

LONG TERM AGROECOSYSTEM RESEARCH IN THE SOUTHERN PLAINS

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The Southern Plains (SP) site of the Long Term Agroecosystem Research (LTAR) network is headquartered at the USDA-ARS Grazinglands Research Laboratory (GRL) in El Reno, Oklahoma. The GRL was established in 1948. A long-term watershed and climate research program was established in the Little Washita River Experimental Watershed (LWREW) in 1961 and in the Fort Cobb Reservoir Experimental Watershed (FCREW) in 2004 (Steiner and others 2014). The GRL mission is to develop technologies, management strategies, and tools to evaluate and manage risks and tradeoffs for integrated crop, forage, and livestock systems under variable climate, energy and market conditions.

Research is conducted at: 1) the 27 km² GRL which is comprised of tall grass prairie, pastures, and annual crops and forages that support beef cattle herds, 2) the 610 km² LWREW watershed which was established to study hydrologic impacts of USDA-funded flood retarding structures, and 3) the 786 km² FCREW watershed that was established to quantify interactive effects of climate, land use, and agricultural conservation practices on environmental outcomes. The climate is continental with about 210 days in the growing season. Mean annual temperature is 15.5 °C and mean annual precipitation is about 850 mm with a gradient across the region. The research sites are within the Southern Plains NEON domain; Red-Arkansas HUC 11 watershed; Prairie Gateway farm resource region. Climate variability and gradients characterize the Great Plains and are a primary driver of agro-ecosystem processes in the region (Garbrecht and others 2014).

The SP LTAR addresses a spectrum of cropland, pastureland, and grazed prairie characteristic of SP landscapes. Extreme climate variability in space and time make it essential to identify sustainable and resilient forage-based production systems that are adaptable across enterprise types. Developing knowledge and tools to support diverse agricultural systems in the face of complex interactive ecological, climate, policy, and economics drivers requires transdisciplinary science conducted over decades to provide understanding that is scalable in time and space. Anticipated outcomes include production systems that support vibrant rural economies, promote biological diversity (soil, plant, and animal), and reduce greenhouse gas emissions, with positive impacts on carbon sequestration, water and air quality, and agricultural sustainability.

