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& Chris Freeman



An inconvenient wetland truth: the need to consider peatland-geoengineering schemes



- Geoengineering
- How do peatlands fit in?
- Peatlands' potential
- The moral dilemma

Geoengineering - definition



The Royal Society – 2009

“The deliberate large-scale intervention in the Earth’s climate system, in order to moderate global warming”

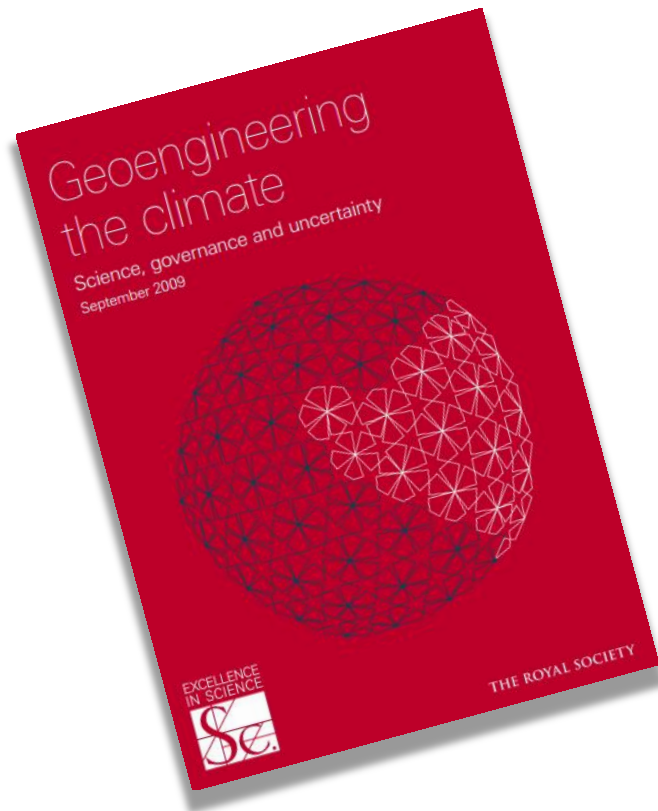


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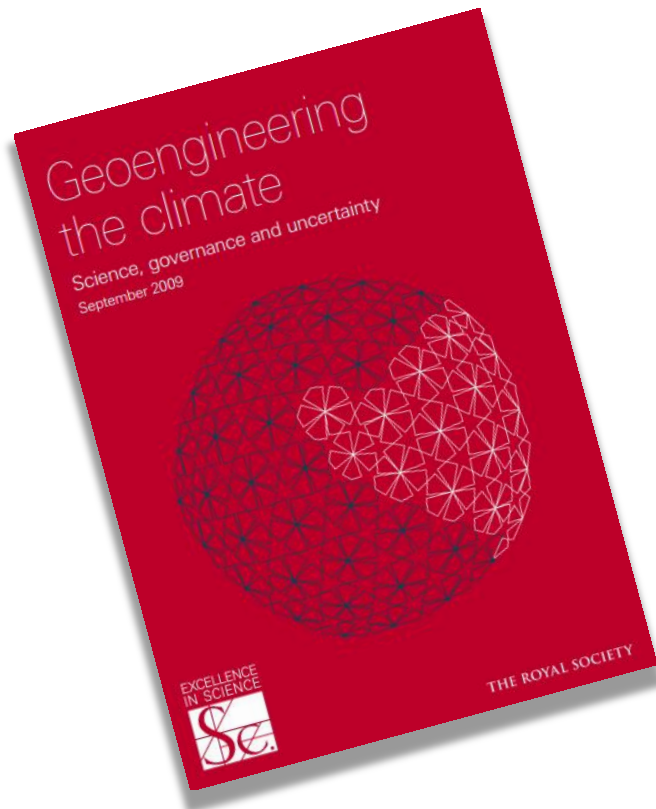


