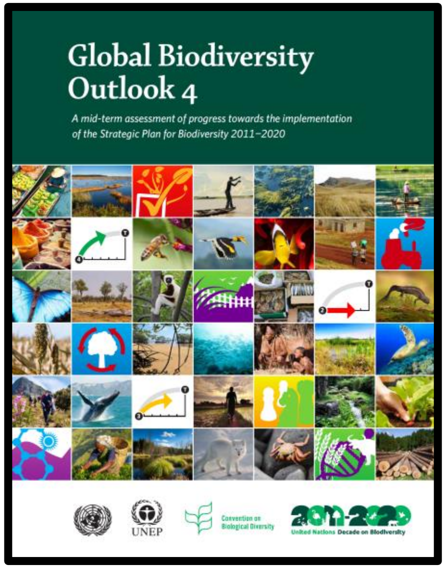
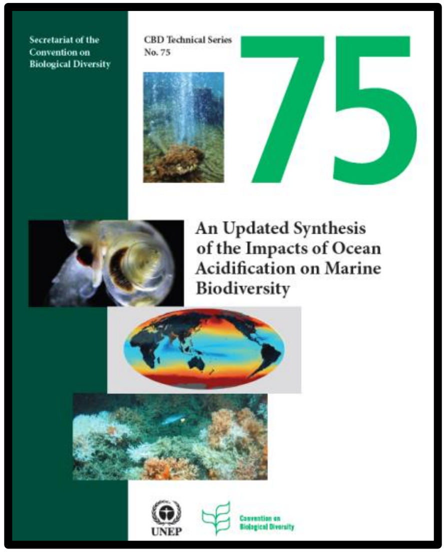
Connecting biodiversity with climate change mitigation and adaptation



Convention on Biological Diversity



David Cooper – Secretariat of the CBD
Paul Leadley – Coordinator: Global Biodiversity Outlook-4
Phillip Williamson – CLA: CBD Ocean Acidification (OA) update

and the contributors to the CBD GBO4 and OA reports

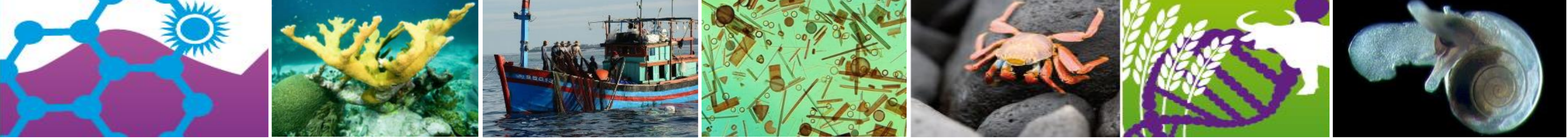
UNEP
Convention on Biological Diversity
2011-2020
United Nations Decade on Biodiversity

Main points

- Many organisms and ecosystems are already impacted by recent climate changes, so additional change will exacerbate impacts. Thresholds are often difficult to identify.

- Biodiversity can play an important role in increasing resilience to climate change.

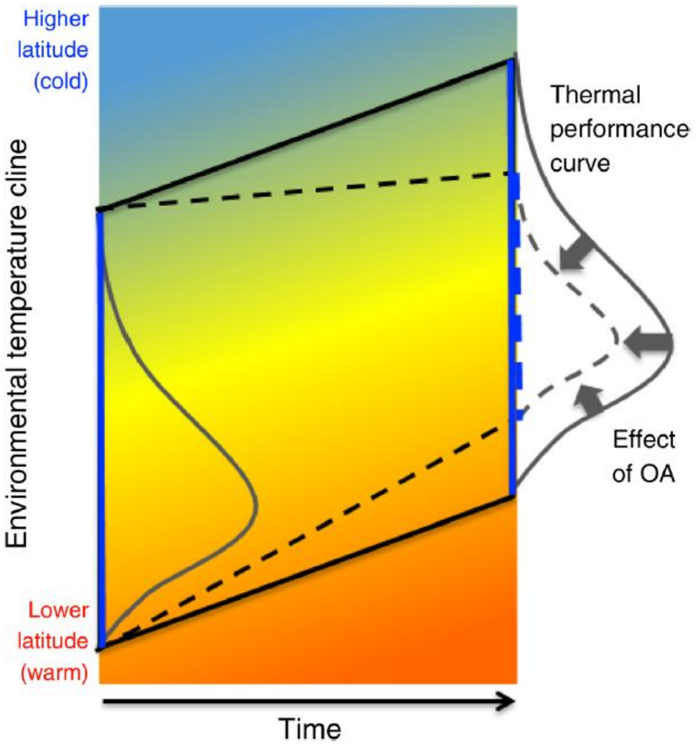
- Pathways to remain within 1.5 or 2°C will require careful management to conserve biodiversity and ecosystems and optimize their contribution to climate mitigation and adaptation.



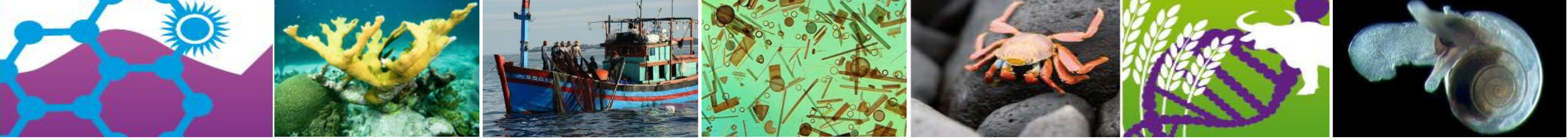
Climate, Biodiversity and Ocean Acidification (OA)

Quick recap on what OA involves: more dissolved CO_2, bicarbonate ions (HCO_3^-) and hydrogen ions (H^+) *i.e. lowered pH*; but less carbonate ions (CO_3^{2-}) *i.e. reduced saturation state, Ω*

- Marine organisms can react to any of these changes – and different organisms react in different ways
- PLUS interactions with: other climate-related stressors (e.g., warming, hypoxia); indirect pH effects (e.g., increased metal toxicity); food & nutrient availability; and biotic factors (e.g., food web changes, competition)
- Even if there is poleward migration, OA will reduce species' ranges (*right*)



Gaylord et al. (2015) Ecology

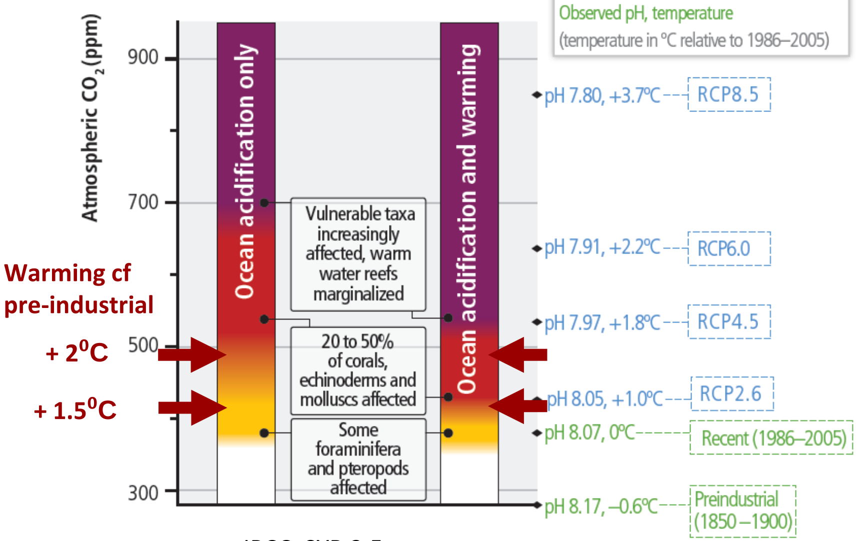


Climate, Biodiversity and Ocean Acidification (OA)

