



Climate change and woodlands in East England

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Climate change predictions for Santon Downham: 2080s High scenario

- Temperature: 3.2°C/5.0°C higher (winter/summer)
- Rainfall in winter: 24% higher
- Rainfall in summer: 46% lower
- Snowfall: 95% less
- Mean windspeed in winter: 7% higher
- Soil moisture in summer: 47% lower
- Humidity in summer: 11% lower
- Cloud cover in summer: 13% lower
- Sunshine hours in summer: 38% higher
- Growing season: 90 days longer



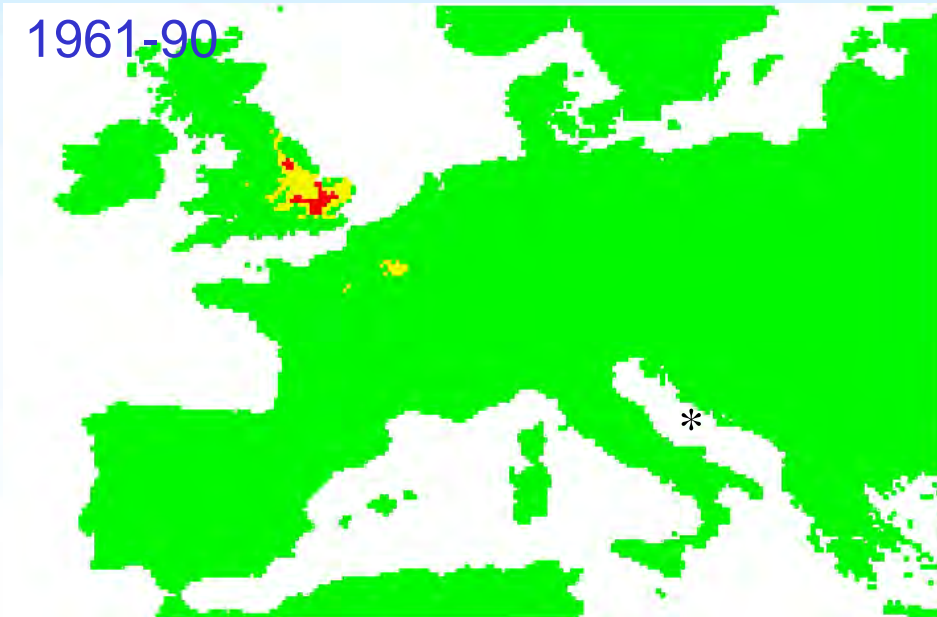
Summary of climate change predictions for Santon Downham

Season	Winter				Summer			
	2050s		2080s		2050s		2080s	
Timeslice	Low	High	Low	High	Low	High	Low	High
Emissions scenario								
Tmean (°C)	+1.2	+1.2	+1.8	+3.2	+1.7	+2.9	+2.6	+5.0
Precipitation	+8.6	+14	+12	+24	+17	-27	-24	-46
Snowfall	-40	-63	-56	-100				
Wind speed	+2.4	+3.8	+3.4	+6.5	-0.3	-0.5	-0.5	-0.9
Soil moisture	-2	-3	-3	-5	-17	-27	-24	-47
Relative humidity	-1	-1.5	-1.4	-2.6	-4.2	-6.6	-5.9	-11.4
Cloud cover	-0.5	-0.8	-0.7	-1.3	-4.7	-7.4	-6.7	-13.0*

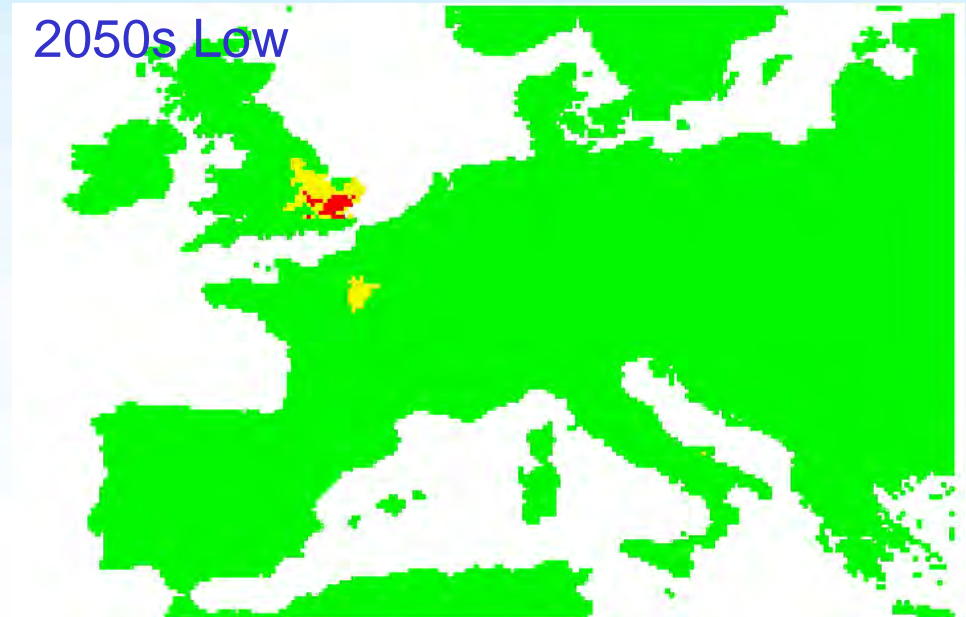
*13% reduction in cloud cover equivalent to 38% increase in 'sunshine'

