



POTSDAM INSTITUTE FOR  
CLIMATE IMPACT RESEARCH

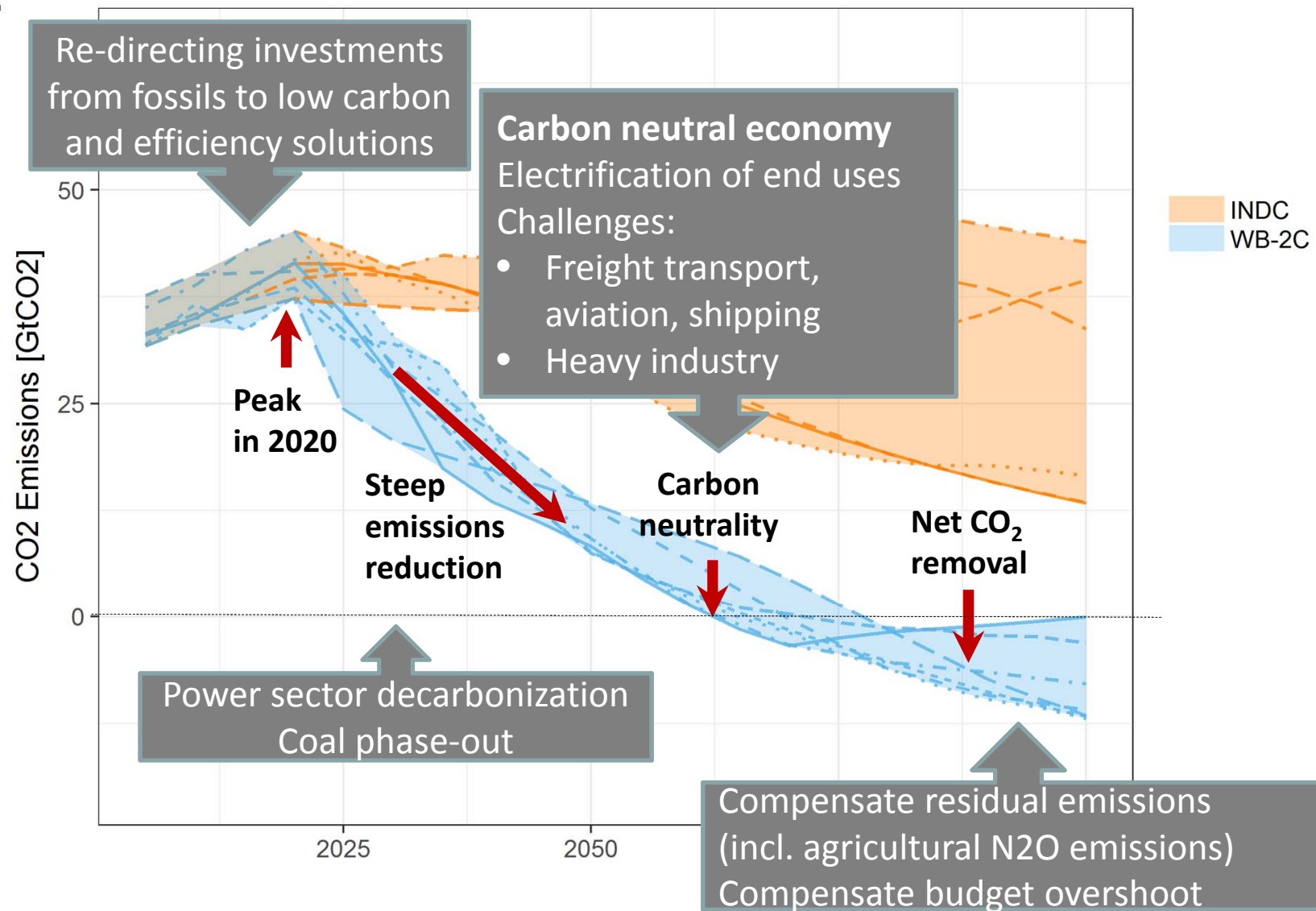
# Climate mitigation pathways and sustainable development

