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Habitat networks for broad leaved woodlands: threats from land use change

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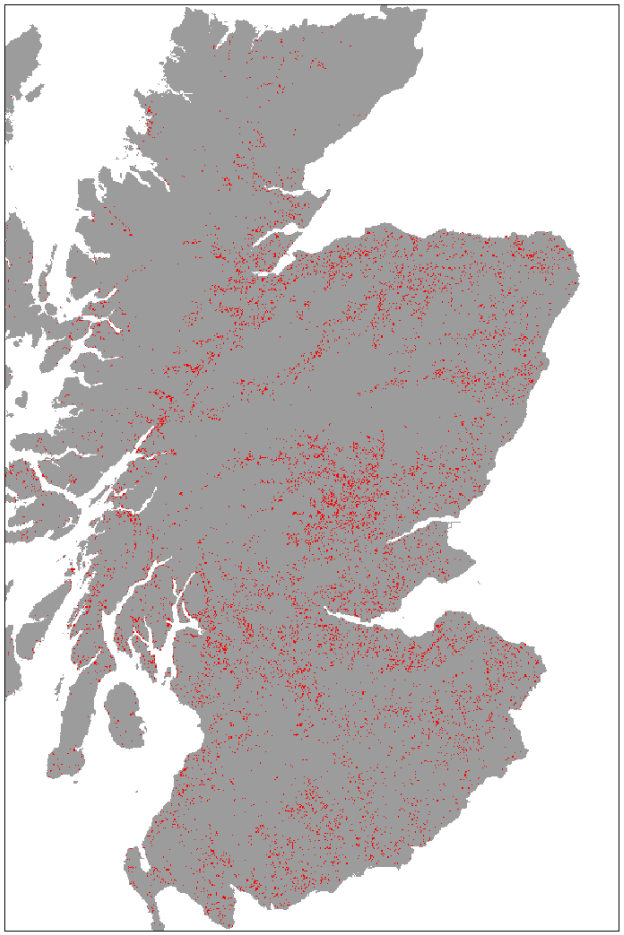
The James Hutton Institute

Contents

- Where are the main dispersal pathways?
- The effects of global factors on land use
- Land capability changes in Scotland
- Consequences for B.L. networks and some initial scenarios
- Conclusions

Broad-leaved woodland habitat

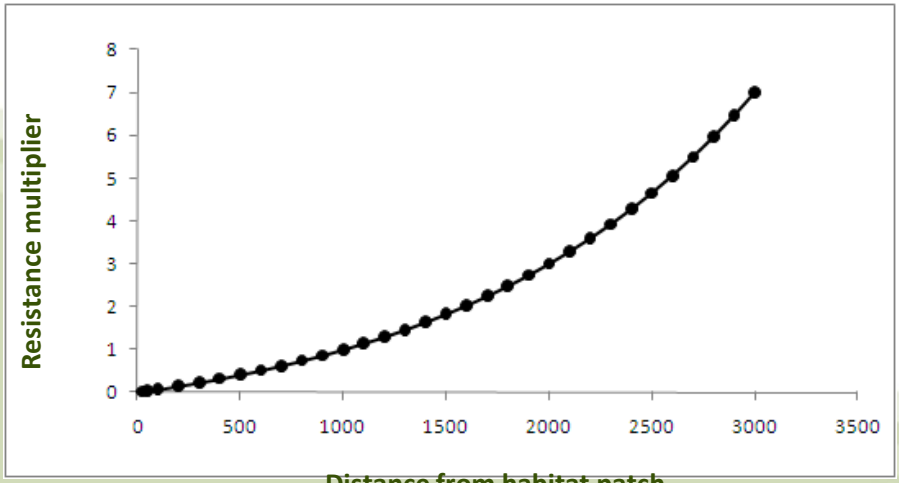


Broad-leaved forest habitat networks: where are important corridors in the landscape?

- Partly followed the 'approach in Watts et al. 2010:

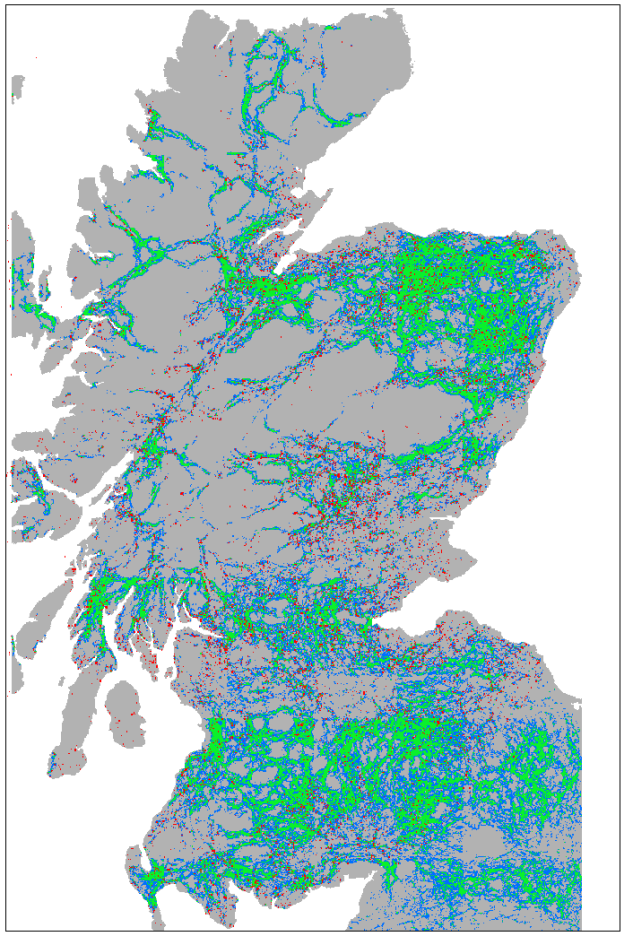
  1)Generic forest sp. -1km dispersal - 2) Matrix between patches dispersal-resistant to various degrees

- 'Current' as an analogy to random walks of disperser (McRae et al., 2008)