Climate matching - Thetford

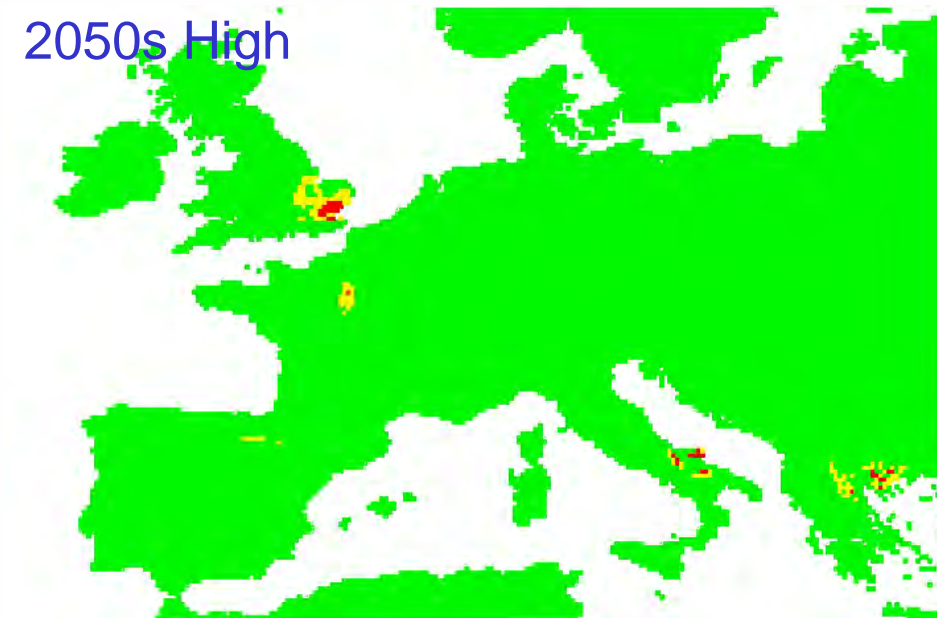
1961-90



2050s Low



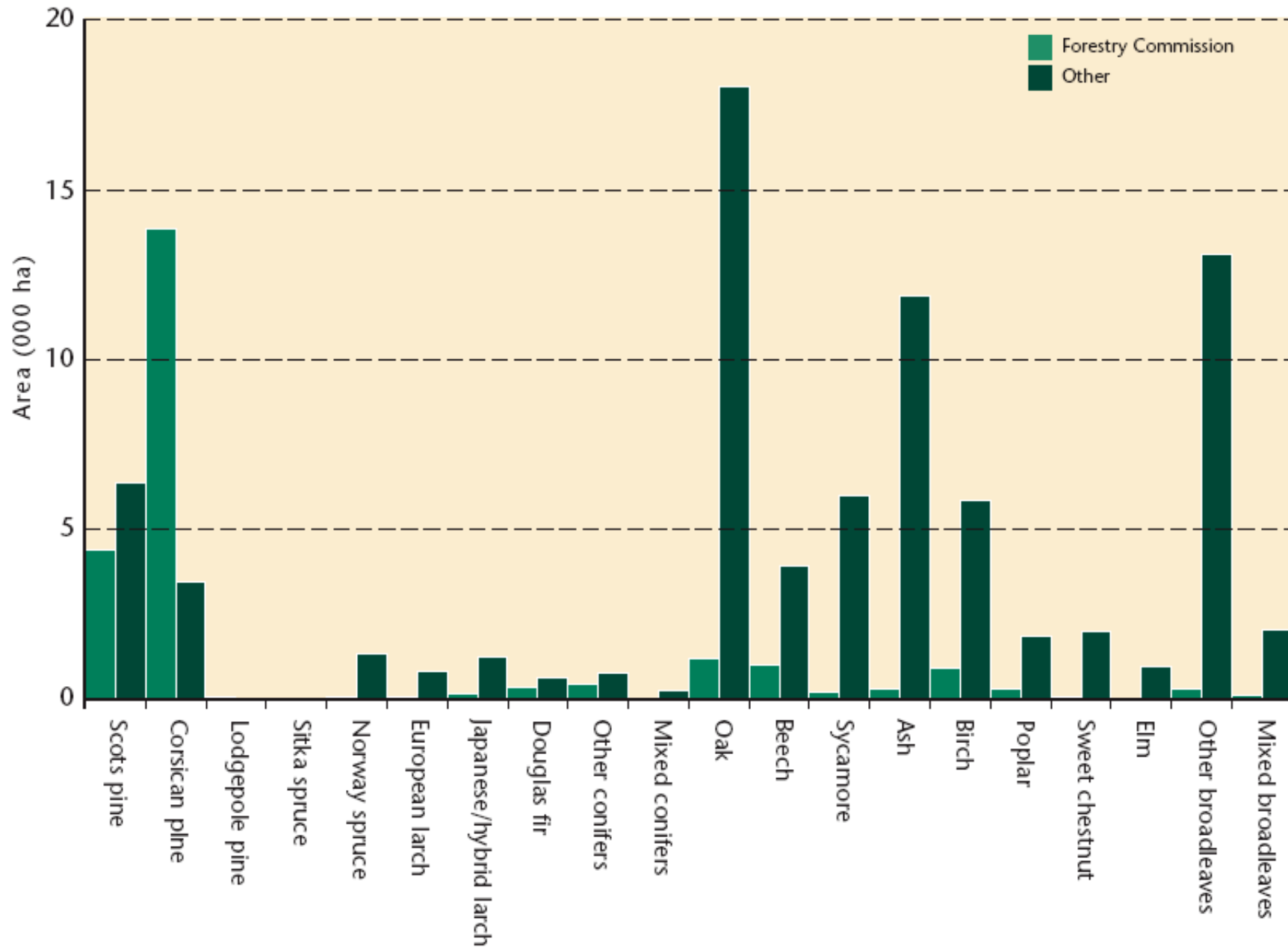
2050s High



2080s High

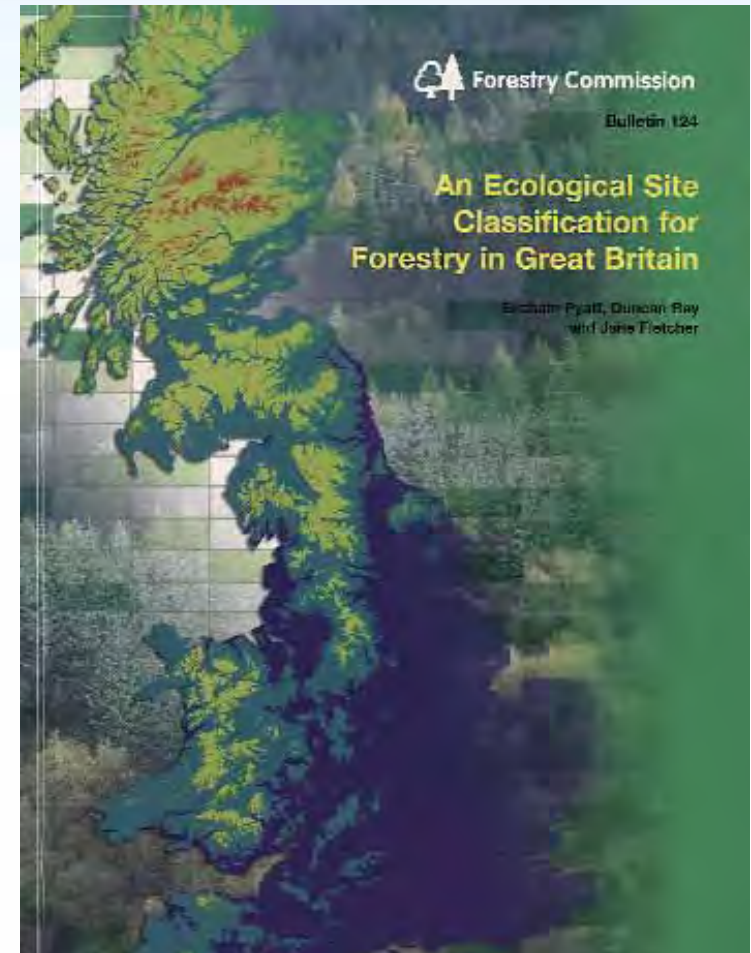


The woodlands of East England



Predicting future species suitability - Ecological Site Classification (ESC)

- ESC is a knowledge-based model; productivity distribution data are used to inform decisions;
- ESC was developed to support the UK forestry industry in commercial species selection;
- there are limitations to the analysis:
 - rising atmospheric CO₂ levels are not accounted for;
 - climate predictions beyond the 2050s are limited and not robust;
 - changing incidence of pests and diseases not accounted for;
 - maps do not show spatial variation at less than 5 km.



Interpretation of ESC output

- 1) The predictions are indicative and should not be applied to individual sites. They are intended to provide an indication of relative change for individual species to be used as background to more detailed site based discussions of potential adaptation options. Adaptation should look to diversification to reflect the high level of uncertainty in the climate and weather of the future and not to restrict options for evolution and adaptation.
- 2) Predictions of changes to future NVC woodland suitability are presented solely to illustrate that there are likely to be changes in community structure - existing definitions of species assemblages are unlikely to hold in the future; less prescriptive management may therefore be an appropriate response. It is important to note that the changes illustrated largely reflect changes to the ground flora rather than tree species.
- 3) These predictions of future suitability apply to one model only and present the 'UKCIP02/HADCM3 view of the future'.
- 4) Particularly for the more extreme scenarios (both time and GHG emissions levels), the ESC models are operating well outside their 'knowledge-base', and can be no more than preliminary; in some cases, the models need extending to account properly for the climate of the future.
- 5) The beneficial effects of rising atmospheric CO₂ levels are not accounted for.
- 6) A changing incidence of pest or disease outbreaks are not accounted for.
- 7) The predictions are for 'mean climate' with an implicit assumption of the current frequency of extreme events. If extreme climatic events do become more frequent (particularly drought), the model may underestimate the effect on yield/suitability.
- 8) The output represents soil type expressed as the dominant soil type in an individual 5 km grid-square (ie, very coarse spatial representation). Where a grid-square is deemed 'unsuitable' there will be soils where a given species might be highly productive.

