

Dissertation Oral Defense—Riva Denny

Thursday, May 3, 2018
3pm-5pm
457 Berkey Hall

All are encouraged and welcome to attend. See you there!

TITLE: A Cross-Scale Examination of How Knowledge and the Physical Environment Influence the Use of Conservation Practices in US Commodity Agriculture

ABSTRACT

While agriculture is of the utmost importance to human societies for its production of food and fiber (and increasingly fuel), it is also a source of environmental harm as a producer of nonpoint source pollution to the air and water. Even though efforts to control agricultural nonpoint source pollution have focused on encouraging farmers to voluntarily use practices that will better keep soil and nutrients on farms, agriculture remain a substantial source of water pollution in the US. This has led to continued efforts to better understand why farmers choose to use these best management practices (BMPs) so that incentives can be improved. Therefore, this dissertation focuses on farmer decision-making related to the use of soil, water, and nutrient conserving BMPs in row-crop agriculture in the US Midwest, with particular interest in the importance of the roles of knowledge and the biophysical environment. Conceptually, my dissertation is informed and organized by a theory of action, in which purposive individual actions cumulatively create system-level effects. This is done by analyzing data at the individual, county, and state scales as well as across-scales in three empirical chapters.

The first analysis uses qualitative interview data from 2014 with 151 Midwestern corn farmers in three states to explore the range and variation of the tillage practices in use, and to consider the reasons farmers give for their tillage decisions. The results show that farmers commonly use more than one style of tillage on their operation and base their tillage decisions on biophysical conditions, compatibility with other practices, and the relative savings and costs of different tillage styles. The second analysis uses 2017 farmer survey data from four states (n=814) to compare the relative importance of a wide range of predictors of BMP use from the literature on the use of five BMPs: pre-sidedress nitrate tests (PSNTs), nutrient maps, variable rate nitrogen (N), variable rate phosphorus (P) or potassium (K), and cover crops. It also explores the use of practice knowledge as a predictor of BMP adoption that has been underutilized in previous research. The results show little overlap in the predictors of the five practices, even between those with similar characteristics. Two predictors in particular—the use of independent crop consultants as an information source and a general measure of practice knowledge—were found to be the most important influences across all five models. The third analysis considers the cumulative decisions of multiple farmers by using county and state data for the North Central region (1,042 counties) to examine the effects of conservation tillage, no-till and cover crops on county-level fertilizer use. The results show that no-till and cover crops increase fertilizer use, counter to expectation, even when controlling for yield, and find normal precipitation to be an important predictor of fertilizer use.

The importance of the biophysical environment is a key finding of all three analyses, and different biophysical conditions can increase and decrease the use of BMPs. The differences in effects of both social and biophysical factors across BMPs has important implications for future research and suggests the need for specific measures of practices that include temporal and spatial variation, and the careful consideration of practices individually, rather than as groups of ostensibly related practices. Knowledge also shows promise as a variable of importance in practice use—both through knowledge of how to use or implement a practice, and through knowledge of environmental-systems that shape how farmers perceive and interpret their biophysical context.

Committee Members:

Sandy Marquart-Pyatt, Chair
Stephen Gasteyer
Aaron McCright
Phil Robertson
Diana Stuart