

Flanders Moss: The Effects of Bog Restoration on Drainage Water Chemistry

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Peatland Conservation

- The importance of peatland conservation and restoration is now well recognised.
- However the impact of restoration on soil and water has not been fully investigated.
- What are the effects of peatland restoration on drainage water chemistry?
- What are the effects on freshwater ecology?
- What can be done to prevent or minimise impacts?

Freshwater Pearl Mussel

- Found only in clean rivers and streams; now threatened with extinction throughout its holarctic range.
- In Scotland viable populations still remain and are the focus of conservation action.
- Environmental factors?

Most likely causes

- oxygen deficiency caused by chronic eutrophication
 - Nutrient and sediment pollution from agriculture
 - Clearfelling in the uplands
 - Sewage discharges
 - Aquaculture discharges

- In Ireland there was a series of significant FWPM kills.
- The main cause was considered to be raised phosphate levels within run-off from peatland forestry following clearfelling (algal blooms) which led to a moratorium on clearfelling in catchments identified as sensitive for FWPM.
- Cummins and Farrell (2003) found that phosphate concentrations increased following clearfelling on peatlands.
- Most other studies assessing the impact of clearfelling on drainage water have provided little evidence of raised phosphate levels after felling.
- However these studies have been on mineral soils which have a higher phosphate sorption capacity than peat.

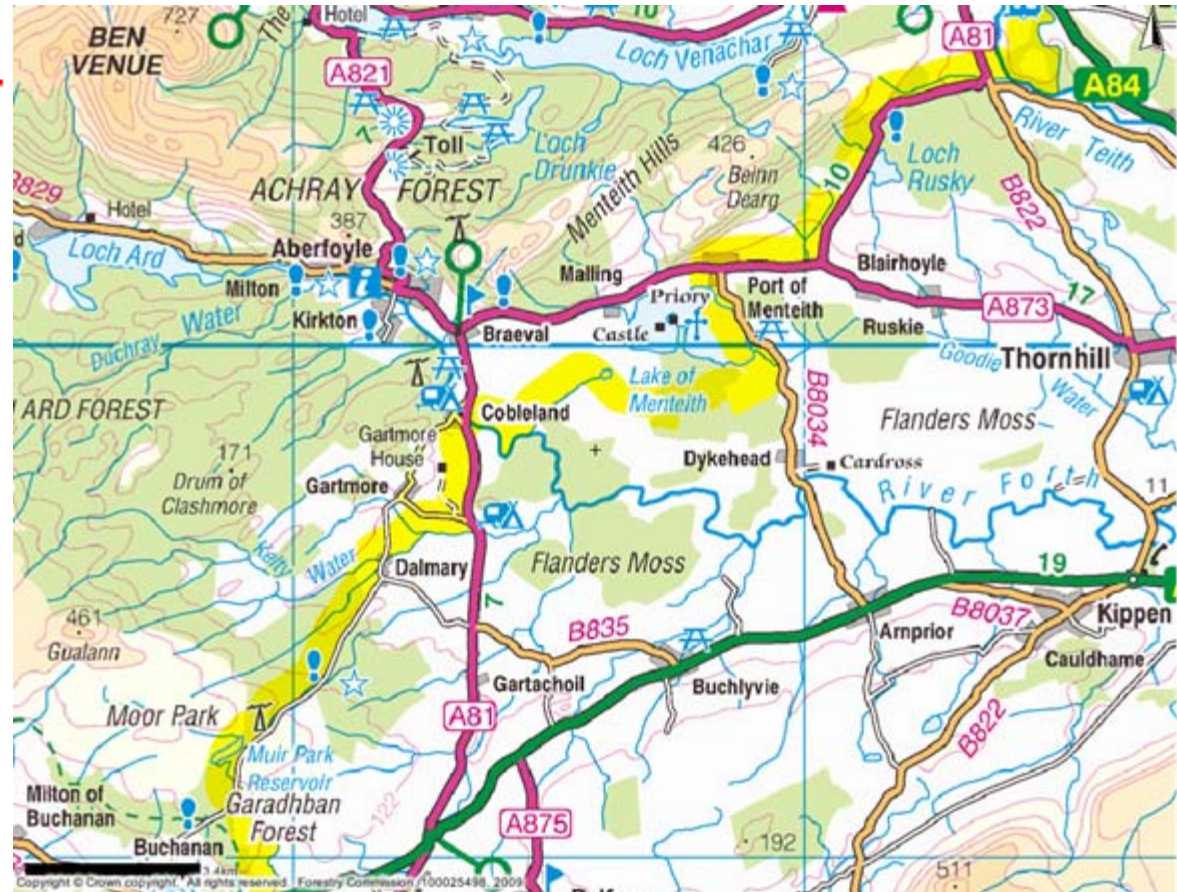
Increased DOC in surface waters

- atmospheric CO₂ concentration
- climate warming
- continued N deposition
- decreased sulfate deposition (DOC more soluble as acidity and ionic strength increase.)
- hydrological changes due to increased precipitation, droughts, and land use change

- Another FR study at Flanders Moss looking at effects of restoration on greenhouse gas flux.

