

Towards Sustainable Agroecosystems: The ARS Long-Term Agro- Ecosystem Research (LTAR) Network

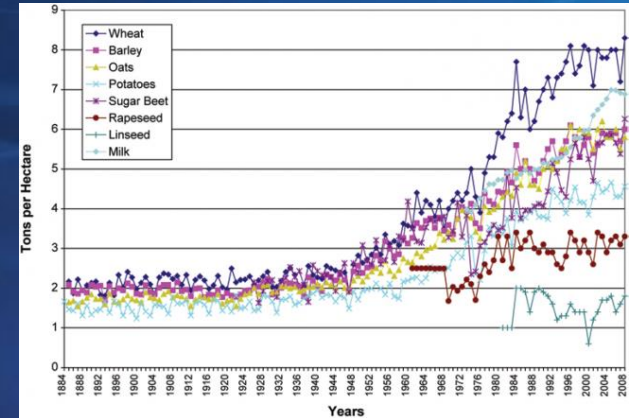
CHARLES L WALTHALL PHD

NATIONAL PROGRAM LEADER

USDA AGRICULTURE RESEARCH SERVICE

Agriculture Marches On:

- Industrial Revolution
 - Mechanization
- “Green” Revolution
 - Genetics, Irrigation, Fertilizers
- Information Revolution
 - Precision Agriculture, Models, Decision Support
- ***Multifunctional Landscapes***
 - Ecosystem Services

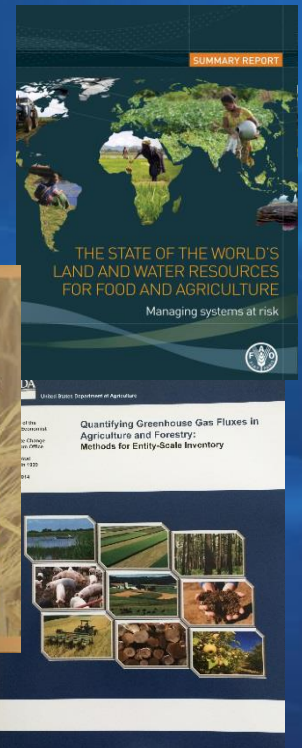
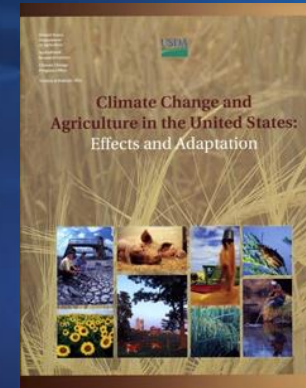


Alston, Babcock & Pardey (eds), 2010

But.....New Challenges

Agriculture must transform itself.....

- **INTENSIFY RAPIDLY**
- **RESPOND TO STRESS and OPPORTUNITY**
- **BE SUSTAINABLE***



*Goals

- Satisfy human needs for **YIELD QUANTITY & QUALITY**
- Enhance **ENVIRONMENTAL QUALITY** & the resources base
- Sustain **ECONOMIC VIABILITY** of producers
- Enhance the **QUALITY OF LIFE** for rural populations & society

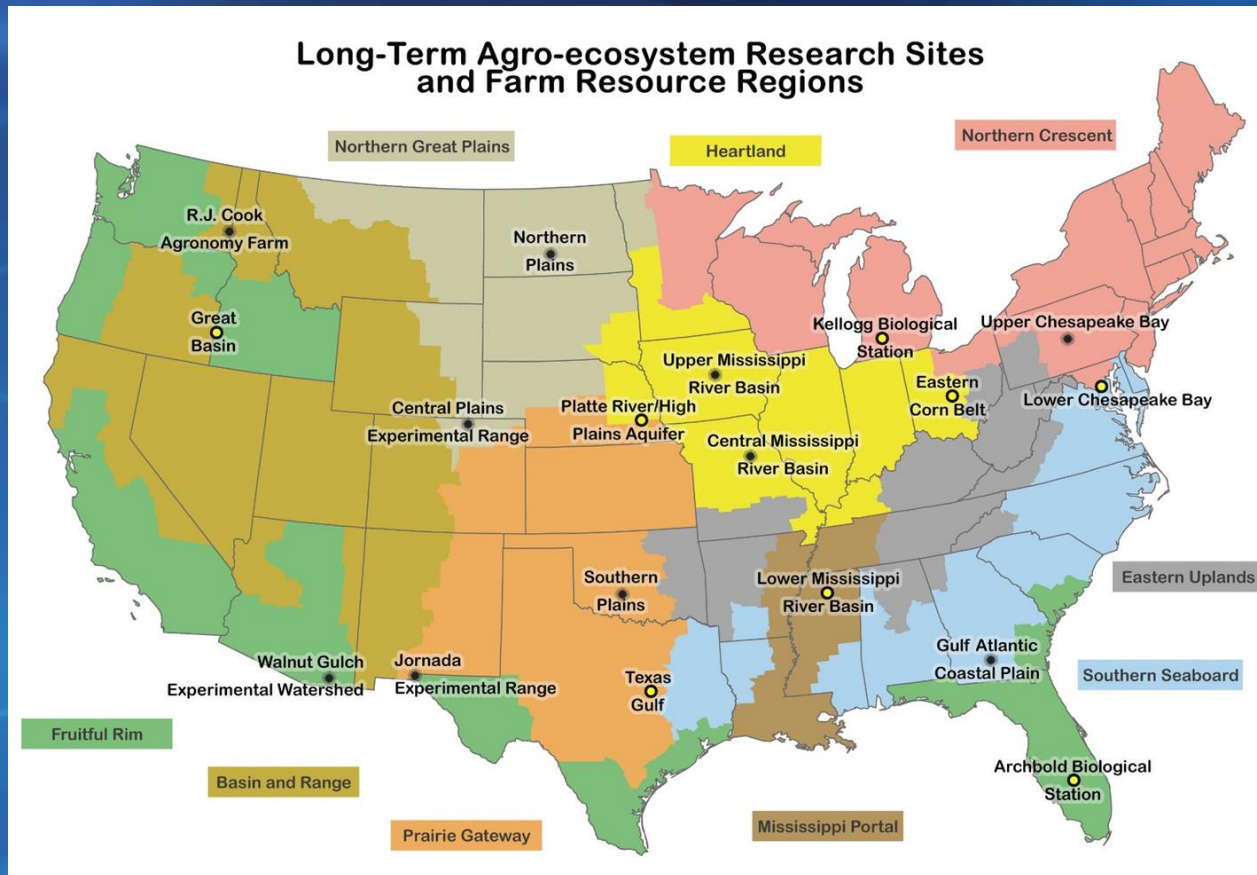
Long Term Agroecosystem Research Network

