Environmental Science Graduate Program Seminar Series

Watershed modeling to support healthy ecosystems under climatic stressors

Haley Kujawa

April 8th, 2022 | 2:00-3:00 PM

Smith Laboratory, Room 3150

Abstract

Climate assessments for the Midwest predict a wetter climate with more extreme precipitation events. This carries the potential to increase nutrient runoff and degrade water quality. Watershed models can be driven by climate models to predict how these changes will alter nutrient loading patterns. However, both climate and watershed models come with inherent uncertainties. In this study, we use an ensemble of climate and watershed models to quantify a) if climate or watershed models introduce more uncertainty in hydrology and nutrient predictions and b) if increasing agricultural conservation will remain effective in mitigating water quality impairments in a future climate. Five watershed models of the Maumee River Watershed (located in Ohio, Indiana, and Michigan) were created by independent research groups using the Soil and Water Assessment Tool (SWAT). Six climate models were used to drive the SWAT ensemble. We ran both a baseline management scenario (business-as-usual agricultural management) and an increased agricultural conservation scenario (total adoption of cover crops, subsurface phosphorus fertilizer placement, and buffer strips on 60%, 68%, and 50% of cropland, respectively). In the baseline management scenario, the climate models were the main source of uncertainty in discharge (96%) and nitrogen loading (63%), but the watershed model introduced more uncertainty in phosphorus loading (57-72%). In the increased conservation scenario, results on the annual scale from the ensemble show decreases of 41% for total phosphorus loading, 18% for dissolved reactive phosphorus loading, and 14% for total nitrogen loading. Comparing results from individual watershed models with the ensemble demonstrated the choice of a single watershed model could alter the messaging to stakeholders on the necessity or effectiveness of increased conservation. In summary, the results from this study demonstrate there can be confidence in the messaging despite uncertainty.