

CLIMATE CHANGE RESEARCH

Selected Initiatives at ARS and USDA

Dr. Marlen Eve, Deputy Administrator

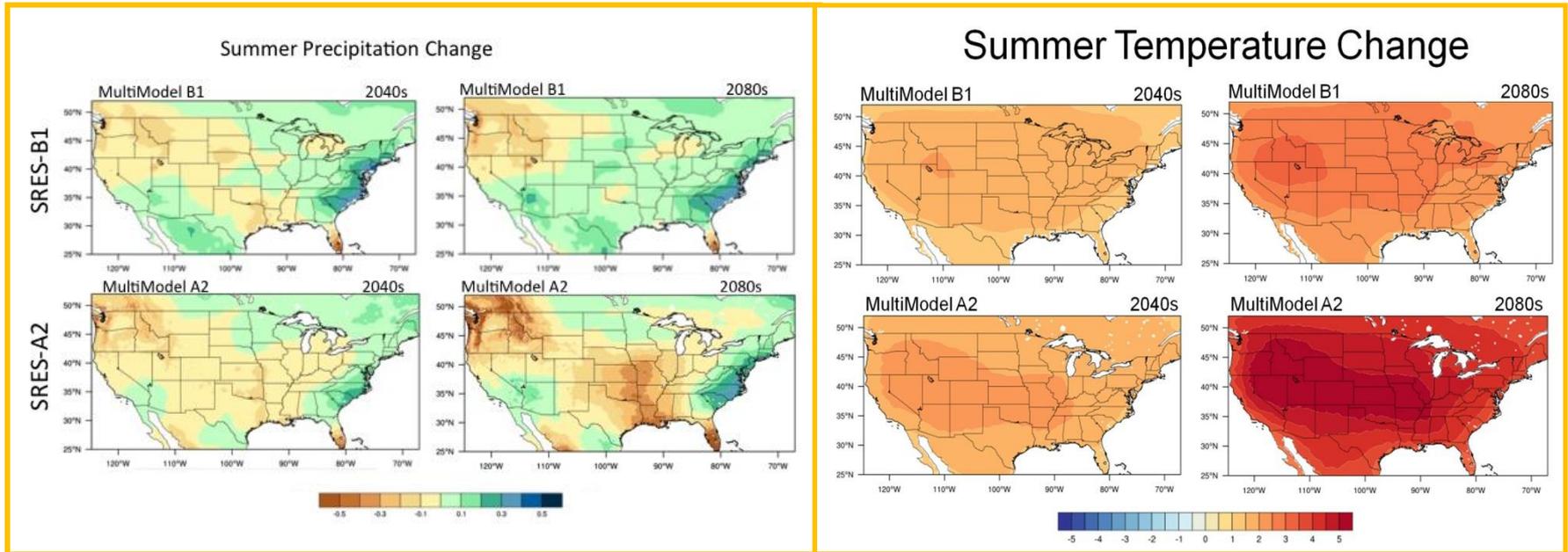
**Natural Resources & Sustainable Agricultural Systems (NRSAS)
USDA/Agricultural Research Service (ARS)**

**PROCINORTE Board of Directors Meeting
25-26 Oct 2018, Las Cruces NM**

Outline

1. Introduction
2. Long-Term Agroecosystem Research network
3. Regional Climate Hubs
4. Highlighted Research
5. AgCROS Data Management

