Global models and scenarios for agriculture, biodiversity & climate

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The agriculture – climate – biodiversity connection: understanding interactions and seeking synergies

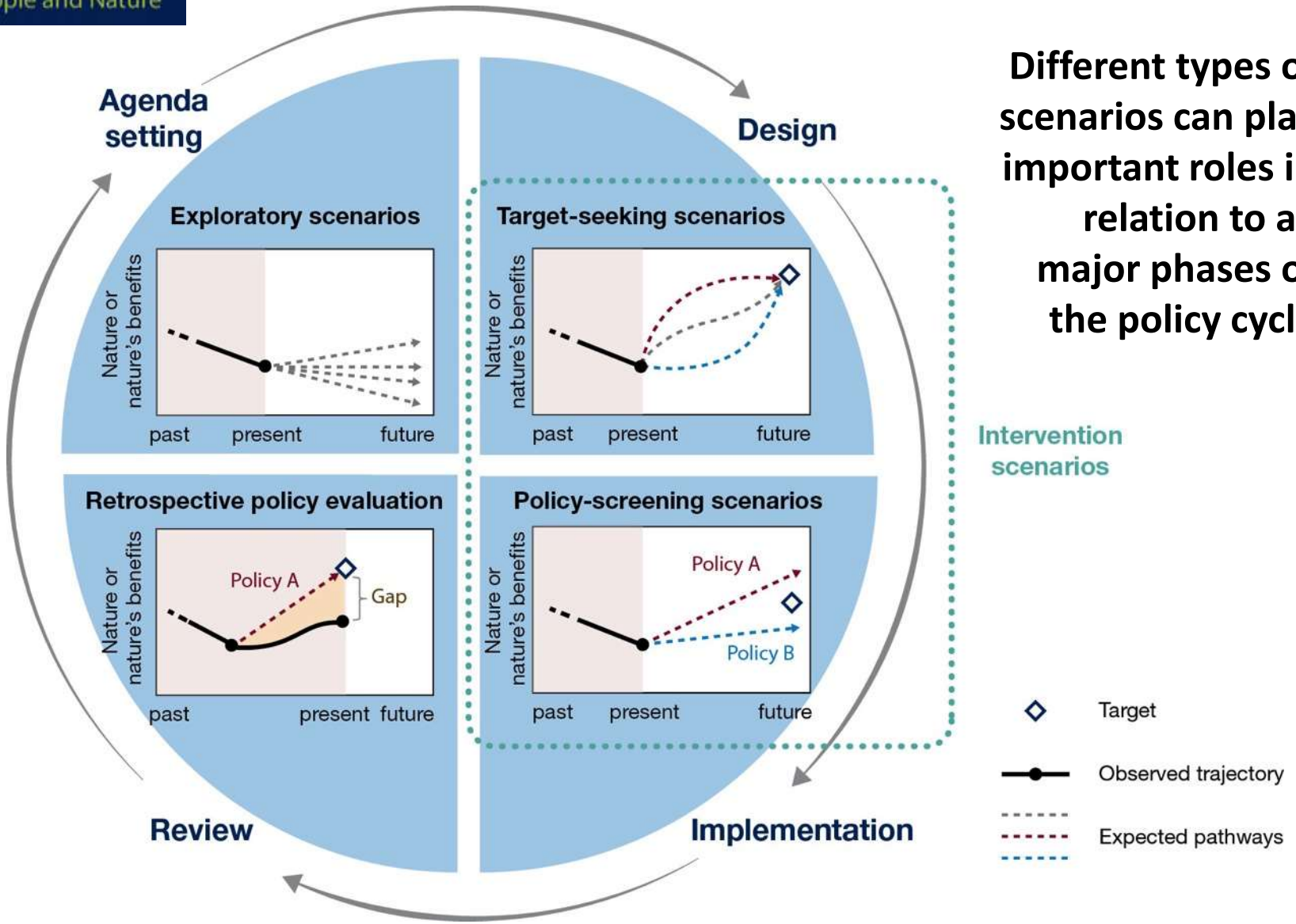
• Greenhouse gas emissions from the agricultural systems contribute 11% of total global warming potential (now greater than deforestation).

• Agriculture currently is the most important contributor to terrestrial biodiversity loss for many species groups.

