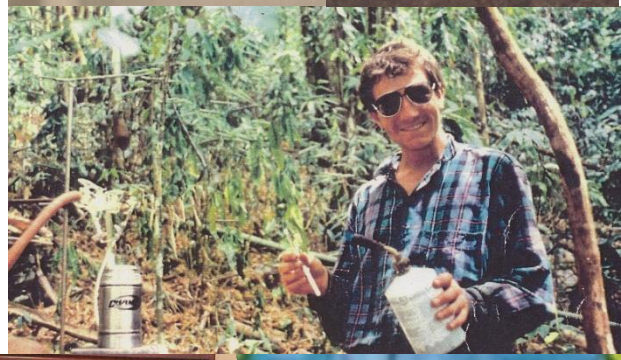
Forestry Commission

Forestry, climate change, net-zero and the climate emergency

Climate change: a personal perspective

- 1966 – an auspicious year! – 321 ppm
- 1987 – started my PhD – 350 ppm
- 1993 – started with FR – 359 ppm
- 2006 – moved to FC – 385 ppm
- 2020 – now – 415 ppm
- 2033 – receive State Pension – 441 ppm



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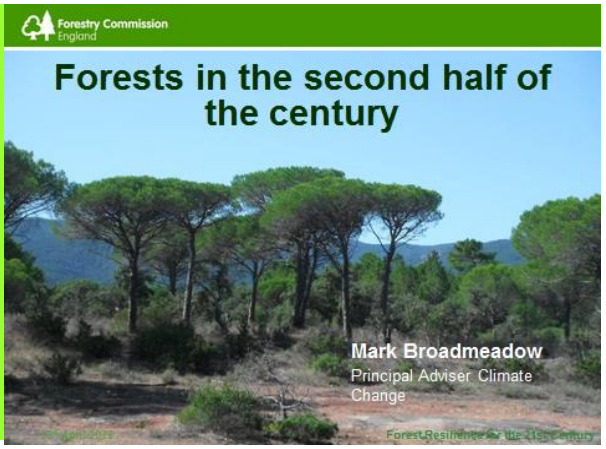
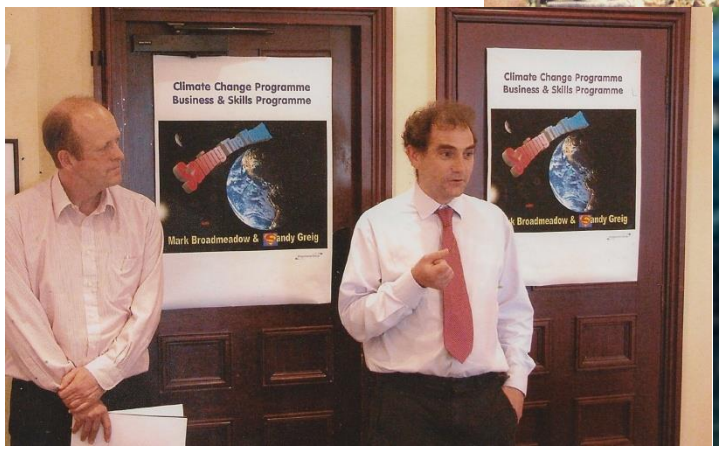


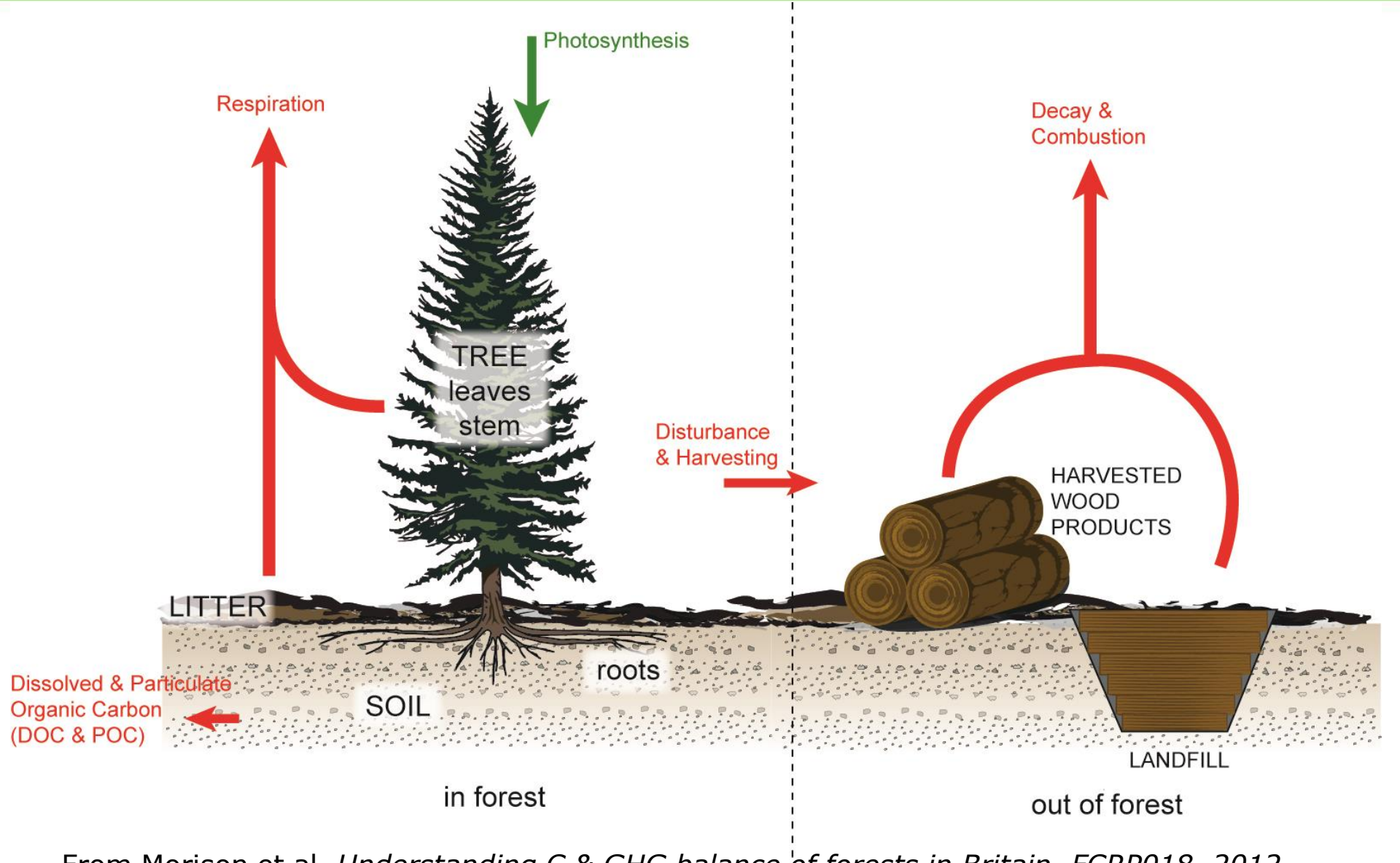


The greenhouse effect – a personal experience

Policy overview: a reminder of 'targets'