Changing Climate Conditions

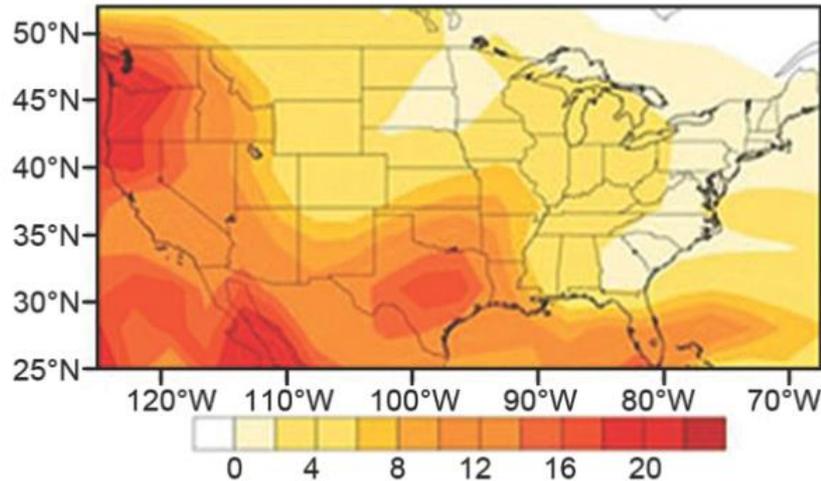


- Temperature* increases: longer growing seasons, less frost, warmer nights
- Precipitation* changes: deficits, excesses, timing shifts, changing mix of rain/snow
- Increased intensity of precipitation events*: more flooding and more droughts
- Increasing carbon dioxide concentrations

**Variability Increasing*

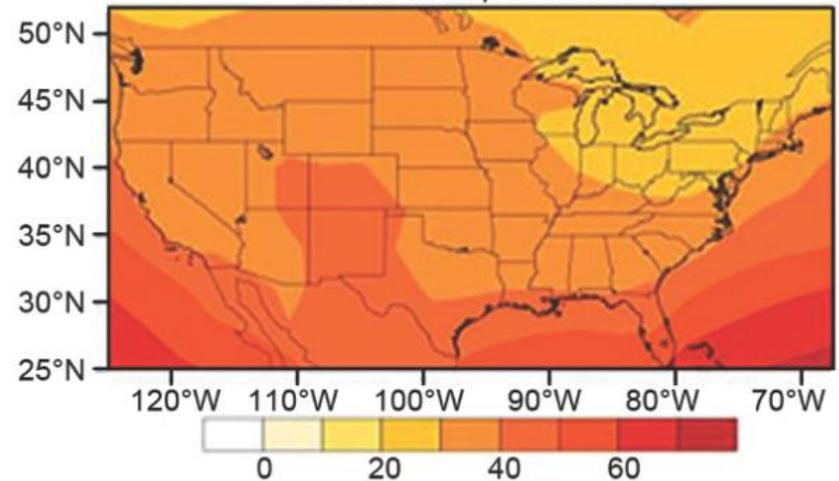
Extreme Events

Change in maximum number of consecutive dry days



Change in number of hot nights

Percent of time $T_{\min} >$ the 90th percentile value of daily minimum temperature %



Change in Dry Periods and Hot Nights by 2100 (high emissions, "SRES A2")

NCDC 2011

Currently, NCDC estimates that the cost of the 2012 drought that affected much of the U.S. had an economic impact of \$12B.

Extreme events have been shown to be more probable than 40–50 years ago.

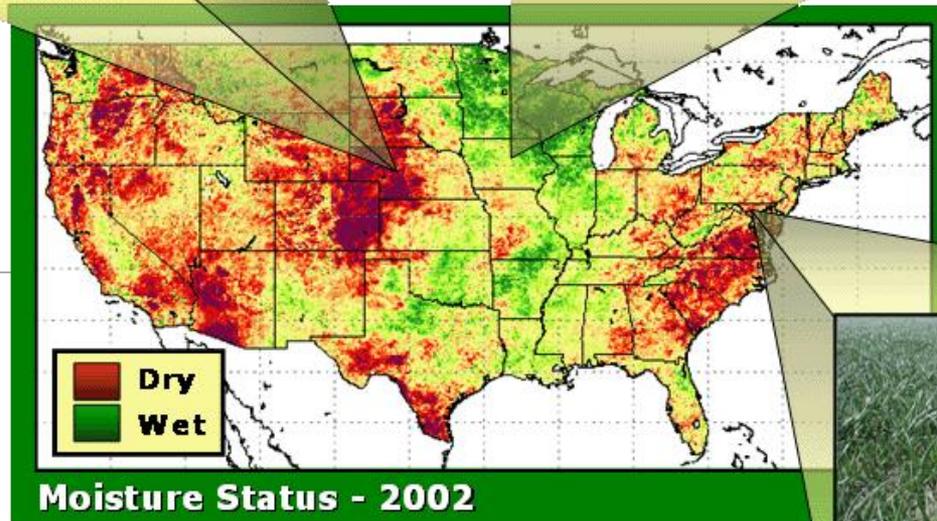
Water Challenges



Drought



Too much,
too fast?



