

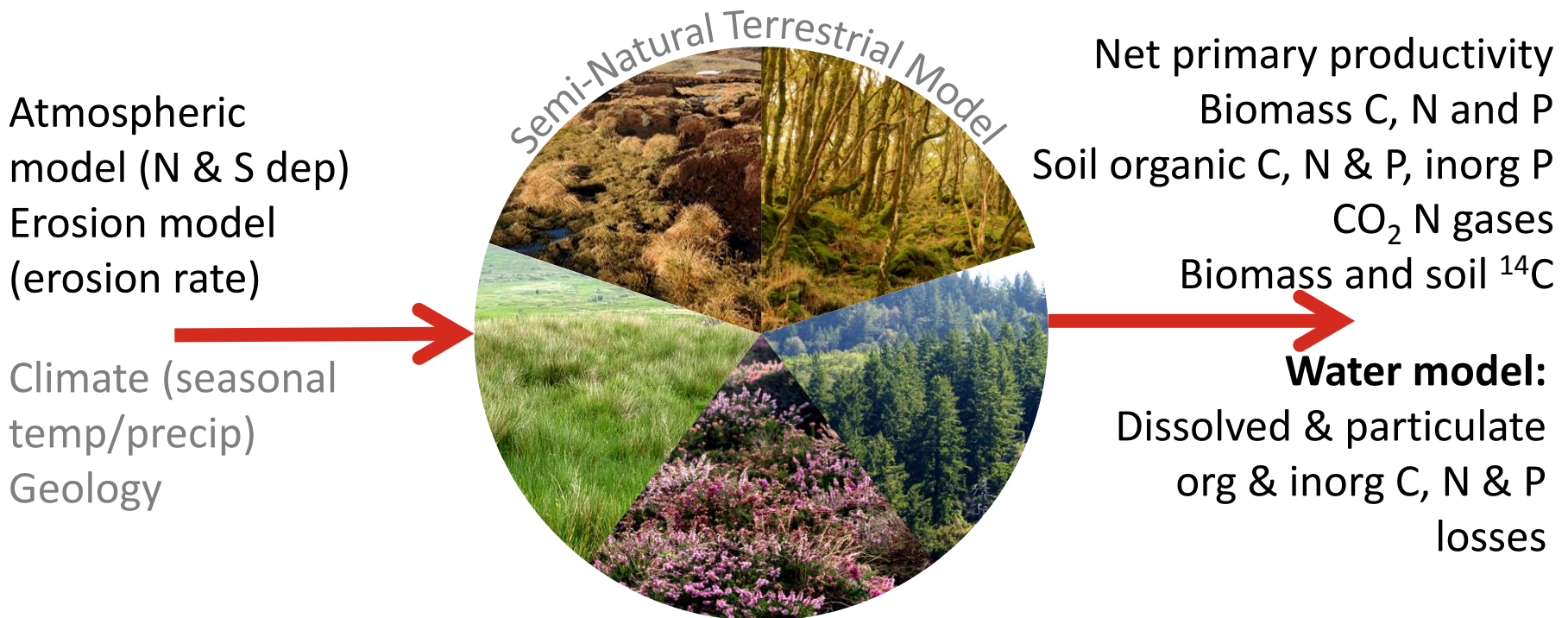


Future effects of climate, N deposition and woodland expansion on semi-natural terrestrial ecosystems

15-16 March, LTLS stakeholder meeting

Jess Davies & Ed Tipping

Semi-Natural Terrestrial Modelling: Overview



Purpose:

- To simulate C, N & P in an integrated manner in plants and soils
- To generate dissolved and particulate nutrient transfers from land to water
- To simulate CO₂ and N gas emissions from natural areas

