




Biodiversity impacts of bioenergy production:
a modelling approach using GLOBIO

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Key points

- Impacts of bioenergy production on biodiversity often neglected
- Trade-off between climate mitigation benefits and biodiversity impacts
- Indirect effects rarely assessed

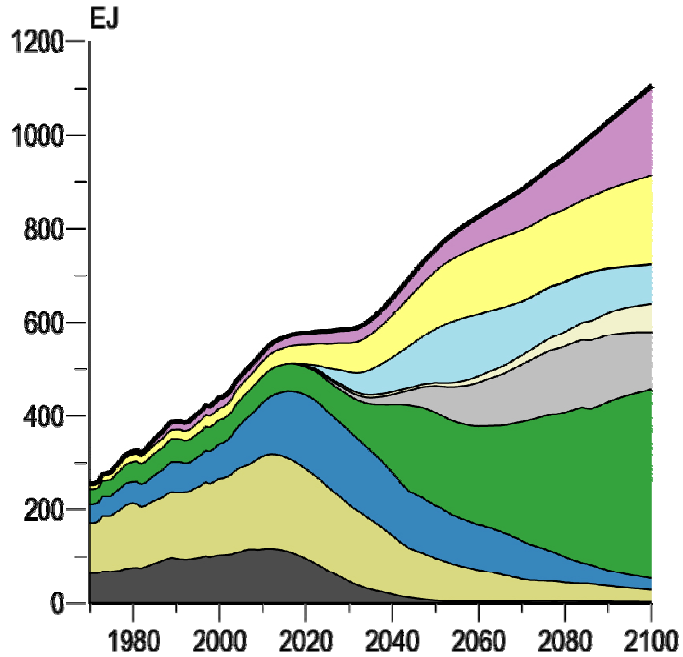
Introduction

Climate change mitigation
Energy security
Synergy for Biodiversity?

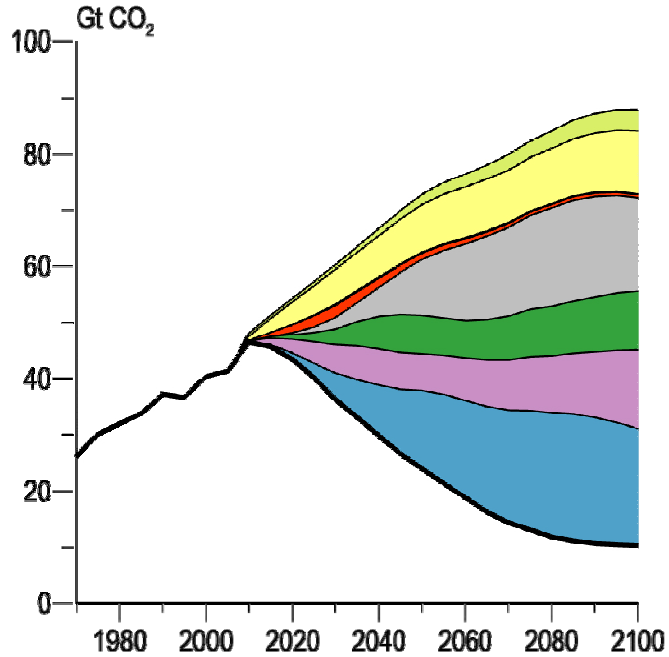
20% renewable energy target in EU by 2020, 10% for transport biofuels
30% biofuels in USA by 2030

