Quantifying the relative importance of natural and anthropogenic land cover changes in the Representative Concentration Pathways

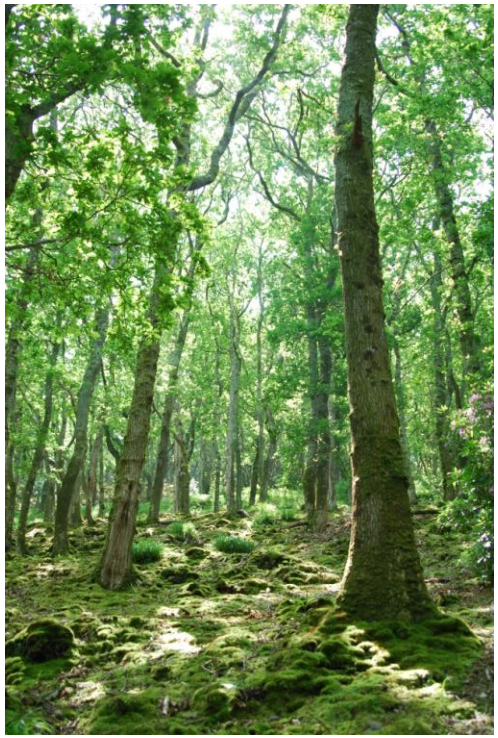
T Davies-Barnard,
Paul Valdes, Joy Singarayer
Andy Wiltshire and Chris Jones

Met Office

NERC SCIENCE OF THE ENVIRONMENT

University of Reading

University of BRISTOL



Vegetation dynamics

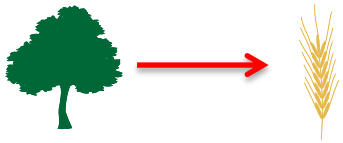
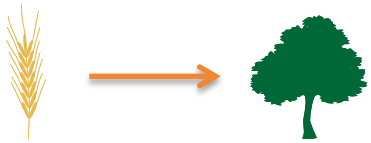
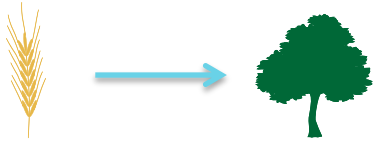
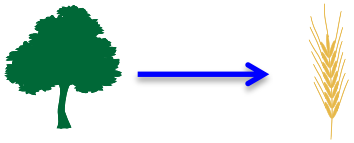
- JULES in the coupled model, HadGEM2-ES
- RCP (representative concentration pathways) used in IPCC AR5.

Anthropogenic Land Cover Change (land use change forced)

vs.

'Natural' Land Cover Change (climate forced)

About the Representative Concentration Pathways (RCPs)

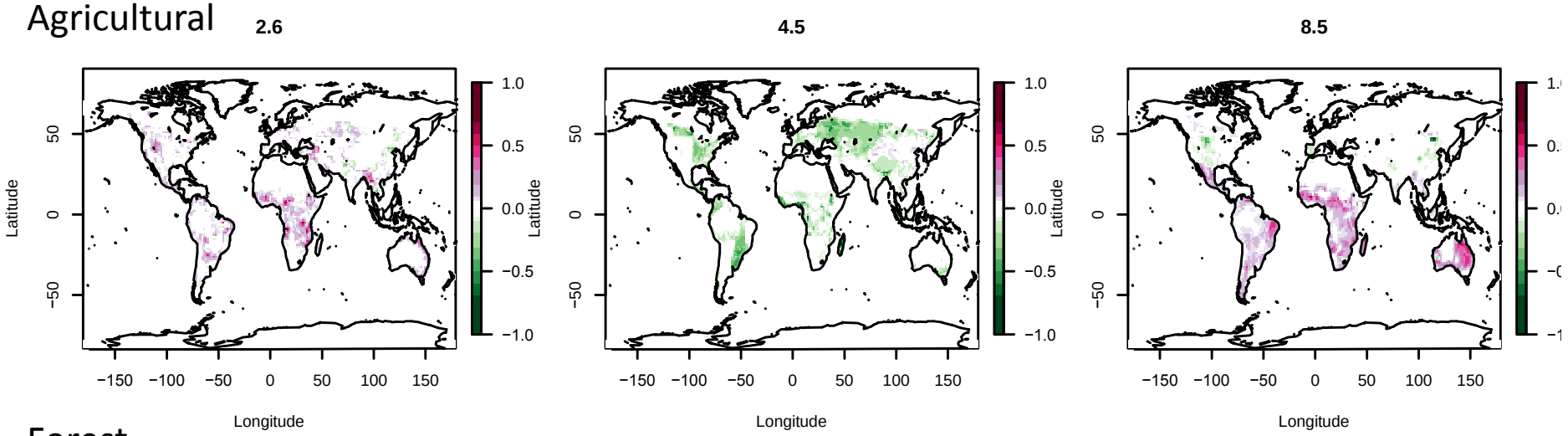
Radiative forcing	Temp. increase	Anthropogenic Land cover change	Climate forced Land cover change
RCP8.5	high		?
RCP6.0			?
RCP4.5			?
RCP2.6	low		?