Semi-Natural Terrestrial Modelling: Site calibration and testing

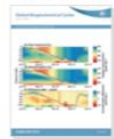
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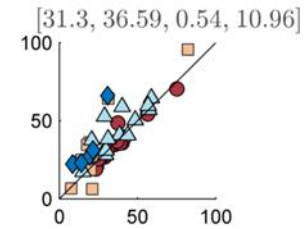
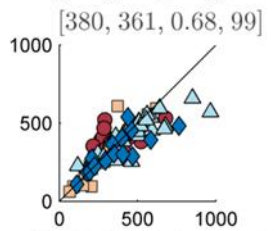
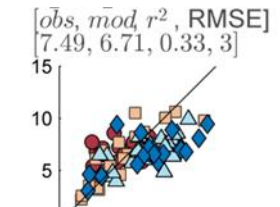
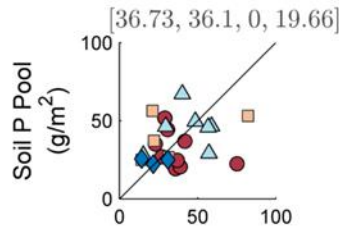
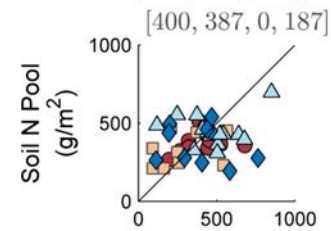
