

The North American Site Network

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Summary

A network of long-term experiments in North America was organized to develop a regionalized database for evaluating environmental and management controls on soil organic matter and to assess the potential for C sequestration in agroecosystems. The network is comprised of 39 field experiments at 33 locations, concentrated in the Great Plains region of the U.S. and Canada and the U.S. corn belt. Historical data on climate, productivity, soils and management have been compiled for the sites. An extensive cross-site sampling of soils and analysis of soil organic matter fractions has been carried out for most of the sites. Information from the long-term experiments is being used to support a wide variety of research, ranging from detailed process studies to large-scale model-based assessments of agroecosystem C balances and CO₂ mitigation strategies. Networks of existing long-term experiments can play an important role in ecosystem and global change research.

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Introduction

Agricultural science has a rich history of long-term field experimentation, as exemplified by the ongoing "classical" experiments here at Rothamsted, the site of this workshop. These and other long-term experiments have made great contributions to the agricultural (and other) sciences over the years. Current concerns about global environmental changes and their potential effects on terrestrial ecosystems, including agroecosystems, are yet another area in which long-term field experiments can provide vital information.

Soil organic matter (SOM) constitutes the largest terrestrial C pool (Post *et al.*, 1990) and thus changes in soil C storage, induced by climatic and/or land use changes could have significant impacts on atmospheric CO₂ concentrations (Jenkinson *et al.*, 1991, Schimel *et al.*, 1994, Kirschbaum, 1995). In addition, SOM is an important factor regulating the emission of greenhouse gases such as N₂O (Robertson, 1993) and CH₄ (Schimel *et al.*, 1993). However, changes in SOM occur relatively slowly, requiring time periods of several years to decades for significant changes to occur. Thus, long-term field experiments in which SOM has been measured repeatedly over time provide one of the best sources of information on the rate of change of SOM. Many of the factors which influence SOM dynamics, such as plant productivity, degree of soil disturbance, microclimate and N availability, vary as a function of management practices such as crop rotation, tillage, and fertilization. Thus, data from these kinds of experiments can help to elucidate fundamental controls on SOM behavior.

In 1991 we began a research project entitled "Agroecosystem Carbon Pools and Dynamics", which included the participation of many of the long-term agricultural experiments ongoing in North America. The objective of the project was "...to develop defensible data to evaluate carbon pools and dynamics for agroecosystems, to identify critical soil and climatic parameters that might affect those dynamics, and to validate models to assess the impact of alternative agricultural management practices on carbon storage and fluxes in agroecosystems."

This paper describes the organization and data resources of the site network and some of the current applications of the site information in global change research.