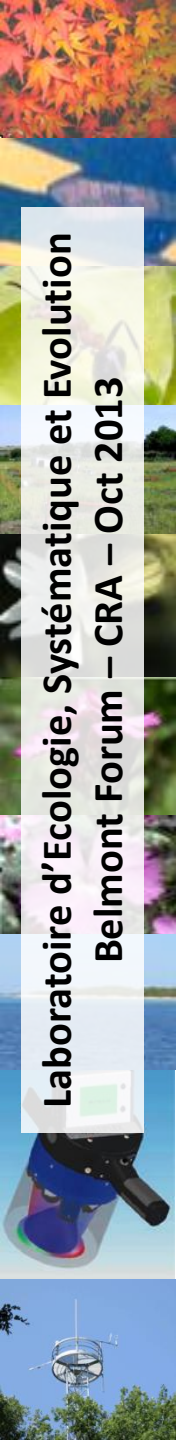


Laboratoire d'Ecologie, Systématique et Evolution
Belmont Forum – CRA – Oct 2013

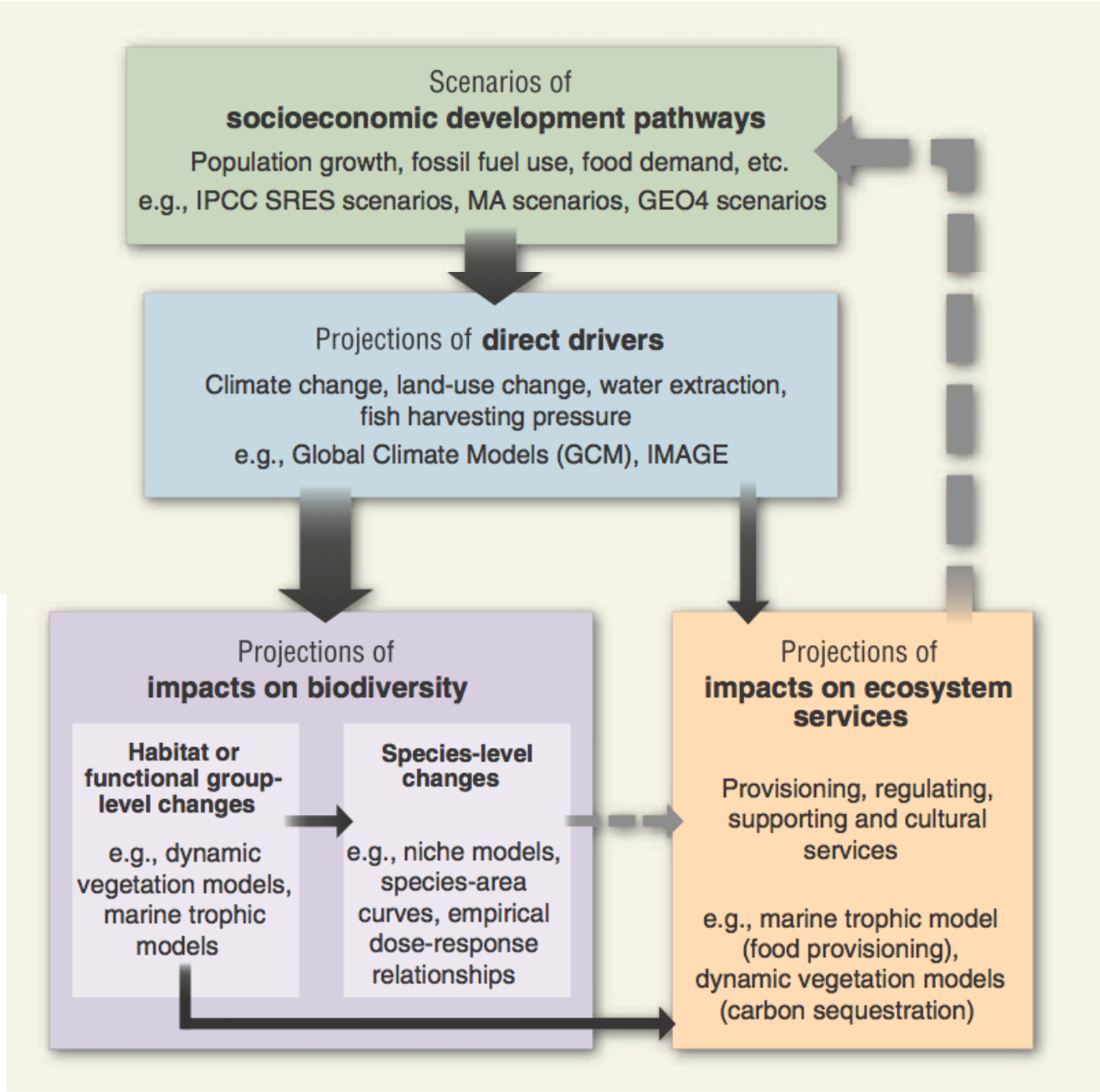
Overview of socio-economic scenarios and models of their impacts on biodiversity and ecosystem services

Paul Leadley
Univ. Paris-Sud

DIVERSITAS
an international programme
of biodiversity science

Future Earth
research for global sustainability

bioDISCOVERY
a core project of DIVERSITAS



Scenarios & Models of Global Change, Biodiversity and Ecosystem Services

Pereira, Leadley et al. 2010. Science.

Overview of scenarios and models of biodiversity and ecosystem services

- **Making socio-economic scenarios more relevant for decision making.**

- **Improving confidence in and the usefulness of projections of biodiversity and ecosystem services and their impacts on human well-being.**

- **Using scenarios and models of biodiversity and ecosystem services to help anticipate, avoid, and manage disruptive global environmental change.**

- **Using scenarios and models to provide insights into the institutional, economic, and behavioural changes to enhance the capacity of social–ecological systems to adapt and support biodiversity and ecosystem services under global change.**
-

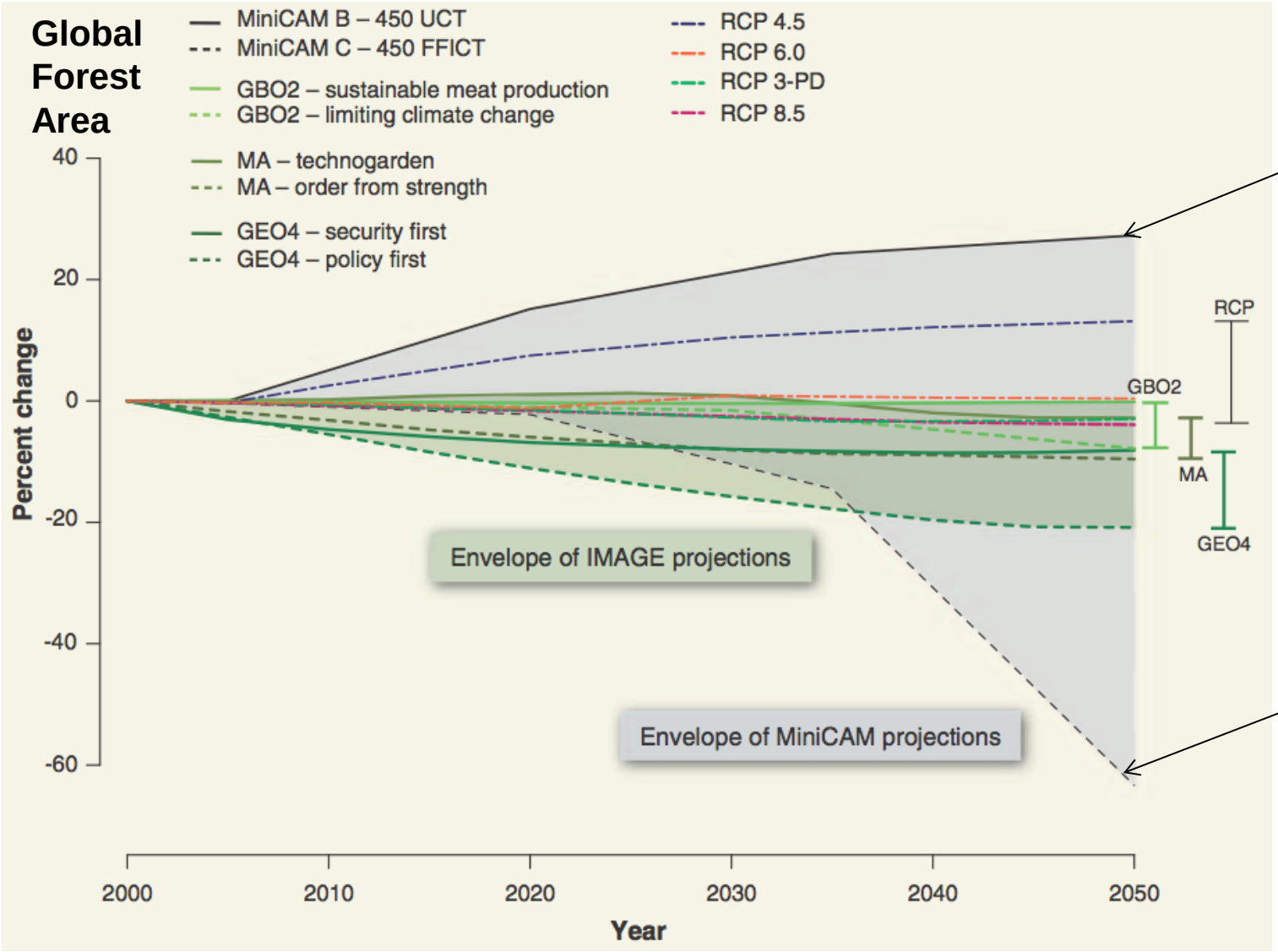
Socio-economic scenarios:

Developing policy relevant scenarios and Harmonizing across spatial and temporal scales

Methods for looking into the future

- **Qualitative scenarios – e.g., based on case studies and national commitments**
- **Extrapolations from current trends – statistical**
- **Extrapolations from current trends – with hypotheses or probablistic**
- **Socio-economic storylines - e.g. MA, GEO, IPCC storylines.**
- **Storylines + policy options - e.g., Rethinking scenarios**
- **Backcasting analyses: working backwards from sustainable endpoints - e.g., Rio+20 scenarios**

Socioeconomic scenarios



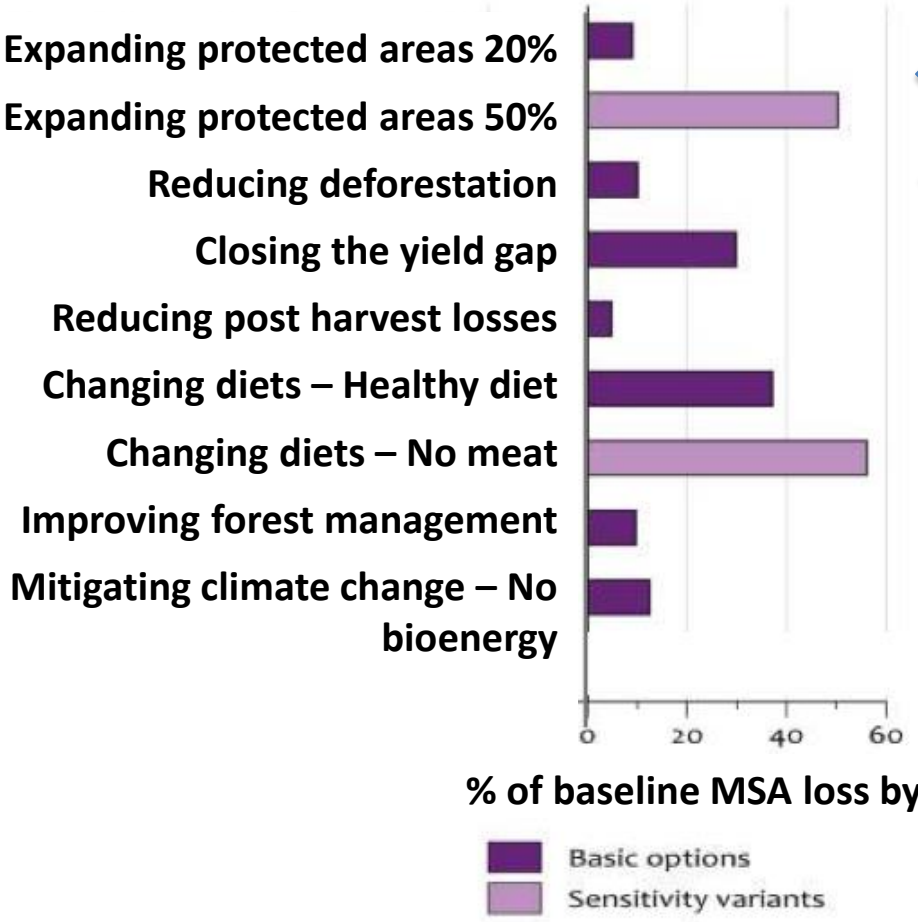
Tax on all sources of C emissions: Limited biofuels, Increased agric. efficiency,

Tax only on fossil fuel C emissions: Massive deployment of biofuels; Little improvement in agric. efficiency,

Pereira, Leadley et al. 2010 Science

Testing impacts of changes in development pathways that are 'Aichi relevant'

Prevented biodiversity loss (MSA)