Geoengineering - report

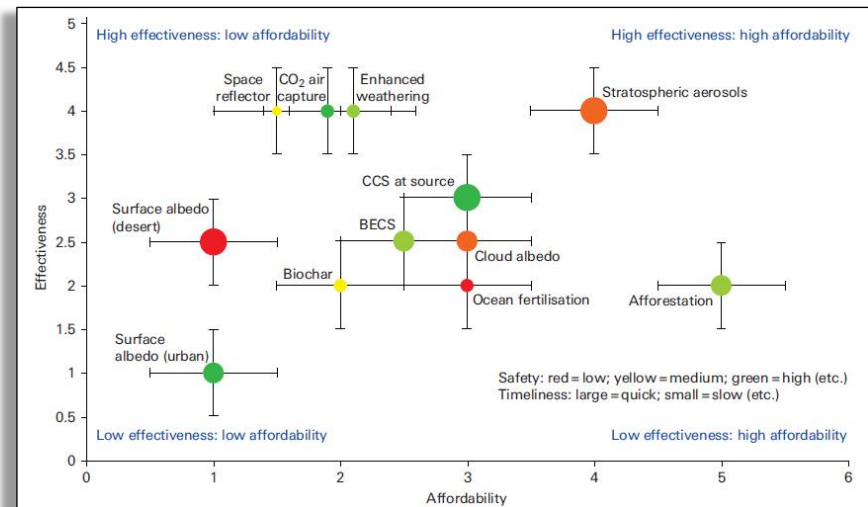


- Climate change is happening
- Global emission reductions not sufficient to avoid dangers
- Geoengineering the climate very likely to be technically possible
- Further research and development should be undertaken

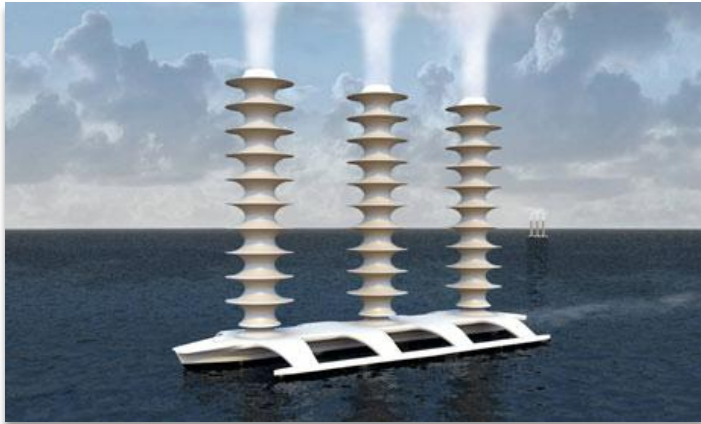
Geoengineering - issues



“Major uncertainties regarding [different methods] effectiveness, costs, and environmental impacts”