The difference between 1.5^0 and 2.0^{0}C: increased risk

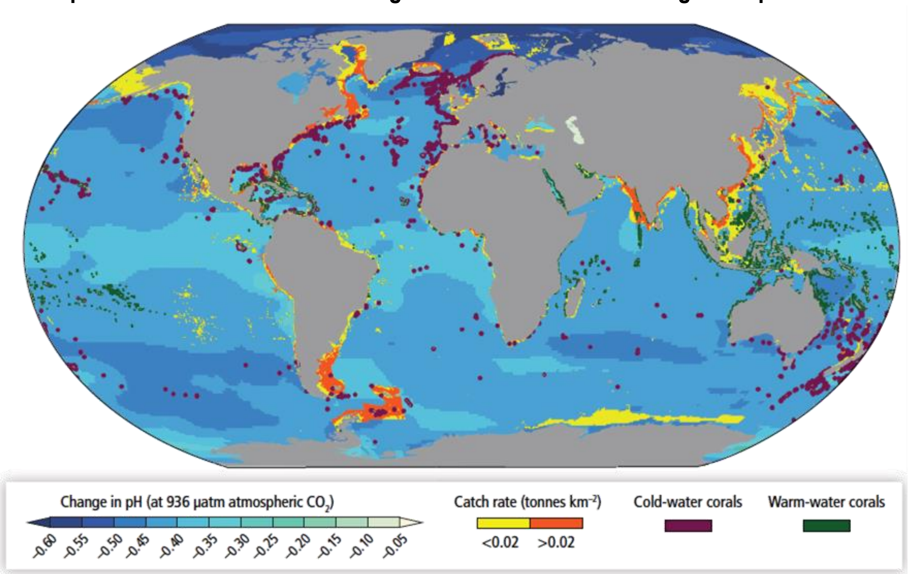
- OA impacts are already occurring in US oyster hatcheries, and are implicated for increased shell erosion of pteropods (planktonic molluscs) and slowing of coral growth
- Any additional increase of atmospheric CO_2 and other stressors progressively increases the OA risk to biodiversity

Risk for marine species impacted by ocean acidification only, or additionally by warming extremes

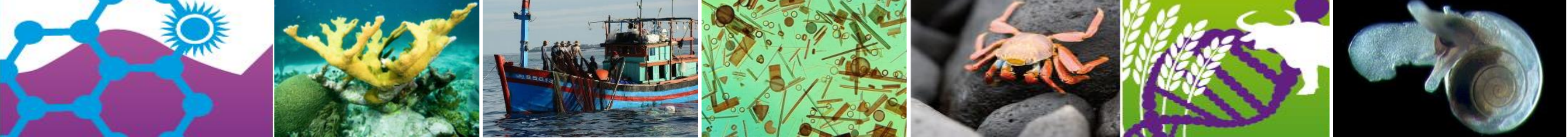


IPCC SYR 2.5

Species vulnerable to OA - of high socio-economic or ecological importance

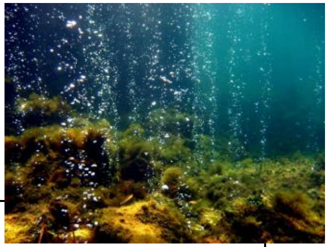


IPCC AR5 WGII Figure 6.10, SPM.6

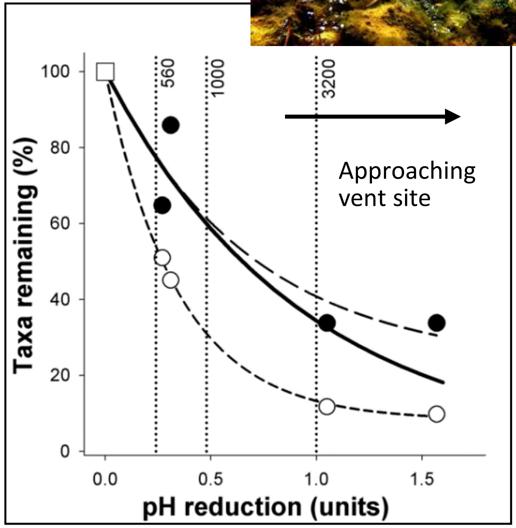


Climate, Biodiversity and Ocean Acidification (OA)

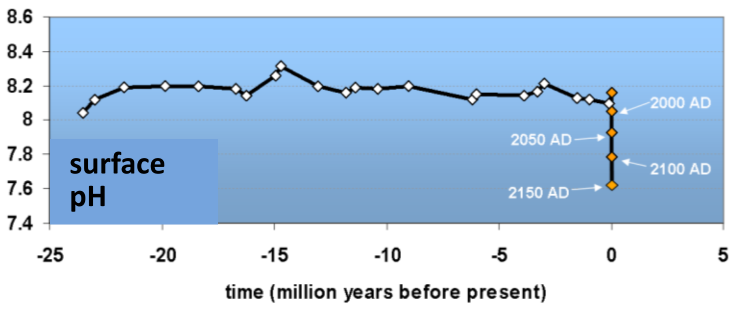
Evolutionary adaptation?

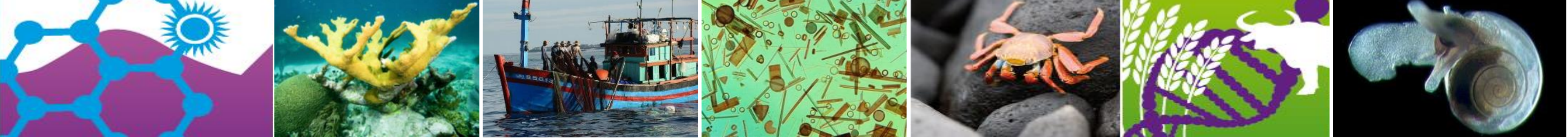


- In experiments, multi-generational adaptation to OA conditions can occur for some calcified phytoplankton
- However, in coastal seas, 'well-established' CO_2 vent sites do *not* show evidence that benthic species can adapt to such conditions: biodiversity losses of 15 – 40% occur at ~560 ppm mean pCO_2
- Palaeo- evidence shows natural OA events (at much slower rates than today) caused the extinction of many benthic species
- Even if some species can adapt, ecosystem changes will occur – also the corrosion of unprotected carbonate structures (e.g. coral reefs) in unsaturated waters



Jason Hall-Spencer et al (2008)

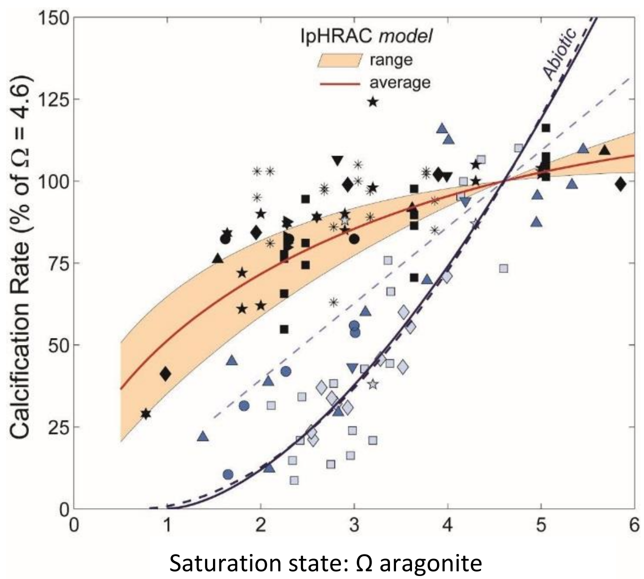




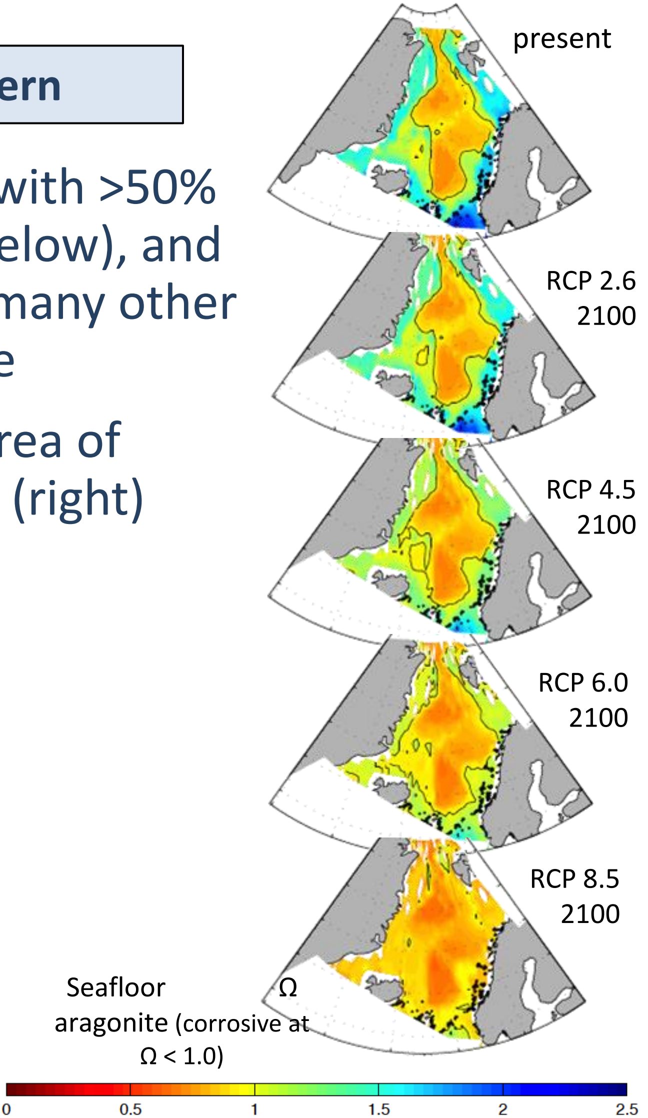
Climate, Biodiversity and Ocean Acidification (OA)

