2011 LTER Baseline Sampling Report

Main Field, Successional, and Forest Sites

Stacey VanderWulp

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 thirteen times between March 23 and November 7. 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 was completed by Cathy McMinn during 2011. The first sampling in April was air-dried and archived. Additionally, a postharvest extensive grid soil sampling was done in all replicates of T1-6 on November 21. 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 2011—March 30 and October 3. 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 was sampled throughout the LTER using static chambers (square). 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. Additionally, all replicates of successional and forested sites, CF, DF, and SF, were sampled. Sampling in these sites included the nitrogen deposition study microplots. With a sample frequency of about twice each month, gas samples were taken fourteen times between March 30 and November 10. The main site was sampled in the morning and forest sites sampled in the afternoon of the same day. 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 moisture measurements were taken from each plot where gas was sampled.

Quartz lysimeters were used to sample water from the soil in T1-7 R2-4 and all replicates of CF, DF, and SF. Lysimeters were evacuated and leachate collected about twice a month. Thirteen collections were made between March 16 and November 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. Inorganic nitrogen analysis for these samples will be done by Cathy McMinn during winter 2011-12.

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. In CF and DF, all trees with a DBH greater than or equal to 5cm were measured from January 4-6. Just prior to tillage, between May 6 and 20, cover crop (red clover) was sampled in T3, T4, and weed control microplots in each. Alfalfa was sampled on June 2, July 12-13 and August 23-24, just prior to machine cutting each time. Poplar trees in T5 were measured July 14-15 in the microplots (established Summer 2011) and December 20 in the main plot. Also in T5, understory was sampled July 18-19. Leaves were collected in traps on the ground as they fell from the trees in T5 from July 19 to November 18. Live leaf samples were taken from the T5 microplots

on July 20-21. Leaf litter was collected in traps in CF, DF, and SF starting August 31 and finishing November 28. All leaf litter traps were checked and leaves collected weekly. At peak biomass in August, plant samples were taken from T7 (including microplots), T8, and SF. Corn was sampled from T1-4 on October 26-28, prior to the entire plot combine harvest. On November 16 and 18, 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^{o}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.

All replicates (1-6) of T7 were burned on April 13.

Scale-up Fields

Stacey VanderWulp

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

Biodiversity Study

Carol Baker

Cover crop biomass was harvested May 17-20. Treatments B4, B5, B7, B15, and B16 had cover crop in 2011. 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, grass, and red clover. Plant material was dried and weighed. Weeds in 2011 wheat crop treatments (B3, B6, B9, B17, B20) were harvested June 27-28. Corn, soybean, and fallow treatment weeds were harvested October 17-18.

Soil samples for inorganic nitrogen, soil moisture, and air dried archive were collected November 7. 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 2010, a freeze-thaw experiment was installed for Leilei Ruan which included 12 chambers deployed in Block 2, treatment F6. Resin strips were also deployed. A snow fence was installed to the west of F6 in Block 2, along F7 to allow the snow to accumulate evenly in the plot of interest. The research project utilized the automated trace gas sampling system and sampled from chambers with ambient snowfall, no snowfall, and twice ambient snowfall. Chamber extensions were added on January 31 due to high snowfall and were removed for increased sensitivity on February 14. Campbell moisture and temperature probes (x3) were deployed near each type of chamber.

On April 15, the chambers were removed and reconfigured for Neville Millar's irrigated/non-irrigated crop study (in corn). The automated chambers were reinstalled in Blocks 2 (non-irrigated) and 5 (irrigated), treatments F1, 3, 4, 5, 6, and 8 in each to assess GHG emissions in each moisture regime. White bucket chambers were installed in triplicate in each treatment and sampled three times during the early growing season. Soil samples were also collected. Campbell probes were added to the irrigated and non-irrigated portion of the study.

A LWET sensor was installed in the buffer plot between Block 2 and 5 that measured leaf wetness and irrigation events. Data was uploaded to the weather variates table daily.

The irrigated/non-irrigated study was removed in November for corn harvest and reinstalled to collect postharvest data. Soil and plant material samples were collected in each of the above plots just prior to harvest.

The project was dismantled on December 2 and reconfigured for a freeze-thaw study in Block 4, F6. Again, 12 automated chambers were installed in varying snow accumulation (4-0x, 4-1x, 4-2x) configurations. Soil samples were collected from F6 of B4.

Gas samples were taken semi-continuously 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 September 13. Ammonium Nitrate (34% N) was used to fertilize on April 22 and November 22. The type of fertilizer used was dependent on availability. Rates of fertilization are $1 g/m^2$/year for the 1F plots, $3 g/m^2$/yr for the 3F plots, and $10 g/m^2$/yr for the 10F plots. Gas was sampled on a routine basis, see above.

Living Field Laboratory

John Green

In the spring, just prior to planting, soil was sampled to 25 cm in all 2011 corn plots. Inorganic nitrogen extractions and soil moisture determinations were done on sub samples from the initial sampling, as well as a sub sample that underwent an aerobic nitrogen mineralization potential 28 day assay. Analyses of these inorganic nitrogen extracts were also performed to determine nitrate and ammonium content.

Cover crop aboveground biomass was sampled just prior to tillage in the continuous corn and the 2 rotational systems for the four crop management regimes (conventional, integrated fertilizer, integrated compost and organic), for a total of 16 treatments, 4 blocks. All

treatments were split into cover crop and non-cover crop sub plots. Plant tissues were dried at 60^{o}C, weighed, then ground and analyzed for total C and N. Yields for corn, wheat, and soybean were determined by mechanically harvesting 2 center yield rows in each sub-treatment (cover and no cover).

Cellulosic Biofuel Experiment

Stacey VanderWulp

Yield data was collected from all of the treatments through machine harvest. Subsamples of mechanically harvested material were oven-dried, weighed, ground and archived.