

2016 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 once or twice each month, for a total of eleven times between March 22 and November 1. 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 2016-2017.

The April 13 soil samples were air-dried and archived. A subsample, from each of the July 18 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 1. 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 second 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 2015. Gas was sampled throughout the LTER using round static chambers between March 23 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 fourteen times during the 2016 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 13 and should continue monthly through March 2017. This sampling includes T1-7 and DF. All gas samples were analyzed for nitrous oxide, carbon dioxide and methane by Kevin Kahmark 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 during the field season. 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. Thirteen collections were made between March 17 and November 9. 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 2016-2017.

Five new soil water samplers were installed in forest plots in November 2016. They replaced samplers where tubing had become detached from the sampler underground.

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 in 2016 began with wheat samples taken from T1-4 and T6 between June 30 and July 7, prior to machine harvest. Wheat was grown in place of alfalfa in T6 in 2016 and alfalfa replanted in those plots on August 26. In T5, understory samples were taken on July 22. Leaves were collected in ground traps as they fell from the trees in T5 between July 22 and November 17. Leaf litter was collected in traps in CF, DF, and SF between September 15 and December 12. 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 November 14, 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 7 and 8.

All replicates (1-6) of T7 were burned on March 21 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 2016.

Rainfall Manipulation Experiment (T1 R1-4, T2 R1-4): Two soil water samplers were installed in the northern-most 15m of each of T1, T2 R1-4 in 2014. The frequency of rainfall was manipulated over the area where one sampler was installed in each plot. The second sampler was left unsheltered as a control. The samplers were evacuated and leachate collected 22 times between March 17 and November 30. Subsamples of the leachate were sent to Stanford for deuterium tracer analysis. Also, anion and cation analysis was done by Dave Weed, primarily monitoring a bromide tracer. Cathy McMinn analyzed the leachate for nitrate and ammonium during 2016.

Weed-control/Fertilization Microplots (T3 R1-6, T4 R1-6): No sampling was done in 2016.

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. On July 12, 2016, fifteen green leaf samples were taken from three randomly selected trees near the center of each microplot. The leaves were ground and will be analyzed for carbon and nitrogen at KBS. The ground material was also sent to the Soil and Plant Nutrient Lab on MSU main campus and they arranged analysis for twelve micronutrients. The basal diameters of twelve trees in the center of each microplot were measured on December 7 and 8. 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 twice from the T7 microplots in 2016 on April 16 and November 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. 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 mid-August for untilled and mid-September for tilled, 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 May 11, July 19 and October 11. 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 MCSE.

Biodiversity Study

In September 2016, Tim Bowles (Grandy lab – University of New Hampshire) took soil samples from B3, B12, B15, and B18 (all 4 blocks) to use in a greenhouse experiment to investigate the effect of longer wet/dry cycles on nitrogen cycling and corn nitrogen uptake in soils from low vs. high diversity plots.

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.

Andrew Myers (Landis lab - Michigan State University) used C1 (which was left unplanted at his request), C2, C3, C10 and a mowed turf grass area in each block to examine the effects of host plant habitat on monarch oviposition rates and egg and larval survival.

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

Resource Gradient Experiment

Bonnie McGill, Stacey VanderWulp

The LTER Resource Gradient experiment automated trace gas system was dormant in 2016.

Bonnie McGill continued to collect soil water samples from the lysimeters installed in 2014. Nearly 500 samples were collected in 2016 and analyzed in the Hamilton lab.

Additionally, Bonnie sampled water from the groundwater well that provides irrigation water to the Resource Gradient for chemistry and dissolved gases. She repeated the sampling 5 times over a seven week period in July and August. These data are complementary to similar samples collected from two other KBS wells (the pasture dairy and Maggie's barn) plus 17 private groundwater irrigation wells in the St. Joseph area and another five private groundwater irrigation wells in the KBS vicinity.

On June 17, GreenSeeker readings were taken in all the plots in the gradient. On the same day, three plant samples were taken from each plot as well. The dried samples will be ground and analyzed for nitrogen to relate to the readings from the GreenSeeker.

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

On November 1, intact soil samples were taken from two randomly selected blocks in each of the rain-fed and irrigated areas. Plots sampled were F1, F5 and F8 in blocks 2, 3, 6, and 7. Three (25cm) cores were taken from each plot and separated into 0-10 and 10-25cm. Bulk density was calculated and samples will be analyzed for carbon and 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)