Forest Research

Forestry and Peatlands: Research Update

Russell Anderson & Ainoa Pravia

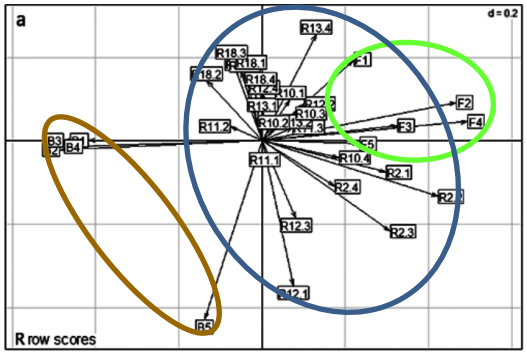
Biodiversity

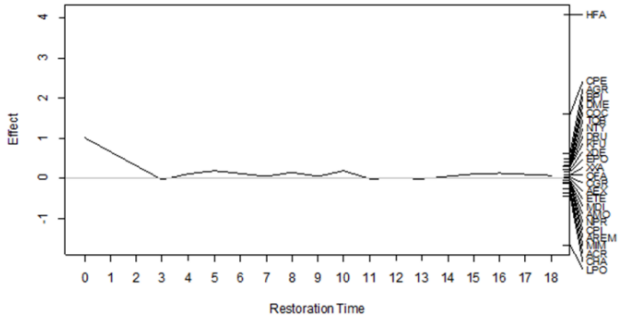
Restoration trajectory of carabid functional traits in a formerly afforested blanket bog

Pravia, Andersen, Artz, Pakeman & Littlewood. Acta Zoologica Academiae Scientiarum Hungaricae, 2019.

Moth responses to forest-to-bog restoration

Pravia, A,. Andersen, Artz, Boyd, Cowie, & Littlewood. Mires and Peat, 2020.





After two decades, restoration sites continue to support carabid communities with higher dispersal capacity and more diurnal activity than those of open bog.

A lack of recovery of typical blanket bog vegetation and microhabitat following felling to waste and drain blocking appear to limit carabid functional recovery.

The moth communities of restoration treatments resembled the bog community within a few years following onset of restoration.

Biodiversity

Ecological resistance of restored peatlands to climate change
Loisel & Gallego-Sala, Communications Earth and Environment 2022.

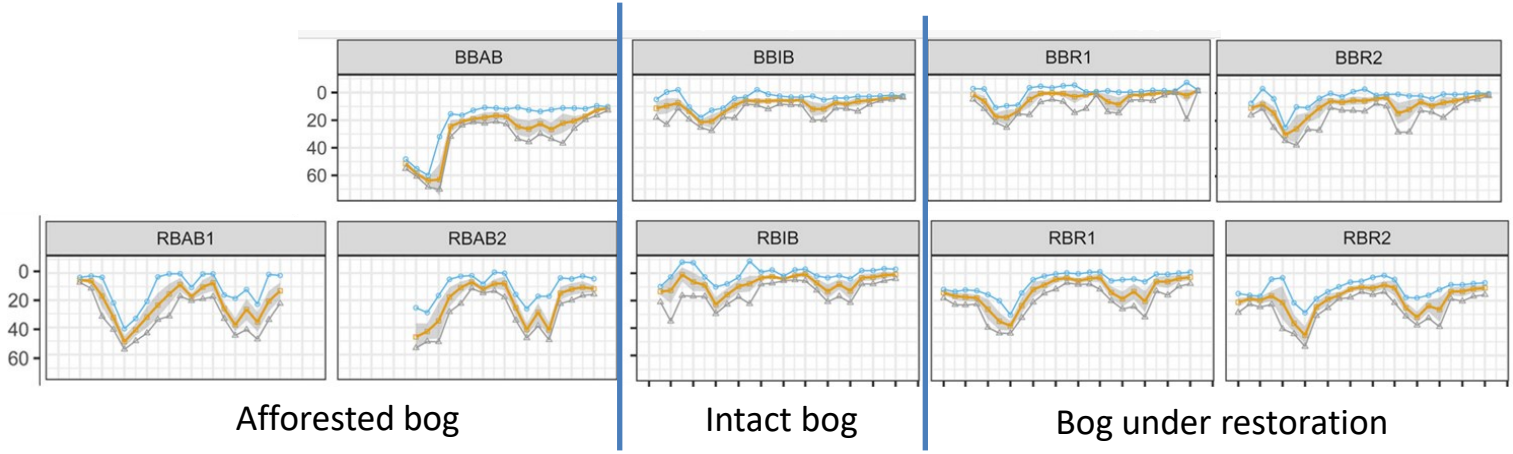
Review shows that vegetation and microbial diversity likely decrease after drainage … this decreases the ability of the affected peatland to cope with stressors (e.g. climate change).

