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2000 years of human activity in Tuchola Pinewoods (northern Poland)

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During the last two millennia human activity and their settlements together with varying climate conditions strongly influenced landscape scale changes. Especially within palaeoecological records these environmental responses are well expressed. However, a robust age control is needed for the evaluation and interpretation of biotic proxies.We present a record from the annually laminated (varved) sediments of Lake Czechowskie, located in northern Poland. The investigated record covers the past 2000 years and demonstrates the continuous vegetation history and human activity in the Northern part of the Tuchola Pinewoods.

The chronology was established by varve counting and confirmed by AMS 14C dating, 137Cs activity measurement and a tephra layer (Askja 1875). We used high-resolution biotic (pollen, green algae and diatom analysis) sedimentological (varve and sublayer thickness variations) and geochemical (μ-XRF data) proxies to reconstruct the environmental changes within a time of increasing human activity and fluctuating climatic conditions. Based on different spatial sampling and measuring increments the temporal resolution varies between subseasonal (μ-XRF), annual (varves) up to five-varveresolution (biotic proxies) making it possible to trace even short lasting local and regional changes.

Our results display visible human pressure in this area between 50- 350 yr. AD (Roman Period) exerted by tribes related to the Wielbark Culture. The development of persisting settlements and agriculture took place at expense of surrounding hornbeam forests. An intensification of lake productivity (expressed as an increase of varve thickness) started after 250 AD. If this lake ecosystem response relates to an intensified agriculture (and a possible transport of nutrients from neighboring rural lands) or to a climate shift will be further discussed. The rapid decline of human indicators about 350 years AD at the transition to the migration period might be related to cooler conditions forcing the people to give up their settlement and move.

The second time of a significant increase of human activities began in Late Medieval time and lasted to the modern time. Pollen analysis shows the beginning of strong deforestation since XV century with the most intensification during industrial revolution (second part XIX century) where pine trees became the dominant species. Intense clear cutting in the lake's vicinity removed its natural "windshelter" and exposed the lake to longer lasting water column mixing. As a consequence varves nearly disappeared whereas the detrital indicators (e.g. Ti) increased due to an open landscape around the lake.

The diatom analysis for the last 2000 years revealed several temporary changes for different species. Strongest fluctuation occurred for the species Stephanodiscus parvus and Cyclotella comensis where the latter show similar occurrences as Tetraedron (Chlorophyta). Recent lake monitoring (including diatom analysis) together with hydrological and meteorological data will help to understand under which conditions different diatom species form. This knowledge will be crucial for the interpretation of past changes.

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