

The Long-Term Agro-Ecosystem Research (LTAR) Network: Status and Future Trends

*Agricultural Air Quality Task Force
College Station, Texas
August 21, 2014*

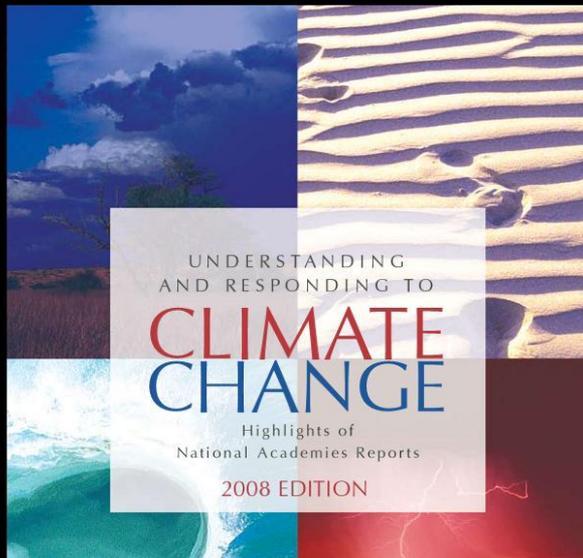
Dr. Jean L. Steiner

Director, Grazinglands Research Laboratory
El Reno, Oklahoma
LTAR Southern Plains Site