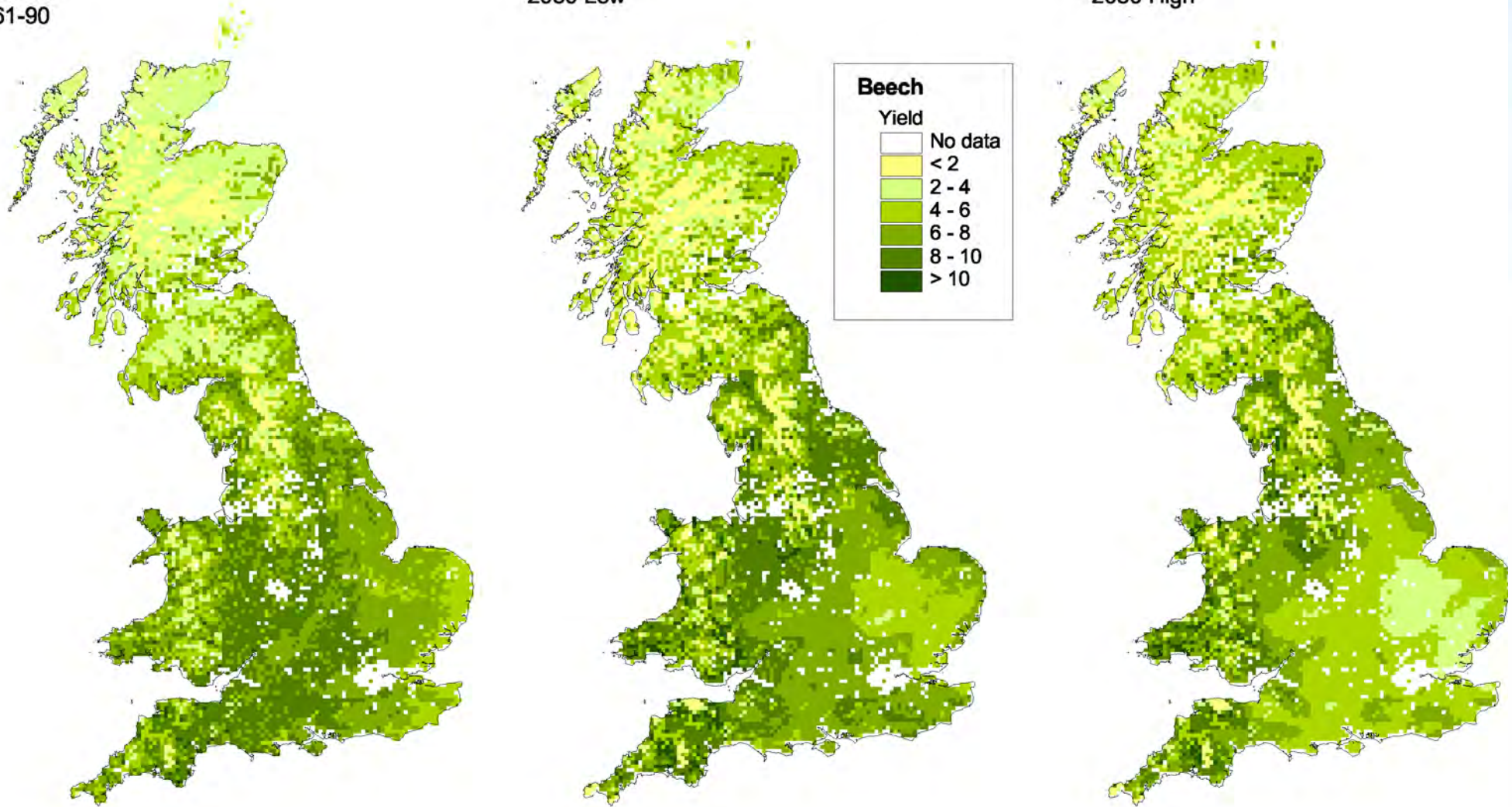


Esc yield - beech

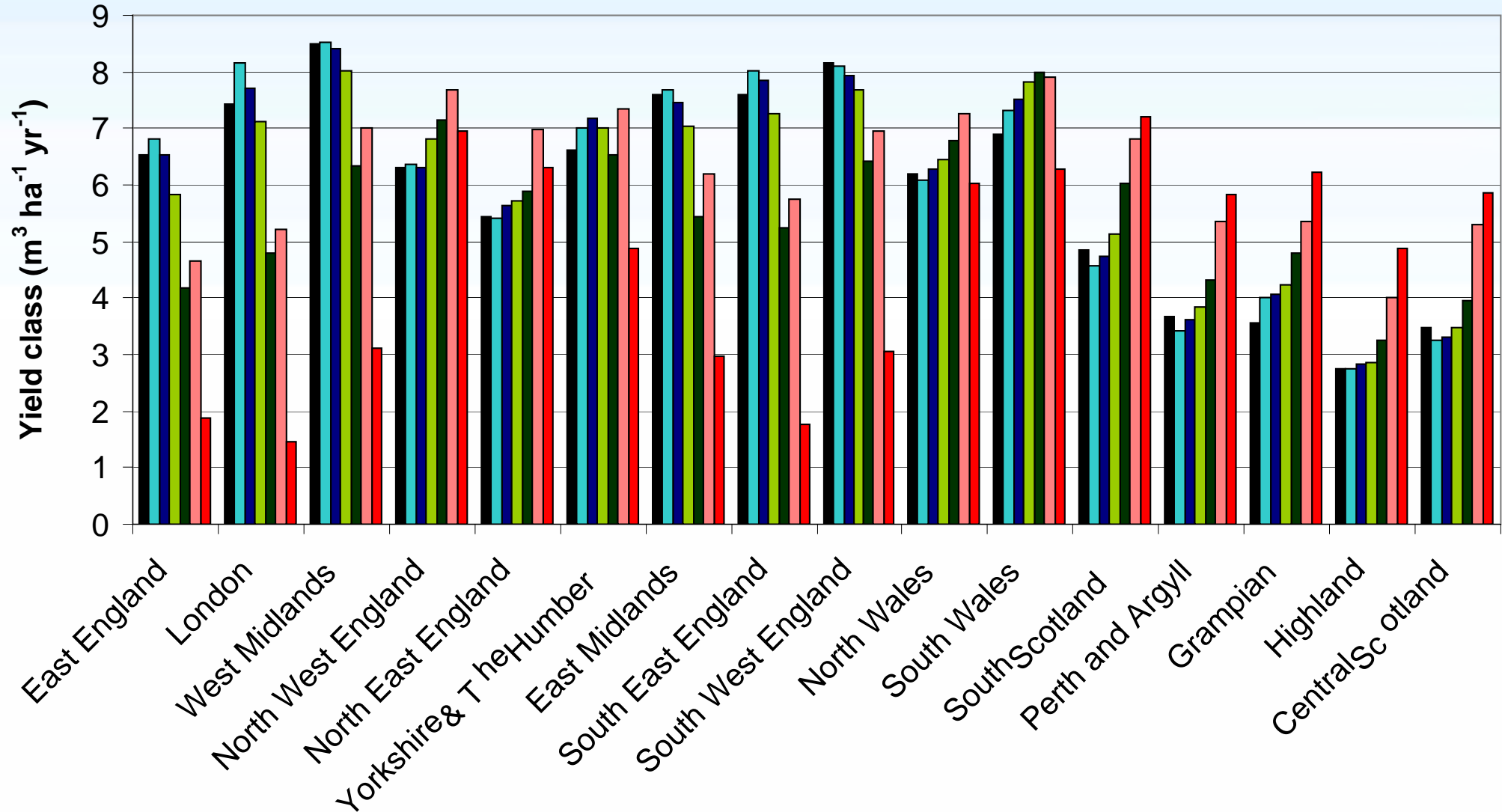
Baseline