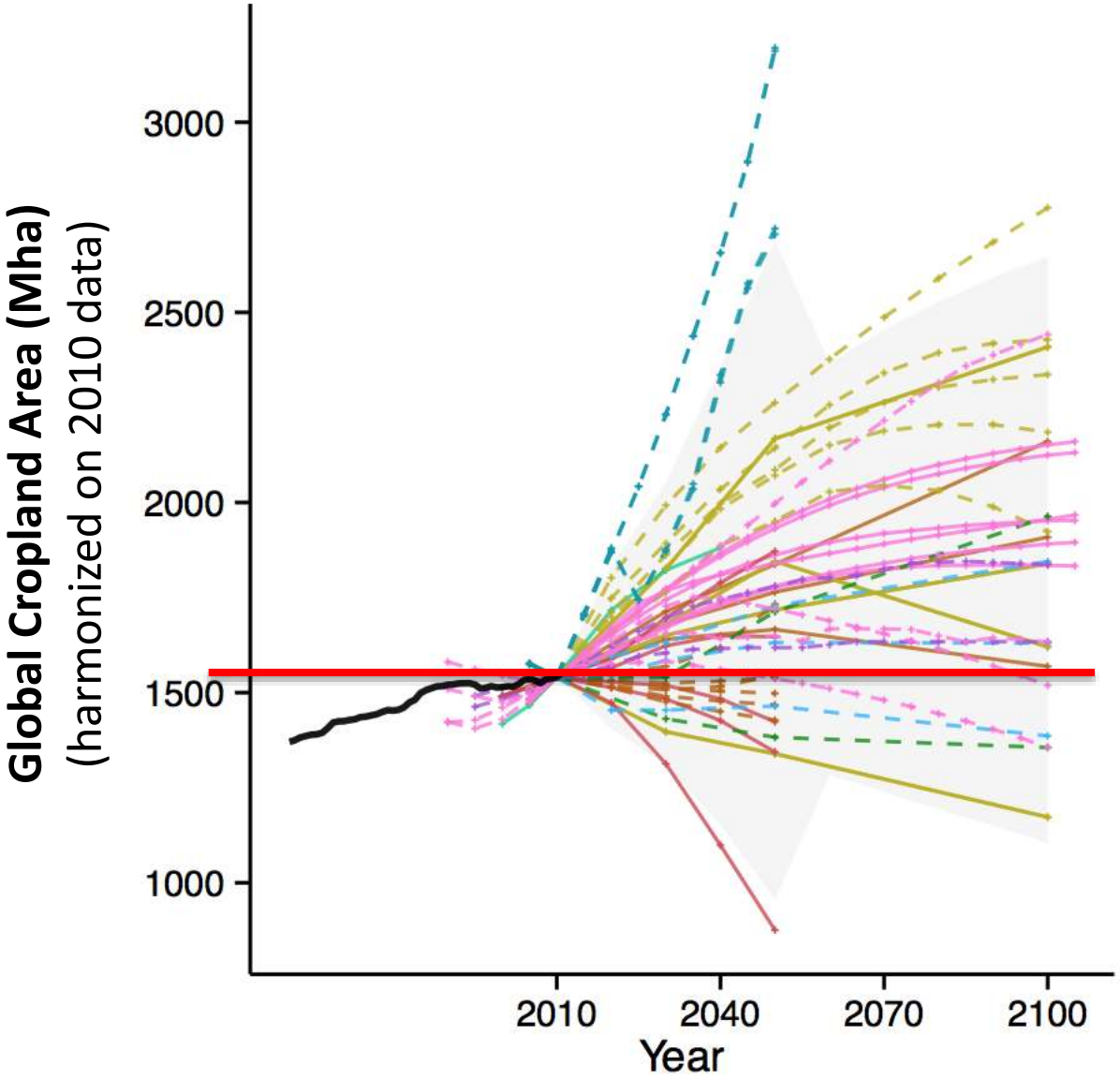
• Key interactions between climate and biodiversity in agricultural systems include:

- **Habitat conversion** to agricultural systems typically releases large amounts of greenhouse gases and results in large decreases in biodiversity
- **Intensive cultivation practices** often degrade soil carbon stocks and lead to loss of soil and aboveground biodiversity
- **Nitrogen fertilizer** contributes to climate change, especially through the release of nitrous oxide (N_2O) and is a major driver of biodiversity loss
- **Ruminants** make substantial contributions to global methane (CH_4). Due to very low efficiencies, ruminants are a major driver of biodiversity los.

Methodological Assessment of Scenarios & Models of Biodiversity & Ecosystem Services



Different types of scenarios can play important roles in relation to all major phases of the policy cycle

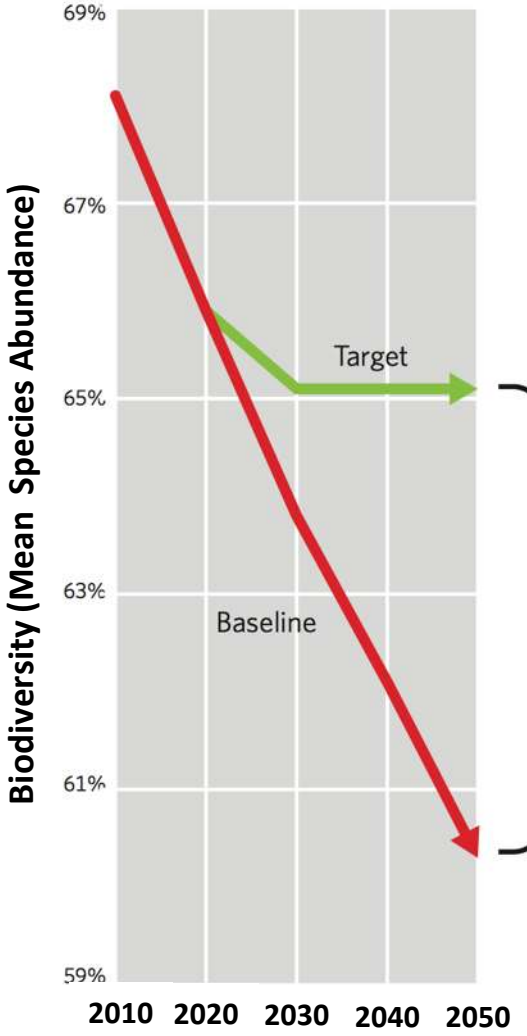


EU LUC4C project
From M. Rousnevell

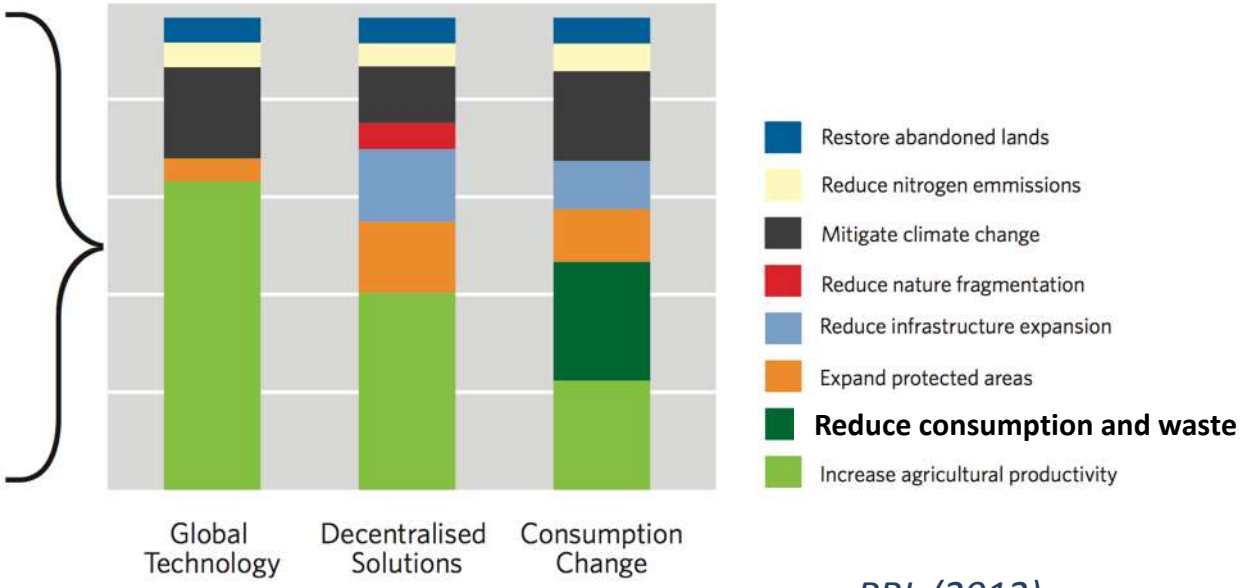
Most, but not all, land use scenarios foresee substantial conversion of natural habitats to croplands over the coming decades

