Forest Research

Understanding the C balance of forestry

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Forest Research

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Introduction

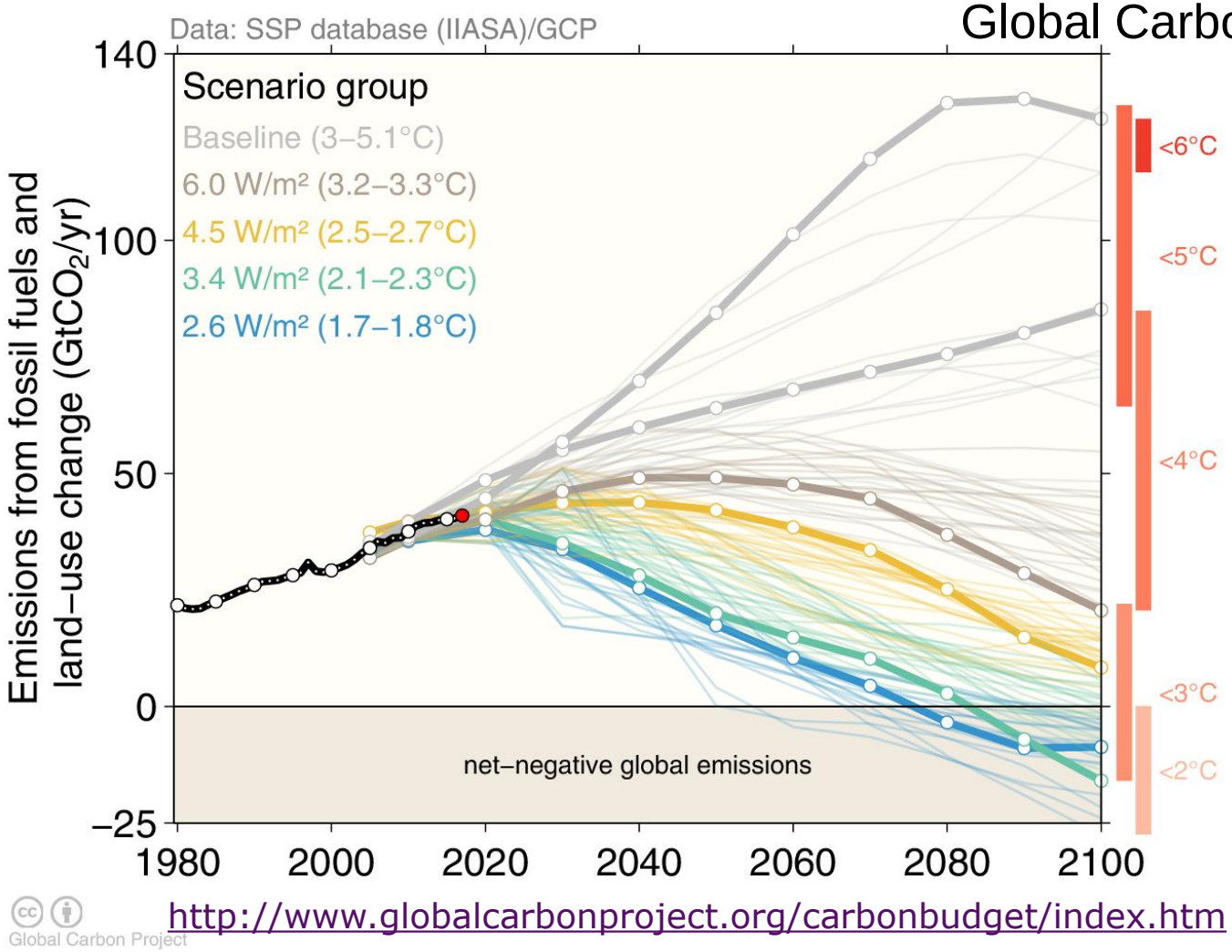
- The climate emergency has brought a spotlight to the role of forests and forestry in the carbon cycle and for climate change mitigation.
- Government has committed UK to a 'net zero' emissions target by 2050. Scottish Government by 2045.

IN THIS TALK >

- Describe carbon in forests & their contribution to governments targets
- The importance of Stocks & Fluxes
- What is known, what is not
- And impact and response to the changing climate itself.

Global emissions projections

Global Carbon Project



http://www.globalcarbonproject.org/carbonbudget/index.htm

Despite Paris Agreement in 2015, last year's IPCC 1.5°C report: "global warming is likely to reach 1.5°C between 2030 and 2052"

CCC Land Use Report Nov 2018

Committee on Climate Change

The benefits of changing the way we use our land

Land is a critical natural resource. How it's used and managed is vital to the UK's ability to deliver deeper emissions reductions and improve resilience to the effects of climate change over the long-term

Decisions need to be made quickly

The UK's goals for addressing climate climate are unlikely to be met without fundamental land reform. Proposed new UK laws on agriculture and the environment means there is now a one-off opportunity to define a new land strategy.

Nationally, action is required to do the following:

26-36%

Reduction in grasslands and rough grazing by 2050

(up to) 1.5 million hectares

of new woodland to store carbon by 2050

(up to) 1.2 million hectares

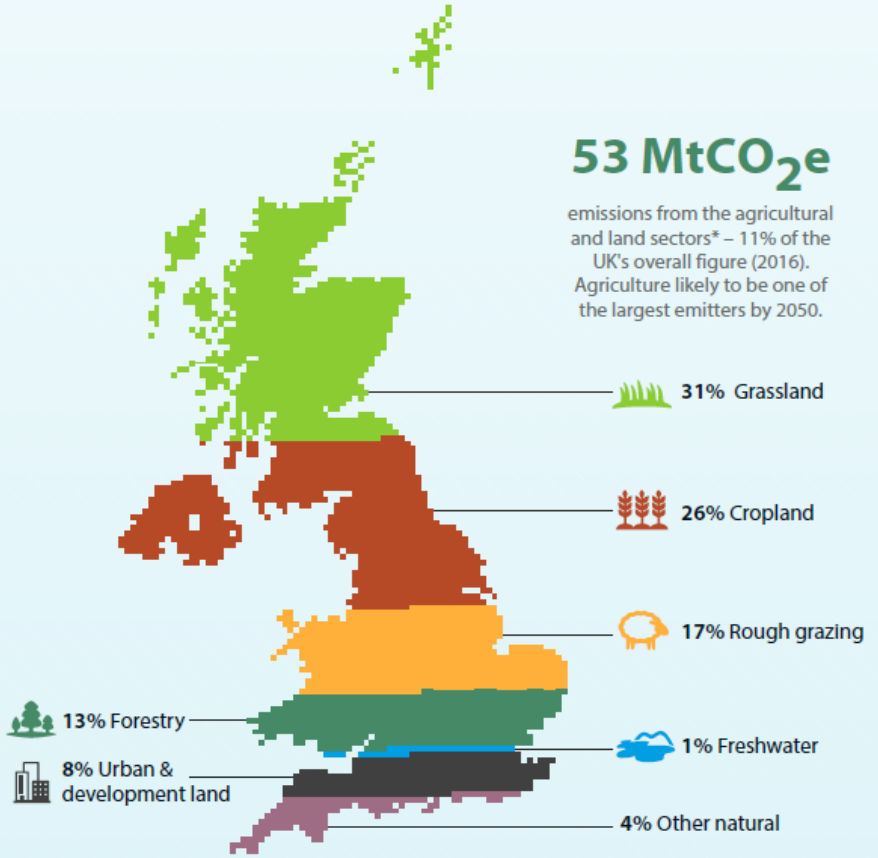
for bioenergy crops by 2050

Locally, addressing the risks early could bring multiple benefits:

Can insulate against rising costs of climate change

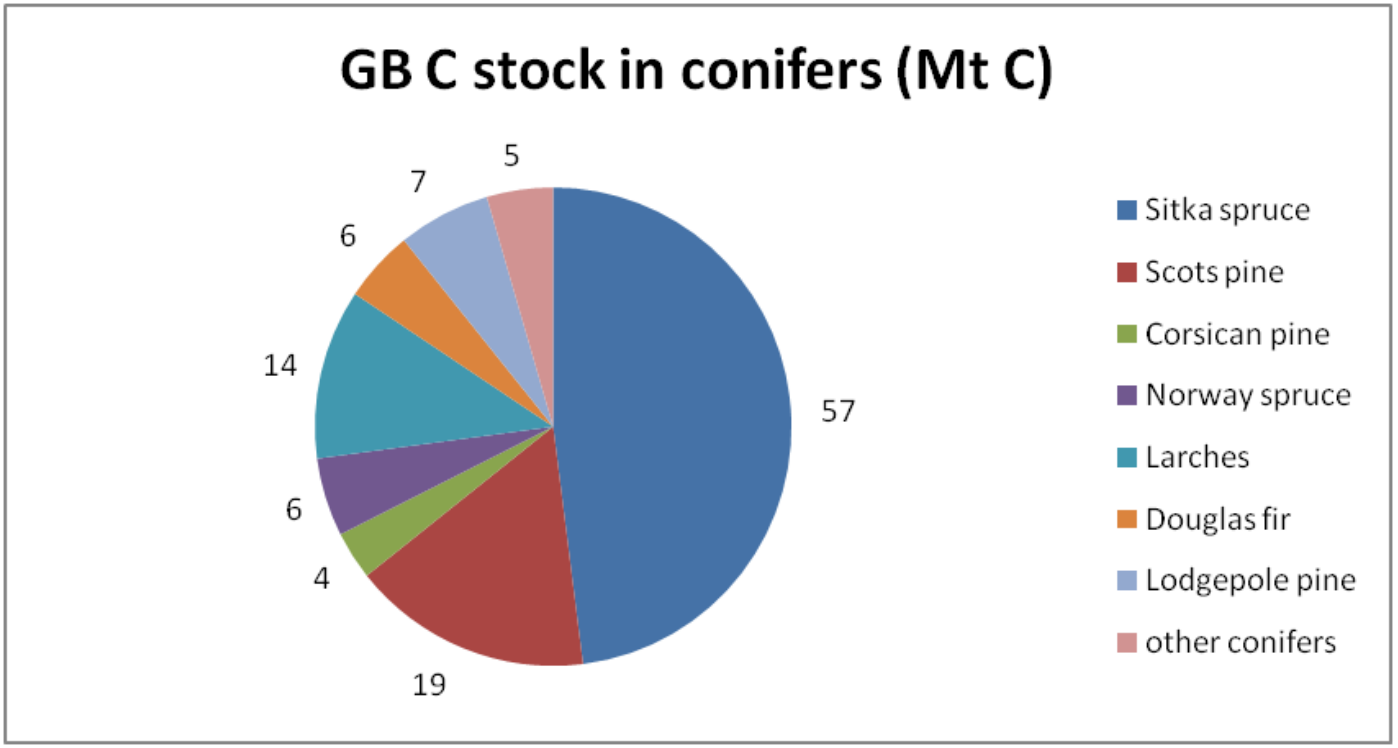
Supports sustainable benefits through long-term resilience

Protects the natural environment against irreversible decline



How our land is used today

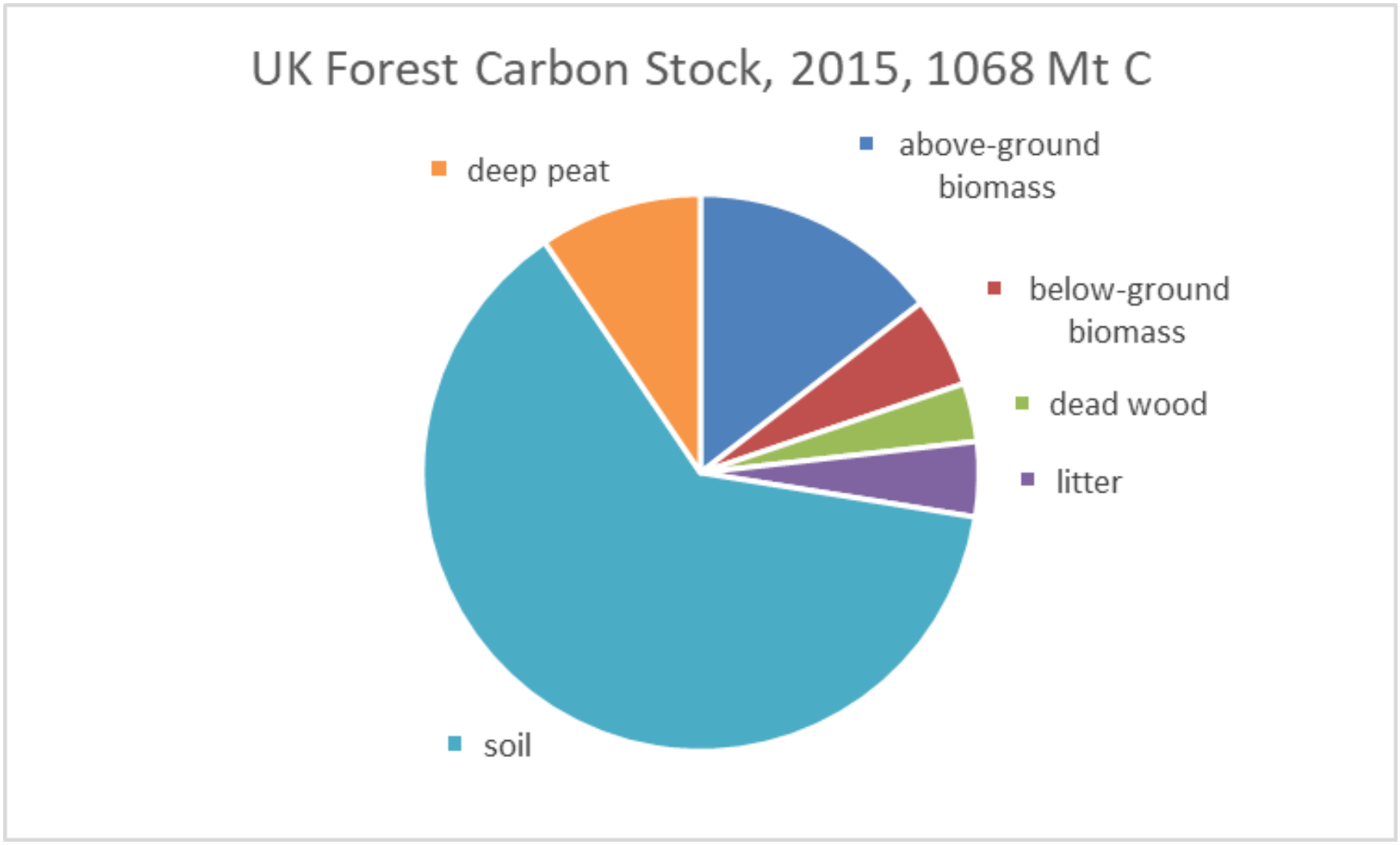
C Stocks



calculated from National Forest Inventory, FC, 2012;