Target 11. Protected areas

Target 5. Habitat loss

Target 7. Sustainable mgmt

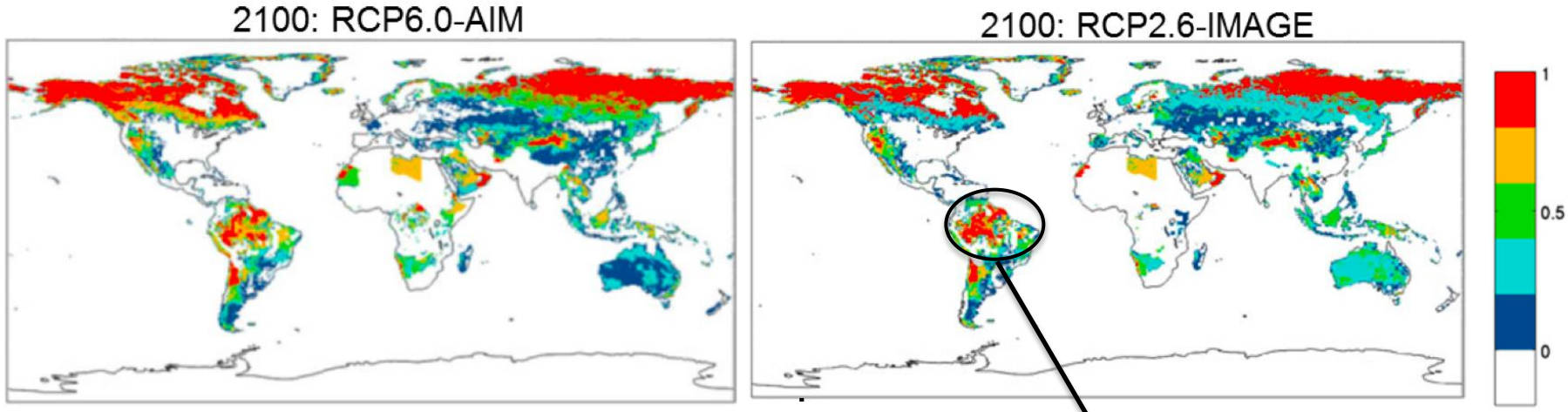
+ broadly Target 4: Sustainability

From B. ten Brink

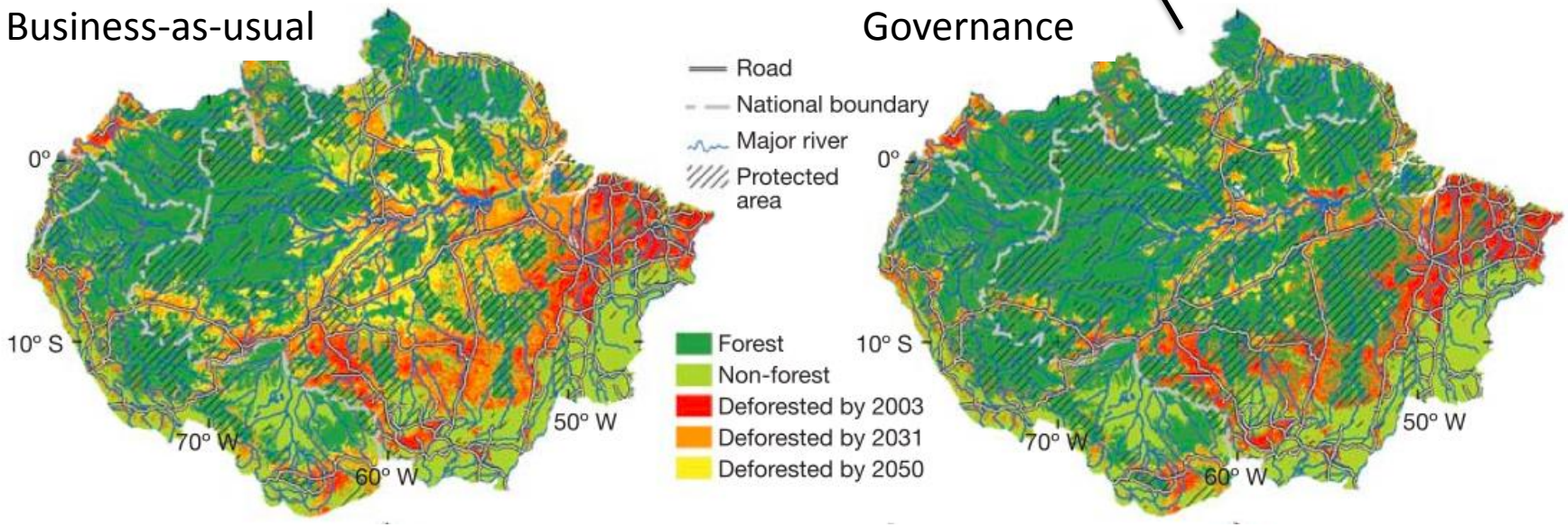
PBL Netherlands Environmental Assessment Agency

Scaling and harmonizing socio-economic scenarios

IPCC AR5 RCP land use



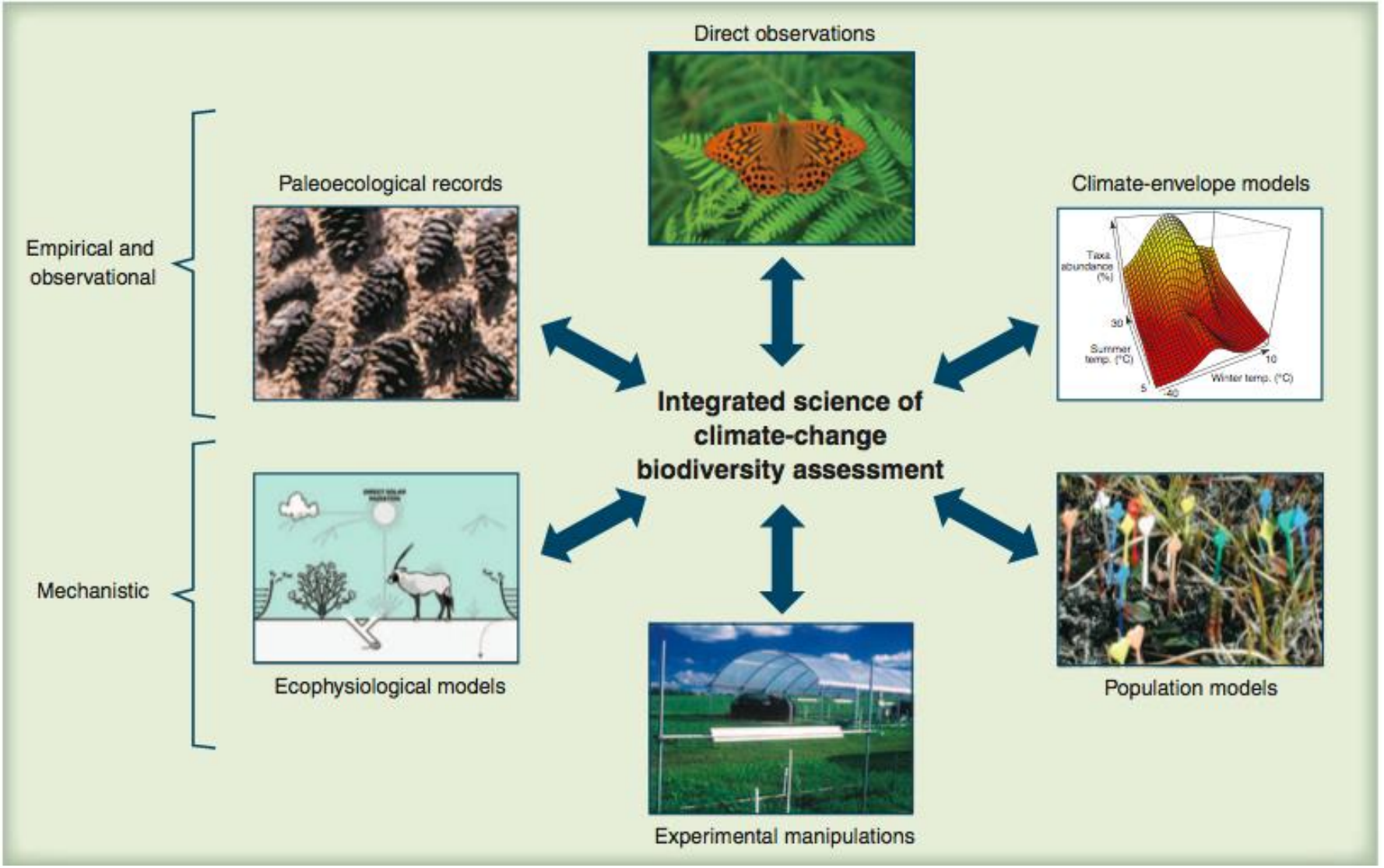
Amazon basin scenarios 2050



Soares-Filho et al. 2006 Nature

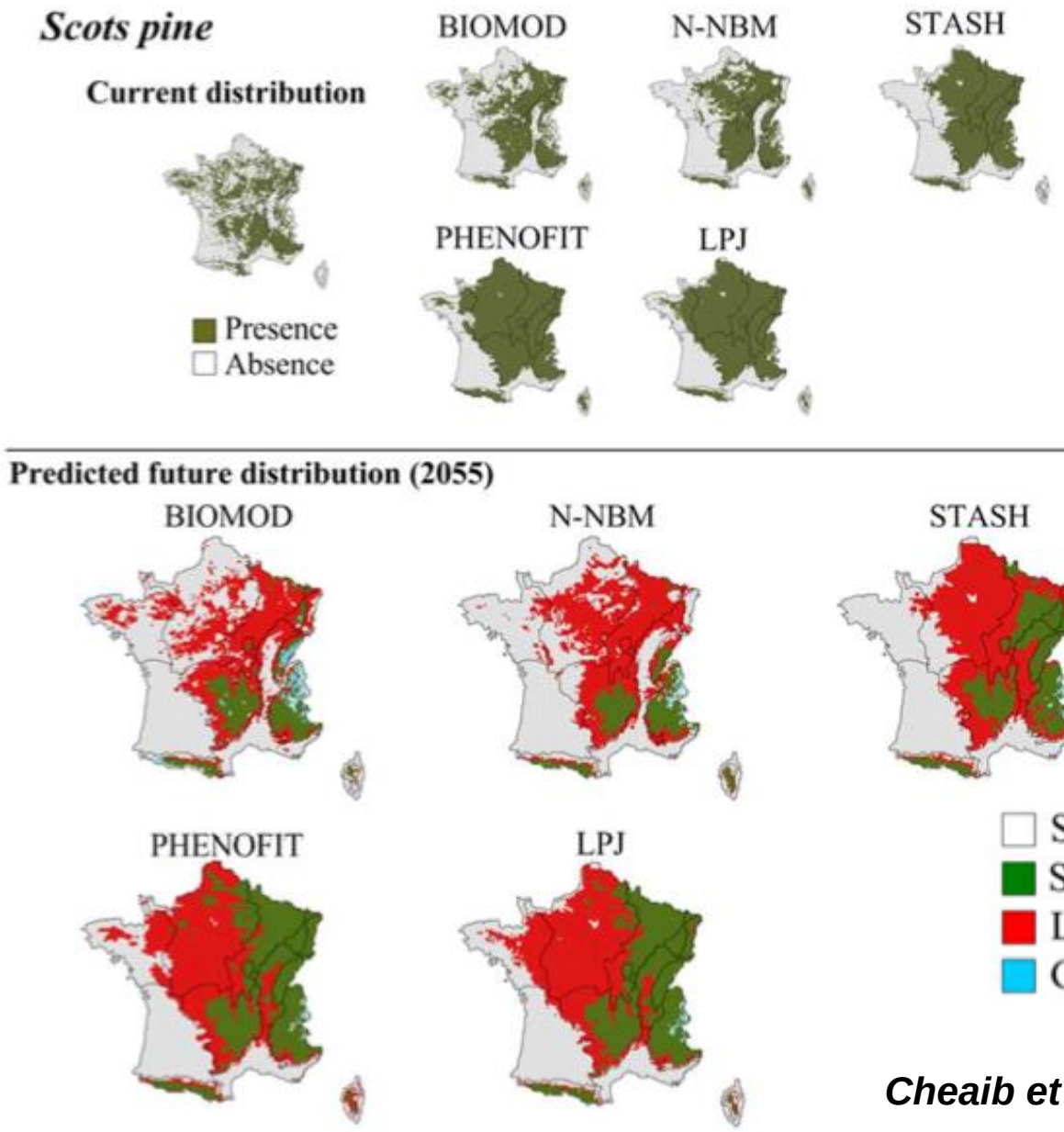
Models of global change impacts on biodiversity and ecosystem services