1961-90

2050 Low

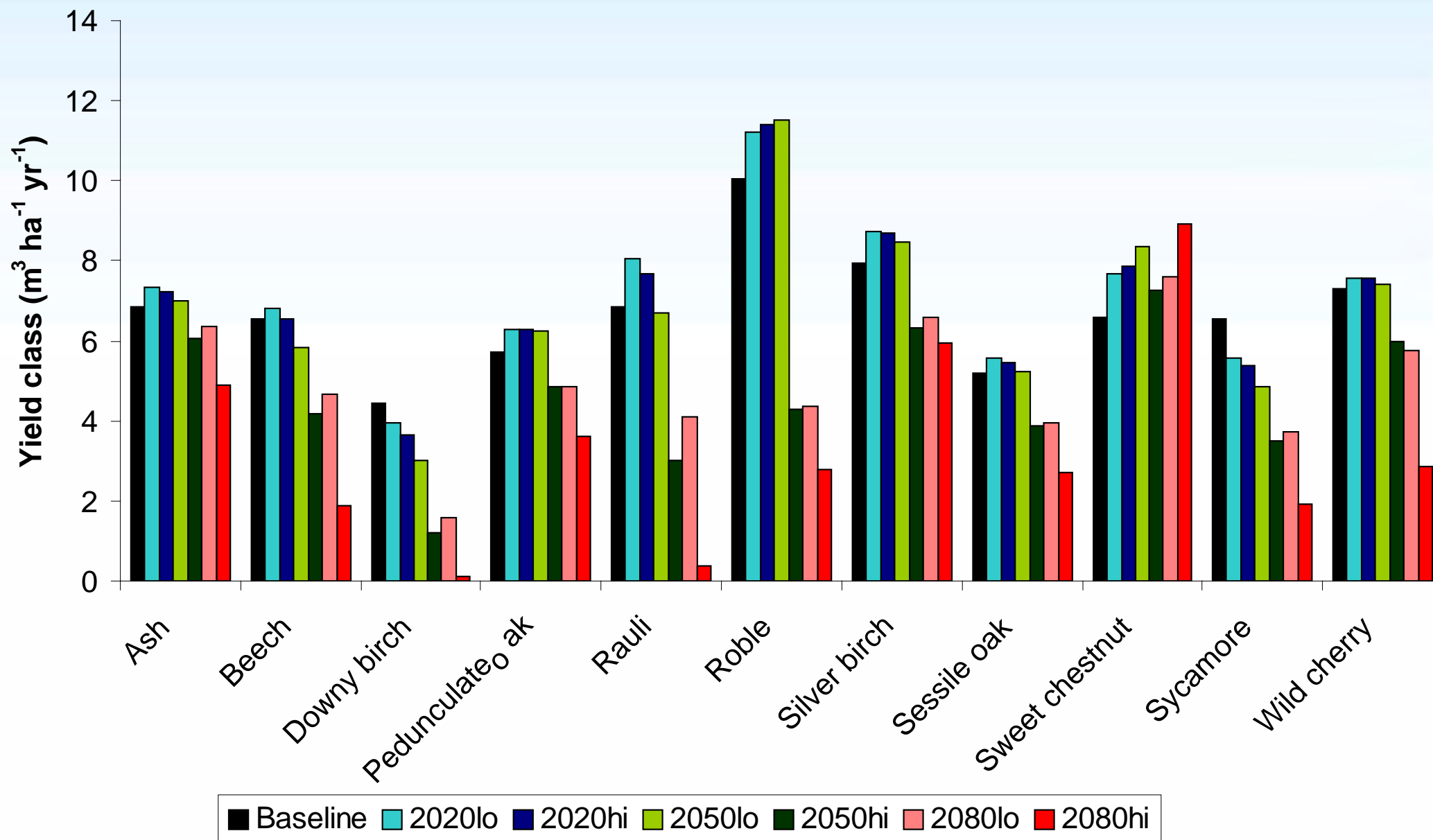
2050 High



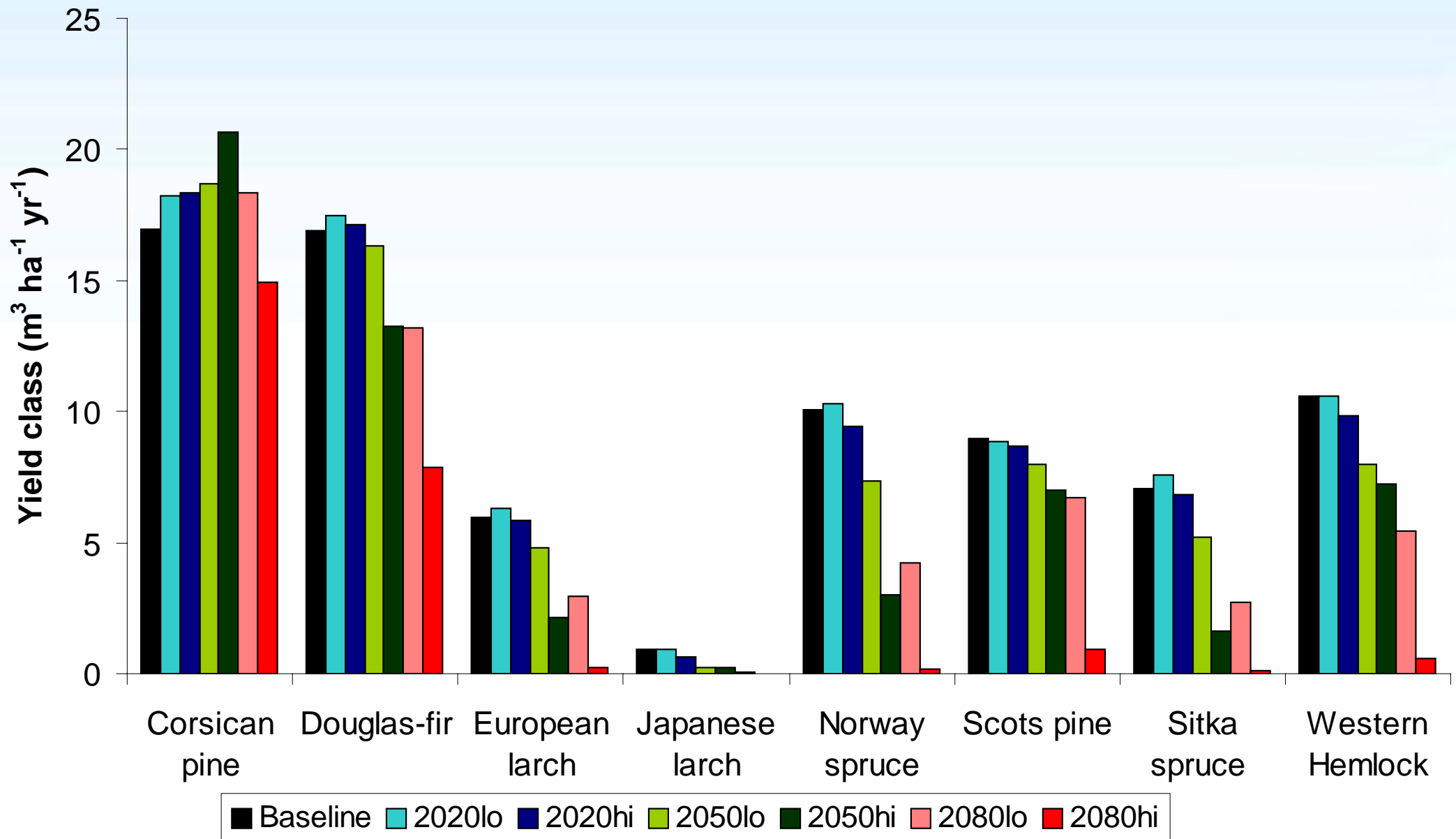
