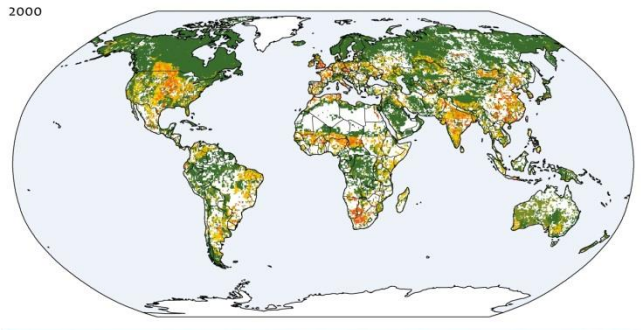

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Global-scale scenarios and models for (aquatic) biodiversity and ecosystem services

Jan H. Janse & Rob Alkemade
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Scenarios

Scenario = possible future; more or less coherent combination of drivers, policies and/or measures

- Trend scenarios; e.g. SSPs
- Target-seeking scenarios: ways to reach a certain target, e.g. halving biodiversity loss

Models used to estimate the impacts

DPSIR framework

Integrated assessment models

Pressures

- DPSIR framework

- Large-scale pressures:

-land-use

-climate change

-hydrology

-…

- Locally/regionally:

- Local variation in large-scale pressures

- Many additional local pressures

- Direct effects of pressures
- Indirect effects, via human adaptation; e.g. biomass energy

Aquatic biodiversity

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Drivers of aquatic biodiversity change in catchments

Climate change

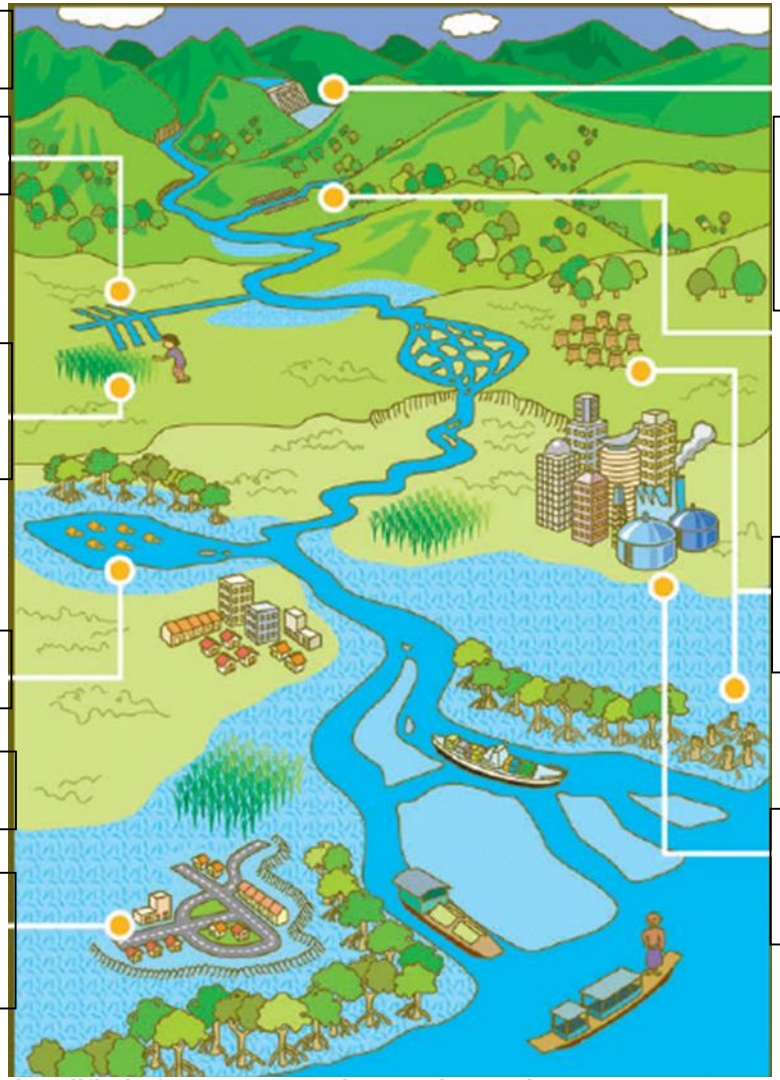
Irrigation

(Agricultural) eutrophication

Overfishing

Invasive species

Hydraulic infrastructure



Dams and river regulation

Deforestation Wetland conversion

Urban pollution (point sources)

(modified after Ratner et al, 2004; in MEA), 2005

Models at PBL: *IMAGE-GLOBIO*

- Integrated Assessment Model (IAM): impact of these **global drivers** on (terrestrial + aquatic) biodiversity and ecosystem services

- Meant for global assessments on climate/energy, land use, water, biodiversity, ecosystem services
- Support policy makers on sustainability at the global level: UNEP, CBD, OECD, EU, IPBES, Ramsar, etc.
- attainment of SDGs (sustainable development goals)

- Also as background for regional studies and assessments

Examples of questions

- - What are hotspots of environmental problems?
- - What pressures are most important where?
- - Link to drivers on economic sectors and behaviour
- - What are options for solutions
- - What are side-effects of solutions for other sectors?