$$Res. = exp(\alpha d)$$

Corridors in the landscape



90th percentile random walks intensity

75th percentile random walks intensity

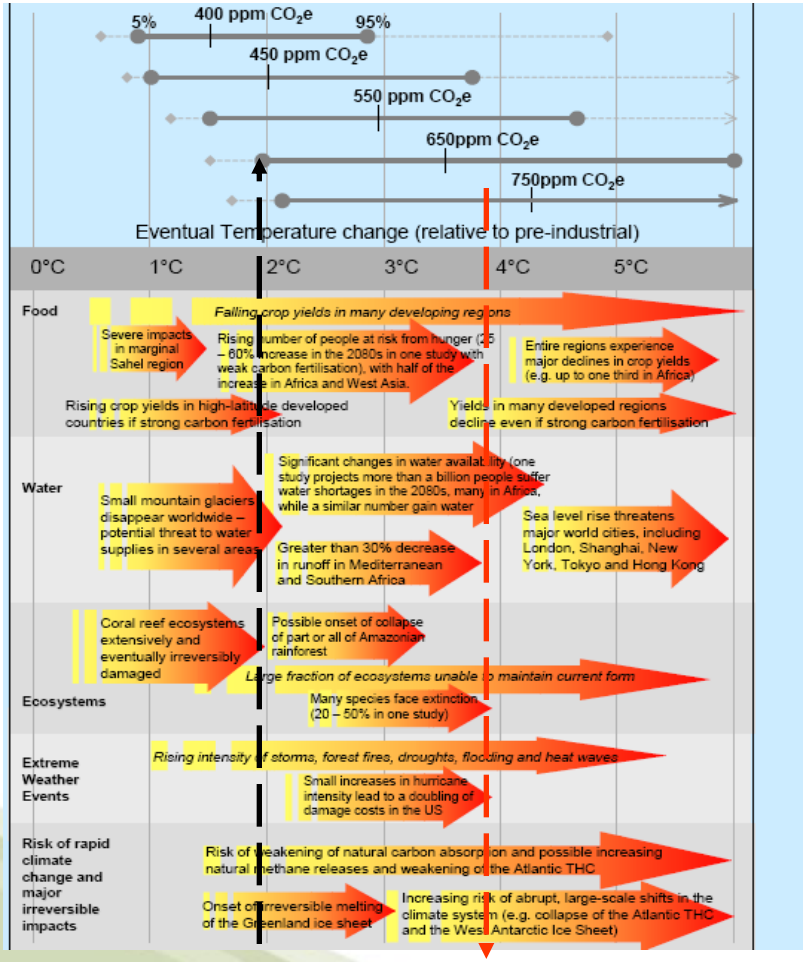
See Gimona et al. 2012, *Biol. Cons*.

Adaptation to Climate Change

- Climate change implies change in habitat distribution and a need for landscape adaptation
- Ecological networks are part of the adaptation strategy……
- …..BUT the context of other impacts is important

Global impacts on land use will depend on degree of warming

Source:Stern Review



We are *committed* to 2 degrees

We are likely to end up here by end of century

More demand for food

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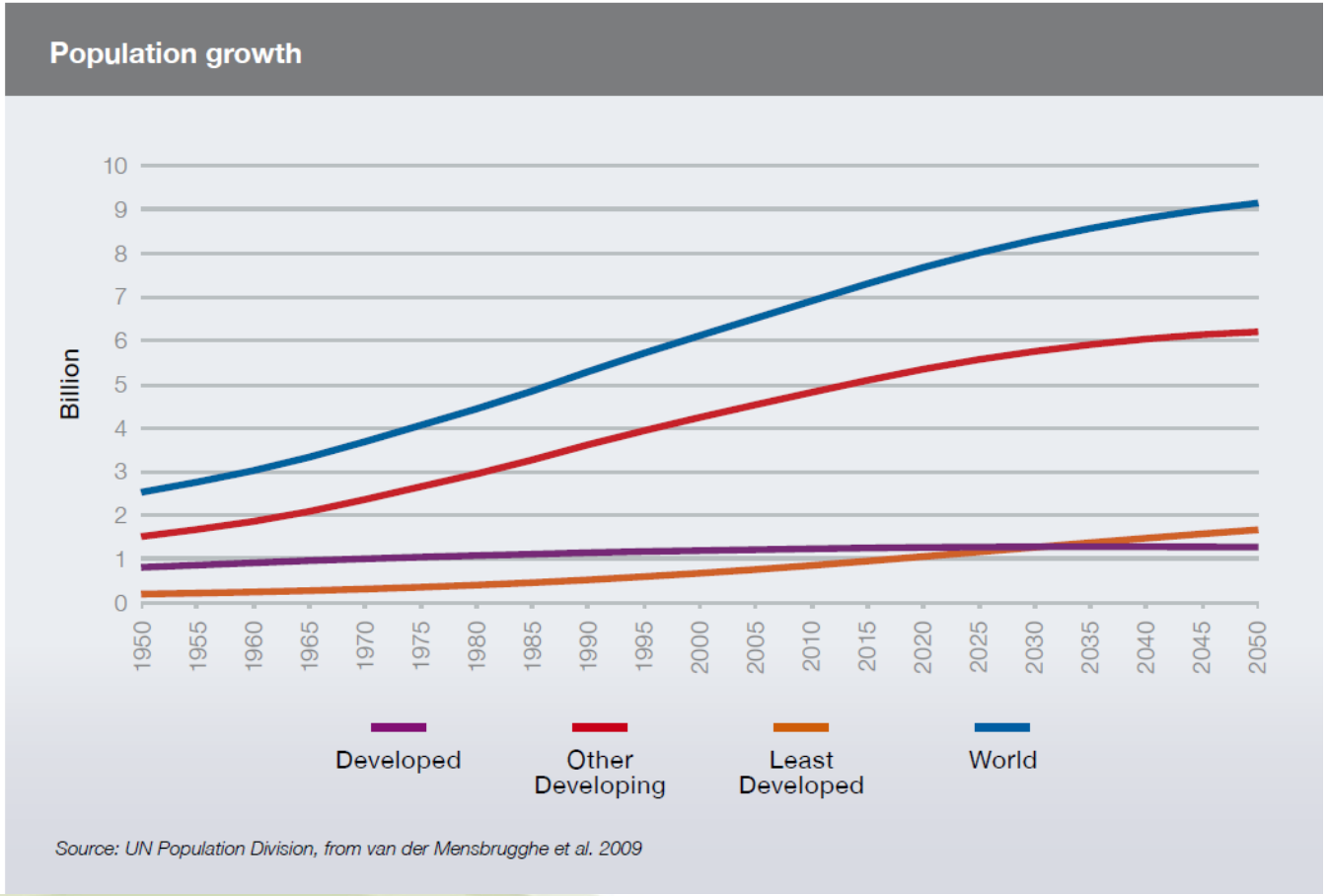

ca 2.7 *extra* billion people will need food by 2050

Agrofuels compete for land

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See e.g. Fritsche et al., 2010;

Financial speculation on food

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The Telegraph

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Glencore enjoys 'strong' trading after US drought

Commodity giant Glencore's controversial prediction that it could benefit from the impact of the US drought on harvests appears to have come to fruition, as it reported business has been "good".