Grace & Morison 2012

C Stocks



From Forestry Statistics (from NFI & FR's BioSoil information)

Forest C sink: mitigation

Carbon sequestration - a question of balance!

Jarvis

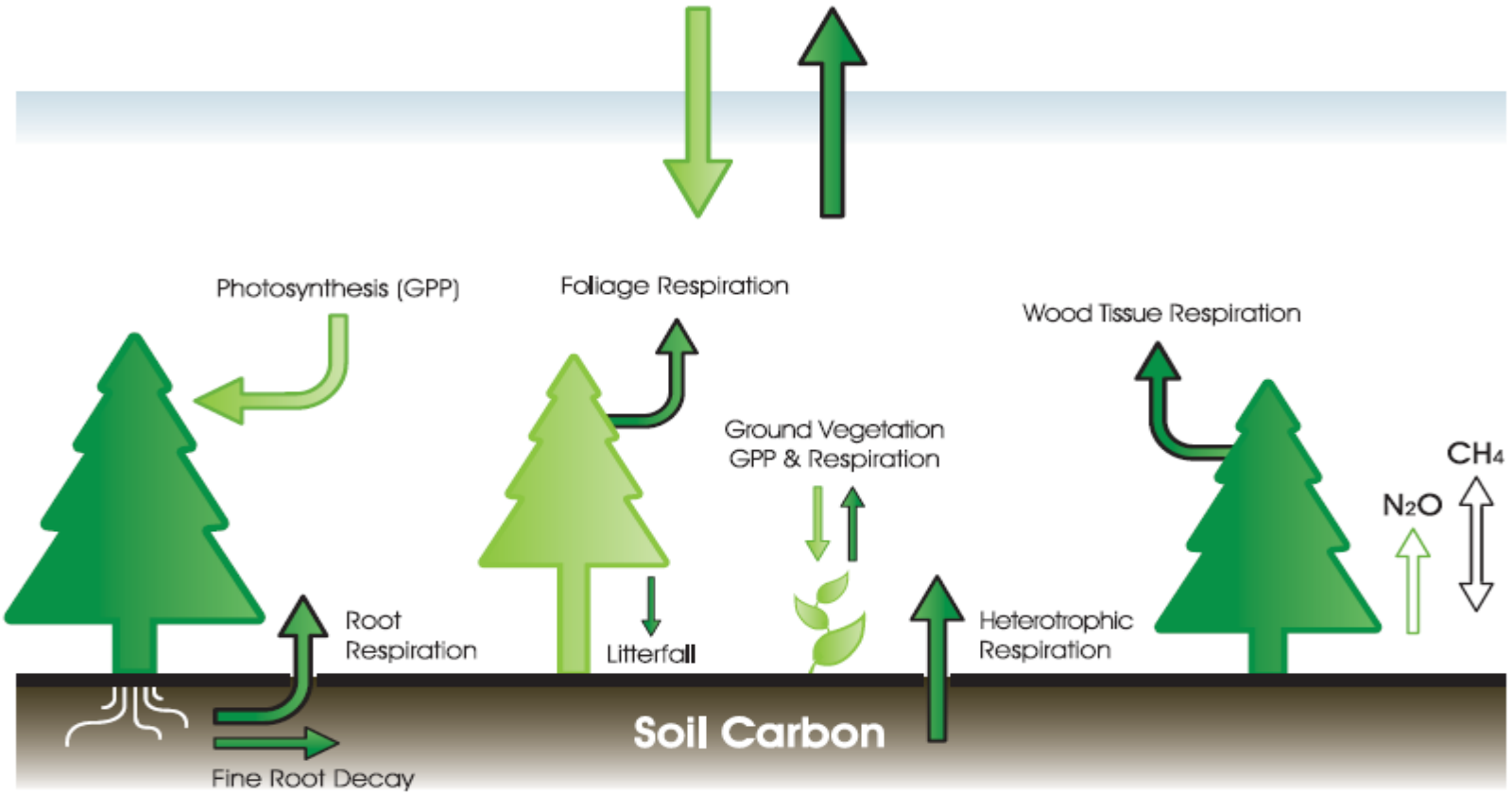
Forests as C sinks

Understanding response of CO_2 uptake to climate

Forest C sink: mitigation

NEE

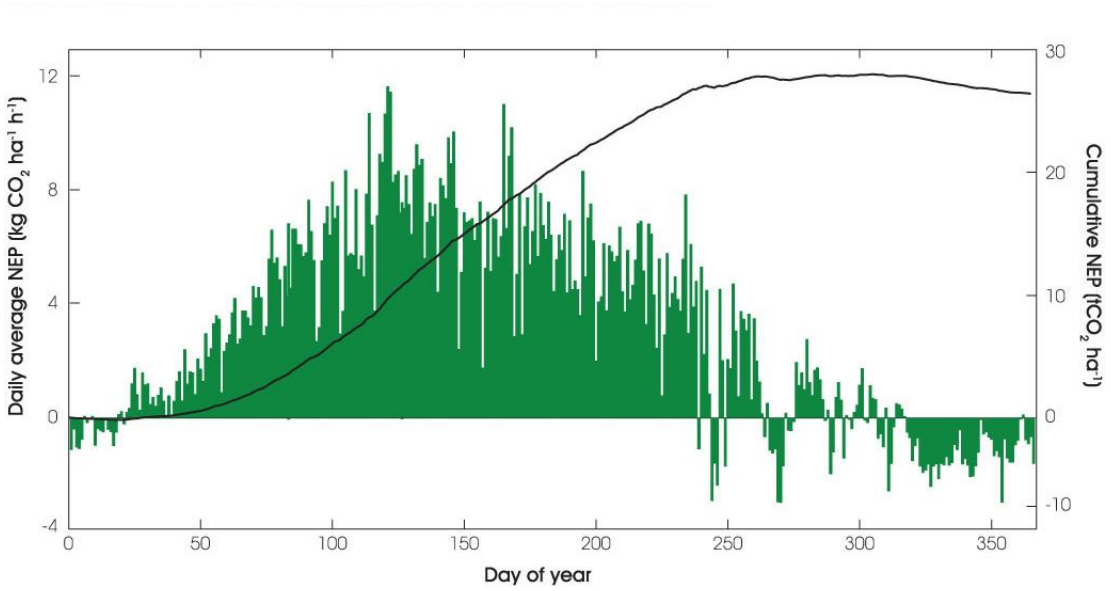
Net ecosystem carbon exchange



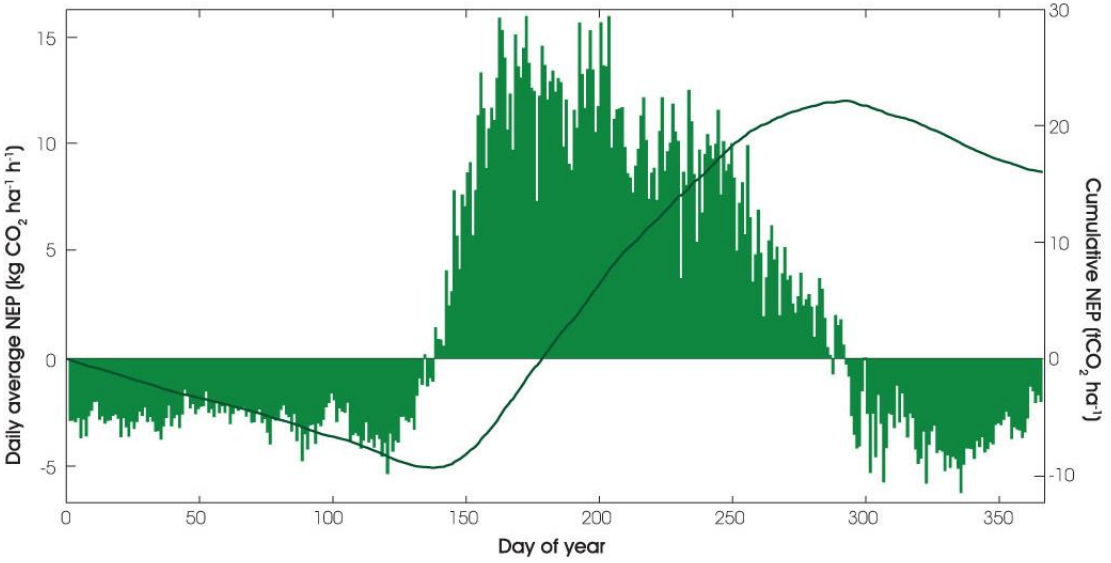
Trees and forest soils lock up carbon

Forest C sink: mitigation

17–21 year old Sitka spruce evergreen.
Annual total removal of CO_2
24 tonnes per hectare per year.



