Improved Mapping of Riparian Wetlands Using Reach Topography

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Abstract:

Riparian wetlands provide a suite of ecosystems services including floodwater retention, biogeochemical processing, and habitat provisioning. However in one mid-Atlantic watershed the National Wetlands Inventory was shown to underrepresent these systems by greater than 50%. These hydrologically and physically complex floodplain systems occur where there is vertical, horizontal, and longitudinal hydrologic connectivity between the floodplain and the stream and groundwater systems. Stream reaches that have floodplain and wetland habitats typically are unconstrained latitudinally and longitudinally where overbank flooding can occur, and where there is regional, groundwater discharge at the toe-of-slopes. Building on this knowledge, the goal of this study was to improve the spatial prediction of headwater riparian wetlands through identification of suitable reach settings that allow for this three dimensional exchange of water. In the Shaver's Creek drainage, a small watershed in the Ridge and Valley Physiographic Province of Pennsylvania) known locations of mapped, non-open water National Wetlands Inventory (NWI) wetlands, field-identified non-NWI wetlands, and non-wetland locations (n=40, 30, and 35, respectively) were used to build a predictive partition tree. Predictive variables were DEM-derived topographic indices for the stream reaches: valley width, mean stream slope, and contributing area. The partition tree resulted in a 5-node tree with classes ranging from very high to very low likelihood of wetland occurrence or least constrained to most constrained. The overall R2 of the tree was 0.61, however two of the classes (very high likelihood and very low likelihood) comprised ~70% of the study reaches and were classified with accuracy >94%. This classification is a useful approach to characterizing likely floodplain wetland and non-floodplain wetland supporting reach settings, especially in screening out the least likely wetland-supporting or most constrained reaches within a watershed. This approach could be developed in other physiographic settings, and could be useful in identifying unmapped wetlands for field study, siting potential restoration efforts, and scaling up findings from site-level to watershed-wide inferences.