Ground water depletion &
soil moisture recharge??



Transdisciplinary Research Networks

Transformative changes are required in order for agricultural production systems to meet current and future challenges. These changes require us to think across **technological, physical, biological, ecological and socioeconomic** boundaries.

Establishing a **long-term agroecosystem research (LTAR)** network is one important component of understanding how to drive these changes.

LTAR: A RESEARCH NETWORK

Purpose: Assess and enable *sustainable* working lands.

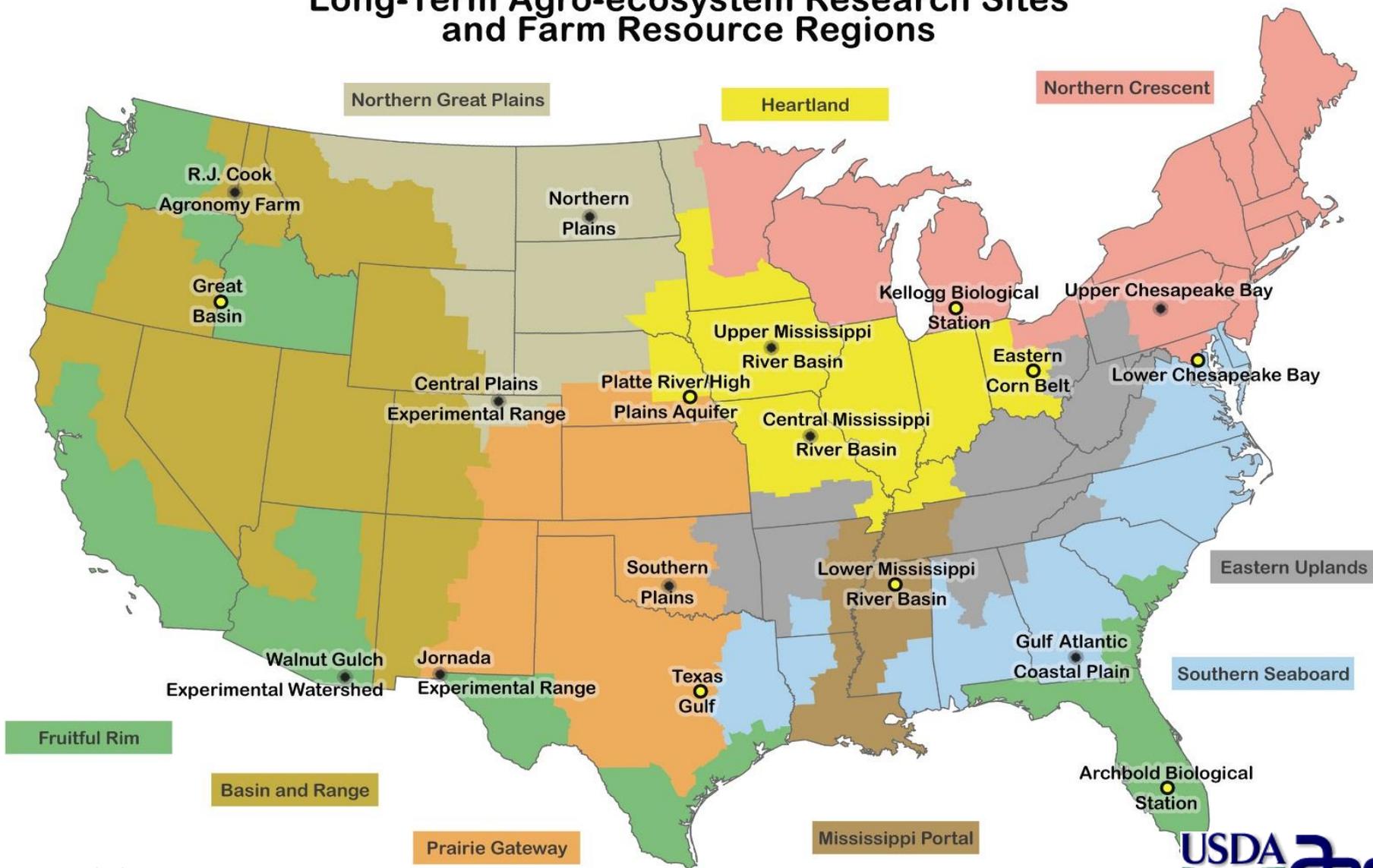
Mission: Enable understanding and forecasting of regional landscape capacities to provide agricultural commodities & ecosystem services under changing conditions.

