Bathymetry and Vegetation in Isolated Marsh and Cypress Wetlands in the Northern Tampa Bay Area

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Wetland bathymetry and vegetation mapping have provided two useful lines of evidence for assessing the hydrologic and ecologic status of expansive coastal and riverine wetlands. In smaller isolated freshwater wetlands, traditional vegetation mapping surveys have been widely used. However, bathymetric data to describe topography has seldom been collected in these systems, despite the prevalence of isolated wetlands in many regions of the United States and the recognized importance of topography as a control on inundation patterns and vegetation distribution.

In the Northern Tampa Bay area of west-central Florida, bathymetry and vegetation were surveyed in ten isolated wetlands: five marshes and five cypress wetlands. The wetlands were grouped into three categories based on the effects due to ground-water withdrawals from municipal well fields: natural (no effect), impaired (drier than natural), and augmented (wetlands with artificially augmented water levels). Bathymetric data were collected using one or more techniques depending on the physical attributes of the wetlands. Delineation of the wetland perimeter was a critical component for estimating wetland surface area and stored water volume. The wetland perimeter was delineated by the presence of Serenoa repens (the "palmetto fringe") at nine of the ten sites. At the tenth site, where the palmetto fringe was absent, hydric soils indicators were used to delineate the perimeter. Wetland vegetation was surveyed twice a year for two years in fixed plots located at three distinct elevations in the wetlands. Vegetation surveys determined the community composition and the abundance of obligate, facultative wet, and facultative species at each elevation.

Bathymetry maps were generated, and stage-area and stage-volume relationships were developed for all 10 wetlands. Bathymetric data sets containing a high density of data points collected at frequent and regular spatial intervals provided the most useful stage-area and stage-volume relations. Bathymetric maps of several wetlands were also generated using a low density of data points collected along transect lines alone, or along both transect lines and elevation contour lines. In a comparative analysis of the three mapping approaches, stage-area and stage-volume relations based on transect data alone underestimated the wetland area and volume significantly (50-100 percent) compared to results using a higher density of data points. Adding data points collected along one elevation contour below the wetland perimeter to the transect data set greatly improved the agreement in the resulting stage-area and stage-volume relationships with the higher-density mapping approach.

Stage-area relationships and routinely monitored stage data were used to compare and contrast the weekly average flooded area in a natural marsh and an impaired marsh over a two year period. Vegetation surveys used together with flooded-area information provided the potential for extrapolating vegetation results from points or transects to the wetland as a whole. A comparison of the frequency of flooding of different areas of the wetland and the species composition in vegetation plots at different elevations indicated the dependence of vegetation on inundation frequency. However, because of the broad tolerances of many wetlands plants to a range of inundation conditions, vegetation surveys alone provided less definitive evidence of the hydrologic differences between the two sites, and changes occurring in the two years, than the flooded-area frequencies.

Comparing flooded-area frequencies and vegetation surveys of impaired and augmented wetlands to flooded-area frequencies in natural wetlands could provide a more useful tool for assessing ecological status than vegetation and stage data alone can provide. The approach requires that flooded-area frequencies be determined in a population of natural wetlands. When assessing the ecological status of impaired wetlands, the historical rainfall, stage data, and vegetation surveys needed to make comparisons with present-day wetland conditions are often not available. Comparing and contrasting flooded-area frequencies and vegetation in natural and impaired or augmented wetlands that have similar geologic and climatic settings provides a useful method to quantify the impacts of climate or human activities on hydrology and ecology. Such comparisons can be used to interpret the degree of wetland mitigation achieved using augmentation, and to objectively assess the extent of change in wetlands impacted by human activities.