IMAGE-GLOBIO model framework

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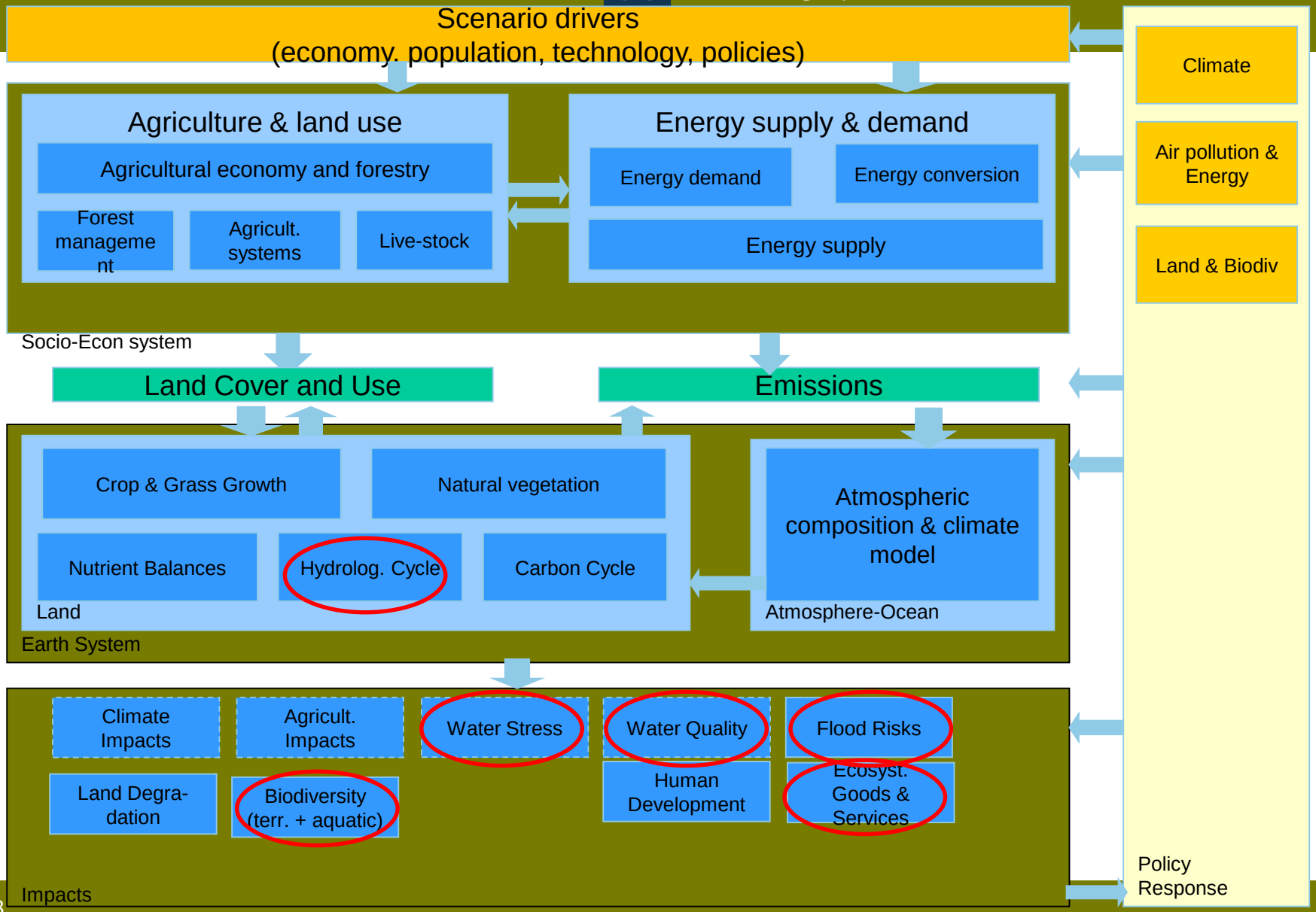
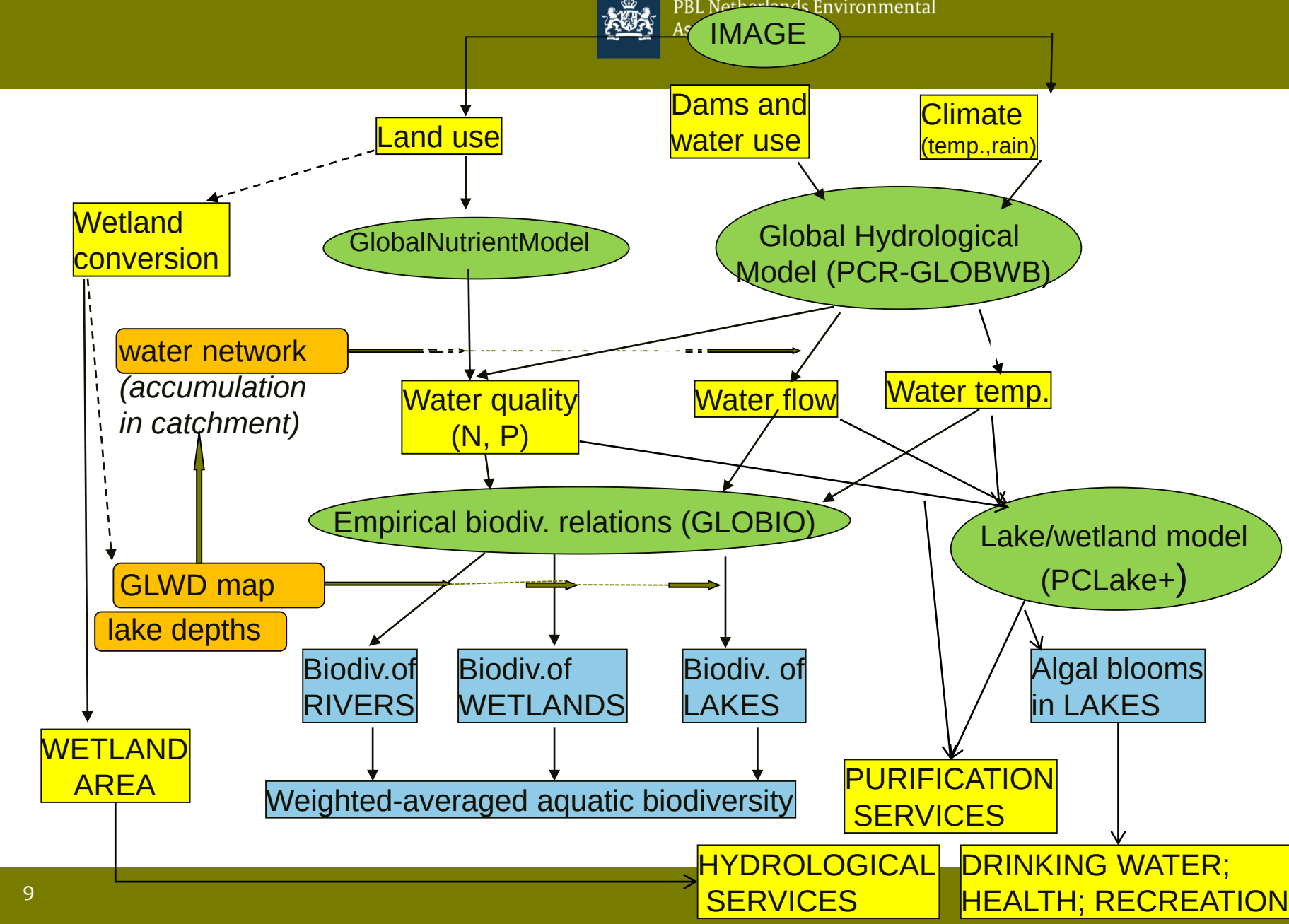
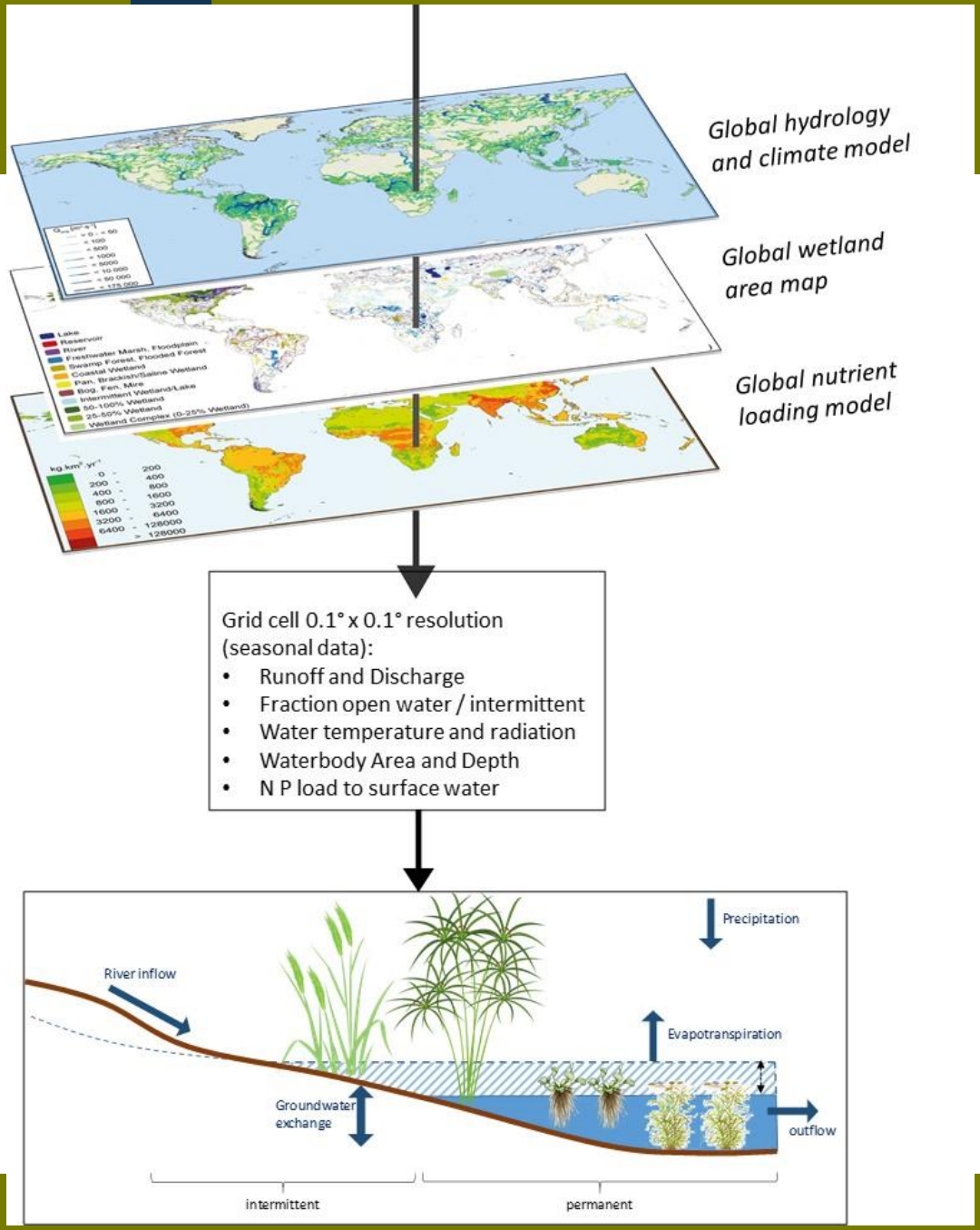


GLOBIO-Aquatic model chain



Model set-up


Global hydrology and climate model
Global wetland area map
Global nutrient loading model
Grid cell 0.1° x 0.1° resolution (seasonal data):
• Runoff and Discharge
• Fraction open water / intermittent
• Water temperature and radiation
• Waterbody Area and Depth
• N P load to surface water
Precipitation
River inflow
Evapotranspiration
Groundwater exchange
outflow
intermittent
permanent

Models

- Combination of different type of models:
- Economic models
- GIS models
- Process models
- Empirical process models
- Statistical models (species composition intactness)

