

2014 LTER Baseline Sampling Report

Main Field, Successional, and Forest Sites

Stacey VanderWulp

Soil

Soil was regularly sampled on the LTER to a depth of 25 cm at each of 5 stations in all replicates (R) of all treatments (T) 1-8, CF, DF, and SF. Samples were taken about twice each month, for a total of eleven times between April 14 and November 12. Soil was sampled using a ¾" diameter push corer. Two cores were taken from each station with all 10 cores composited for each plot. Inorganic nitrogen extractions and soil moisture determinations were done on subsamples from all soil sampled. Analysis of the inorganic nitrogen extracts for nitrate and ammonium will be completed by Cathy McMinn during winter 2014-2015.

The April 14 soil samples were air-dried and archived. A subsample, from each of the July 9 samples, was incubated in the field for 21 days and then inorganic nitrogen extracted to evaluate mineralization potential.

A post-harvest extensive grid soil sampling was done in all replicates of T1-6 on December 10. This soil was air-dried and will be sent to the MSU Soil and Plant Nutrient Lab for standard analysis which includes pH, lime requirement, P, K, Ca, and Mg.

Lastly, soil samples for inorganic nitrogen, soil moisture, and air-dried archive were collected twice from the T7 microplots in 2014 – May and October. Five soil cores were taken to a depth of 10 cm in the 3 x 3 meter center of each experimental plot and composited.

Gas

Gas was sampled throughout the LTER using static chambers (square) between April 16 and November 11. Main site plots that were sampled include T1-7 R1-4, as well as the fertilized, untilled microplots in T7 R1-4. Static chambers were also sampled in T8 R1-4 and all replicates of successional and forested sites, CF, DF, and SF. Sampling in the forest sites included the nitrogen deposition study microplots. With a sample frequency of about twice each month, gas samples were taken twelve times in 2014. The main site (including T8) was sampled in the morning and forest sites sampled in the afternoon of the same day. Square chambers were removed in late November and replaced with round chambers in T1-7 and DF. Round chamber sampling began on December 11 and should continue monthly through the winter. All gas samples were analyzed for nitrous oxide, carbon dioxide and methane by Kevin Kahmark and Cathy McMinn using the Agilent/Gerstel automated GC in Academic 330.

Soil temperature and soil samples to determine moisture content were taken near each chamber where gas was sampled. Additionally, beginning in 2012, air temperature and humidity were measured with digital thermometer/hygrometers both inside and outside of some chambers.

Water

Soil water samplers were used to sample water from the soil in T1-7 R2-4 and all replicates of CF, DF, and SF. Samplers were evacuated and leachate collected about twice a month. Eleven collections were made between April 2 and November 24. The volume of leachate collected was recorded. When 20mL or more of leachate was collected, the sample was filtered and frozen for analysis and archive. Inorganic nitrogen analysis of these samples will be completed by Cathy McMinn during winter 2014-2015.

Plants

Plant biomass samples were taken from plots prior to tillage or harvest in T1-6, or at peak biomass in T7, 8 and SF, and species separations completed. The plant sampling season began with cover crop samples taken from T3 and T4 on May 19-21, prior to tillage in those plots. Alfalfa was sampled in T6 three times - on May 29, June 30 and August 4, just prior to machine cutting each time. Live leaf samples were taken from the T5

microplots on July 15. In the main part of T5, understory samples were taken on July 17. Leaves were collected in ground traps as they fell from the trees in T5 between July 17 and November 7. Leaf litter was collected in traps in CF, DF, and SF between September 5 and December 12. Typically, leaf litter traps were checked and leaves collected weekly. At peak biomass, late July through early September, plant samples were taken from T7 (including microplots), T8, and SF. Corn and weeds were sampled from T1-4 beginning October 21, immediately preceded by sampling weeds in T3 and T4 micro-plots. On December 2, post-frost biomass samples were taken from T7. Species separations were not made on post-frost biomass, but surface litter was collected. All plant material from all samplings was dried at 60°C for at least 48 hours. All dried biomass will be weighed, ground and archived. Subsamples will be analyzed for carbon and nitrogen by Stacey VanderWulp.

In CF and DF, all trees with a DBH (diameter at breast height) greater than or equal to 5cm were measured in January. The diameter of poplar trees in T5 main and microplots were measured at 15cm above the ground on December 4 and 8.

Yield data was collected from all of the mechanically harvested plots.

All replicates (1-6) of T7 were burned on April 11 to help control woody species.

Scale-up Fields

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2013 was the last year for the LTER Scale-up experiment.

Nitrogen Deposition Study

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Fertilizer solutions were applied to the 1F, 3F and 10F plots in this study on three dates. Urea (46% N) was applied on April 30, July 15 and November 4. The type of fertilizer used was dependent on availability. Rates of fertilization are 1g/m²/year for the 1F plots, 3g/m²/year for the 3F plots, and 10g/m²/year for the 10F plots. Gas was sampled on a routine basis in this study; see the Gas section under the Main Field, Successional, and Forest Sites summary.

Biodiversity Study

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Yield data was collected from all of the annual crop treatments when harvested mechanically.

Cellulosic Biofuel Experiment

Stacey VanderWulp

Yield data was collected from all of the treatments through machine harvest.

Nitrogen Fertility Gradient

Kevin Kahmark

The LTER resource gradient study automated trace gas system was dormant in early 2014 until corn was planted on 5/20/2014. We installed chambers on the resource gradient in four treatments, with three chambers per treatment on Block 2 (rainfed). The treatments and chamber placements include F1 (between row), F3 (on row to capture initial fertilization), F5 (between row), and F8 (on row). After fertilizer sidedressing in June, the on row chambers were relocated to a between row placement. The treatments (F1, F3, F5, and F8) were selected after discussions with Neville Millar and Kevin Kahmark. The study will cover

the scope of standard fertilization practices at roughly doubling rates of application. The intent of the study was to look at spatial and system variability with replication of chambers.

Chambers were removed as necessary for field operations and the study was completed on 11/4/2014. The chambers were removed from the study area for rehabilitation. The trailer remains placed in the buffer nearest Block 2, F6 on the east side of the buffer plot.

Campbell moisture and temperature sensors were placed in the buffer plot near block 5, treatment F1 and in block 2, F8 and F6. No soil samples were collected for this project.

The automated GHG system was reconfigured to collect trace gas samples on six hour increment, four times per day. The collection scheme was randomized by treatment, sampling each of the three chambers in a given treatment.

These semi-continuous gas samples were taken using an automated chamber system with on-site GC analysis for nitrous oxide, carbon dioxide, and methane. Four time series samples (T0-T3) and an air sample were collected on each of 12 chambers for each configuration above.

Bonnie McGill and Kevin Kahmark installed Decagon suction cup lysimeters on south side of Block 2 and 5 in treatments F1 through F8 in April. Each treatment has one lysimeter at a depth of approximately 1.23m. Additionally, treatment F1 and F8 have lysimeter installations at 2.47 and 3.3 meters. There are access utility boxes installed outside the plots near treatment boundaries.

Added 1/13/2015: Soil samples were taken on December 8 and the field-moist soil analyzed for pH by Erica Annis. Four cores (0-25cm) were taken from each plot, two in the row and two between rows.

Living Field Laboratory Sieglinde Snapp

This was the last year of the Living Field Laboratory. In 2014, corn was grown (unfertilized) across the entire experiment to evaluate corn response to soil properties and management history. A deep soil core sampling was done in the fall to compare to the baseline soil sampling undertaken by Dr. Dick Harwood.