Achieving the CBD 2050 Vision and ties with Sustainable Development Goals

- Stop biodiversity loss by 2050
- Meet Millennium Development Goals, with a focus on eliminating hunger
- Keep global warming below 2°C



Contribution of measures to stopping biodiversity loss

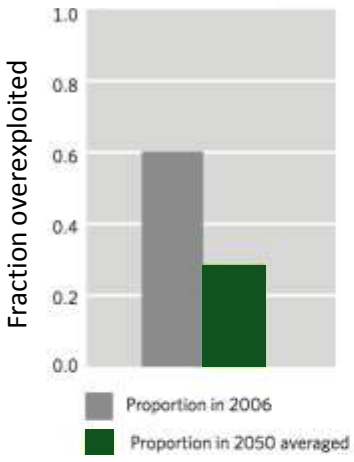


Three scenarios for achieving the 2050 vision

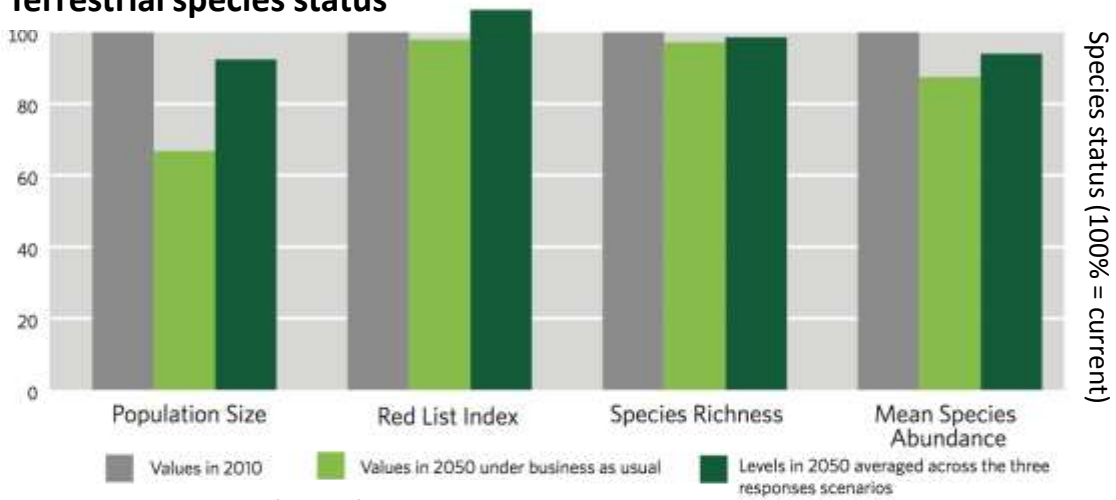
PBL (2012)
Leadley et al. (2014)