Combined results: MSA-aquatic

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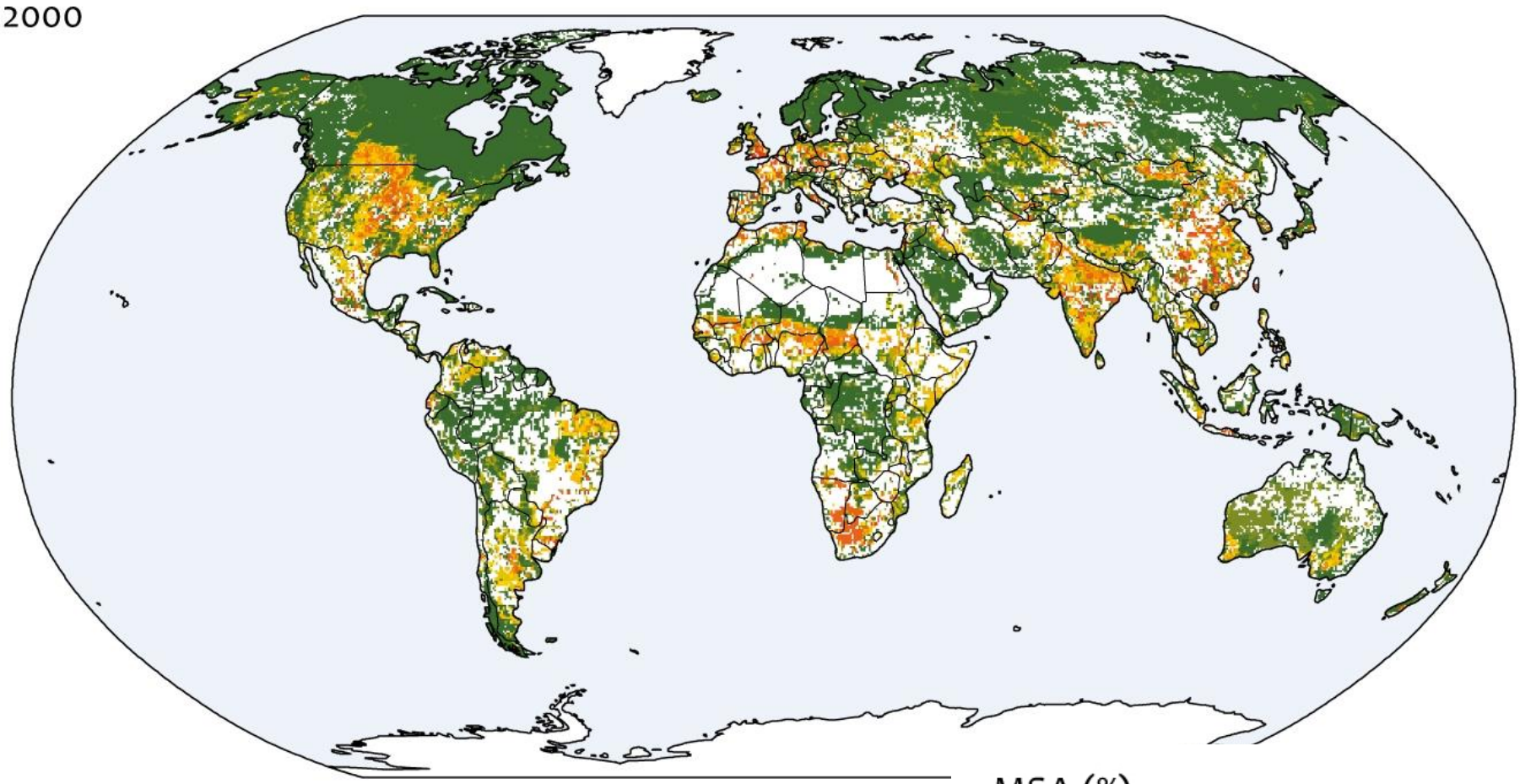
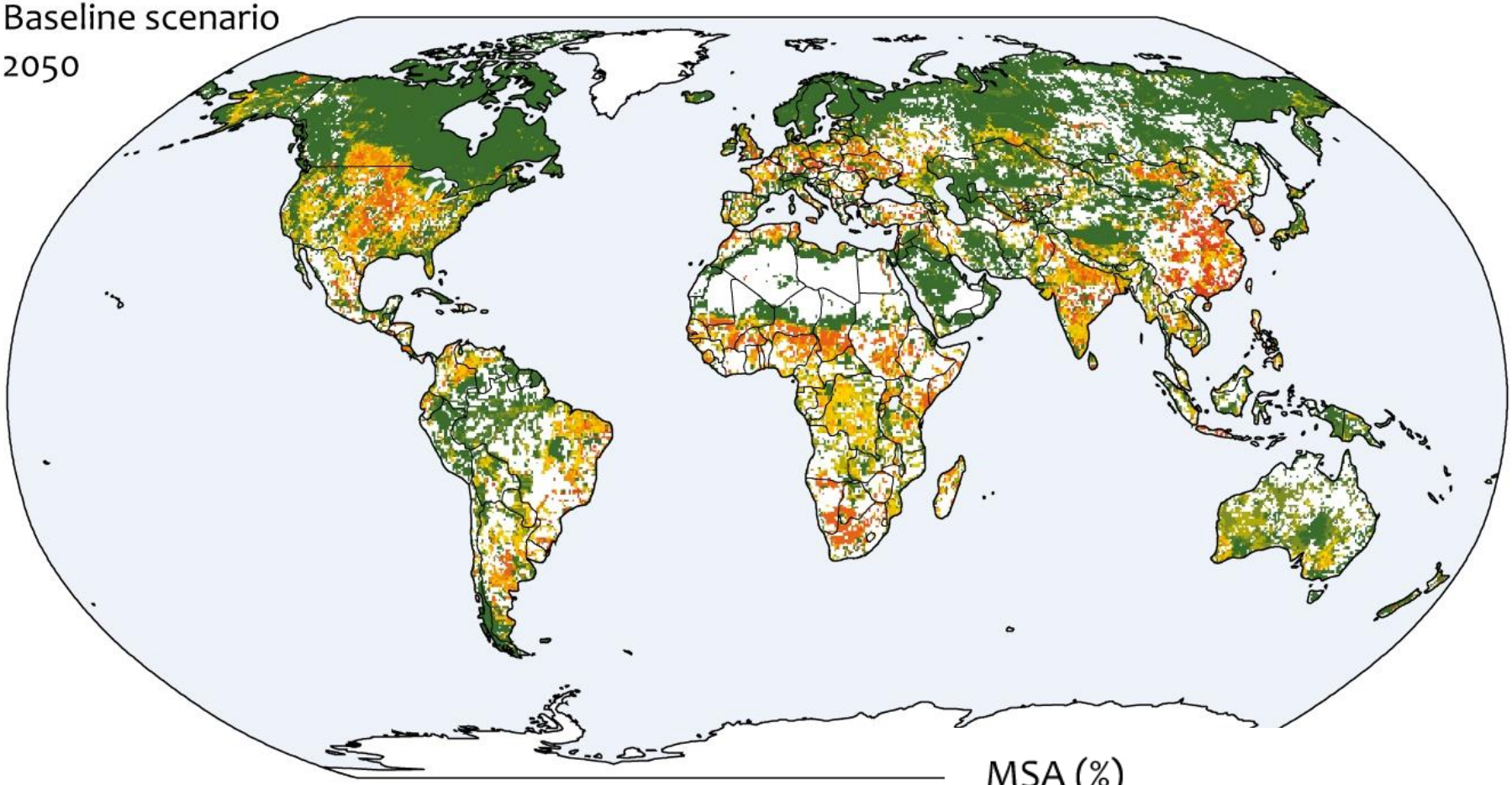