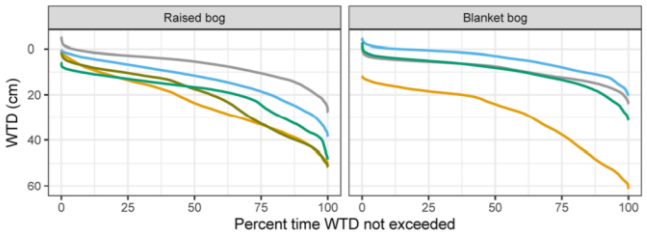
Peatland biodiversity has been a poorly-funded research field. This justifies greater investment.

Water

The effect of forest-to-bog restoration on the hydrological functioning of raised and blanket bogs

Howson, Chapman, Shah, Anderson & Holden. Ecohydrology, 2021.





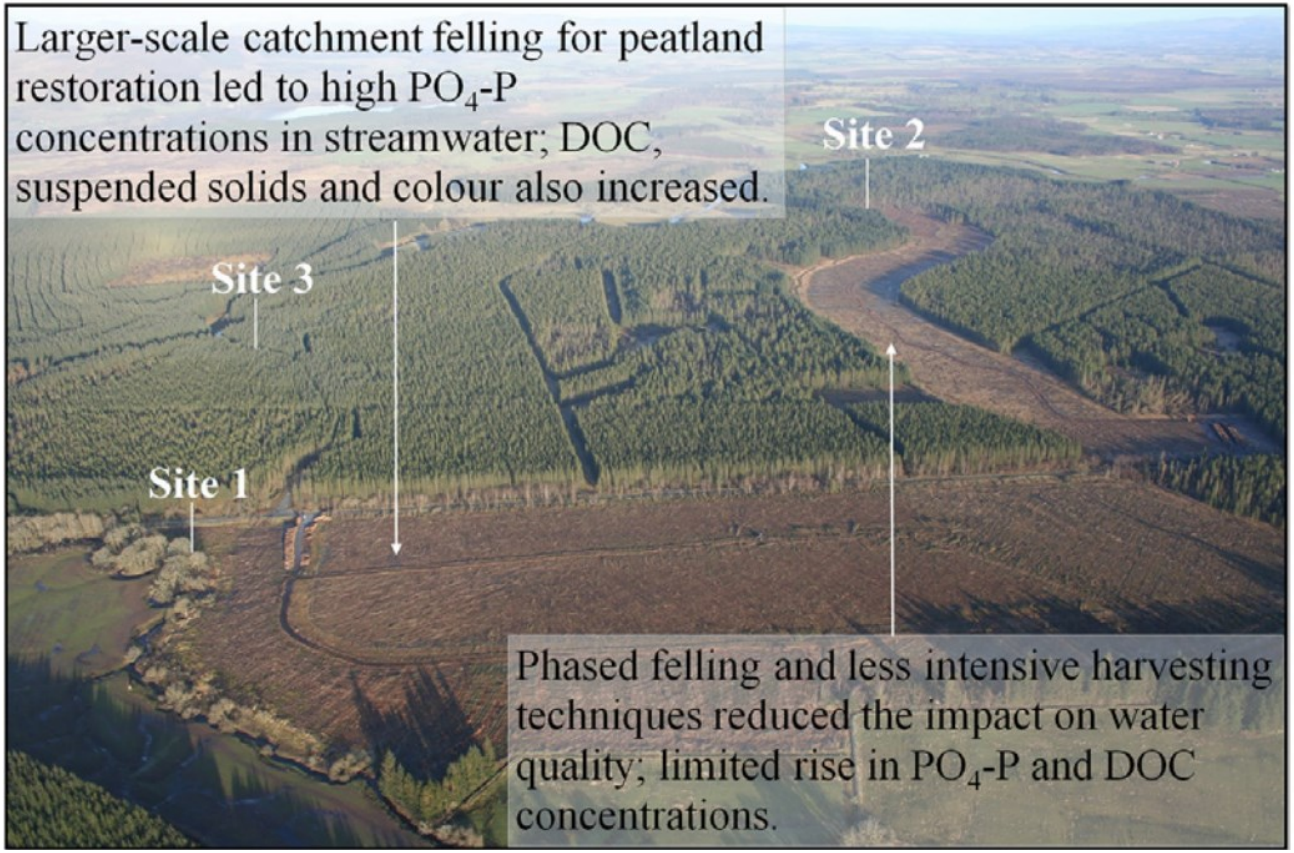
- Evapotranspiration greater in Afforested than Intact
- Water levels lower in Afforested than Intact
- Water table fluctuated more in Afforested than Intact
- Overland flow less in Afforested than Intact
- Restored bog generally intermediate