Achieving the CBD 2050 Vision and ties with Sustainable Development Goals

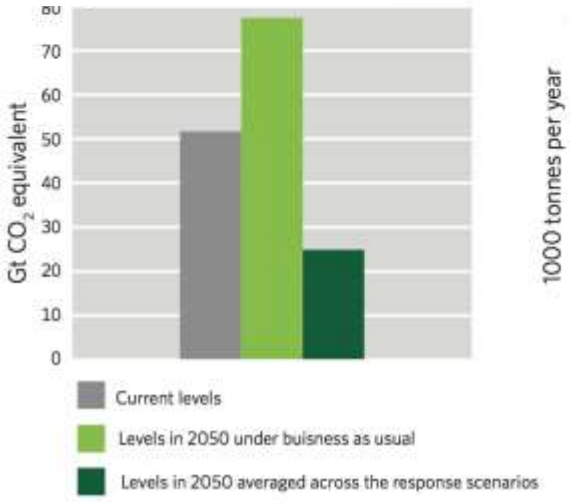
Fisheries



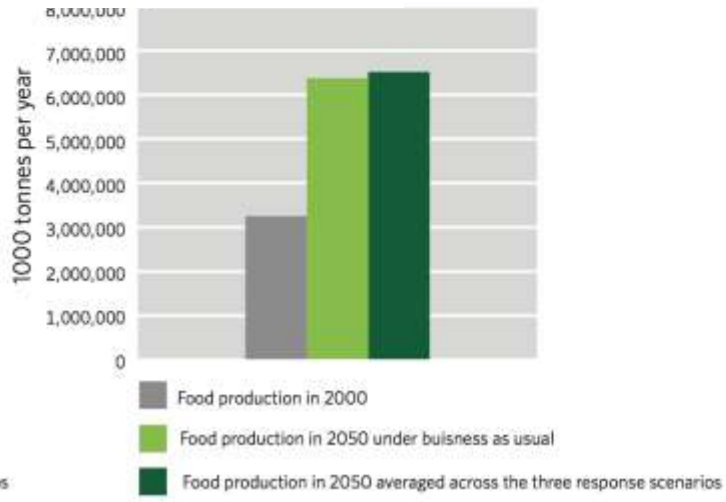
Terrestrial species status



GHG emissions

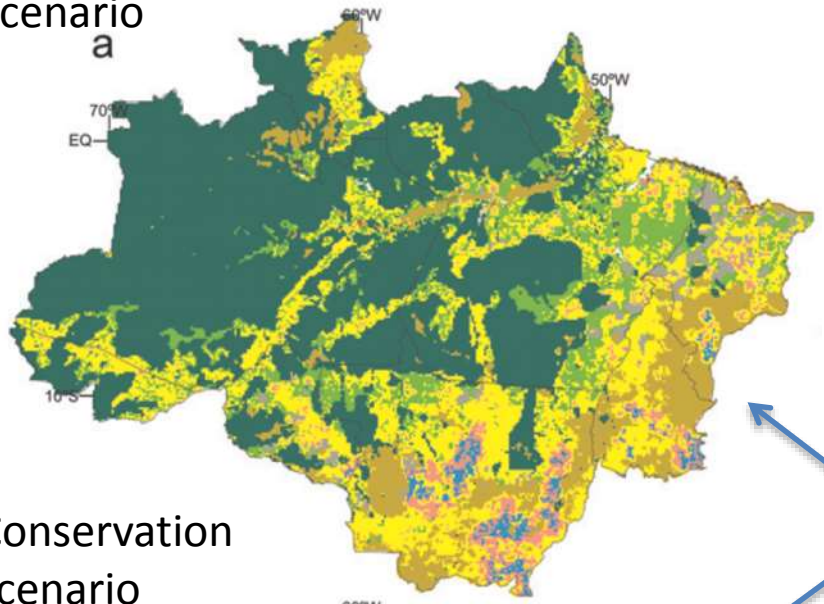


Food production

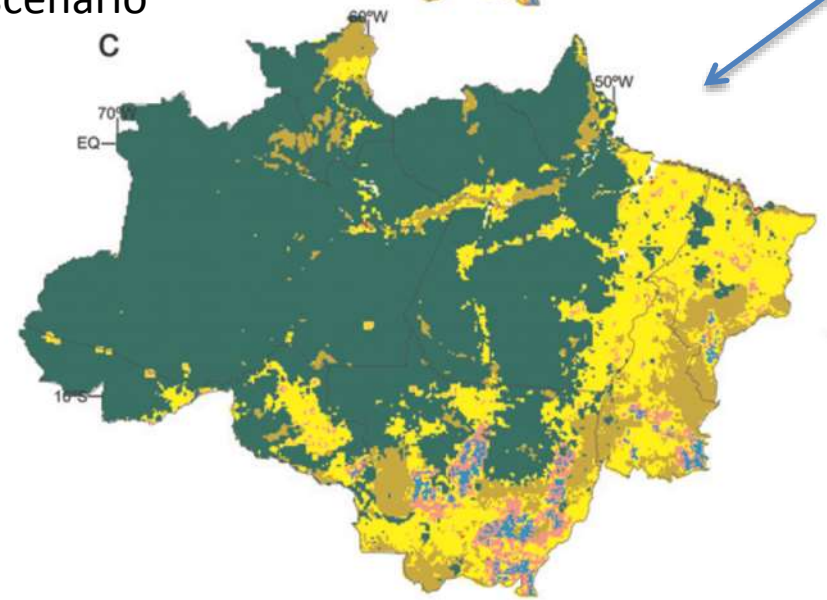


PBL (2012)
Leadley et al. (2014)

“Business-as-usual” scenario



Conservation scenario



Forest
Other natural veg.
Soybean
Other crops
Well-m. pasture
Poorly-m. pasture
Abandoned
Urban

Agricultural management to minimize land use change and its impacts on climate & biodiversity:

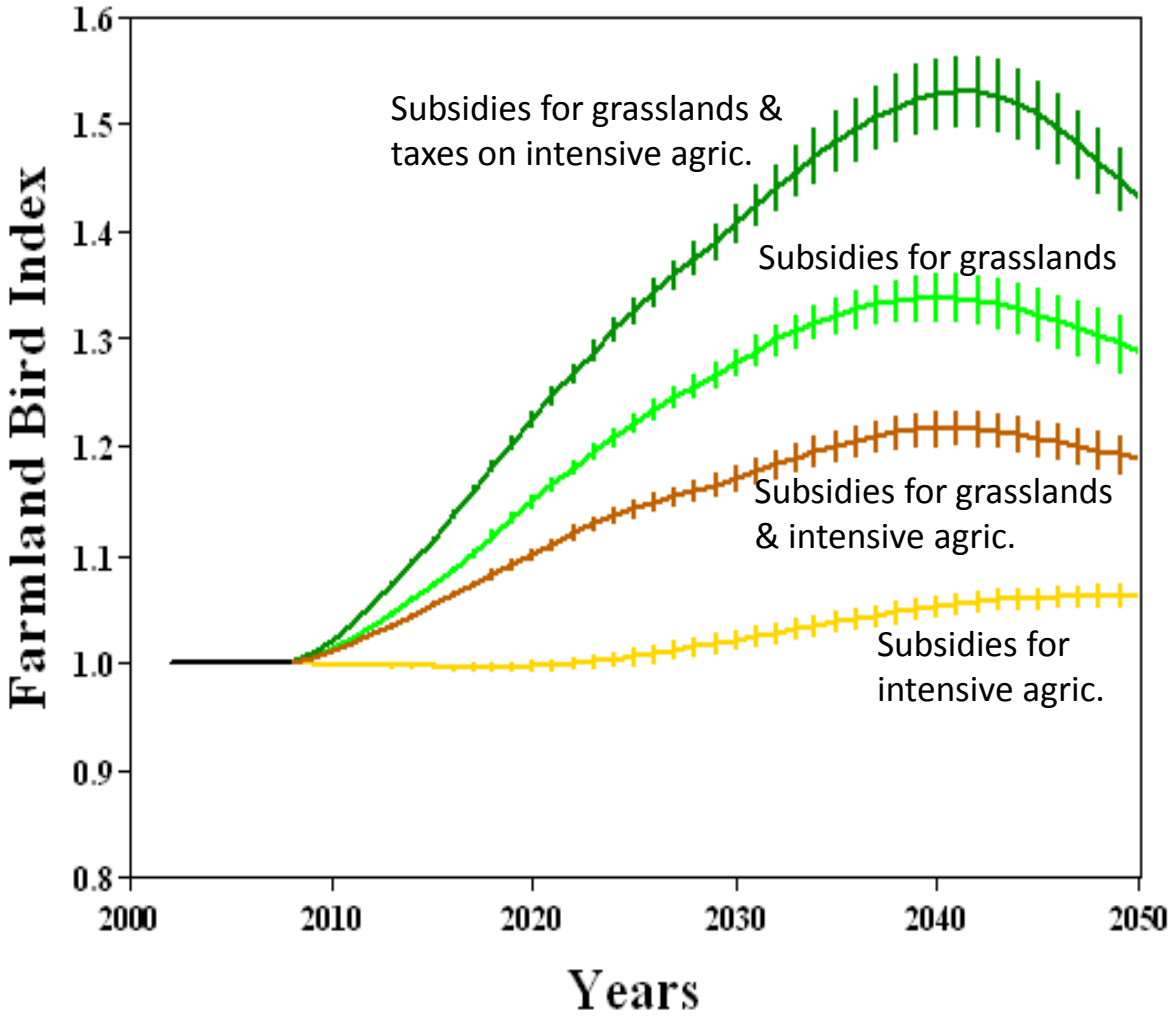
Example of pasture management impacts on deforestation in legal Amazon