**Elmar Kriegler**

ThinkForest Workshop on  
Climate Policy and Forest Bioeconomy

Brussels, December 4<sup>th</sup>, 2018

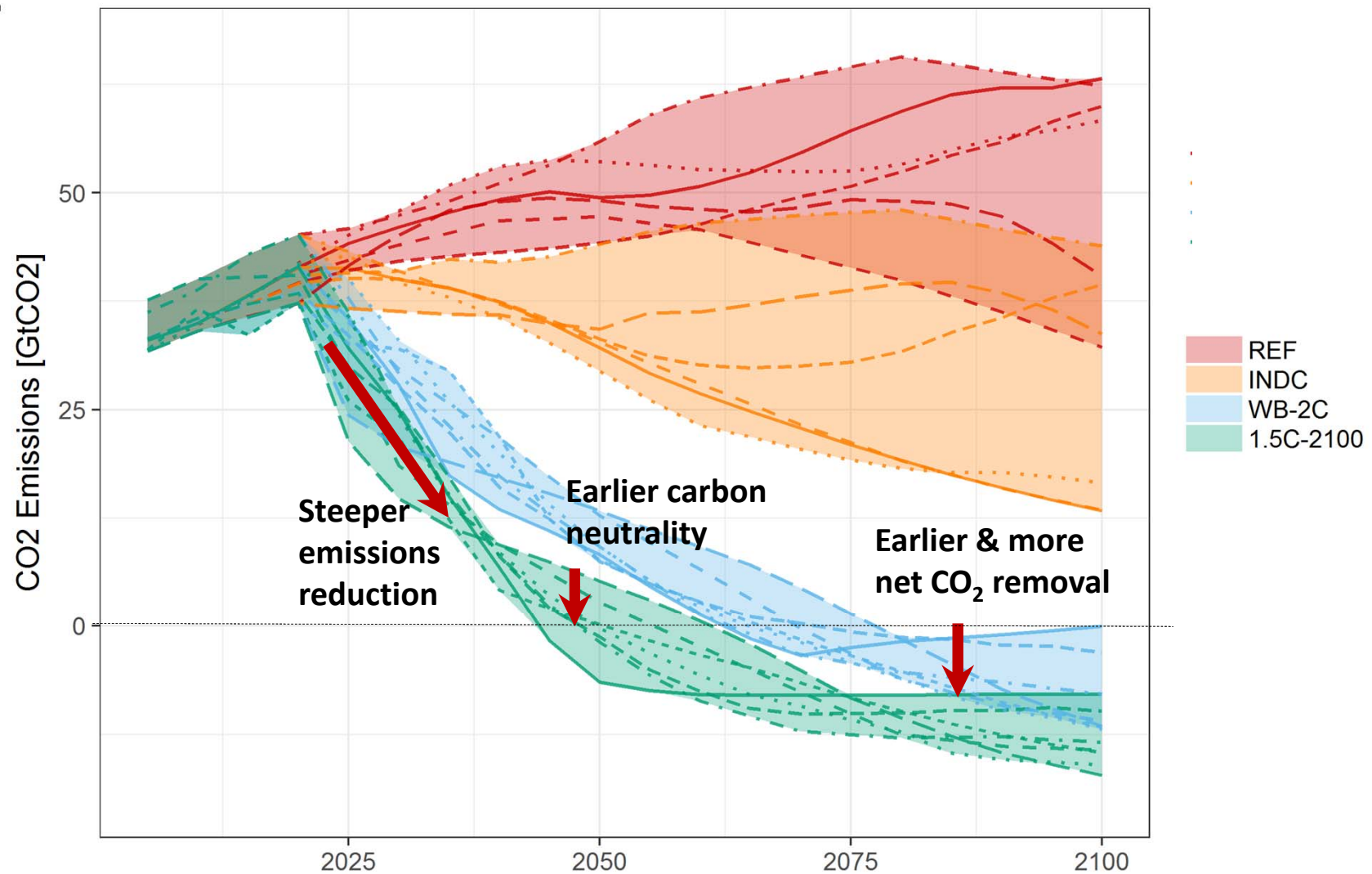
# The Story of 2°C Mitigation Pathways



Luderer et al. (2018) *Residual fossil CO emissions in 1.5–2°C pathways*. Nature Climate Change