Effect of restoration on flooding needs further research

Water Quality

The effects of forest clearance for peatland restoration on water quality

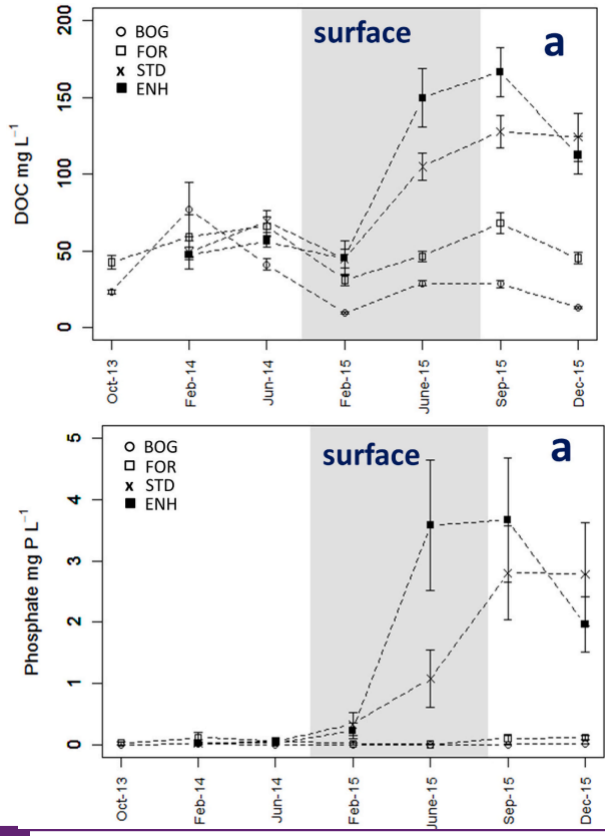
Shah & Nisbett. Science of the Total Environment, 2019.



Water Quality

Restoration of afforested peatland: Effects on pore- and surface-water quality in relation to differing harvesting methods

Gaffney, Hancock, Taggart & Andersen, Ecological Engineering, 2022.