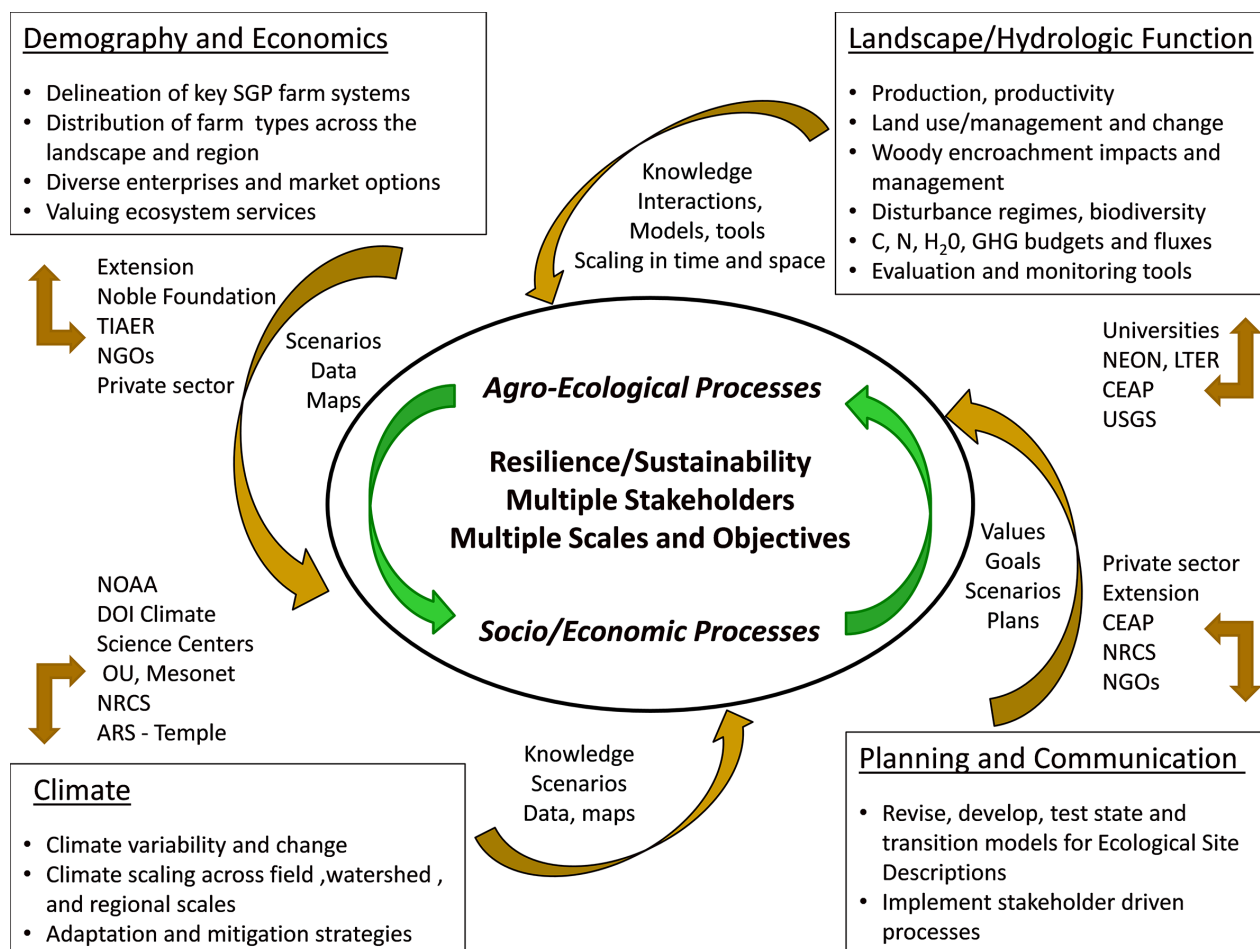
Research is affiliated with four of the USDA-ARS National Programs: Water Availability and Watershed Management; Forage, Pasture, and Rangeland Systems, Food Animal Production; and Global Change, Emissions, and Soils. Major collaborations (Table 1) include the Grazing CAP coalition: Oklahoma State University, Kansas State University, University of Oklahoma, Tarleton State University, The Samuel Roberts Noble Foundation, and USDA-ARS-Bushland, supported by USDA-NIFA-AFRI. The long-term watershed research includes numerous key partners, including Oklahoma State University, the Oklahoma Mesonet, Oklahoma Water Resources Board (OWRB),

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Table 1—Key Partners and Collaborators of the Southern Plains LTAR

Oklahoma State University	Tarleton State University - TIAER
University of Oklahoma	Samuel Roberts Noble Foundation
Oklahoma Mesonet	Oklahoma Conservation Commission
Grazing CAP	Oklahoma Water Resources Board
Southern Plains Climate Hub	USGS
Kansas State University	USDA-NRCS, other federal agencies
South Central Climate Science Center	Numerous ARS locations
RISA-SCIPP	Numerous international universities
Langston University	

**Figure 1—Schematic of the LTAR-SP research.**

USGS, Oklahoma Conservation Commission, USDA-NRCS, EPA, US Bureau of Reclamation, and landholders in the watershed. Many other aspects of the research involve partnerships with additional universities, including Texas AgriLife, University of Oklahoma, Beijing Normal University, Universidad Autónoma de Zacatecas, Jomo Kenyatta University, DOI South Central Climate Science Center, International Center for Agroforestry.

The broad research emphasis spans productivity and resilience of forage-grazing systems, multiple marketing options, agro-ecosystem impacts of climate variability and change at multiple scales, and environmental impacts of conservation practices (fig. 1). All of these issues are of global relevance. Improved understanding within this regional research program will be linked with other long-term research efforts to advance our understanding of processes that transcend regions.

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