# The Additional Challenge of Limiting Warming to 1.5°C



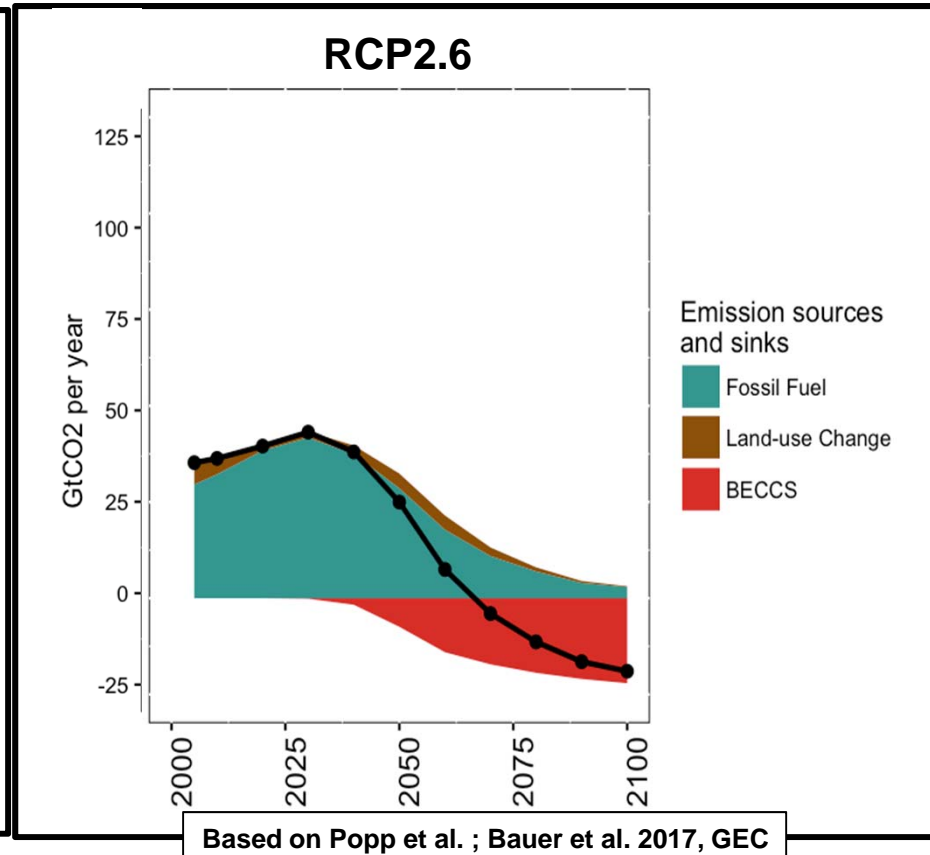