Agricultural Research Service

Pressures on Agriculture



Water and Climate Pressures



Drought



Drying lake

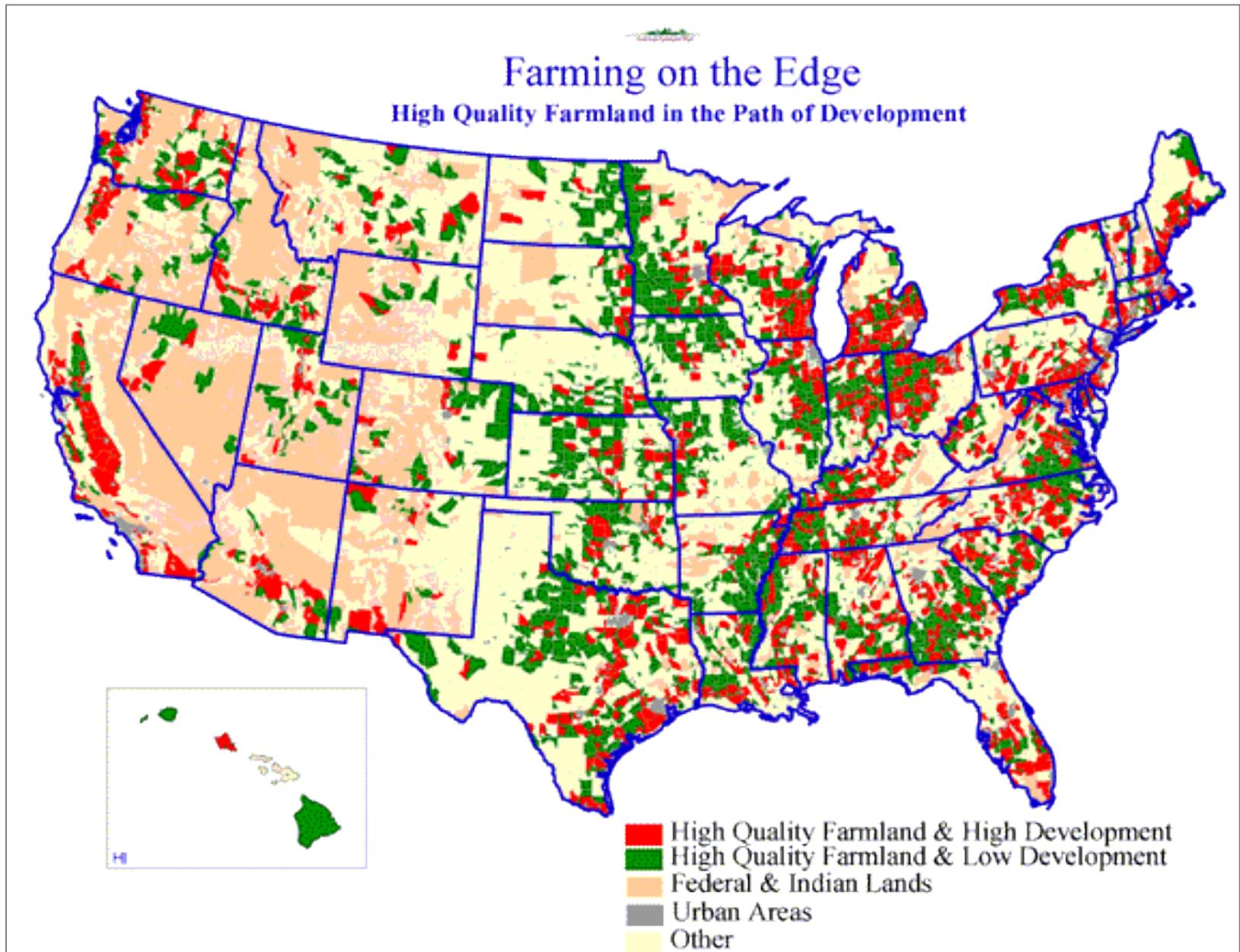


Wildfire



No Snow

Loss of Prime Farmland



Top 100 questions of importance to the future of global agriculture

(Pretty et al. 2010. Int. J. of Ag. Sustainability 8:219-236)

In light of:

Growing impacts of climate change.

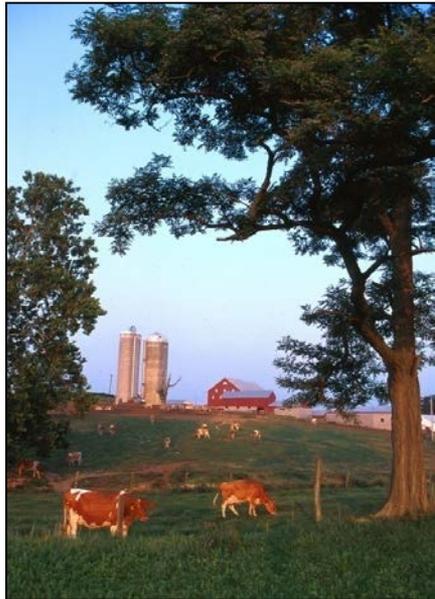
Concerns over energy security.

Regional dietary shifts.

**And the Millennium Development target of a 50%
reduction in world poverty and hunger by 2015:**

“Rather than simply maximizing productivity, the goal for the agricultural sector is to optimize productivity across a far more complex landscape of production, rural development, environmental, social justice and food consumption outcomes.”

Meeting these challenges require production systems and agricultural landscapes that:



Represent a significant departure from the dominant systems of present-day agriculture.

Capitalize on synergies, efficiencies, and resilience associated with complex natural systems and linked social, economic, and biophysical systems.

Integrate information about productivity, environmental, economic, and social aspects of farming systems to understand their interactions.

Address issues of resilience and vulnerability to changing climatic and economic conditions.

(NRC 2010)