Esc yield - beech



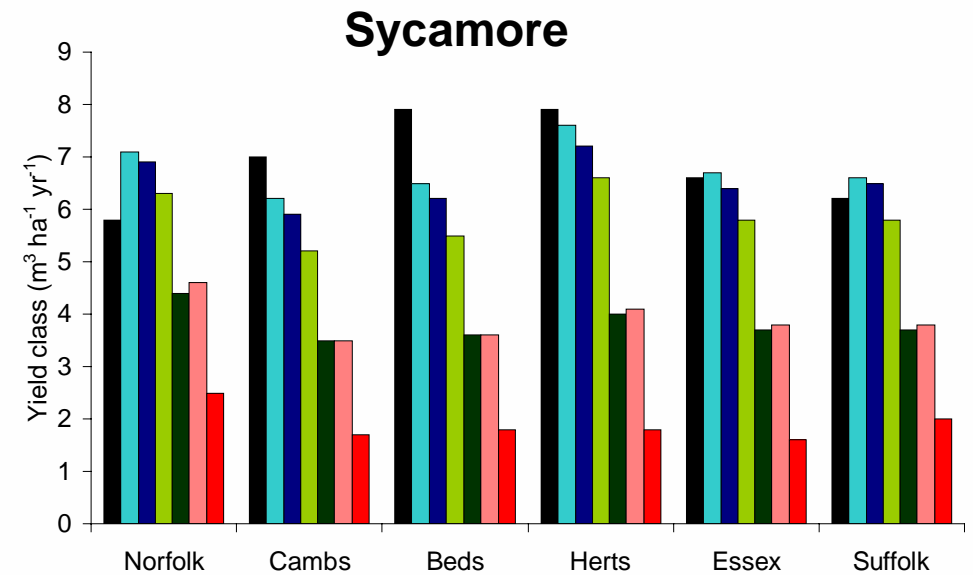
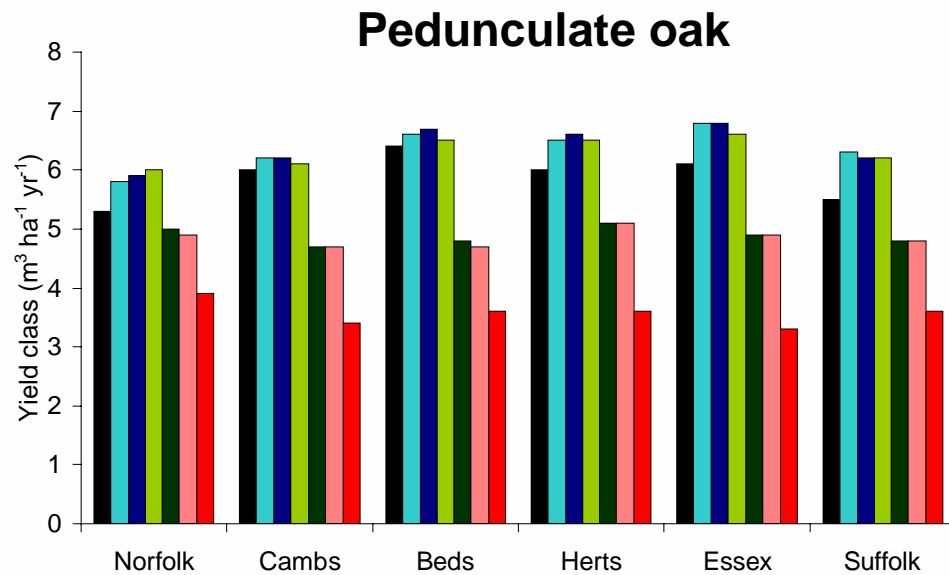
