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Diatom-based models for inferring water chemistry and hydrology in temporary depressional wetlands

Riato L
Leira M
Della Bella V
Oberholster PJ

ABSTRACT:

Information on the response of temporary depressional wetland diatoms to human-induced disturbances is a limited and important component for the development of temporary wetland biological assessments in human-modified landscapes. Establishing a reference condition of variation due to natural disturbances in depressional wetlands using diatoms is necessary for further investigations of anthropogenic impacts. We examined the temporal and spatial responses of epiphytic diatom communities to natural environmental disturbances within three least disturbed wetlands in the Mpumalanga Province, South Africa. Alkalinity, Na^+ and Cl^-, water depth and total relative evapotranspiration (ETo) accounted for the highest proportion of temporal variation in composition of epiphytic diatoms, as revealed by canonical correspondence analysis (CCA). Alkalinity, Na^+ and Cl^- explained a much higher proportion of species variation, using partial CCA. A simple WA with inverse deshrinking produced reasonably robust models for Na^+ (r^2_{boot} = 0.71), depth (r^2_{boot} = 0.64) and alkalinity (r^2_{boot} = 0.46), not for Cl^- and ETo. We determined species optima and tolerances for Na^+, depth and alkalinity which can facilitate identification of anthropogenic impacts based on changes of indicator taxa assemblages. Our study provides a basis for newly developed quantitative tools to be used in biomonitoring studies and evaluations of reference conditions for temporary wetland management.