communication goals.

## Metrics of Success

Increased interdisciplinary collaboration among LTAR scientists resulting from strengthened internal communication.

More use of LTAR science by decision makers and incorporation into best-management practices, cost-share programs, regulations, and recommendations.

Producers see themselves as partners in the research who benefit from the results and apply and share what they learn.

Increasing use of LTAR science, data, and insights in external media and scientific publications.

## Roles and Responsibilities

The communication and engagement initiative should be a joint effort by ONP and LTAR Executive Team in collaboration with the Communication Strategies, Human Dimensions, and Data Management working groups and the communication team expected to be established under this plan.

Technical assistance with producing digital content could be pooled from ARS/USDA offices of communications and university partners.



Photo courtesy of USDA, ARS

# Part III:

## Outcomes

### Near-Term Network Outcomes

The LTAR network is recognized as a national leader in agroecosystem research that addresses complex problems related to agricultural productivity, sustainability, and resilience in a changing world.

The network engages in research co-production to generate influential research products, innovations, tools, and solutions that are applied on the ground across diverse landscapes and incorporated into education, policy, and public discourse.

Network research provides a robust framework to assess the provision of ecosystem services and rural societal outcomes.

The network has a robust data management system with network-wide participation and a user-friendly interface that facilitates routine use of network data by scientists, producers, and policymakers in research, management, and decision making.

The network is a trusted and frequently referenced source for information on climate change mitigation and adaptation strategies at local to national levels and for a broad range of stakeholder types.

The network supports productive careers for diverse and highly engaged members, effective shared platforms for work, and a corps of centralized support staff that enhance collaboration, communication, and data management.

### Long-Term Societal Outcomes (10–20 years)

Agricultural stakeholders are well informed about the costs and benefits of agricultural practices and use scientific knowledge in decisions.

Scientific knowledge and direct involvement is accessible to increasingly diverse stakeholders and communities.

LTAR science is produced by an increasingly diverse workforce.

Open data produced by the LTAR Network are findable, accessible, interoperable, and reusable.

LTAR network science supports climate change mitigation and adaptation strategies at local to national levels.

Agricultural practices adopted based on LTAR network science have demonstrable positive effects on production, environmental outcomes, rural communities, and climate mitigation and adaptation.

# Part IV: Implementation



## Proposed Funding Priorities

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Establishment of a centralized LTAR network office with support for network coordination, data management, science communication, and engagement.

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Increased site funding as needed to establish equity across all existing sites.

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Funding for new sites with a priority on filling key gaps in geography and agroecosystem representation.

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Funds to support working groups, including in-person meetings with a focus on proposal development to advance shared science initiatives and research associates to carry out short-term projects.

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Development/training funds for workshops and training on logic model and theory of change, co-production of knowledge, DEIA, and science communication.

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## Research Initiatives

Initiative	Phase 1	Phase 2
<b>#1 - Indicators framework</b>	<p>Hold Indicators working group meeting to review initiative.</p> <p>Establish planning subcommittee for joint meeting with ONP, site leads, data management working group, and communication strategies working group.</p>	<p>Hold joint meeting with relevant working groups and develop detailed action plan.</p> <p>Develop and engage with stakeholder groups.</p> <p>Prioritize indicators for network-wide research targets that can be implemented within current funding levels.</p>
<b>#2 - Climate-Smart Science</b>	<p>Establish new Climate-Smart Innovations working group.</p> <p>Draft action plan with tasks, roles, and timelines.</p>	<p>Post action plan internally and present at LTAR leadership and all meetings.</p>
<b>#3 - Science to Adoption</b>	<p>Convene meeting of Human Dimensions working group.</p> <p>Draft action plan with tasks, roles, and timelines.</p>	<p>Post action plan internally.</p> <p>Plan workshop on participatory research and co-production.</p> <p>Develop and engage with stakeholder group.</p>

## Organizational Initiatives

Initiative	Phase 1	Phase 2
<b>#4 - Network-Building</b>	<p>Form a steering committee including members from ARS leadership &amp; LTAR Executive Team to develop a plan for establishing a network coordination office.</p> <p>Executive Team/ONP recommend equitable funding plan for all existing sites.</p>	<p>Executive Team/ONP define priorities for new sites, funding needs, and timeline for bringing sites online.</p> <p>Executive Team convenes a series of meetings with working group that lead to defined best practices.</p>
<b>#5 - Data Management</b>	<p>RDAT develops an action plan for data management, with framework, tasks, roles, resource needs, and timelines.</p>	<p>RDAT develops a proposal with plan of work, resource needs, and hiring needs.</p> <p>Hire network data manager (pending funds) and establish process for central and site governance of data management.</p> <p>Establish a framework for data flow.</p>
<b>#6 - DEIA</b>	<p>Establish a DEIA working group with a charter, co-chairs, and membership.</p> <p>Develop an action plan with tasks, roles, and timelines.</p>	<p>Collect DEIA statements and guidance documents from other science networks.</p> <p>Draft an LTAR DEIA statement.</p> <p>Draft surveys and assessments outlined in the initiative.</p>
<b>#7 - Communications &amp; Co-production</b>	<p>Communications Strategies working group meets to review initiative.</p> <p>Draft action plan with task, roles, and timelines.</p> <p>Work with LTAR coordinator to develop an LTAR e-newsletter using LTER as example.</p> <p>Plan quarterly meetings with USDA and ARS communications staff.</p>	<p>Working group drafts a proposal with scope of work and budget for consulting contract for communications plan and shares with Executive Team.</p> <p>Working group drafts a list of wants and needs for a potential new communications staff position and share with Executive Team.</p> <p>Design internal survey of communications needs.</p> <p>Develop list of wants and needs and scope of work for updating the LTAR website.</p>



