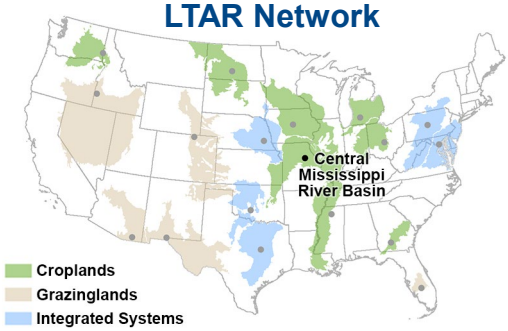
Central Mississippi River Basin (CMRB)

Mission: To anticipate needs, develop knowledge, and provide technological solutions to optimize the economic and environmental sustainability of agricultural production systems on surface-runoff-prone soils.

LTAR Network



Location

CMRB is located near Columbia, Missouri at the southern edge of the southern, not artificially drained, Corn Belt. This site represents surface-runoff-prone soils in the Central United States.

Climate

The CMRB has median temperatures and is slightly wetter than median among the LTAR sites.

Mean Annual Temperature
12° C
54° F

Mean Annual Precipitation
101 cm
40 in

Major Commodities and Ecosystem Services

Commodities: corn, soybean, sorghum, forage, beef cattle, wheat

Ecosystem Services: carbon sequestration, erosion regulation, fresh water, grain production, livestock production, pollinators, quality of life, soil health improvement, water regulation, wildlife habitat

Research Sites and Infrastructure

Goodwater Creek Experimental Watershed (est. 1971)

Long-term rain gauge, meteorological station, and flume/weir network

Centralia Research Station (est. 1991)

Long-term rain gauge, meteorological station, and flume/weir network; eddy covariance (EC) flux tower

Agroecological Research Emphasis

Water movement

- Observation and modeling of physical processes
- Eddy covariance (EC) land-atmosphere flux measurements
- Carbon, water, and energy budgets
- Effects of changes in climate

Erosion, Nutrient, and Herbicide Management

- Nutrient budgets
- Observation and modeling of physical processes
- Spatial sensing technologies

Soil Health

- Observation of soil health benefits
- Linkage with soil physical, chemical, and biological properties; hydrologic processes; crop productivity; and landscape factors

Production

- Cover crops
- No tillage
- Extended rotations
- Crop productivity and yield variability
- Inputs managed with precision agriculture practices
- Perennialization

LTAR Network-wide Research Involvement

Working Groups

- Communication Strategies
- Common Experiment Croplands
- Data Management *
- Modeling
- Water Quantity *
- Weather and Climate

Projects

- Dissolved Organic Matter
- Meteorology sub-group within the Weather and Climate *
- Phenology Project
- Regionalization

* Indicates leadership roles

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Site Accomplishments

No-till on Claypan Soils

CMRB has been crucial in establishing that no-till does not reduce runoff volume on claypan soils. As a result, it increases the transport of surface applied agricultural inputs.

Productivity and Environmental impacts

For CMRB, the areas most vulnerable to degradation are also those where annual crop production is most marginal.

Soil Health

Reduced tillage, increased rotational crop diversity, and cover crops have demonstrated benefits in soil physical, chemical, and biological properties.

Decision Support Tools

Management Zone Analyst: software for clustering data to define within-field zones. Over 3500 downloads.
Yield Editor: software to identify and remove errors and data artefacts from crop yield maps. Over 11,000 downloads.
Soil Vulnerability Index: CMRB has been instrumental in validating this NRCS developed soil interpretation tool.

Long-term Instrumentation and Data Curation

CMRB has been collecting and curating production, hydroclimatic and water quality data since 1969 including from 11 rain gauges and 3 stream gauges over the 72 km^2 Goodwater Creek Experimental Watershed, 3 fields and 18 large plots in the headwaters of the watershed, and 3 additional stream gauges in the Mark Twain Lake watershed.

Precision Agriculture

Long-term research at CMRB has shown that a precision agriculture system sustained profits compared to conventional management while incorporating enhanced conservation practices.
CMRB researchers have been leaders in developing and evaluating soil and crop sensing technologies for precision agriculture.

Focus on Sustainability: Common Experiment
No-till grain and cover crops systems, precision agriculture, and targeted management

Soil erosion is a concern in the CMRB due to the high potential for runoff and limited top soil above the claypan. If erosion is not addressed, cropping systems can lead to depleted top soil, poor germination and crop establishment, and ultimately decreased grain production and additional soil erosion. No-till in combination with cover crops and precision agriculture practices has been shown to address soil erosion while mitigating the transport of surface applied chemicals.

Research in CMRB aims to use long-term monitoring to better understand the production, ecological, and hydrological effects of no-till, cover crops, and precision management and to improve treatment practices.

Prevailing practices

A tilled grain system defined and operated by a cooperating grain producer. Crop selection and management decisions are based on market forces and weather. Approach results in increased soil erosion and decreased production and ecosystem function.

Alternatives practices

A no-till corn-soybean-wheat system with cover crops, in which precision agriculture is used to optimize inputs. System decreases soil erosion, increased production, and improved ecosystem function.

Collaborators and Stakeholders

CMRB works with a broad range of collaborators and stakeholders to address agroecological concerns of the region.

More Information

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ARS Website:
https://www.ars.usda.gov/midwest-area/columbia-mo/cropping-systems-and-water-quality-research/

LTAR Network Website:
ltar.ars.usda.gov/sites/cmrb/