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The real hunger games: How banks gamble on food prices – and the poor lose out

In the last decade, financiers have speculated billions of pounds in food, helping to make prices dearer and more volatile

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A radical shake-up: Overseas officers will be able to run police forces for the first time

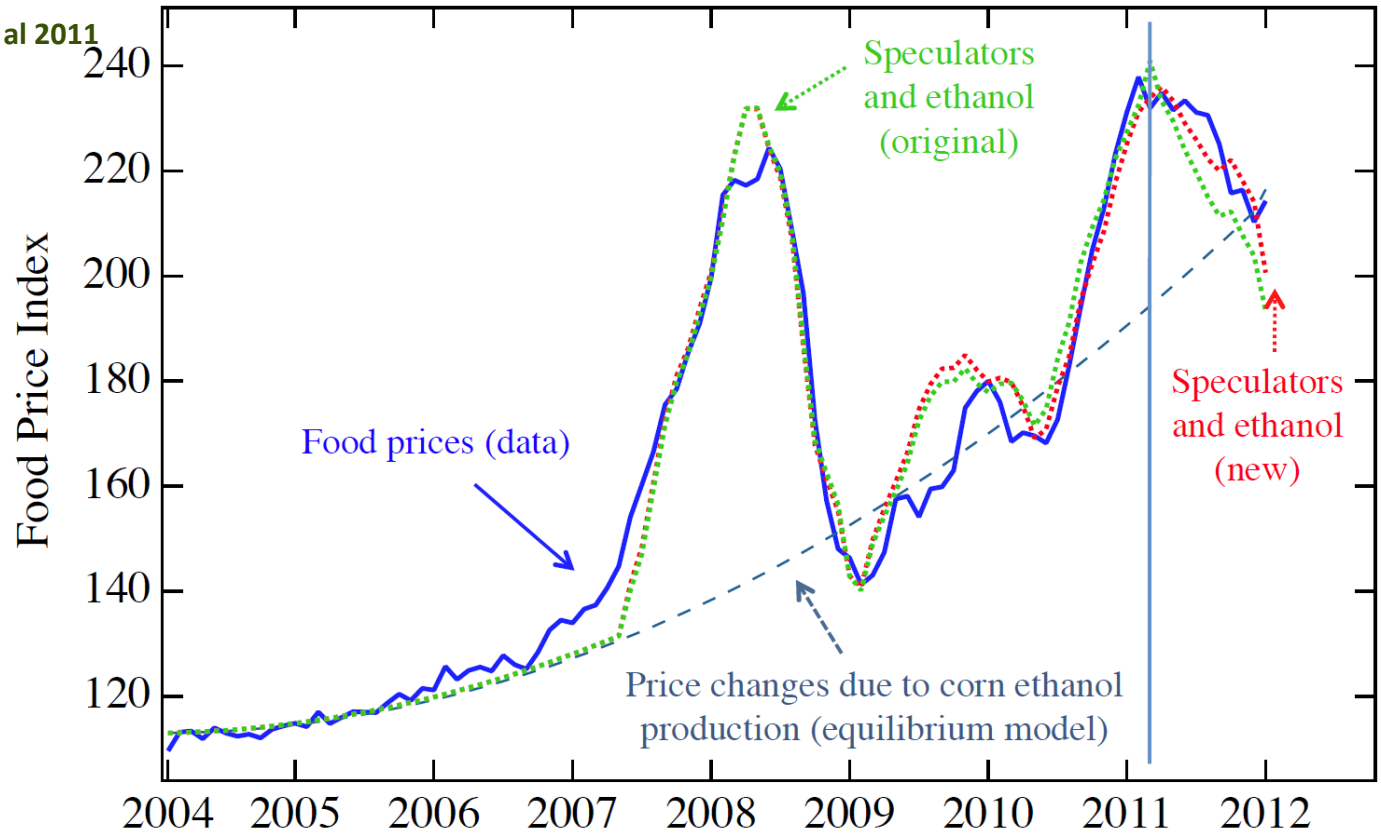
Cloud control: Thought

Food price trend

Principal causes: weather; 'burning food' as fuel; financial speculation

Financial speculation on food causes rather than follow price increase

Source: Lagi et al 2011



Diets are changing (more animal products)

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Figure B1. Growth in demand for beef from 2000 to 2030

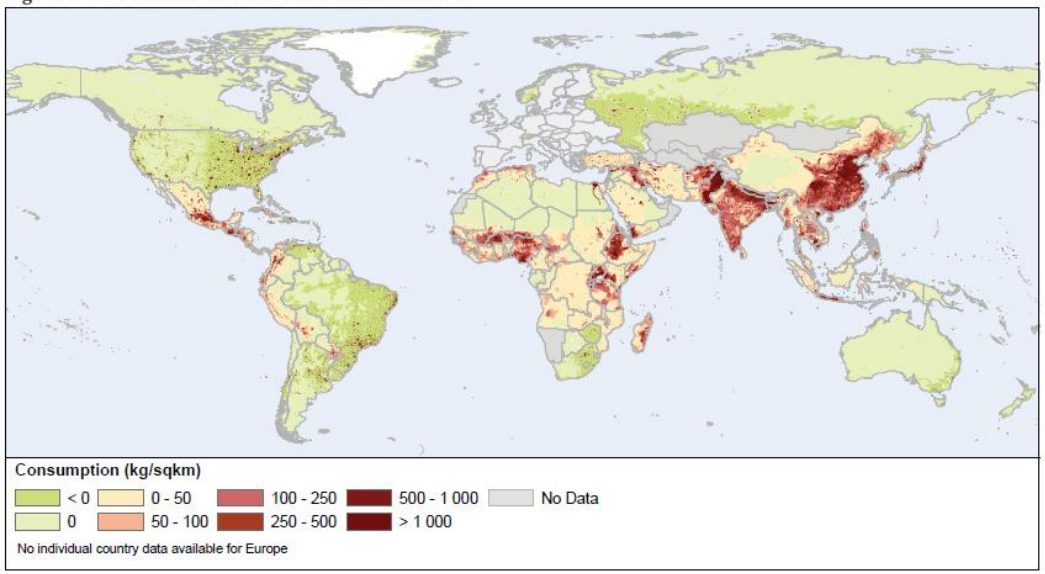
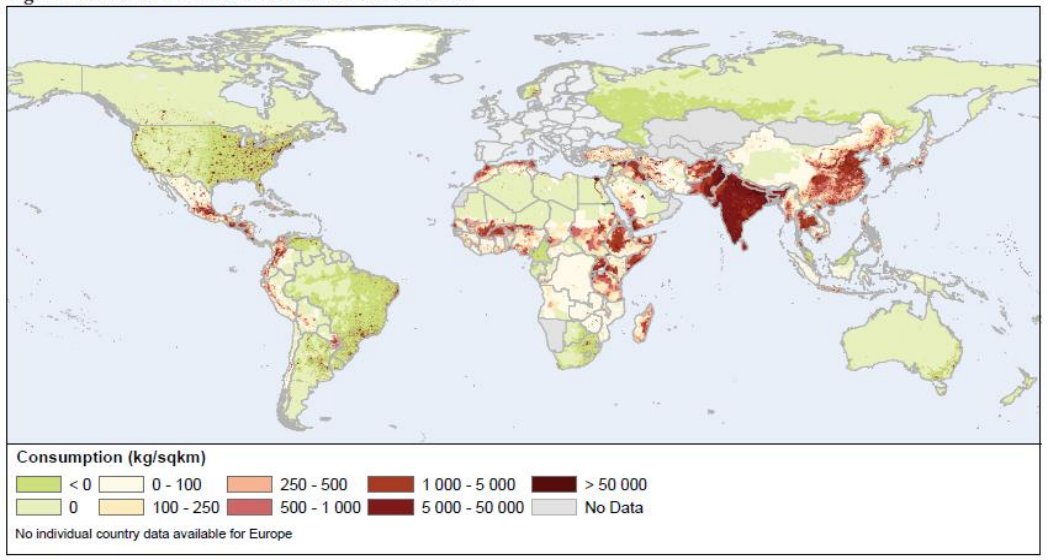


Figure B2. Growth in demand for milk from 2000 to 2030



Source: FAO 2011

The outlook for food prices is upward

"Agricultural production needs to increase by 60% over the next 40 years to meet rising demand for food" (FAO 2012).