# Appendix

## Appendix A: Plan Development Process

Strategic plans communicate the direction of an organization and identify how resources will be allocated to achieve a desired future state. The strategic plan for LTAR is designed to facilitate the network's evolution from an exciting start-up to a mature organization that delivers positive agricultural outcomes for society. LTAR, whose origins date to 2012, established its initial directions via a Shared Research Strategy that described network goals and activities needed to achieve them. LTAR has now expanded beyond its beginning framework and an evolving vision for development is needed. We envision this strategic plan to guide the network for the next decade and to be updated in 5 years. It is important to note that the plan is both actual and aspirational in the sense that some of what is described can be initiated now, but other outcomes are contingent on expanded support.

### The LTAR network strategic planning process engaged researchers and stakeholders to:

1. define a networkwide vision,
2. prioritize resource allocation,
3. develop evaluation metrics, and
4. differentiate the network from its peers.



### The LTAR strategic planning process timeline.

Interviews and surveys of site and working group leads	August 2021
Summary report of network strengths and challenges	August 2021
Leadership team workshop to refine challenges and draft strategic priorities	August 2021
Interviews with seven external stakeholders	August-October 2021
LTAR networkwide workshop during the Annual Science Meeting to define strategic initiatives	September 2021
LTAR leadership team meetings to refine strategic initiatives	September-October 2021
Draft strategic plan with facilitators and writing team	October-January 2021
Feedback on draft strategic initiatives from	December 2021
Senior level review of draft plan	January 2022
Final leadership team meeting	January 2022
Presentations of strategic initiatives to LTAR community	January-July 2022
Strategic Plan editing and summary publication development	March 2023
Final editing by Office of National Programs, lead authors, and final approvals	April 2024

To support the strategic planning process, a team of consultants (Kathy Fallon Lambert and Patrick Field) was hired in 2021 to facilitate the process and assist with writing the plan. The plan followed a common process used by many organizations, starting with a comprehensive scan to define the strengths and challenges of the network. From this scan, an initial report with key themes highlighting strengths and challenges was produced. The LTAR leadership team used these themes to define a set of seven strategic initiatives as well as near-term network outcomes and desired long-term societal outcomes. The network's mission, vision statements, and supporting strategic goals were updated by the writing team. The process included the elements below. The end result is the plan herein, intended to guide network activities for the decade beginning in 2022.

## Appendix B: LTAR network working groups in 2024

### Research and Measurement Groups

Working Group	Purpose
Agroecosystem Erosion	Develop systems to support wind and water erosion management across U.S. agroecosystems
Biology	Develop protocols for, and lead collection and analysis of, network-wide biological measurements
Common Experiment: Cropland	Develop production systems that promote the sustainability of cropland agriculture
Common Experiment: Grazingland	Develop production systems that promote the sustainability of grazing land agriculture
Drainage	Reduce the ecological impacts of agricultural production intensified by tile drainage
Eddy Covariance	Support collection and publication of land-atmosphere flux data using the eddy covariance method
Human Dimensions	Incorporate understanding of the cultural, economic, and social aspects of agroecosystems
Indicators	Build and improve indicator frameworks to evaluate the performance of agricultural innovations
Manureshed	Identify and evaluate solutions to uneven nutrient distribution in agriculture

### Research and Measurement Groups (continued)

Working Group	Purpose
Modeling	Facilitate the application and testing of natural resource models across the network
Non-CO <sub>2</sub> Gases	Develop standard measurement procedures to advance the science of non-CO <sub>2</sub> greenhouse gas mitigation
Phenology	Devise tools and research for monitoring growing season dynamics from field to satellite
Remote Sensing/GIS	Address agroecosystem problems using remotely sensed data, GIS, and related spatial information and techniques
Resilience	Cogenerate critical collaborative priorities for application of resilience science to agroecosystems
Soils	Understand and predict the impacts of management and environmental factors on agricultural soils
Stakeholder Engagement	Facilitate site and network level stakeholder engagement
Water Quality	Improve water quality and aquatic ecosystem services while enhancing agricultural productivity
Water Quantity	Facilitate hydrologic measurements and promote network research efforts connected to water quantity
Weather/Climate	Collaborate to develop weather and climate information and tools for agroecosystem management

### Network-Level Support Groups

Working Group	Purpose
Communication	Disseminate network research to stakeholders and broader audiences via clear and concise media products
Data Management	Organize network data and information systems aligned with FAIR principles and USDA policies





## More Information

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