

The Long-Term Agroecosystem Research Network

Creating databases that deliver knowledge for improved management

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Producing a sufficient amount of food, feed, and fiber while protecting environmental quality represents a Grand Challenge of the 21st century. Current trajectories in climate change and non-renewable resource use underscore the immensity of this challenge, and have increased emphasis on developing agroecosystems that are inherently resistant to external stress, yet are highly productive, economically competitive, and environmentally benign. This nexus of production, profit, and environmental quality highlights the critical role of agricultural research to develop 'transformative' production systems to meet future needs.

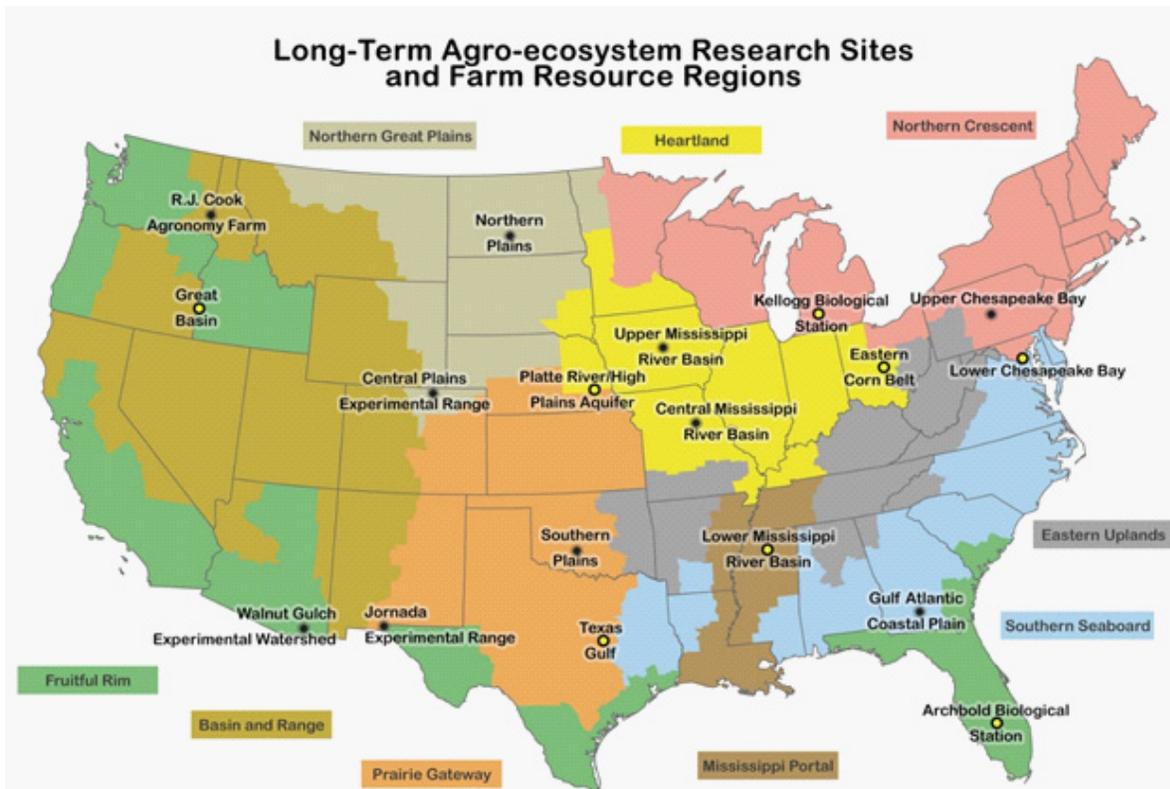


Figure 1. Long-term Agroecosystem Research network locations.

Long-term research is essential for understanding how agriculture will adapt to changes in technologies, consumer demands, policy, resource availability, and environmental stresses. Existing networks, such as the National Ecological Observatory Network (NEON) and Long Term Ecological Research (LTER) network, emphasize the importance of well-coordinated national research teams for delivering knowledge for improved land management. Recent calls for similar networks highlight the need for longer-term, broader-scale, and more-integrative transdisciplinary efforts focused on agricultural production systems.

Recognizing this need, the U.S. Department of Agriculture (USDA) Agricultural Research Service developed a Long-Term Agroecosystem Research (LTAR) network in 2011 to sustain a land-based infrastructure for research, education, and outreach to enable understanding and forecasting for providing agricultural commodities and ecosystem services under changing conditions. A key expectation of the LTAR network is the application of research results to solve critical challenges facing agriculture. To meet this expectation, scientific activities within the LTAR network are directed toward knowledge gaps and technology needs in four areas: 1) agroecosystem productivity and sustainability, 2) climate variability and change, 3) conservation and environmental quality, and 4) socioeconomic viability and opportunities.

Long-Term Agroecosystem Research Network at NGPRL

Long-term research has been a cornerstone of the Northern Great Plains Research Laboratory (NGPRL) since its establishment in 1912. Already home to some of the oldest grazing trials in North America, NGPRL has had a strong concurrent history of cropping studies that sought to improve dryland farming in the northern Great Plains.

As one of the 18 LTAR network locations nationally (Fig. 1), NGPRL is currently engaged in generating new knowledge for the development of future agricultural production systems from novel experiments coordinated at the national scale, coupled with findings from local/regional historical datasets. Outcomes from new, ongoing, and completed studies will improve our understanding of how management practices affect key ecosystem services, and in turn, agricultural sustainability.

Measuring ecosystem services at NGPRL: an example

Agroecosystems in the northern Great Plains are currently transitioning to more intensified production, mainly due to climate-driven shifts in greater early-season water availability and a longer growing season. This transition to a wetter and warmer climate – while beneficial to agricultural productivity – will increase the susceptibility of soil degradation on agricultural lands through increased rates of erosion, nutrient loss, acidification, and salinization. Developing production systems that enhance ecosystem services will be essential to mitigate soil degradation in this important agricultural region.

Synthesizing and applying findings from this type of research at a scale relevant to a wide variety of users will require the use of networks, collaborators and ways to disseminate that information. In 2015, the NGPRL became part of the National Wind Erosion Research Network, which is a collaboration between the USDA Agricultural Research Service, the Bureau of Land Management (BLM), Department of Defense and The Nature Conservancy. This network aims to address the need for reliable field measurements of wind erosion and its controlling factors to support the development of an improved wind erosion model. This model will be publicly available for use as a decision support tool and for research purposes.

Network sites will be located on USDA land, integrated with the new Long Term Agro-ecosystem Research (LTAR) network. Sites will also be located on BLM land, Department of Defense land and private land with cooperating partners. At the NGPRL, wind erosion network instrumentation was installed in field H5 of the Area 4 SCD Cooperative Research Farm in 2015. The National Wind Erosion Research Network site at the NGPRL began streaming data on July of 2015 with the intention that this site will be maintained as a source of valuable long-term data. These data will be publicly available at <http://winderosionnetwork.org/network-sites/mandan-ltar>.

The National Wind Erosion Research Network will be the first national, long-term, intensively instrumented wind erosion research network in the world. It is expected that the Network will attract local and international collaborators researching wind erosion. The detailed data, collected using standard methods across a range of land use and management systems, will provide excellent opportunities to build our understanding of wind erosion processes and develop models in a way that will have direct benefits for land managers.

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