Models of climate change impacts on biodiversity & ecosystems: a need for better integration of models and data



Dawson et al. 2011 Science

Model intercomparison to help quantify uncertainty in climate change impacts on trees: Scots pine in 2055



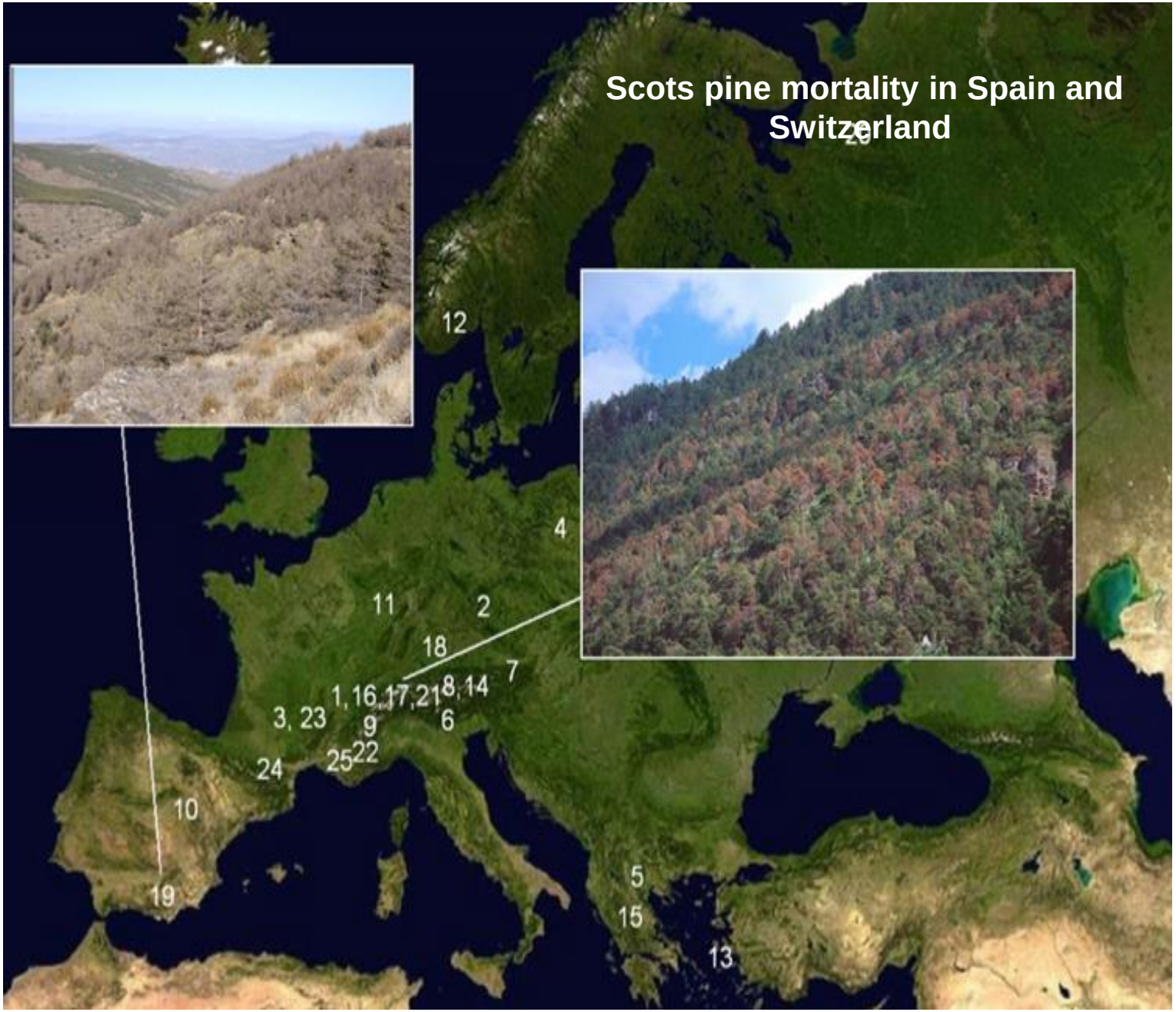
Climate

IPCC A1B SRES

Downscaled ARPEGE

+2.4 °C; -20 mm in monthly summer precip.