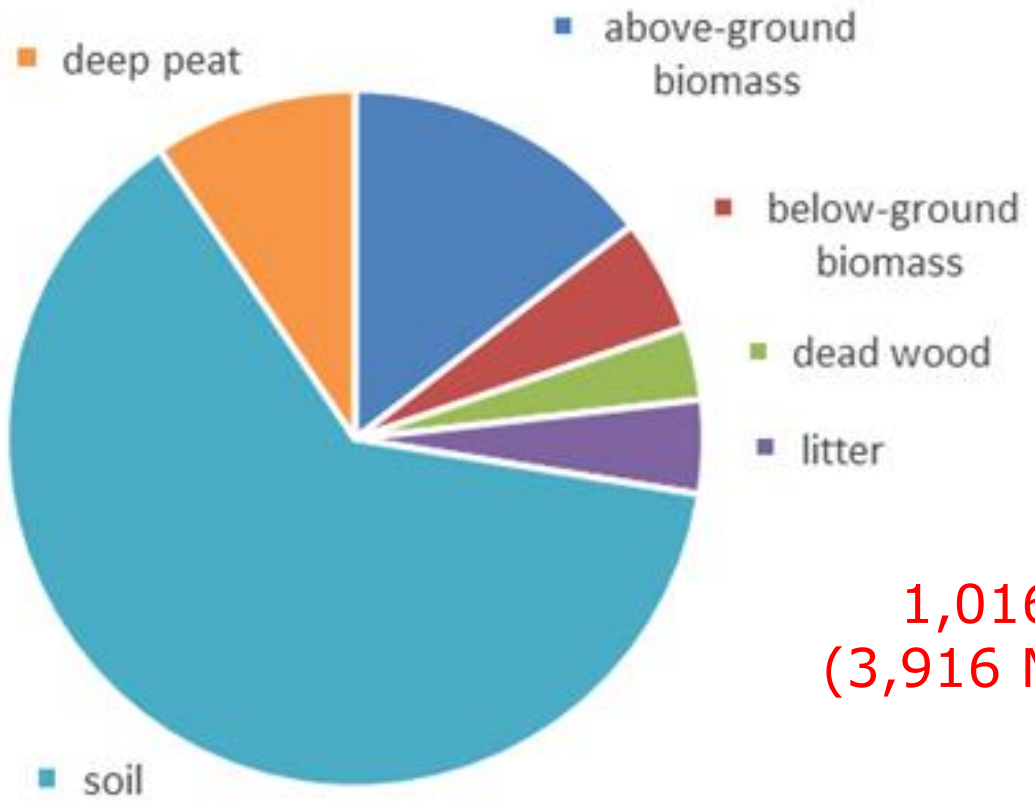
- Clean Growth Strategy
  - 130,000 ha by 2032 (~10,000 ha/yr), plus
  - 50,000 ha 'energy forestry' by 2032 (~3,800 ha/yr)
- 25-year Environment Plan
  - 180,000 ha by 2042 (7,500 ha/yr)
  - 12% woodland cover by 2060
- CCC net-zero
  - 30,000 ha/yr (~10,000 ha/yr in England)
  - plus domestic biomass
- Declaration of 'climate emergency'
  - 2019
- Consultation on English Tree Strategy
  - Spring 2020

Forest carbon balance



From Morison et al. *Understanding C & GHG balance of forests in Britain, FCRP018, 2012*

UK forest carbon stocks



1,016 MtC
(3,916 MtCO2e)

From Forestry Statistics (from NFI & BioSoil information)

Soil C emissions & Ground Prep

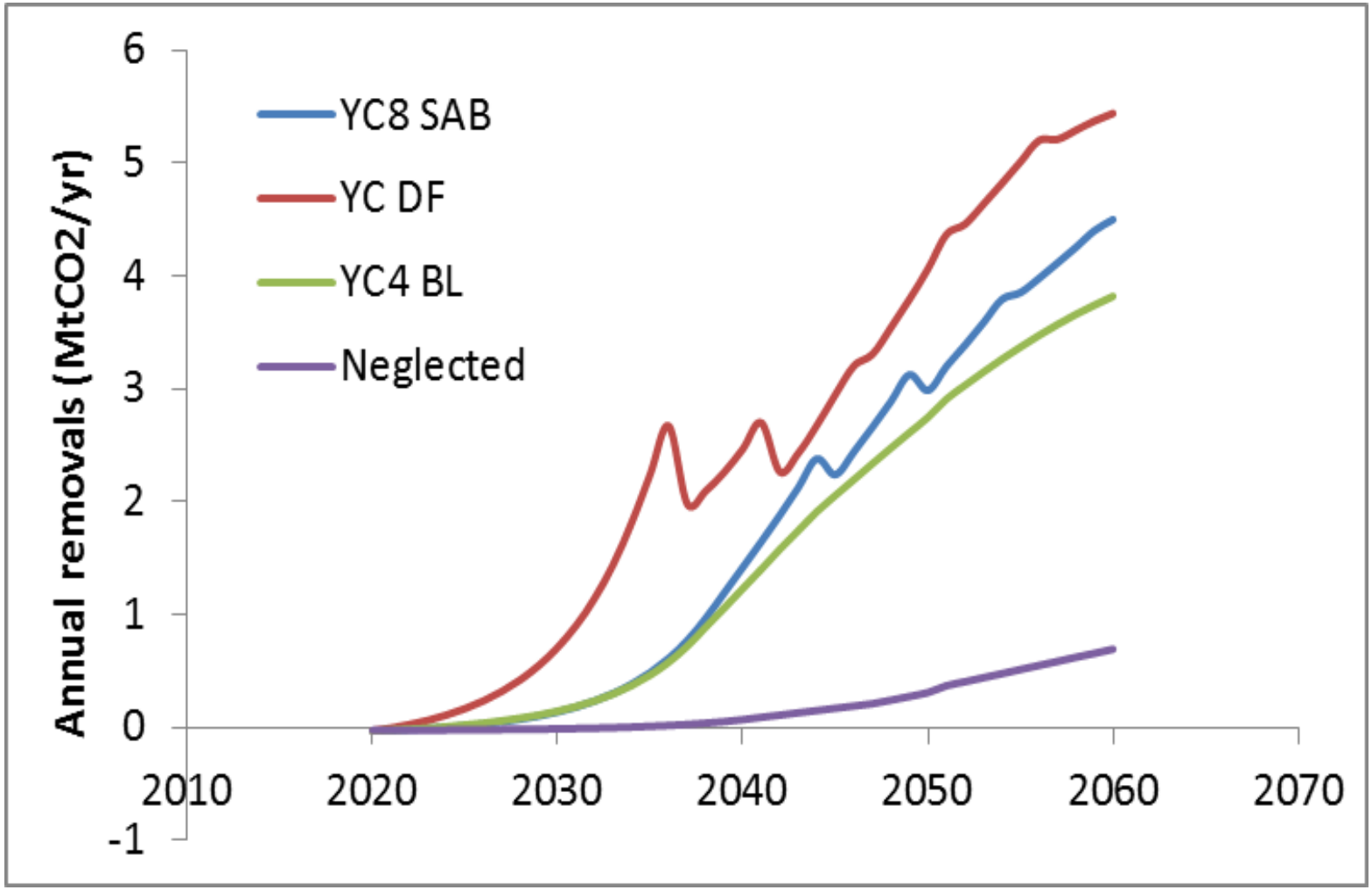
- **Mixed Native Woodland, YC6, Min Intervention**
- Organo-mineral soil, previously pasture