Baseline scenario
2050



Difference 2000 -> 2050

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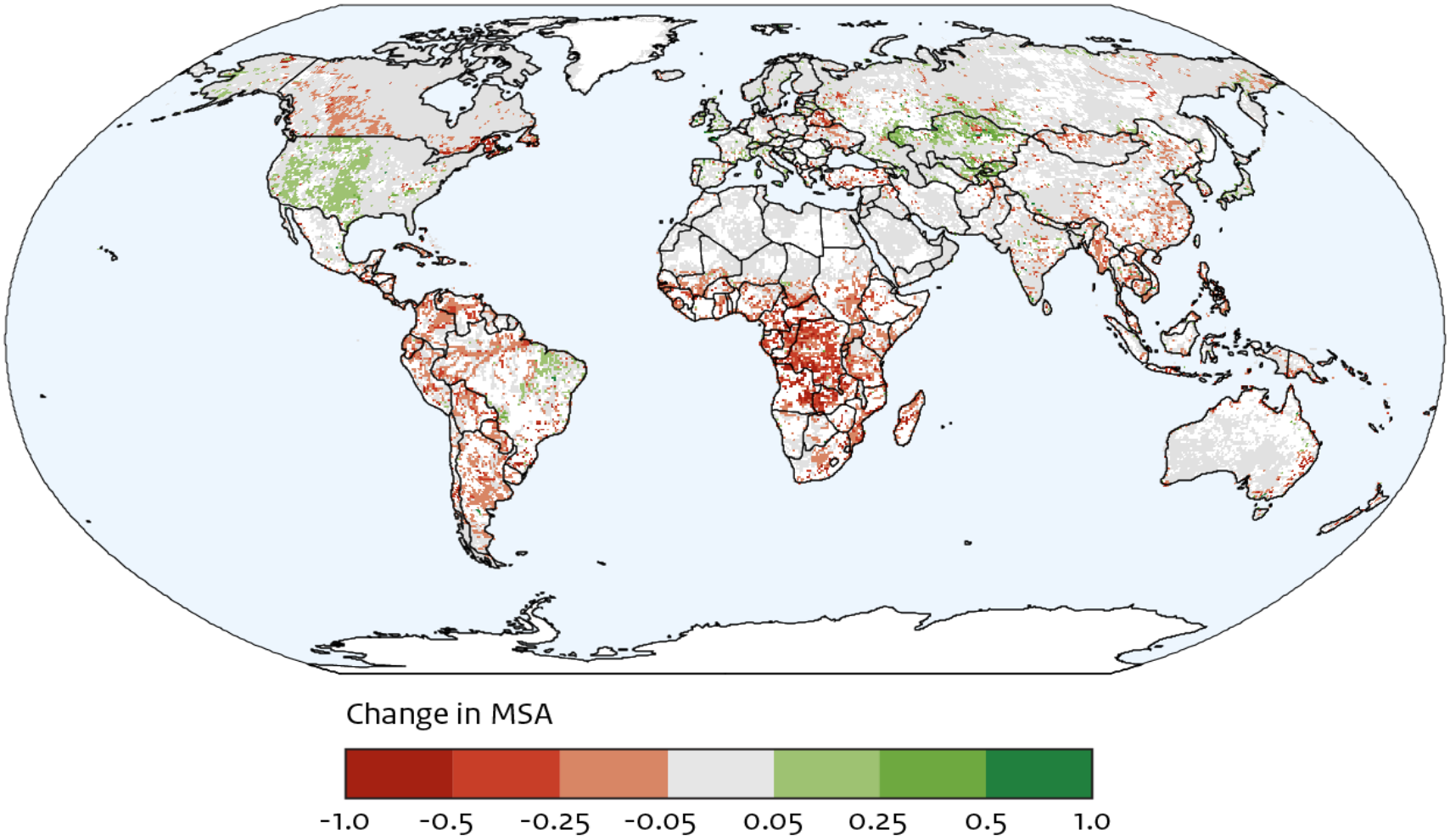


Global scenario initiatives

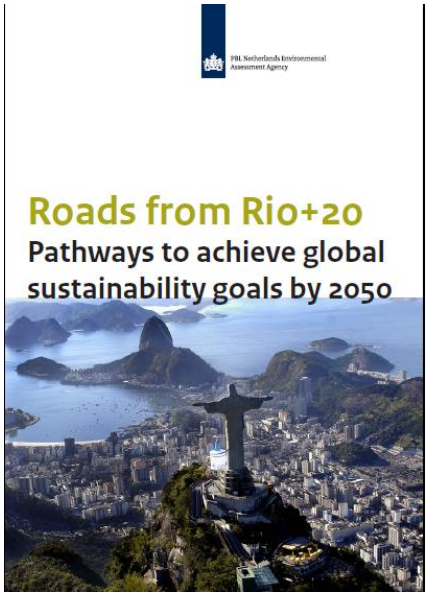
- Fourth Global Biodiversity Outlook (GBO4) 2014
- Shared Socio Economic Pathways (SSPs; IPCC) 2016-2018
- Bending the Curve initiative (IIASA, WWF) 2018
- IPBES Nature's Futures, ongoing
- Scenarios for the CBD post-2020 Biodiversity Agenda, ongoing
- SIM4Nexus, EU project 2016-2020

Some recent assessments with IMAGE-GLOBIO

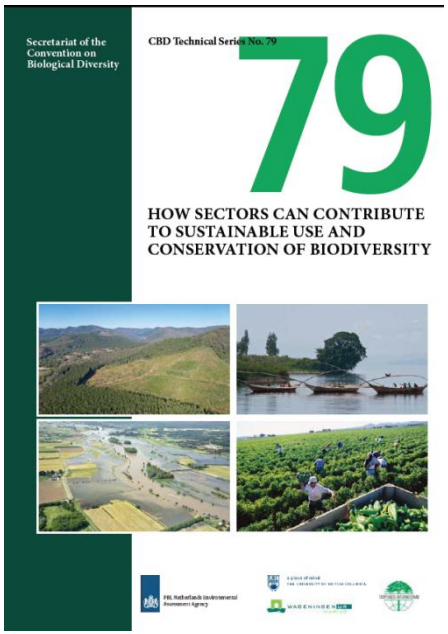
2010
(COP CBD, Nagoya)

OECD-EO, 2012

2012
(Rio Conference)



GBO4, 2014



Pressures on terrestrial biodiv. in the Trend scenario

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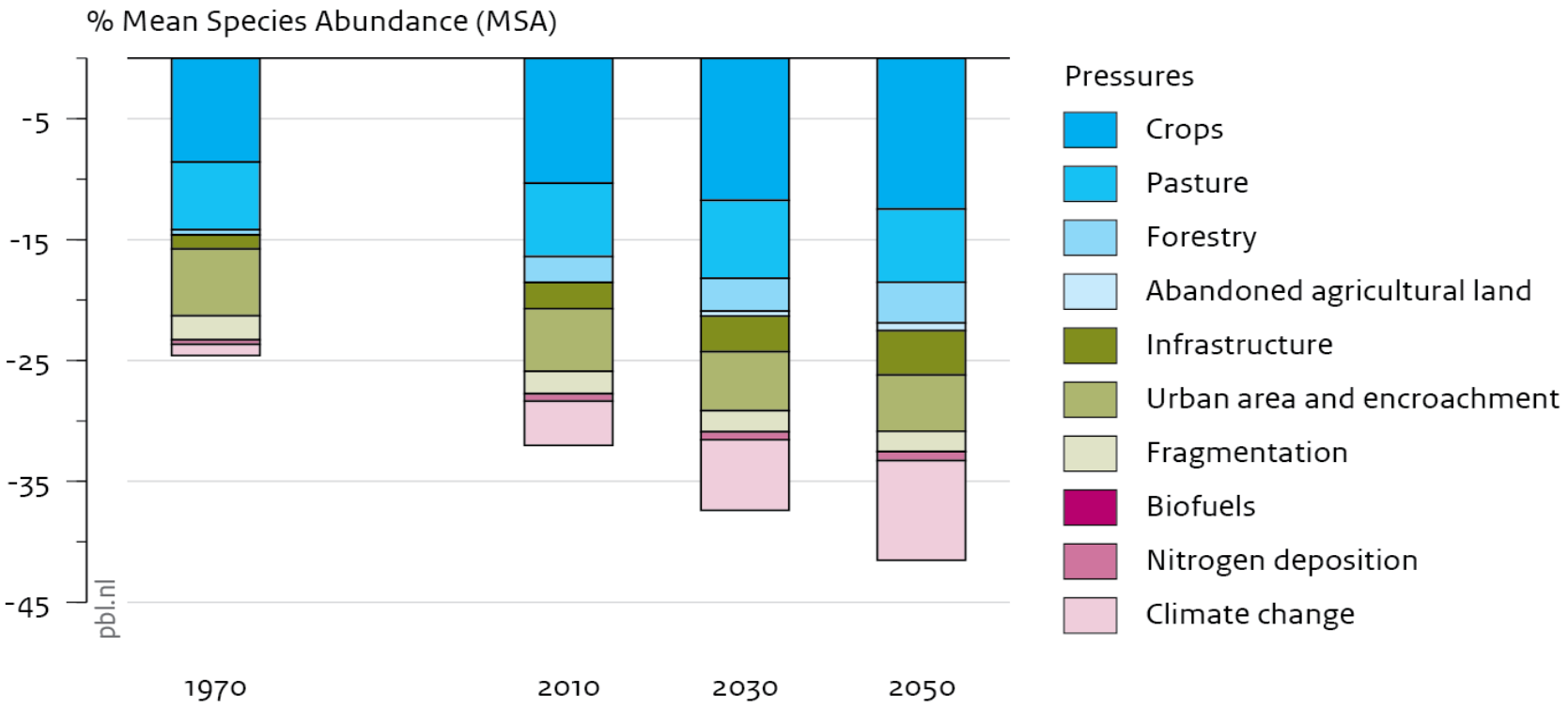
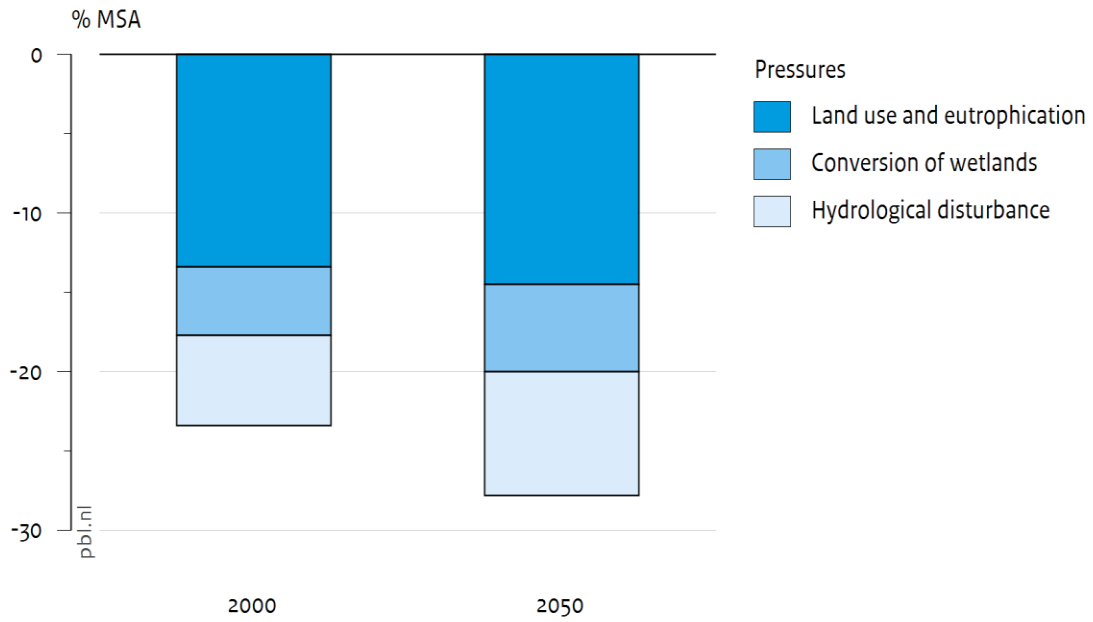
Pressures driving global terrestrial biodiversity loss under the Trend scenario