Global energy consumption and reduction options for stabilising at 450 ppm

Global energy consumption



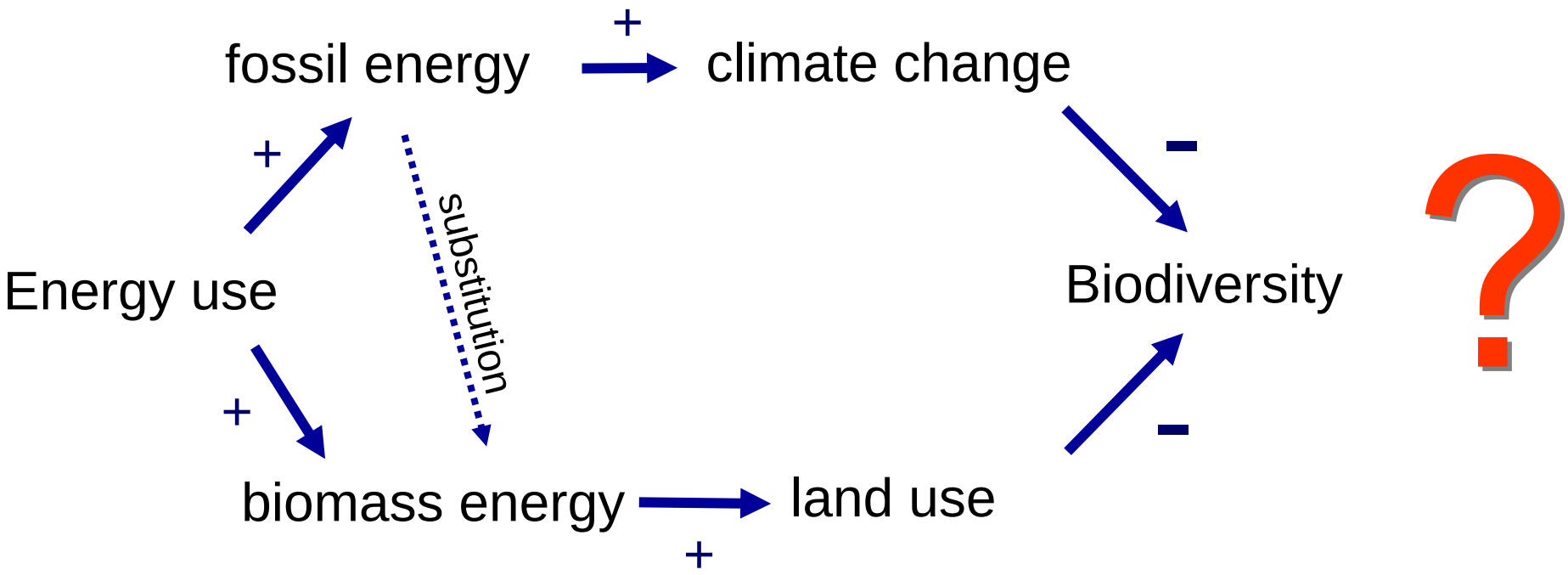
Contribution by reduction options