Ground Prep Technique	% topsoil (30cm) disturbed	% topsoil Carbon lost	Estimated soil C emissions (tCO_2/ha)	'Carbon Payback' time (years)
Screef	Negligible	0%	0	0
Mounding techniques	4%-12%	5%	22	12
Shallow plough (<30cm)	20%-30%	10%	44	15
Deep plough (>30cm)	35%-50%	20%	88	17

Afforestation Programme: 10,000 ha/yr from 2020

CB9: 2048-2052 YC8 SAB:15.6 MtCO2e YC4 BL: 13.8 MtCO2e

YC16 DF: 20.2 MtCO2e Neglected: 1.6 MtCO2e



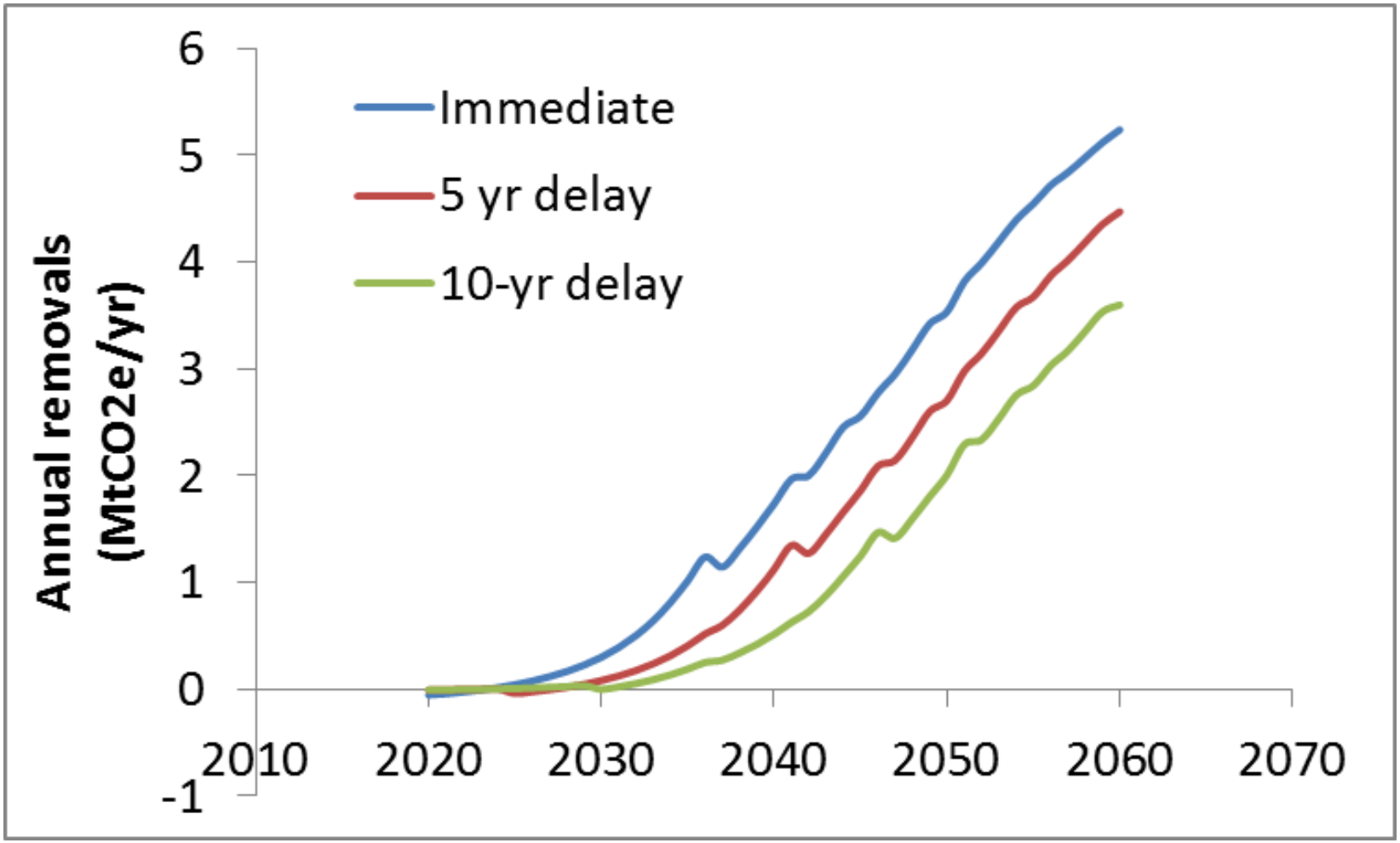
Impact of delaying planting

CB9: 2048-2052

Immediate: 17.9 MtCO2e

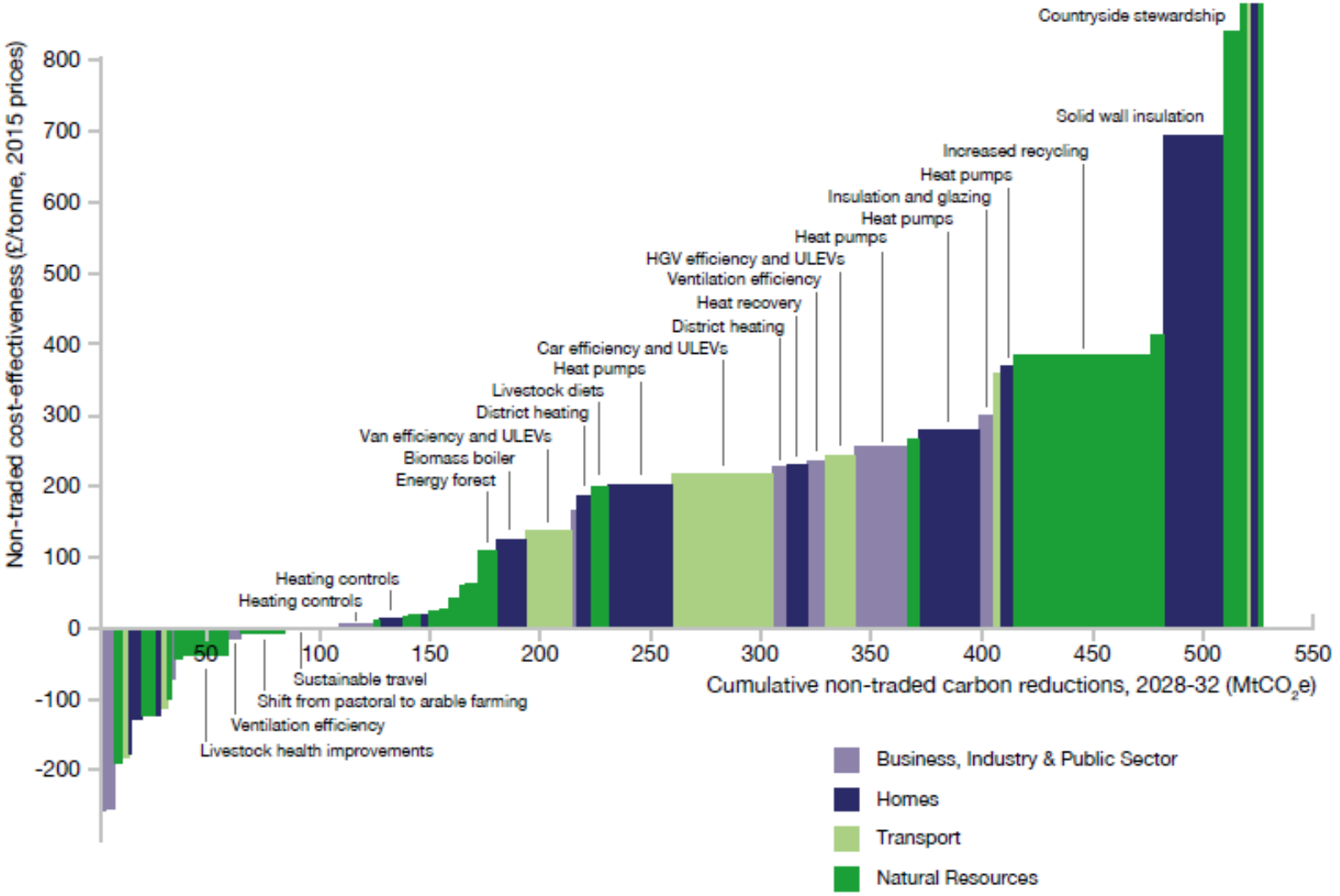
5-yr delay: 13.8 MtCO2e

10-yr delay: 10.0 MtCO2e



Cost-effectiveness of carbon reduction measures

Figure 33: Non-traded sector MACC showing maximum theoretical potential (central case, 2028-2032)