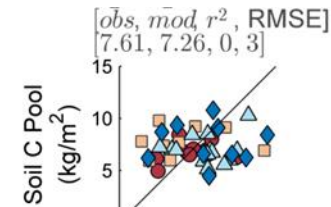
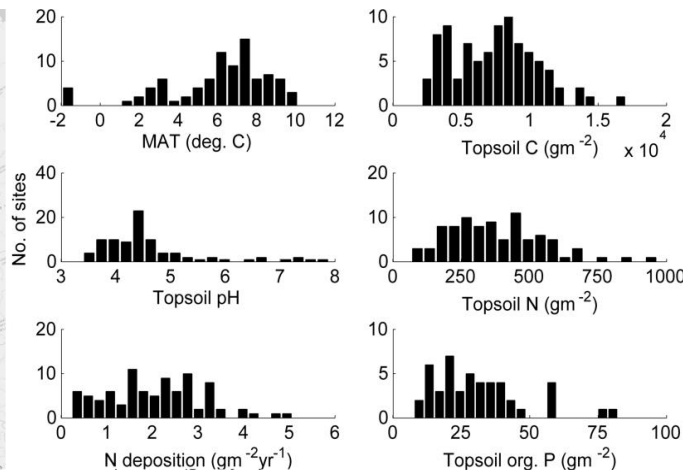
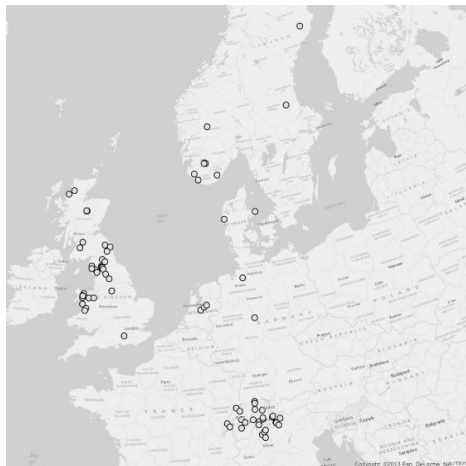
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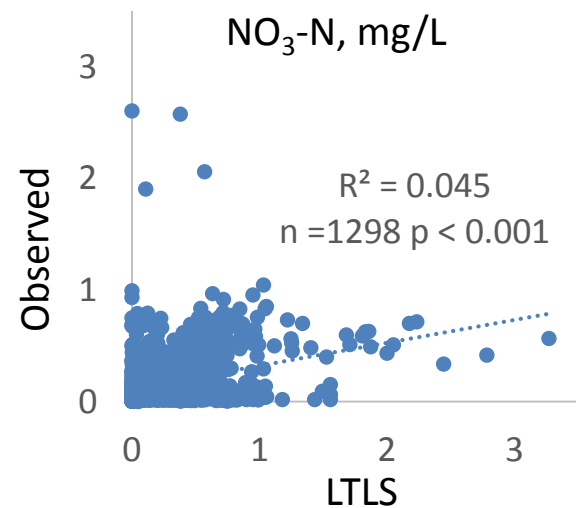
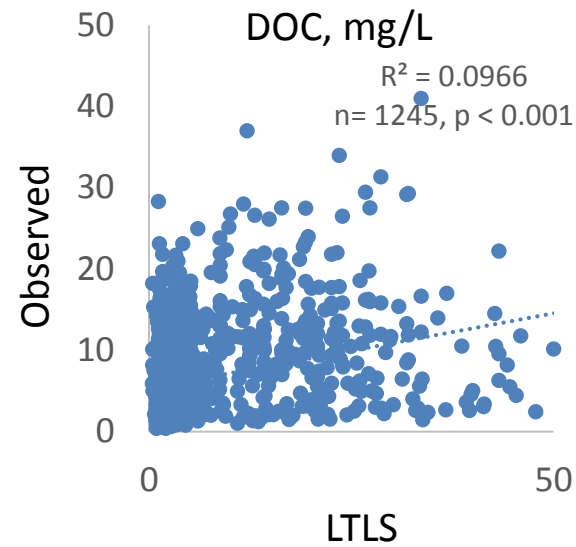
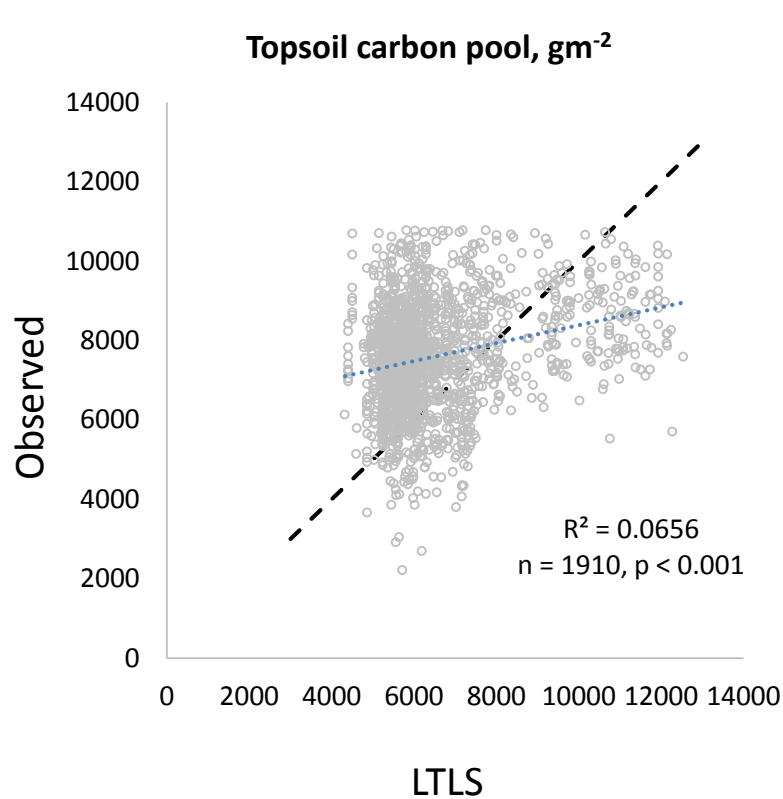
Long-term P weathering and recent N deposition control contemporary plant-soil C, N and P[†]