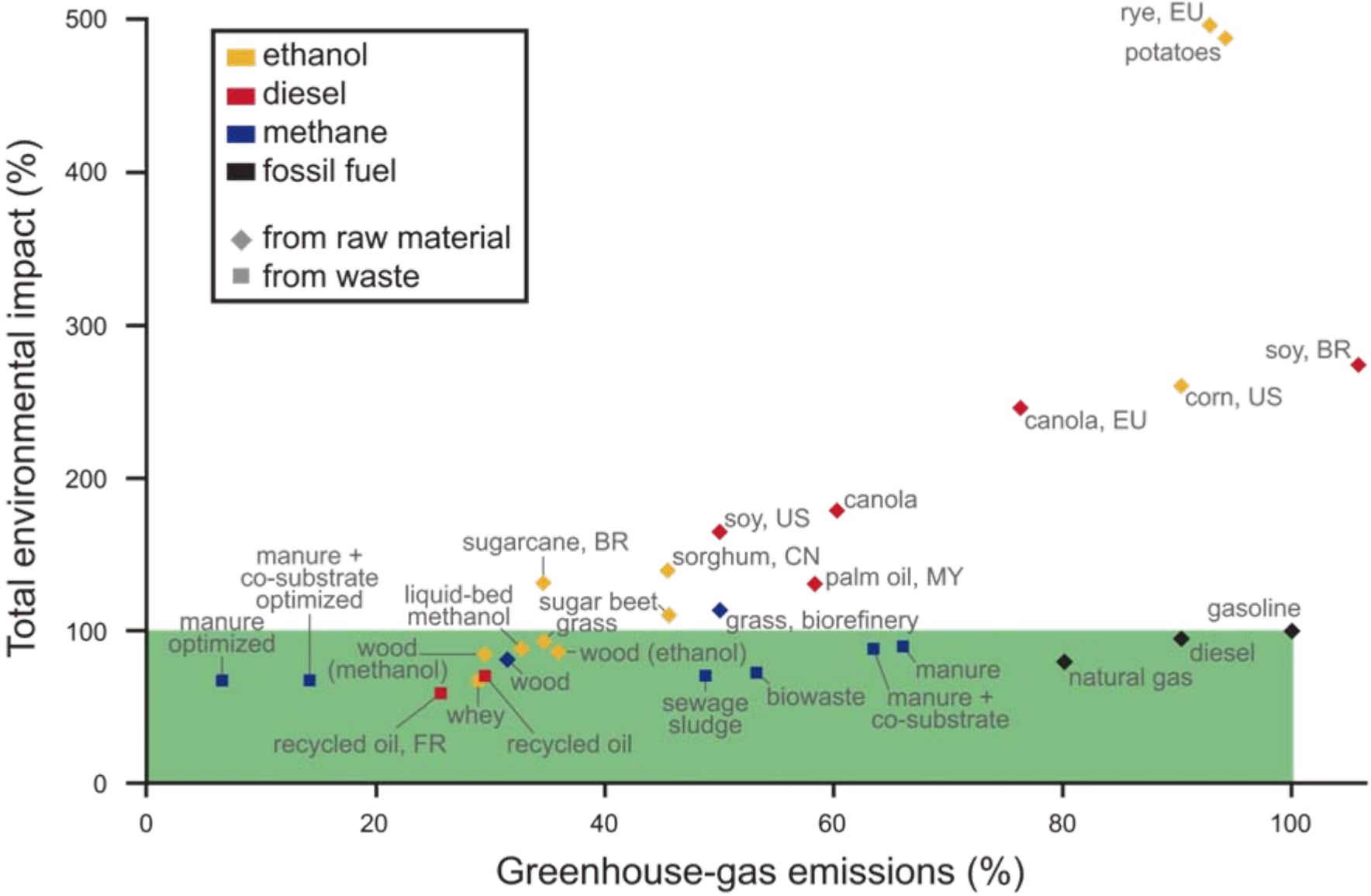
- Nuclear energy
- Renewables
- Bioenergy + capture & storage
- Gas + capture & storage
- Oil + capture & storage
- Coal + capture & storage
- Bioenergy
- Gas
- Oil
- Coal