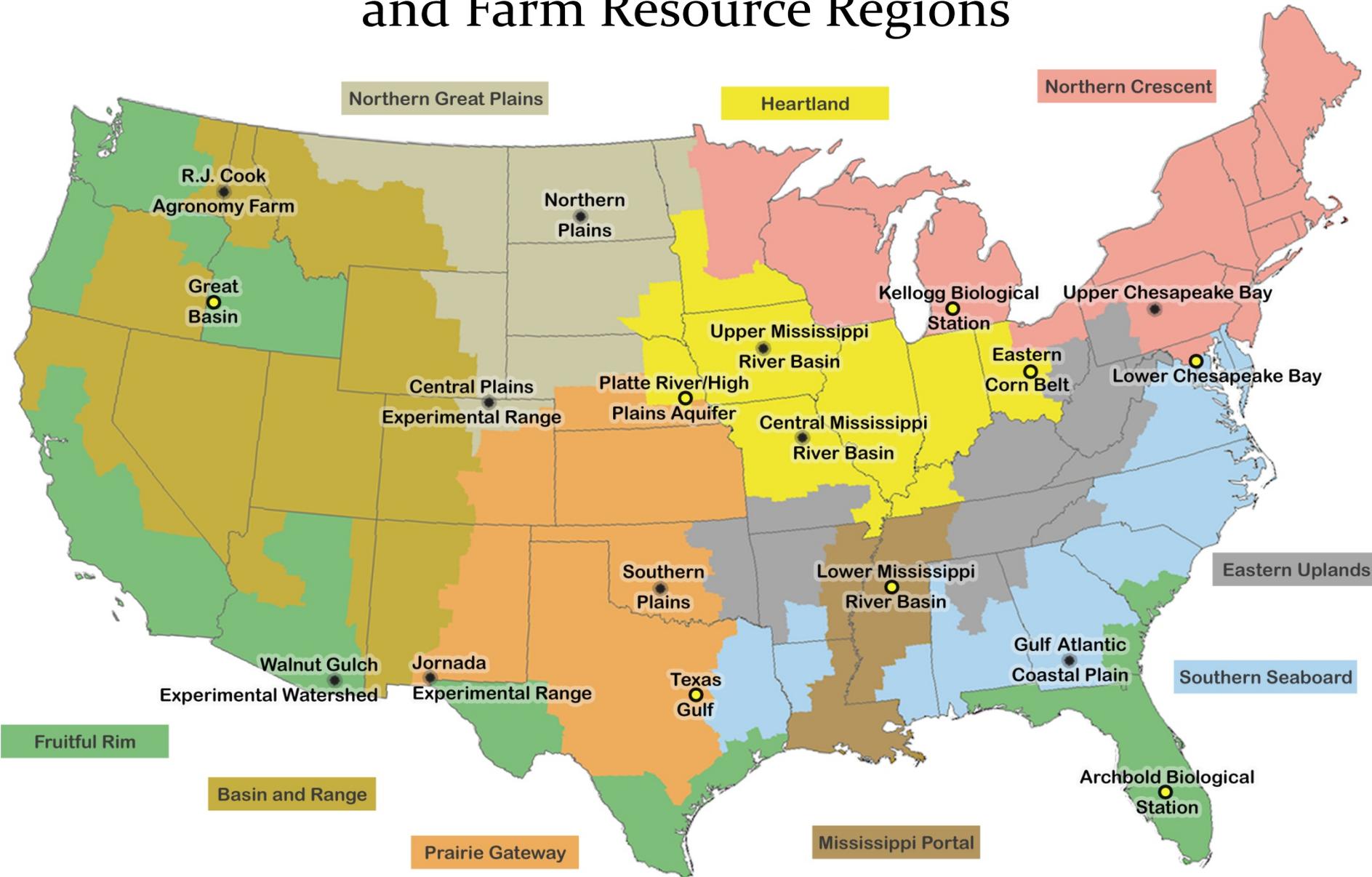
USDA Research, Education, and Extension Action Plan 2012

- “...in light of the many pressing challenges we face, it is time to renew our Nation's **commitment to maintaining and growing a progressive and innovative system of agricultural science.**”
- “.....priorities are clearly linked—in science, nature, and through the multitude of goods and services produced on our Nation’s working lands.”
- “These linkages between priority areas reflect **the inherent complexity of agricultural systems** and highlight our **need for even more interdisciplinary investigations** as we move forward.”