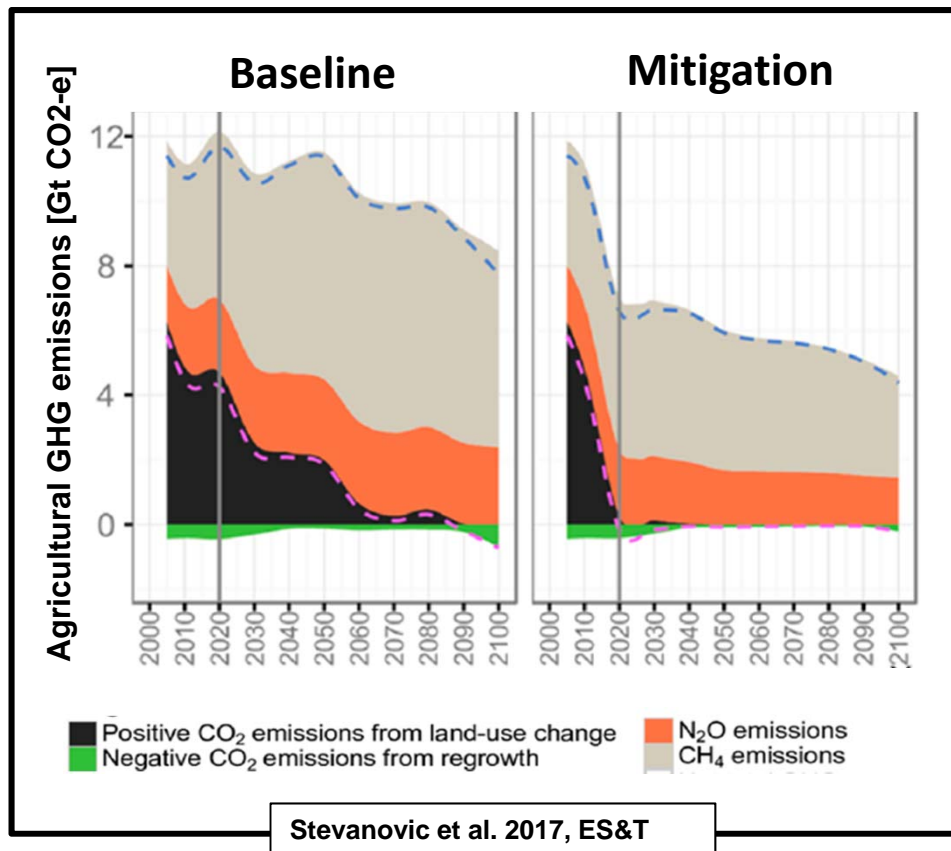
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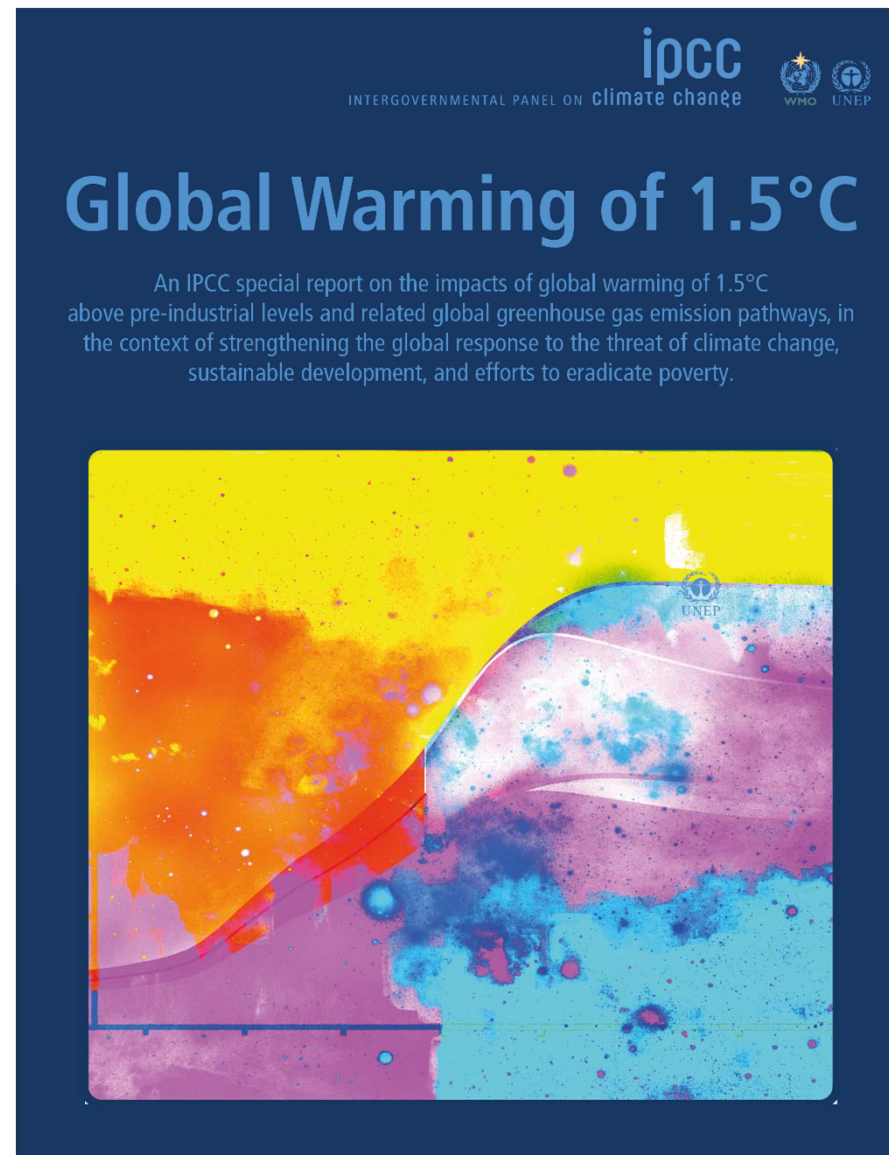