- Carbon sinks
- Non-CO_2
- Other
- Fuel switch
- Capture & storage
- Bioenergy
- Sun, wind, nuclear energy
- Energy savings
- Emissions ceiling when stabilising at 450 ppm

Climate - bioenergy - biodiversity



How green are biofuels?



Zah *et al.* 2008, reviewed in Scharlemann & Laurance (2008) *Science*

GLOBIO

- Considers 5 pressures on biodiversity:
  land use
  climate change
  fragmentation
  infrastructure
  nitrogen deposition
- Biodiversity indicator
  Mean Species Abundance

  Linear dose - response relation for each pressure

Forest change and Biodiversity

Pristine forest

Selective logging

Secondary vegetation

Plantation

Degraded

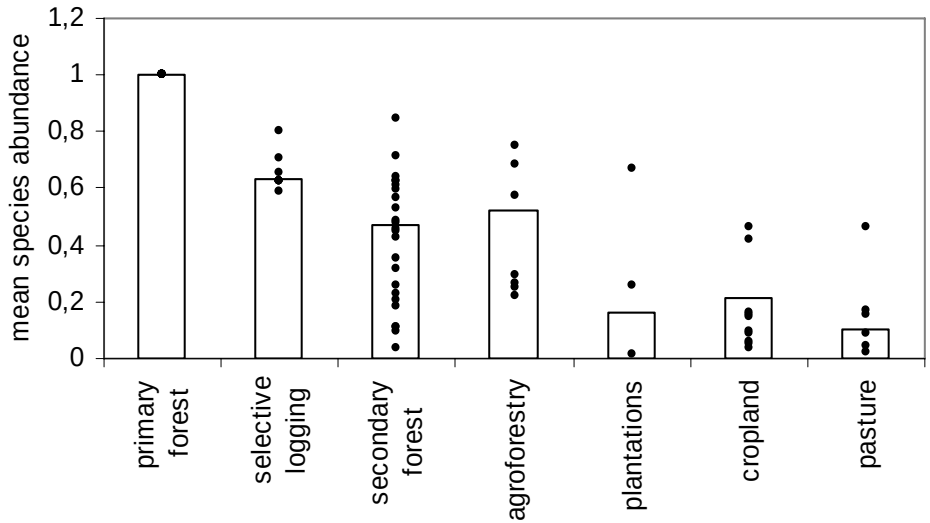
100%

50%

0%

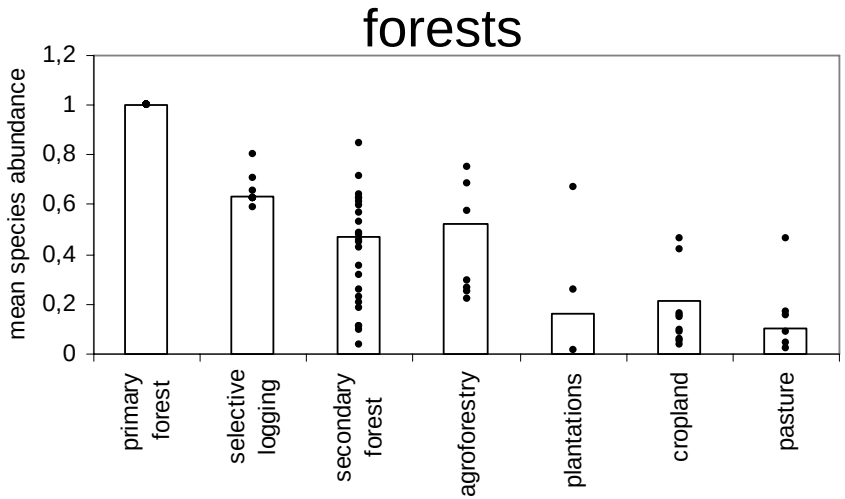
Biodiversity indicator
Mean species Abundance

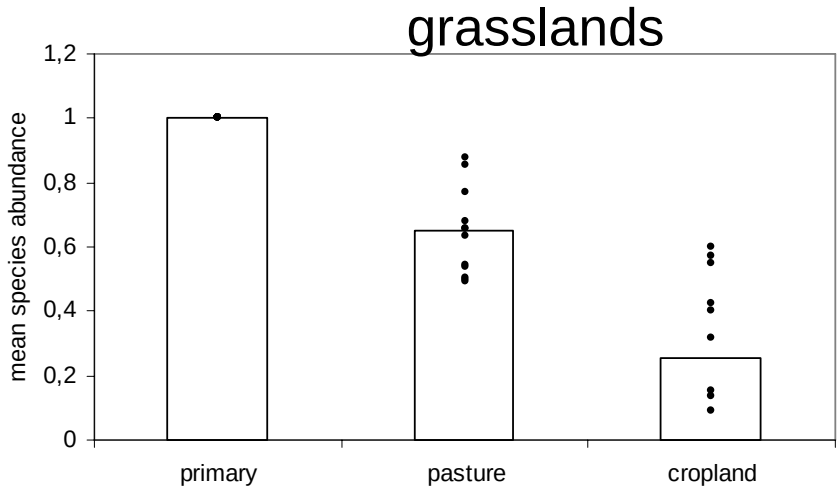
Literature review comparing disturbed and undisturbed sites
- Tropical & temperate regions
- 5700 species: 2100 plants, 1700 insects, 1300 birds, 150 other vertebrates



