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:

Mhairi Coyle, Roxane Andersen, Rebekka Artz, Jens-Arne Subke, Tim Hill, Mark Hancock, Neil Cowie, Yit Arn Teh, Graham Hambley, Paul Gaffney, Renee Hermans, Rebecca McKenzie, Peter Gilbert, Daniela Klein, Kirsten Lees, Myroslava Khomic, Matthew Saunders, Peter Levy

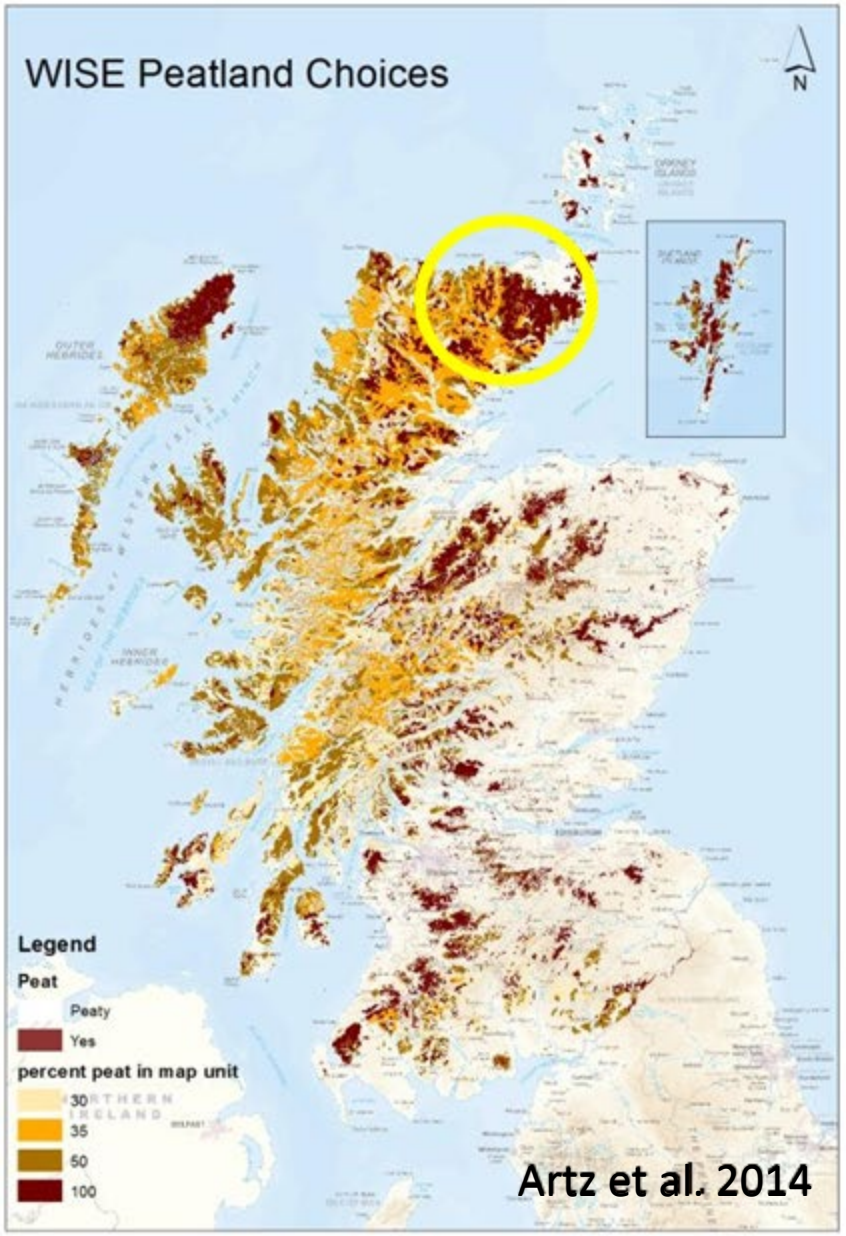
The Flow Country: ~8000 years of peat accumulation

