Environmental Science Graduate Program Seminar Series

Effect of climate change and conservation practices on agroecosystem services at a landscape scale

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Abstract

Ecosystem services from agricultural production systems (agroecosystem services) can be influenced by weather and management practices such as type of tillage, fertilizer source, timing and application rate, presence of cover crops, and residue incorporation. To achieve a greater reduction in greenhouse gas (GHG) emissions to address climate change while also improving soil health, agriculture needs to be more innovative and sustainable. Hence, the overarching goal of this study is to assess the effects of climate change and conservation practices such as the use of no-tillage, cover crops, and organic amendments (i.e., manure) on agroecosystem services such as soil organic carbon (SOC), GHG emissions, and crop yield with diverse soil types. For this, we are using the process-based biogeochemical DeNitrification and DeComposition (DNDC) model to simulate the tradeoffs that arise from management choices and environmental conditions. The preliminary results for one site showed that the conservation scenarios reduced nitrous oxide (N_2O) emissions from around 3% to 26%, increased SOC sequestration from 1 to 8.6%, while carbon dioxide (CO_2) emissions were found to vary from -4 to 34% compared to the baseline scenario. To understand the magnitude of variability in ecosystem services with the adoption of these conservation practices in fields with different soil types and weather conditions, the DNDC model is being run for 35 sites with soil properties and crop rotation systems that are dominant in the Western Lake Erie basin under baseline management conditions, conservation scenarios and climate change scenarios. Quantification of variability in ecosystem services under various scenarios in a spatially explicit manner and assessment of tradeoffs between them will help farmers select suitable specific conservation practices based on their field conditions and help increase their resilience towards the changing climate.

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