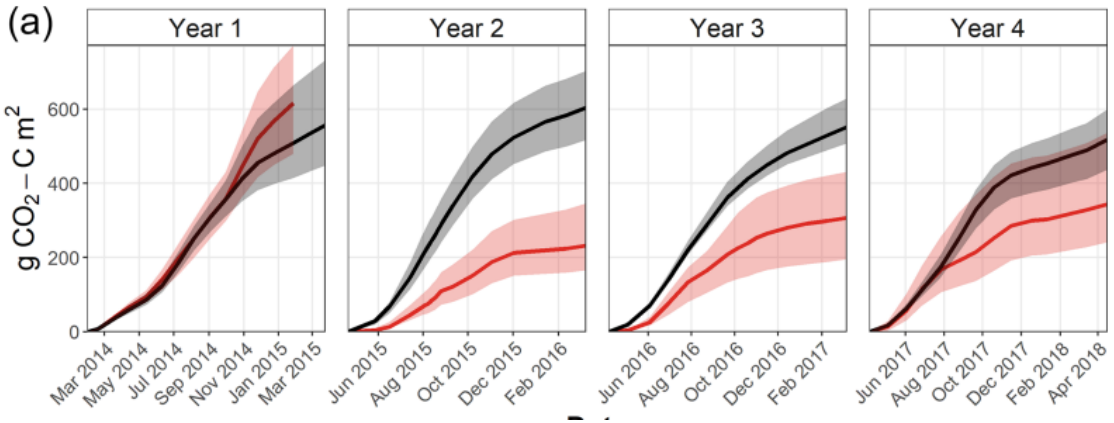
Although longer-term monitoring would be required to test this, our results suggest that there remains merit in removing brash (compared to stem-only harvest) when considering longer-term recovery to bog.

Restoration techniques are still evolving – useful finding here.

Greenhouse gases

Effects of clear-fell harvesting on soil CO2, CH4, and N2O fluxes in an upland Sitka spruce stand in England.

Yamulki, Forster, Xenakis, Ash, Brunt, Perks & Morison. Biogeosciences, 2021.



On shallow peat, over 3 years following clear-fell, soil GHG emission (CO_2 equivalents basis) reduced by 45% due to much larger reduction in CO_2 than the combined increases in CH_4 and N_2O.

Greenhouse gases

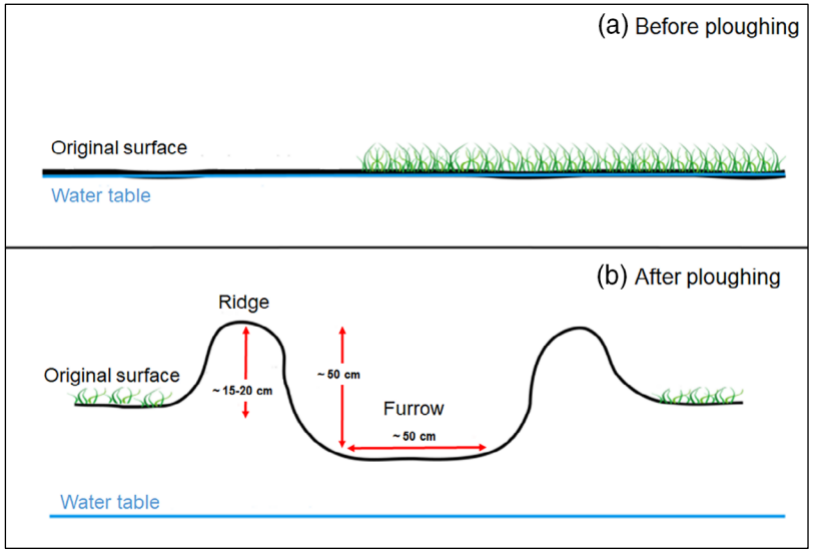
Seasonal patterns of greenhouse gas emissions from a forest-to-bog restored site in northern Scotland: Influence of microtopography and vegetation on carbon dioxide and methane dynamics

Mazzola, Perks, Smith, Yeluripati & Xenakis. European Journal of Soil Science, 2020.

The original surface was near greenhouse gas equilibrium, at −0.28 g CO_2eq m^{-2} day^{-1}.

Microtopographic features were a net sink (ridges = −0.94 g CO_2eq m^{-2} day^{-1}, furrows = −0.86 g CO_2eq m^{-2} day^{-1}).