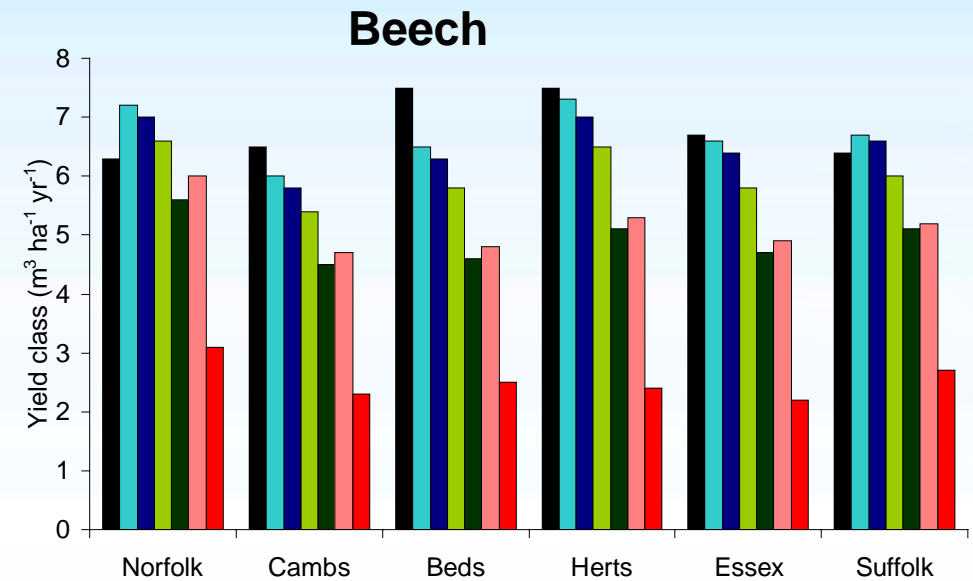
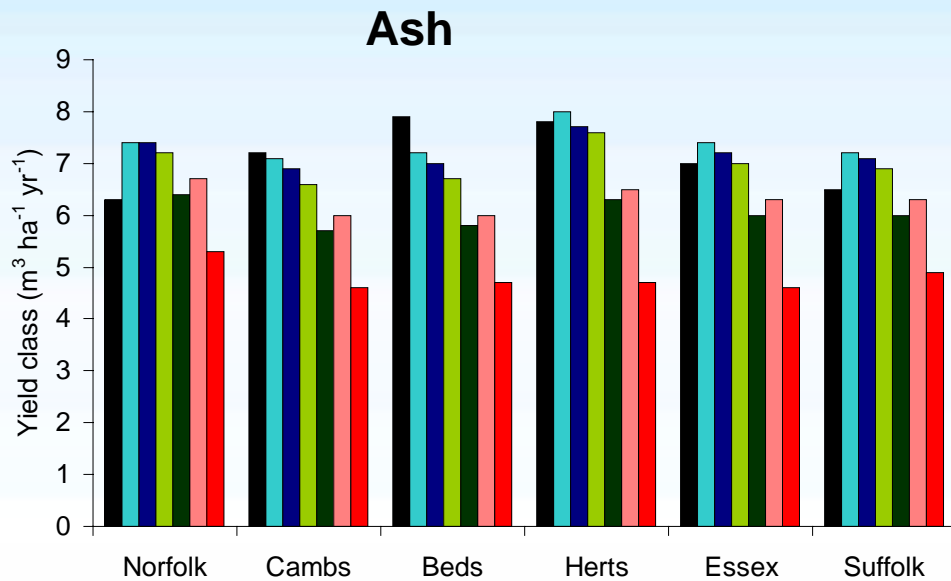
ESC yield - broadleaves in East England