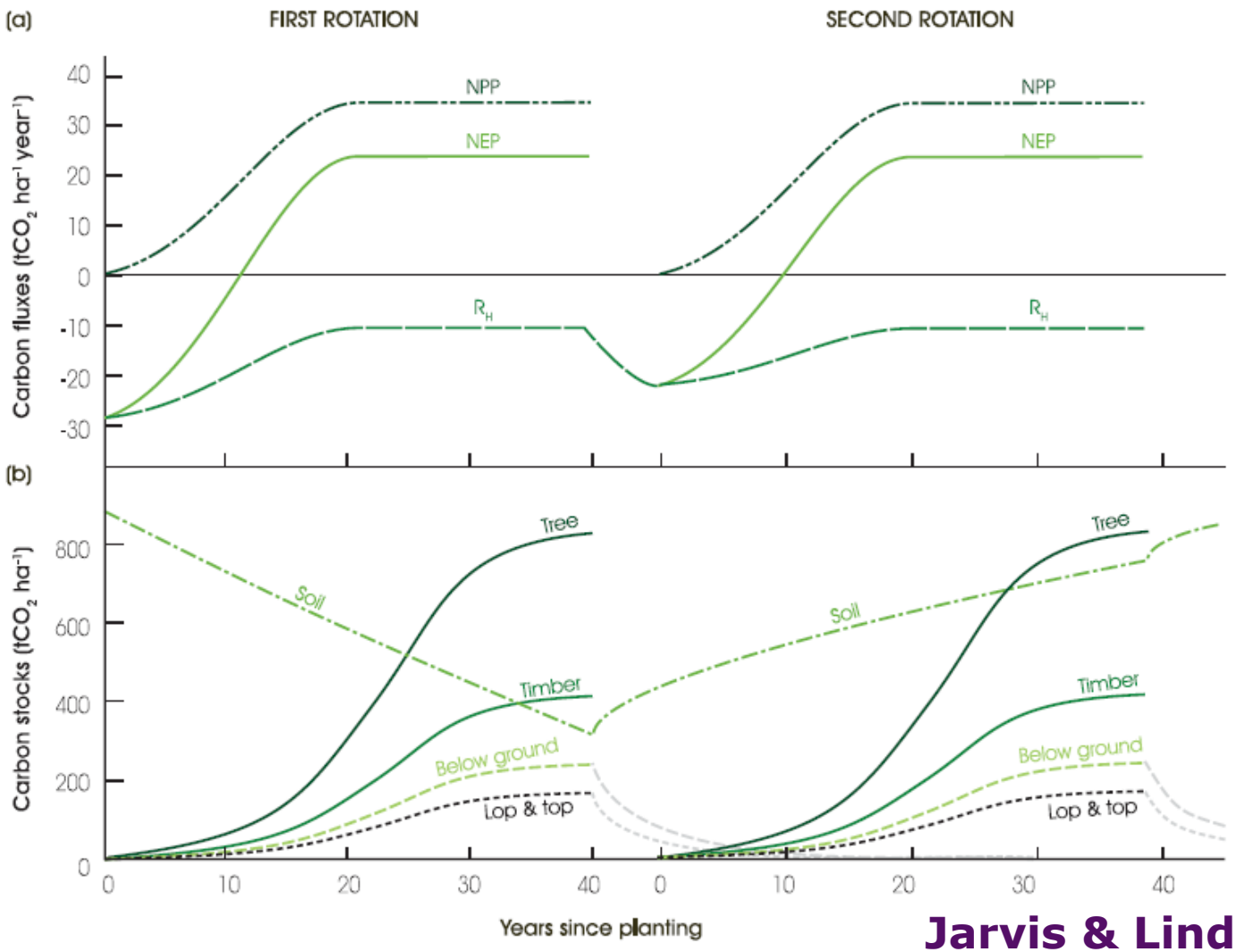
72–80 year old oak & mixed deciduous.
Annual total removal of CO_2
15 tonnes per hectare per year.



Griffin and Alice Holt Forests

Forest C sink: mitigation

Rotational Impacts on Forest NEE



Jarvis & Linder 2009

Forest C sink: mitigation

These reports take the subject further

Government drivers

Department
for Environment
Food & Rural Affairs

Policy paper

At a glance: summary of targets in our 25 year environment plan

Updated 16 May 2019

"Increasing woodland in England in line with our aspiration of 12% cover by 2060: this would involve planting 180,000 ha by 2042."