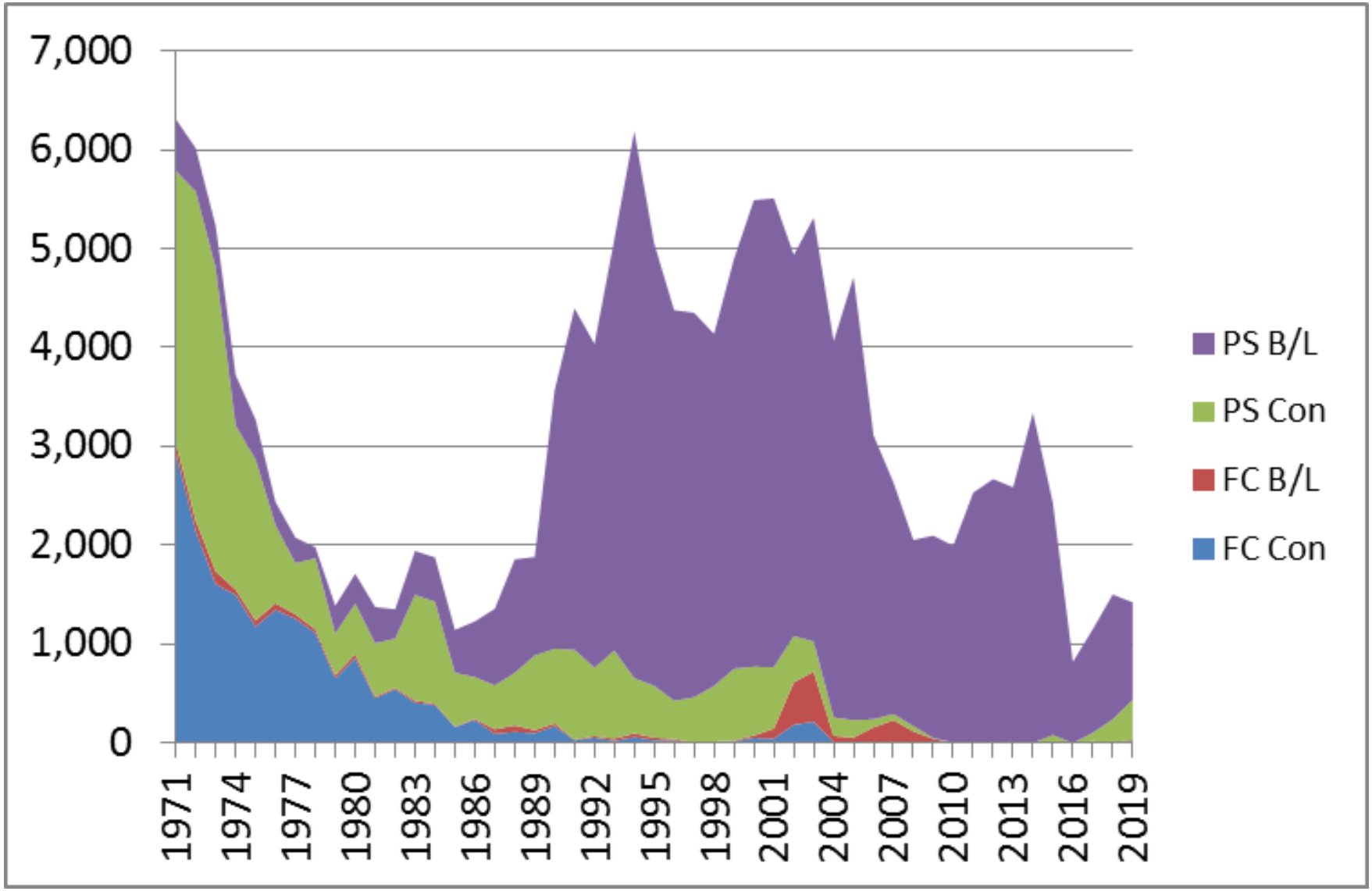
Forestry's potential contribution

Reality check

- 'Core scenario': 17,000 ha/yr
- 'Further ambition': 30,000 ha/yr (UK-wide)
  - 10,000 ha/yr in England from 2025
  - 700,000 ha energy crops
- 'Speculative': 50,000 ha/yr (UK-wide)
  - Additional 11 MtCO2 savings in 2050
  - Unspecified increase in energy crops

	Emissions MtCO2			Hectares required to be planted in 2020		
	2017	2050 core scenario	2050 Further ambition	2017	2050 core scenario	2050 Further ambition
UK	503	193	33-45	30.4 million	11.7 million	2.4 million
UK Agriculture	42	26	15	2.55 million	1.58 million	0.91 million

and……. a long way to 10,000 ha/yr…..



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Where can we put it?