UK Foresight report

"Agricultural commodity prices have been a key driver of land use and land management practices"

"The amount of land used by agriculture in the UK reflects the proportion of the UK's total raw food requirements sourced from UK farms".

"The changing demand for food in the UK: organic and animal welfare systems generally require additional land use compared with conventional agricultural production systems".

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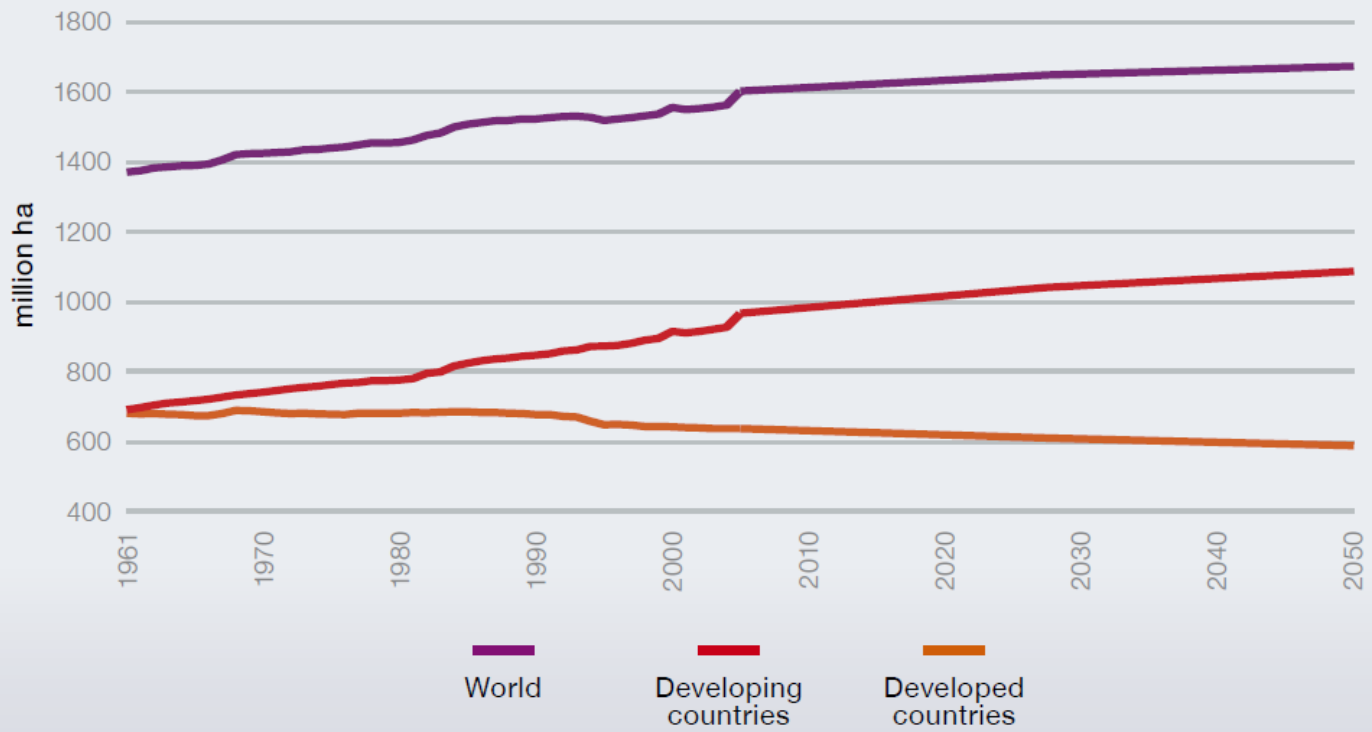
Arable land



Source: Bruinsma, 2009

Land capability will change

By 2050:

Climate change will alter the pattern of yields around the world (e.g. Stern review, 2007)

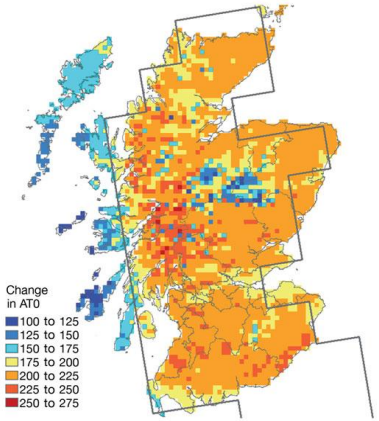
- **In Scotland** land capability likely to improve (e.g. Brown et al., 2008; 2011)

Land capability for agriculture

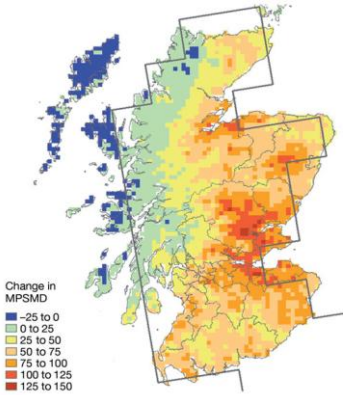
- How is it likely to change in Scotland ?
- What are the implications for broadleaved forest networks
- a scenario-based, spatial approach to incorporate new future constraints

Land capability for Agriculture: Climatic component and soil component

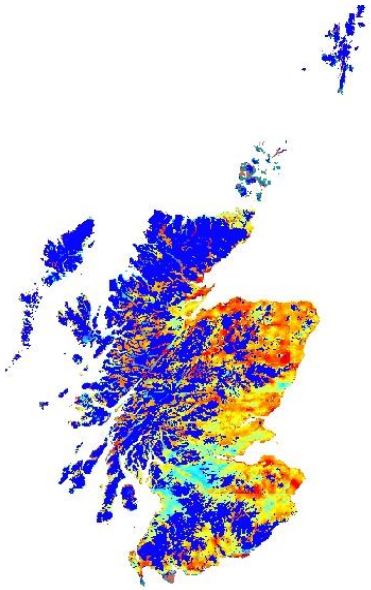
See : Gimona and Birnie 2002; Brown et al., 2011; Gimona et al. 2012.



Accumulated temp.



Atmospheric moisture deficit.