Vision: *Sustainable agro-ecosystems providing goods and services.*

*How Do We Sustain or Enhance
Productivity, Profitability, and Ecosystem
Services in U. S. Agroecosystems and
Agricultural Landscapes?*

LTAR Sites in Farm Resource Regions

Long-Term Agro-ecosystem Research Sites and Farm Resource Regions



Current LTAR Network



18 sites

Data Records: 12 (Pullman, WA) to 100 years (Las Cruces, NM and Mandan, ND)

Area Covered (km²): 0.57 (Pullman, WA) to 6,200 (Ames, IA)

NEON Domains: 11 out of 17 (in lower 48 states)

Major Drainage Basins: 12 out of 18 (in lower 48 states)

Farm Resource Regions: 8 out of 9 (in lower 48 states)



Multi-institutional and Collaborative

60 Colleges & Universities

15 Federal Agencies

12 State Agencies

11 Other Research Networks

25 NGO's

19 Industry Organizations

29 International Organizations

Engaging local producer communities

Shared Research Strategy

G x E x M

- Genetics x Environment x Management

- Genetics: *Variety, breed, or animal haplotype*

“Potential”

- Environment: *Stress effects on agriculture: time & space*

“What cannot be controlled”

- Management: *Production practices*

“What can be controlled”

$$\text{Production} = f(\text{GxE x M})$$

Overcoming Variability for Maximum Yield

G x E x M
Genetics x Environment x Management



- Adding Post-processing/Socioeconomic

$$\text{Consumer Product} = f(\text{GxE x M})P$$

USDA Regional Climate Hubs



USDA's Regional Climate Hubs are translating science and deploying tools to help land managers build resilience into production systems.

Extending the Reach of ARS Science

SAVE THE DATE

**Forest Science and Manager Dialogues:
Developing Reforestation Tools for Silviculturists**

USFS Wildland Fire Training & Conference Center, Thirty Mile Room
Wednesday Nov. 28th, 2018
10:00AM – 4:45PM

Register at: <https://tinyurl.com/y97jn5cx>

Lodging Options: [Lions Gate Hotel](#), [Crowne Plaza](#) and [La Quinta](#)

Because of your expertise and experience in forest management and reforestation, we are requesting your participation in a set of scientist-manager dialogues designed to exchange information around the needs, concerns, and time relevant decisions that silviculturists interface with when prioritizing, planning, and implementing reforestation projects. With a focused understanding of the needs of forest managers, scientists can begin to better understand how their investments and outputs can be better designed to meet those interests. This “by invitation” dialog event is ultimately being developed to more effectively link the science-manager interface by putting the co-production model into practice with the interests in investing in reforesting California’s forests in the context of climate change, large fires, and tree die-off events.

NOTE: This Day #1 dialog event will be a smaller group, “invite-only” engagement, whereas Day #2 reforestation symposium will be open to anyone with interest (up to the registration limit of 200).