Land cover change (as % of total land surface area)

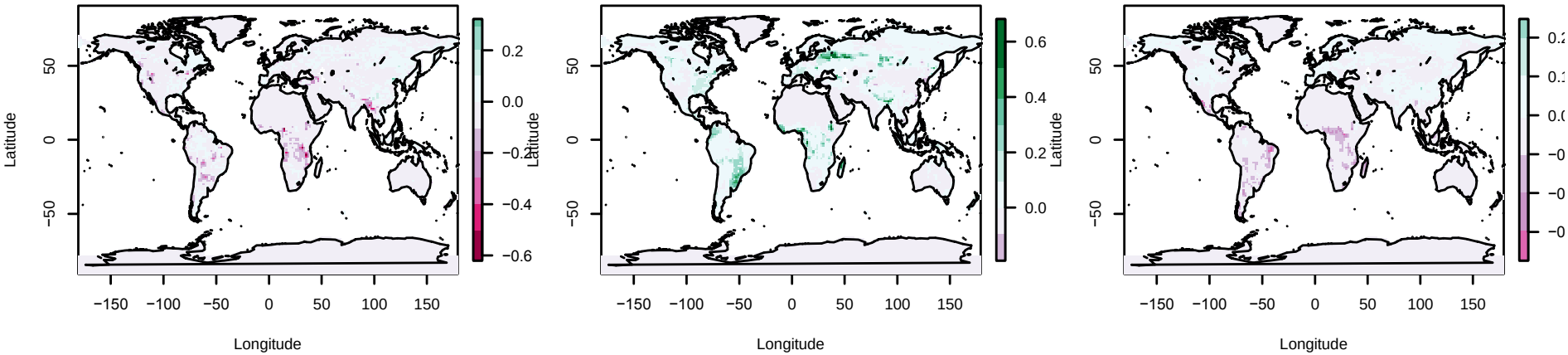
	RCP2.6	RCP4.5	RCP8.5
Anthropogenic LCC (in model)	2.2%	4.7%	2.3%
Agricultural LCC change (imposed)	2.9%	5.1%	3.9%
Natural LCC	3.2%	5.6%	8.6%

