INFERRING LAKE DEPTH USING DIATOM ASSEMBLAGES IN THE SHALLOW, SEASONALLY VARAIBLE LAKES OF THE NEBRASKA SAND HILLS (USA).

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The Nebraska Sand Hills are a unique eco-region in the semi-arid Great Plains of the western United States. The water table underlying the Sand Hills is part of the High Plains/Ogallala aquifer, an important water resource for the central Great Plains. The aquifer reaches the surface in many inter-dune depressions creating thousands of lakes and wetlands which serve as critical habitat for migratory birds and other wildlife and support the local ranching economy. Understanding long-term hydrologic variability and its effect on the lakes is important for future water management planning. Lake levels are affected directly by fluctuations in the water table, which is recharged primarily by local precipitation and responds quickly to climatically induced changes in regional water balance. Modern instrumental records are available for only 50-100 years, and paleolimnological data provide important insights into the extremes and variability in moisture balance over longer time scales.

A set of 69 lakes from across Nebraska was used to establish a statistical relationship between diatom community composition and water depth. This relationship was then used to develop a diatom-based inference model for water depth using weighted averaging regression and calibration techniques. Development of the inference model was complicated by strong intra-seasonal variability in water depth and the linkages between depth and other limnologic characteristics, including water clarity and nutrient concentrations. Analysis of historical diatom communities from multiple lakes allowed for the reconstruction of lake-level fluctuations over the past several thousand years. Comparisons of these reconstructions with instrumental records and additional proxy records showed that diatoms may not faithfully reflect short-term fluctuations in water level but do reflect large and persistent change in moisture availability. Thus diatoms are a useful addition to the tools available for understanding past drought in the central Great Plains, especially when trajectories of change are constrained by data from multiple sites or other proxies.