WETLAND EXTENT AND PLANT COMMUNITY COMPOSITION VULNERABILITY TO CLIMATE CHANGE

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The potential impact of climate change on wetland-provided ecosystem services has been largely unspecified because of the difficulty in predicting changing hydrologic conditions, which are a major driver of structure and function in these ecosystems. The Penn State Integrated Hydrologic Model (PIHM), constructed and calibrated using nationally available data sets (e.g., soils, topography, national wetlands inventory (NWI) wetlands, USGS stream gages), was used to generate groundwater depth conditions for multiple hydrogeomorphic (HGM) wetland types (depression, slope, riverine), across a range of ecoregions in Pennsylvania, under historical and future climate scenarios. The vulnerability of wetland extent to climate change was assessed based on changes in groundwater depth and changes in the percent of time groundwater was present in the rooting zone (upper 30 cm). These estimates of extent vulnerability were calculated at annual, seasonal, and growing season scales as well as at ecoregion, watershed, and HGM-specific spatial scales. Such scale-specific vulnerability assessments provide insight into the complexity of wetland sensitivities to changes in the hydrologic drivers of wetland structure and function and offer a surrogate for the estimation of which wetland-provided ecosystem services will be the most vulnerable to future climate change. Wetland plant community composition can also be a measure of wetland vulnerability and may be both more sensitive and an earlier indicator of climate change induced stress than wetland extent. To test this, an existing database of metrics characterizing the floral community (e.g., percent invasives, percent annual, floristic quality assessment index) and long-term hydrologic monitoring was used to develop relationships linking hydrology, anthropogenic disturbance, and community composition. Using the effects of disturbance on hydrology as a proxy for climate change, the hydrology and plant community relationships were extended to the modeled future hydrology scenarios to provide estimates of wetland plant community composition responses to climate change.

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