OA effects on corals: a particular concern

- Warm-water coral reefs are already under stress, with >50% currently in poor health. OA slows calcification (below), and hence recovery from bleaching. Reef loss affects many other species, and increases the impacts of sea-level rise
- Cold-water corals are at risk from the increasing area of seafloor experiencing aragonite saturation of <1.0 (right)



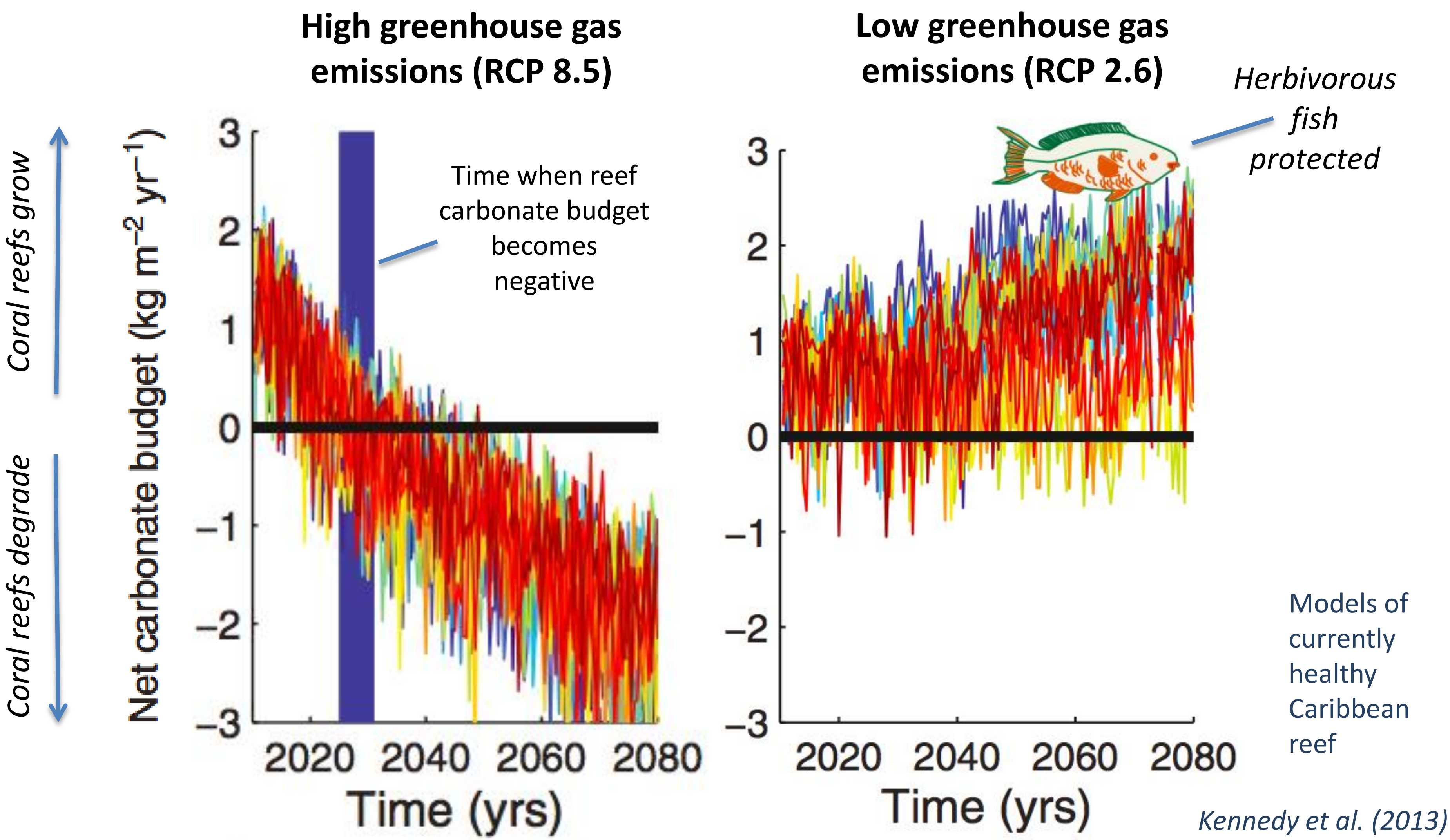
McCulloch et al (2012)
Nature Climate Change



A Olsen & J Tjiputra; OSPAR-ICES OA Study Group

Protecting coral reefs requires:

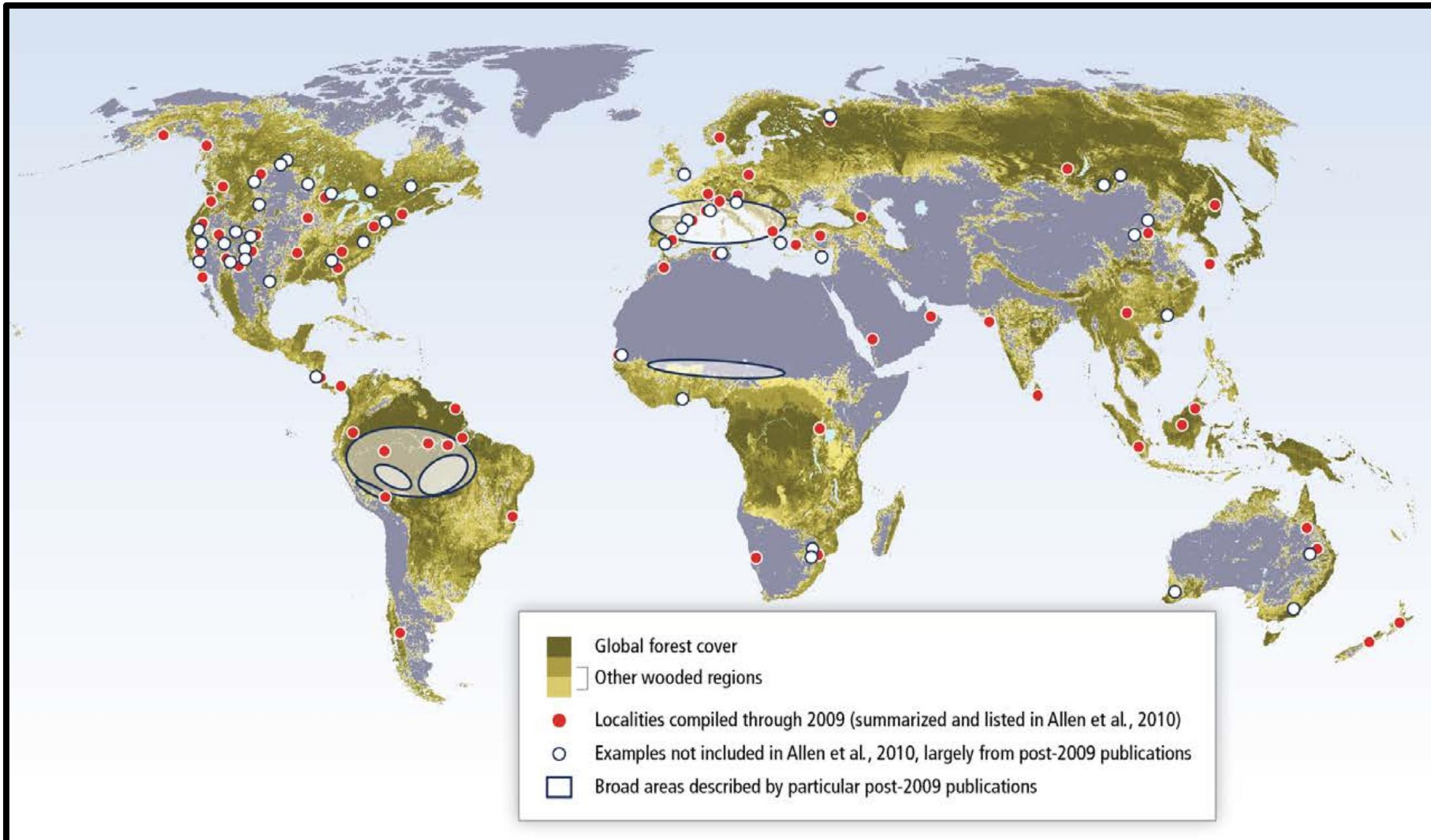
Global action ***(CO_2 emissions mitigation for climate and ocean acidification) &***
Local action ***(e.g., protection of herbivorous fish, reduction in pollution)***



