

Dynamics and environmental impact of smouldering peat fires

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Aim of the project

The main objective of this project is to determine how smouldering fire propagates into natural peatland soils from around the world. For this we combine **controlled experiments**, **mathematical models** and **data on smouldering fire occurrence in Ireland**.

Peatland wildfires are considered extreme events that are becoming more frequent both in Ireland and internationally. However, the study of smouldering fires has been limited in comparison with flaming wildfire studies.

Peatlands cover over 3% of the Earth's land surface. They are an important ecosystem for a wide range of wildlife habitats and an important store of carbon (one third of the world's terrestrial soil carbon).

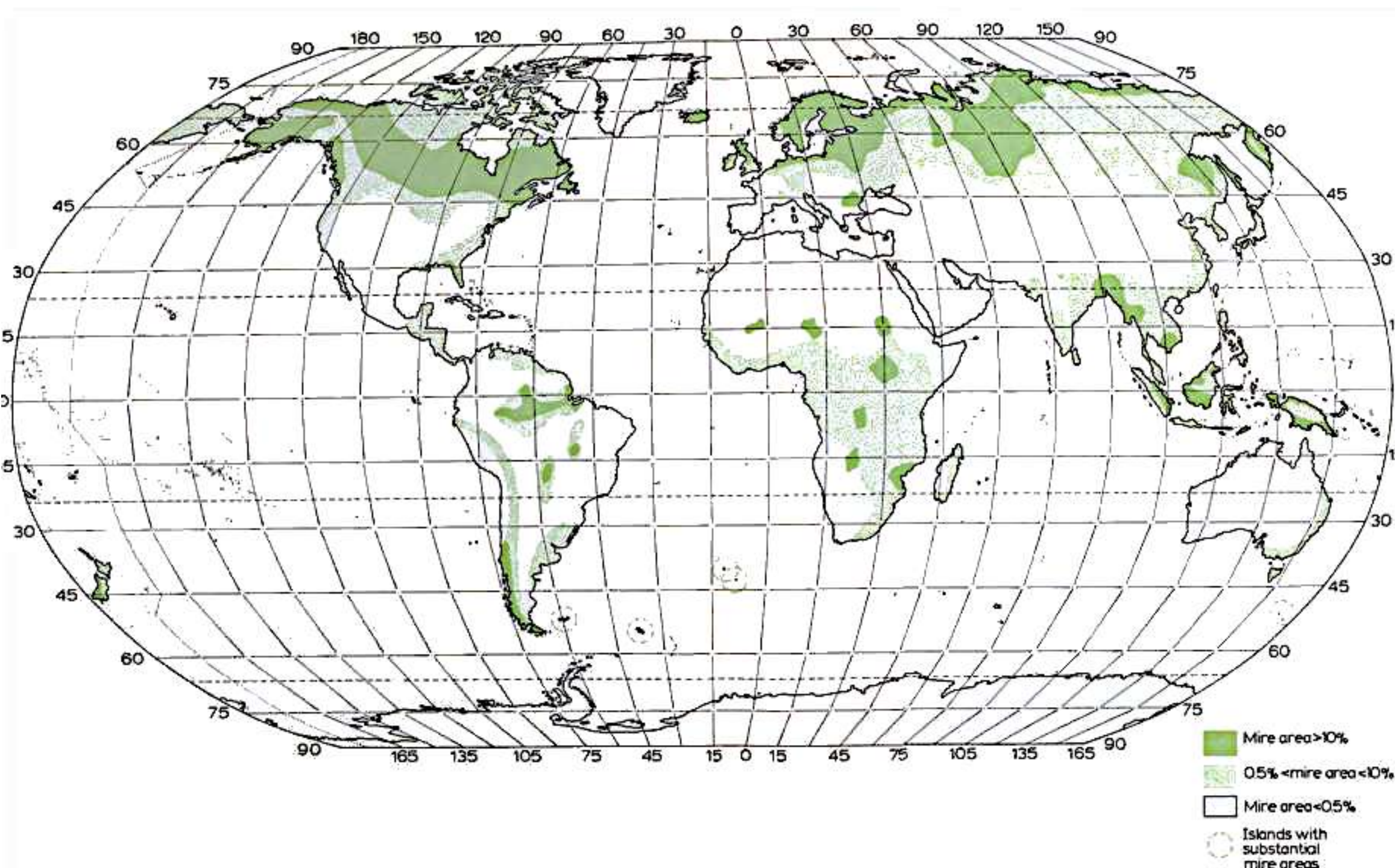


Figure 1: The global distribution of peat-forming ecosystems (mires). Dark green (mire area >10%), light green (0.5% to <10%) and white (mire area <0.5%), (Gore, 1983).

Smouldering combustion is different from the flaming because the oxidation reaction and the heat release occur on the surface of the solid, burning slowly and without a flame. Smouldering can take place in the organic material stored in shallow forest layers, like duff, humus or peat.



Figure 2: Example of a peat smouldering consequences in Scotland, summer 2006. Left unburned forest, right ground forest after the fire with a severe consequences: the organic soil layers were removed and the the root system was effected. Photo: Guillermo Rein.

Visible **impacts of smouldering** are smoke haze, removal of soil layers, ground destabilisation, local subsidence, carbon emissions, effects to the **local soil system and damage to roots system** (Rein et al., 2008).