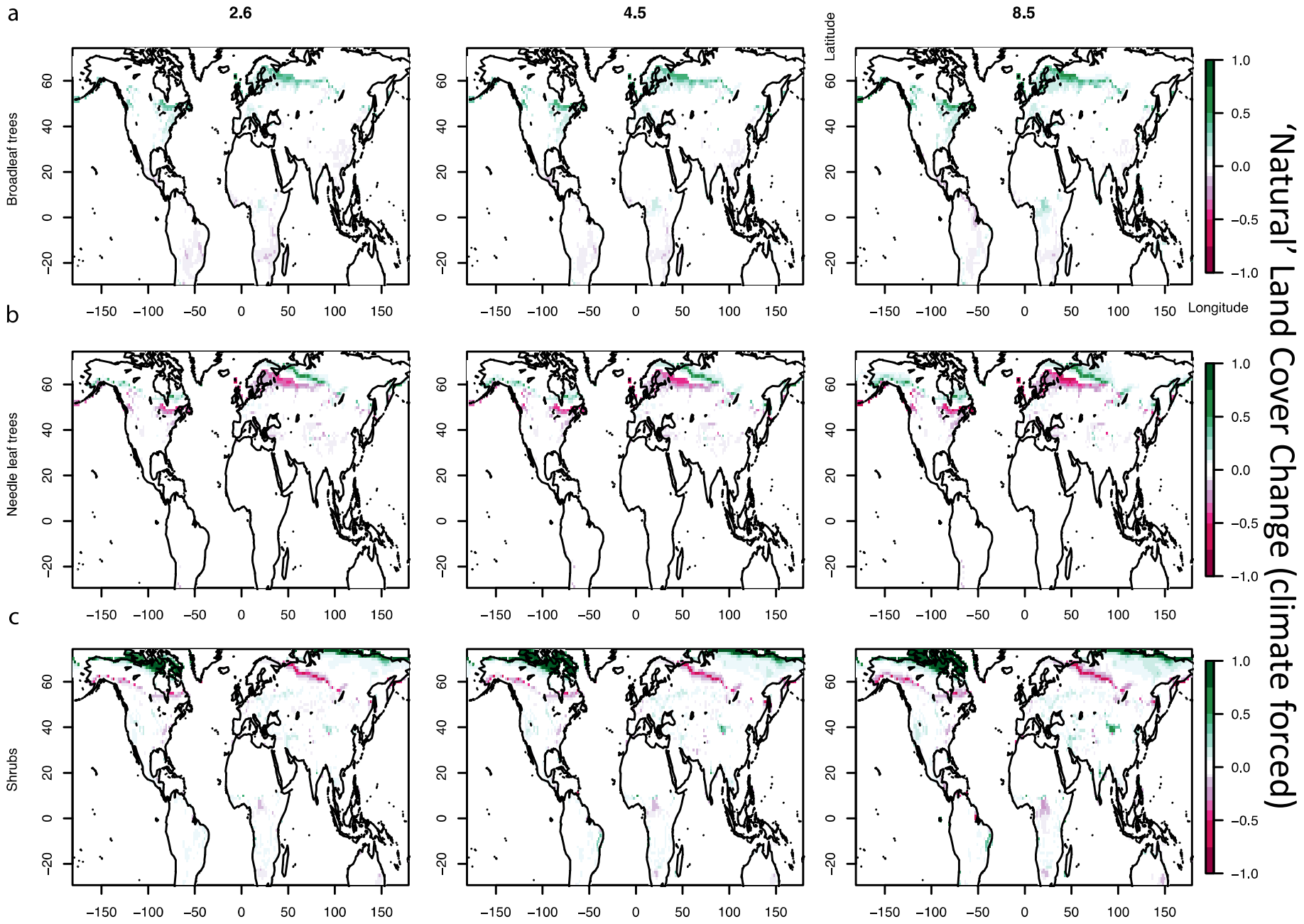
Anthropogenic Land Cover Change (land use change forced)