# The role of land in 1.5 and 2°C pathways

GHG emission reduction

Carbon dioxide removal (CDR)

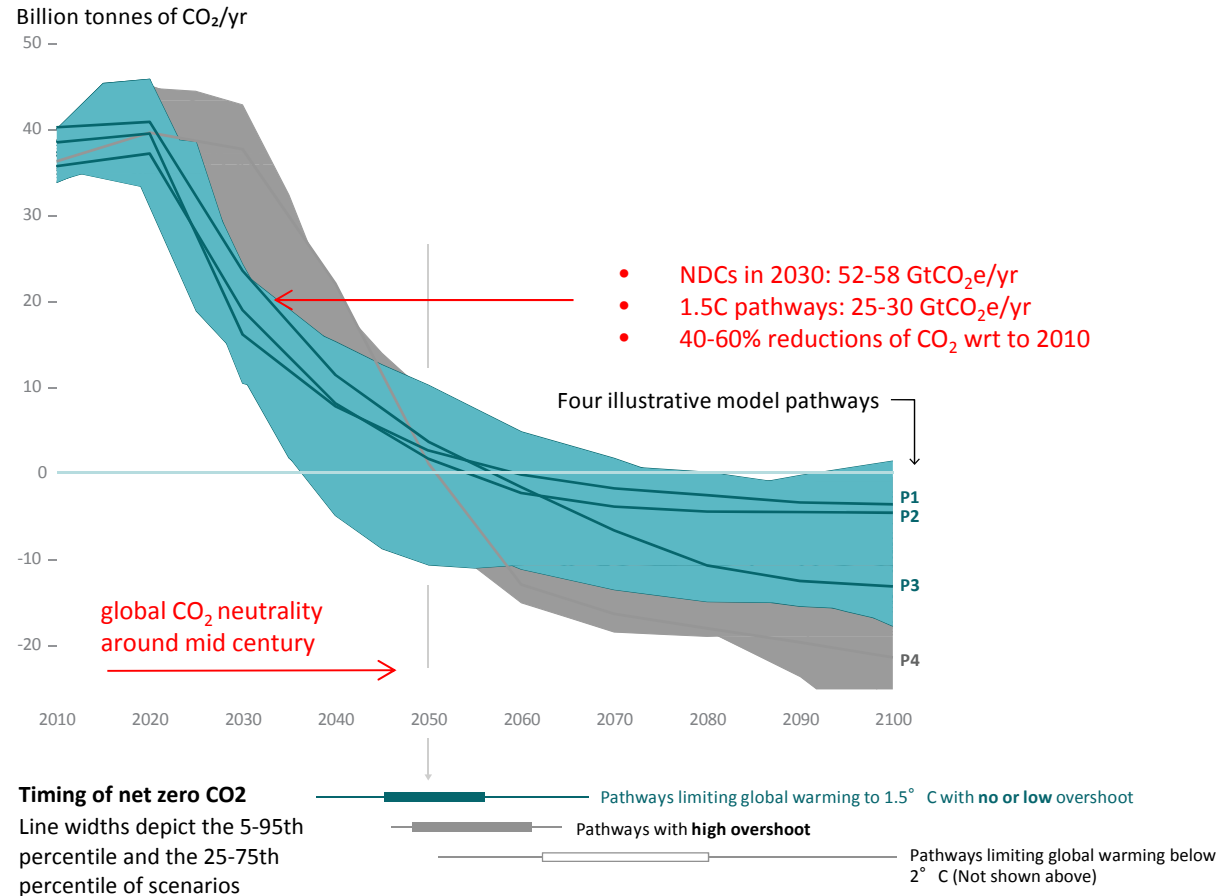




# IPCC SR1.5 findings on 1.5°C pathways

- Requires substantial emissions reductions until 2030 and global net zero CO<sub>2</sub> emissions by mid century
- If NDCs until 2030 are implemented, 1.5°C will be breached, even if supplemented by drastic emissions reductions thereafter.
- **Requires transformational change at unprecedented scale in all sectors**

