Geophysical and sedimentological studies to model wetland evolution in a landscape perspective: A case study from South Africa.

Hilbich, Ch.¹, Helmschrot, J.², Mäusbacher, R.¹, Daut, G.¹

¹ Department of Physical Geography, University of Jena, Germany
² Department of Geoinformatics, Geohydrology and Modeling, University of Jena, Germany

Since geophysical and sedimentological approaches provide information on spatial and temporal landscape dynamics, such methods have been used to evaluate the evolution and recent dynamics of palustrine wetlands within a landscape perspective in the semi arid headwaters of the Umzimvubu catchment (20,000 km²), Eastern Cape, South Africa. Seismic refraction methods have been applied to 7 selected reference wetlands to identify the thickness of sediments, their structural layering and physical properties. The seismic profiles show that all wetlands are characterized by relatively homogeneous sediment layers ranging from 2 to 3.5 m above underlying bedrock. The overall layer thickness is neither associated with the extent of wetlands tributary area, nor with wetland type or size significantly. Geochemical and physical parameters (grain size, pH, TOC, N, S, Al, Fe, pF, hydraulic conductivity, etc.) have been determined by sedimentological analyses of soil cores and samples from several wetland transects. Soil profile analysis indicates that wetland evolution was induced by a late Holocene infilling of former valley bottoms with fine materials. This process started about 3370±51 ¹⁴C years BP according to radiocarbon dating. Significant layers of clay and silt in upper parts of the profile are addressed to phases of increased sedimentation of fine materials as a consequence of either climate change and/or anthropogenic influences associated to low fluvial dynamics and sparse vegetation cover. In addition, Fe-/Mn-concretions indicate soil formation processes associated to increased groundwater fluctuation. As a result an impervious layer has been developed that affects the seasonal hydrological dynamics and therefore enables recent wetland conditions.