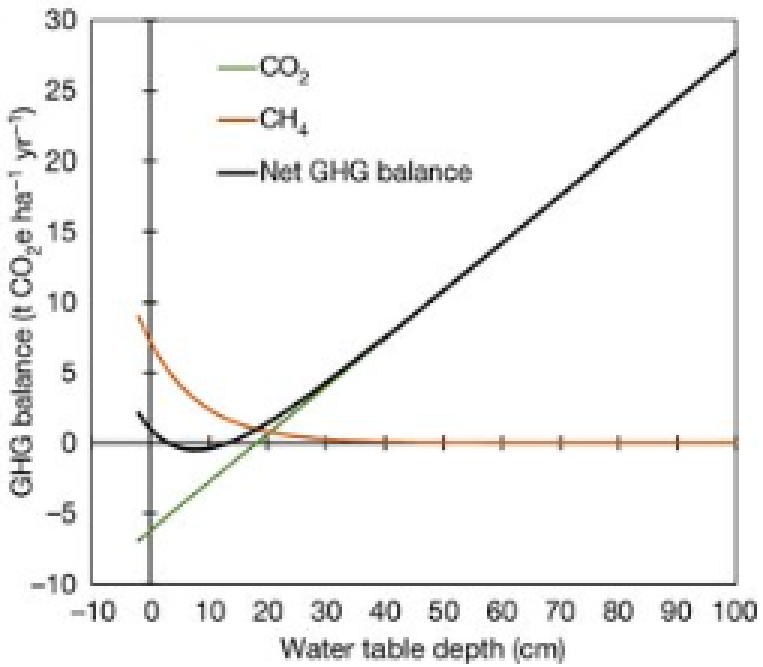
Bog pool was a net source (0.98 g CO_2eq m^{-2} day^{-1}).



Greenhouse gases

Overriding water table control on managed peatland greenhouse gas emissions.

Evans et al. (31 authors). Nature, 2021



Water-table depth (i.e. the average depth of the aerated peat layer) overrides all other ecosystem- and management-related controls on greenhouse gas fluxes.

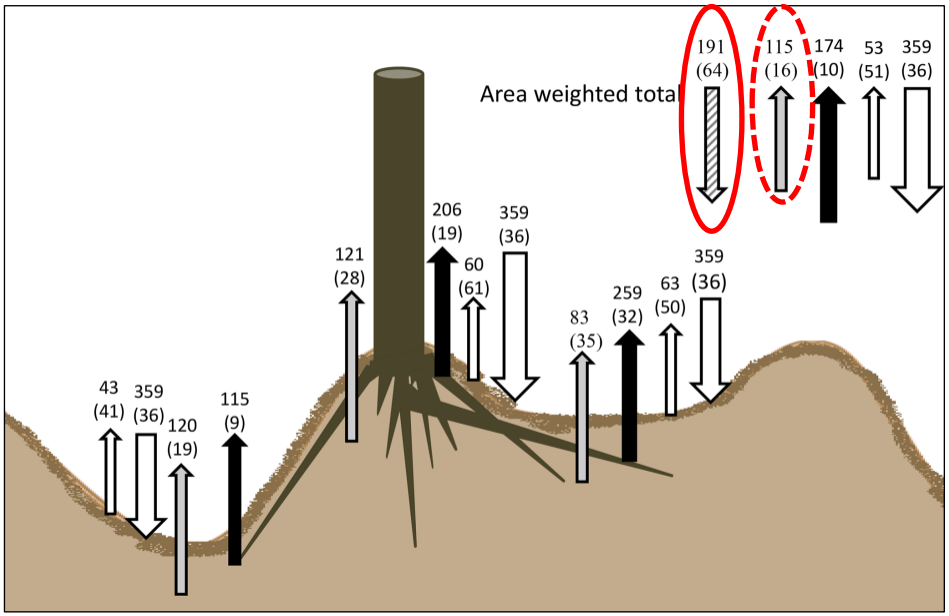
Every 10 cm of reduction in depth could reduce the net warming impact of CO2 and CH4 emissions by at least 3 t CO2e ha-1 yr-1, until depth is < 30 cm.

Raising water levels further would continue to have a net cooling effect until depth is < 10 cm.

