Central Mississippi River Basin LTAR, Columbia, MO

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The Central Mississippi River Basin (CMRB) member of the Long-Term Agro-ecosystem Research (LTAR) network is operated by the USDA-ARS Cropping Systems and Water Quality Research Unit located in Columbia, Missouri, on the campus of the University of Missouri. The CMRB LTAR represents a runoff-prone geophysical context with documented erosive soils despite gentle slopes. Row crop production in this region is economically marginal and environmentally risky. Claypan soils are especially vulnerable to soil erosion, which has degraded soil and water quality throughout the basin.

The core research infrastructure is the 72 km^2 Goodwater Creek Experimental Watershed (GCEW), located approximately 50 km NNE of Columbia. Rain gauge network data have been collected since 1969 and streamflow and sediment load have been collected since 1971. In 1991, water quality measurements were added for surface water and groundwater. Scales studied ranged from plots at 3.4 m^2, to whole fields at 0.12 to 0.35 km^2, to streams up to 73 km^2. In 2005, 12 larger-scale watersheds (200 to 1200 km^2) within the Salt River basin were instrumented, 8 of these co-located with USGS flow sites. Since 2010, 3 of the 12 have been retained to provide a combination nested and parallel design up to 466 km^2.

This watershed represents surface-runoff-prone soils found in several Midwest and central states of the southern Corn Belt (IL, MO, IA, NE, and KS). Most soils within the basin are classified as Hydrologic Group C or D by NRCS. Land use is predominately agricultural. The primary row crops are soybean, corn, and sorghum, and forage is mainly tall fescue. Livestock production is mainly beef cattle and confined swine operations. Average annual precipitation is about 1000 mm per year, stream flow about 30% of that, and runoff about 85% of total stream flow. The CMRB LTAR is considered to be within the Corn Belt agro-ecosystem, and is part of the Upper Mississippi HUC region 07. Within Corn Belt states, the Missouri context is the only substantial area not drained by tiles. CMRB, including GCEW and the surrounding instrumented watersheds, is in NEON domain 6 – Prairie Peninsula, the Upper Mississippi River HUC-2, and the Heartland Farm Resource Region.

The CMRB LTAR includes collateral infrastructure proximal to GCEW that has provided substantial research data critical for understanding transport processes. Expertise comprised within the CSWQRU scientific and support staff enables field and laboratory research using both empirical and theoretical analyses; a wide range of complementary expertise is embodied in cooperators. Primary cooperators include the University of Missouri Water Quality Extension, Departments of Soil, Environmental, and Atmospheric Sciences, Biological Engineering, Forestry, Agricultural Economics, Geography, and Statistics, the Center for Agroforestry, Plant Sciences Division, and NCR Sustainable Agriculture Research and Education (SARE), Lincoln University, the Environmental Resource Coalition. US EPA, USGS, USDA-NRCS, Missouri Department of Natural Resources, MFA, Inc. Cooperative, MFA Oil Biomass LLC, Clarence Cannon Wholesale Water Commission, and numerous producers.

Principle research projects in the CMRB related to the LTAR network are:
1. Improving water quality in agricultural watersheds underlain by restrictive layer soils
2. Landscape-based crop management for food, feed, and bioenergy
3. Ecological resilience study across watersheds, ranges, and forests
4. Estimating impacts of projected climate change on regional water availability and quality
5. Regional investigation into in-season sensor-based N corn management
6. Regional and National Phosphorus Index projects