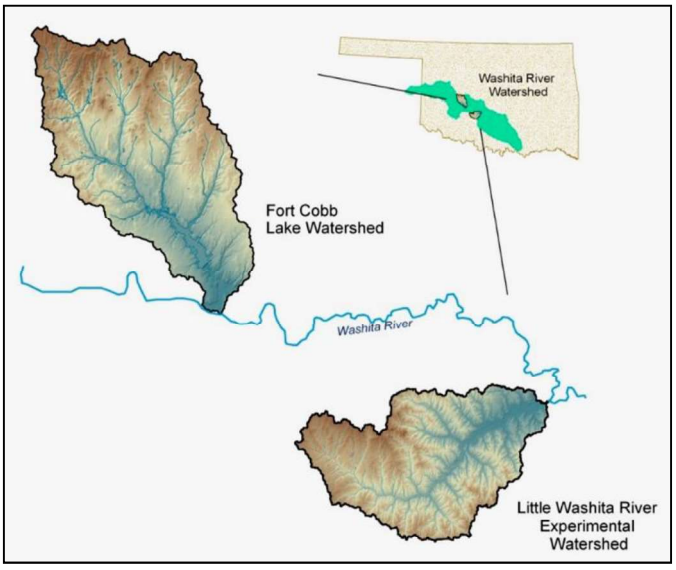
United States Department of Agriculture
Agricultural Research Service

Soil Water Content Measurement Network(s)

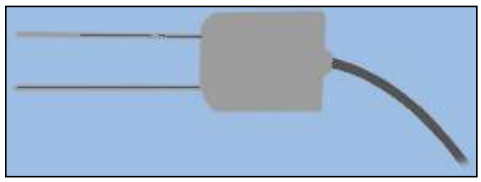
Grazinglands Research Laboratory, El Reno, Oklahoma May 2017

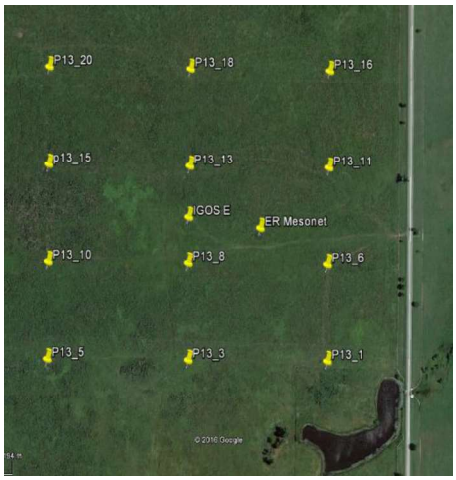
Rationale: Soil water accounts for only about 0.0001% of the total water on earth, yet it is a key component in describing the transfer and distribution of mass and energy between the land surface and atmosphere—thus, of major importance to the field of meteorology; it partitions rainfall into runoff and infiltration—thus, of primary importance to the field of hydrology; and it exerts major influences on forage and crop productivity—thus, of critical importance to the agricultural production and research communities.

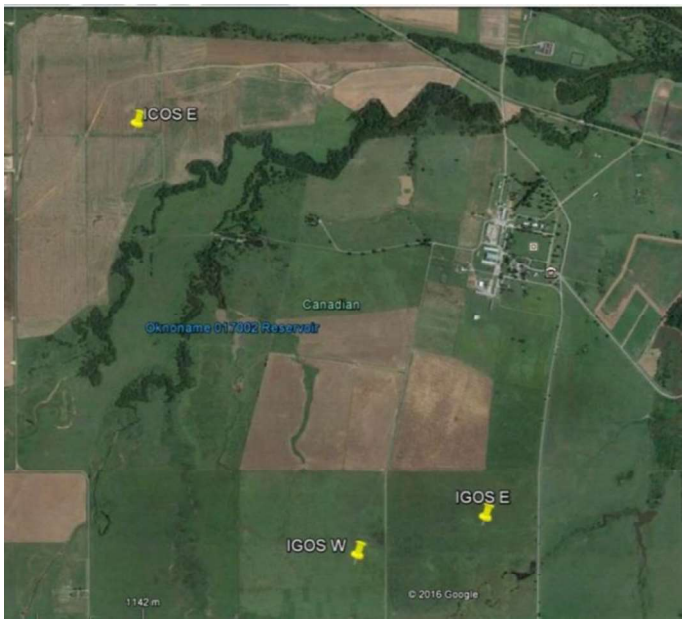
Objective: Establish soil water content measurement networks to support on-going, long-term watershed scale hydrologic research and to address research goals connected with ARS' newly established Long-term Agro-ecosystem Research network.



What we are doing: We previously established a network of meteorological stations on both the 610 km^2 Little Washita River Experimental Watershed (LWREW) and the 800 km^2 Fort Cobb Reservoir Experimental Watershed (FCREW) in southwestern Oklahoma. The data from these sites are used in modeling exercises to evaluate the effectiveness of conservation practices. Additionally, they are being used by NASA and other research agencies to develop and test new satellite soil moisture sensors and algorithms. We recently established a smaller network of similar sensors on the GRL laboratory grounds to monitor soil moisture dynamics of both pastures and croplands to determine best management practices to conserve water and increase water use efficiency of plants. The GRL, LWREW, and FCREW soil water networks incorporate point-based sensors (see above). To the right is an example of the station layout.







Additionally, we are testing and calibrating a new soil moisture sensor (COSMOS – Cosmic-ray Soil Moisture Observing System) that provides field-scale footprint estimates of soil water content. This sensor uses the interaction of naturally occurring cosmic rays with hydrogen (soil water being the largest pool of hydrogen) to estimate soil water content. The method uses an above-ground sensor (above left) and we have installed four of these on the GRL property (3 locations are shown above right and are co-located with our Integrated Grassland/Cropland Observing Systems).

Contact Persons:

Jean L. Steiner (jean.steiner@ars.usda.gov)
Patrick J. Starks (Patrick.starks@ars.usda.gov)

7207 West Cheyenne Street
Grazinglands Research Laboratory
El Reno, OK 73036

Telephone: (405) 262-5291
FAX: (405) 262-0133

https://www.ars.usda.gov/plains-area/el-reno-ok/grazinglands-research-laboratory/