USDA United States Department of Agriculture
California Climate Hub

CAL FIRE

ARS UNIVERSITY of CALIFORNIA
Agriculture & Natural Resources

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

SIERRA NEVADA CONSERVANCY



GlobalChange.gov
U.S. Global Change Research Program

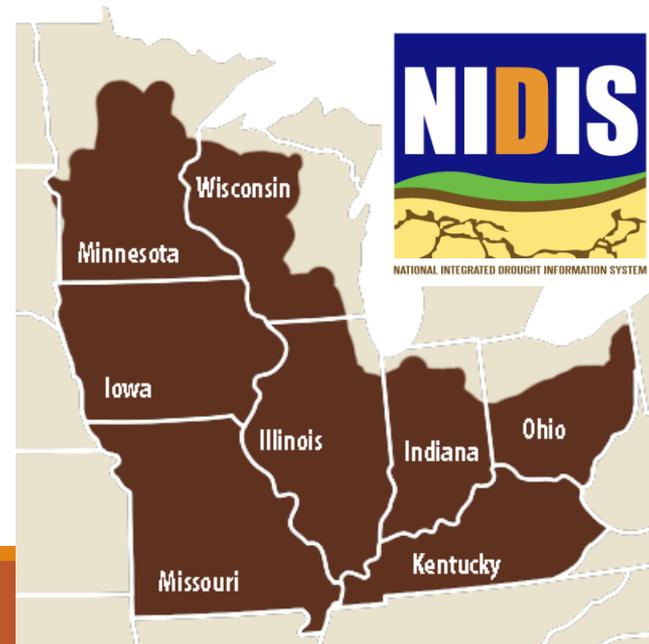
ABOUT USGCRP WHAT WE DO AGENCIES

National Climate Assessment

In May 2014, USGCRP released the Third National Climate Assessment, the authoritative and comprehensive report on climate change and its impacts in the United States.

[EXPLORE THE NCA](#) [DOWNLOAD THE NCA](#)

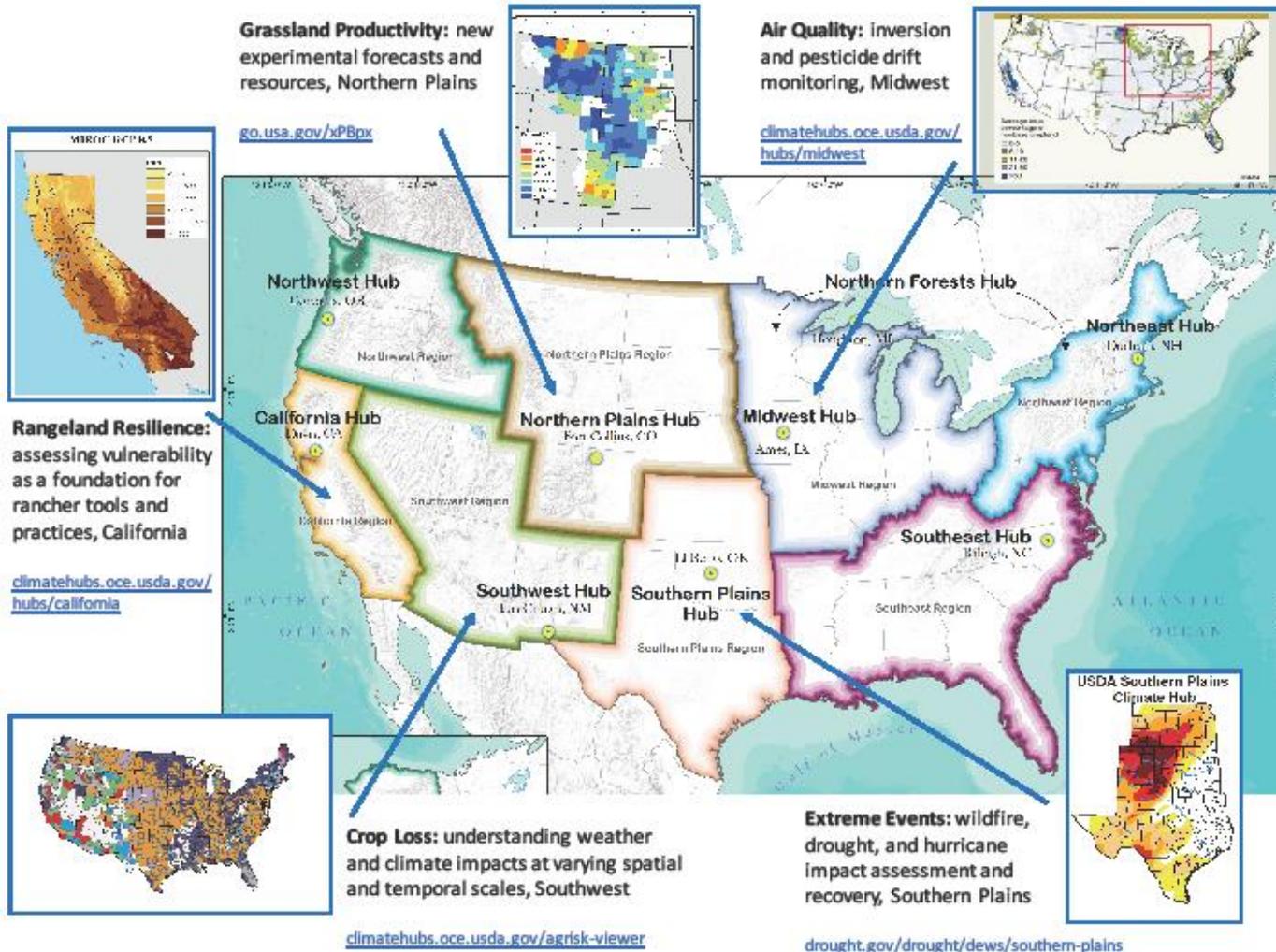
Understand Climate Change | Explore Regions & Topics | Browse & Find Resources, Data, & Multimedia | Follow News & Updates