Greenhouse gases

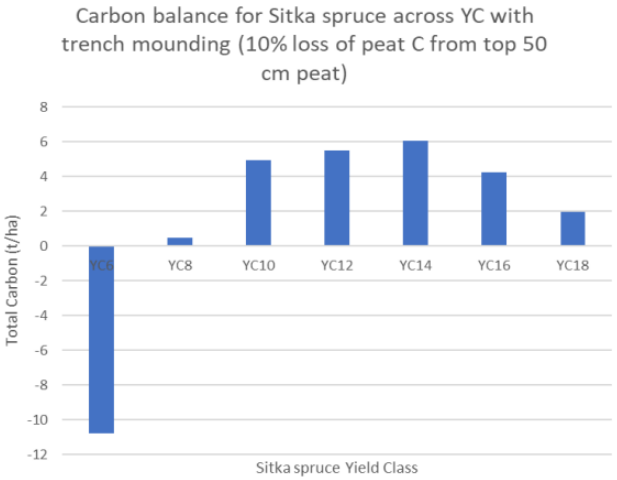
Net soil carbon balance in afforested peatlands and separating autotrophic and heterotrophic soil CO2 effluxes

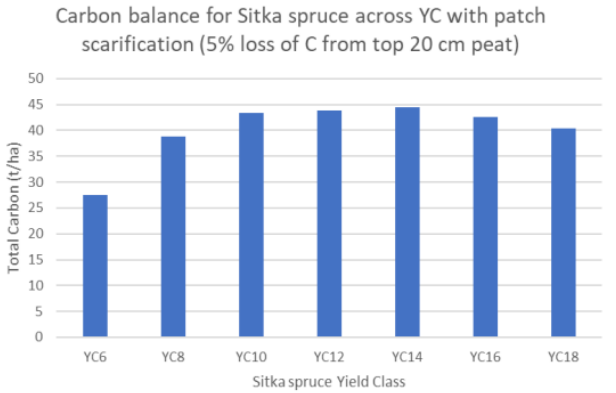
Hermans, McKenzie, Andersen, Teh, Cowie & Subke. Biogeosciences, 2022.



Soils in these 30-year-old drained and afforested peatlands are a net sink for C since substantially more C enters the soil organic matter than is decomposed heterotrophically.

Carbon balance





Carbon balance of Northern Ireland Forest Service forest on deep peat. Forest Research Report, March 2021

Vanguelova, Broadmeadow, Randle, Yamulki & Morison, 2022.

https://www.daera-ni.gov.uk/forest-service-publications

Replanting deep peats by trench mounding and second rotation stand of YC10 and higher could deliver a net carbon accumulation between 2 and 6 t C/ha (accounting for roundwood only).

If a much lighter ground preparation techniques is applied such as patch scarification … the carbon balance of Sitka spruce will be positive across all yield classes.

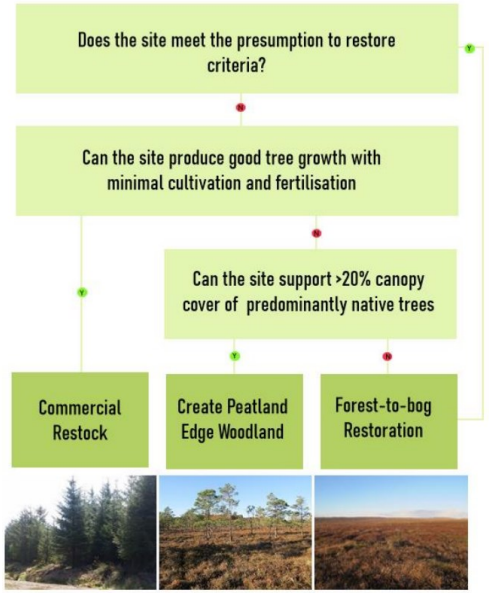
Land use

Is Peatland Edge Woodland an appropriate management option for afforested peatlands after harvesting?

Barrop. PhD thesis, University of York, 2022.

Assessing soil carbon dioxide and methane fluxes from a Scots pine raised bog-edge-woodland

Mazzola, Perks, Smith, Yeluripati & Xenakis. Journal of Environmental Management, 2022



For some stakeholders, PEW is a useful concept for developing peatland management strategies.

PEW may be capable of providing climate change mitigation services.

Scots pine bog-edge-woodland may affect soil C fluxes around the trees, enhancing soil CO2 emissions, while reducing CH4 fluxes.

Time now for questions and discussion