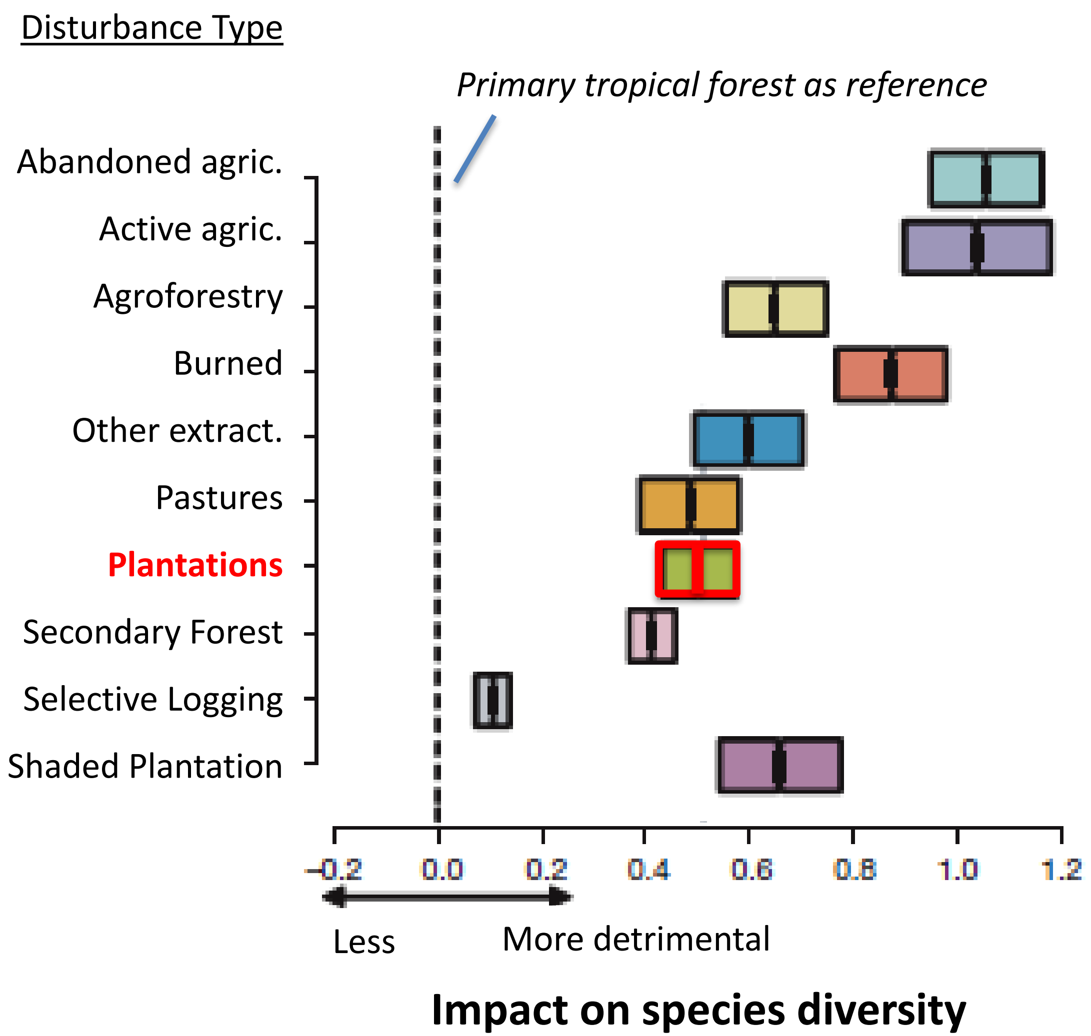
Climate, Biodiversity and Forests

- Forests are being negatively impacted by climate change sooner than had been anticipated. Impacts vary substantially across tree species and regions (IPCC AR5, WG II Chapter 4).
- Reinforcing species and genetic diversity of trees can enhance the adaptive capacity of forests to climate change (GBO4, Aichi Target 13, but see Grossiord et al. 2014).
- Reducing deforestation can make a substantial contributions to climate mitigation and biodiversity protection (GBO4, Target 5).
- Restoration using diverse tree species mixes or natural regrowth can contribute to climate mitigation & biodiversity protection (GBO4, Target 15).
- Planted forests could make important contributions to future bioenergy, but if they replace primary forest they have negative impacts on biodiversity and medium-term C balance (GBO4, Target 4, CBD 2050 vision).

There is evidence that tree mortality is increasing globally, but confidence in attribution of this to recent climate change is low - Chapter 4



Climate, Biodiversity and Forests



Conversion of tropical forests to plantations has very large, long-term negative impacts on:

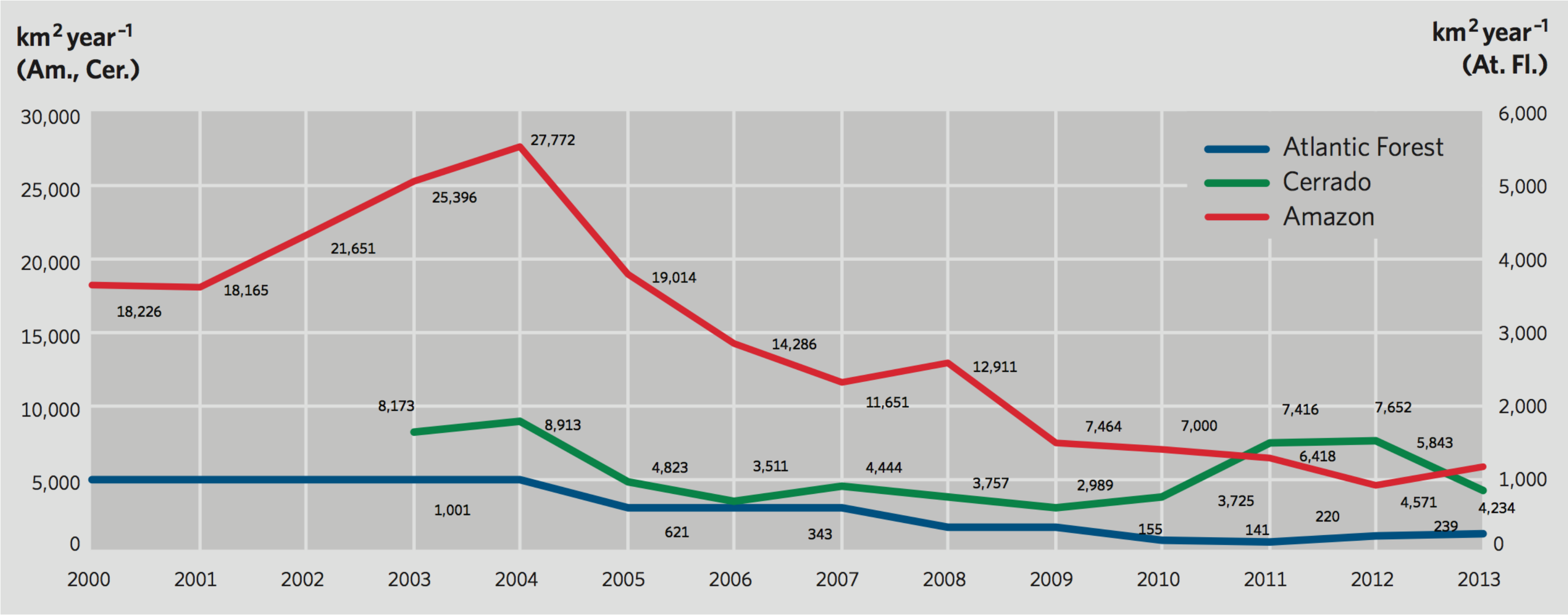
- **Biodiversity**
(e.g., Gibson et al. 2011)

and

- **Soil carbon stocks**
(e.g., Chiti et al. 2014)

So leaving tropical forests intact is win-win!