... REE Under Secretary and USDA Chief Scientist Dr. Catherine Woteki



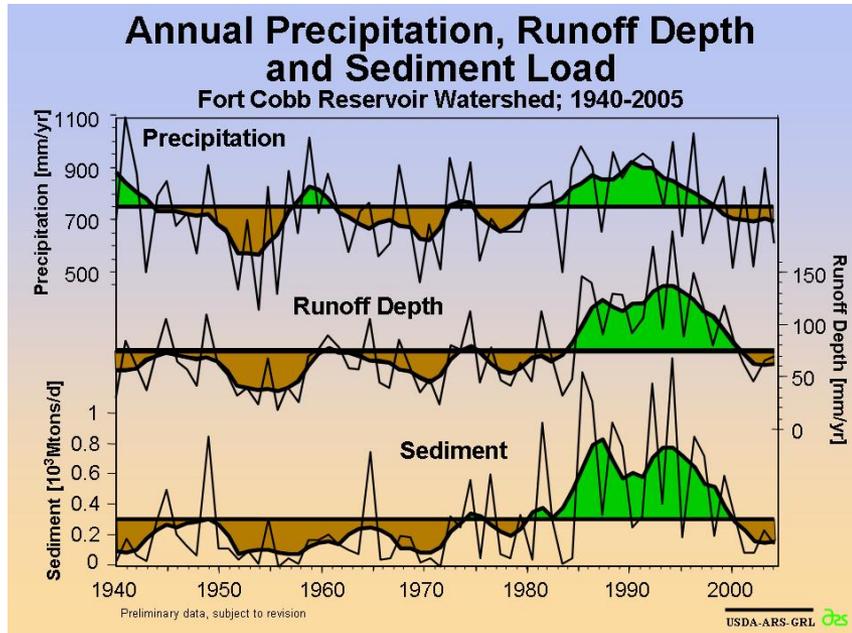
Long Term Agro-Ecosystem Research Sites and Farm Resource Regions



How Will a Long-Term Agro-Ecosystem Research (LTAR) Network Help Us Meet These Challenges?

- By helping us understanding **how key agricultural system components interact at larger scales** (e.g., watershed; landscape);
- By helping us anticipate the **environmental effects of shifting agricultural practices**;
- By helping us improve the **effectiveness of conservation programs**;
- By helping us identify the broader **societal benefits of modern agriculture** (e.g., bio-energy production; carbon sequestration; improved water quality & water-use efficiency; wildlife habitat).

Why Long Term Studies?

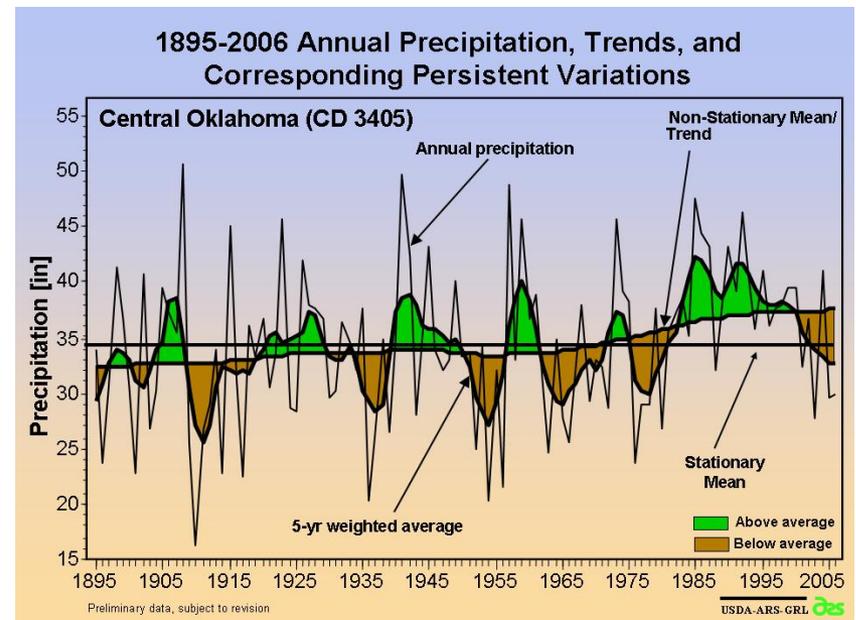


Variable and changing climate

- Multi-year persistence of climate
- Long term climate change

Slow-occurring processes

- Soil degradation or restoration
- Vegetative community degradation or restoration
- Land use change