**Global total net CO<sub>2</sub> emissions**



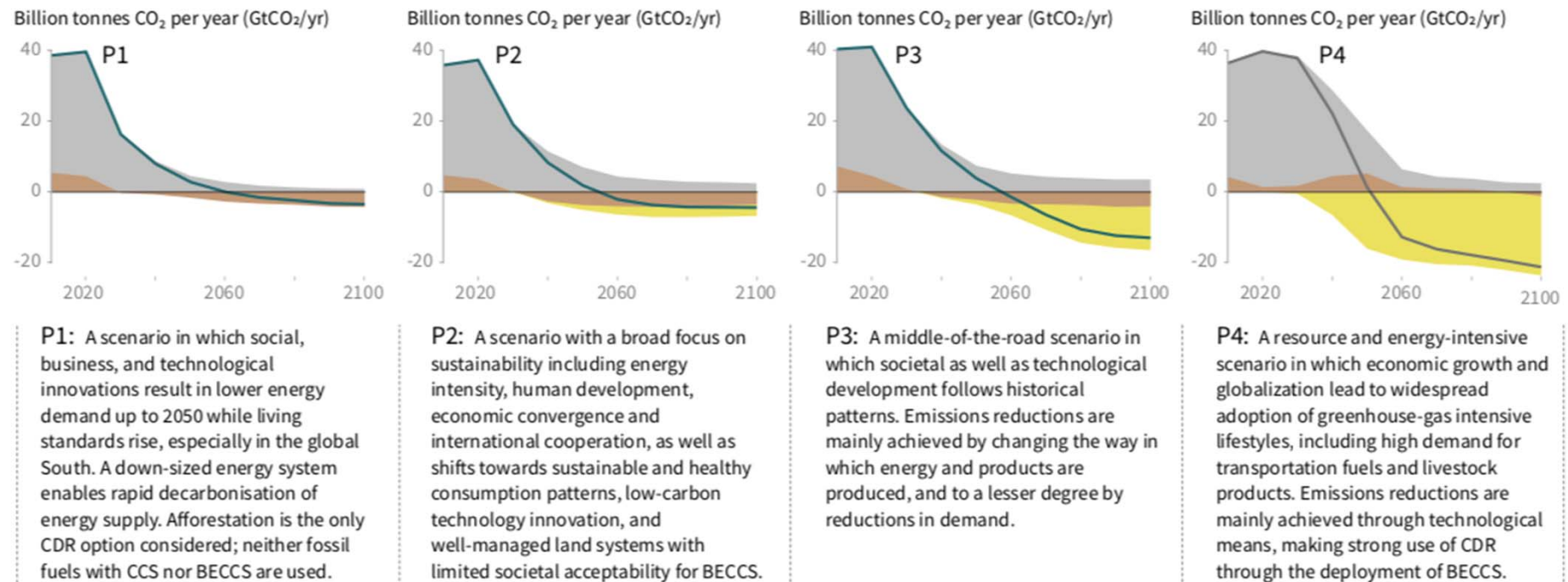
Source: IPCC Special Report on Global Warming of 1.5° C, Fig. SPM3a