Where to plant: low risk areas for fewer constraints

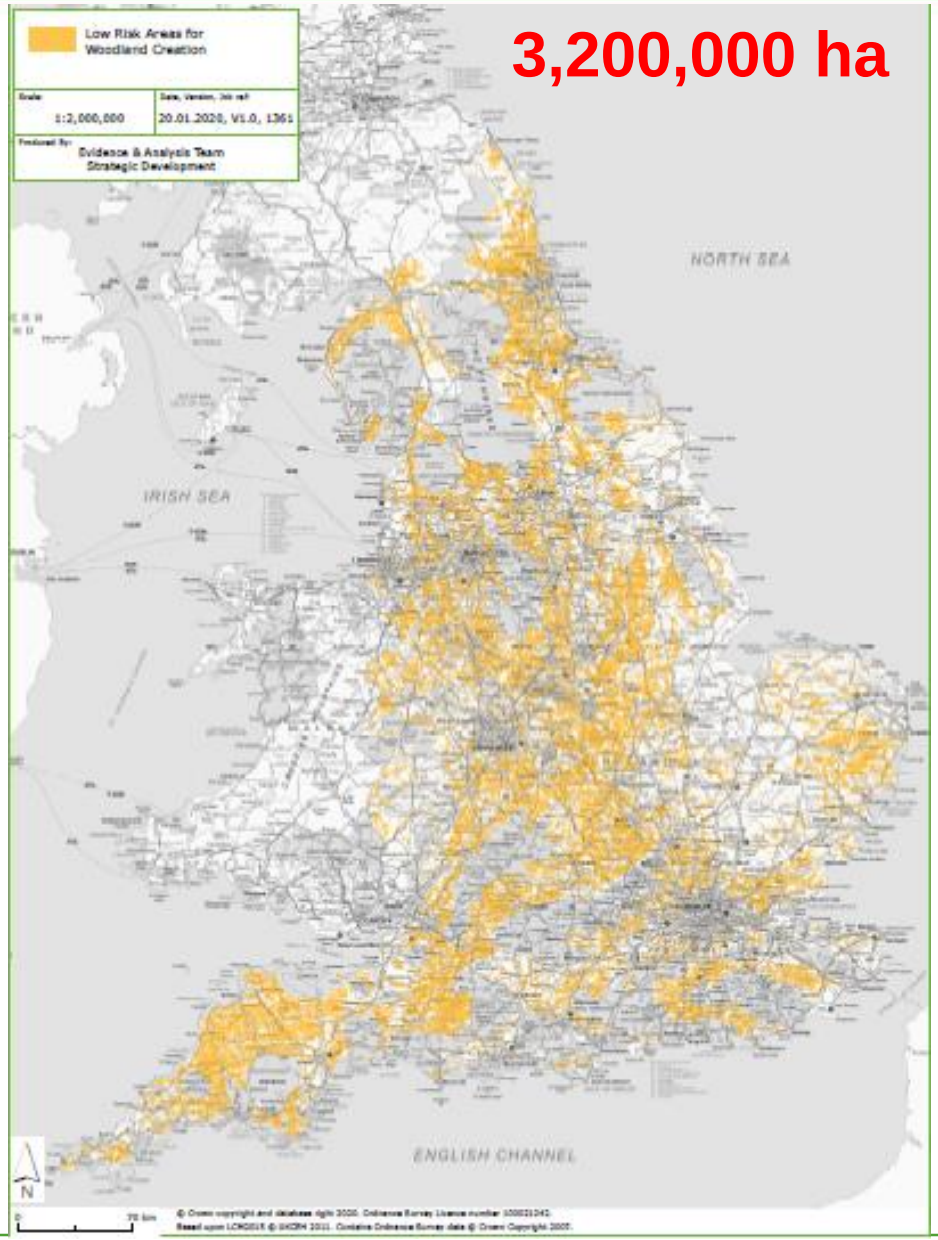
'Low risk areas' exclude:

- All "sensitive areas"

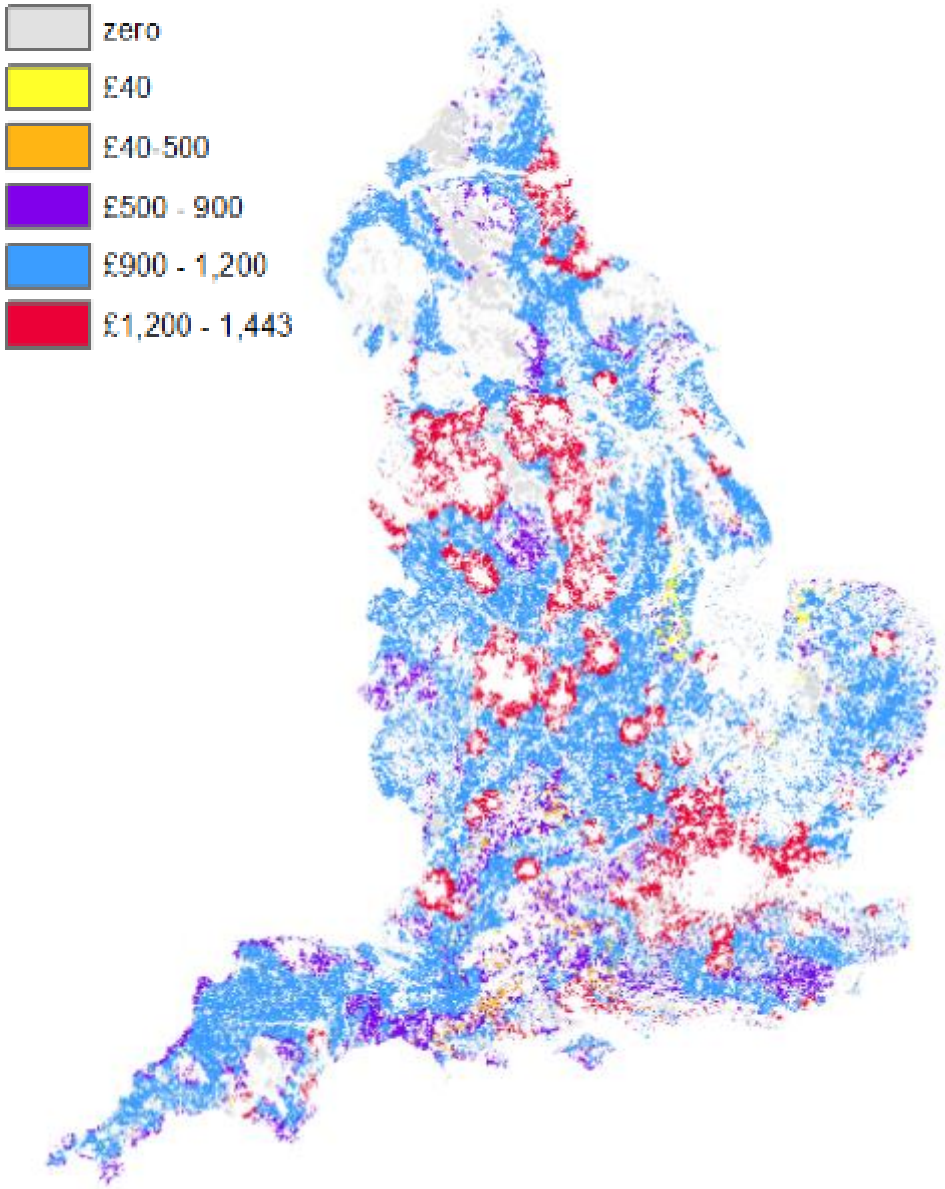
And…

- RSPB Important Bird Areas
- Acid Vulnerable Catchments
- Common Land
- HLS agreements
- Best and Most Versatile Agricultural land (ALC 1-3a)
- Priority habitat
- Registered battlefields
- Registered parks and gardens
- Deep peat