J.A.C. Davies , E. Tipping, E.C. Rowe, J.F. Boyle, E. Graf Pannatier, V. Martinsen

Accepted manuscript online: 6 January 2016 Full publication history



Semi-Natural Terrestrial Modelling: Blind UK scale testing in progress



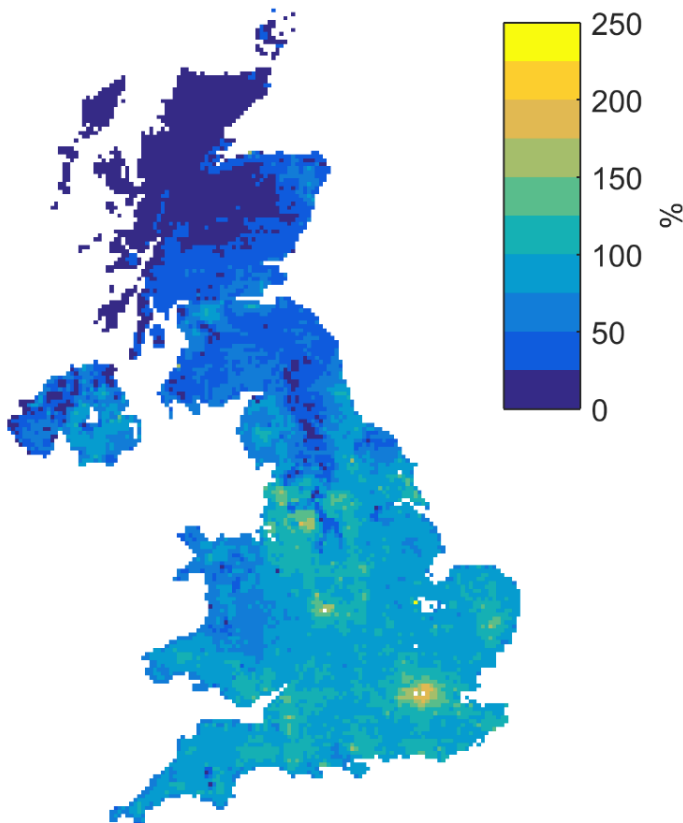
Highlights for today

1. N deposition affect on plant growth and soil C
2. Terrestrial carbon gains from woodland expansion
3. Dissolved organic carbon change

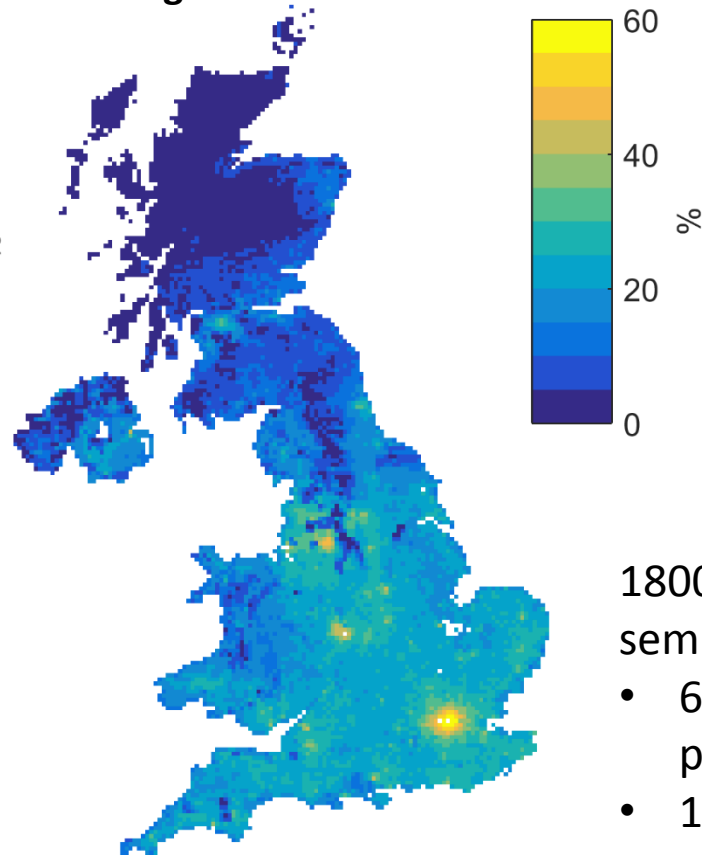
N deposition affect on plant growth and soil C – Past change