Scenarios of land use in 2050

Lapola et al. 2011

Agricultural policy can have strong positive impacts on biodiversity and climate mitigation

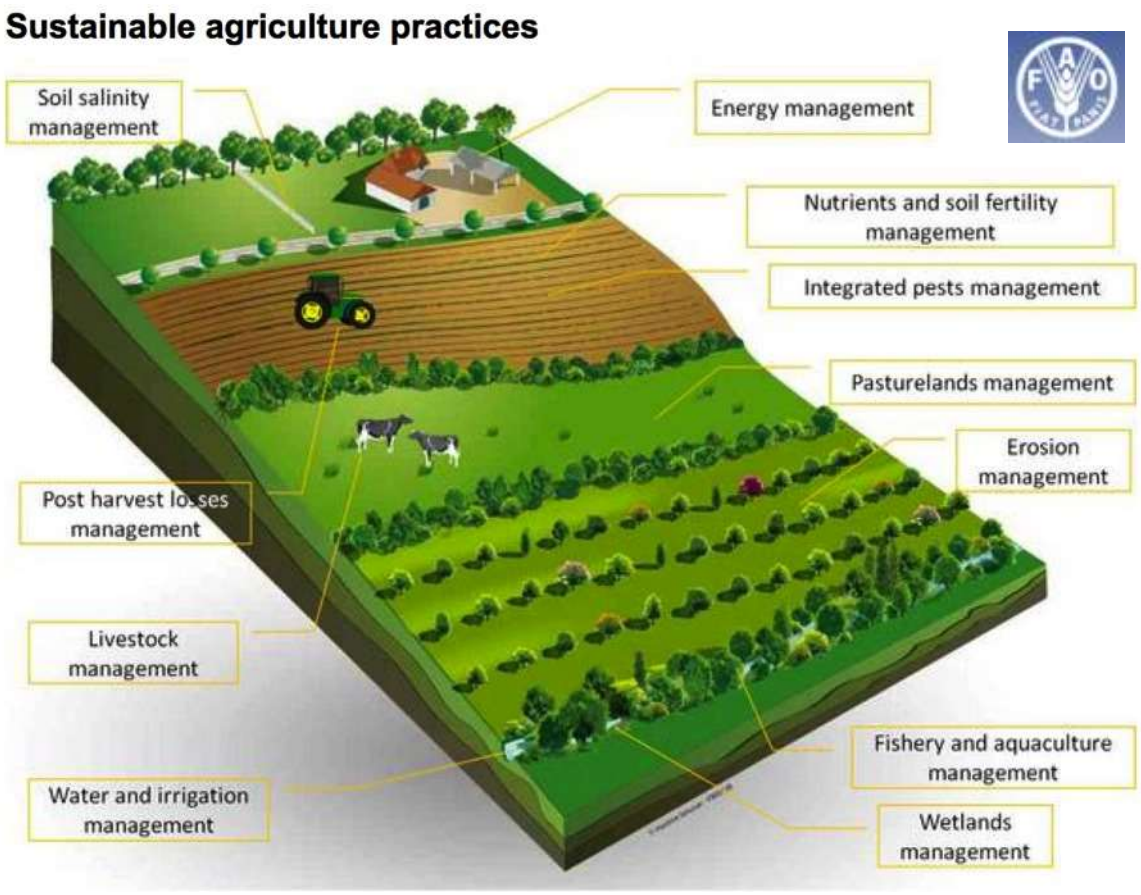
Example of scenarios of alternative EU Common Agricultural Policies on farmland bird diversity in France