Cheaib et al. 2012 Ecology Letters



Evidence of a global scale increase in tree mortality

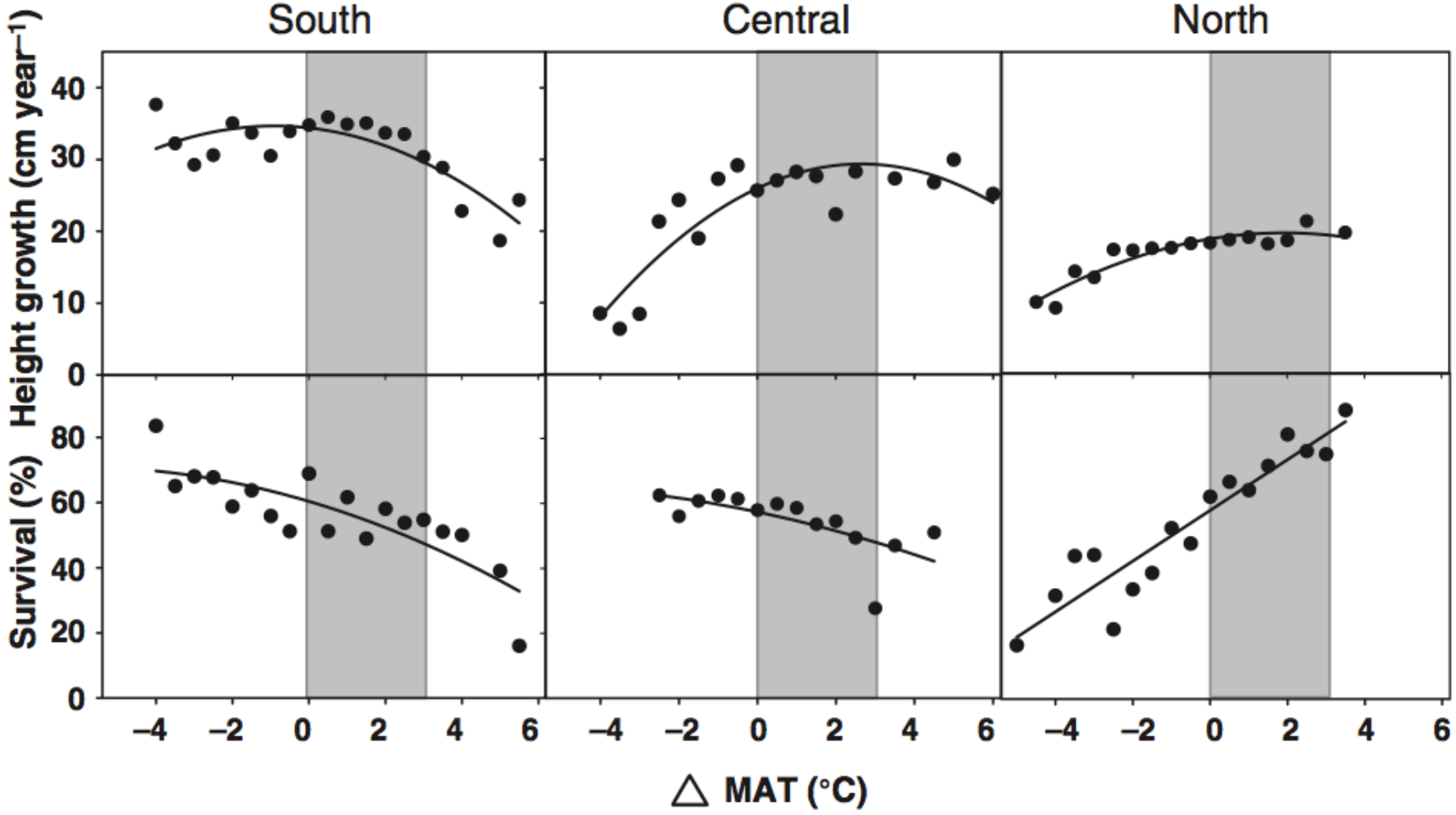
Allen et al. 2010

Ecology Letters, (2008) **11**: 588–597 doi: 10.1111/j.1461-0248.2008.01172.x

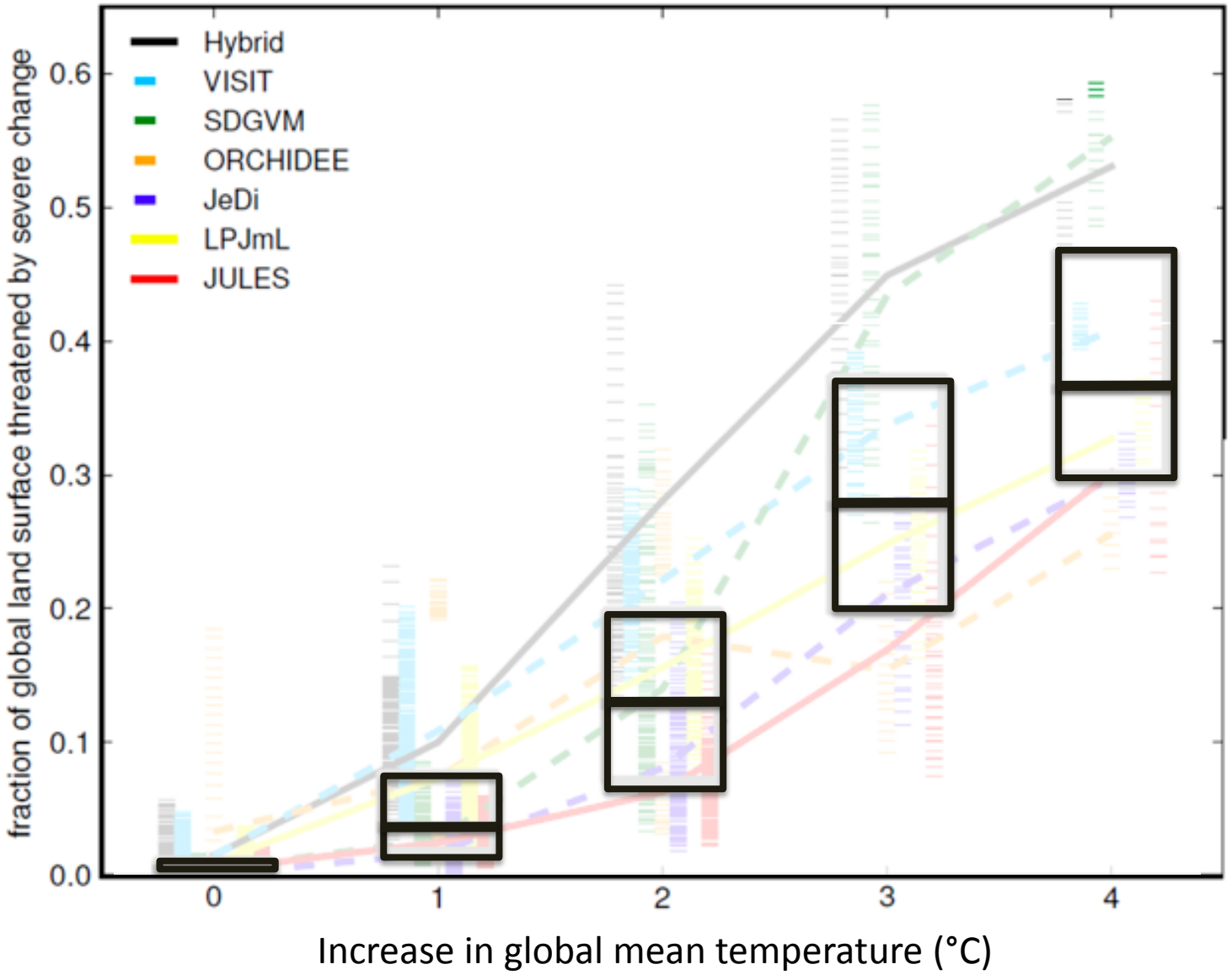
LETTER

Climate warming will reduce growth and survival of Scots pine except in the far north

P. B. Reich[1]* and J. Oleksyn[1,2]

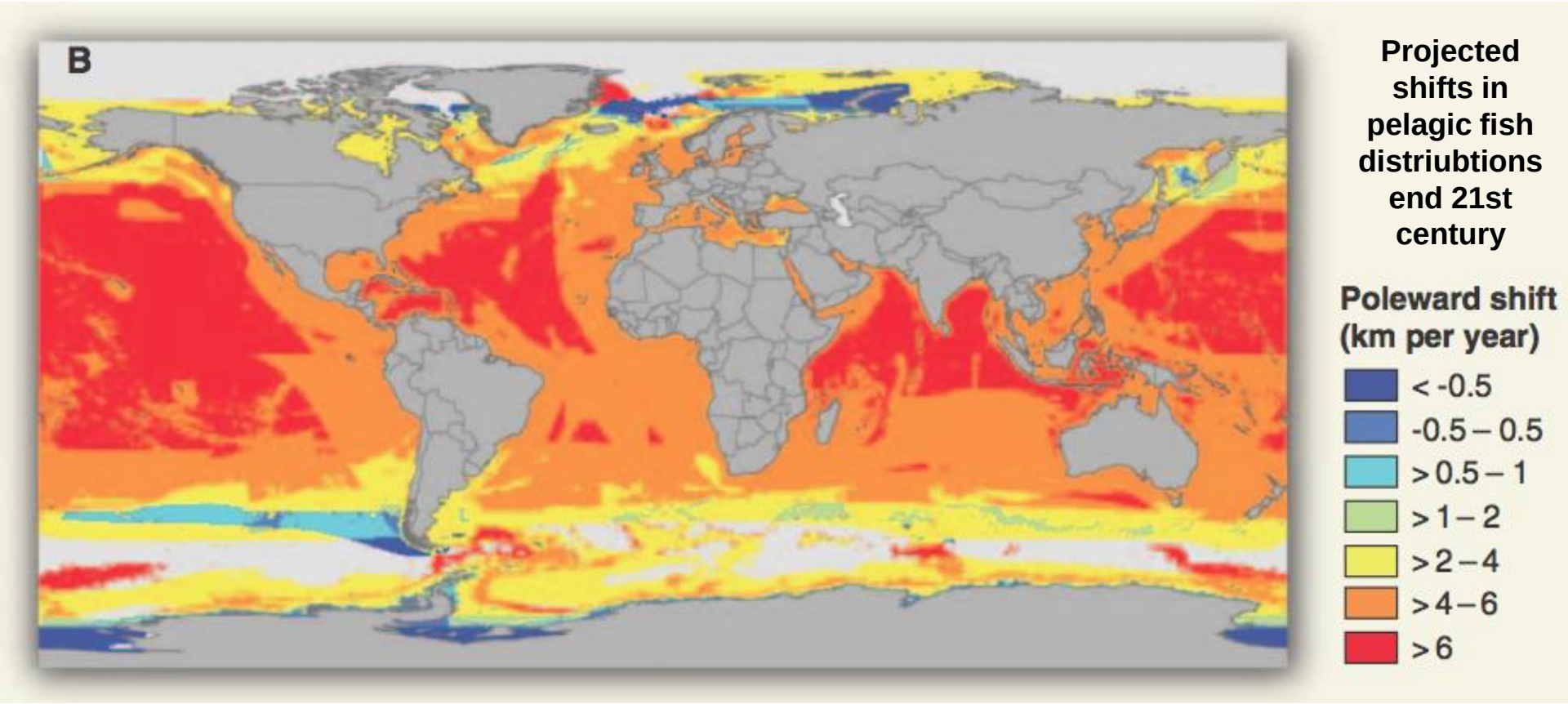


Biodiversity and ecosystem function at larger scales
Using Dynamic Vegetation Models



Linking scenarios and models of biodiversity, ecosystem services and human well being

PROJECTED SHIFTS IN THE DISTRIBUTION OF SPECIES, SPECIES GROUPS AND BIOMES



Source: Pereira, Leadley et al. 2010 Science. Based on Cheung et al. 2009. IPCC SRES A1B scenario.