Mean change in undisturbed semi-natural areas, 1800-2000

Net Primary Productivity



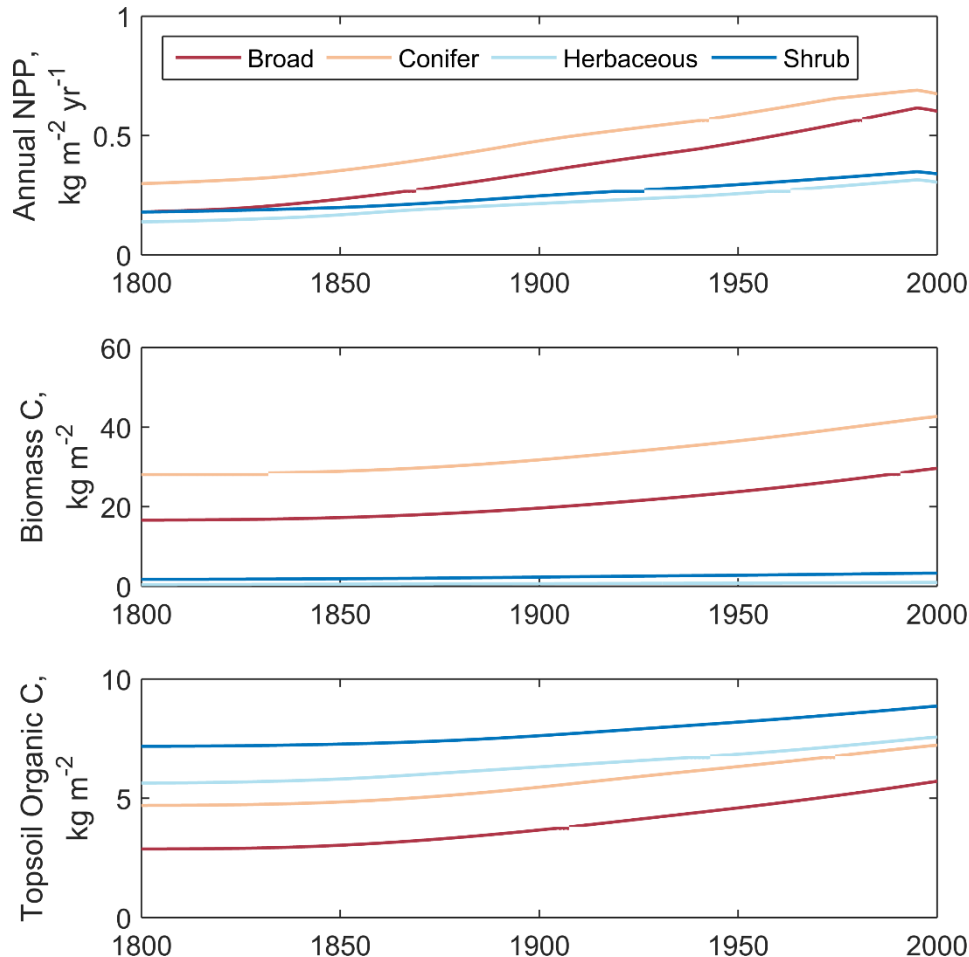
Soil organic carbon



1800-2000, per m² of UK semi-natural habitat:

- 64% increase in net primary productivity
- 17% increase in soil C

N deposition affect on plant growth and soil C – Site scale change



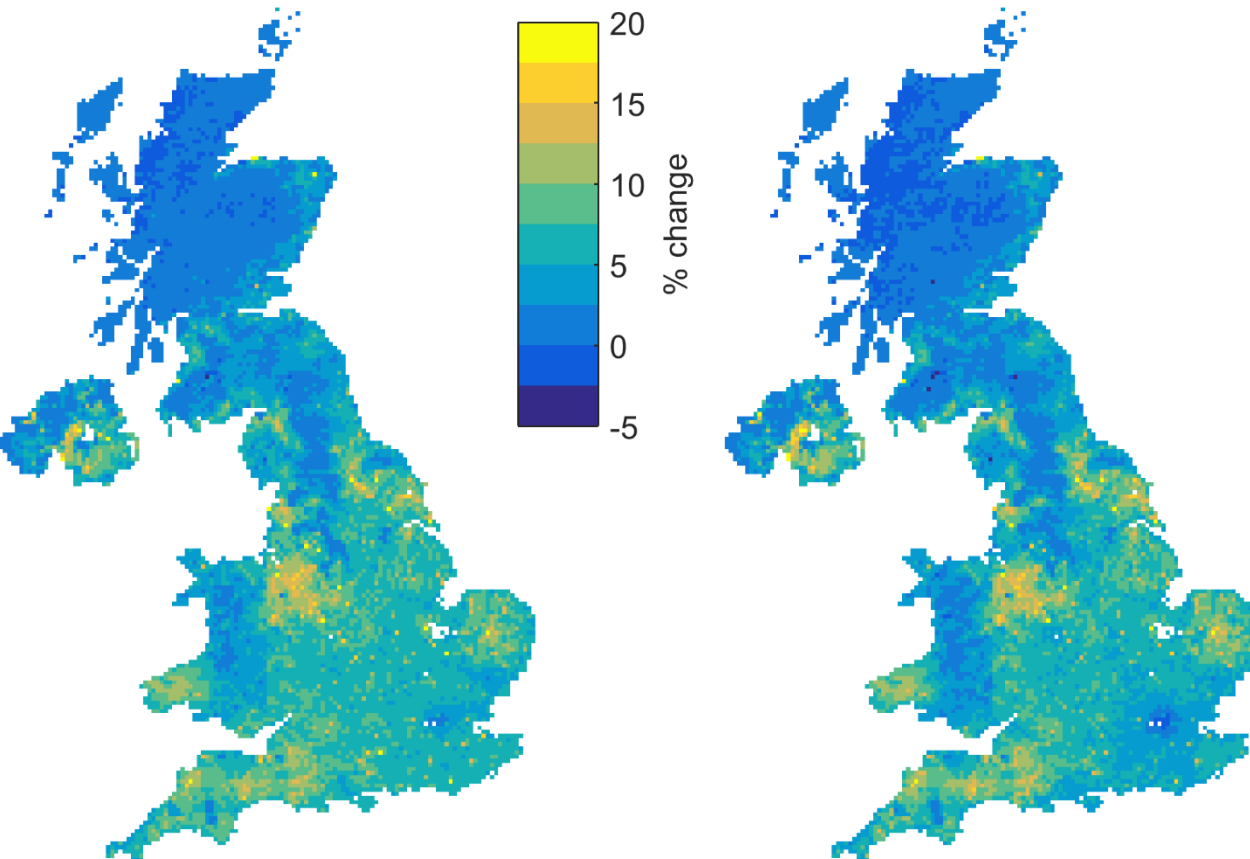
Forested habitats: Total biomass gain of 60 gC/g atmospherically deposited N