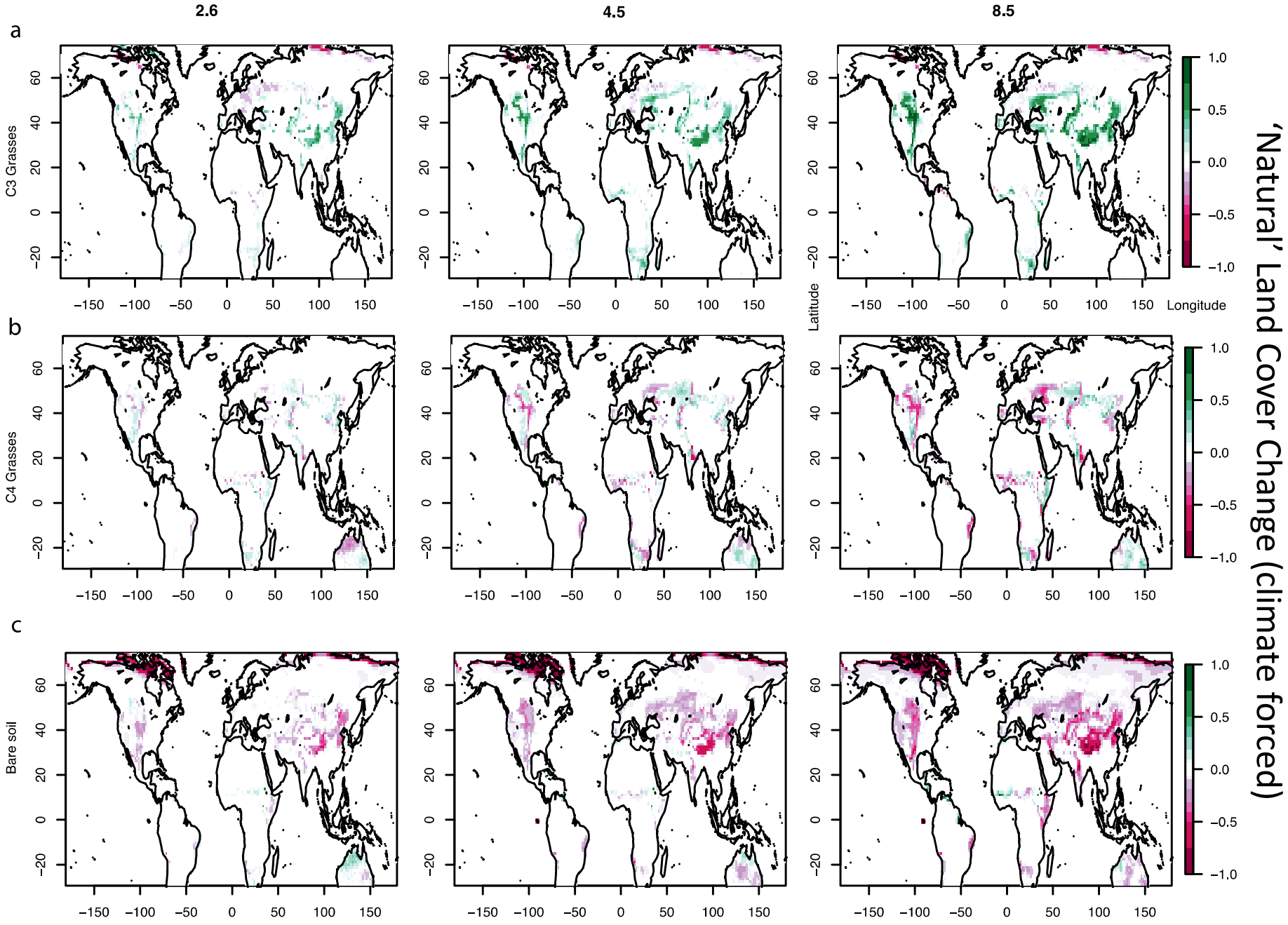
Agricultural

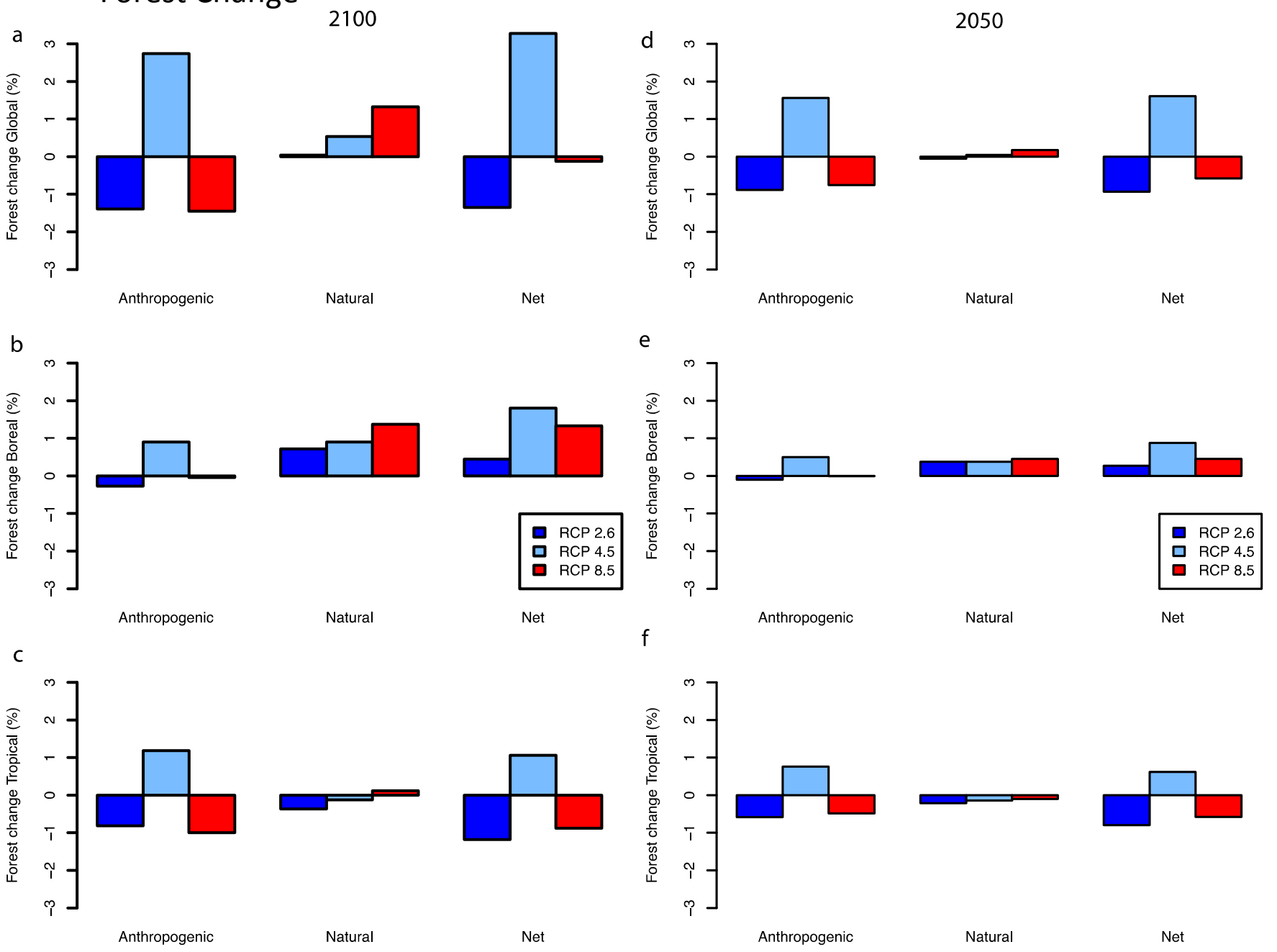


Forest

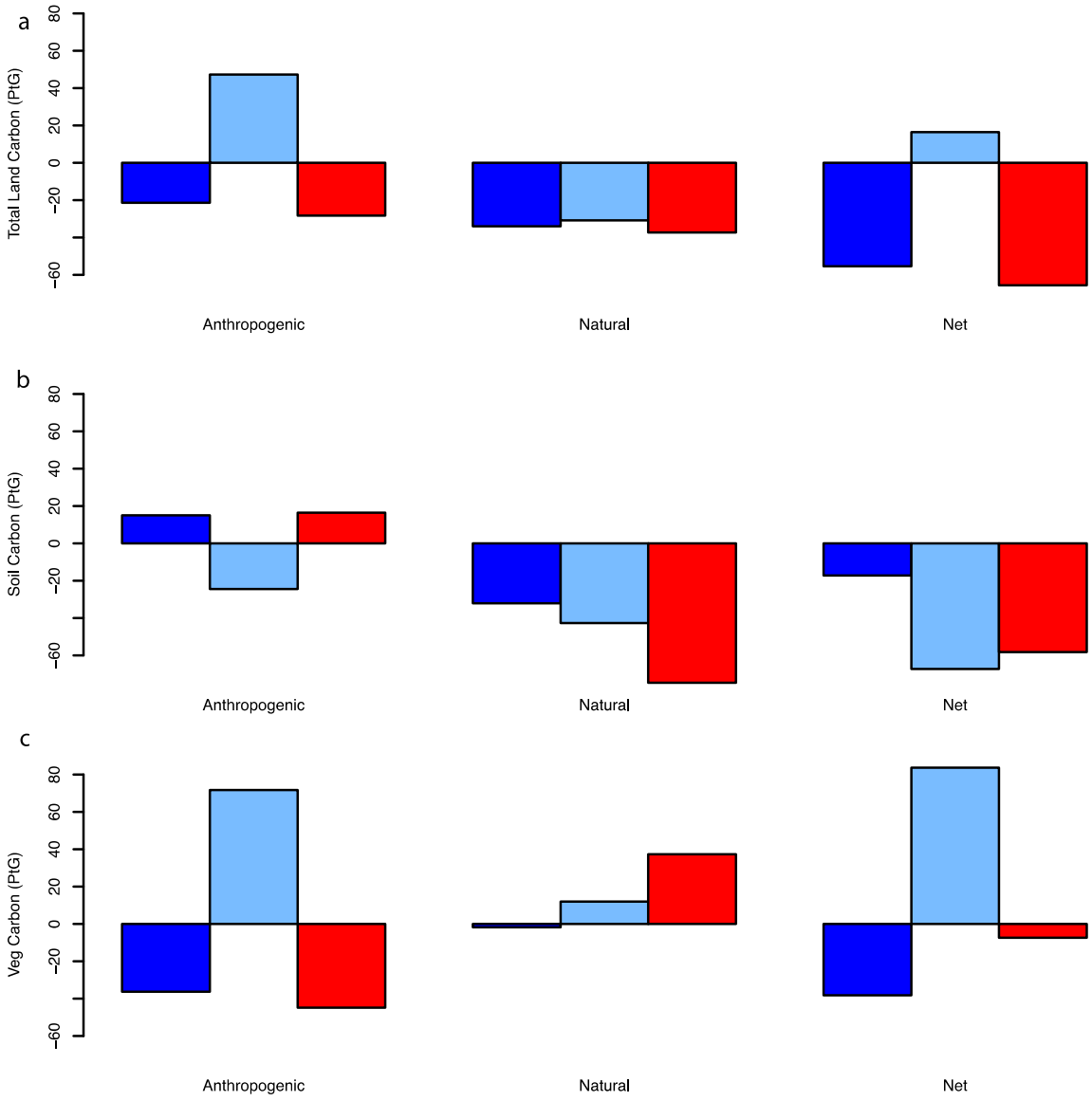



a
b
c
2.6
4.5
8.5
Broadleaf trees
Needle leaf trees
Shrubs
Latitude
Longitude
60
40
20
0
−20
−150
−100
−50
0
50
100
150
1.0
0.5
0.0
−0.5
−1.0
'Natural' Land Cover Change (climate forced)


2.6
4.5
8.5
a
b
c
C3 Grasses
C4 Grasses
Bare soil
Latitude
Longitude
60
40
20
0
−20
−150
−100
−50
0
50
100
150
1.0
0.5
0.0
−0.5
−1.0
'Natural' Land Cover Change (climate forced)


Forest Change
2100
2050
a
b
c
d
e
f
Forest change Global (%)
Forest change Boreal (%)
Forest change Tropical (%)
−3
−2
−1
0
1
2
3
Anthropogenic
Natural
Net
RCP 2.6
RCP 4.5
RCP 8.5

Land carbon changes



Conclusions

- Total land area changed is larger from climate change than from anthropogenic land use change
- Climate forced changes in trees offsets 90% of anthropogenic deforestation in RCP8.5, but only 3% in RCP2.6.
- The carbon emissions from natural land cover change are bigger than those from anthropogenic land cover change in the deforestation scenarios
- Bigger land cover change contributions tend to originate from anthropogenic land cover change in the shorter term or lower radiative forcing scenarios, and from climate changes in the longer term and higher radiative forcing scenarios.
- To what extent natural land cover change can mitigate anthropogenic land cover change raises difficult questions regarding global forest and biodiversity offsetting, especially at different timescales.