Soil moisture content

Future agricultural prime land 2050

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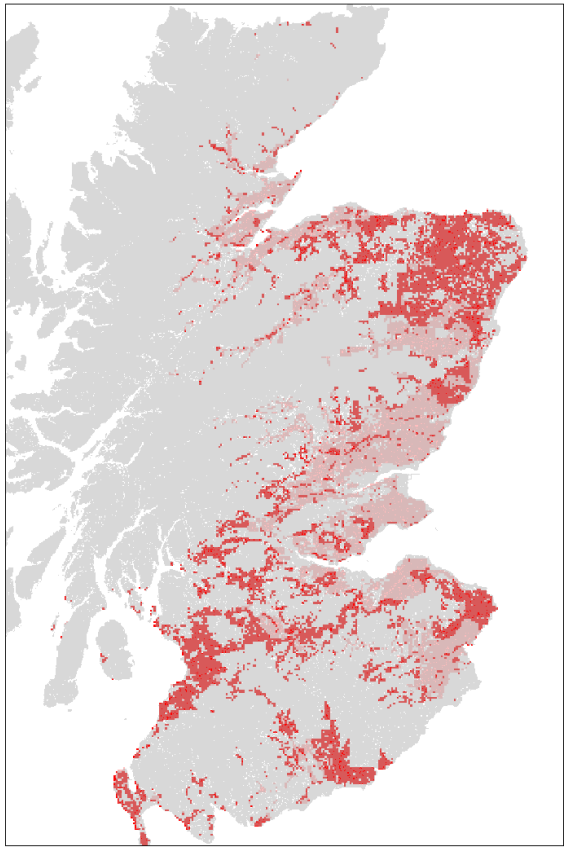
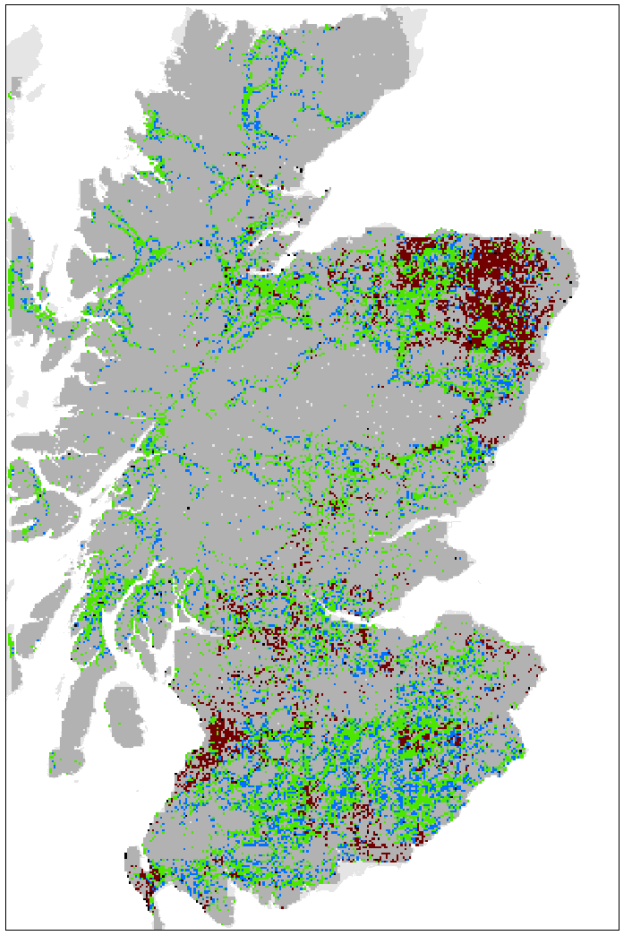


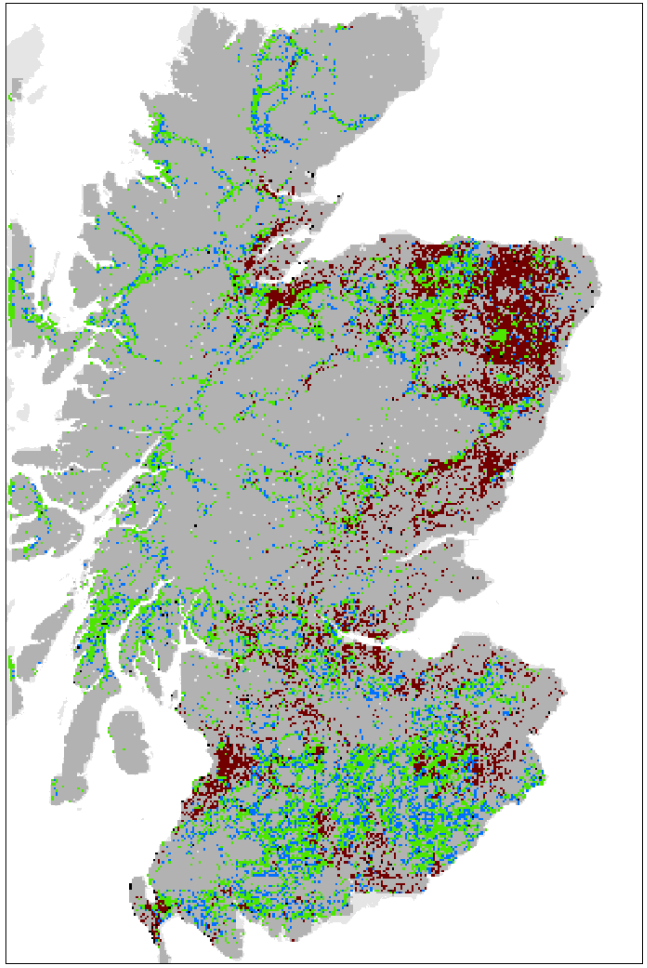
With water restrictions

Without water restrictions

Based on HadRM3 model-med-high emissions scenario

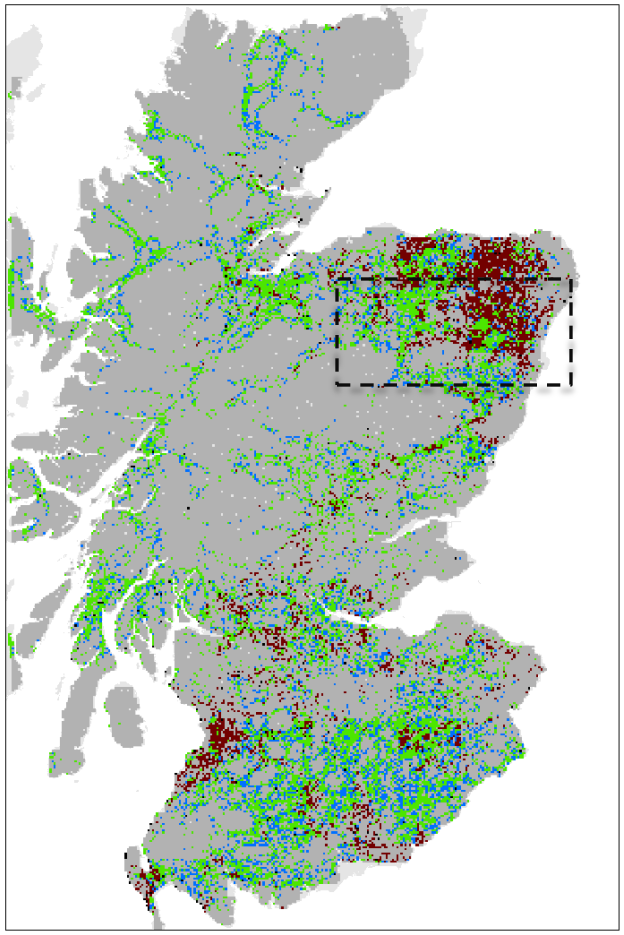
Potential impact on dispersal corridors





Water restrictions lifted (e.g. irrigation, tolerant crops)