Climate, Biodiversity and Forests



<u>Reducing deforestation in Brazil has relied on a multi-faceted approach including</u>:

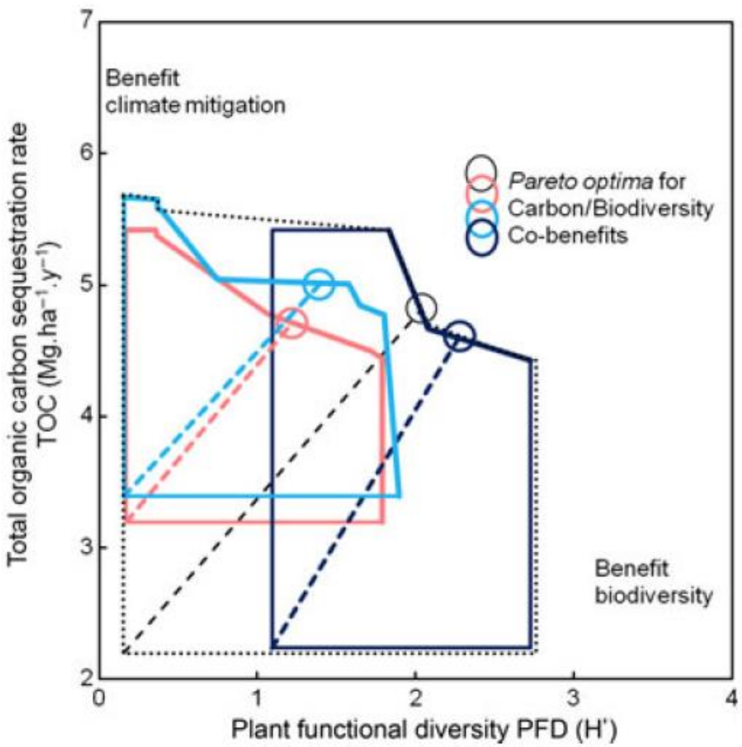
- "Real-time", publically available monitoring of deforestation
- Enforcement campaigns to crack down on illegal deforestation and logging
- Involvement of businesses and stakeholders to reduce deforestation.
- Incentive measures, including restricting credit for rural landowners with the highest rates of deforestation.
- Expansion of protected areas and demarcation of indigenous lands: ecosystems in these areas store 117±22 GtCO_2e!

GBO4 (2014), Lapola et al. (2014), Soares-Filho et al. 2014

Climate, Biodiversity and Forests

Examples of very large scale reforestation / afforestation (see CBD GBO4):

- Three North Shelterbelt Project – monoculture based restoration in China
- Grain for Green – passive restoration in loess region of Western China
- Great Green Wall of Africa – active restoration in Sahel region of Africa
- Atlantic Forest of Brazil – active restoration, high diversity

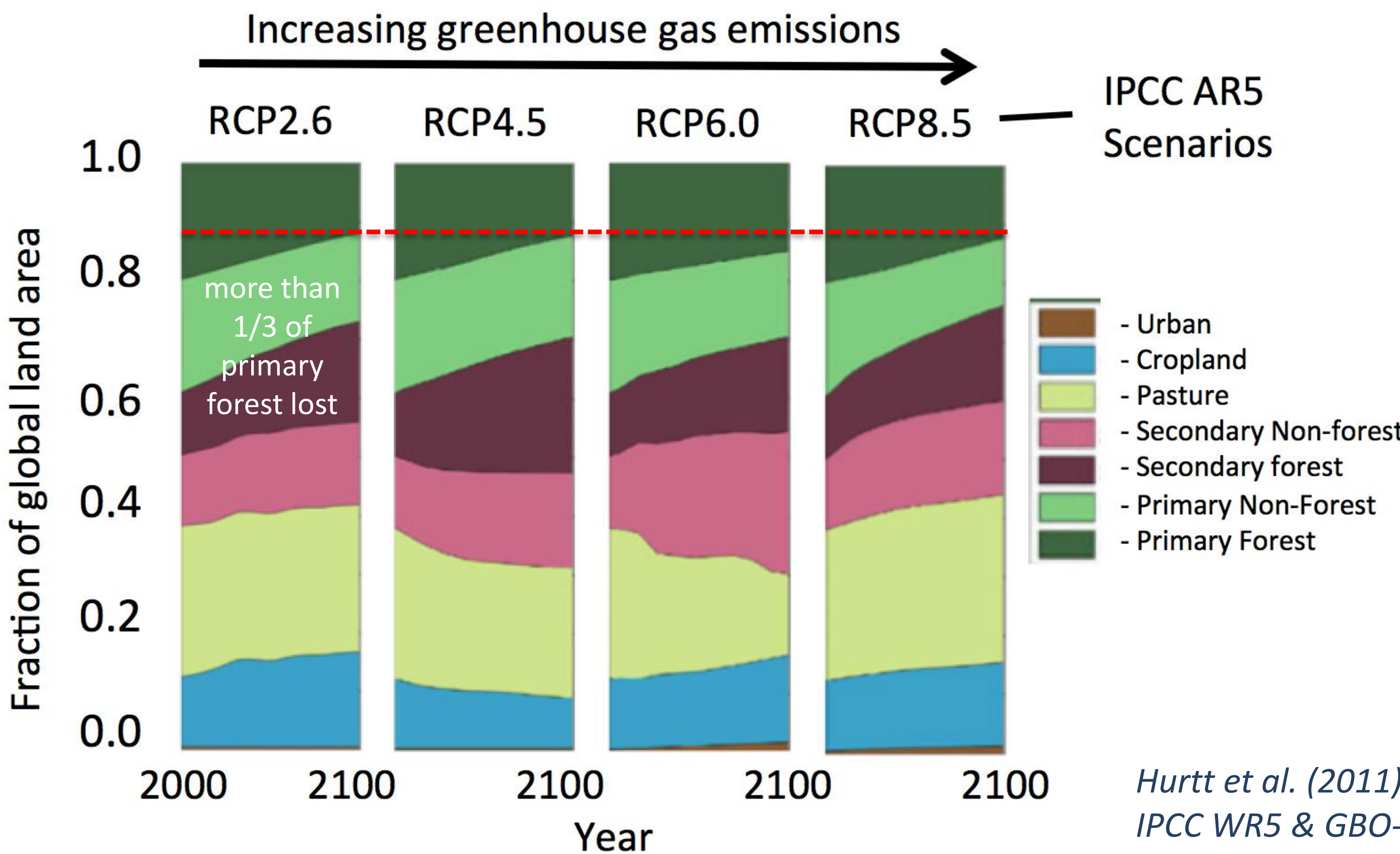


Optimizing co-benefits for biodiversity, climate mitigation and other ecosystems services for restoration projects is complex…

but new decision support tools can help to evaluate tradeoffs.

e.g., Pichancourt et al. (2014)

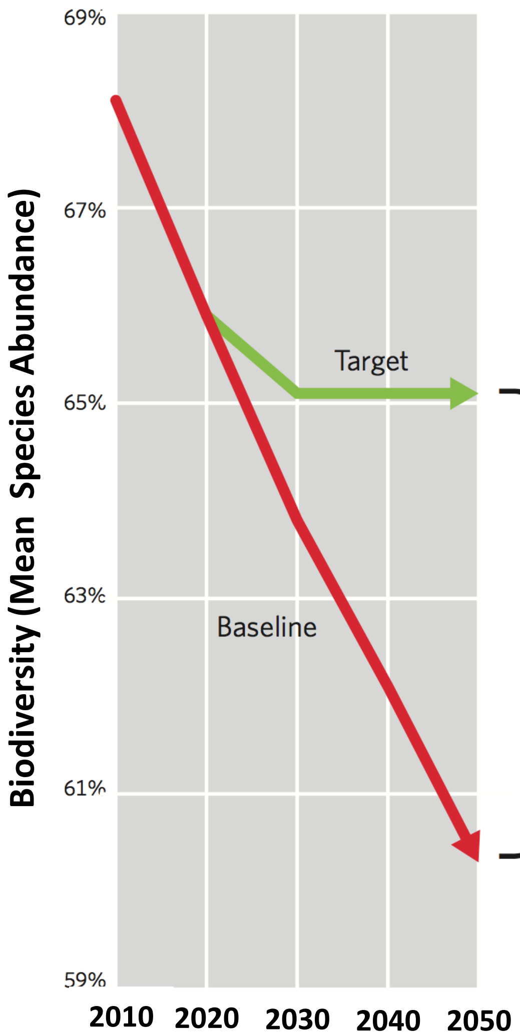
IPCC: primary land use scenarios associated with the four relative concentration pathways (RCPs)