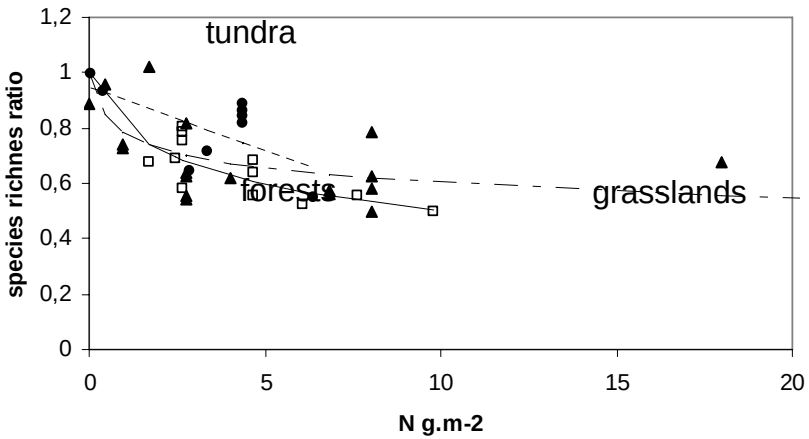
MSA Relationships for several pressures

Land use change

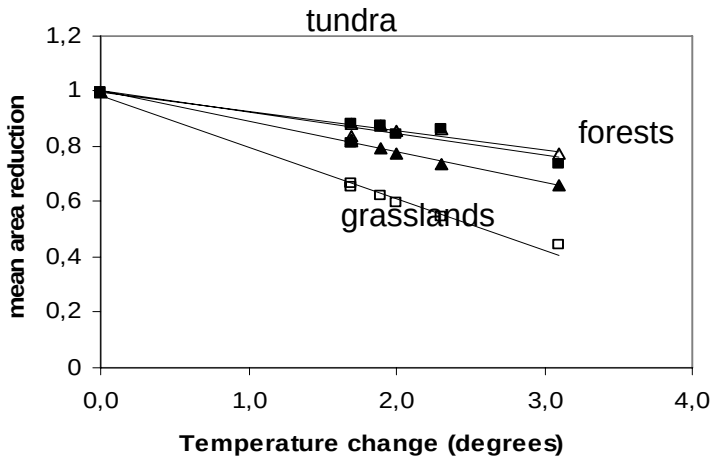




Nitrogen deposition

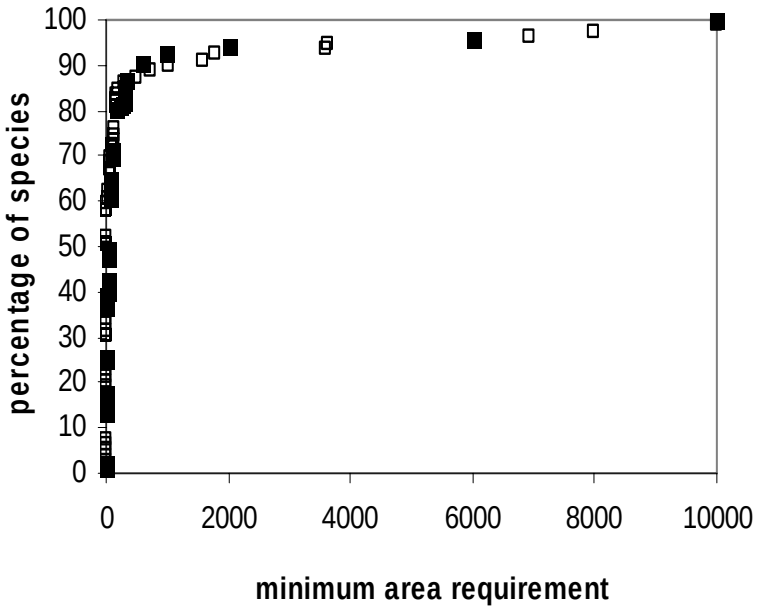


Climate



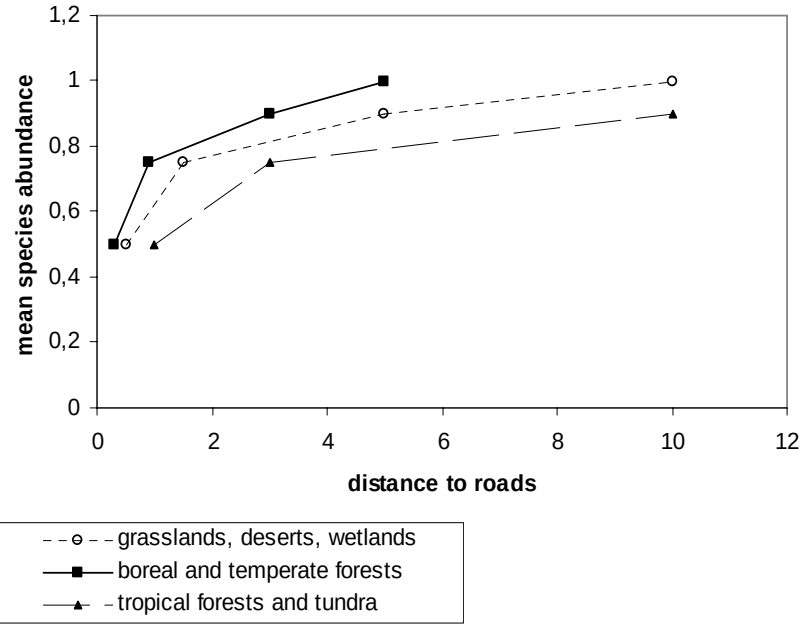
MSA Relationships for several pressures

Fragmentation

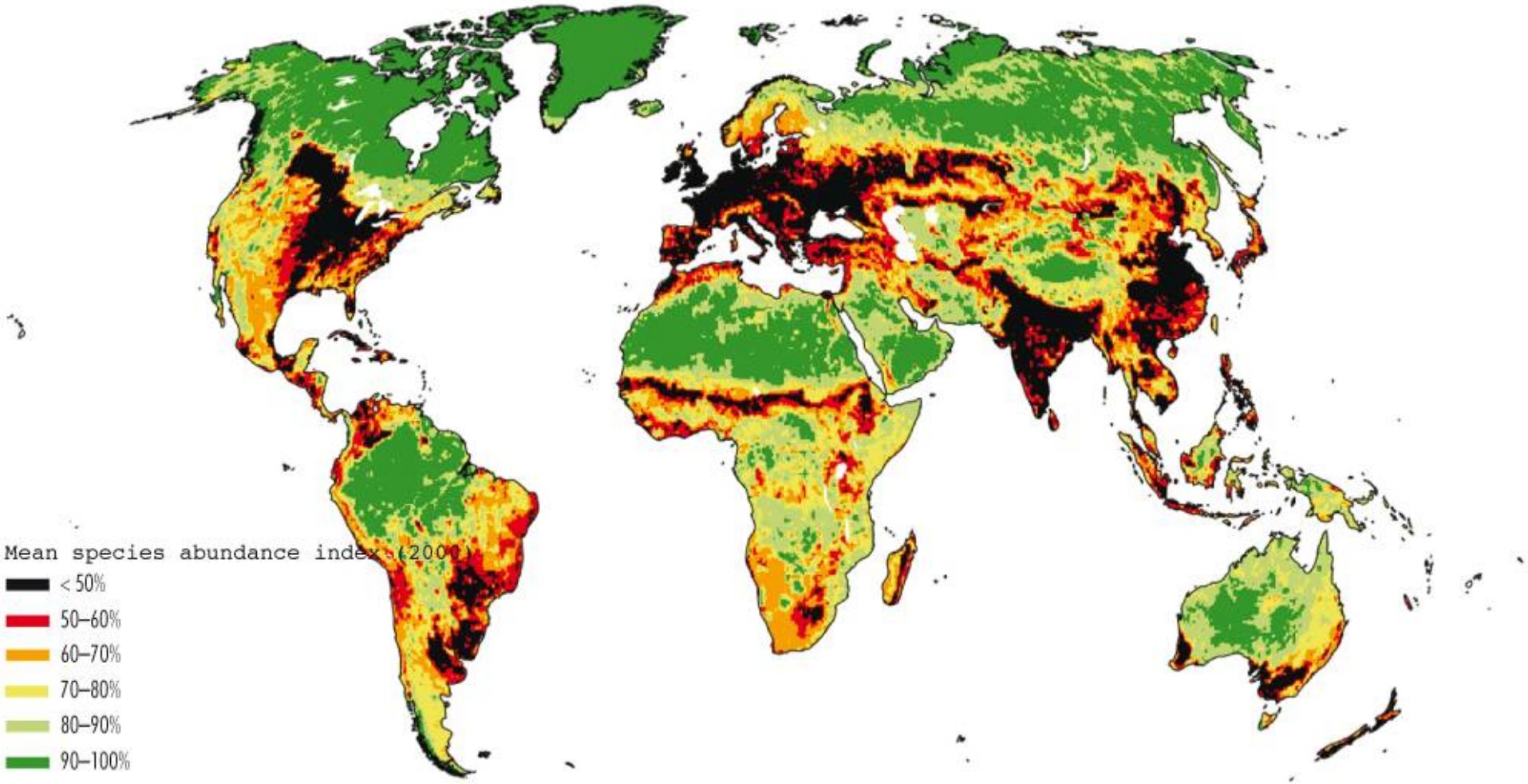