N deposition affect on plant growth and soil C – Future change

Mean change in undisturbed semi-natural areas, 1800-2000

Current N dep scenario

Reduced N dep scenario

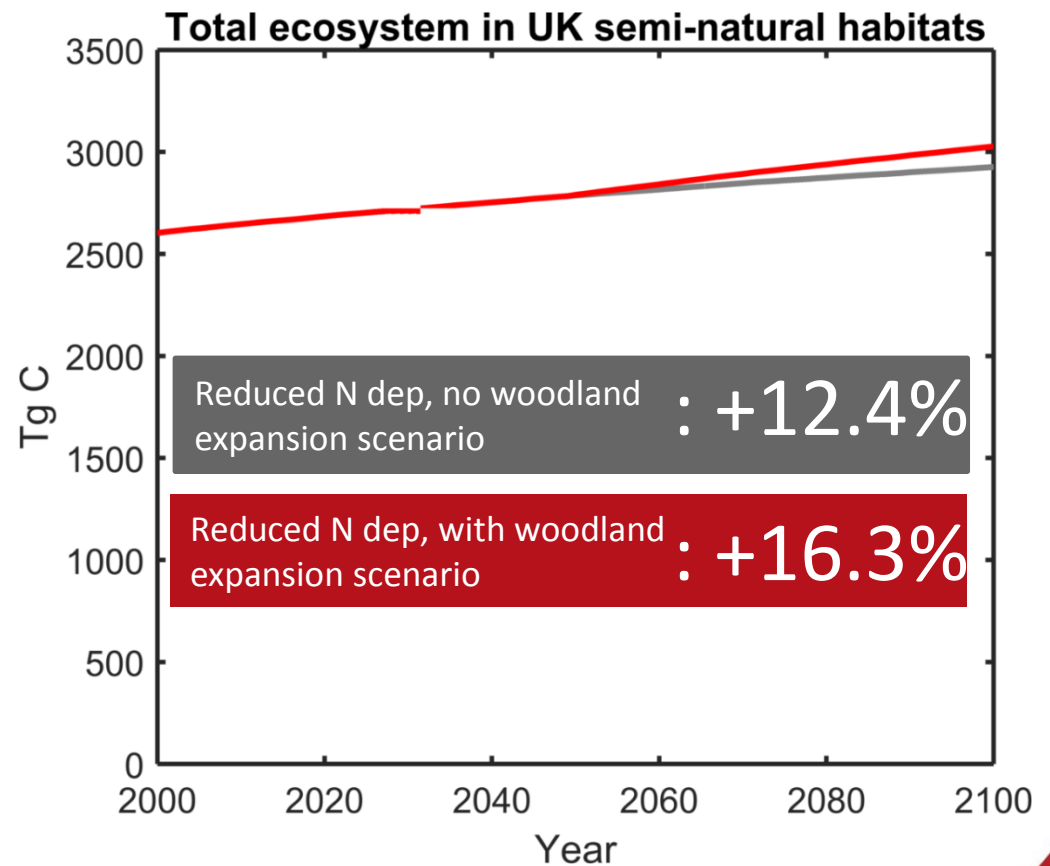
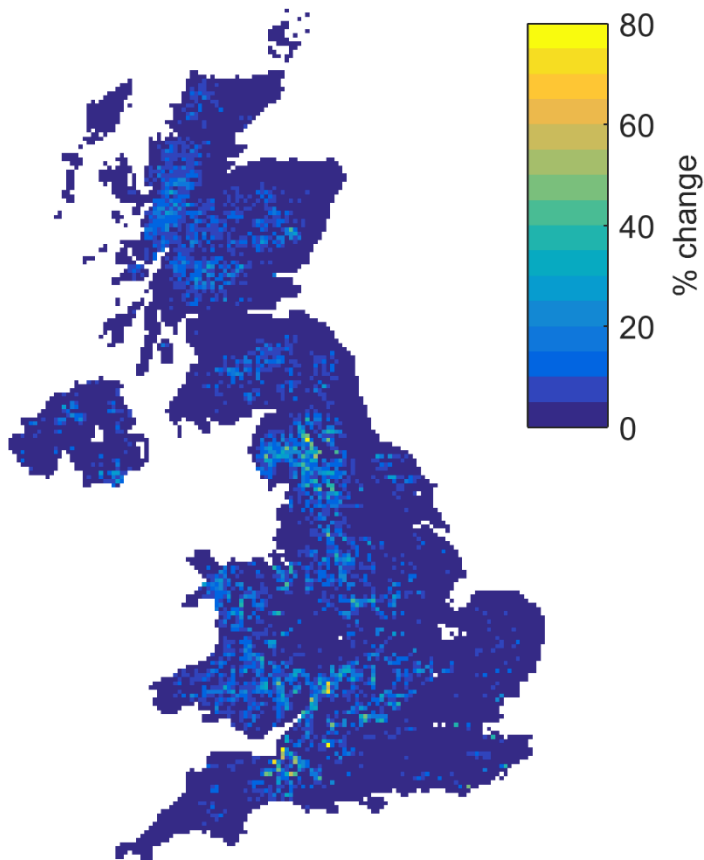