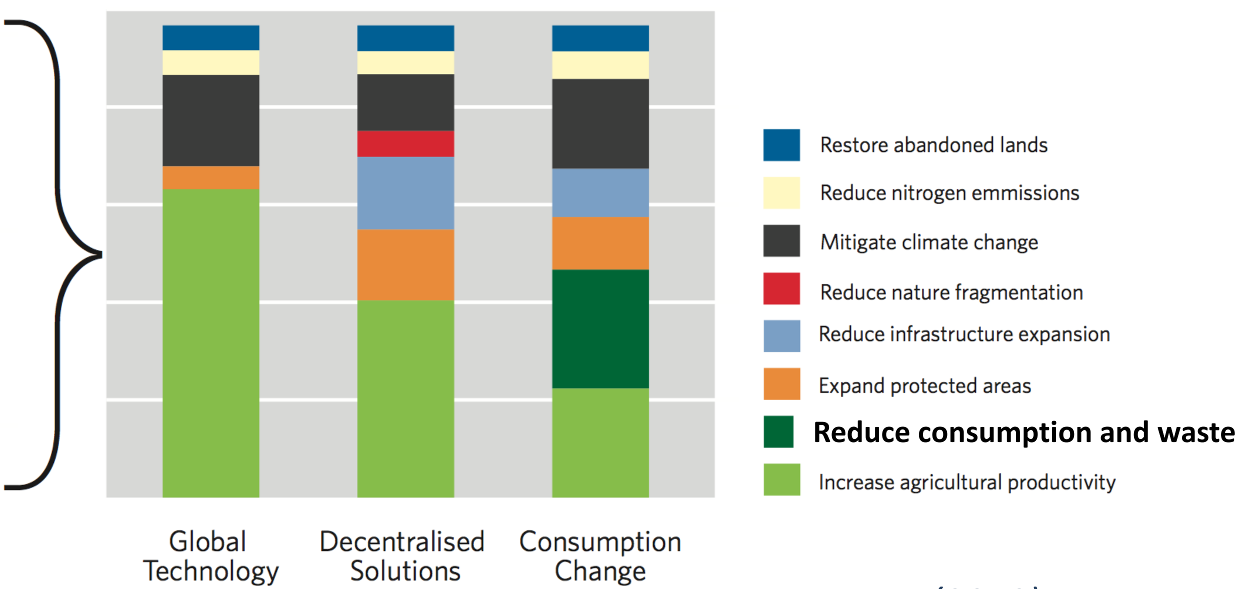
Hurtt et al. (2011), IPCC WR5 & GBO-4

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

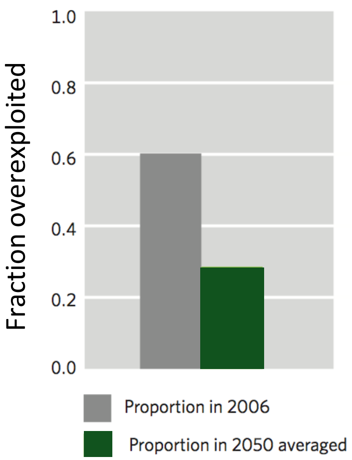


Three scenarios for achieving the 2050 vision

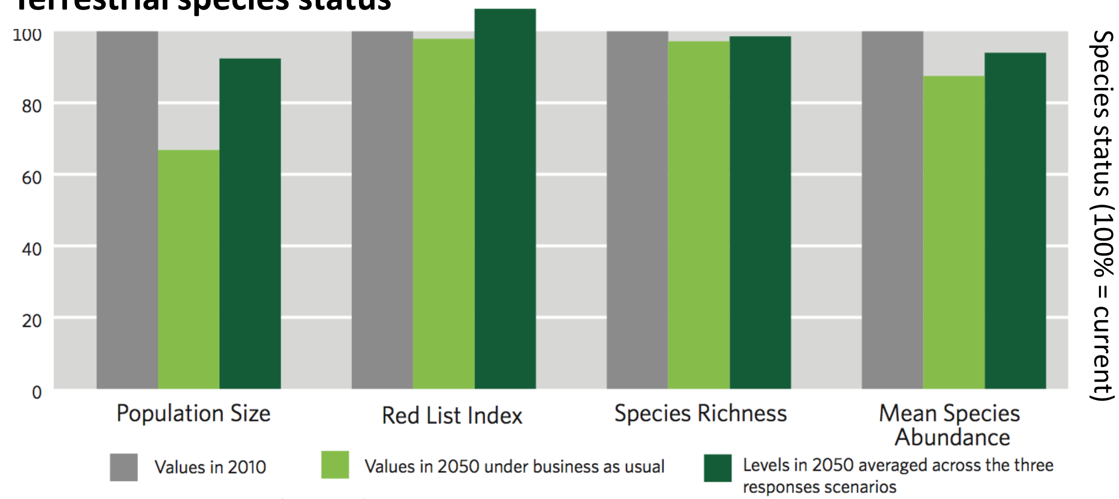
PBL (2012)
Leadley et al. (2014)

Achieving the CBD 2050 Vision and ties with Sustainable Development Goals

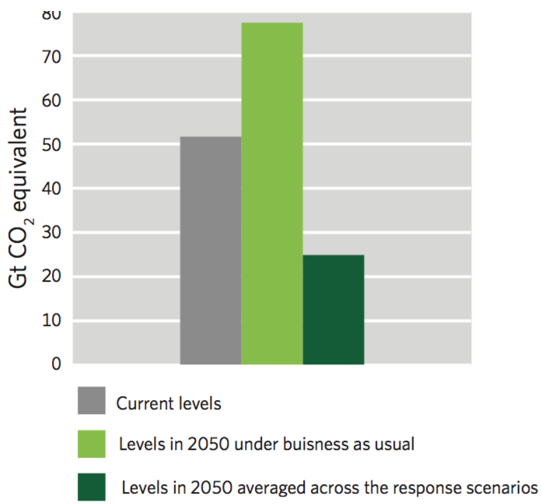
Fisheries



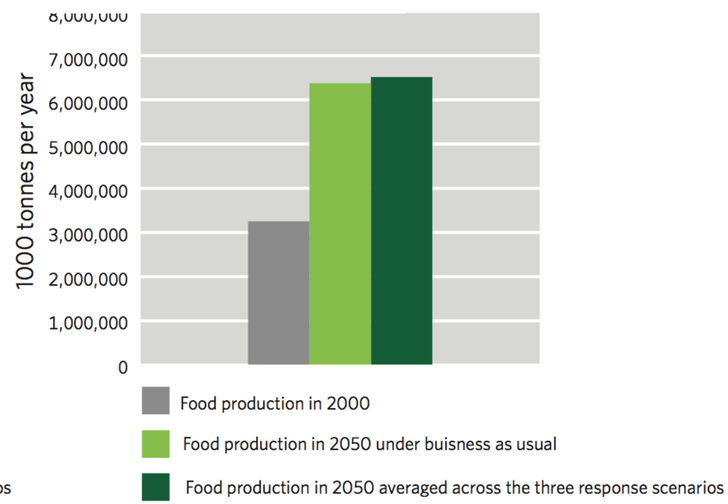
Terrestrial species status



GHG emissions



Food production



PBL (2012)
Leadley et al. (2014)

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• Pathways to remain within 1.5 or 2°C will require careful management to conserve biodiversity and ecosystems and optimize their contribution to climate mitigation and adaptation.

UNEP Convention on Biological Diversity 2011-2020 United Nations Decade on Biodiversity

Many thanks to contributors to the CBD GBO4 and OA reports!

Consortium Leading the Preparation of the GBO4 Technical Report

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Many thanks to contributors to the CBD GBO4 and OA reports!

Biodiversity Indicators Partnership contributions to GBO4

The Partnership is coordinated by UNEP-WCMC. Indicator partners include Biodiversity International, BirdLife International, Cardiff University, CITES, FAO of the United Nations, Forest Peoples Programme, Forest Stewardship Council, Global Biodiversity Information Facility, Global Footprint Network, International Nitrogen Initiative, IUCN, IUCN SSC Invasive Species Specialist Group, University of Auckland, Marine Stewardship Council, McGill University, National Centre for Ecological Analysis and Synthesis, Organisation for Economic Co-operation, Royal Society for the Protection of Birds (RSPB), TEAM Network, Terralingua, TRAFFIC International, UBC Fisheries Centre (University of British Columbia), UNEP GEMS Water Programme, Union for Ethical BioTrade, United Nations Educational, Scientific and Cultural Organization, University of Queensland, Australia, and WWF.

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Many thanks to contributors to the CBD GBO4 and OA reports!

