

ECOLOGICAL REGIME SHIFTS IN LAKE KÄLK SJÖN, SWEDEN, IN RESPONSE TO ABRUPT CLIMATE CHANGE AROUND THE 8.2 KA COOLING EVENT

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A detailed diatom record from Lake Kälksjön, west-central Sweden, reveals two periods of abrupt ecological change correlative with the 8.2 ka cooling event. Using a combination of abrupt step changes and piece-wise linear regressions, the diatom data were analysed for change points over time, and two sudden and large events that can be described as regime shifts were detected. During the first event at c. 8040 cal. yr BP, a doubling in diatom biomass took place over 5-10 years time. This increase in primary productivity can be connected to a major erosion event in the catchment that resulted in an abrupt increase in nutrient supply to the lake. The second event was characterised by a substantial shift within the planktonic diatom community from taxa indicative of colder conditions to those indicating warm over 5-10 years at c. 7850 cal. yr BP. This event was superimposed on a successive change from periphytic to planktonic diatom dominance over a 250-year period and a gradual diversification of the periphytic community that spanned c. 150 years. Rapid climate warming following the 8.2 ka event likely caused these changes. Both observed regime shifts are examples of abrupt ecological change that is externally driven. In the first case, nutrient input was the primary causative agent, and in the second case climate change is the cause of the more complex shift.

This study demonstrates that it is possible to detect, quantify and test for regime shifts in paleoecological data, and it also highlights the need for high sampling resolution and precise chronological control. High-resolution paleoecological reconstructions of ecological regime shifts in response to climate change can provide useful analogues of future changes in ecosystem structure and functioning with impending climate change.