Mouysset et al. 2011, GBO4 2014

Perdrix perdrix

Sustainable agriculture

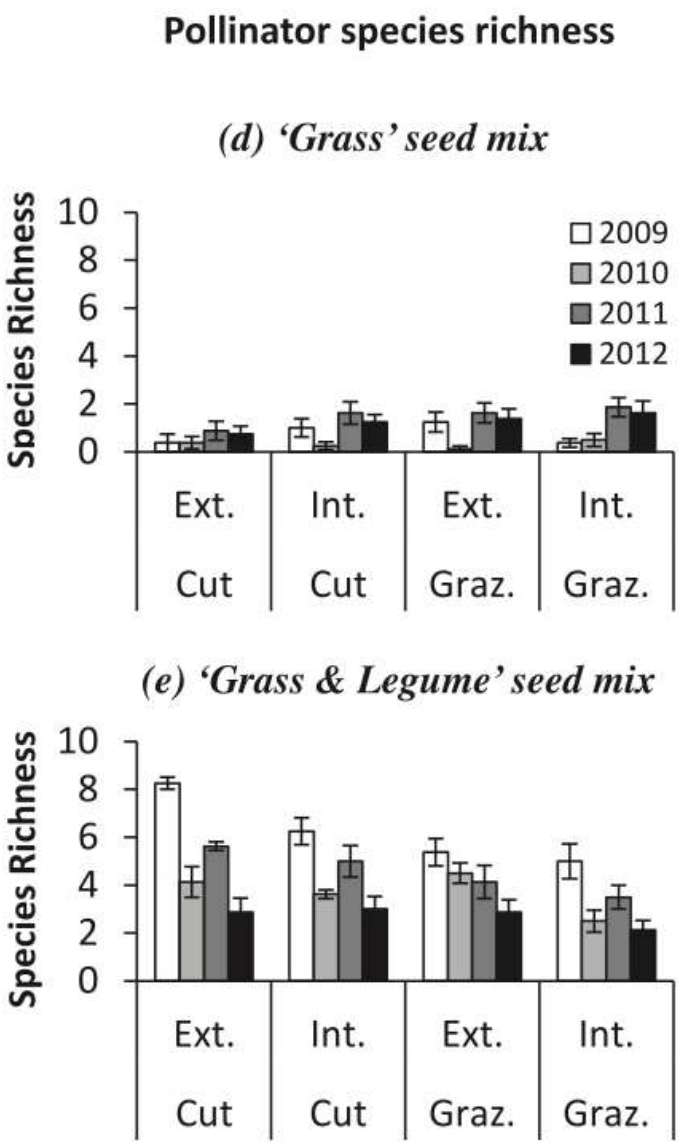


- **Sustainable agricultural practices, including promoting soil carbon sequestration, could contribute to climate mitigation while reducing impacts on biodiversity.**

- **Reductions of greenhouse gas emissions of 0.3 to 1.2 PgC/yr could be achieved soon through conservation tillage, better fertilizer and water management, and reducing methane emissions from rice paddies and livestock.**

Global carbon budget (2000-2009): 7.8 PgC/yr = emissions from fossil fuel and cement; 1.0 PgC/yr = emissions due to land use change; 2.4 PgC/yr = terrestrial sequestration

(1) Adding legumes to grasslands increases pollinator diversity

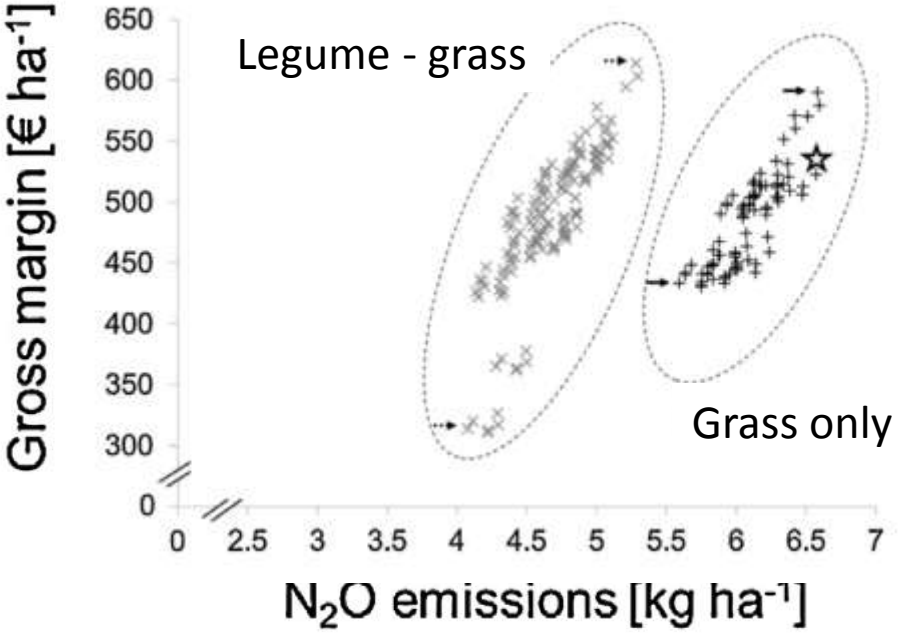


Woodcock et al. 2014

Using legumes in agriculture as a nature-based solution for climate change mitigation:

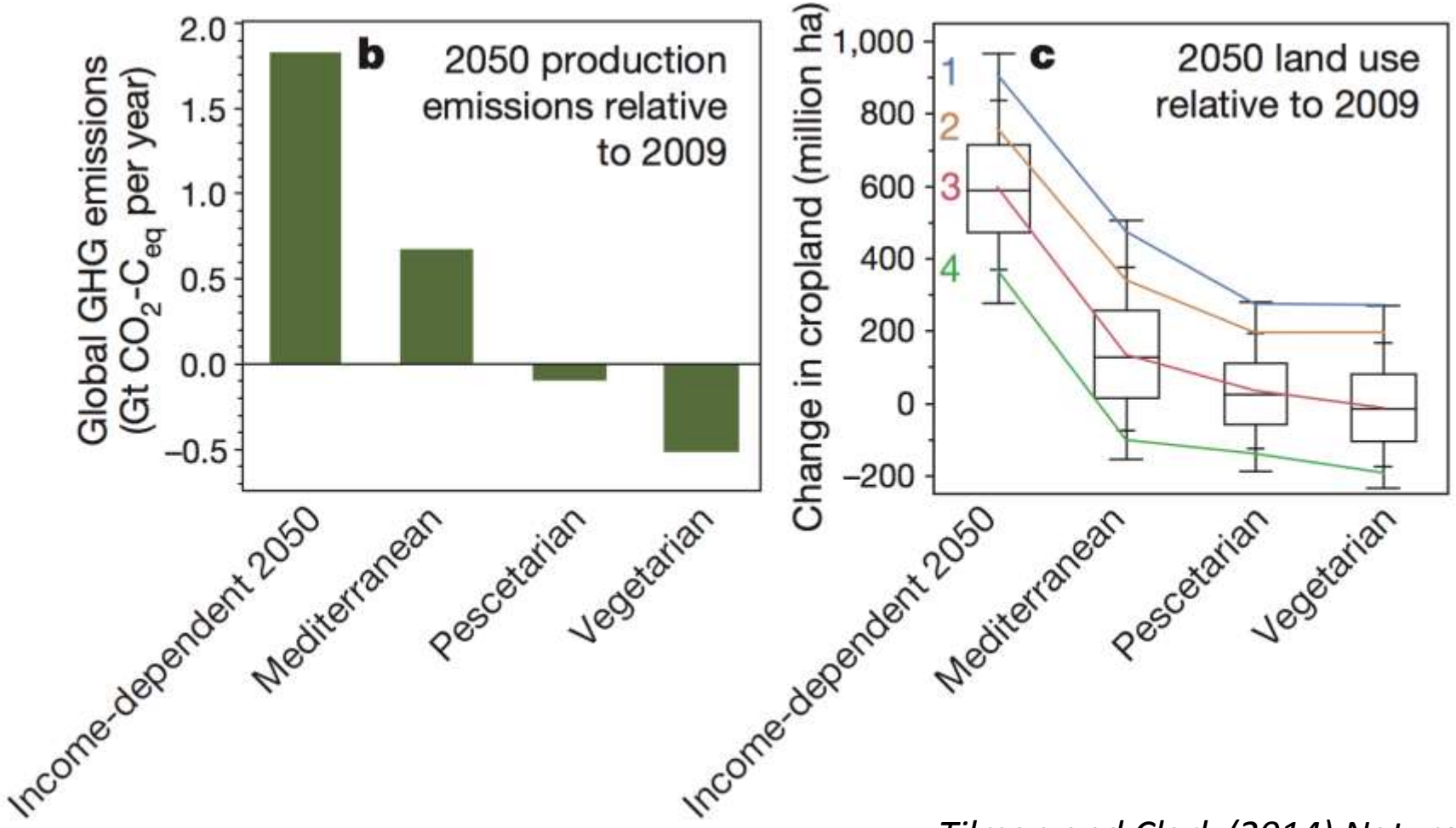
Example of grasslands in Europe

(2) Adding legumes to grasslands contributes to climate mitigation by reducing N_2O emissions and reducing CO_2 emissions from fertilizer production and application

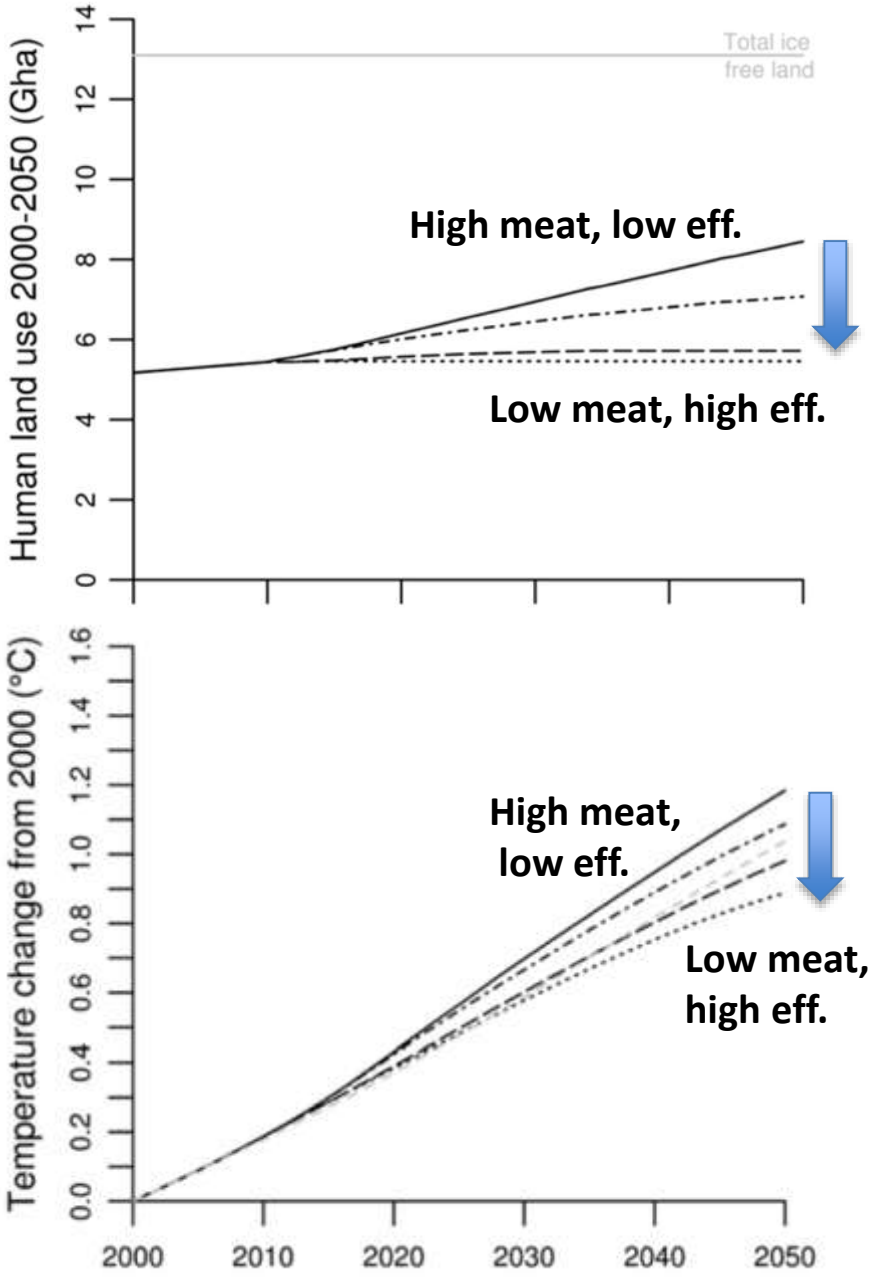


Reckling et al. 2015

Changes in diet and reductions of losses in food systems can make large positive contributions to climate mitigation, biodiversity, water security and human health