Source: PBL

Global average MSA loss and contribution of drivers

Pressures driving global freshwater biodiversity loss in the Trend scenario



Source: PBL

3 'pathways' to reduce biodiversity loss: Pressures on terrestr. biodiv.

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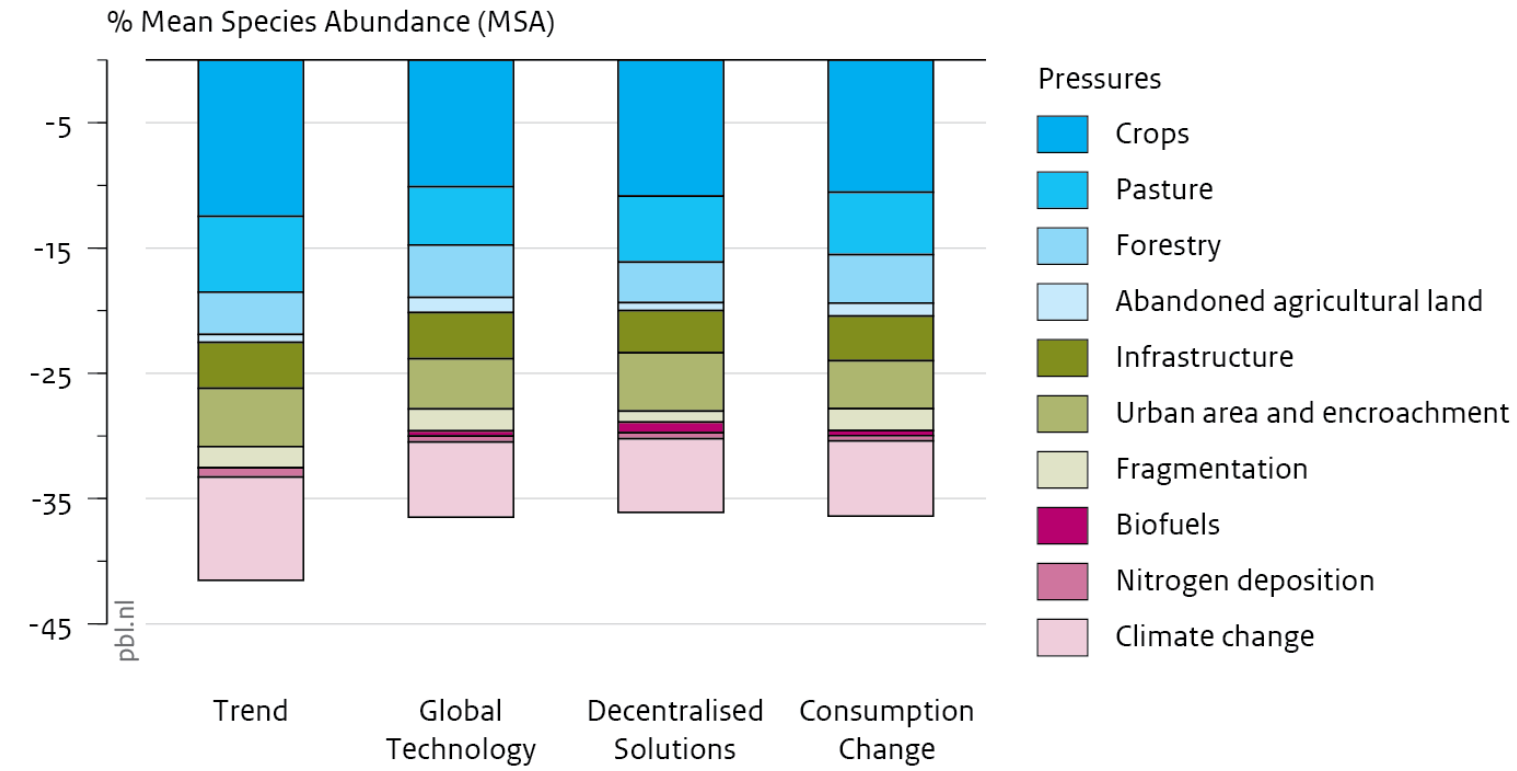
Pressures driving global terrestrial biodiversity loss in 2050



Source: PBL

Pressure on aquatic biodiv. in 3 'pathways'