An updated synthesis of the impacts of ocean acidification on marine biodiversity

<u>Coordinating lead authors:</u>

Sebastian Hennige, Murray Roberts and Phillip Williamson

<u>Lead authors:</u>

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<u>Reviewers:</u>

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Tree diversity does not always improve resistance of forest ecosystems to drought

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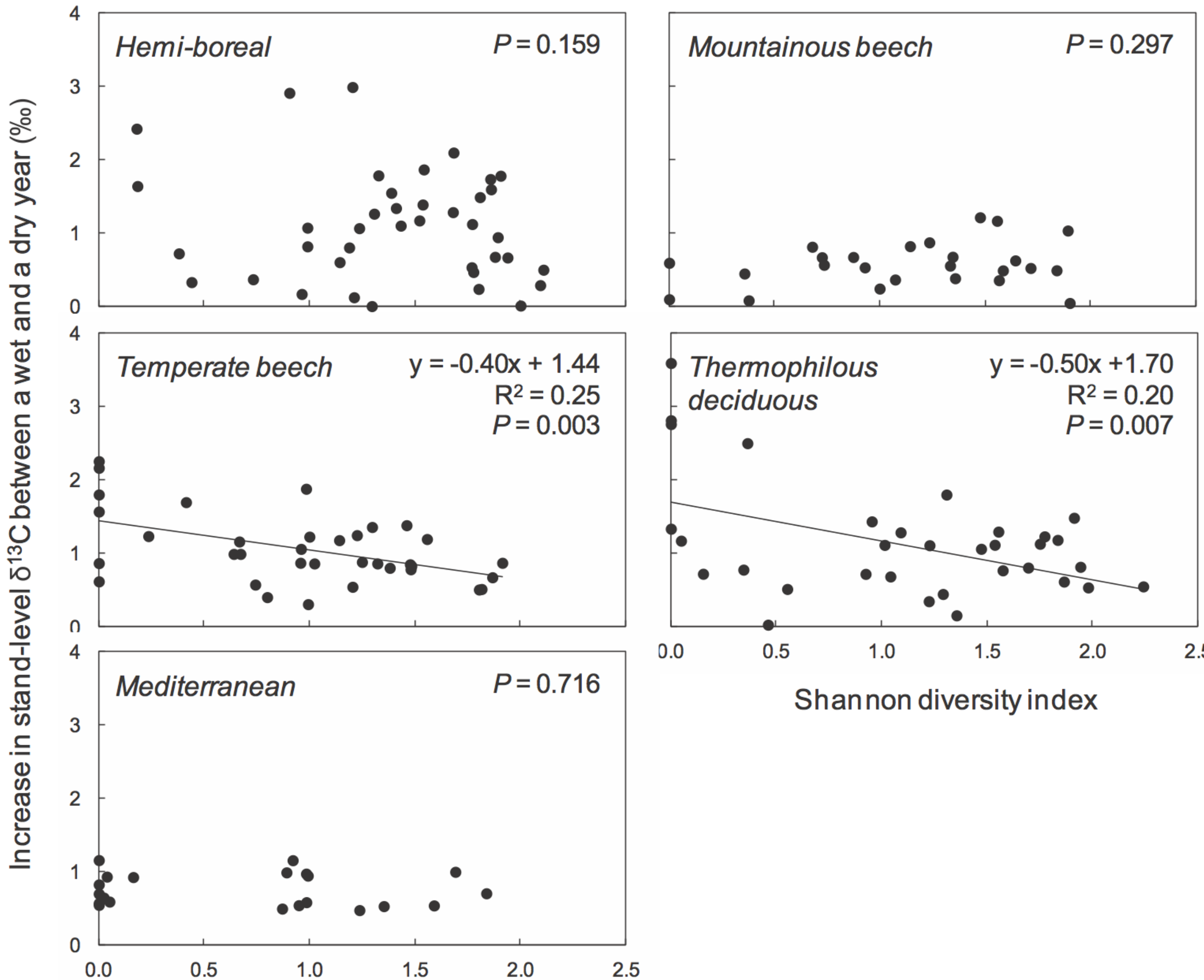
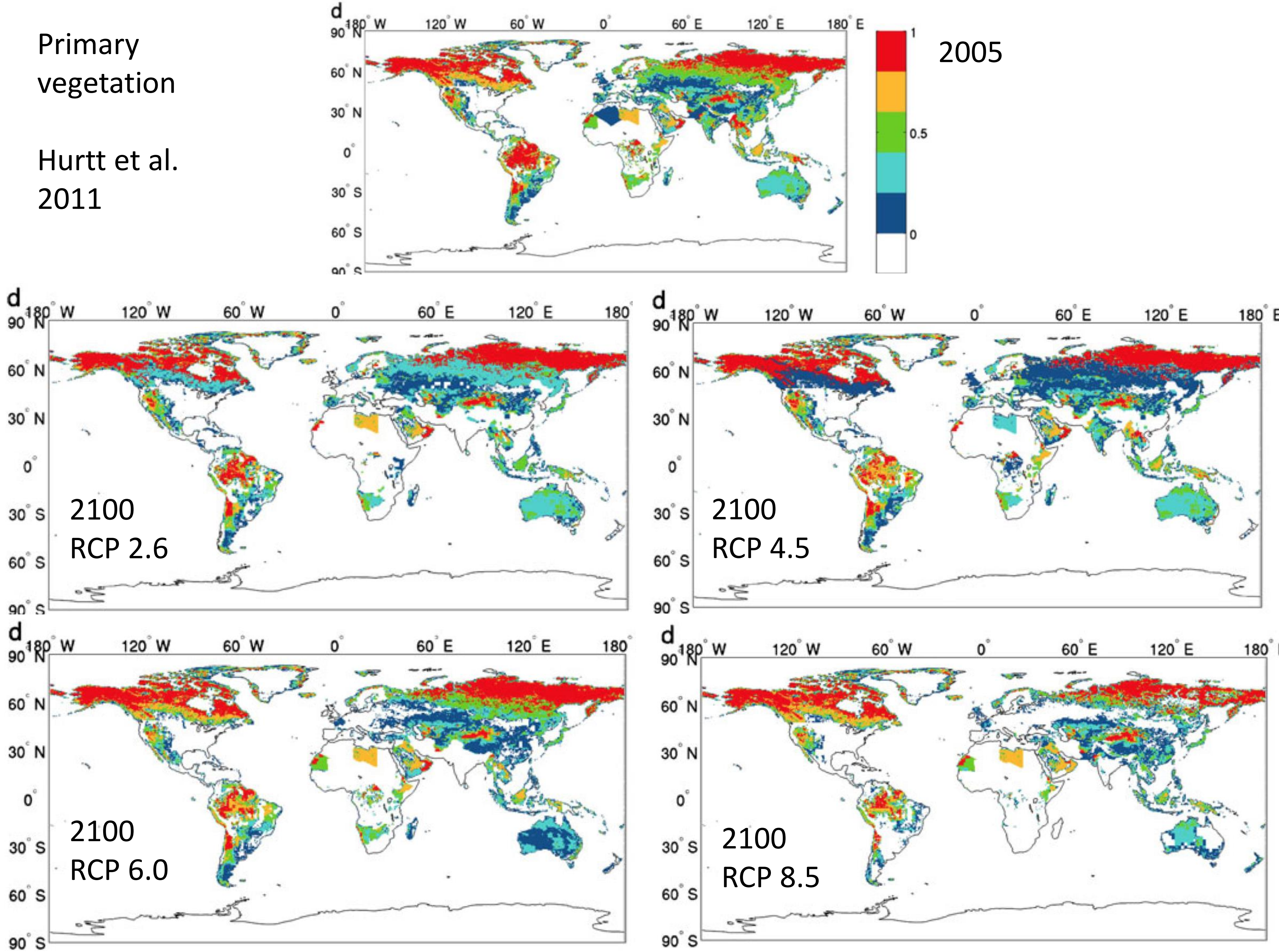
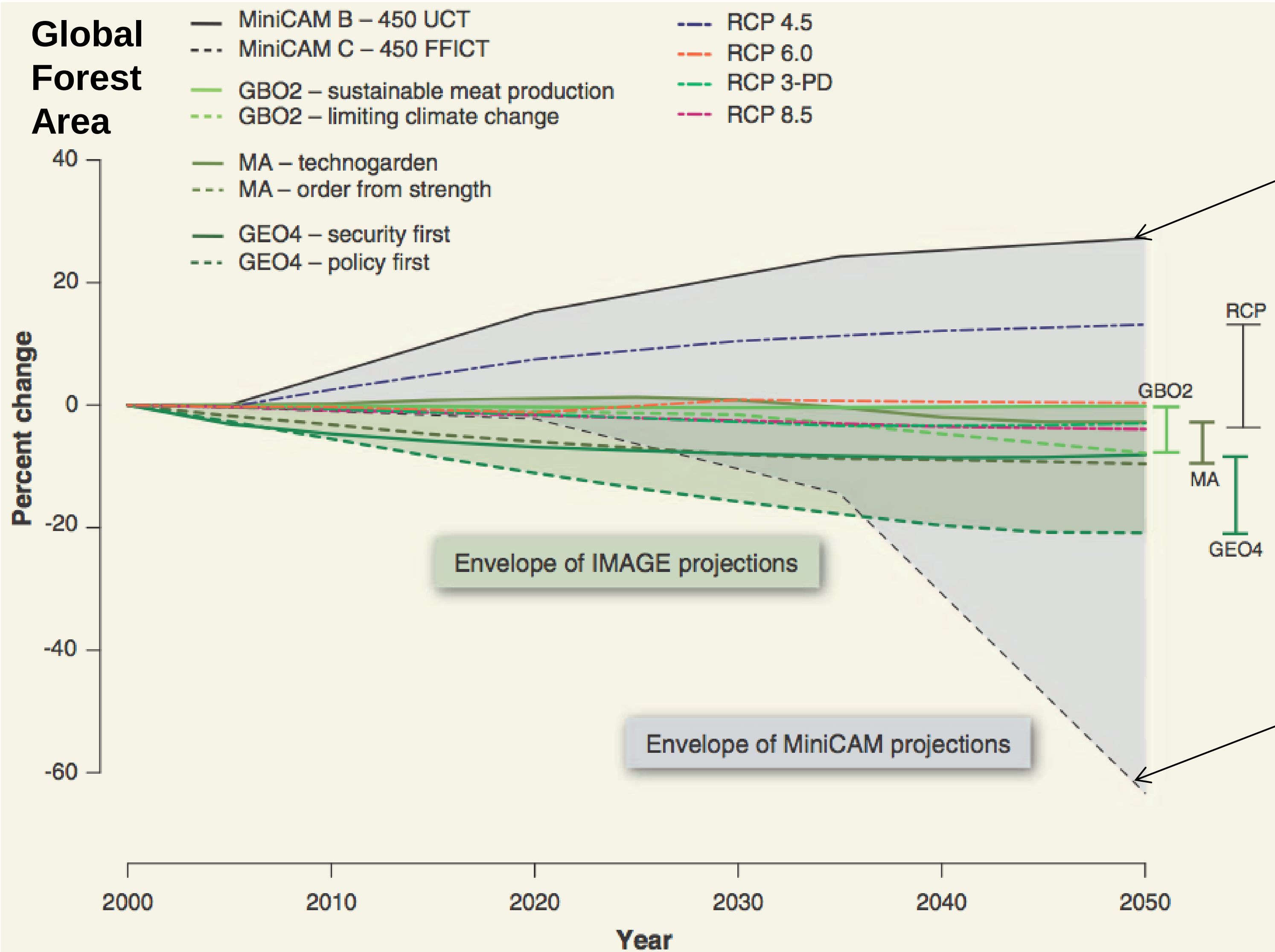