Patch size dependence

Infrastructure



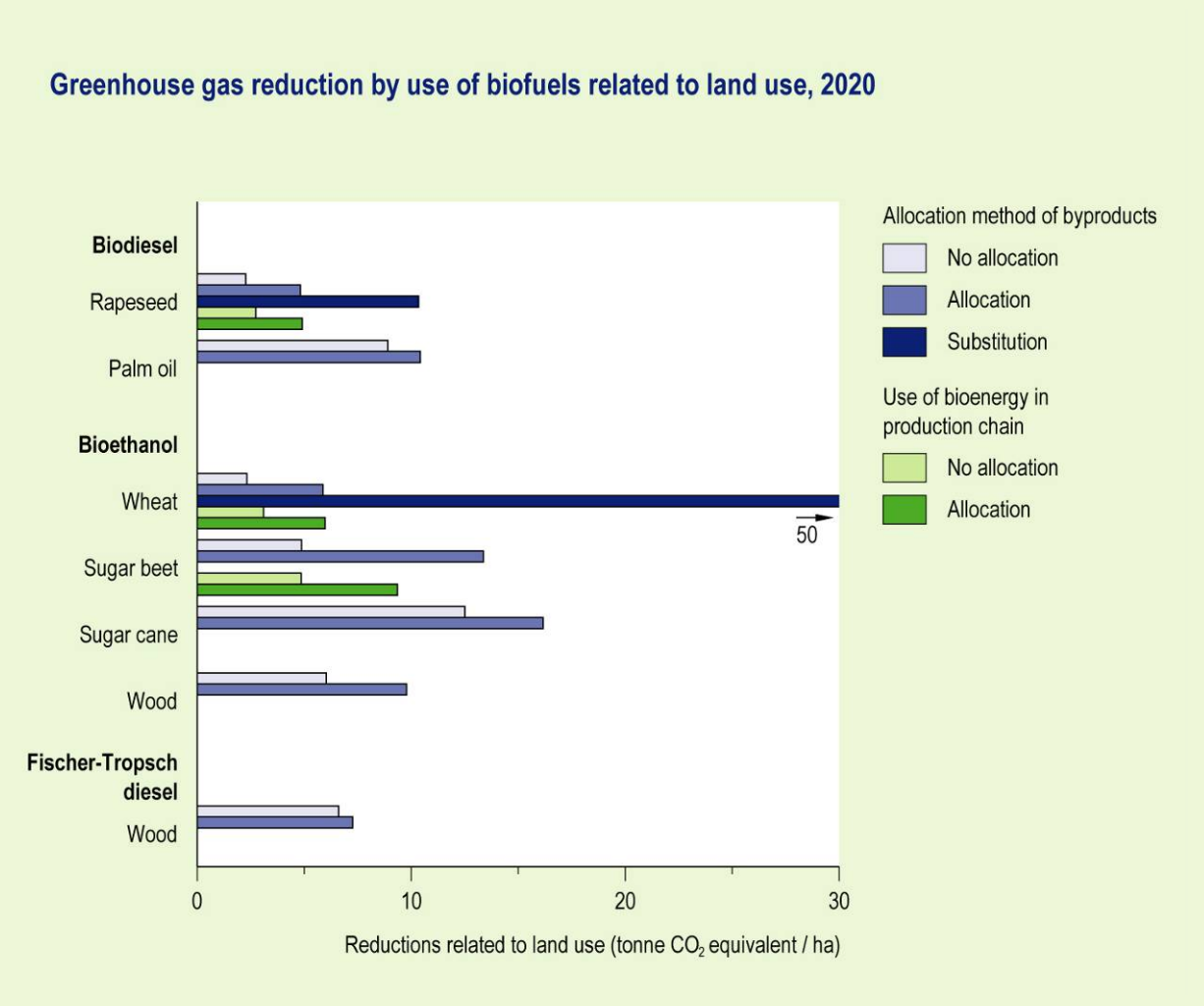
GLOBIO3


Mean species abundance index (2000)
< 50%
50–60%
60–70%
70–80%
80–90%
90–100%

Advantages & Limitations

- Operational tool to assess combined effects of pressures on biodiversity
- Quantification of relative combinations of different pressures
- Static, deterministic model
- Limited set of studies, not all biomes covered or species groups
- Dependent on quality of input data – FAO land use, IMAGE model, GLC2000 land cover
- Interactions not considered, also not invasive species, CO2 concentrations, exchange of species
- Species richness not considered
- Use species distribution and abundance data