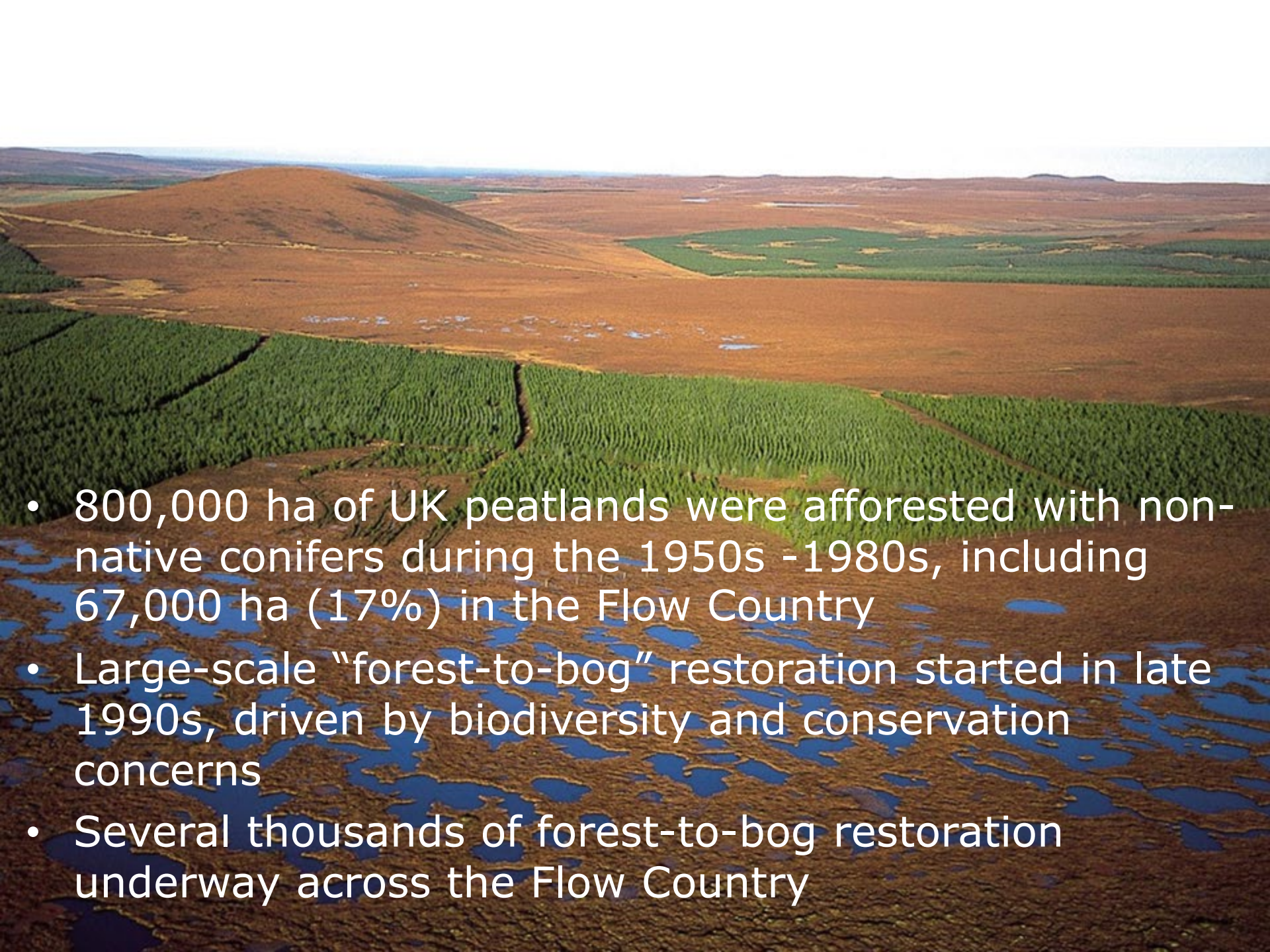
UK Peatlands: 1620 Mt of C

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

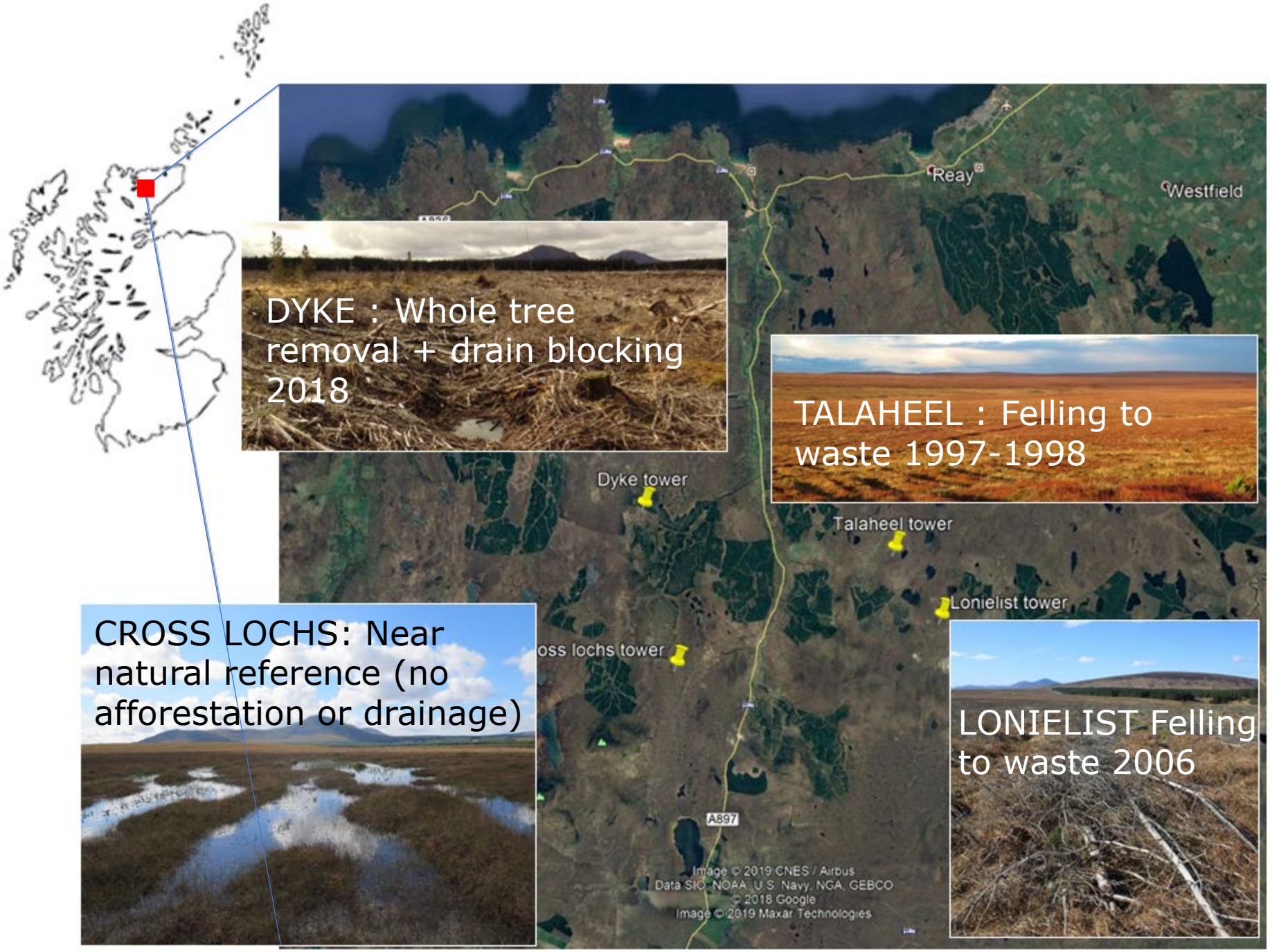




- 800,000 ha of UK peatlands were afforested with non-native conifers during the 1950s -1980s, including 67,000 ha (17%) in the Flow Country
- Large-scale "forest-to-bog" restoration started in late 1990s, driven by biodiversity and conservation concerns
- Several thousands of forest-to-bog restoration 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