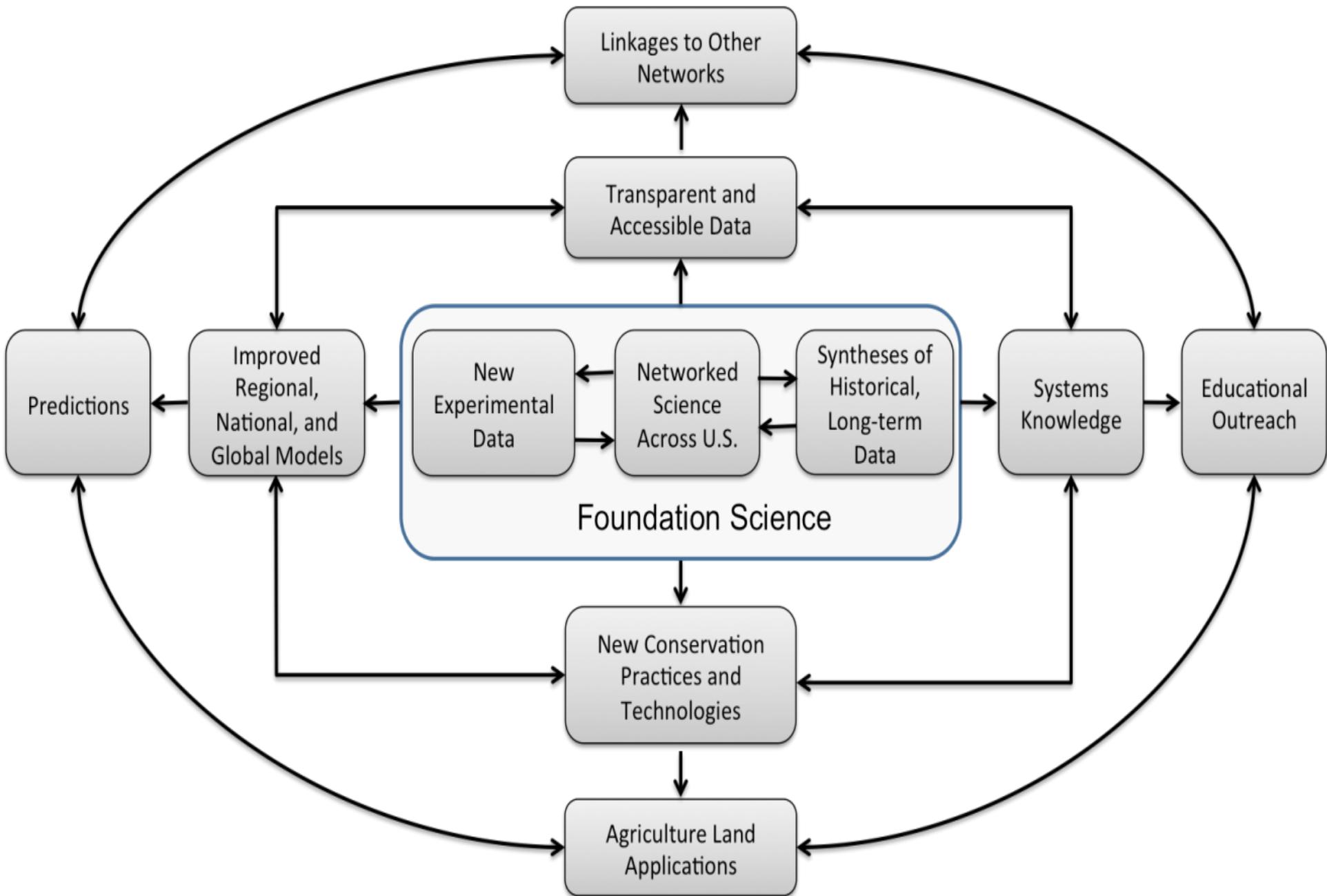


Long Term Agro-Ecosystem Research Network

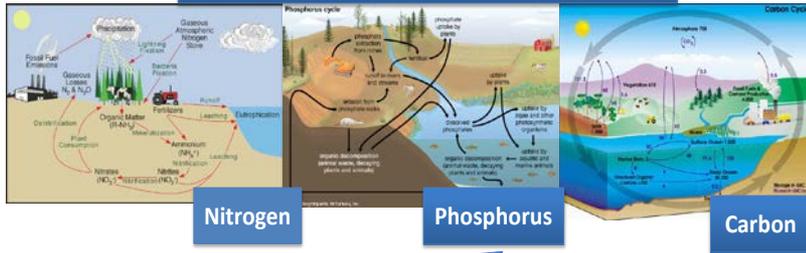
Shared Research Strategy (www.ars.usda.gov/ltar)