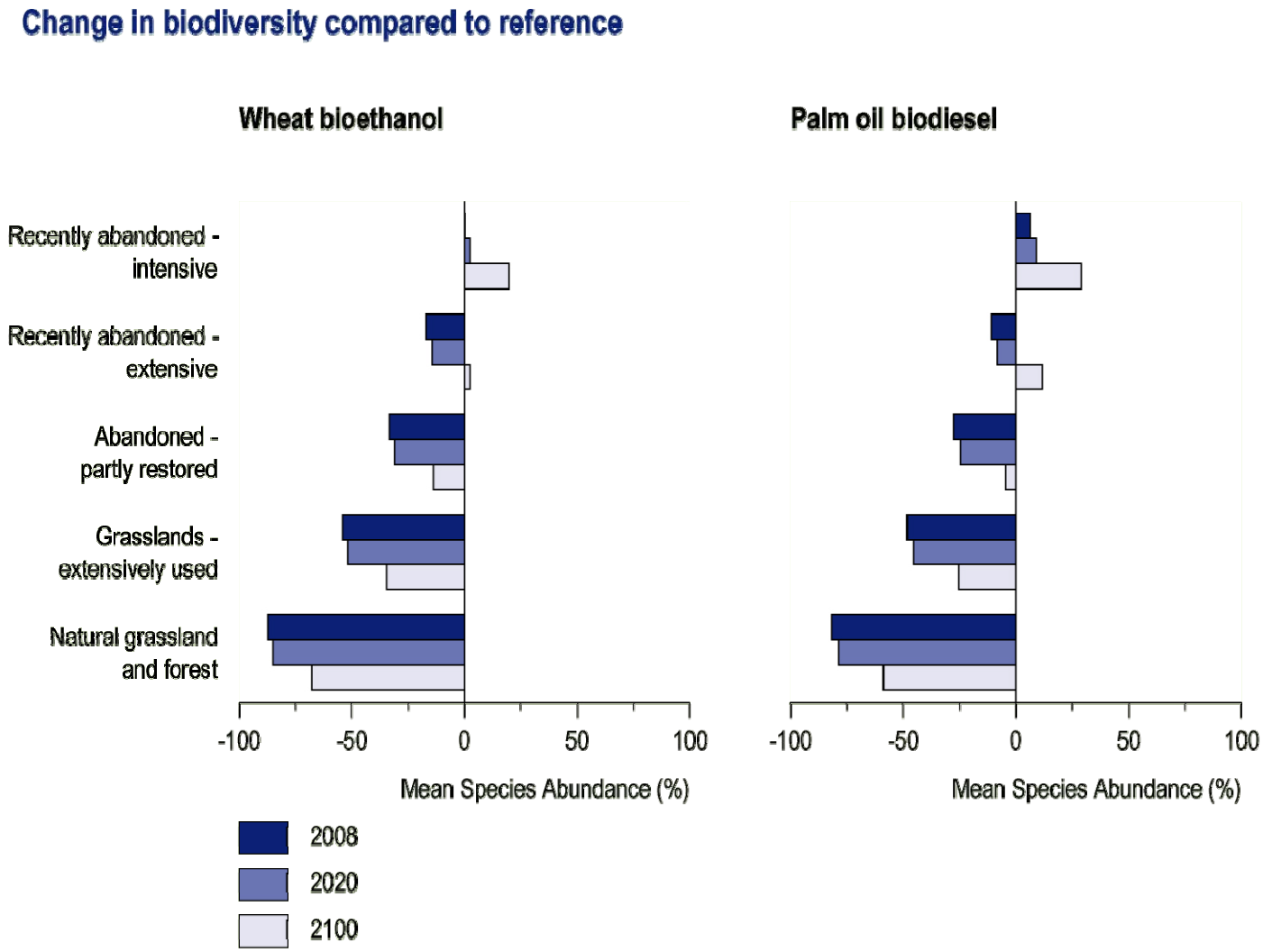
Biofuel effects and “Biodiversity debt”



Include
- process energy
- by-products
- soil emissions
  (N2O and CO2)

Simplified indicators
- Δ CO2/ha.yr

Biofuel effects and “Biodiversity debt”



Δ MSA/ha.yr

Uncertainties
- climate sensitivity
- biodiv. response
- crop biodiv. value
- soil emissions

Summary

- GLOBIO3 can assess impacts on biodiversity using scenarios
- Land use conversion for biofuels has larger negative impact on biodiversity than climate change mitigation
- Further improvements possible, e.g. model different bioenergy crops, include NOx impacts, include species richness
- Indirect effects need to be considered

A world where biodiversity counts

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