ESC yield - conifers in East England



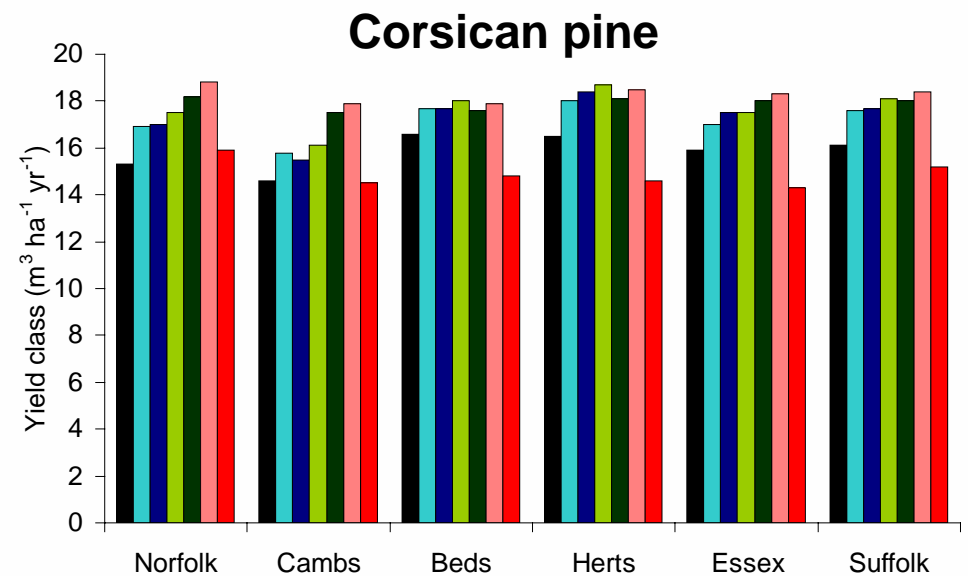
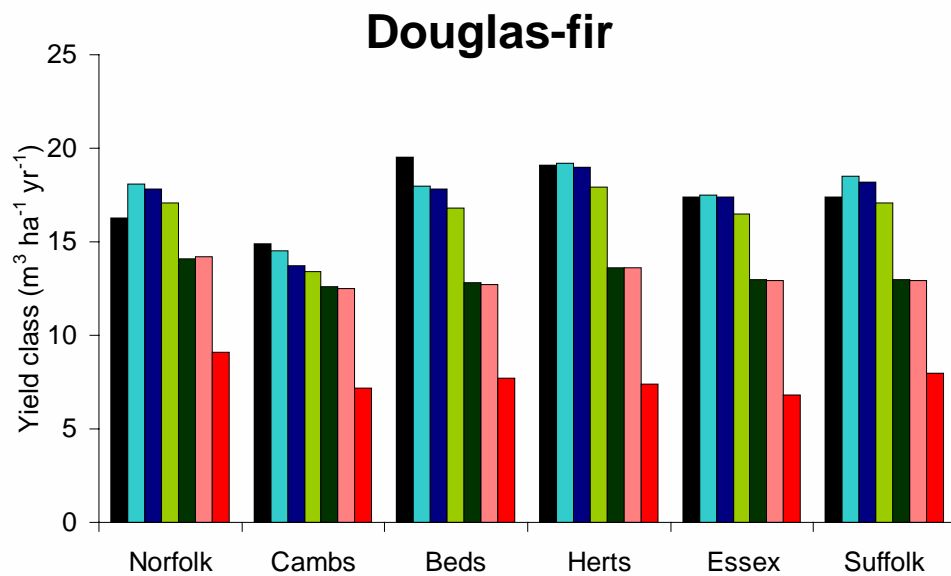
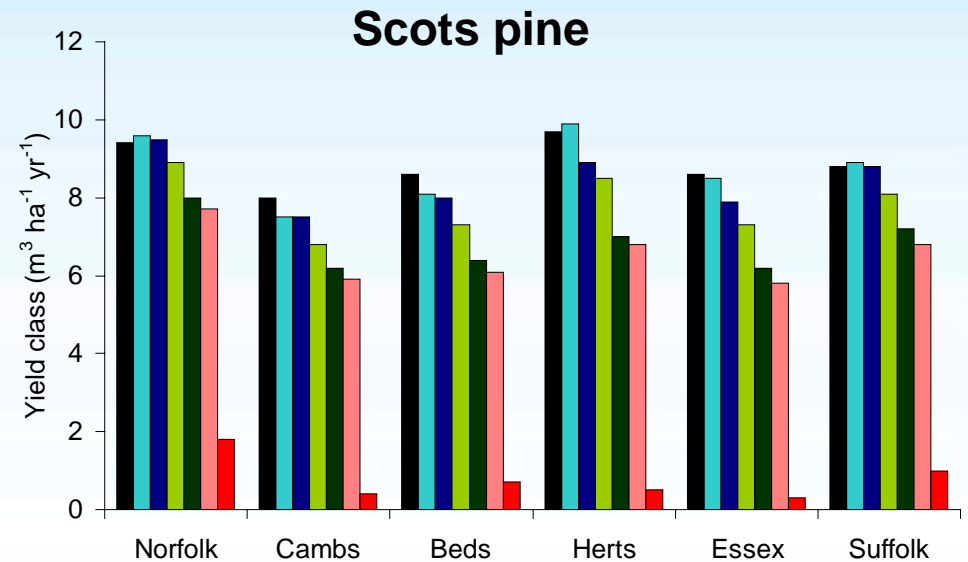
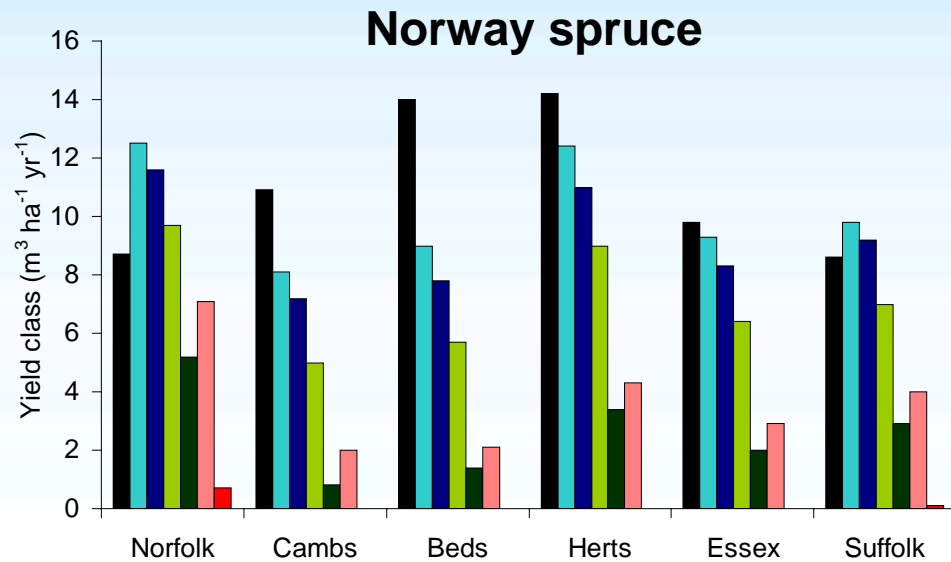
Esc yield - broadleaves