Some detailed analysis. Deeside



Economic

WORLD MARKET

No Subsidy [Prices-first]

Reactive Adaptation

Weak regulation

Arable intensification

Irrigation for high value crops

Coniferous plantations

NATIONAL ENTREPRISE

Food/Energy Security [Policy-first]

Planned and reactive Adaptation

Arable expansion

Large scale irrigation

Coniferous plantations

Global

Local

GLOBAL SUSTAINABILITY

Sustainability [Policy-first]

Planned Adaptation

Strong regulation (e.g. irrigation)

Prime Land protected

Native woodland

LOCAL STEWARDSHIP

Local Choices [Preferences-first]

Planned and reactive Adaptation

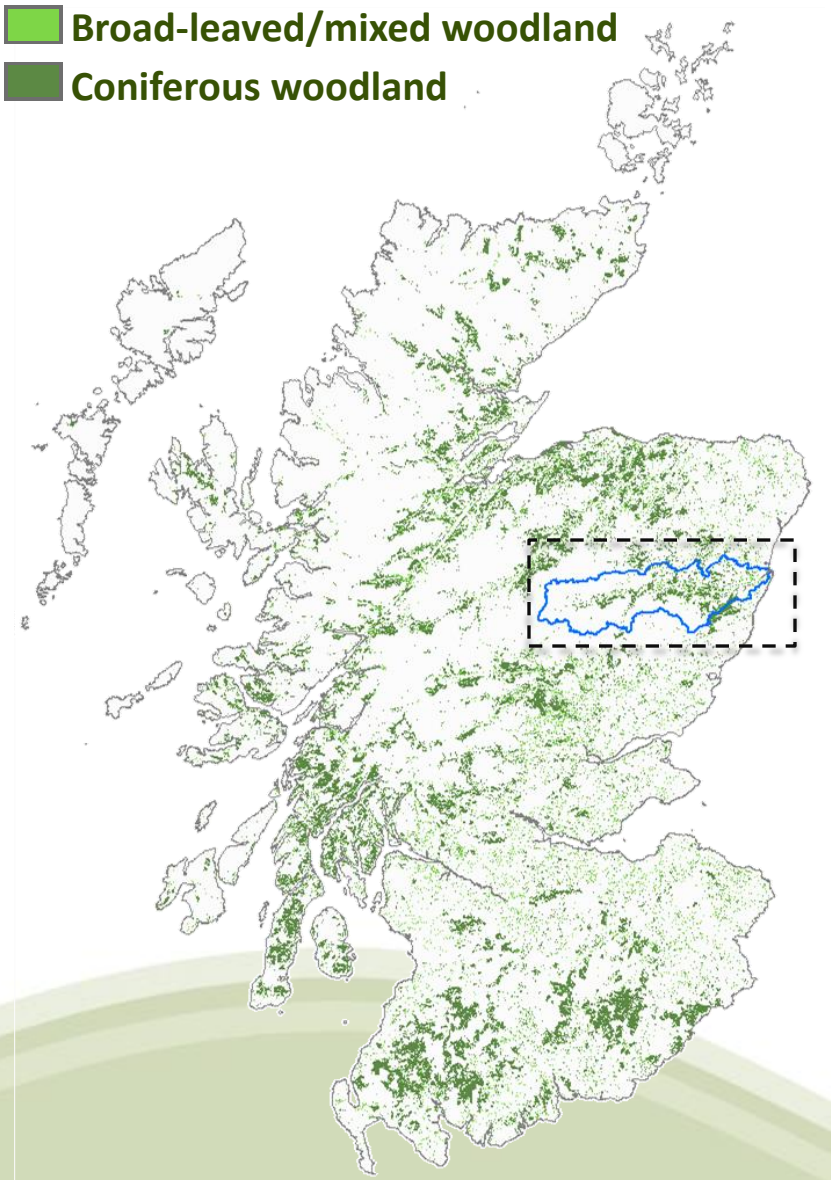
Shared resources (e.g. water)