Geoengineering - methods



Solar Radiation Management
Reflect sun's light and heat back into space



Carbon Dioxide Removal
Remove greenhouse gases from the atmosphere

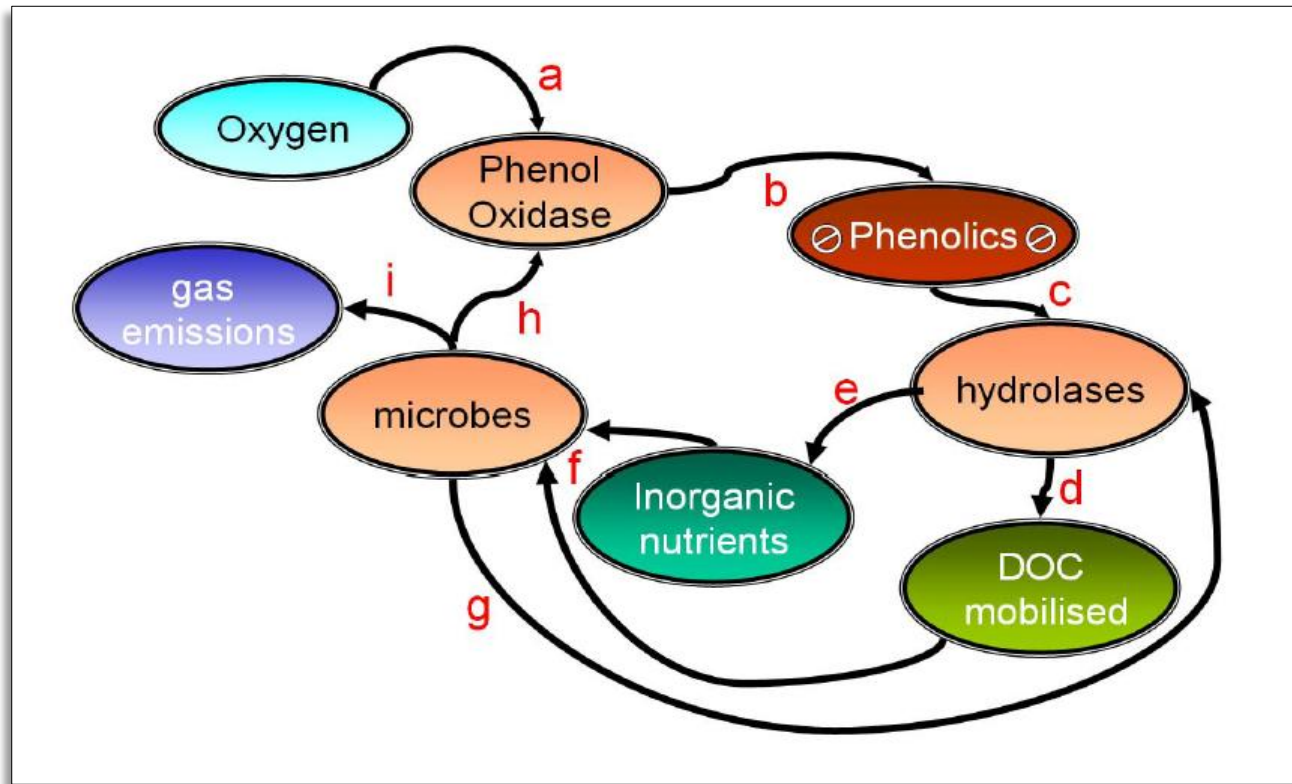
Peatlands



- Net global sinks of atmospheric carbon
- Store 455 Pg of carbon
- Primary productivity exceeds exceptionally slow decomposition rates
 - Low pH
 - Anoxic conditions
 - Low nutrients
 - Low temperatures



Peatlands – enzymic latch



- Freeman, C., Ostle, N. & Kang, H. An enzymic 'latch' on a global carbon store. *Nature*. 2001.
- Fenner, N. & Freeman, C. Drought-induced carbon loss in peatlands. *Nature Geoscience*. 2011

Using the latch



Strengthening the latch

- Increasing phenolic abundance
 - Manipulating edaphic factors to slow decomposition

Increasing carbon influenced by the latch

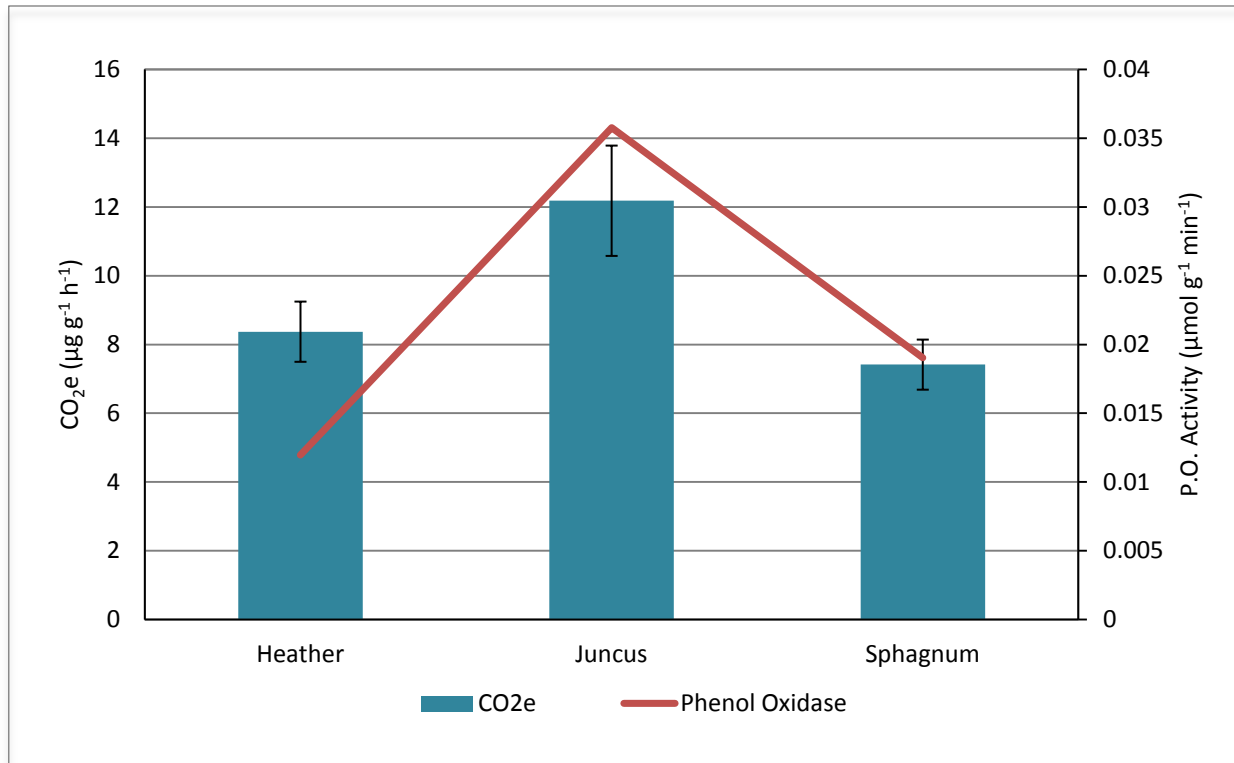
- Increasing plant productivity
- Introduce externally captured carbon