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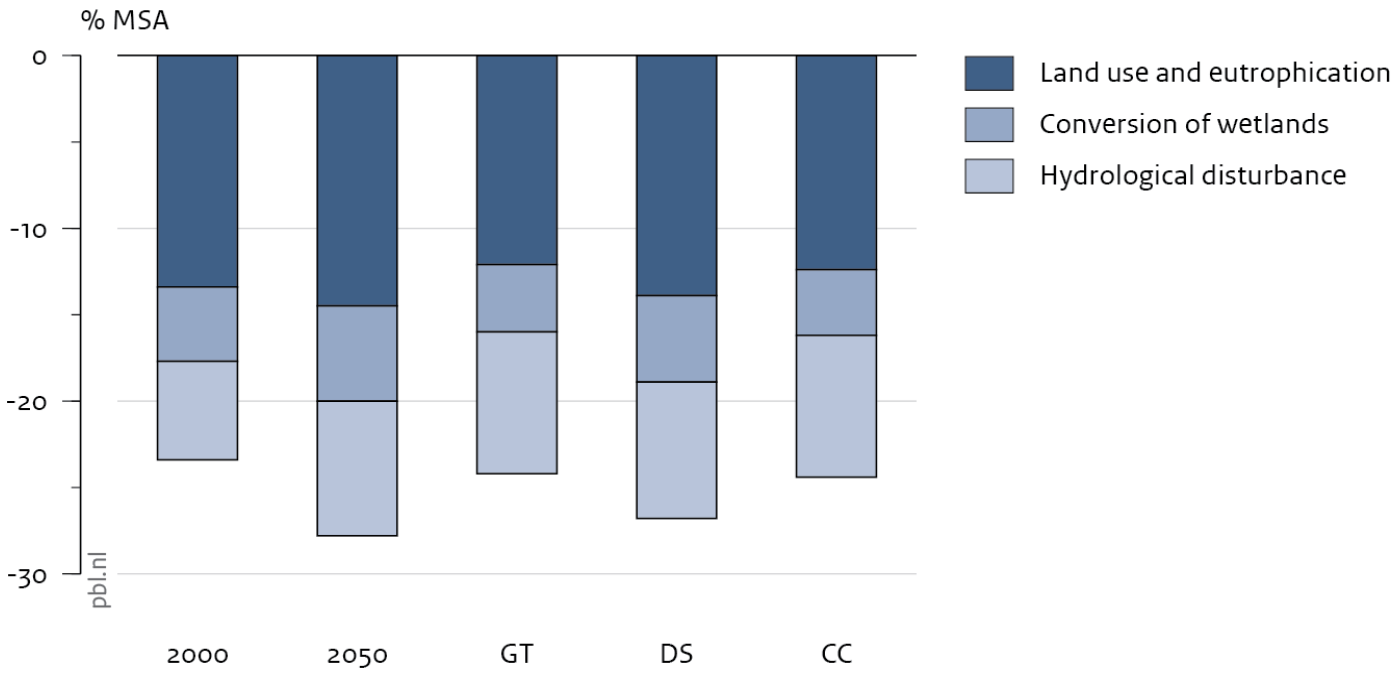
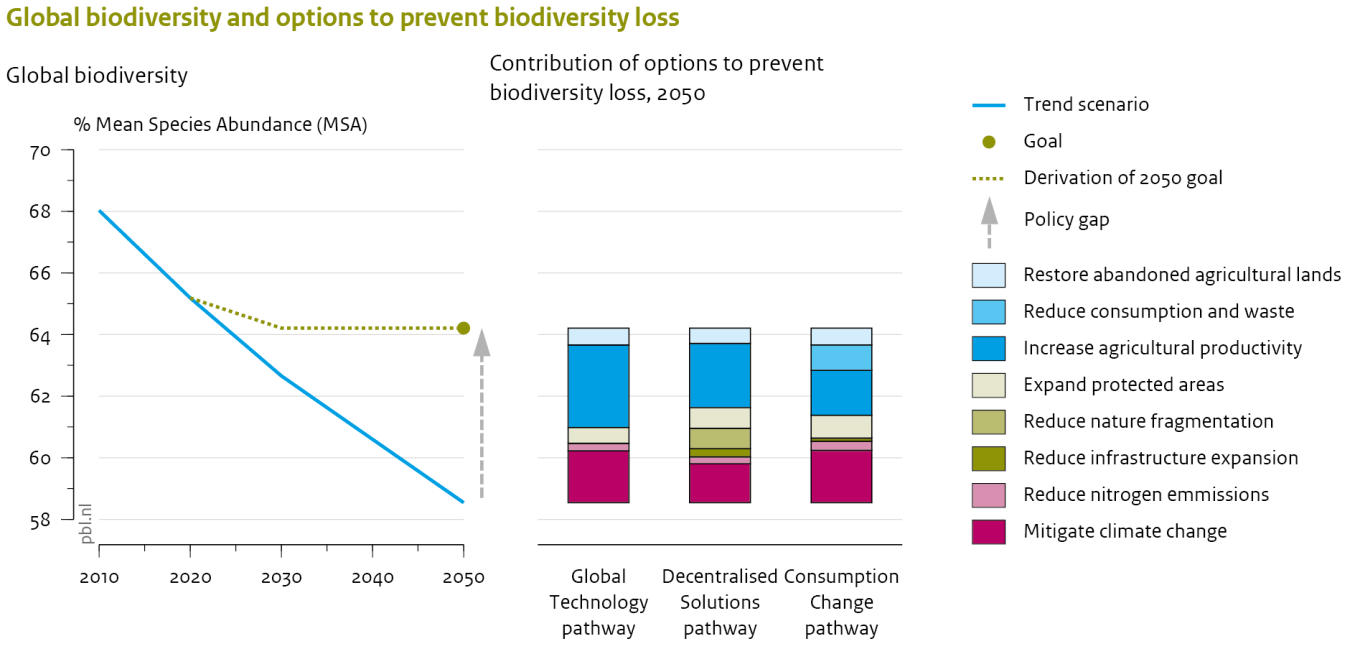


Figure 1. *Pressures driving global-averaged freshwater biodiversity loss under the Trend scenario (2050) and three development pathways (GT: global technology, DS: decentralized solutions, CC: consumption change). Source: PBL (Kok et al., 2014)*

Note: for hydropower, assumptions equal to Trend in all pathways

=> All 'pathways' can reduce but not stop further biodiversity decline.

GBO4 outcome: Large potential for biodiversity-friendly production methods and nature-based solutions exist to realise 2050 vision



Source: PBL/LEI

Pathways play out differently among regions

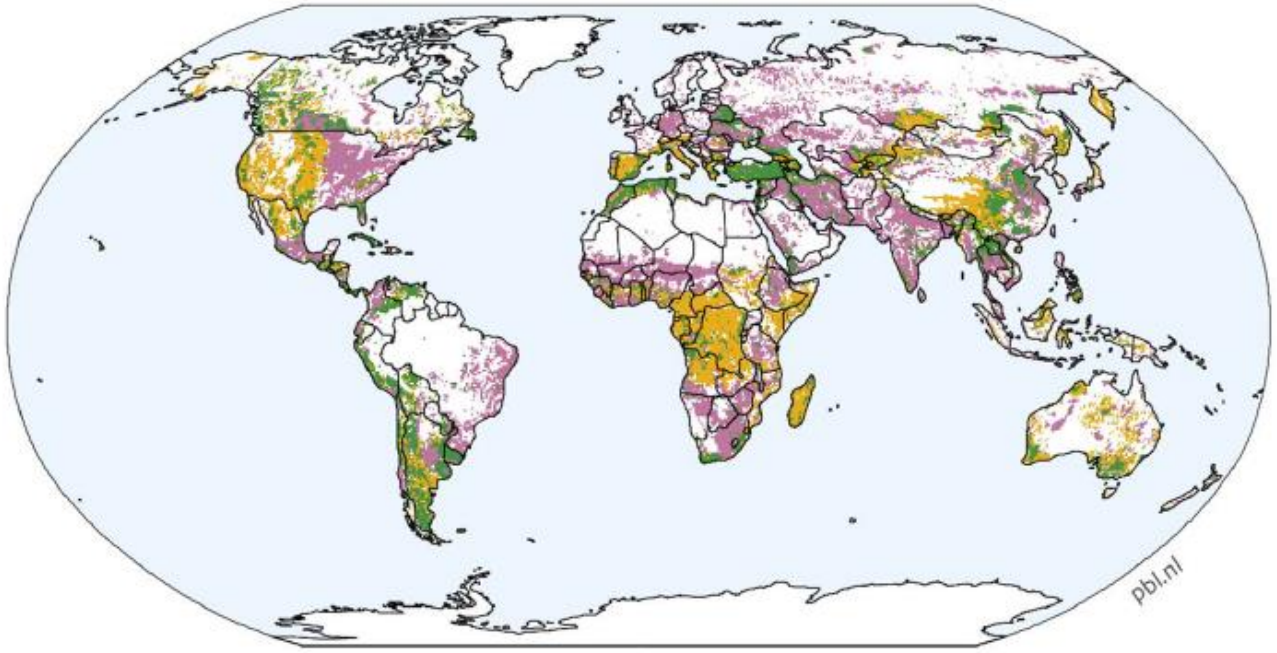
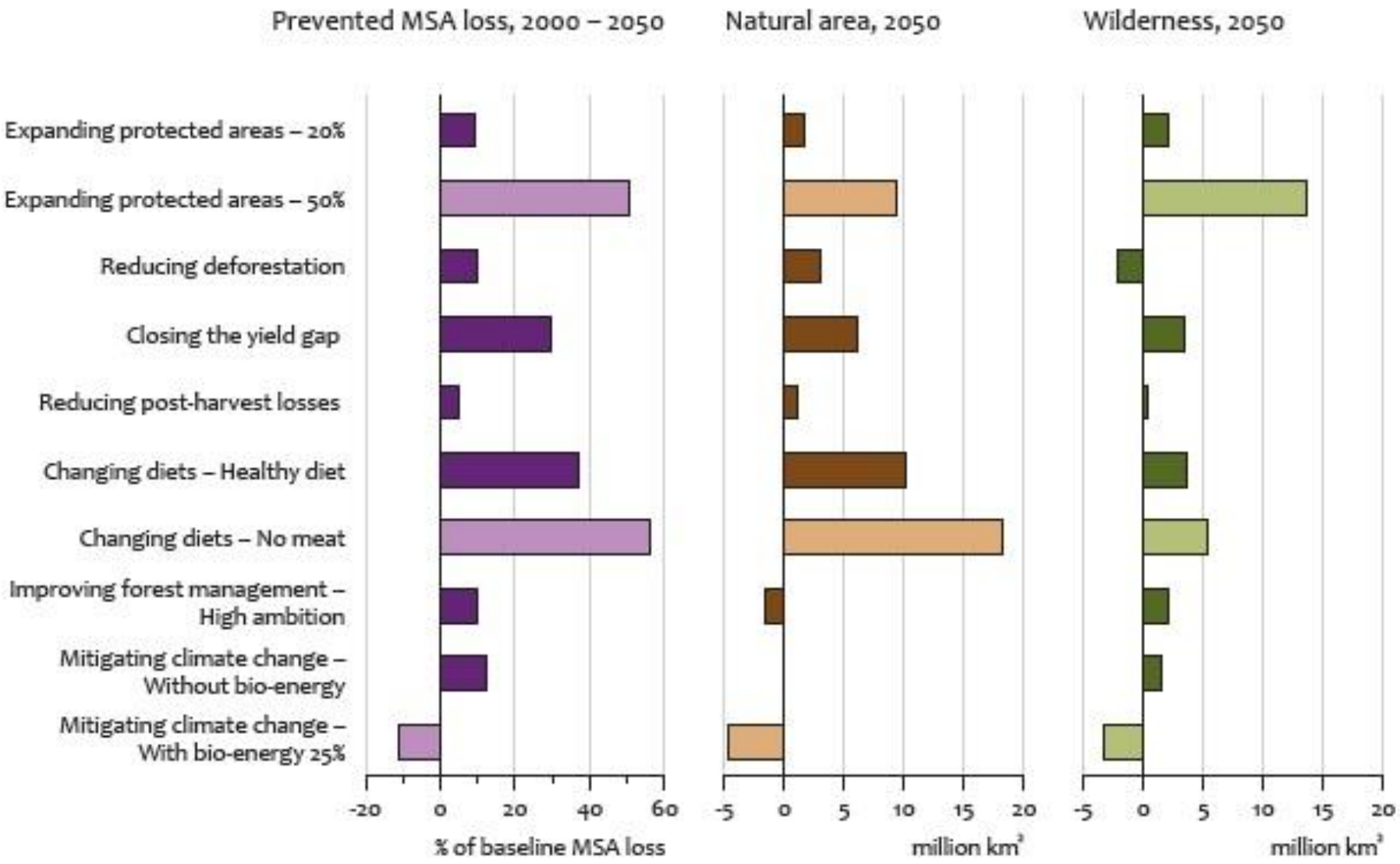