'Low Risk' areas only apply to Afforestation



Deliver public benefit



Social benefit
Biodiversity
Landscape
Flood risk management
Air quality
Recreation
Water quality
Carbon sequestration

The 'mantra'

The right tree

in

The right place

for

The right reason

[with effort put in to protect the new woodland and ensure that it establishes vigorously to perform its intended function(s)]

Businesses, net zero and the Woodland Carbon Code

- Is your business engaging in tree planting for net zero for purely altruistic reasons?
  - If so, great!
- Might you wish to use the carbon your woodland sequesters to 'offset' your business's future carbon footprint (i.e. to move towards net zero).
  - If so, register with the WCC.
- Might you wish to sell the carbon your woodland sequesters to 'offset' another business's future carbon footprint (i.e. to move towards net zero).
  - If so, register with the WCC and consider the Woodland Carbon Guarantee.
- If you don't register with the WCC when you establish a woodland you will not be able to generate WCUs/carbon credits in the future;

- Rule of thumb – a business currently emitting 500 tCO2/yr would need to plant ~35 ha of woodland now to compensate for all its emissions up to 2050, as part of an emissions reduction plan.

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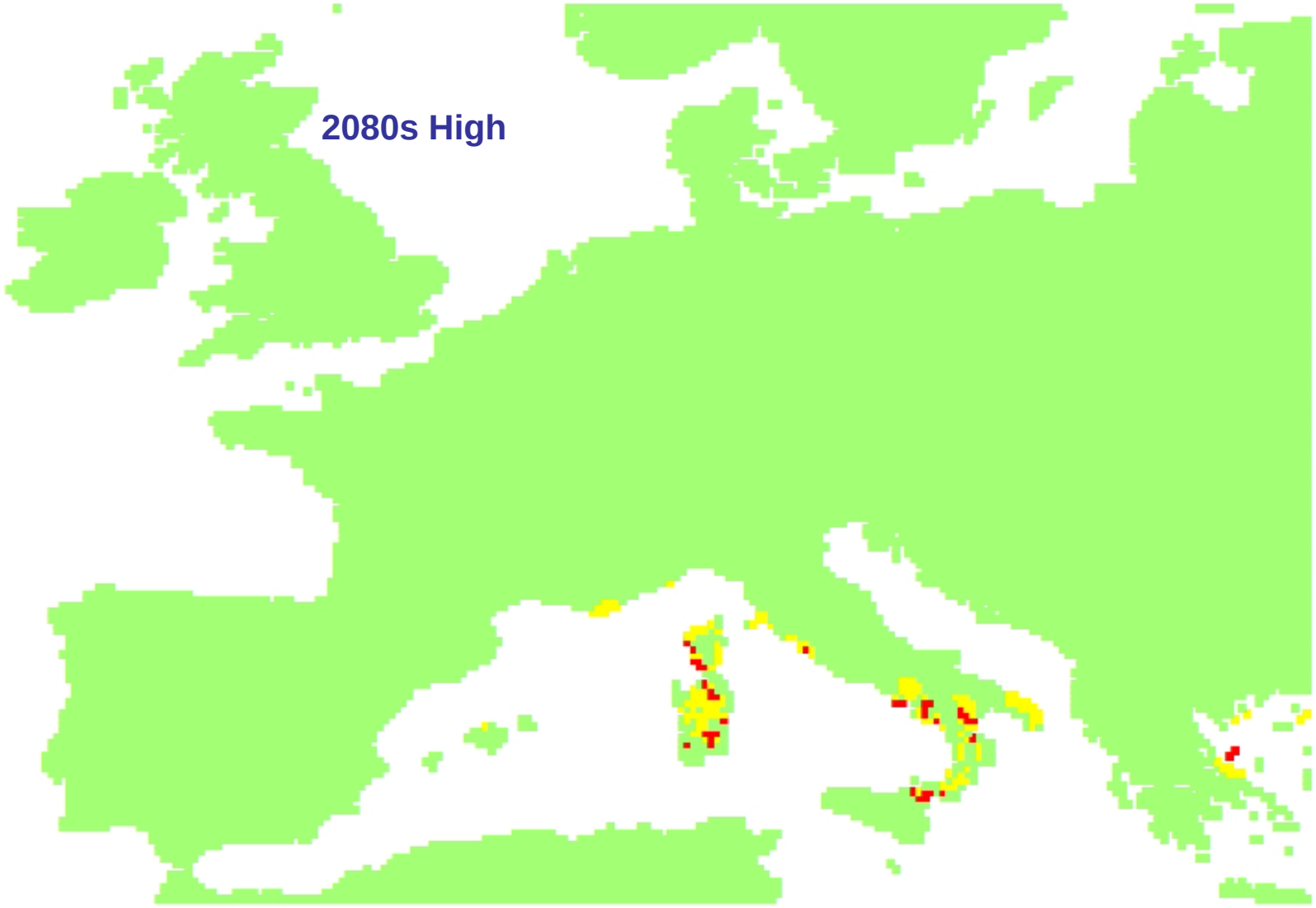
How should we be managing our forests given the impacts of climate change

The future climate of southern England?



What we don't know

- The detail of the climate of the future;
- The nature and impact of extreme ***weather*** events;
- How trees will respond;
- How plants will have adapted
  - Climate change is an experiment
- The pests and diseases our trees will be exposed to;
- Future timber markets;

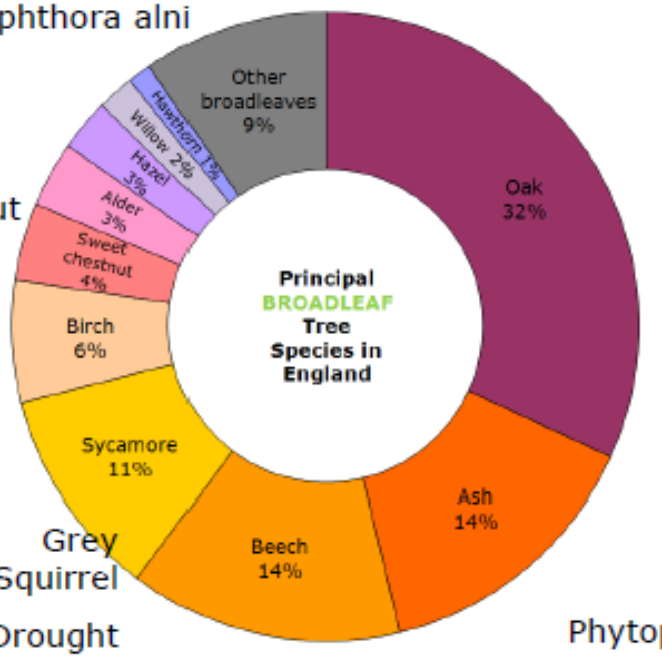
What we do know

- The climate will be different, pretty certainly warmer and probably drier;
- Whatever actions we take must cope with the current climate;
- We're intervening in less than 1% of England's woodland area each year, so:
  - We need appropriate action at scale to enhance resilience;
  - Mistakes (but see later caveats) will have little impact;
- Wood fibre will be needed as a chemical feedstock, as a minimum;
- Carbon will attract a high price – otherwise the planet is in trouble!