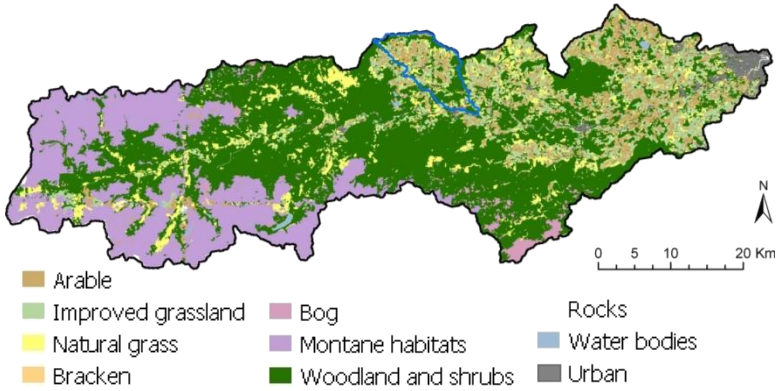
Landscape heterogeneity

Native woodland, Local food

Environmental

Deeside Scenarios





Common criteria: protect peatland and future prime land

Forest expansion as B.L. in areas of high current near rivers

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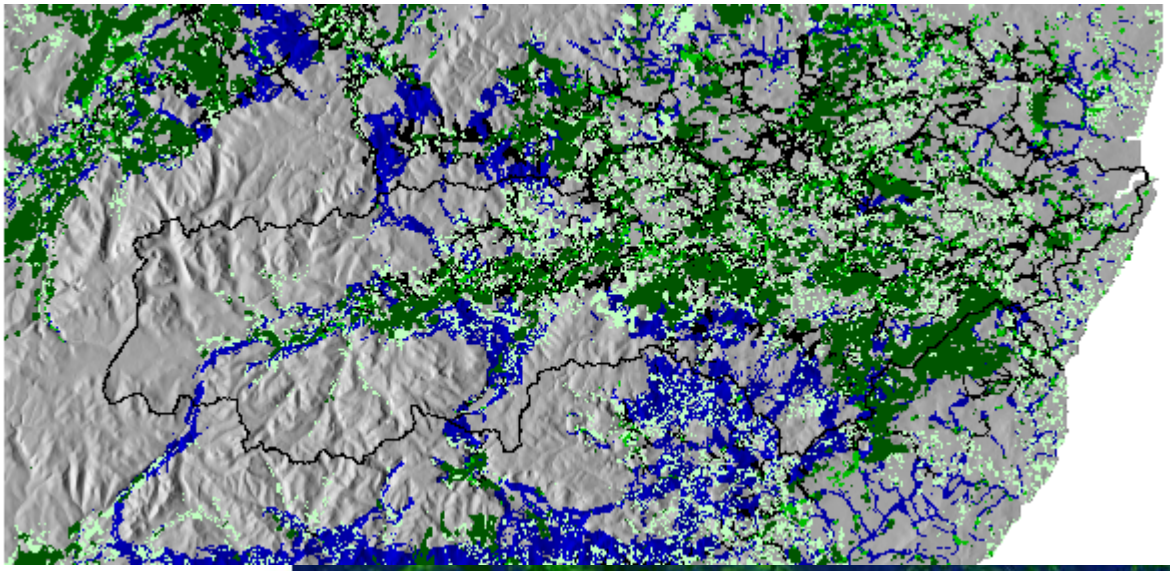
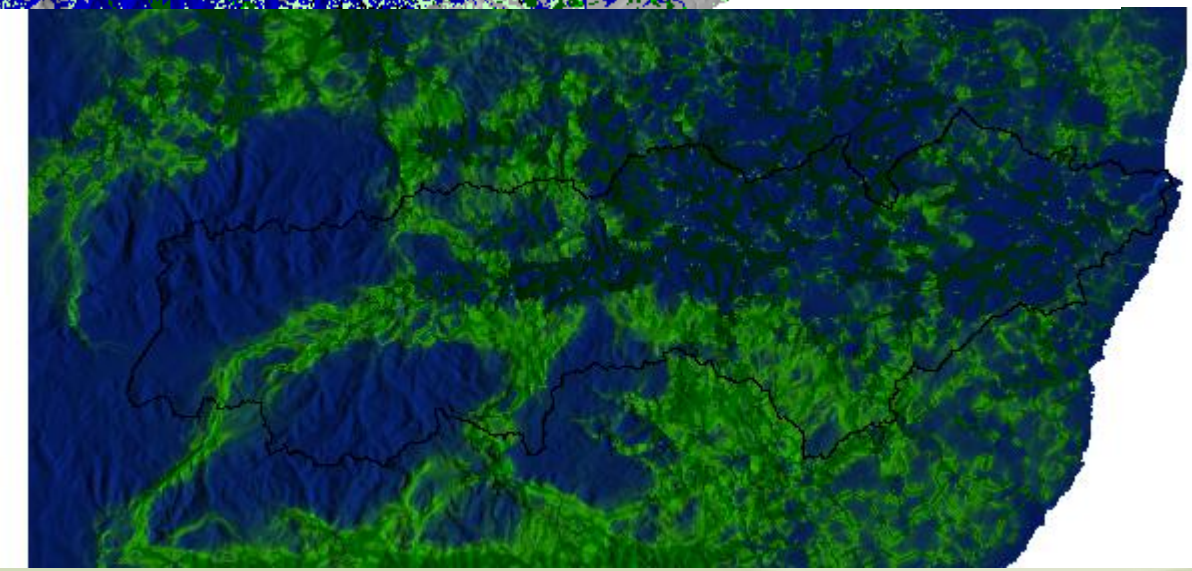


IPCC-SRES =~ GS



Areas of high current and distance from rivers (equal weight) as expansion with felling on P.L.

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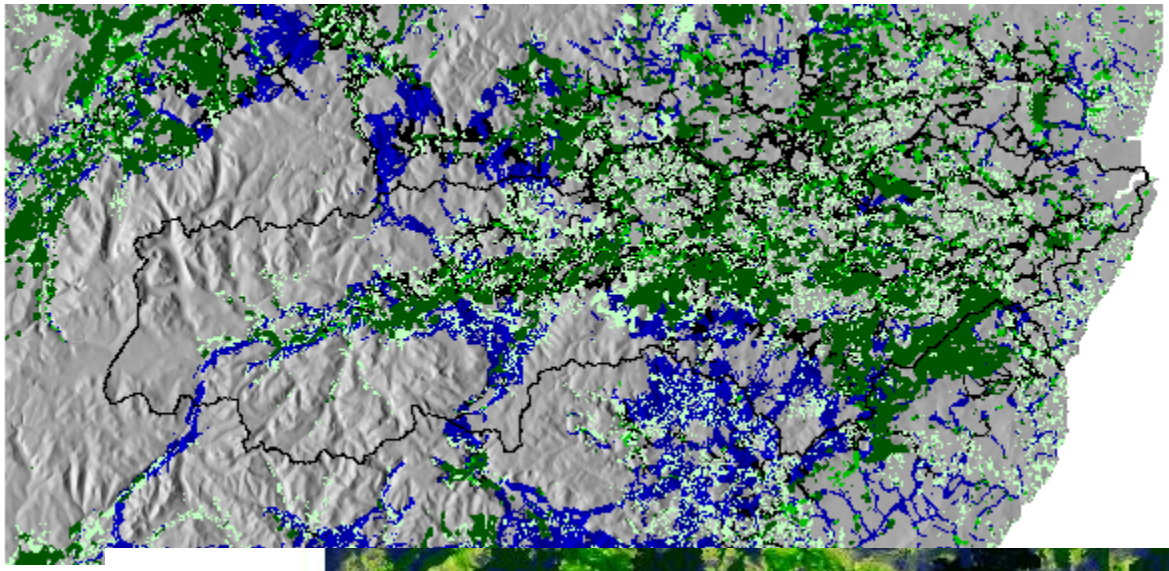