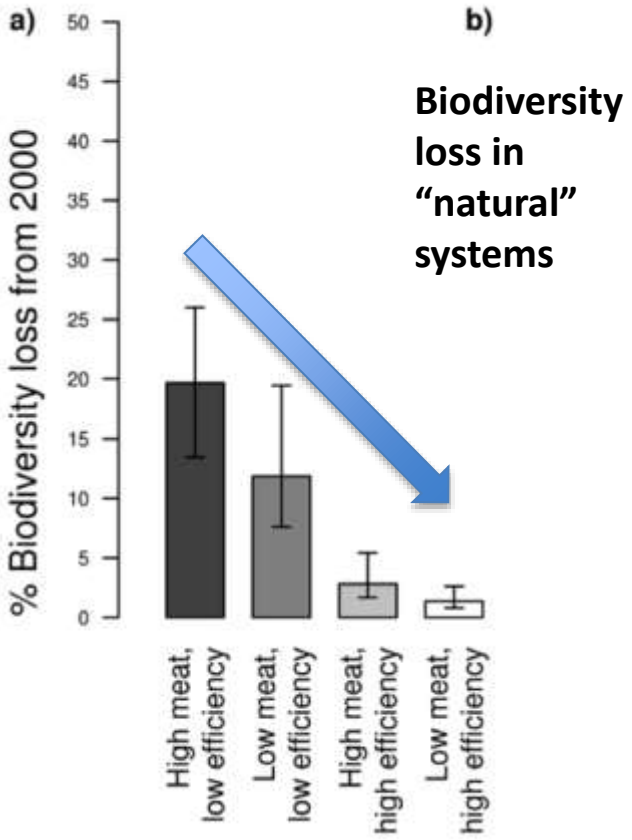


Tilman and Clark (2014) Nature



"Healthy" diets and reducing losses in food systems make reaching long-term sustainable development goals much more feasible

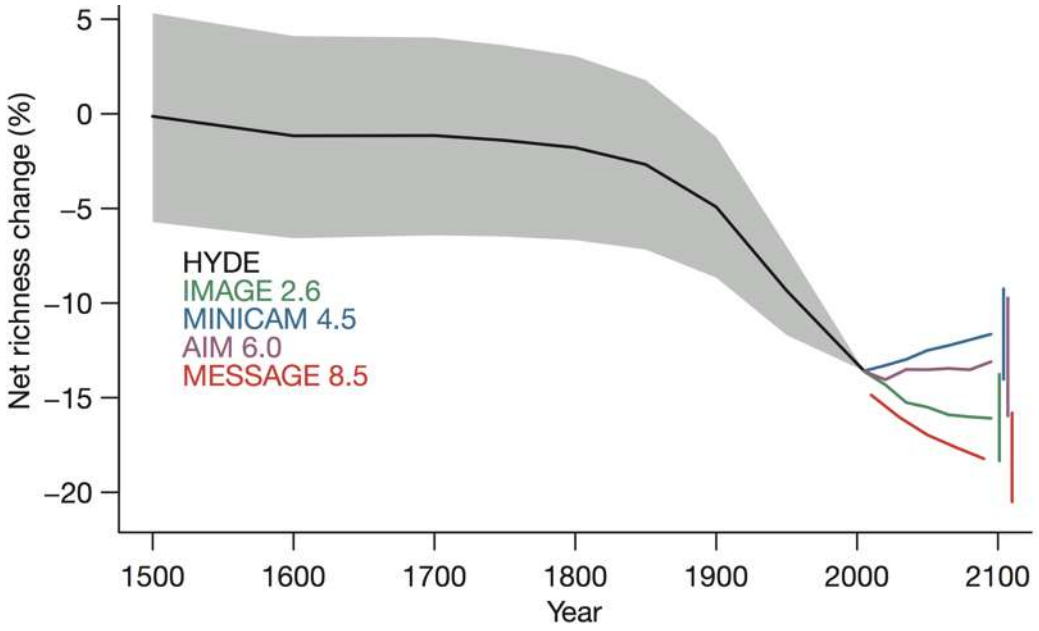
Example: Powell & Lenton 2013



Biodiversity loss in "natural" systems

See also Brunelle et al. 2014 / Liu et al. 2014 / Odegard et al. 2014 / Foley et al. 2011 / Stehfest et al. 2008

It's really important that the agriculture, climate and biodiversity communities tell a coherent story about the future!



Projected impacts of RCP ("Climate") scenarios of land use change on local species richness

Newbold et al. 2015

Linking Climate & Biodiversity Scenarios & Models

UNESCO – Paris, April 2016

Supported by the CBD, UNESCO & bioDISCOVERY
and in support of IPBES and IPCC

Convention on Biological Diversity

United Nations Educational, Scientific and Cultural Organization

bioDISCOVERY

IPBES Scenarios & Models Assessment

"Close collaboration between IPBES, IPCC and the scientific community would provide the opportunity to build on the strengths of the new shared socio-economic pathways scenarios and at the same time match the needs of IPBES…"

IPBES 3rd Plenary - January 2015 - Bonn

L-R: IPBES Executive Secretary **Anne Larigauderie**; IPBES Chair **Abdul Hamid Zakri**; and IPCC Chair **Rajendra Pachauri**

France - Climate and biodiversity: two meetings of the IPCC and IPBES experts

COP 21 – December 2015 - Paris

Rio Conventions PAVILION

Linking biodiversity, climate change and sustainable land management

Convention on Biological Diversity