CCRA

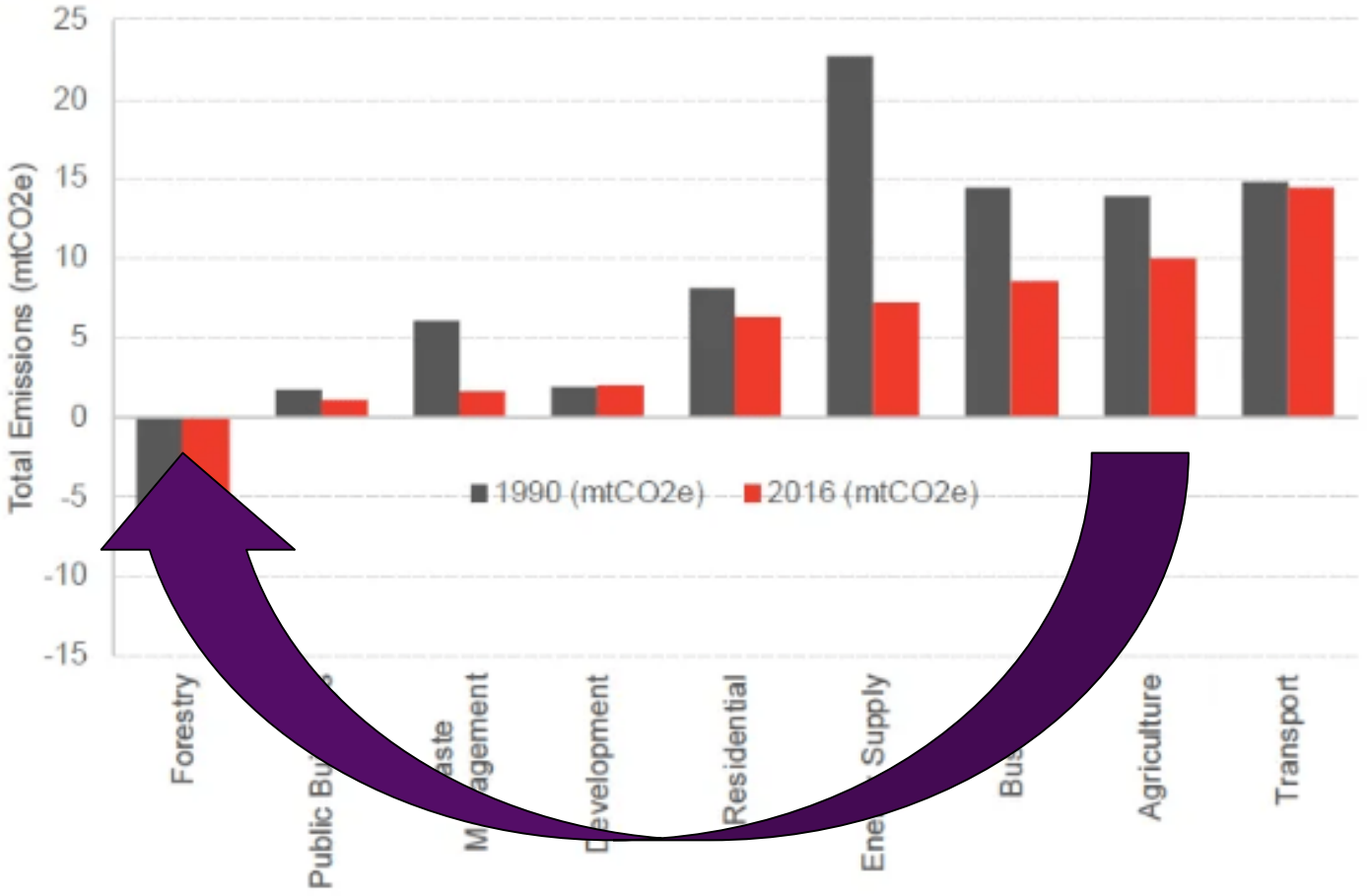
Summary Report
2019 Progress Report to Parliament

Committee on Climate Change
July 2019

	Agriculture & Land use	• Firm policies to reduce GHG emissions • Development of an effective post-CAP framework • Strategies across UK for 30,000+ hectares/year afforestation • Publication of England's Peatland Strategy

Key Government policies

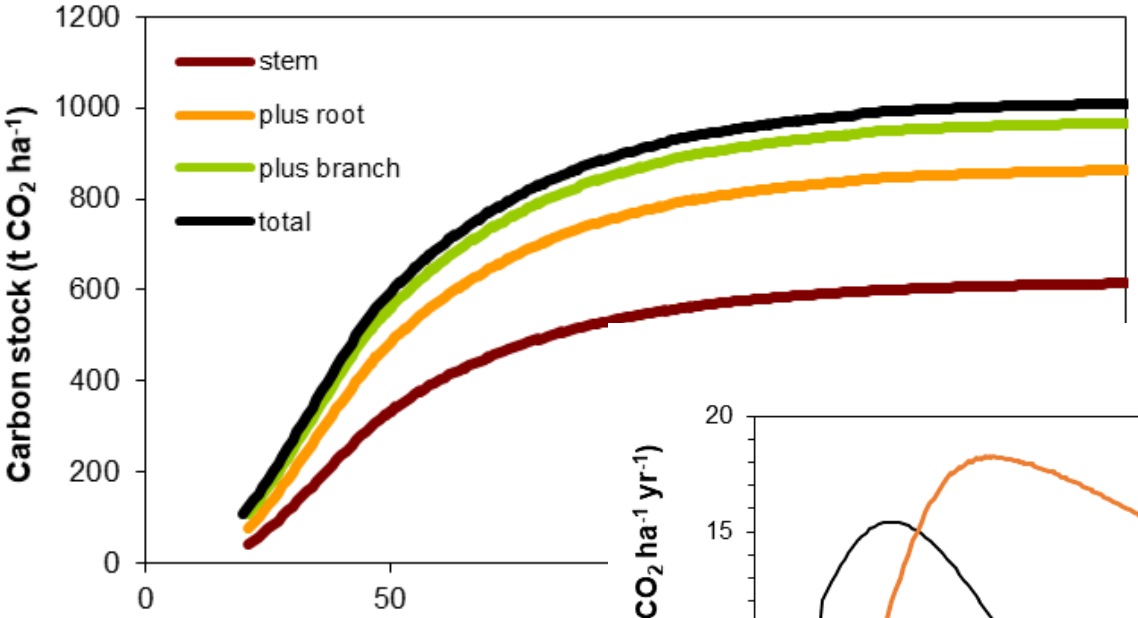
Chart 64: Scottish emissions by sector, 1990 & 2016