Tree non-diversity in England

Phytophthora alni

Chestnut Blight



Grey Squirrel

Drought

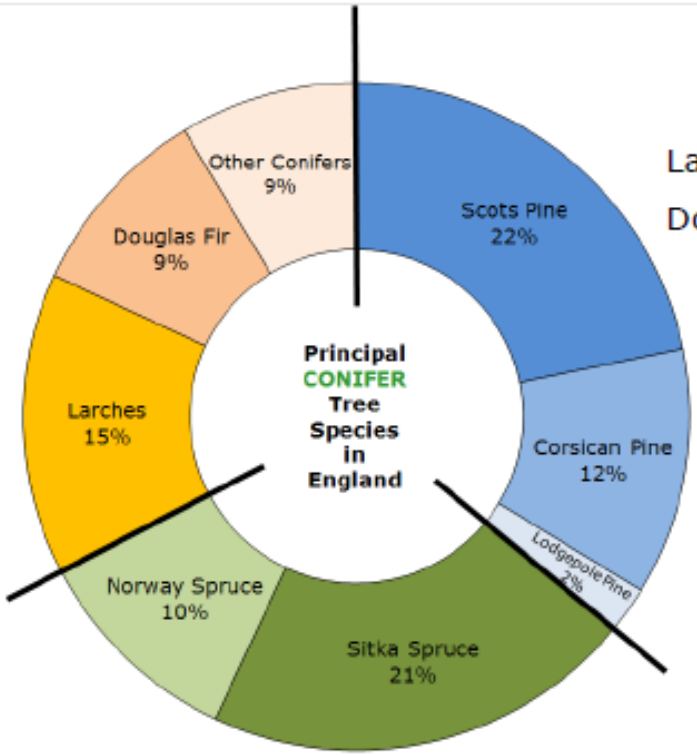
Produced by: Forestry Commission England
Measure: Standing Volume in Millions of Cubic Metres Overbark Standing. Source: Forestry Statistics 2013
Broadleaves: National Forest Inventory: Preliminary estimates of quantities of broadleaved species in British woodlands, with

Broadleaves ... 5 species make up 77% of the total

Acute Oak Decline

Oak Processionary moth

Phytophthora ramorum



Lappet moth

Dothistroma DNB

Spruce aphid

Drought

Conifers...6 species makes up 89% of the total

Produced by: Forestry Commission England
Measure: Standing Volume in Millions of Cubic Metres Overbark Standing. Source: Forestry Statistics 2013
Conifers: National Forest Inventory: Standing timber volume for coniferous trees in Britain (2012)

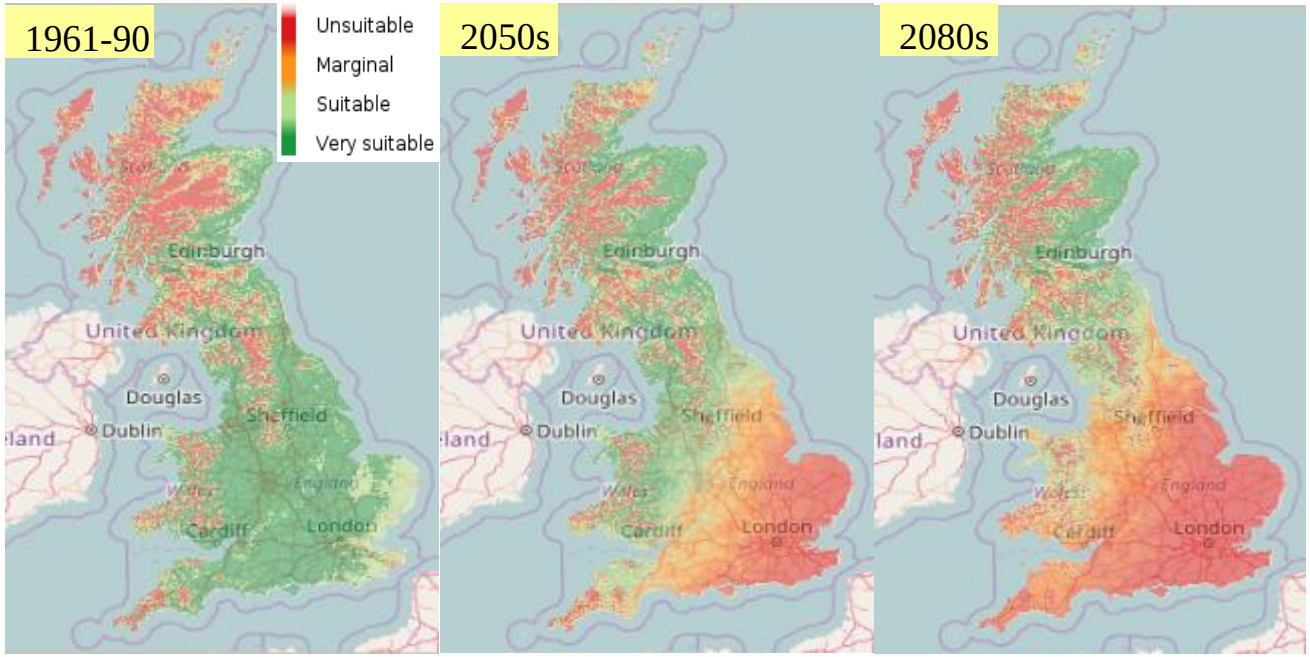
Climate change and plant health

- What does climate change mean for the resilience of our woods to pests and diseases?
  - Existing challenges;
  - Climate stress on woodlands making them vulnerable to pests and diseases;
  - Climate change making the UK climate more amenable to a range of novel pests and diseases;
  - New pathways for introducing P&Ds due to societal response to climate change;
  - **There will be new challenges.**





Projecting future tree 'performance'



Sessile oak

- Suitability for timber production;
- Medium-high climate scenario;
- Low resolution soil maps.