International

International Coordination and Projects

Recent Climate Hubs Impact



- ### USDA CLIMATE HUBS REGIONAL HIGHLIGHTS FY 2018
- #### ARS Administered Climate Hubs
- California (Davis, CA)
 - Steven Ostoja, Director
 - Midwest (Ames, IA)
 - Dennis Todey, Director
 - Northern Plains (Fort Collins, CO)
 - Dannele Peck, Director
 - Southern Plains (El Reno, OK)
 - David Brown, Director
 - Southwest (Las Cruces, NM)
 - Emile Elias, Acting Director
- #### FS Administered Climate Hubs
- Caribbean (San Juan, PR)
 - Ricardo Goenaga, ARS Co-Lead
 - Northeast (Durham, NH)
 - Tony Buda, ARS Co-Lead
 - Michel Cavigelli, ARS Co-Lead
 - Curtis Dell, ARS Co-Lead
 - Northern Forests (Houghton, MI)
 - Northwest (Corvallis, OR)
 - Dave Huggins, ARS Co-Lead
 - Southeast (Raleigh, NC)
 - Alan Franzluebbers, ARS Co-Lead

ARS Research Examples

- ✓ LTAR research efforts with climate change adaptation and mitigation components
- ✓ Leveraging the strength of the Regional Climate Hubs
- ✓ Working directly with stakeholders throughout the research process
 - ✓ To ensure research relevance
 - ✓ To maximize adoption
 - ✓ To increase impact
- ✓ Resulting in more sustainable and resilient production systems

Example: Collaborative Adaptive Rangeland Management, Fort Collins CO

Justin Derner and Dannele Peck



Incorporates stakeholders directly into research process through collaborative, participatory grazing experiments at the ranch scale.

Leverages the efforts of the local USDA Climate Hub.

- Stakeholder-driven adaptive management treatment **integrates local knowledge, conservation concerns, drought resilience and monitoring data**. Multiple forms of knowledge work together to improve management outcomes and **build trust** among diverse groups of people

“Besides generating a wealth of long-term data, the LTAR project at this rangeland site has fostered an environment for learning, shared experience, and trust among the participants. “The project ***allows for a melding of different stakeholder information in a common experiment,***” says Derner. ***“They’ve really made it their own.”***”

Soil Carbon Research in Cropping Systems, Raleigh NC

Alan Franzluebbers



- 1. Long term silvopasture research** (from 2007): Planted trees on marginal cropland in a multi-disciplinary approach to conservation agriculture – in collaboration with local landowners
- 2. Long-term farming systems research** (from 1999) Compares production, soil biogeochemical properties, and socio-economic impacts of typical farming systems in the region