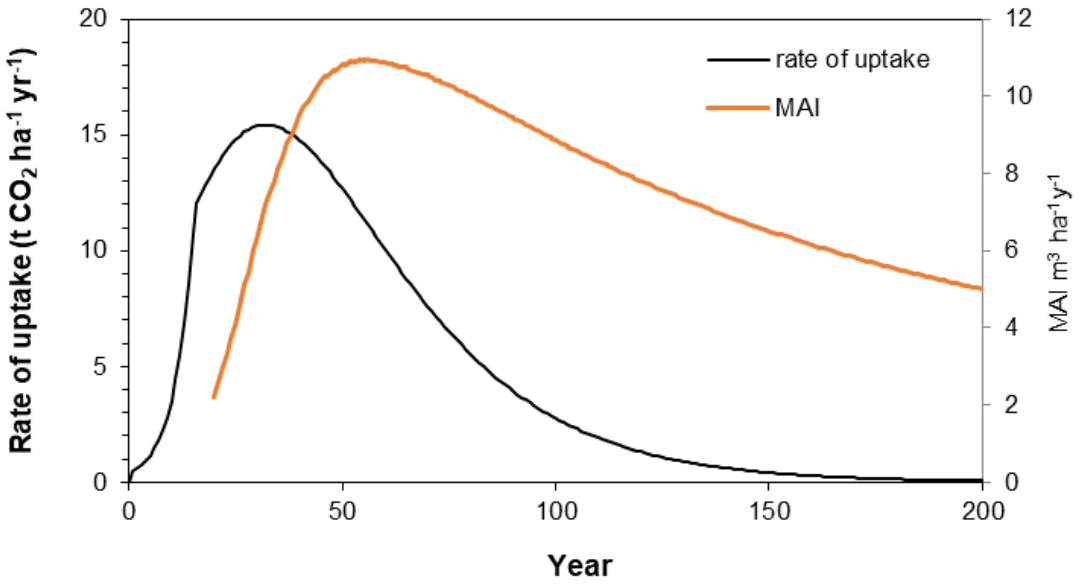


Source: *Scottish Government*

Tree growth and C uptake

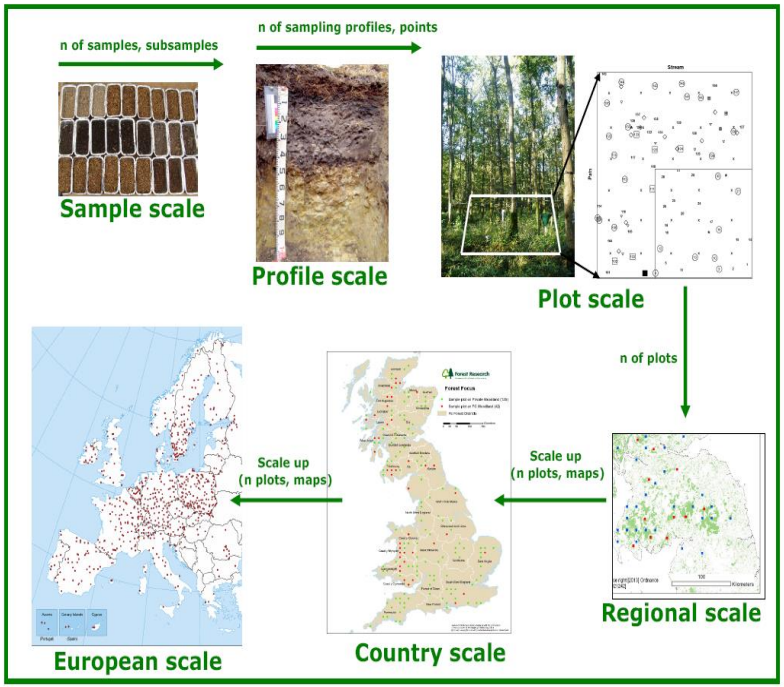
BSORT model predictions: SS, YC 12, no-thin, 2m

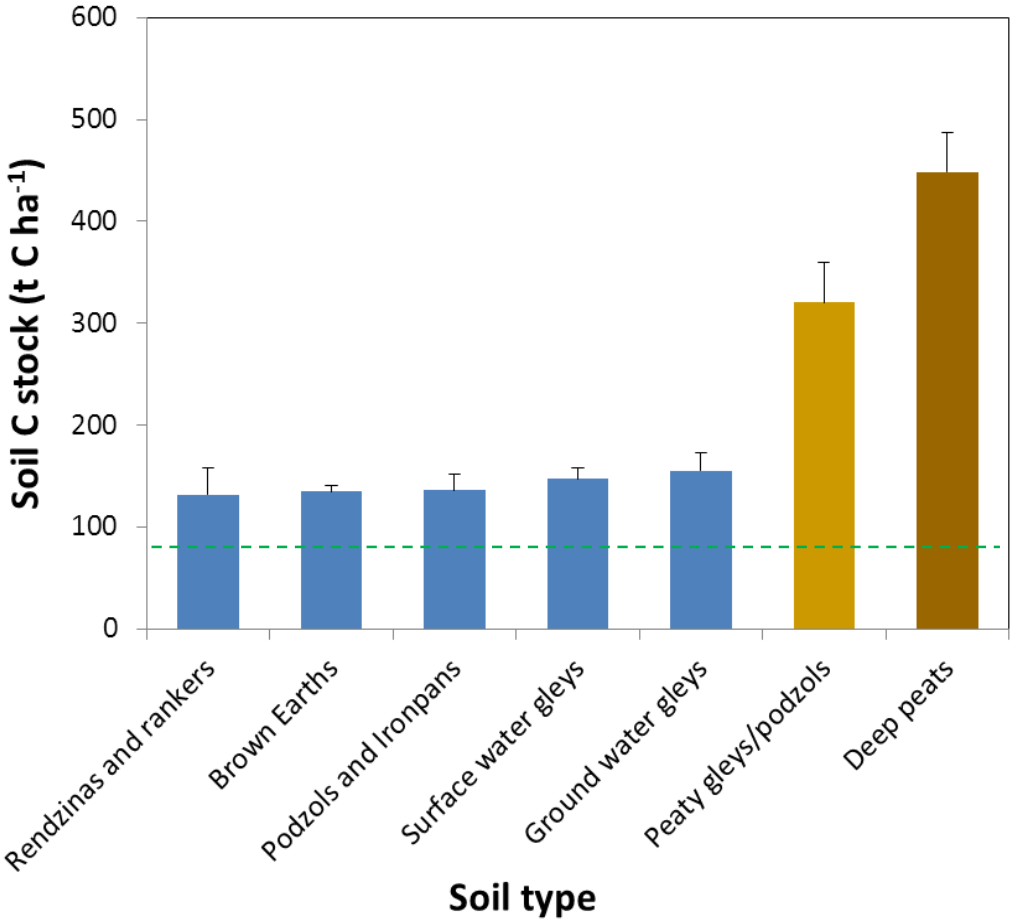




Woodland C stocks - national

BioSoil survey (2005-2010)





(Vanguelova et al., Soil Use & Management, 2013)