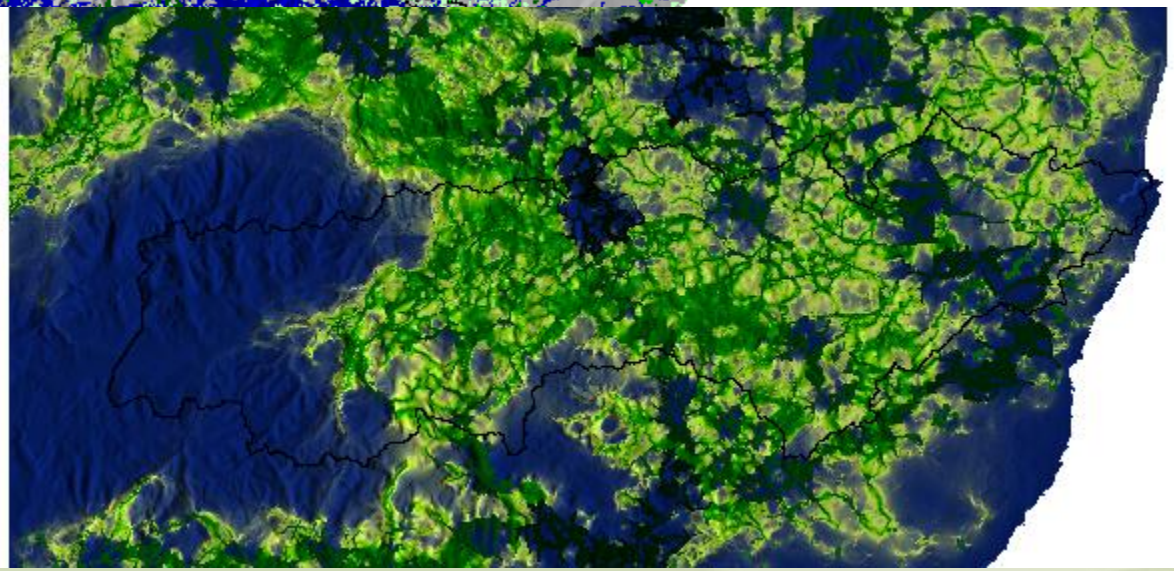

Expansion as plantations with felling on prime land

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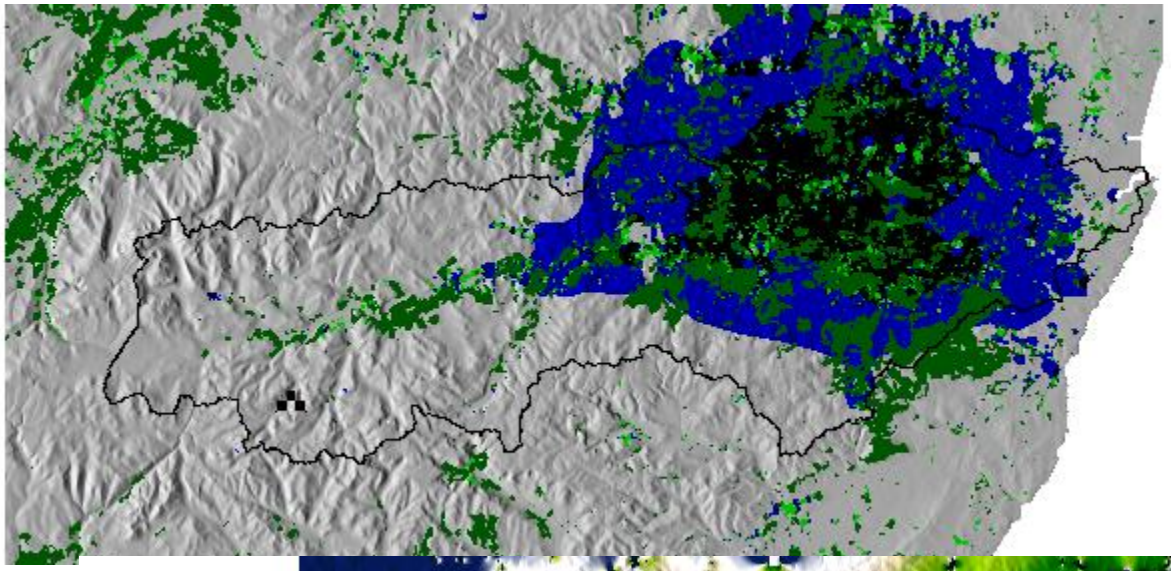
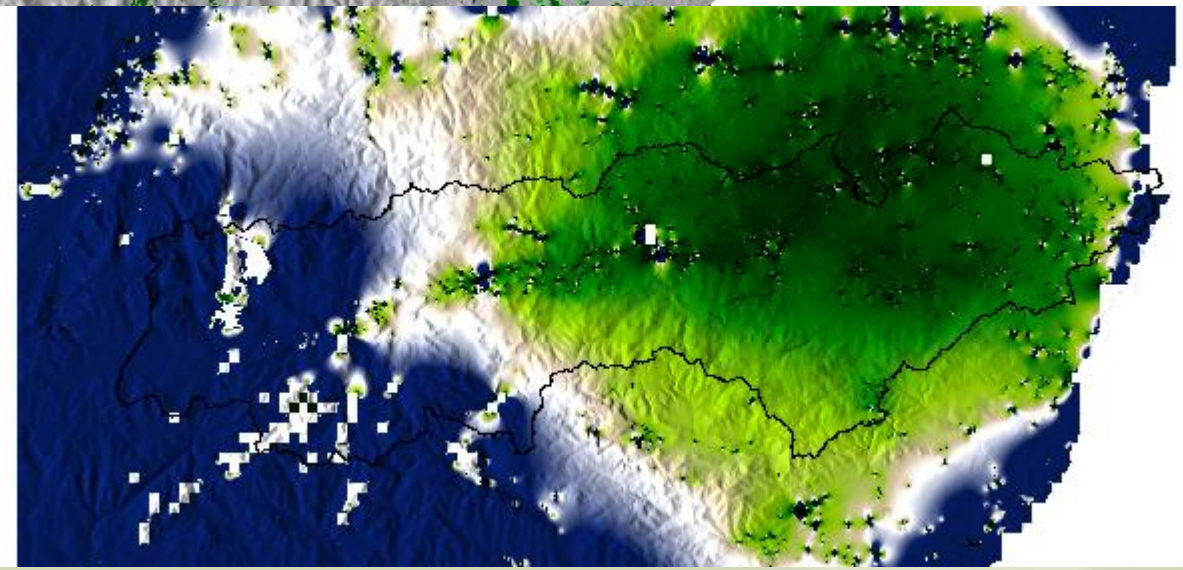
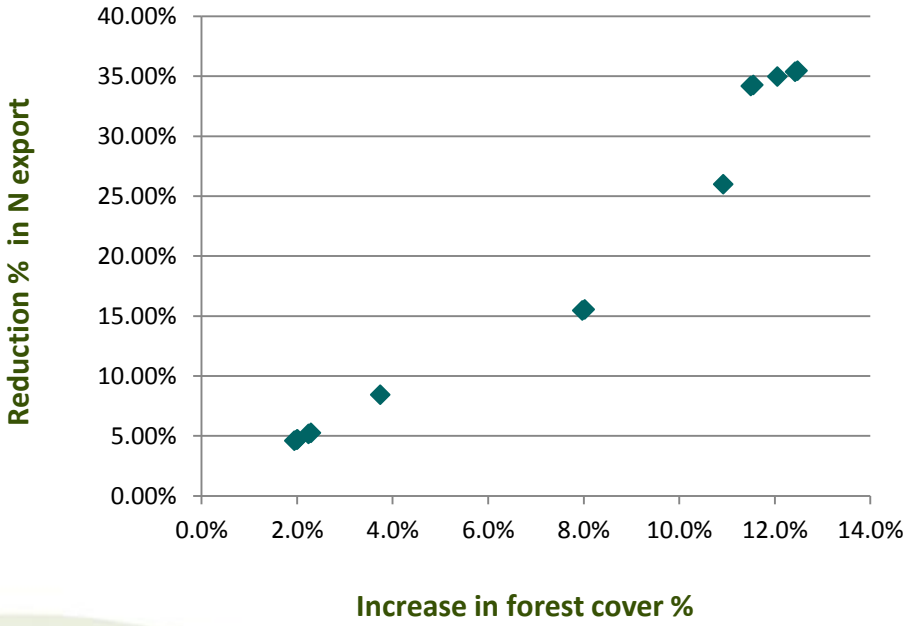


IPCC-SRES =~ NE



Ca 7 times less current/dispersal

Reduction in N export to the Dee



Conclusions

- Threats from land use change from interaction of global and local factors (land capability, land managers..)
- Woodland networks can have trade-offs and co-benefits wrt food, carbon and biodiversity + ecosystem services
- Future conflicts with food production and other LUs can be reduced and biodiversity enhanced with foresight about *where* and *how* to expand
- [We need to learn more about barriers and incentives wrt land managers]

Acknowledgements

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