Vegetation management



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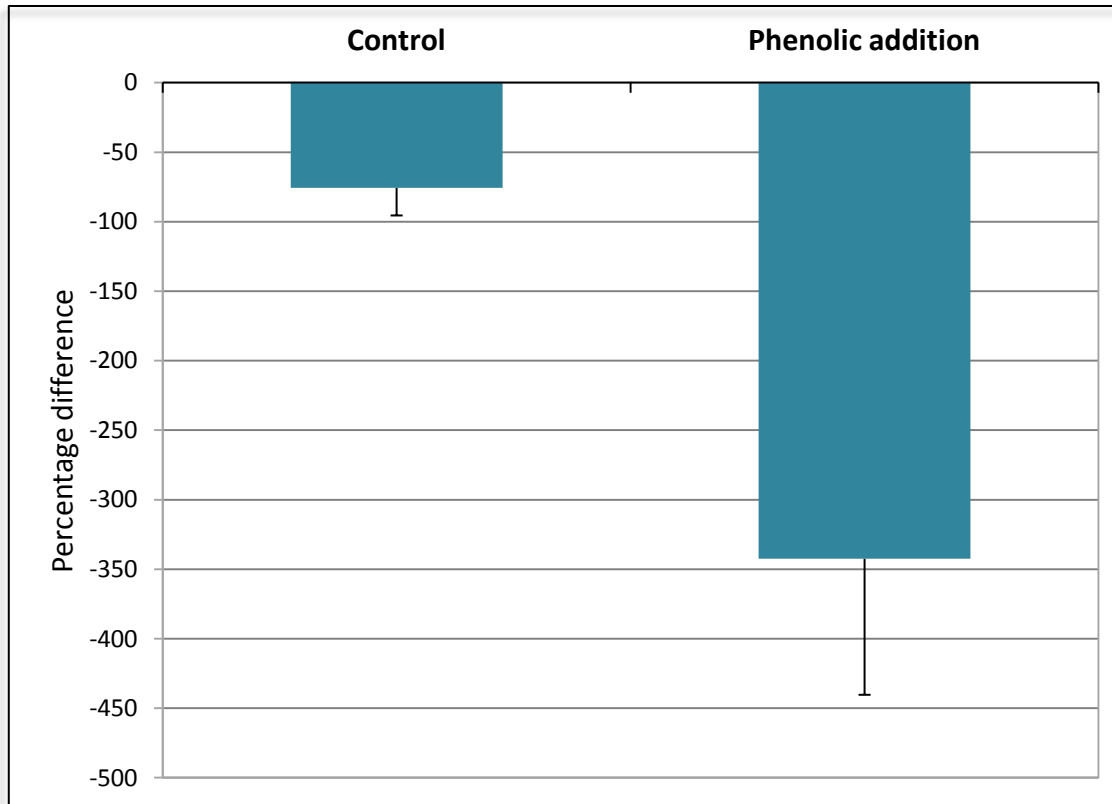
Trace gas production (CO₂ equivalent) and phenol oxidase activity from peat soil taken from the rhizosphere of peatland plants



