2015 LTER Baseline Sampling Report

Main Cropping System Experiment (MCSE)

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 fourteen times between March 31 and November 11. 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 extracts for nitrate and ammonium will be completed by Cathy McMinn during winter 2015-2016.

The April 13 soil samples were air-dried and archived. A subsample, from each of the July 6 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 November 4. 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.

Gas

This was the first year that the LTER field-season gas sampling was done with the same round chambers as on the GLBRC. The round chambers had been used for winter sampling only on the LTER prior to this year. Gas was sampled throughout the LTER using round static chambers between April 10 and November 19. 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 fourteen times during the 2015 field season. The main site (including T8) was sampled in the morning and forest sites sampled in the afternoon of the same day.   Winter sampling began on December 9 and should continue monthly through March 2016. This sampling includes T1-7 and DF. 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 when gas was sampled. Air temperature was logged both inside and outside, while light was measured outside, of some chambers using HOBO dataloggers.

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. Fifteen collections were made between March 19 and December 3. 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. Analysis for nitrate and ammonium of all leachate samples taken should be completed by Cathy McMinn during winter 2015-2016.

There are nine soil water samplers in the forest sites that are no longer functional, mostly due to damage by animals. New samplers will be installed in the spring of 2016 with minimal disruption to the plot. On the main site, there are four soil water samplers that consistently produce low volumes and/or rarely hold a vacuum. Installing replacement samplers in these main plots could be very disruptive to the plot. More discussion is needed before deciding how to proceed. There are three samplers in each of these main plots (R2-4) and in all cases two of the three are functional.

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 18, prior to tillage in those plots. Alfalfa was sampled in T6 three times in 2015 - May 19-20, June 22-24 and July 27, just prior to machine cutting each time. In T5, understory samples were taken on July 20. Leaves were collected in ground traps as they fell from the trees in T5 between July 20 and October 30. Leaf litter was collected in traps in CF, DF, and SF between September 4 and December 18. Typically, leaf litter traps were checked and leaves collected bi-weekly. At peak biomass, early August through early September, plant samples were taken from T7, T8, and SF. On August 27, weed biomass was sampled in T4 but only the portion of the weeds standing above the soybeans. This was done just prior to machine cutting of these tall weeds in an attempt to control weeds in T4. Soybeans and weeds were sampled from T1-4 beginning September 28 with T1, 2 then T3 and finishing October 12 with T4. On November 20, 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 November 24, 25.

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

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

Microplot Experiments

Herbicide-free Microplots (T1 R1-6, T2 R1-6): No sampling was done in 2015.

Rainfall Manipulation Experiment (T1 R1-4, T2 R1-4): Lead by Laura Hess, as part of her graduate student work. Soil water samplers were installed in the northern-most 15m of T1, T2 R1-4 in 2014. The frequency and amount of rainfall was manipulated over the areas where these samplers were installed. Leachate was collected regularly from these samplers and will be analyzed for nitrate and ammonium by Cathy McMinn during winter 2015-2016. Surface and deep core soil samples were taken from these microplots, as well, with inorganic nitrogen extractions also analyzed by Cathy.

Weed-control/Fertilization Microplots (T3 R1-6, T4 R1-6): No sampling was done in 2015.

Poplar Fertilization Gradient (T5 R1-6): Beginning in 2011, six levels of nitrogen fertilizer were applied to microplots in the northern-most 15m of each T5 plot. In early July 2015, fifteen green leaf samples were taken from three randomly selected trees near the center of each microplot. The leaves will be ground and analyzed for carbon and nitrogen at KBS and twelve micronutrients by the Soil and Plant Nutrient Lab on MSU main campus. The basal diameters of twelve trees in the center of each microplot were measured in late November. The same twelve trees are measured annually in late fall or early winter.

Disturbance/Fertilization Microplots (T7 R1-6): Lead by the Lau Lab. Soil samples for inorganic nitrogen, soil moisture, and air-dried archive were collected once from the T7 microplots in 2015 on April 6. Five soil cores were taken to a depth of 10 cm in the 3 x 3 meter center of each experimental plot and composited. Soil was not sampled in the T7 microplots in the fall. Greenhouse gases were sampled fourteen times in the untilled, fertilized microplots of T7 R1-4, as detailed in MCSE Gas section above. The T7 microplot biomass was sampled at its peak in August, but species were not separated and no grinding or archiving was done.

Nitrogen Deposition Study

Fertilizer solutions were applied to the 1F, 3F and 10F plots in this study on three dates. Urea (46% N) was applied on April 22, July 28 and October 6. The type of fertilizer used was dependent on availability. Rates of fertilization are 1g/m^2/year for the 1F plots, 3g/m^2/year for the 3F plots, and 10g/m^2/year for the 10F plots. Gas was sampled on a routine basis in this study; see the Gas section under MCSE.

Biodiversity Study

Joerg Schnecker (Grandy lab – University of New Hampshire) used soil samples taken from B9 and B13 to investigate the role of crop rotation on microbial resilience/resistance to precipitation extremes (drought and excessive wetting).

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

Cellulosic Biofuel Experiment

Sarah Emery (University of Louisville) used switchgrass plots: C4, C5, C6 and C7 for rainfall manipulation experiments. The aim of this research was to try to help address the role that soil communities play in drought stress tolerance.

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

Resource Gradient
Bonnie McGill, Stacey VanderWulp

The LTER Resource Gradient experiment automated trace gas system was dormant in 2015.

Bonnie McGill collected weekly soil water samples from the lysimeters installed in 2014 from March – December 2015.

In April, McGill added a potassium bromide solution of 1 g Br- / liter to plots 201, 203, 205, 207, 209, 501, 503, 506, and 508. The KBr was not added to the entire plot; rather it was added to the localized area above the lysimeter cups (approximately 1 meter diameter circles for plots with one lysimeter and a 2x1 m rectangle for plots with 3 lysimeters). 2 liters were added to plots with 1 lysimeter and 7 liters were added to plots with 3 lysimeters.

In November, McGill and Kevin Kahmark collected 12 feet deep soil cores from plots 101, 108, 404, 405, 603, 607, 703, and 709.

In December, McGill and Kahmark installed additional Decagon Devices SC20 suction cup lysimeters on south side of blocks 1 and 6 and the north side of blocks 3, 4, 7, and 8 in treatments F1, F5 and F8. Each treatment has one lysimeter at a depth of approximately 1.23m. In 2016 we will install access utility boxes outside the plots near treatment boundaries for the sampler bottles.

Soil samples were taken on October 20 and the field-moist soil analyzed for pH by Erica Annis. Four cores (0-25cm) were pooled from each plot, two in the row and two between rows.

Ilya Gelfand used F0 and F9 plots to look at nodulating and non-nodulating soybean plants. His research was looking at how fertilization affects biological nitrogen fixation, as well as rhizobium abundance and quality.

Nzube Prisca Egboluche (Tiemann lab – Michigan State University) sampled soil from F1, F3, F4, F5, and F7 to help her answer questions related to how cover crop chemistry may regulate soil microbes, SOM dynamics and plant available nitrogen.

Yield data was collected when plots were harvested mechanically.

Scale-up Fields – ended in 2013

Living Field Laboratory – ended in 2014

Written by Stacey VanderWulp (unless otherwise noted)