Project summary

- PART 1: Relate the **presence of smouldering fires in temperate regions** to environmental risk factors.
- PART 2: Laboratory study of the main **stages of the combustion** and the **effect of moisture content**.
- PART 3: Apply the study of **smouldering dynamics to natural peat soils**.

Part 1 and 2 of the project have been started in parallel. Part 2 (studying the fire dynamics) is the project's most important contribution to the knowledge of smouldering fire. Below are the first data obtained from the laboratory experiments.

First experimental results in smouldering dynamics

A series of small-scale experiments are being made to analyse the propagation of smouldering fire in organic soils. This will determine the **influence of moisture content** on the spread of smouldering.

Homogenized peat soils is burnt in insulated trays of 20x20x5cm. Bulk density, mineral content and moisture content are all controlled for.

Experiment set up:

Peat is ignited with a heating coil (100W during 30 min), the position of the smouldering front is recorded with a infrared camera, temperature evolution is tracked with thermocouples and a scale measures the mass loss during the experiment.

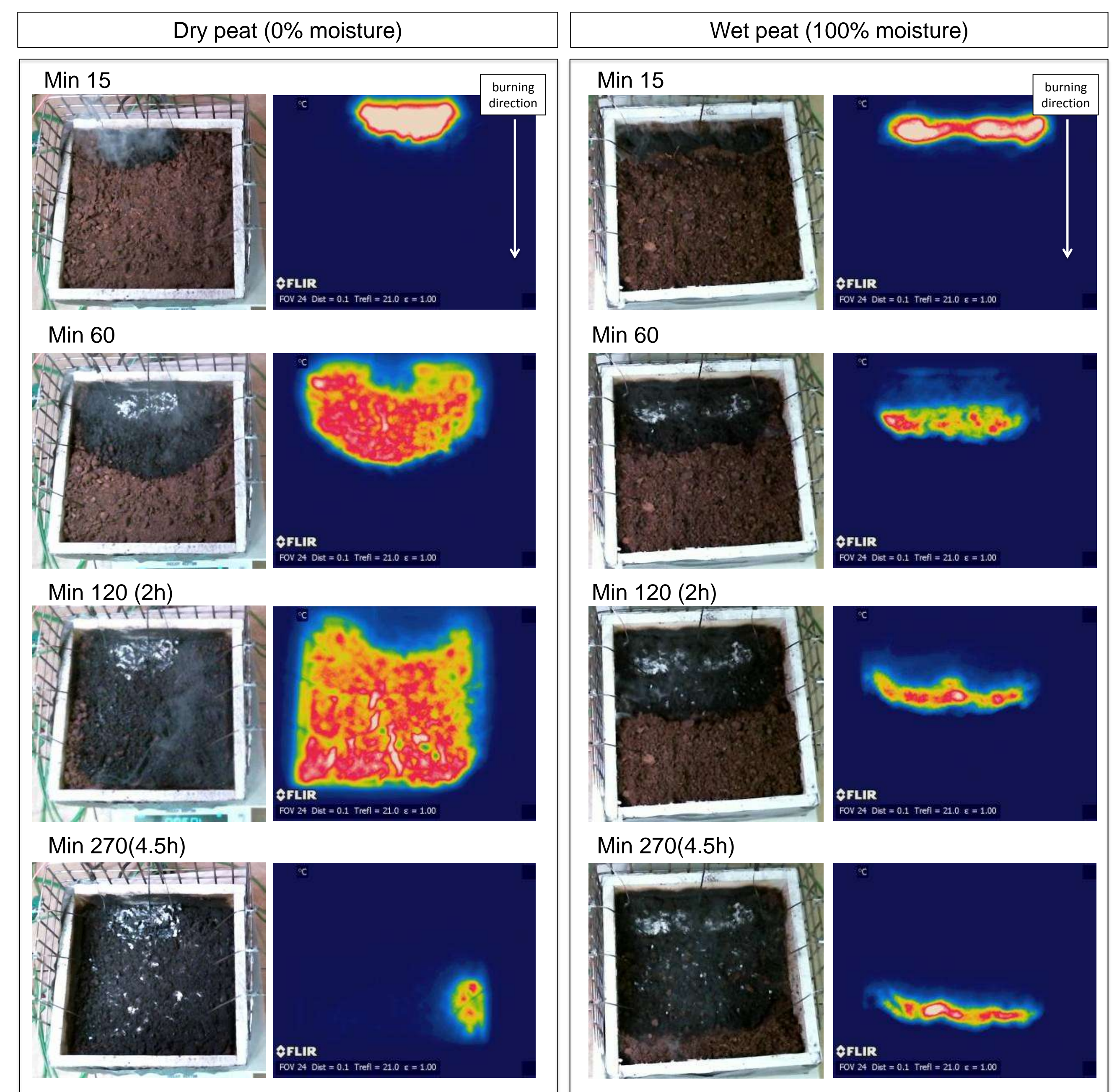


Figure 3: The position of smouldering fronts for different moisture content. Left, dry peat with 0% moisture content and right, wet peat with 100% moisture content. Smouldering is slower and more localised under wetter conditions.

The second part of the experimental study will run experimental burns with patches of wet and dry peat. This will mimic the heterogeneous moisture distribution in natural organic soils.

References

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- Gore, A. J. P., editor. 1983. *Mires: Swamp, bog, fen and moor*. Elsevier, Amsterdam.