Ecological site classification

- Timber production & ecological suitability
- Knowledge-based system
- Based on climate, soil moisture regime, soil nutrient regime and management prescriptions
- Includes climate projections
- NOT a forecast, as we can't second guess exactly how climate change will unfold
- Put in your grid reference and play
- http://www.forestdss.org.uk/geoforestdss/esc4.jsp

Principles of species diversification

- Consider suitability under current and future projected climate;
- Have a broad genetic base;
- Be based on past performance, pest and disease susceptibility and resilience to weather extremes in the UK;
- Consider the risk of the species becoming invasive and damaging to native biodiversity as the climate changes;
- Consider its timber properties and its future use;
- Follow biosecurity procedures that consider the risk of introduction of novel pests and disease through seed or living plant material;
- Considers its ecological function and appropriate species assemblages.

Greek fir: *Abies cephalonica*

Coast redwood: *Sequoia sempervirens*

We're far from being in the dark: alternative/minor species

Species for which there is existing UK-based knowledge of performance from operational trials/ forest gardens/arboreta	Species for which there is little or no UK trials data but expert knowledge suggests that they merit screening for UK potential
Conifers	
Abies alba	*Abies bornmuelleriana*
Abies amabilis	*Abies cephalonica*
Abies nordmanniana	*Pinus armandii*
Cedrus atlantica	*Pinus ayacahuite*
Cedrus libani	*Pinus brutia*
Cryptomeria japonica	*Pinus elliottii*
Picea omorika	*Pinus koraiensis*
Picea orientalis	*Pinus monticola*
Pinus peuce	*Pinus strobus*
Pinus pinaster	*Pinus taeda*
Sequoia sempervirens	*Pinus wallichiana*
Thuja plicata	*Pinus yunnanensis*

Read report (2009). Combating Climate Change – a Role for UK Forests

Species' characteristics that confer resilience

- Ready regeneration…
  - Douglas fir, hemlocks, pines
  - Ash, sycamores, birches
- Suckering and sprouting…
  - Sequoias
  - Limes, aspens, cherries, elms
- Shade tolerance within established stands..
  - Hemlocks, silver fir
  - Beech, lime, hornbeam, Norway maple
- Coppicing species…
  - Sequoia,
  - Lime, maples, hazels, ash, alders

Use the Genetic variability inherent in tree species

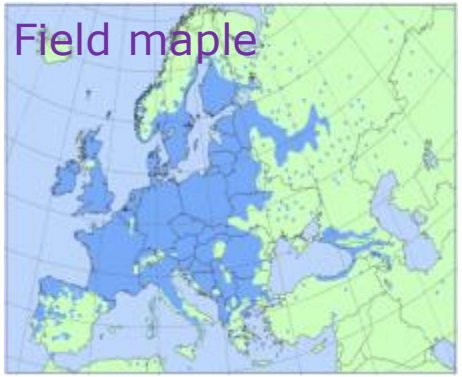
Range of ash

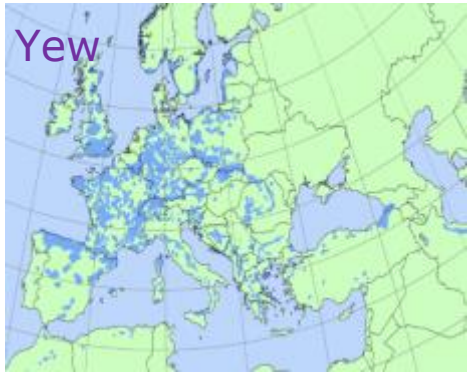
Dunnottar - Scotland

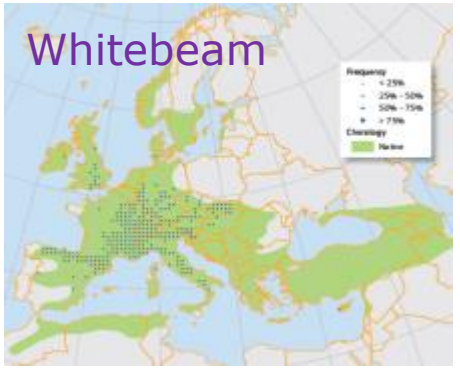
Grimsthorpe - England

Slovenia

European distribution of a selection of native species







…..and monitor

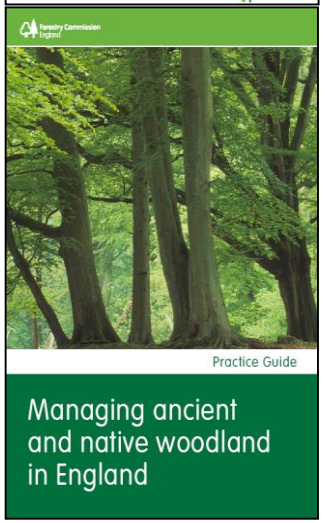
- At some point the rate and magnitude of climate change may well mean that woodlands start to decline – climate change is an experiment;
- We need to know when that point is so that appropriate intervention can proceed.

What it means in practice

- Woodland design and contingency planning
  - understand climate change projections
  - create fire, windstorm and flood contingency plans
  - monitor and review
- Bring existing woodlands into management
  - manage deer, squirrels and invasive species
  - thin to encourage regeneration
  - enrichment planting to diversify species
- Adapt choice of planting material
  - understand the site and soils
  - diversity of species – including ‘minor species’
  - genetic diversity and more southerly origins
  - species capable of withstanding hotter, drier climate
- Transform to ‘continuous cover forestry’
- Landscape approaches
  - link woodlands in the landscape
  - enlarge existing woodlands

Horses for courses: different approaches in different woodland types

- Existing semi-natural woodland
  - work with nature, reducing other pressures (deer, squirrels)
  - manage to encourage natural regeneration
  - use landscape approaches to expand habitat and reduce fragmentation
- New native woodland
  - native species, but include more southerly provenances
  - mainly native species, but consider including near natives
  - a small proportion of exotics may be appropriate
- ‘Amenity woodland’
  - similar to new native woodland, but more scope for exotics
  - fast growing species may create a ‘mature feel’
- Commercial plantations
  - Diverse range of species (landscape or intimate)
  - Consider future wood products alongside species
  - Much scope for using provenance to increase resilience



Practical 'dynamic' guidance: 2019

Forestry Commission

Managing England's woodlands in a climate emergency

A guide to help foresters and agents implement adaptation actions

Climate change and woodland: key points

England's woodlands and forests have **developed in a stable and predictable climate.**

For the past 8,500 years, the **English Channel** has acted as a **natural barrier** to species migration.

Winters are predicted to become **wetter, and summers drier,** with more **frequent and severe** periods of summer drought and intense rainfall events.

These changes are predicted to be **more severe** in the east and south.

With the current projections[4], global warming is projected to **increase by a further degree** within the next two decades. However, global temperatures could **rise to 4°C** above pre-industrial levels by the end of the century, and summer maximum temperatures could **rise by up to 10°C** in parts of England.

Because the earth's climate system responds slowly to past emissions, **we are locked into a level of climate change** over the coming decades, regardless of future emissions.

Global emissions are currently tracking close to **some of the more extreme projections** that have been published.

It is probable that the rate of change is **greater than what our woodlands can adapt to** without human action.

4 www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-fact-sheet-derived-projections.pdf. To see future climate meshing: http://193.185.149.20/v4l/cmc

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? QUESTIONS ?

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