Flanders Moss

- Investigate the effects of bog restoration, through clearfelling, on drainage water chemistry.
- Quantify changes in nutrients (particularly phosphate) and DOC following restoration.
- Recommendations to improve best practice.
- Guidance for restoration.



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Figure 1 Flanders Moss location

Background

- Flanders Moss - raised bog and part of Achray Forest on the floodplain of the River Forth.
- Organic rich peaty gley soil -Sphagnum/Eriophorum peat up to 8.5 m deep (average 4.6 m).
- The land has been drained since the 1920's, initially to improve grouse shooting.
- Drained and ploughed in 1964/65 for a silvicultural experiment.
- Planted with Lodgepole Pine and Sitka Spruce; phosphate fertilizer application around each tree in 1965

- Three sampling points; one control catchment.
- Two drains and a natural stream (Blackrat burn)
- Fortnightly water sampling began in 2008
- Major inorganic anions and cations
DOC, conductivity, pH, colour, suspended solids and occasional ICP.



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Figure 2 Aerial photograph of Flanders Moss showing sampling points.

- Installed automatic pressure and temperature sensor - depth and temperature reading every 15 minutes.
- Rating the channels
- Convert chemical concentrations to fluxes.



Figure 3 Water level recorder and stilling well at Flanders Moss Site 3

- Clearfelling delayed due to on-site problems
- One area was clearfelled in winter 09/10
- Preliminary data



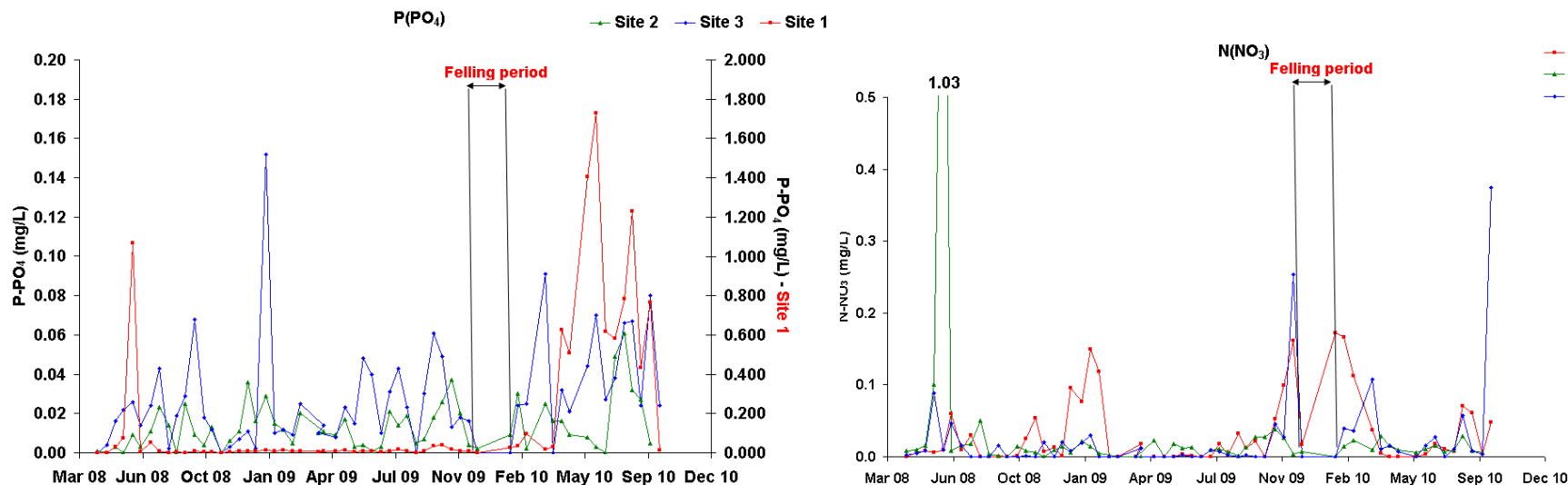


Figure 4 P(PO₄) and N(NO₃) in Flanders Moss drainage water; vertical lines indicate clearfelling period at Site 1

- Phosphate concentration increases following felling
- Delayed response – (brash dries out and phosphate is leached.)
- Is there more P to come? Will regrowth of vegetation prevent further leaching– recycling of P