Fig. 5. Areas with at least 5% avoided loss in pathways, compared to the Trend scenario.

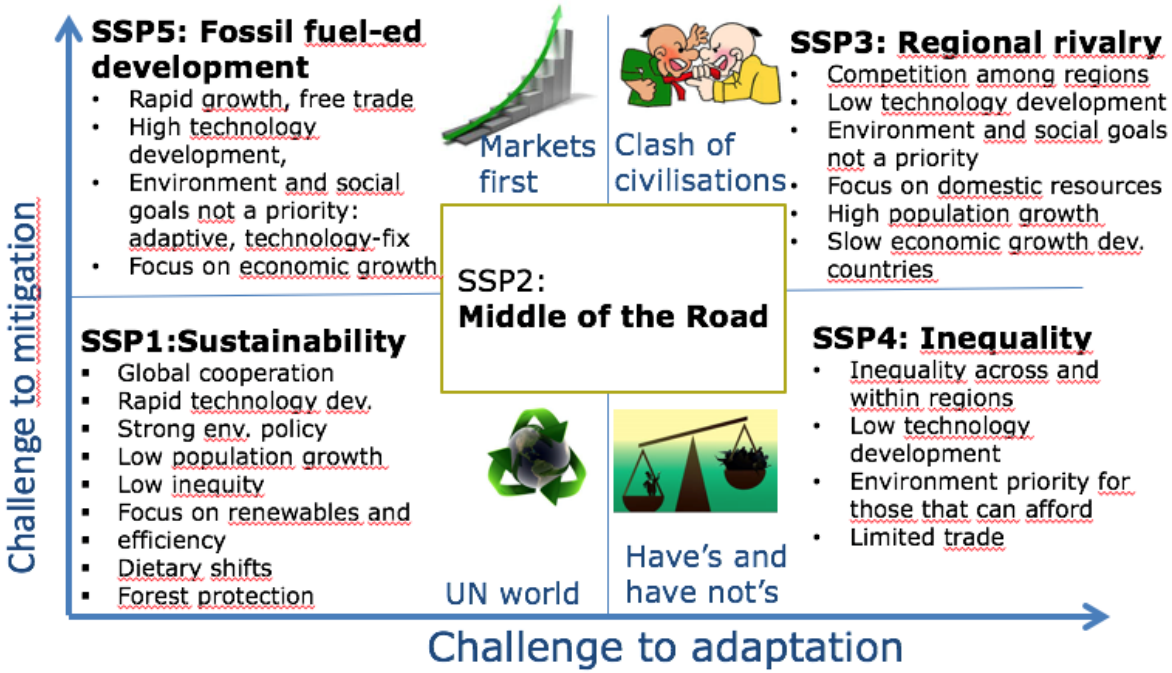
Effects of options *compared to baseline*



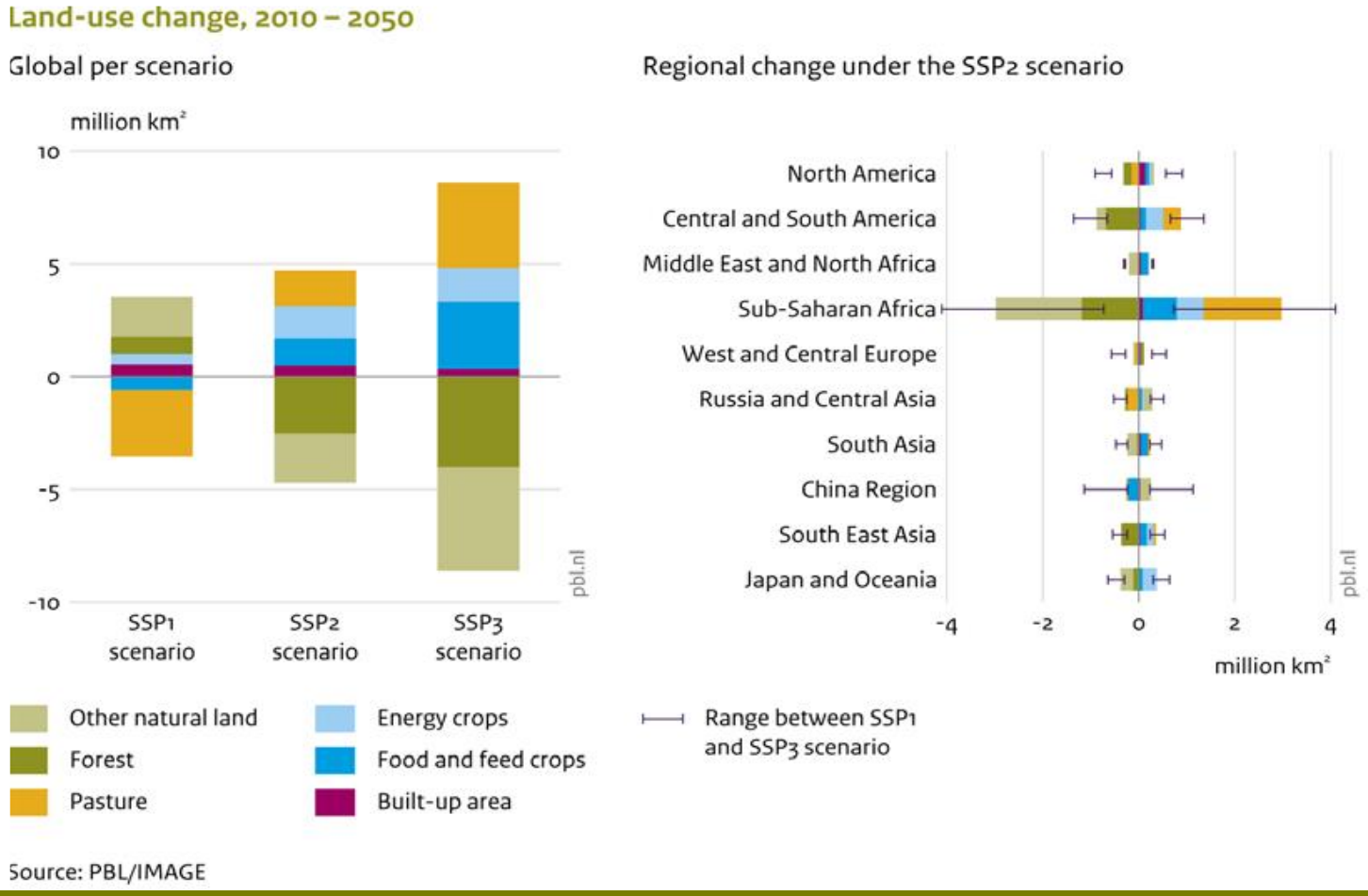
Conclusions from GBO4: Strategies to step-up, scale-up and speed-up efforts to mainstream biodiversity

