Climate benefits from forest-to-bog restoration on deep peat: a case study in the Flow Country

On behalf of the Flow Country Research Hub

With thanks to:
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The Flow Country: ~8000 years of peat accumulation

UK Peatlands: 1620 Mt of C

Flow Country: 400Mt of C
- Largest blanket bog in Europe
- Single largest C store in UK

Payne et al., 2016 & 2017; Ratcliffe et al., 2019, Chapman et al., 2009; Artz et al, 2014
• 800,000 ha of UK peatlands were afforested with non-native conifers during the 1950s - 1980s, including 67,000 ha (17%) in the Flow Country

• Large-scale “forest-to-bog” restoration started in late 1990s, driven by biodiversity and conservation concerns

• Several thousands of forest-to-bog restoration underway across the Flow Country
Can forest-to-bog restoration return C sink function and deliver climate benefits?
• Between 2012-2016, 3 interlinked PhD projects were created and ran alongside the Scottish Government RESAS programme
• All used the same sites and looked at different components of the C sink function
TALAHEEL : Felling to waste 1997-1998

DYKE : Whole tree removal + drain blocking 2018

CROSS LOCHS: Near natural reference (no afforestation or drainage)

TALAHEEL : Felling to waste 1997-1998

LONIELIST Felling to waste 2006
Lonie list after 10 years is a NET SOURCE of CO₂

Talaheel after 16 years is a NET SINK of CO₂

Near Natural reference: -114 g C m² yr⁻¹

Hambley et al., 2018; Levy et al., 2015

MORE DETAILS ABOUT LATEST RESULTS ON POSTER!!!
Key message: Felling to waste leads to net climate benefits within 10-15 years

- Open and forest-to-bog sites emit CH$_4$ but no systematic CH$_4$ “pulse” was observed in forest-to-bog sites
- Taking CH$_4$ emissions into account, open and 15 year old site have a net cooling effect on climate
- CO$_2$ uptake (photosynthesis) similar within 5-7 years
- Woody debris + change in water quality ↑ initial CO$_2$ emissions in forest-to-bog sites
- Higher CO$_2$ emissions during summer drought in forest-to-bog sites suggest they are more vulnerable to climate change
- Newer techniques may help faster recovery of C sequestration (Hambley et al., 2019, Hermans et al., 2019, Gaffney et al., 2018, Lees et al 2019)
Future direction:
How do additional management measures (furrow blocking, ground smoothing, brash crushing) affect the GHG balance and climate benefits of forest-to-bog peatlands?

Current strategy:
- Continued long-term monitoring over key areas of the Flow Country
- Share data across UK network of sites
Future direction:
Can we use remote-sensing technology to measure GHG emission or improve our models?

Current strategy:
- Collaborative approach and data sharing with remote-sensing research community
- Several projects underway (MODIS, InSAR, etc)
Future direction:
What is the effect of wildfire on the fate of C in peatland across a range of land-uses?

Current strategy
- NERC Urgency FIRE BLANKET project (UHI Andersen lead) will look at aquatic C and vegetation recovery
- NERC Urgency FIRE RECOVER project (JHI Artz lead) will look at drivers of GHG
THANK YOU FOR YOUR ATTENTION

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