Cedar Creek Natural History Area (CDR)

Cedar Creek Natural History Area was established in 1940. The first 500 acres of CCNHA were acquired with the understanding that they would be kept in their natural condition and used for scientific and educational purposes. Funds for additional acquisition of land and development of permanent buildings were made available by a variety of private and public sources. Early researchers at the site included Raymond Lindeman, who pioneered the science of ecosystem ecology at CDR's Cedar Bog Lake. In 1975 Cedar Creek was designated a National Natural Landmark by the National Park Service, and in 1982 it was one of 11 sites in the United States selected by the National Science Foundation for LTER funding. Since its inception, the overarching goal of the CDR LTER has been to gain a deeper understanding of the processes and principles that govern the dynamics and functioning of communities and ecosystems.

Site characteristics. CDR is a 22 km^2 site located about 35 miles north of Saint Paul, Minnesota, U.S.A. (45.4 N**,** 93.2 W). This region has a continental climate with cold winters and hot summers. Mean annual precipitation is 80 cm, which is distributed fairly evenly throughout the year. The mean July temperature is 22.2°C and the mean January temperature is –l0° C.

CDR is unique among LTER sites because of its location on the boundary between North America's prairie and forest. Much of the site is covered in wetlands including white cedar (*Thuja occidentalis*) and ash swamps, acid bogs, wet meadows, and marshes. Upland areas consist of variety of habitat types including: (1) savanna areas with a sparse canopy of burr oaks (*Quercus macrocarpa*), (2) prairie openings largely dominated by little bluestem (*Schizachyrium scoparium*), (3) dry oak woods dominated by pin oaks (*Quercus ellipsoidalis*), and smaller stands of (4) hardwood forests with a large component of basswood (*Tilia americana*) and sugar maple (*Acer sacharrum*) and (5) white pine (*Pinus strobus*). These upland ecosystems are quite species rich: one m^2 of savanna contains 10-40 plant species, and one hectare about 200 plant species.

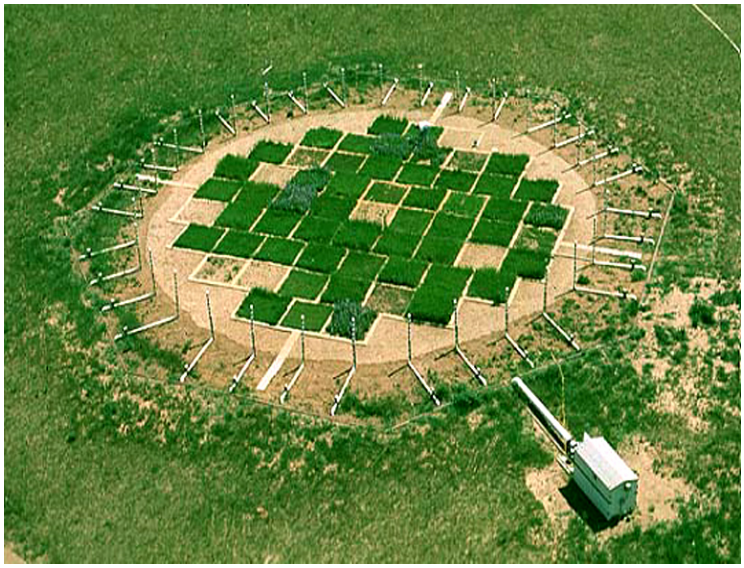
This diverse mosaic of upland ecosystems has been shaped by a variety of factors including the soil parent materials, the pattern and history of physical disturbances including fire, and European settlement and agriculture. The soils of CDR are derived from a glacial outwash sandplain, and span five of the ten soil orders. Upland soils are nitrogen poor, and numerous nutrient addition experiments performed in both old fields and native savanna have shown that nitrogen is the major soil resource that limits plant growth. The burn history of CDR has been influenced both by natural landscape features—especially wetland areas—as well as our program of prescribed burns. Since 1964, 12 blocks of native oak savanna have been subjected to fire frequencies ranging from one per year, to one per 7 years, to unburned controls. These areas have diverged dramatically in their vegetation and soils in response to fire frequency and some are now exhibiting characteristics not seen in this region since settlement in the 1800's. CDR also includes a successional chronosequence of more than 80 old fields of known history.

Research focus. CDR research examines the population, community and ecosystem impacts of human-driven environmental changes, especially changes in biodiversity and community composition, elevated levels of atmospheric CO2 and nitrogen (N) deposition, and altered disturbance regimes and trophic structures. New projects will include two other major drivers of environmental change: climate change and land use change in the region surrounding CDR.

A high diversity prairie planting at Cedar Creek.

Much of our research has focused on the causes and consequences of biodiversity. Following a severe drought in 1989, we observed that plant diversity appeared to have a stabilizing effect on productivity. In response we established experiments specifically designed to test hypotheses about diversity effects and the underlying mechanisms. A related experiment (BioCON) was established to study interactions between species diversity, and elevated levels of atmospheric CO2 and nitrogen deposition. Results from these projects continue to inform ecological theory. We have recently started to explore the practical applications of our research on biodiversity, such as the use of diverse prairies as a potential source of biofuels.

We have also begun to incorporate an evolutionary perspective into our research, examining how phylogenetic relationships combine with environmental conditions to determine the pattern and dynamics of community assembly, ecosystem dynamics, and biogeochemistry.



BioCON examines ecosystem responses to changes in biodiversity, atmospheric CO2, and nitrogen deposition