Northern Great Plains Production Systems Research, Mandan, ND

Dave Archer and John Hendrickson

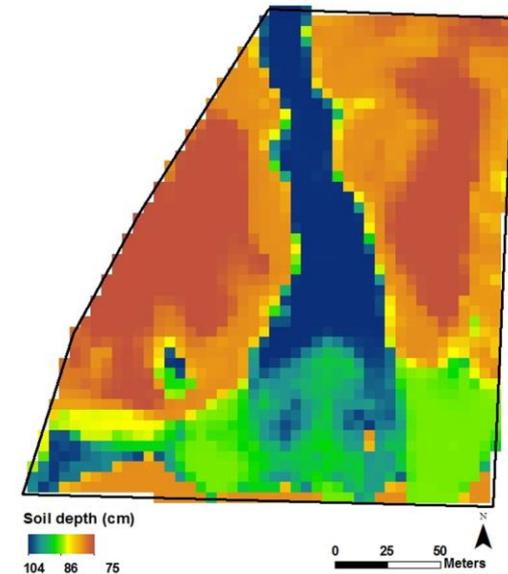


- Research on cropping systems that integrate livestock and crop production. Highly collaborative with local producers. The unit has a ***Customer Focus Group (CFG) that meets twice a year.*** Scientists provide them with information about current research and get feedback from the group on emerging issues.
- With Virginia Tech: ***project to identify human dimensions of managing Northern Great Plains ecosystems.*** Objective identify factors influencing landowner decision-making processes and why some landowners might choose to do some types of management versus others. Currently developing a survey instrument.
- With KSU, ISU and UTenn: NIFA funded effort on producing oilseeds for use as jet fuel. Analyzed ***factors influencing producer adoption of oilseeds, analysis of social capital, and regional and national-scale economic impact analysis using the POLYSYS model.***

Beyond current LTAR .. Soil, Carbon and Livestock Dynamics

Dale Bumpers Small Farms Research Center - Booneville, AR
Phillip Owens, Tom Sauer, Amanda Ashworth, Dan Pote

- With U Ark. Digital mapping of soils and interpretation for managers.
- Interactions between soil carbon and forage production.
- Agroforestry and tree carbon storage
- Cattle grazing patterns and preferences studied using GPS collars. This has shown striking patterns of grazing along the soil patterns
- Economic assessments of production systems to improve profitability, risk management, and sustainability.



USDA ARS Information Management

Transdisciplinary studies generate a lot of data

Production systems: management, yields, treatments, residue, quality, forage health...

Animals: cattle, dairy cows, poultry, fish, reproductive rates, health...

Biodiversity: wildlife, pollinators, invasive species...

Water: quality, hydrology, drought, conservation, erosion...

Soil: biology, chemistry, physical, erosion, cover, health...

Air: quality, gas leaching, emissions, wind erosion, dust...

Genomics: plant, animal, preservation, new varieties/cultivars...

Foods: quality, nutritional value, cost, human health...

Chemicals: antibiotics, pesticides, fertilizers, nutrients...

Qualitative: decision making, resiliency, adaptation, adoption rate...

Environment: greenhouse gas, climate, weather...

Economics: profit, cost of operation, breakeven...



Agricultural Collaborative Research Outcomes System: AgCROS

- AgCROS is “a network of networks” that brings together information from diverse scientific fields into one place, facilitating collaboration, the connection of ideas, and the process of making new research discoveries.
- AgCROS, a publicly-available database, is essential to drive innovation for maintaining profitability, sustaining higher yields, increasing nutrient use efficiencies, decreasing undesirable environmental impacts, optimizing crop and food nutritional quality, and providing ecosystem services.



Agricultural Collaborative Research Outcomes System: AgCROS

- AgCROS contributes to National Agricultural Library's (NAL's) Ag Data Commons, the portal for discovery of agricultural research data in the US.
- AgCROS can support data intensive science, modelling, decision-making and management related to a variety of questions, such as how a given set of site-specific management practices could contribute to climate change adaptation.



Questions?

Links of interest:

ARS Office of National Programs

<https://www.ars.usda.gov/research/programs/>

LTAR

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

USDA Regional Climate Hubs

<https://www.climatehubs.oce.usda.gov/>

National Ag Library, Ag Data Commons

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

AgCROS

<https://data.nal.usda.gov/dataset/agricultural-collaborative-research-outcomes-system-agcros>



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