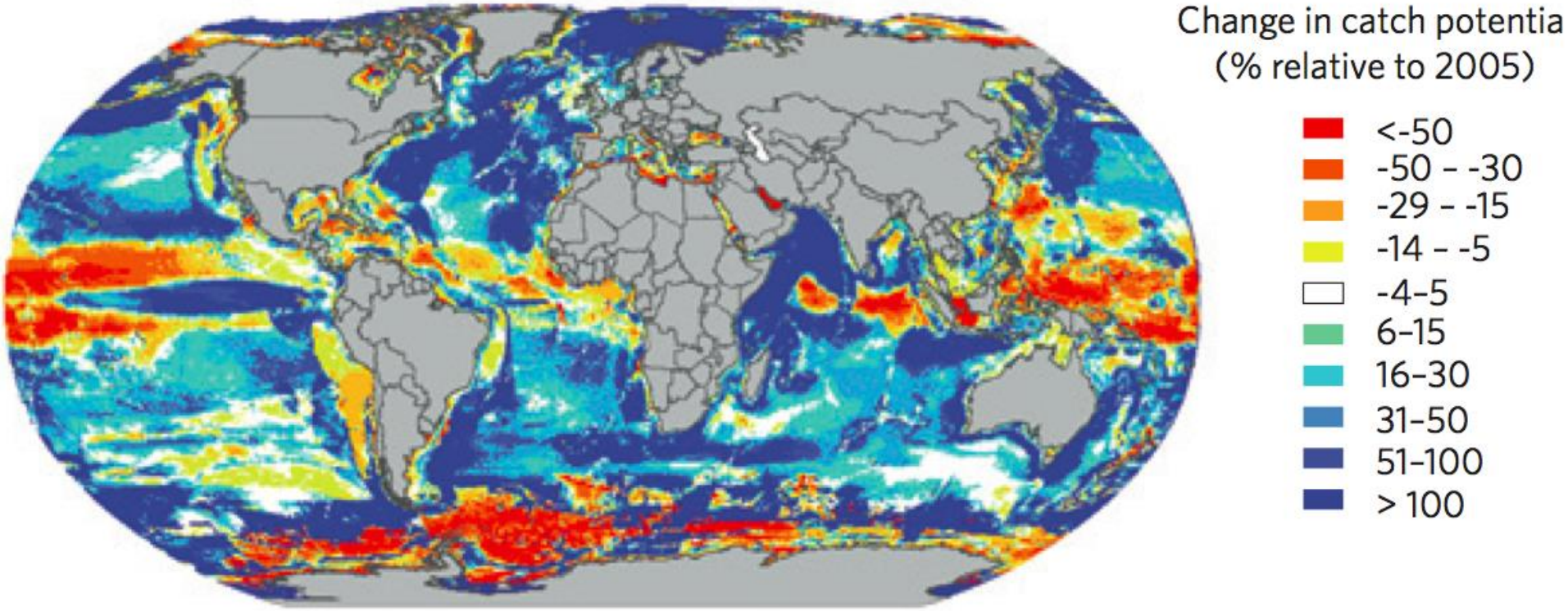
nature climate change

REVIEW ARTICLE

PUBLISHED ONLINE: 20 NOVEMBER 2011 | DOI: 10.1038/NCLIMATE1301

Climate change impacts on the biophysics and economics of world fisheries

U. Rashid Sumaila[1]*, William W. L. Cheung[2], Vicky W. Y. Lam[1], Daniel Pauly[2] and Samuel Herrick[3]

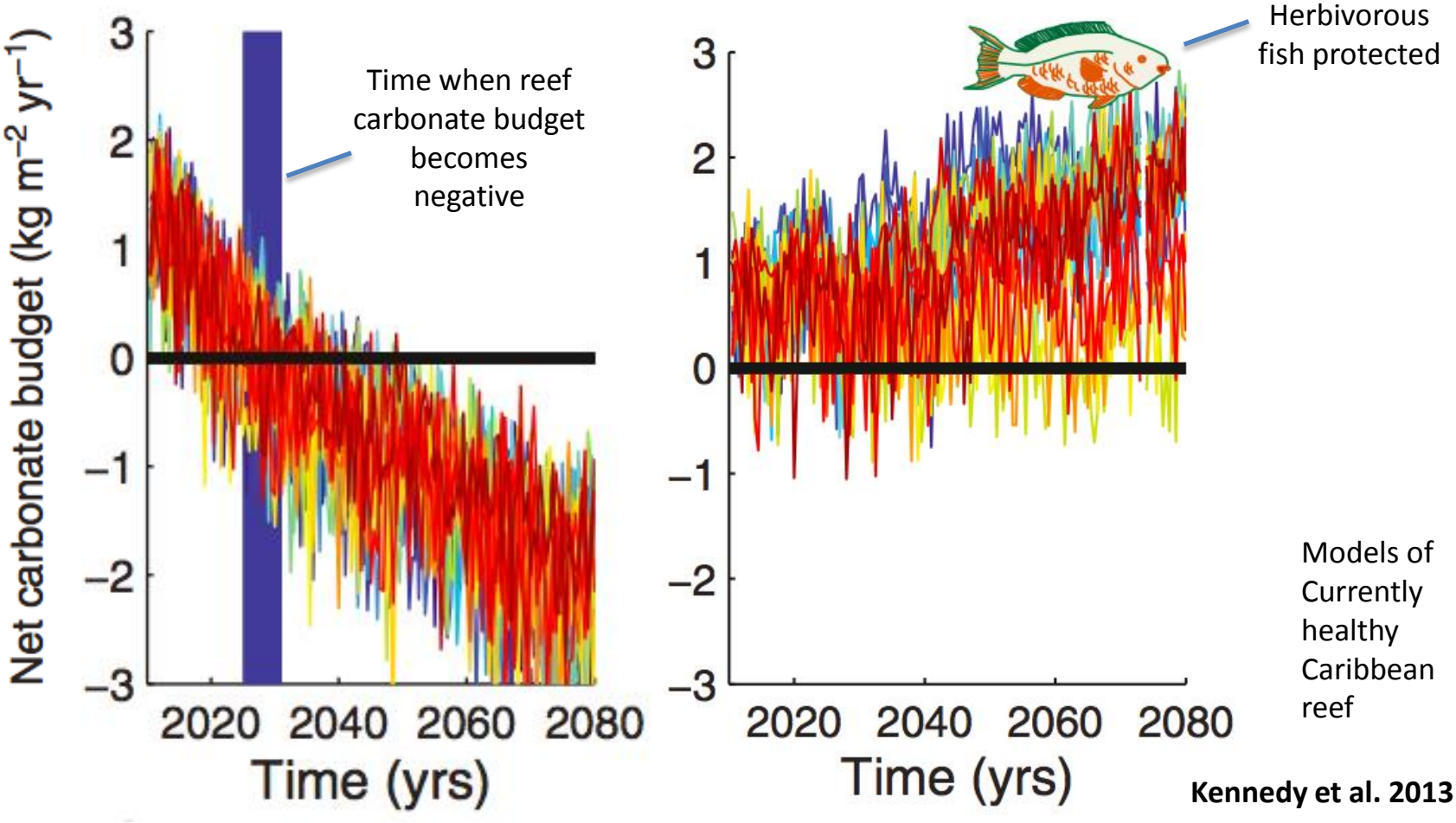


Target 10 - Actions to prevent tropical coral reef degradation

Global action (climate mitigation) and
Local action (protection of herbivorous fish) are need