Baseline
 2020lo
 2020hi
 2050lo
 2050hi
 2080lo
 2080hi



Esc yield - production conifers

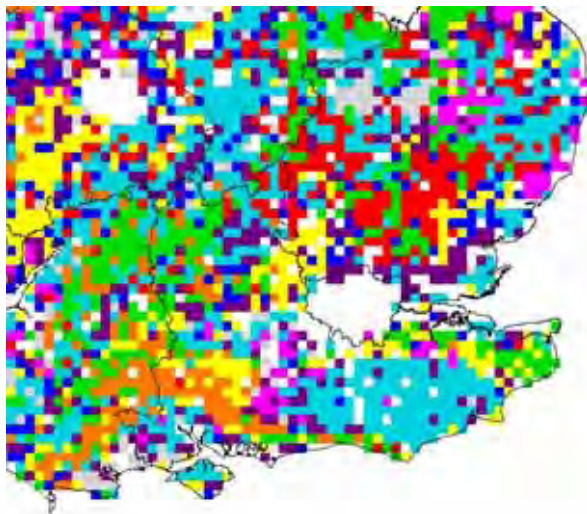


Baseline
 2020lo
 2020hi
 2050lo
 2050hi
 2080lo
 2080hi

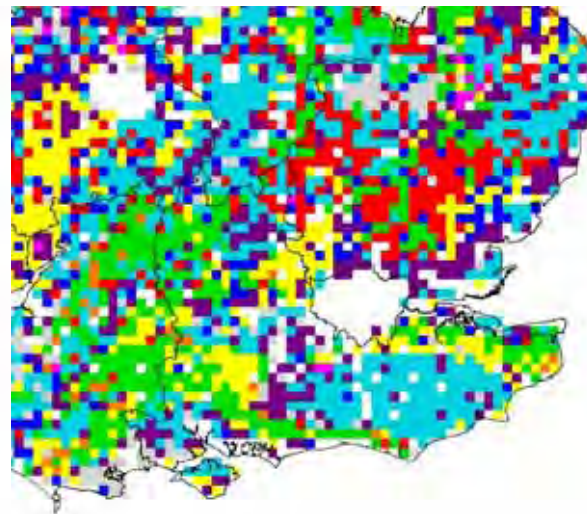
ESC suitability for 'lowland' NVC woodland types



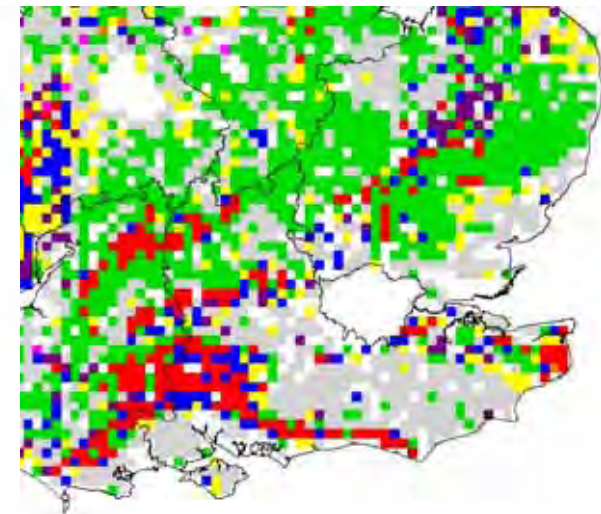
1961-90



2050s Lo



2050s Hi



Conclusions

- Much of EE will remain a good region for growing trees - at least to the middle of the century;
- But.....extreme events difficult to account for;
- Diversification of species, provenance plus changes to species choice is an appropriate response;
- Non-native species may need to be considered as part of the species mix on some sites;
- Woodlands can contribute to climate change mitigation through sequestration and fossil fuel substitution;
- Well managed woodlands will be most resilient to CC and contribute most to CC mitigation;
- The woodlands of EE have a future - but the present will not be the same as the future.



Further information

- FC Bulletin 125. Climate change: impacts on UK forests
- FCIN 48. Forests, carbon and Climate change: the UK contribution
- FCIN69. Climate change and British woodland
- Broadmeadow *et al.* (2005). *Forestry* **78**, 145-161.
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