Crop
Systems

Data
Systems

Livestock
Systems

Shared
Resources



Vision: "Sustainable agro-ecosystems providing goods and services"
(Walbridge & Shafer, 2011)

LTAR: A RESEARCH NETWORK

- Purpose: “*sustain* a land-based infrastructure for research, education, and outreach...”
- Mission: “*enable* understanding & forecasting of capacity to provide agricultural commodities & agroecosystem goods & services under changing conditions”.

Bottom Line Questions:

Are current *Business-as-Usual* systems sustainable?

Are new, innovative, *Aspirational* systems sustainable?

What metrics indicate this?

Shared Research Strategy

Data/Metrics/Indices

- **Measurements, Models**
- **“Barrier”** identification and elimination
- **Resistance, Resilience, Flexibility:**
exposure, sensitivity, capacity to adapt
- **Soil, Plant/Animal, Atmosphere**
 - *Productivity; nutrient, energy, water use efficiency; soil health; soil erosion; water quality; water availability; gaseous emissions; biodiversity....*

What do the data, model projections, indicators, etc. tell us about the sustainability of the system?

Shared Research Strategy

Concerns

- **Factors** controlling stability (resistance to change) & recovery from negative impacts (resilience)
- **Processes** affecting productivity & other ecosystem services
- **Consequences** of decision-making at multiple scales (farmer to policy) on sustainability

Approach via Genetics x Environment x Management

*Nothing about the LTAR makes
sense without attention to
sustainability.....*

*Yield
Environment
Economics
Quality of Life*

Charles L. Walthall PhD

National Program Leader
Natural Resources & Sustainable Agriculture Systems
USDA Agricultural Research Service
Office of National Programs
5601 Sunnyside Avenue
Beltsville, MD 20705
Email: Charlie.walthall@ars.usda.gov

http://www.ars.usda.gov/research/programs/programs.htm?np_code=211&docid=22480


<https://ltar.nal.usda.gov/>

Long-Term Agro-ecosystem Research (LTAR) network

Sustaining US Agricultural Production and Ecosystem Services through 2050

How can US agriculture be intensified in a sustainable fashion?

- 1) What factors drive agricultural productivity and its environmental impacts?
- 2) What are the tradeoffs between productivity, product quality, societal preferences, and ecosystem services?
- 3) What are the barriers to sustainable intensification?
- 4) How do we better target our use of resources?
- 5) What technologies and management strategies are needed for agriculture to be resilient to extreme events (e.g., weather, disease outbreaks, pest infestations)?
- 6) What scientific synthesis products are needed for decision making?



Collaboration including:
LTER, NEON,
Expt'l Forests,
Climate Hubs
GRACEnet,
CEAP REAP,
CZO,
AmeriFlux

LTAR investigates sustainable intensification by comparing
Business as Usual with Aspirational
management of Croplands and Rangelands

LTAR's research is supported by

Field Experimentation, Remote Sensing, Data management systems, Modeling, and Synthesis

**Above Ground Processes,
Functions and Outcomes**

NPP, Harvest Index and Quality,
energy/water/sediment/carbon
flux, biological diversity

**Below Ground Processes,
Functions and Outcomes**

Nutrient cycles/fertility,
biology/ecology/pathology,
GHGs, water availability

**Watershed and Landscape
Processes and Services**

Micrometeorology, hydrology,
water quality, detoxification,
biodiversity, habitat availability