Title: *Impacts of potato and maize management and climate change on groundwater recharge across the Central Sands*

Project I.D.: *DNR Project #215*

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Period of Contract: *7/1/12-6/30/15*

Background/Need: *The Wisconsin Central Sands region irrigates 80,000 hectares of potato, maize, pea, and bean crops by pumping groundwater from a coarse, shallow aquifer. The expansion and intensification of irrigated agriculture and recent surface water stresses have led to a community conflict over groundwater in this region. Effective regional groundwater management requires an increased understanding of groundwater recharge and evapotranspiration from irrigated cropping systems.*

Objectives: *The overarching goal of this project was to quantify on-farm crop ET and potential groundwater recharge for dominant crop rotations in the Wisconsin Central Sands with greater spatial and temporal resolution than previous endeavors to test causal relationships and collect physiological and biophysical data required to parameterize and calibrate a process-based agroecosystem model of ET and recharge for the Wisconsin Central Sands.*

Methods: *We implemented a semi-permanent network of 25 vadose zone lysimeters on Isherwood Farms, a 600-hectare, sixth generation family farm in Plover, WI. Between 2013-2015, we collected drainage, soil moisture and temperature, micrometeorological, crop physiological, and crop phenological data from irrigated potato, maize (field and sweet), and pea cropping systems under real agronomic management practices on Isherwood Farms.*

Results and Discussion: *We observed significant intrafield variability in potential recharge and evapotranspiration from cropping systems on Isherwood Farms. This variability may the result of interfield variability in crop type (our initial hypothesis) or intrafield variability in soil texture, topography, and phenology.*

Conclusions/ Implications/ Recommendations: *We have furthered our understanding of several biophysical mechanisms unique to irrigated agroecosystems in the WCS. We plan to use this increased mechanistic understanding, our robust field dataset, and site-specific physiological parameters to build process-based models of potential recharge and ET (Agro-IBIS) for potato, sweet corn, and pea functional types. By linking hydrology and carbon assimilation in these models, it will be possible to mechanistically explore the relationship between crop water use and crop productivity in the WCS. A future goal of this work will be to model regional solutions (i.e. precision irrigation, irrigation scheduling, deferred irrigation) over the WCS and assess their resilience to changes in climate.*

Related Publications: *We are in the process of preparing publications from this work to submit for peer-review. We anticipate 2-3 peer-reviewed publications resulting from this work during 2016-2017.*

Key Words: *Wisconsin Central Sands, groundwater, irrigated agriculture, recharge, evapotranspiration*

Funding: *Wisconsin Department of Natural Resources State of Wisconsin Groundwater Joint Solicitation Program.*

Final Report: A final report containing more detailed information on this project is available from Wisconsin's Water Library, (*http://wri.wisc.edu/Default.aspx?tabid=69*), 1975 Willow Drive, Madison, Wisconsin 53706 (608) 262-3069.