The Long-Term Agro-Ecosystem Research (LTAR) Network

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By 2050, agriculture will need to:
• Supply enough food, feed, fiber, & fuel to support a global population of 9 billion people;
• Without depleting our natural resources or degrading our environment;
• Against a background of changes in climate that are expected to alter patterns of temperature and precipitation on which the world’s food production systems depend.

These challenges threaten our food security & the availability of fresh water for a variety of needs.
• 25% of Earth’s lands are already degraded.
• More than ¾ of the 70% increase in global food production needed by 2050 will have to come from the ‘sustainable intensification’ of existing agricultural lands (FAO 2011).
Recent Calls for the Creation of Such a Network for Agro-ecosystems (Walbridge & Shafer 2011) (Similar to NSF’s LTER network for Non-Managed Ecosystems)

- Infrastructure to enable research on agricultural processes from field to landscape scales;
- To support long-term investigations into key components of the sustainable intensification of agricultural production;
- Historical data records would provide a baseline against which to evaluate future changes;
- Collect common datasets using shared research protocols over the next 30-50 years—likely representing the most important datasets collected by such a network.
Existing ARS Infrastructure That Could Be Used To Start Such a Network.
Given the Current Fiscal Climate, Receiving Appropriations of the Magnitude Necessary to Establish Such a Network From Scratch Was Unlikely.

- ARS already had significant relevant infrastructure in place (experimental watersheds and rangelands).
- As USDA’s primary intramural agricultural research organization, ARS has sustained, long-term appropriations that could be used to start such a network.
- We felt that the best way to realize such a network for the agricultural research community as a whole was to step up and make the initial commitment.
In Feb. 2012, ARS Announced the Organization of 10 Existing Experimental Watersheds, Ranges, & Research Farms Into an LTAR Network

Based on 7 Criteria:

1. **Productivity** – the team’s research track record;
2. **Infrastructure Capacity** – presence of an instrumented watershed or other long-term research facility large enough to capture landscape-scale processes;
3. **Data Richness** – the length, breadth, depth, and quality of the existing data record;
4. **Data Availability/Accessibility** -- organization and accessibility of existing data sets;
5. **Geographic Coverage** – how potential sites were distributed in terms of major agricultural production regions, watershed basins, and eco-climatic zones;
6. **Existing Partnerships** – with producers, other stakeholders, universities, etc.;
7. **Institutional Commitment** – to support continued site operation for the next 30-50 years.
THE PROCESS

• 21 ARS locations voluntarily submitted information to address these 7 criteria.

• The 21 applications were evaluated by an ad-hoc panel of experts, as guided by these criteria.

• The 10 sites chosen as the initial LTAR network were those recommended by this ad-hoc panel of experts.

• The organization of the LTAR network was formally announced via a USDA press release in September 2012.
LTAR Network Overview

- 10 sites
- Data Records: 12 (Pullman, WA) to 100 years (Las Cruces, NM and Mandan, ND)
- Area Covered (km$^2$): 0.57 (Pullman, WA) to 6,200 (Ames, IA)
- NEON Domains: 8 out of 17 (in lower 48 states)
- Major Drainage Basins: 8 out of 18 (in lower 48 states)
- Farm Resource Regions: 7 out of 9 (in lower 48 states)
Upper Mississippi River Basin LTAR

USDA-ARS, at Ames IA; St Paul MN, Morris MN, and Marshfield WI, and Pioneer Farm at the University of Wisconsin Platteville
Central Great Plains
(Rolling Wheat and Range)
Land Resource Area

GRL, El Reno & Langston
Research Watersheds

MLRA 78C Central Rolling Red Plains

MLRA 80A Central Rolling Red Prairies of central Oklahoma
Vision and Goal for an LTAR Network

• **Vision**
  - A sophisticated platform for trans-disciplinary research, conducted over decades on the land in different regions of the country;
  - Data collected would be geographically scalable;
  - Research would support the sustainable intensification of the production of agro-ecosystems goods and services.

• **Goal**
  To sustain a land-based infrastructure for research, testing of management options & alternatives, and education, that enables understanding and forecasting of the Nation’s capacity to provide agricultural commodities and other ecosystem goods and services under changing environmental and resource-use conditions.
LTAR Network Operating Principles

- Develop research questions that are shared and coordinated across sites.
- Provide the capacity to address large-scale questions across sites through shared research protocols.
- Collect compatible datasets across sites, and provide the capacity and infrastructure for cross-site data analysis.
- Facilitate and foster shared engagement in thinking and acting like a network.
Long Term Agro-Ecosystem Research Network

Shared Research Strategy

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Network Goals

- Ensure sustained crop and livestock production and ecosystem services from agro-ecosystems;
- Forecast and verify the effects of environmental trends, public policies, and emerging technologies.
Long Term Agro-Ecosystem Research Network

Shared Research Strategy

Four Priority Areas of Concern
1) Agro-ecosystem Productivity;
2) Climate Variability and Change;
3) Conservation and Environmental Quality;
4) Socio-economic Viability and Opportunities.

Four Key Products
1) New knowledge of processes & systems;
2) New technologies & management practices;
3) Improved agro-ecological models;
4) Comprehensive, accessible data.
Current Partners in the LTAR Network (http://www.ars.usda.gov/ltar)

- 60 colleges and universities
- 15 U.S. Government agencies
- 12 state government agencies
- 11 established research networks
- 25 non-governmental organizations
- 19 private industries or associated organizations
- 29 international collaborations
The LTAR Network is ARS’ Research Platform to Support Its Future Conservation Research

Enhance Linkages With CZO, LTER, NEON, and Other Networks

Address Key Gaps by Adding:

- Additional ARS sites that can increase capacity to meet criteria;
- Sites operated by other Federal agencies, colleges & universities, or other organizations that meet criteria:
  - E.g., USDA Forest Service
  - 2nd RFI Appeared in December 2012
  - Twelve Responses Received April 1, 2013
  - Proposals are Currently In Review by an Ad Hoc Panel of Experts.
Agriculture faces tremendous challenges over the coming century. Addressing these challenges will require transformative changes to agriculture. Establishing a long-term agro-ecosystem research network is an important component of understanding how to make these changes. The Agricultural Research Service has leveraged existing infrastructure and ongoing research as the foundation for an LTAR network for agriculture.
The LTAR Network’s long-term success will depend on...

- Partners...and lots of them
- Capacity building for NEON-inspired instrumentation and measurements
- Resources and policies for data management
- Funding for research itself in the network
- Wide interest and use of the network – not just natural resources
- University involvement – in existing locations, and for additional locations
- A spirit of partnership across locations and agencies