Adaptation tipping points of a wetland under a drying climate

Wetlands experience considerable alteration to their hydrology, which typically contributes to a decline in their overall ecological integrity. Wetland management strategies aim to repair wetland hydrology and attenuate wetland loss that is associated with climate change. However, decision makers often lack the data needed to support complex social environmental systems models, making it difficult to assess the effectiveness of current or past practices. Adaptation Tipping Points (ATPs) is a policy-oriented method that can be useful in these situations. Here, a modified ATP framework is presented to assess the suitability of ecosystem management when rigorous ecological data are lacking. We define the effectiveness of the wetland management strategy by its ability to maintain sustainable minimum water levels that are required to support ecological processes. These minimum water requirements are defined in water management and environmental policy of the wetland. Here, we trial the method on Forrestdale Lake, a wetland in a region experiencing a markedly drying climate. ATPs were defined by linking key ecological objectives identified by policy documents to threshold values for water depth. We then used long-term hydrologic data (1978-2012) to assess if and when thresholds were breached. We found that from the mid-1990s, declining wetland water depth breached ATPs for the majority of the wetland objectives. We conclude that the wetland management strategy has been ineffective from the mid-1990s, when the region's climate dried markedly. The extent of legislation, policies, and management authorities across different scales and levels of governance need to be understood to adapt ecosystem management strategies. Empirical verification of the ATP assessment is required to validate the suitability of the method. However, in general we consider ATPs to be a useful desktop method to assess the suitability of management when rigorous ecological data are lacking.