Supplementary phenolics

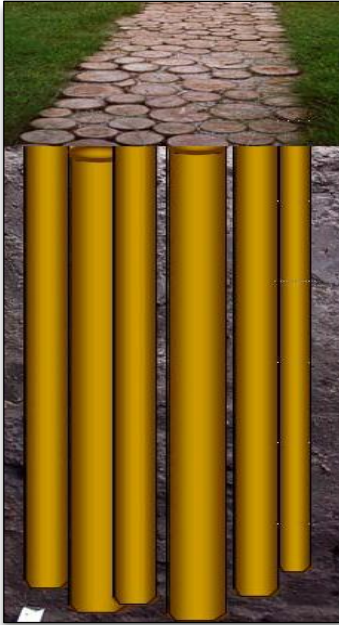


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Percentage difference in the average CO₂ flux from bog-peat cores during six months of treatment compared to pre-treatment fluxes

The next step?



Lignin addition

Injecting timber, forestry waste & paper milling by-products to peatlands

Genetic modification

Increased expression of phenolic inhibitors by *Sphagnum* mosses



Freeman, C. , Fenner, N. & Shirsat, A. Philosophical Transactions of the Royal Society. A. 2012.

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Peatlands' potential



- **2 Pg of additional carbon sequestration a year**
- Equal to the carbon produced by global transport
- Not including the supplementary carbon added to the peatlands
- Carbon markets could supply revenue to pay for peatland management / restoration

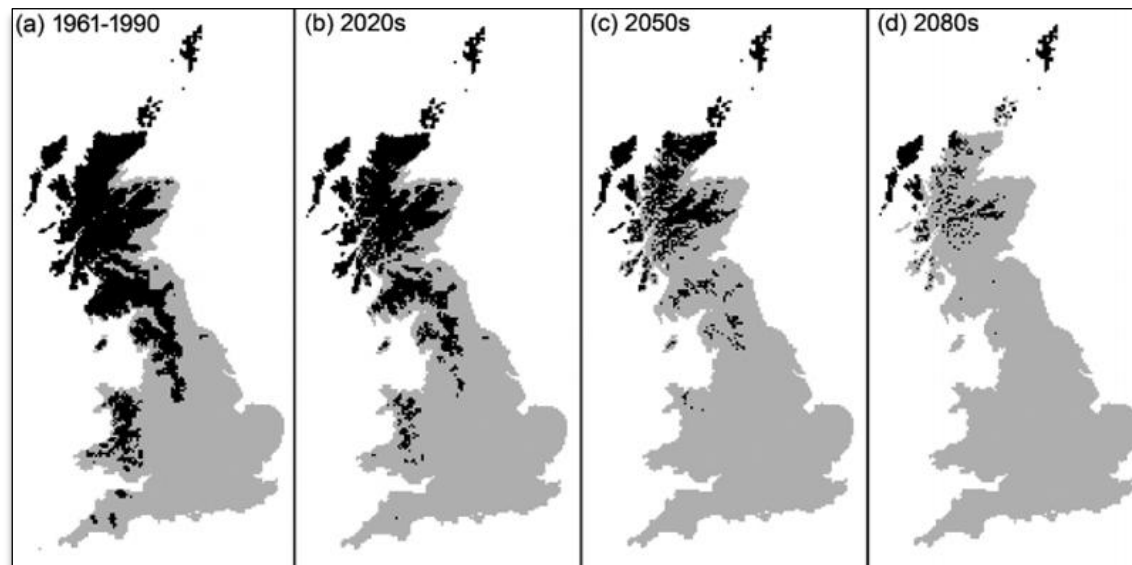
Moral dilemma



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Sir John Houghton, co-founder of the IPCC
Global warming represents the “single
greatest threat mankind has ever faced”.



Predicted area of blanket peatlands in the UK.

Gallego-Sala, A.V. *et al.* Clim Res. 2010.

Should we leave our peatlands alone, while average global temperatures continue to rise, if they have the potential to significantly reduce GHGs levels?

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