A Palynological Reconstruction of the Late Holocene Flora and Climate Change from Three Minnesota Lakes

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Abstract

This study is a coordination between the LacCore Facility (Limnologic Research Center, University of Minnesota) and the Department of Natural Resources for the Fond du Lac Reservation located in Northern Minnesota. The primary focus is on the historical presence and abundance of Wild Rice (Zizania palustris and Zizania aquatica). Pollen grains found within lake sediment cores extracted from Deadfish Lake, Perch Lake, and Rice Portage Lake on the Fond du Lac Reservation were used to reconstruct the paleoenvironment from the late holocene to present. A minimum of 300 pollen grains were counted from each 16cm (~25 years) sample interval of sediment and were identified down to the species, genus, or family level. The data was then compared to the climate sensitivities (xeric/mesic) of each taxa to relate observed changes in the pollen record. Changing environmental conditions were derived from the vegetational responses.

Study Area

The study area is located in Northern Minnesota on the Fond du Lac Reservation. It is 20 miles from the westernmost point of Lake Superior and is comprised of three rice lakes, characterized by their shallow basins and ability to support wild rice populations. The elevation of the lakes changes from 1287 to 1300 feet over a 5 mile range. The trend observed was a shift from a Pinus-Poaceae dominated zone (1400-1000 y BP) to a Pinus-Betula-Poaceae dominated zone (200-1000 y BP) to a Pinus-Poaceae dominated zone (100 y BP to present) at Deadfish lake. Perch Lake exhibited a relatively stable dominance pattern of Pinus-Betula-Poaceae (1700 y BP - present) with minor surges in mesic species beginning at 1700 y BP and ending ~1400 y BP. Rice Portage Lake and Perch Lake show a similar dominance of the signal by the arboreal pollen due to their close proximity, with little fluxes of the hardwoods Ulmus, Quercus, and Tilia every 500-1000 years. The surges of hardwoods can indicate warming conditions due to their inability to survive harsh frosts as could be indicative of a stand releasing event such as a massive fire caused by droughts. This study is going to be compared to phytolith, plant macrofossils, and diatom evidence to find a higher resolution of changing conditions. There was much charcoal observed but not counted, I suggest a study to reference charcoal with fire sensitive species presence for deriving conditions.

Lab Methods

A minimum of 300 grains were counted on each slide and obtained by a simple line survey with a 1 mm increment coordinate system. Total grain counts at each interval depth were entered in Microsoft Excel® and imported into Tilia® to be converted into percentages. The Bacon Aging Model was incorporated as a time axis and the basic Σ of squares were calculated in a cluster analysis to show variance between transitions. A separate grass count was conducted to show the proportion of grass pollen versus all other pollen in the assemblage.

Results

Conclusions

I would like to thank my mentor Emma Locatelli (Macalester) for guiding me through this journey and my advisor Antony Ball (SKC) for giving me this opportunity. I would like to thank Diana Dalbotten (SAFL) and the NSF for funding this project and the staff of the LacCore (LRC) facility and Fond du Lac Natural Resources for making the REU program so enlightening and meaningful. Thank You All!!