Business as usual GHG emissions

Low Greenhouse Gas (GHG) emissions



Kennedy et al. 2013

‘Backcasting’ as an innovative way to explore alternative pathways for reaching agreed upon objectives

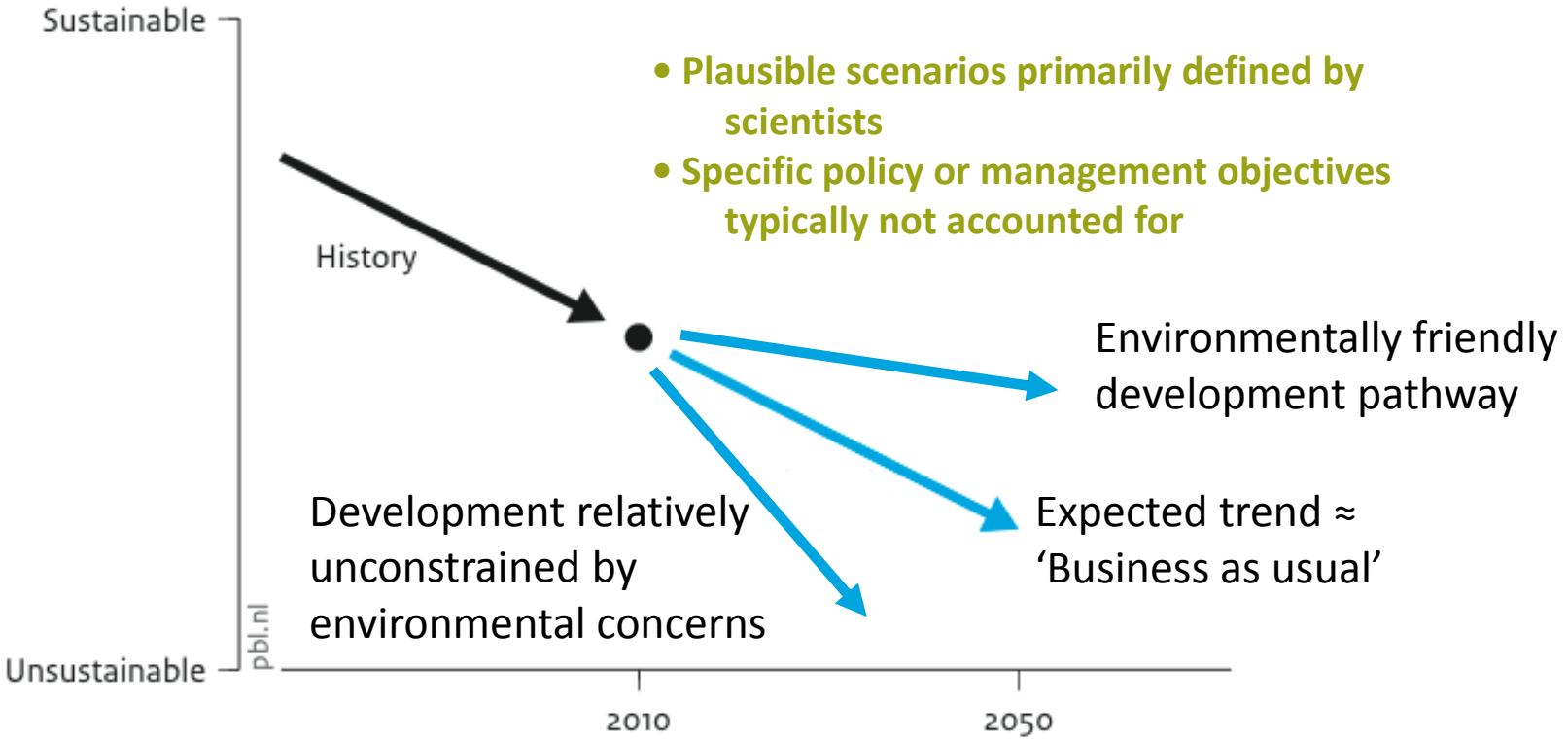
PBL Netherlands Environmental Assessment Agency

Roads from Rio+20

Pathways to achieve global sustainability goals by 2050

The ‘Storyline’ approach to developing plausible socio-economic scenarios

- **Plausible scenarios primarily defined by scientists**
- **Specific policy or management objectives typically not accounted for**



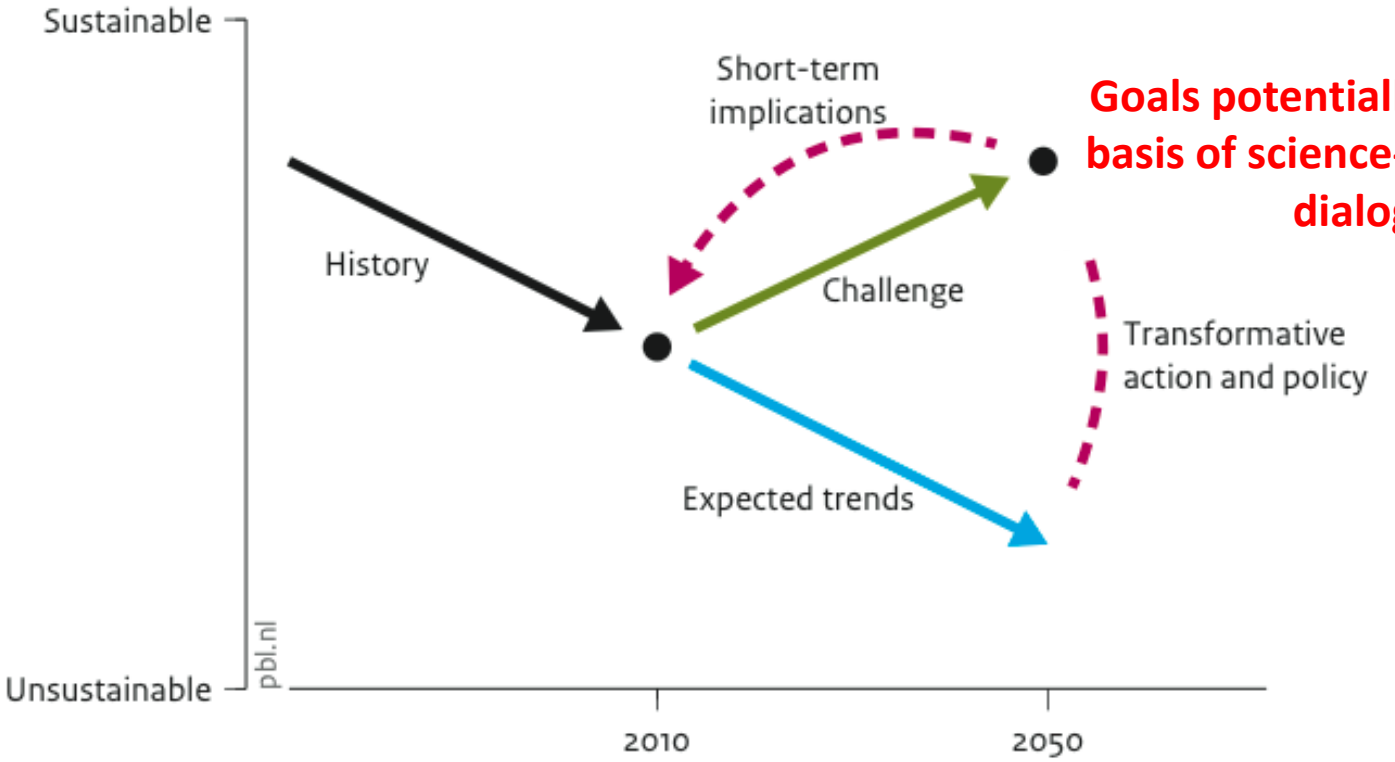
‘Backcasting’ as an innovative way to explore alternative pathways for reaching agreed upon objectives

PBL Netherlands Environmental Assessment Agency

Roads from Rio+20

Pathways to achieve global sustainability goals by 2050

Backcasting analysis, working back from a sustainable end point to determine actions for today

