Geophysical Research Abstracts
Vol. 18, EGU2016-16448, 2016
EGU General Assembly 2016

Recent changes in vegetation, hydrotopography and peat accumulation in detailed case studies of northern aapa mires

Teemu Tahvanainen, Timo Kumpula, and Kimmo Tolonen
Department of Environmental and Biological Sciences, University of Eastern Finland (teemu.tahvanainen@uef.fi)

Aapa mires are northern mire complexes with typical patterned central fen areas and relatively thin peat layers. In principle, aapa mires could develop into raised bogs either 1) through autogenic succession, given enough time for peat accumulation or 2) through allogenic mechanism triggered by hydrological change. Climate change models predict that the climatic envelop of aapa mires will move north and, indeed, that hydrology may change sufficiently to cause allogenic change pressure. Potential resilience or pace of ecosystem-scale responses are poorly understood, however, in the case of aapa mires.
We studied recent (ca. 60 years) changes in vegetation, hydrotopography and peat accumulation of two aapa mires at their southern limit of distribution in eastern Finland. We used repeated sampling after 60 years combined with peat stratigraphy and time-series of aerial images in a multi-proxy approach.

The study site at the Valkeasuo mire was affected by extensive drainage activities in its catchment, while the aapa mire area itself was not drained. This resulted in the loss of minerotrophic hydrology that lead to rapid changes over the whole patterned fen area. Wet minerotrophic sedge fen vegetation was almost totally covered by ombrotrophic Sphagnum mosses within few decades. Even up to 50 cm high hummocks emerged on the patterned fen strings in an abrupt response that could be precisely dated by simultaneous encroachment of pine seedlings and from the aerial images. The recent apparent rate of carbon accumulation of the new Sphagnum peat was ca. 100 g m-2 –a.

The other study site in the Ilajansuo aapa mire persists in a more pristine setting without significant disturbance in its catchment area. Here the mineral-water limit was studied across a transition between a bog zone and an aapa mire zone of the mire complex. We were able to exactly locate a 100 x 300-m special study area and repeat e.g. mapping of all trees, of all topographic patterns (hummocks, hollows, pools), 155 peat depth measurements and 38 vegetation plots. Despite the pristine wilderness character of the site, we found increased tree encroachment, significant increase of height of Sphagnum hummocks, lateral expansion of ombrotrophic bog zone over fen vegetation and increase of dwarf-shrubs typical to raised bog vegetation. Peat thickness in the bog zone had increased by 2.2 mm per year, greatly exceeding the long-term average of bogs in the region.

Our case studies demonstrate a remarkable potential of ecosystem-scale responses in northern aapa mires, ecotone mire type between temperate-south boreal bogs and subarctic palsa mires. Hydrological disturbances can rapidly trigger an allogenic mechanism of fen to bog transition. Traces of ongoing changes in aapa mires can be apparent also in seemingly pristine sites when accurate repeated measurements are performed. Although the observed changes may threaten aapa mire habitat types and biota, they are progressive in terms of peat growth and carbon dioxide sequestration.