Priority Areas of Concern

- Agro-ecosystem Productivity
- Climate Variability and Change
- Conservation and Environmental Quality
- Socio-economic Viability and Opportunities



Nutrient cycles

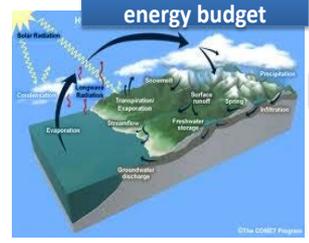


Nitrogen

Phosphorus

Carbon

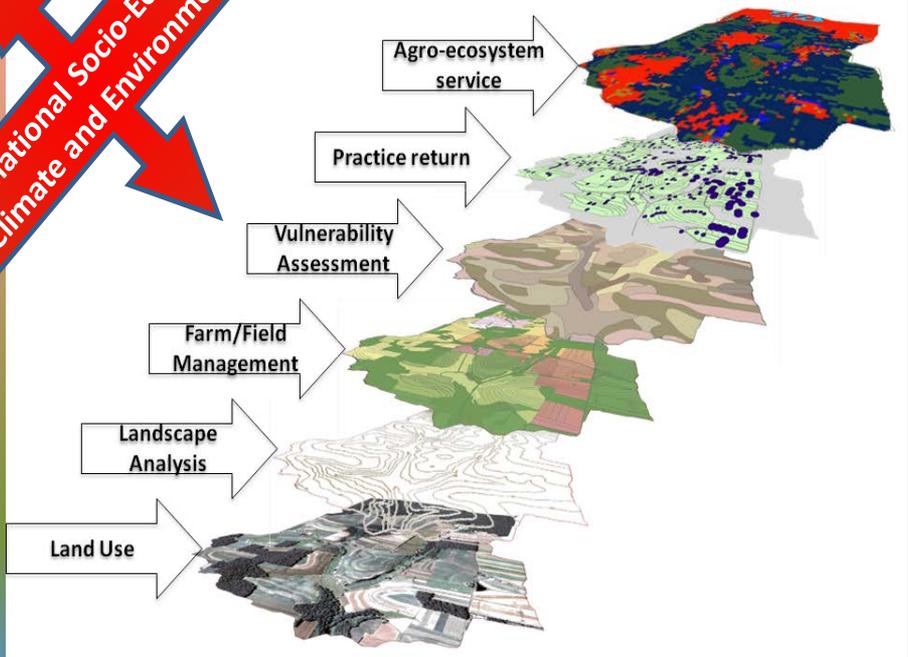
Hydrologic cycle and energy budget



Net primary production

Crop and Livestock Production

Technology Advancement; Local-to-International Socio-Economic Preference; Policy and Regulation;
 Climate and Environment



LTAR Sites Will

- **Collect a core set of common measurements;**
- **Participate in an annual LTAR network meeting or workshop;**
- **Encourage partnerships;**
- **Seek extramural funding to support long-term research;**
- **Undergo a site review every 5 years.**

What Is the Central Question That the LTAR Network Addresses?

How Do We Sustain or Enhance Productivity, Profitability, and Ecosystem Services in Agro-ecosystems and Agricultural Landscapes?

May 28-29, 2014 LTAR Network Meeting in Nunn, CO



ARS FY14 Budget added \$10 M for the LTAR network.

Next Steps – Site Partners

- Pair new and existing LTAR to
 - share information and resources;
 - provide background on the earlier organization and development of the LTAR network.