Current N dep scenario:
+2.1%
in soil C per m² of UK
semi-natural habitat

Reduced N dep scenario:
+1.7%
in soil C per m² of UK
semi-natural habitat

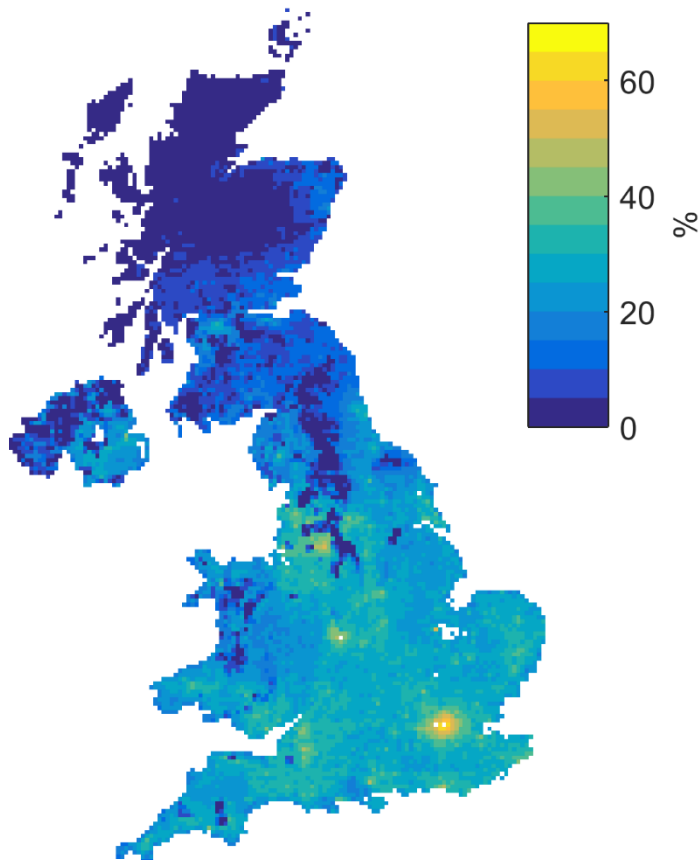
Terrestrial carbon gains from woodland expansion

Total ecosystem C change due to woodland expansion 2000-2100



Dissolved organic carbon change: Past change

Mean DOC change in undisturbed semi-natural areas 2000-2100



DOC increases in model arise from:

- Increased soil C
- Increase in temperature
i.e. there is no pH effect, but could be incorporated

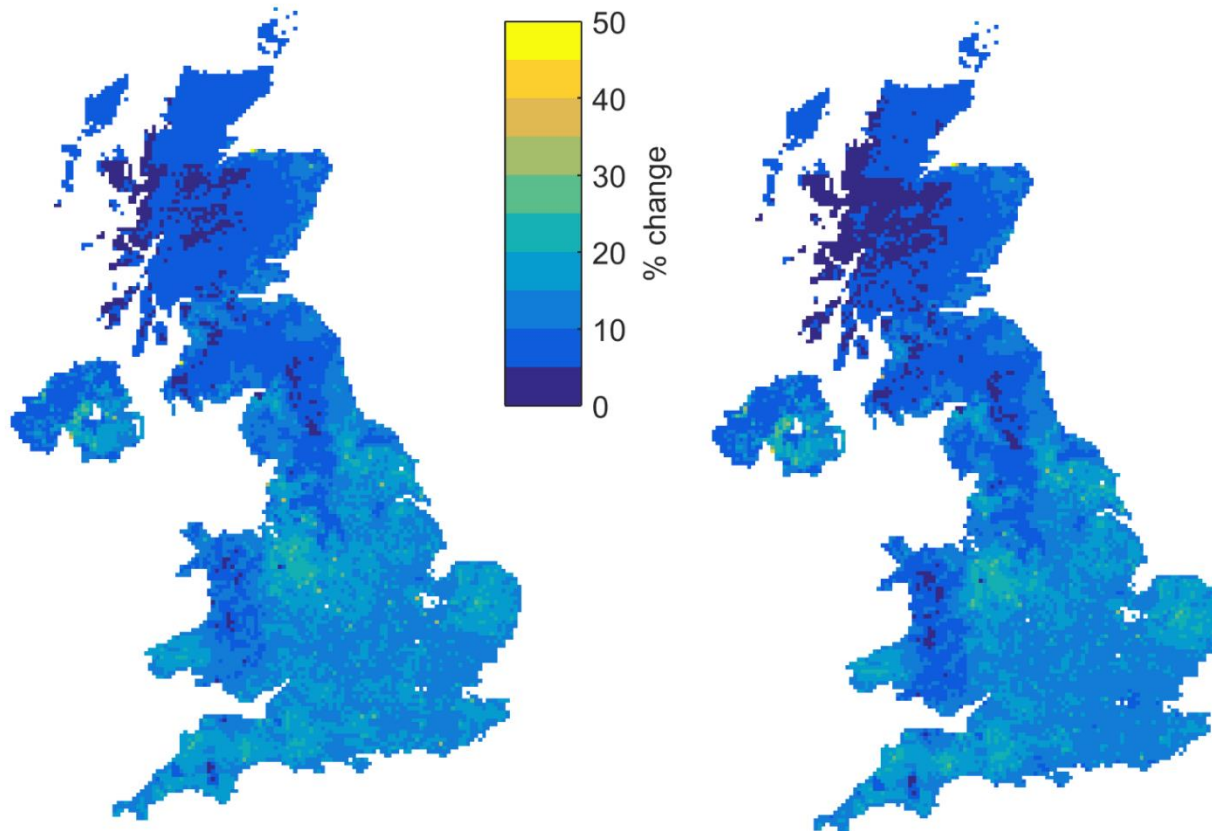
1800-2000 increase in DOC per m² of semi-natural habitat = 17.4%

Dissolved organic carbon change: Future trends

Mean DOC change in undisturbed semi-natural areas 2000-2100

Current N dep scenario

Reduced N dep scenario



Current N dep scenario:
+7.7%
in DOC per m² of UK semi-natural habitat

Reduced N dep scenario:
+7.4%
in DOC per m² of UK semi-natural habitat

Summary

The model suggests that:

- Past N deposition has driven widespread increases in NPP, and subsequently SOC and DOC release.
- Total UK SOC set to increase by ~2% and DOC by ~7% in next 100 years under baseline and N deposition reduction scenarios.
- Woodland expansion could increase UK ecosystem carbon stocks in semi-natural habitats by 16% compared with a 12% increase for no expansion scenario