Reay
Westfield
DYKE : Whole tree removal + drain blocking 2018
TALAHEEL : Felling to waste 1997-1998
Dyke tower
Talaheel tower
Lonielist tower
oss lochs tower
CROSS LOCHS: Near natural reference (no afforestation or drainage)
LONIELIST Felling to waste 2006
A897
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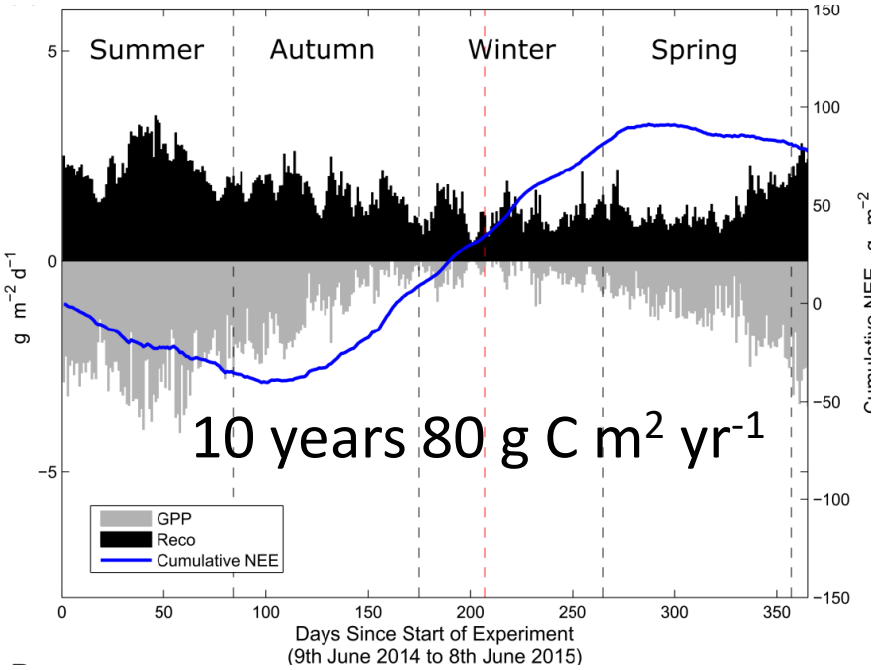
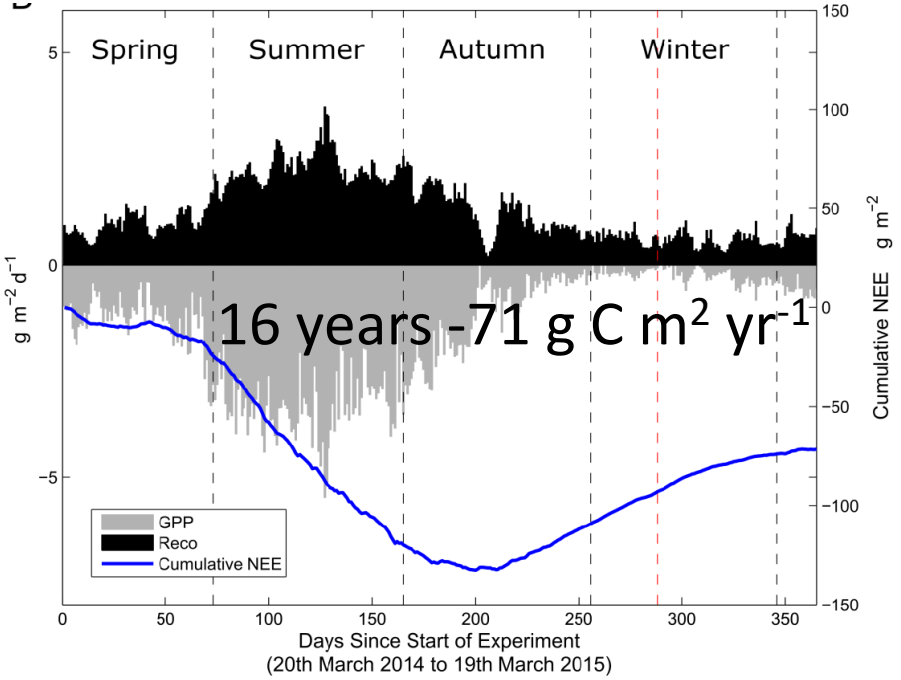
Lonielist after 10 years is a NET SOURCE of CO_2



Talaheel after 16 years is a NET SINK of CO_2



Near Natural reference: -114 g C m^2 yr^{-1}

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

MORE DETAILS ABOUT LATEST RESULTS ON POSTER!!!

climate change — Scotland's centre of expertise connecting climate change research and policy