Primary vegetation

Hurtt et al. 2011



HABITAT LOSS



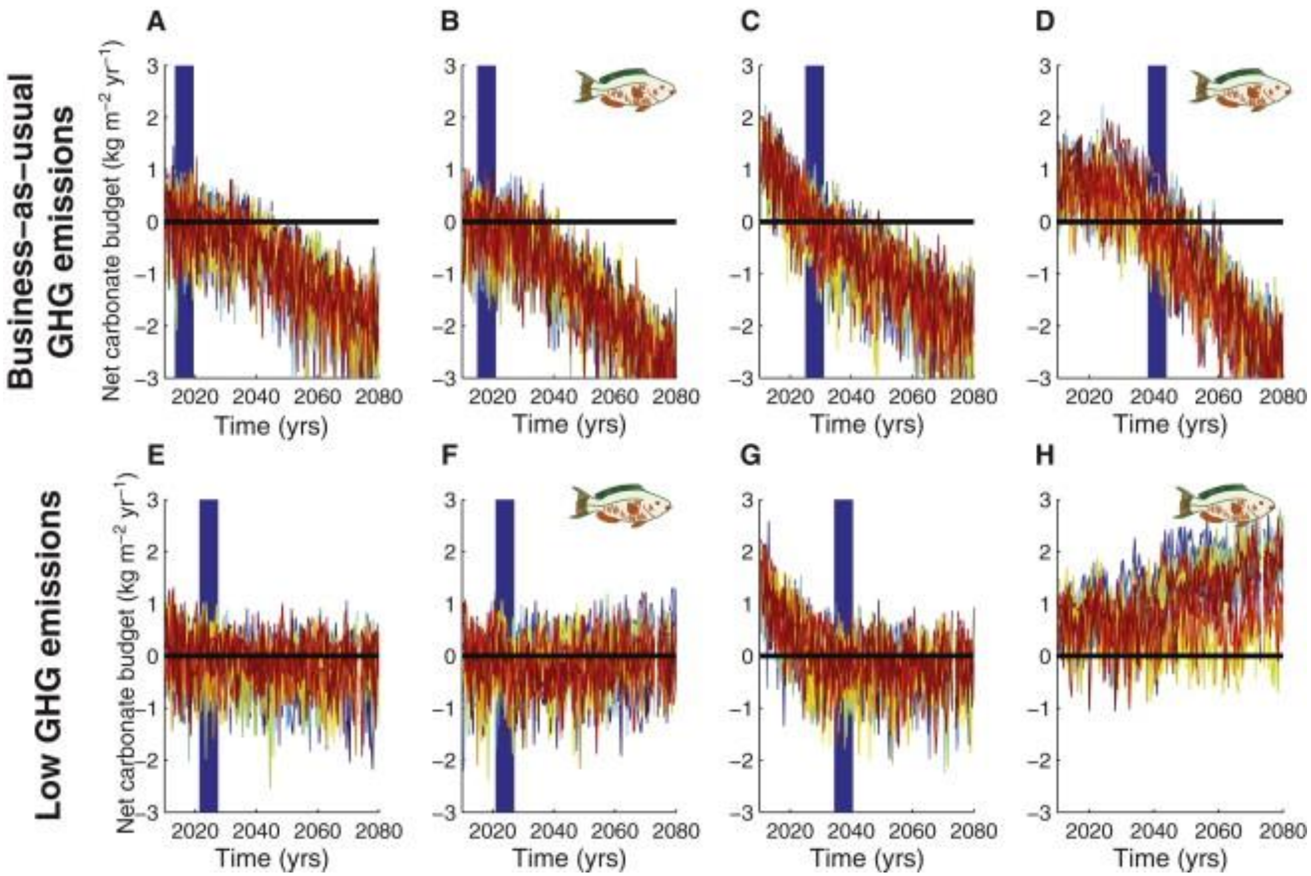
Tax on all sources of C emissions: Increased agric. efficiency, limited biofuels

Tax only on fossil fuel C emissions: little improvement in agric. efficiency, massive deployment of biofuels

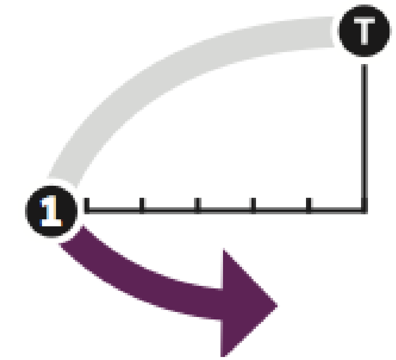
Pereira, Leadley et al. 2010

Management to improve adaptive capacity of warm coral reefs

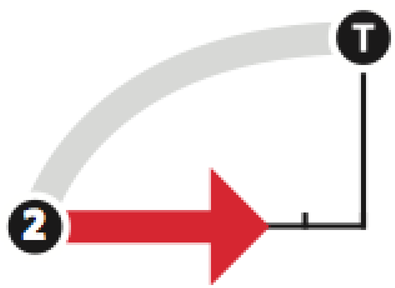
<u>Global action</u> (climate mitigation) and
<u>Local action</u> (e.g., protection of herbivorous fish, reduction in pollution) are needed



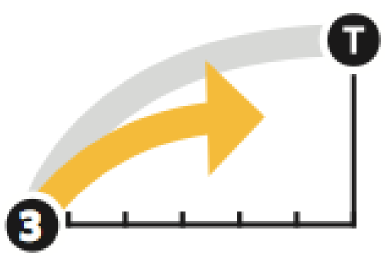
Assessment of progress towards the Aichi Targets in the "dashboard" of the GBO-4 Executive Summary



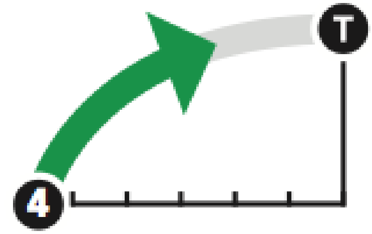
Moving away from Target



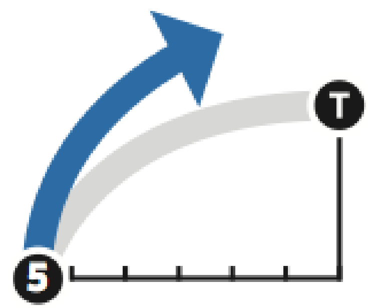
No progress towards target



Progress towards target, but not to achieve it



On track to achieve Target



On track to exceed Target

No clear evaluation

Insufficient information to evaluate progress

Overview of the "Dashboard" for the Aichi Targets