ABSTRACT SUBMISSION

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Modelling the effects of climate change on plant species composition and carbon sequestration in peat bogs

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The analysis of the long-term effects of climate change on bog ecosystems requires a model that includes competition between plant species and feedbacks between vegetation, hydrology and soil. We developed such a process-based model describing the plant species composition and carbon accumulation of peat bogs in relation to changes in climate and environment. This first bog ecosystem model that includes vegetation dynamics was tested by comparing the outcome with observed historic vegetation changes in peat cores.
The model successfully simulated the major changes in the species composition between 1766 and 1999 in two ombrotrophic bogs in Europe as reconstructed from peat cores. The simulations suggest that the historic shifts between dominant Sphagnum species were driven by climatic changes. The Sphagnum species have a large influence on the modelled bog ecosystem. By producing slowly decaying litter of a high C:N ratio, Sphagnum reduces N mineralisation rates, thereby controlling the growth of vascular plants. It is known that Sphagnum acts as an ecosystem engineer and this species effect has now for the first time been included in a model. The simulated effects of temperature, precipitation, N deposition and CO2 were not all straightforward, as interactions between these components of global change occurred. For example, our model simulations suggest that an increase in temperature may increase carbon accumulation at low N deposition but not at high N deposition.

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