Forestry & bioenergy

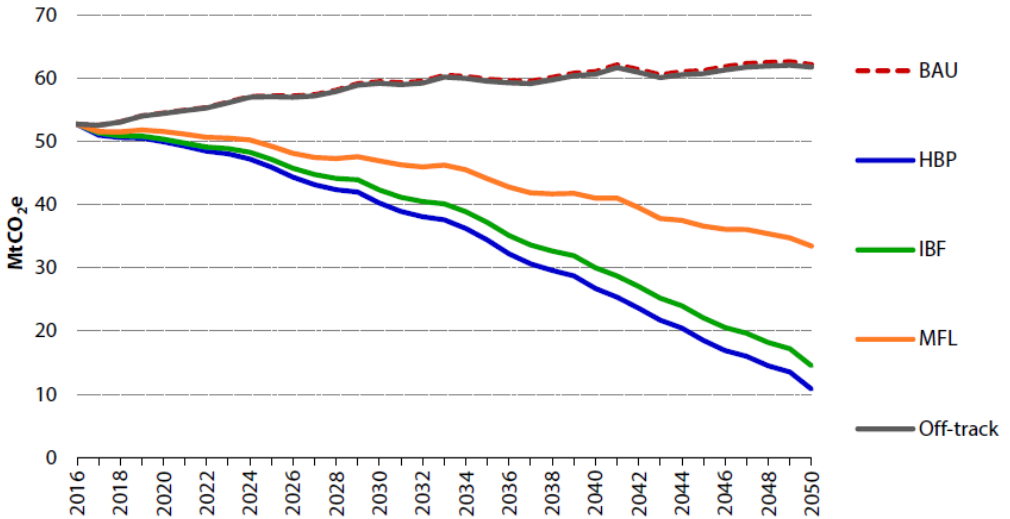
'Forestry' is the only C sink

CCC Report: *Reducing emissions & preparing for climate change* 2018

https://www.theccc.org.uk/publication/land-use-reducing-emissions-and-preparing-for-climate-change/

HBP – high biomass & natural peatland scenario
MFL – multifunctional
IBF – innov & behave focus

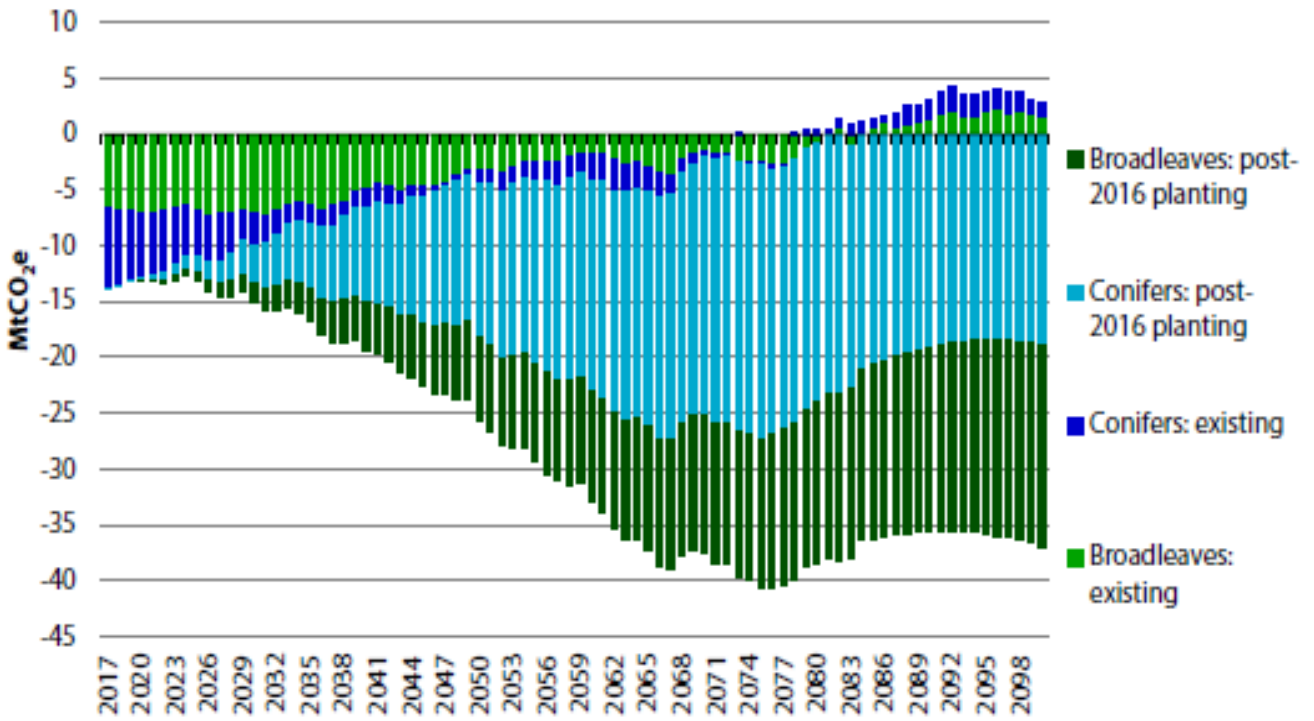
Figure 2.5. GHG emissions for different land use scenarios, 2016-2050



Source: CEH and Rothamsted Research (2018) and CCC analysis
Notes: Includes emissions from land-use change for settlement and urban expansion. A 2016 start date is illustrative only. In practice, pathways would start to diverge from BAU from the point at which land use drivers change

CCC Land use report

Figure 2.9. Net carbon sequestration of high ambition of tree planting by type of forest, 2017-2100



Source: CEH and Rothamsted Research (2018), CCC analysis

Notes: This is based on the high level of ambition for tree planting, forestry yield improvements and forestry management. 'Existing' refer to trees planted before 2017. Forestry net carbon sink is estimated using the C-Flow model

CCC – Net zero report quotes

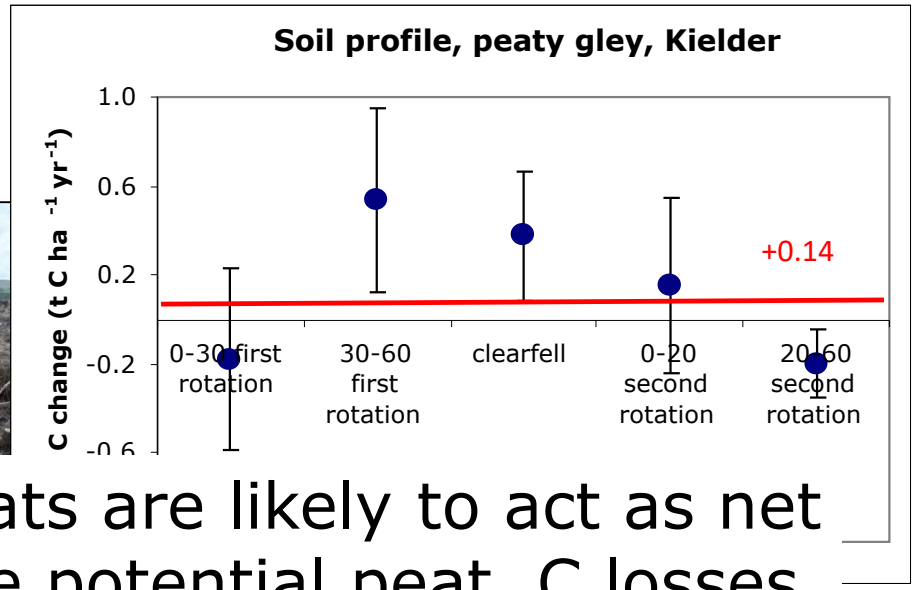
- "A net-zero target requires deep reductions in emissions, with any remaining sources offset by removals of CO_2 from the atmosphere (e.g. by afforestation)."
- "Afforestation targets not being delivered. The voluntary approach that has been pursued so far for agriculture is not delivering reductions in emissions."
- "there are excellent opportunities to remove CO_2 from the atmosphere through afforestation and carbon capture and storage in Scotland"