Climate benefits of forest-to-bog restoration on deep peat – Policy briefing

Renee Hermans, Roxane Andersen, Rebekka Artz, Neil Cowie, Mhairi Coyle, Paul Gaffney, Graham Hambley, Mark Hancock, Tim Hill, Myroslava Khomik, Yit Arn Teh, Jens-Arne Subke

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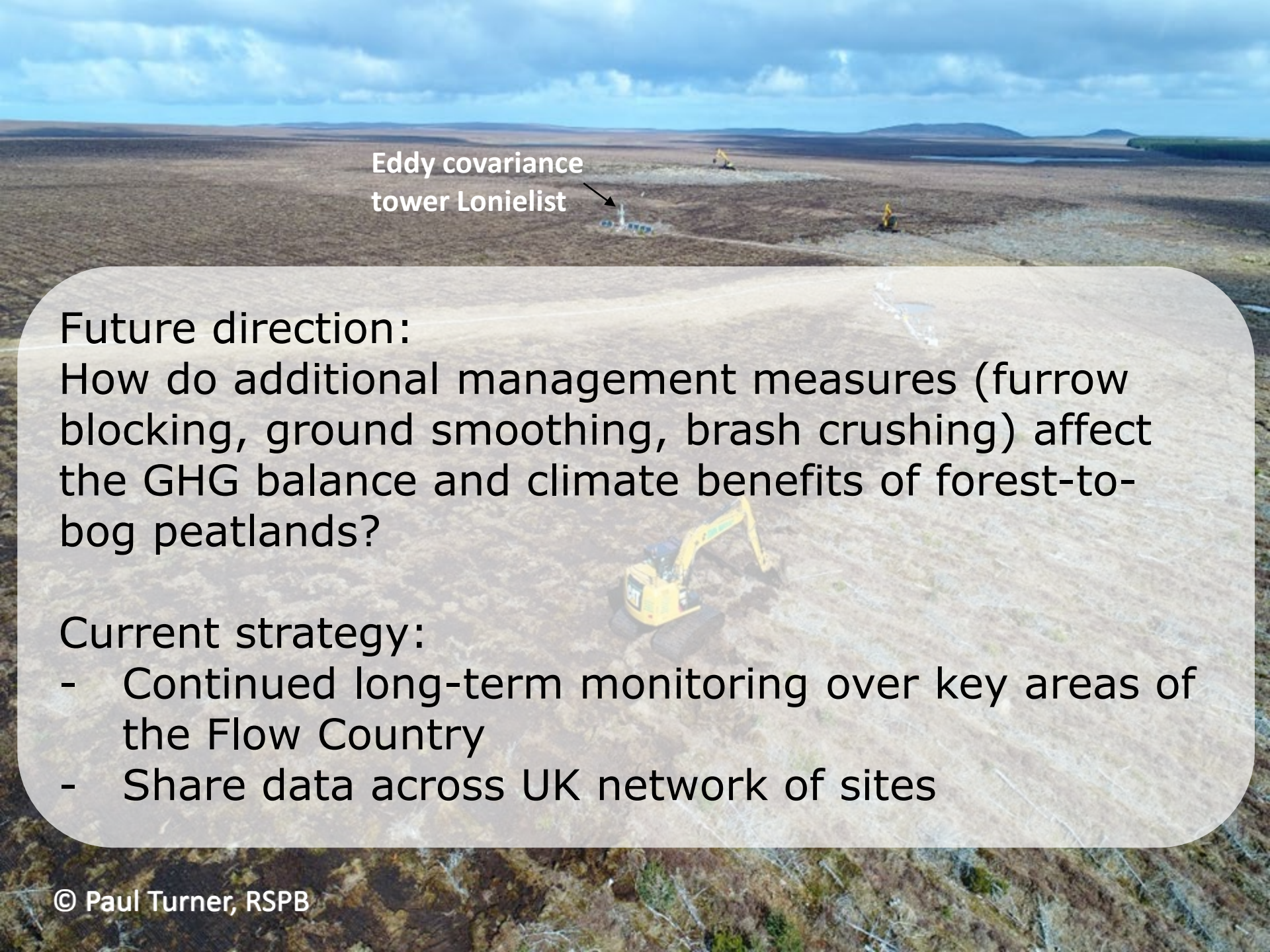
Key message: Felling to waste leads to net climate benefits within 10-15 years

