Title: Using Cross-Scale Data to Constrain an Agro-Ecosystem Model to Produce Estimates of Miscanthus Production at a Field-Scale

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Project Goals: Evaluate a research plot-calibrated agro-ecosystem model performance at predicting harvest yields at commercial miscanthus sites and determine what environmental and management factors most likely explain model error.

Abstract Text: There is evidence from both field experiments and ecosystem models that the perennial C4 bioenergy crop *Miscanthus x giganteus* (miscanthus) can provide more energy per sown area, reduce net carbon dioxide emissions, and lower nitrate leaching rates than corn ethanol in certain locations. Typically field experiments are at scales too small while ecosystem models predictions are often at scales too coarse to represent commercial operations. Because the primary goal of producers is to generate profit, it is important to identify locations where miscanthus can potentially compete economically with other management options while not compromising environmental goals. This requires resolving genotype, environment, and management interactions and representing those interactions in a framework capable of resolving variations at scales useful to miscanthus producers. Therefore, the objective of this project is to utilize plant- and field-scale measurements from several commercial and experimental plots of miscanthus in Iowa and Illinois to inform a mechanistic agro-ecosystem model (Agro-IBIS) and ultimately improve miscanthus yield predictions. Growing season leaf-level gas exchange, biomass, and leaf area data were collected from a miscanthus field experiment in central Iowa and were used to calibrate Agro-IBIS. The model was also calibrated and validated using SLOPE, a novel satellite-based product that estimates gross primary productivity, and observed biomass yields to calibrate and validate Agro-IBIS's predictions at the commercial miscanthus sites. Utilizing a length-mass allometric model for miscanthus, we corrected Agro-IBIS yield predictions based on the estimated cutting height of the chopper. Preliminary results indicate that using subfield-scale measurements in conjunction with field-scale measurements while also accounting for different harvest managements will improve Agro-IBIS's miscanthus yield predictions at a field-scale. This work will allow for more strategic placement of this bioenergy crop candidate that would optimize profit for the producer while reducing nitrate leaching and sequestering carbon.

References/Publications

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