- Apply integrated land-, water- and seascape approaches
- Better integrate biodiversity in voluntary sustainability initiatives along supply chain
- Further develop consumption perspective on biodiversity, including food security and sustainable, healthy diets
- Shift investment flows in key sectors towards more biodiversity-friendly alternatives

Shared Socio-Economic Scenarios (IPCC)

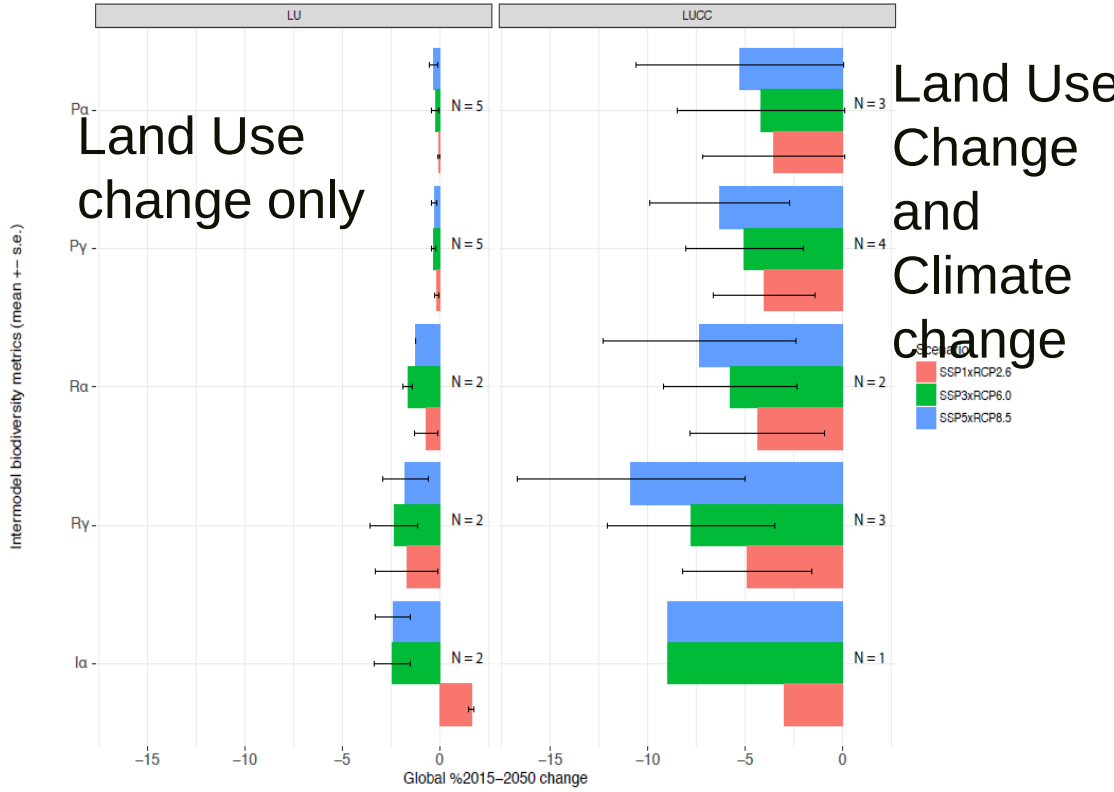


SSP scenarios: land-use changes 2010-2050



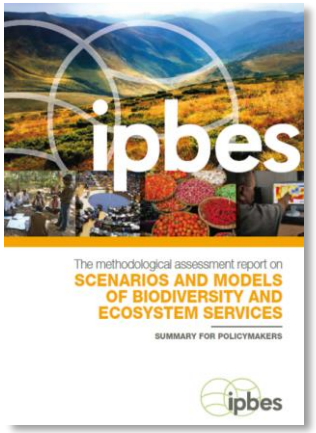
Results on biodiversity

- *three SSP variants*
- *10 biodiversity models*
- *biodiversity measured by*
- *- species richness at local, regional and global levels,*
  - Intactness and
  - habitat change



IPBES scenarios: Conclusions from the IPBES scenario assessment (2016) scenarios

- Most global scenarios are limited to assessing the impact of drivers on Biodiversity and Ecosystem Services
- Most global scenarios are developed for other purposes, e.g. climate change and its impacts
- Most global scenarios lack a participatory approach.

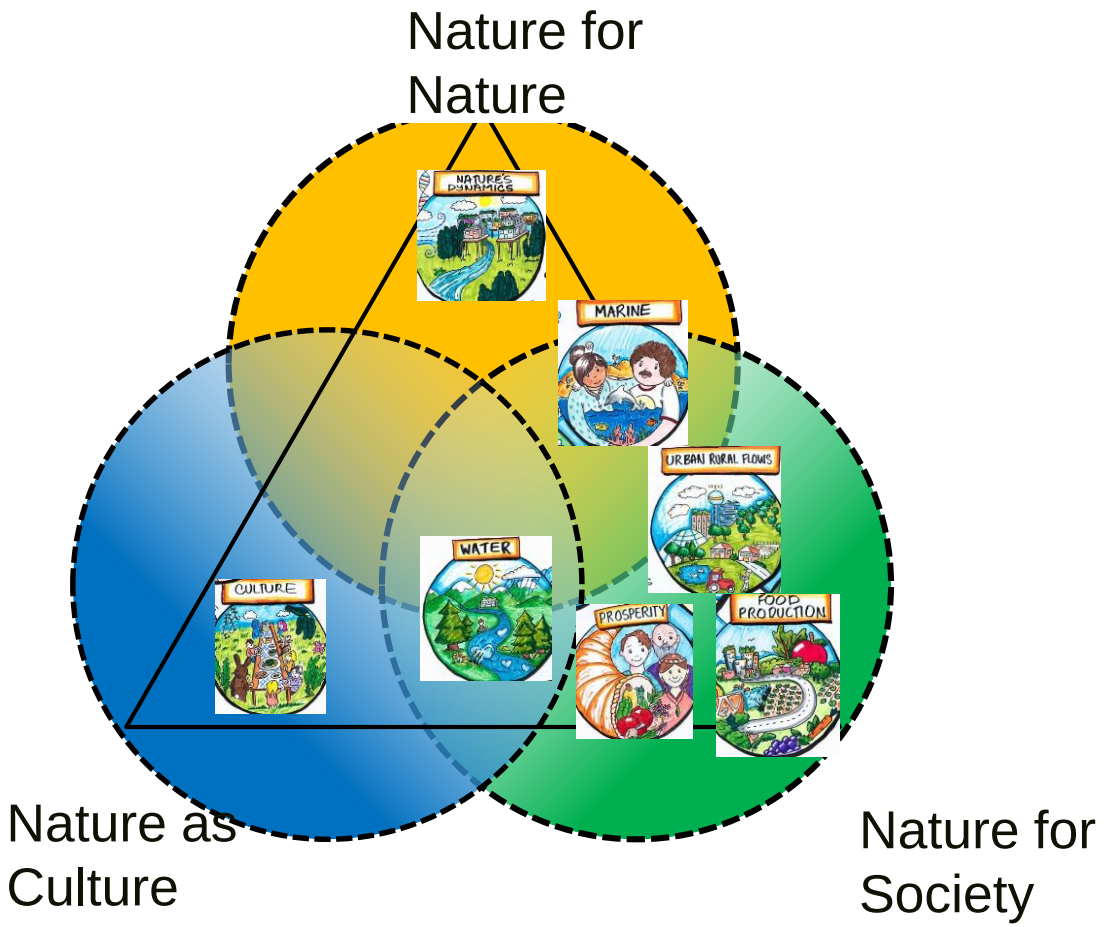


Visioning workshop: from seeds to visions

Resulting 7 visions

Lundquist et al., 2018, NIWA

Relation between visions and perspectives



Use of scenarios and models in policy making

- Land in reports
- Awareness building
- Promote integrated policy (Nexus approach)
- Cooperation between countries
- Playing (e.g. serious game)

Conclusions on biodiversity

- Land-use, climate and hydological changes can be translated into water quality, ecological functions and biodiversity
- Already considerable decrease in Europe, N.America, China, India
- Africa and S.America will follow
- Biodiv. decrease can be reduced by 50%, but this will require fundamental societal changes

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Thank you for your attention

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