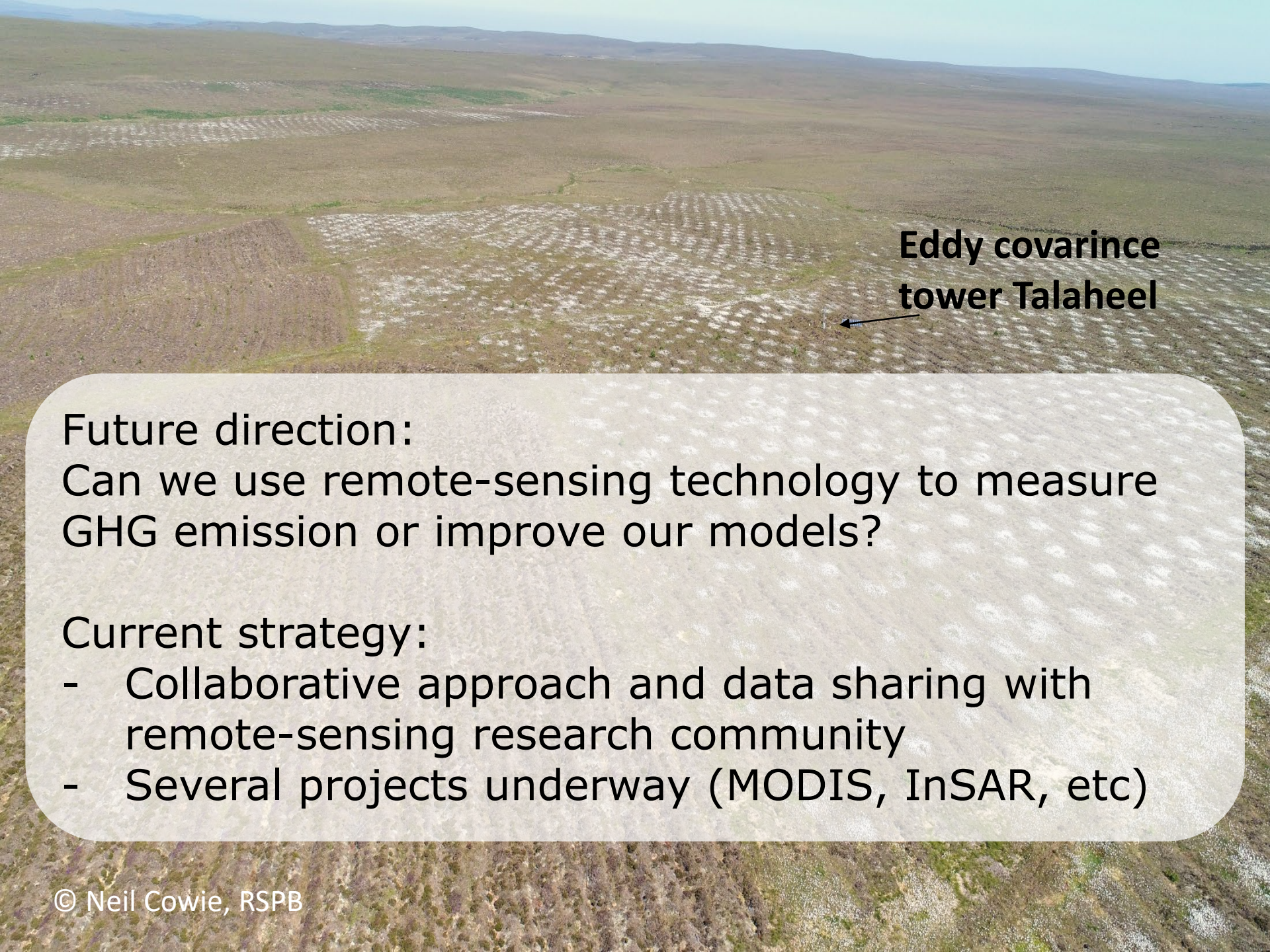
- Open and forest-to-bog sites emit CH_4 but no systematic CH_4 "pulse" was observed in forest-to-bog sites
- Taking CH_4 emissions into account, open and 15 year old site have a net cooling effect on climate
- CO_2 uptake (photosynthesis) similar within 5-7 years
- Woody debris + change in water quality ↑ 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)

New eddy covariance tower

Dyke eddy covariance tower…

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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