Forestry & bioenergy

- Currently only *produce* 0.3 Mt wood pellets,
- Presently *importing* 6.9 Mt wood pellets
- Potential to increase bioenergy from *existing* and from *new* woodland
  - UK annual forest increment ~ 20 Mt, so 'stock' is increasing
  - new short-term sources – e.g. ash die-back
  - new woodland creation – all 4 UK countries have expansion targets
  - essential to meet decarbonisation targets
- Forest fibre will be in demand for:
  - Heating – local plants, domestic
  - BECCS (bioenergy with C capture & storage)
  - Hydrogen economy feedstock
  - 'Bioeconomy' source materials

Forestry & peat question

- Much of UK forestry expansion has been on upland peat-containing soils (peaty-gleys & deep peats)
- Wet peaty soil – anaerobic, low CO_2 emissions, but some methane (more potent GHG)
- Drainage increases SOC oxidation releasing CO_2



afforested drained peats are likely to act as net C sinks <u>overall</u> despite potential peat C losses, dependent on the forest growth and yield class.

(E. Vanguelova et al. FR, paper in press)

Woodland creation targets

All countries have woodland creation targets

Should targets be:

- tree numbers?
- woodland areas?
- locations, habitats, or functions?
- tCO2 or broader ES?

- We need methods to assess future woodland purpose, function & ecosystem service provision under different scenarios

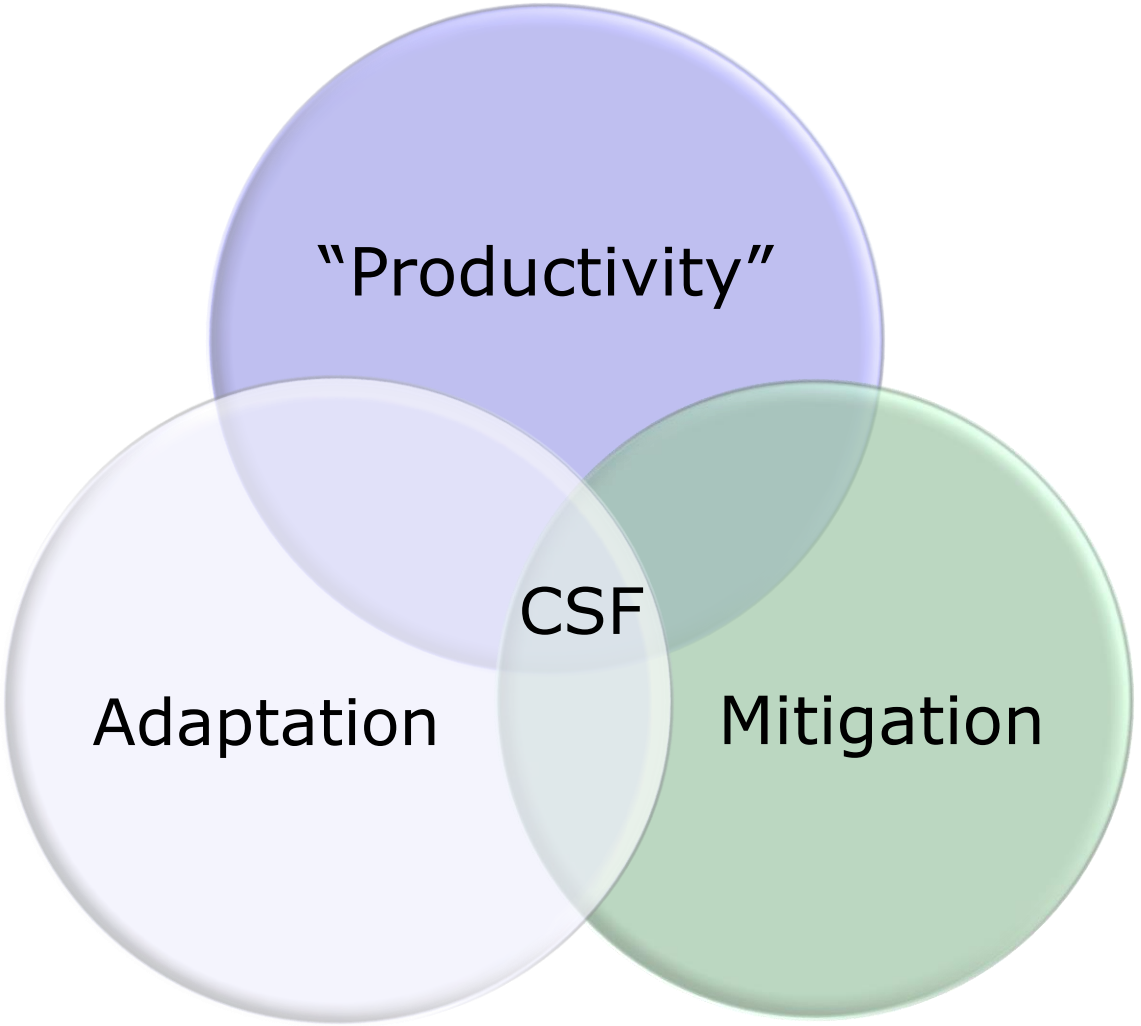
Final point

- UK forests and woodlands are part of *mitigating* climate change:
  - Carbon sequestration
  - Fossil fuel substitution – bioenergy & materials
- BUT they will be affected by climate change so we need to be adapting management
  - Aware of risks of wind, fire, flood, pests and pathogens
- AND they are a key help for society to adapt
  - Natural Flood Management (NFM)
  - Slope stability
  - Shade & shelter (for buildings, people, livestock, streams)
  - Landscape connectivity to reduce biodiversity crisis

No adaptation – no future mitigation !

"Climate Smart Forestry"

- Increase climate benefits from forests and forestry sector and create synergies with other needs for resilience and sustainability
- 'optimise' desired outcome for the forest against adaptation and mitigation objectives



Key messages

- *Reiterate important role – and 'interest'*
  Urgency: ?
- *Research requirements:*
  - C balance management evidence, soils,
  - What species, genotypes, silviculture – optimality ?
  - (establishment) and growth in changing climate
  - Is old C different from 'new' C ? - C stability ?
  - Data from the industry can help – spatial variation across Britain is key, and expts can only usually do a minimum of sites (harvest & survey data)
  - More data for LCA ?
  - More evidence to support 'best practice' and appropriate policy goals?

Thank you for listening!

What species & management regimes do we choose for the future?

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