Low Hanging Fruit

- **Leverage ongoing research efforts at LTAR sites**
- **Link related efforts toward broader LTAR objectives**
- **Move toward standardized methodology and methods**

Straw Management and Crop Rotation

Alternatives to Stubble Burning:

Assessing Economic and Environmental Trade-offs

Dave Huggins, Soil Scientist,
USDA-ARS

Cook Agronomy Farm
LTAR



- Assess wheat stubble burning effects on: residue C and nutrient (N, P, S) losses, soil organic matter, soil erosion, soil condition index
- Assess crop sequences that benefit from retaining wheat residues in no-tillage systems







Assessing impact of changes in land management practices on dust emissions

Assessing soil and carbon loss in the field and with the Wind Erosion Prediction System (WEPS)

Brenton Sheratt
Pullman, lead



Wind Erosion Modeling

Horizontal flux
(saltation)



Vertical flux (dust)



Jeff Herrick,
Las Cruces, lead

Model Calibration

Requirements

AIM Core methods

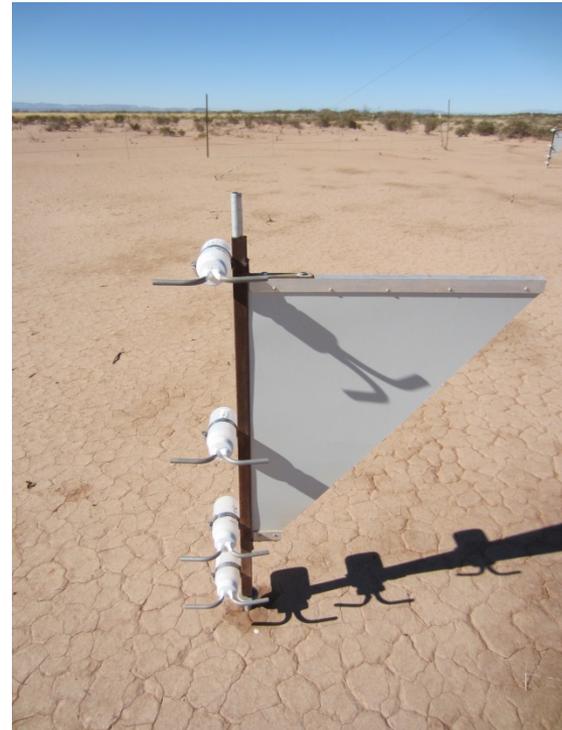
20k equipment

More frequent site visits
(4x/year) than for
monitoring

LTAR: 6 initially, with more
to be added

BLM: 4

Will invite others (e.g. USGS,
DOE)



[MWAC samplers]

Social Science: Better understanding of the social factors that contribute to system vulnerability and resilience.



Next Steps (cont.)

- Cross-Site Denitrification Research
- Design the Observatory Component of LTAR
 - NEON-comparable infrastructure (i.e., sensors)
 - Linked across LTAR sites (and with the Forest Service's Smart Forests network) and accessible via the web

Next Steps (cont.)

- Design a 'Cross-Site Sustainability Experiment' that addresses LTAR's central question.
- Implement GRACEnet across all LTAR sites within the next two years.
- Sponsor a symposium at the AGU Annual Meeting in San Francisco, CA (Dec. 2014)

- Key Products over the next two years:
 - Revised Shared Research Strategy to update information regarding the 8 new LTAR sites;
 - A *BioScience* article;
 - A paper on rainfall intensity/soil erosion, based on existing data across the LTAR sites;
 - A review paper on inter-annual productivity variations across LTAR sites.

Technological Issues That LTAR Will Address

- Data Archiving, Storage, & Management
- Big Data
- Dealing With Sensor-Driven Observatory Data Streams
- Moving From Individual Site Data Base Management Issues to Network-Wide Data Base Management Issues

A satellite view of Earth showing the Americas, with the text "LTAR: Fostering Collaboration" overlaid. The image shows the Western Hemisphere, including North and South America, surrounded by the Atlantic and Pacific Oceans. The text is centered over the continent of North America.

**LTAR:
Fostering Collaboration**

Thank You!

