

2013 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 10 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 2013-2014.

The April 10 soil samples were air-dried and archived. A subsample, from each of the July 22 samples, was incubated in the field for 21 days and then inorganic nitrogen extracted to evaluate mineralization potential. Fresh sub samples of soil sampled on November 12 were analyzed for pH in the lab.

Additionally, a post-harvest extensive grid soil sampling was done in all replicates of T1-6 on November 5. This soil was air-dried and 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 2013 – April 5 and October 10. 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 9 and November 15. Main site plots that were sampled on a regular basis 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. 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 December and replaced with round chambers in T1-7 and DF. Round chamber sampling will begin in early January 2014 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 from each plot 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 (also known as low-suction quartz lysimeters) 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. Thirteen collections were made between March 26 and November 13. 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 done by Cathy McMinn during winter 2013-2014.

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. Alfalfa was sampled three times - on May 24, July 9 and August

16, just prior to machine cutting each time. Wheat and weeds were sampled from T1-4 beginning July 12, immediately followed by sampling in T3 and T4 microplots. In the main part of T5, understory was sampled July 30 and leaves were collected in traps on the ground as they fell from the trees between July 30 and November 14. Live leaf samples were taken from the T5 microplots on July 12. Leaf litter was collected in traps in CF, DF, and SF starting August 23 and finishing December 2. All leaf litter traps were checked and leaves collected weekly. At peak biomass, throughout August, plant samples were taken from T7 (including microplots), T8, and SF. On November 26, 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 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 2 and 3.

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

All replicates (1-6) of T7 were burned on March 29 to help control woodies.

Scale-up Fields

Stacey VanderWulp

Yield data was collected from all of the scale-up fields when harvested mechanically.

Biodiversity Study

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Cover crop biomass was harvested on May 6. Treatments B3, B5, B6, B8, B15, and B16 had cover crop in 2013. Eight 25 x 25 cm areas in each plot were harvested at ground level and sorted in the field to dicots, grass, red clover and cereal rye. Plant material was dried and weighed.

Weed biomass was harvested in all treatments. The weeds in two 25 x 100 cm areas were harvested in each plot and sorted in the field to dicots, grasses, and red clover. Plant material was dried and weighed. Weeds in 2013 wheat crop treatments (B4, B7, B10, B17, B20) were harvested July 22. Corn, soybean, and fallow treatment weeds were harvested October 1.

Soil samples for inorganic nitrogen, soil moisture, and air dried archive were collected November 4. A total of four soil cores per plot were taken to a depth of 25 cm at two points and composited.

Nitrogen Fertility Gradient

Kevin Kahmark

In December 2012, we installed a freeze-thaw experiment for Leilei Ruan which included 12 chambers deployed in Block 4, treatment F-6. The automated system trailer was moved from block 2, treatment F-4, to just south of block 4, treatment F-1. Resin strips were also deployed in each chamber. The research project utilized the automated trace gas sampling system and sampled from chambers with ambient snowfall, no snowfall, and double ambient snowfall. No chamber extensions were added during the sampling season. Campbell moisture and temperature probes (x3) were deployed near and in each type of chamber.

Leilei Ruan also collected 72 10-cm soil cores using a bulb planter for soil aggregate measurements and 18 soil cores for inorganic nitrogen measurements.

On April 23rd (2013), the chambers were removed and reconfigured for Neville Millar's irrigated/non-irrigated crop study (in wheat). The trailer is now placed in the southwest buffer adjacent to Block 2, F-6. The automated chambers were reinstalled in Blocks 2 and 5, treatments Rainfed-F1,3,4,5,6,8 and Irrigated-F1,3,4,5,6, 8 to assess GHG emissions in natural and irrigated moisture regimes. Campbell moisture sensors were placed in the buffer plot near block 5, F1 and in block 5, and F4. Sensors were placed in chamber and just outside the chamber. Temperature sensors were placed in the buffer plot, and inside the R-F4 and I-F1 chambers, each chamber has an air temperature and soil temperature sensor. No soil samples were collected for this project. The system was reconfigured to collect samples on six hour increments.

The irrigated/non-irrigated chambers were removed several times during the growing season for various field operations. No plant or soil material was collected by Neville Millar. The core lab took soil samples to 25cm depth on October 29 for pH and CN analysis.

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. Each sampling configuration was run on six hour increments, four times per day. Individual chamber closure periods varied depending on the study.

Nitrogen Deposition Study

Stacey VanderWulp

Fertilizer solutions were applied to the 1F, 3F and 10F plots in this study on three dates. Urea (46% N) was applied on April 17, July 30 and October 28. The type of fertilizer used was dependent on availability. Rates of fertilization are 1g/m²/year for the 1F plots, 3g/m²/yr for the 3F plots, and 10g/m²/yr 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.

Living Field Laboratory

Sieglinde Snapp

Soil samples (0-10 cm depth) for water stable aggregates and soil C pools were collected November 18th week and liquid nitrogen frozen soils for DNA analysis (0-10 cm depth) were collected from Integrated Fertilizer and from Integrated Compost systems on December 4-6.

All cropping system treatments and practices were implemented and maintained throughout the growing season for Integrated Fertilizer and Integrated Compost systems.

Yields for corn and wheat (mid-July, 2013) were determined by mechanically harvesting two center yield rows in each sub-treatment (cover and no cover), December 13-14. Soybean yield samples were collected by hand harvesting 10 foot row sections November 18-20.

Cellulosic Biofuel Experiment

Stacey VanderWulp

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