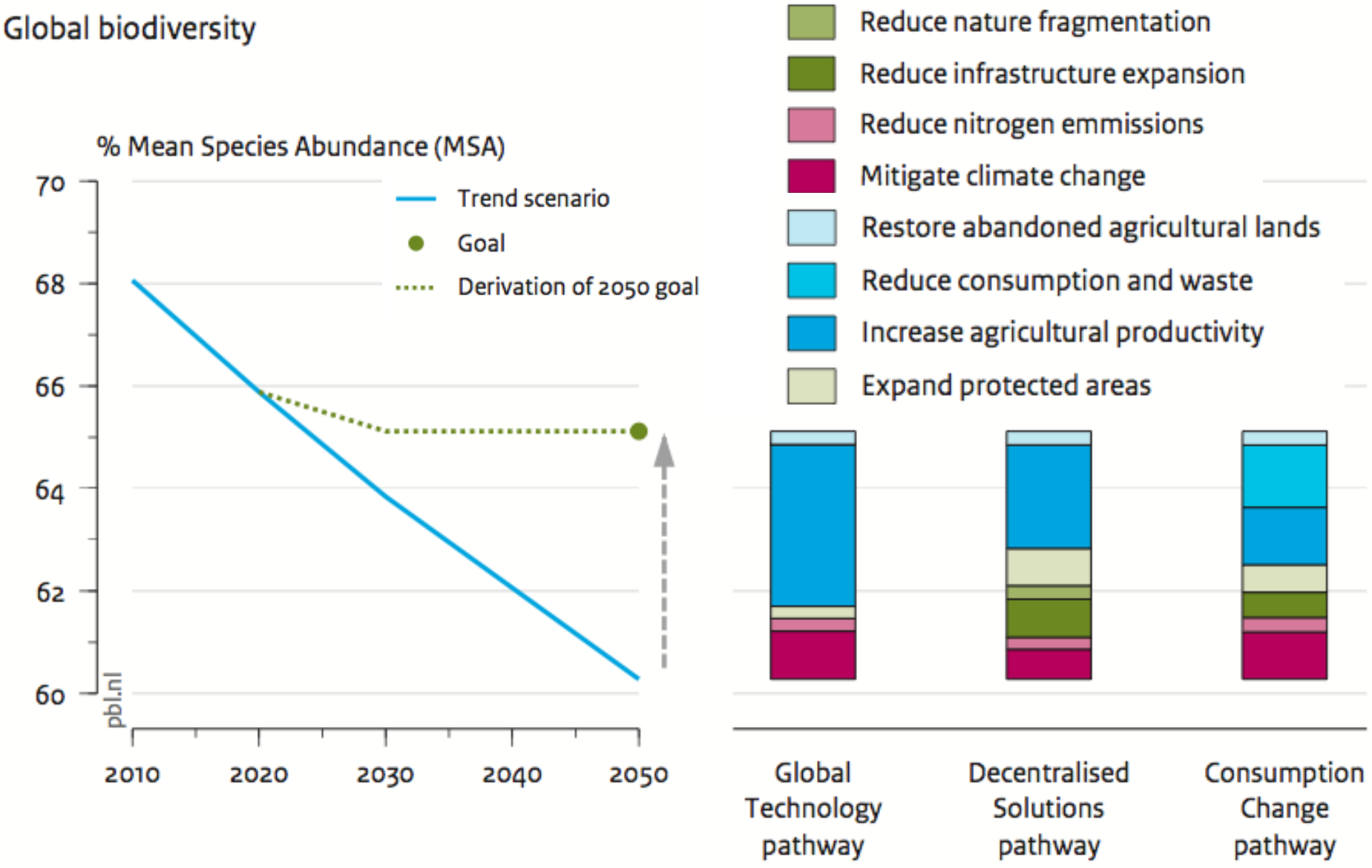


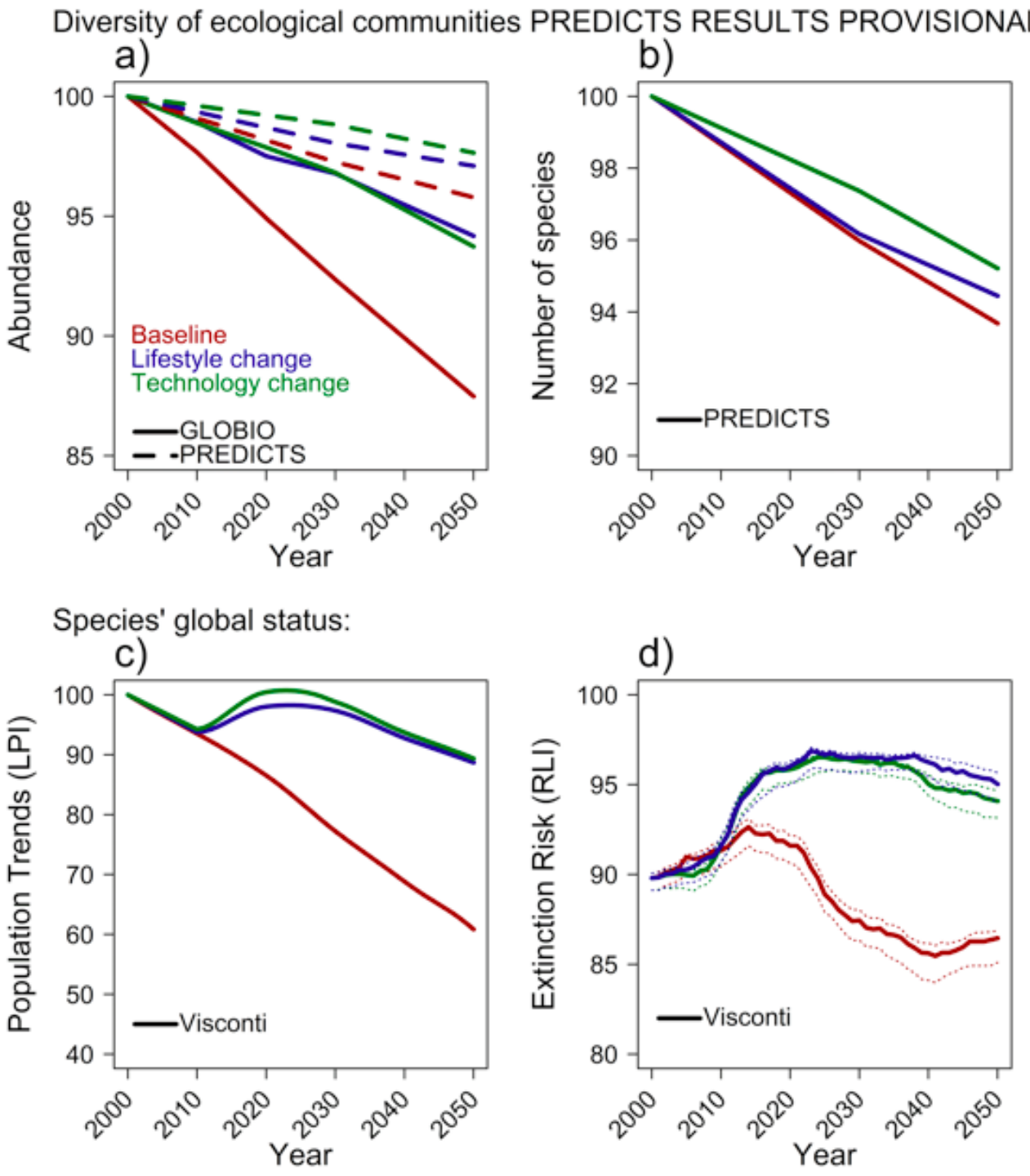
Goals potentially set on the basis of science-stakeholder dialogs

PBL Netherlands Environmental Assessment Agency

Roads from Rio+20
Pathways to achieve global sustainability goals by 2050

Global biodiversity and options to prevent biodiversity loss





Comparing multiple indicies of impacts of global change on species conservation status using the Rio+20 socio-economic scenarios

Draft for the CBD Global Biodiversity Outlook

Overview of scenarios and models of biodiversity and ecosystem services

- **Scenarios and models of biodiversity and ecosystem services are a rapidly expanding field of research.**

- **There are several international networks focusing on these issues, for example DIVERSITAS, EU-COST Action Harmbio, SESYNC themes (US Socio-Environmental Synthesis Center), etc.**

- **There is a great need for international research projects especially in developing integrated scenarios and models at regional to global scales. This includes research in support of national, regional and global assessments.**