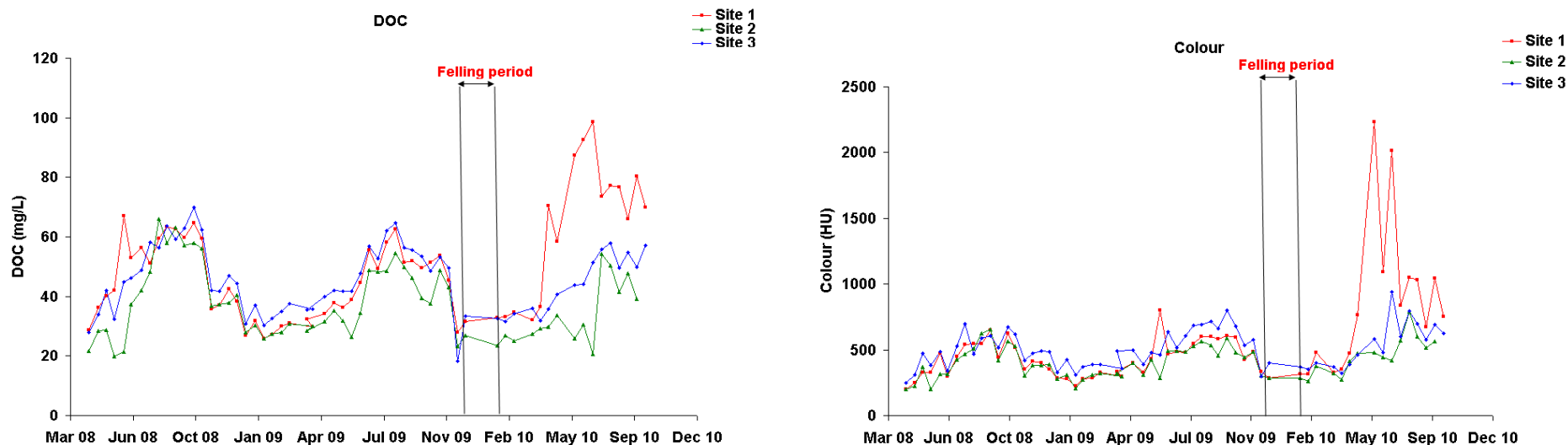


Figure 5 Colour and DOC in Flanders Moss drainage water; vertical lines indicate clearfelling period at Site 1

- Colour and DOC increase following felling period
- Is there more DOC to come in Spring/Summer 2010?

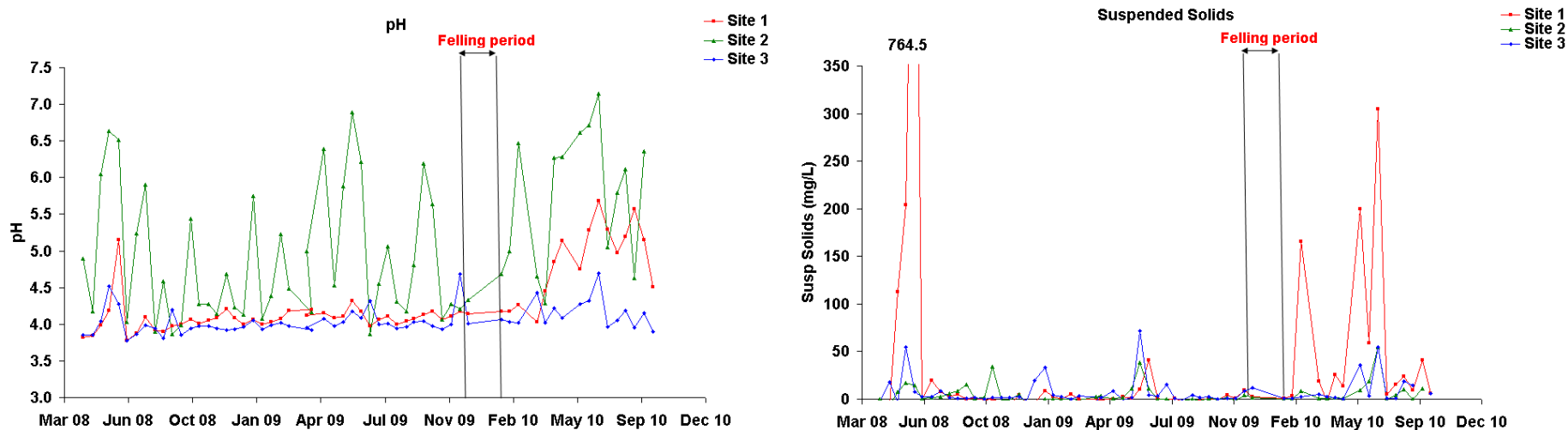


Figure 6 pH and suspended solids in Flanders Moss drainage water; vertical lines indicate clearfelling period at Site 1

- pH increase at Site 1 following felling – proximity to road?

Points to note

- Clearfelling led to an increase in Phosphate and DOC in drainage waters.
- Too early to draw any conclusions on the environmental impacts.
- Monitoring of clearfelled site is ongoing and further clearfelling is planned.
- Implications for management and restoration - depending on proportion of catchment felled, catchment size, receiving waters and local ecology

Thank you