# The timing of land-based mitigation and CDR

## Breakdown of contributions to global net CO<sub>2</sub> emissions in four illustrative model pathways

● Fossil fuel and industry ● AFOLU ● BECCS

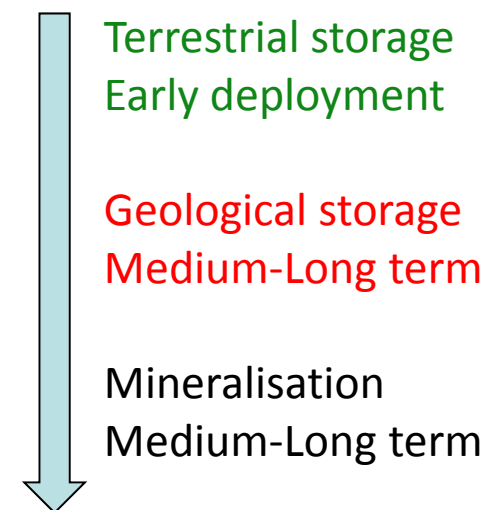


Source: IPCC SR1.5 SPM Fig. SPM3b

# Range of carbon dioxide removal options

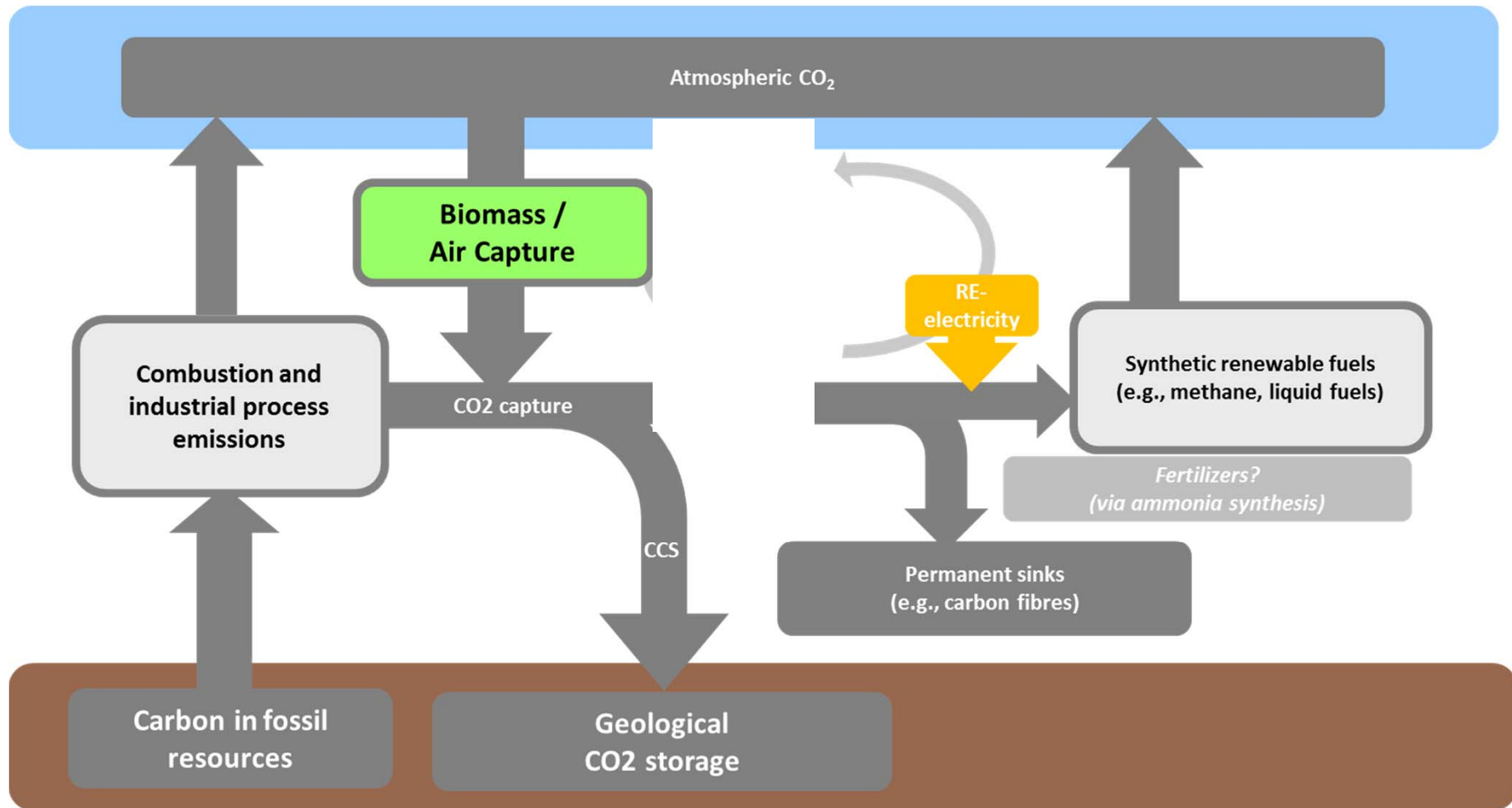
**Portfolio of CDR technologies** would limit deployment and therefore sustainability issues for each single technology

- *Soil carbon enhancement, biochar and land restoration*
- **Afforestation**
- **BECCS using energy crops**
- *BECCS using algae*
- *Direct Air Capture (DAC) + Geological storage*
- *Carbon capture and usage (e.g. carbon fiber / wood)*
- *Enhanced Weathering*
- *Artificial ocean alkalization*



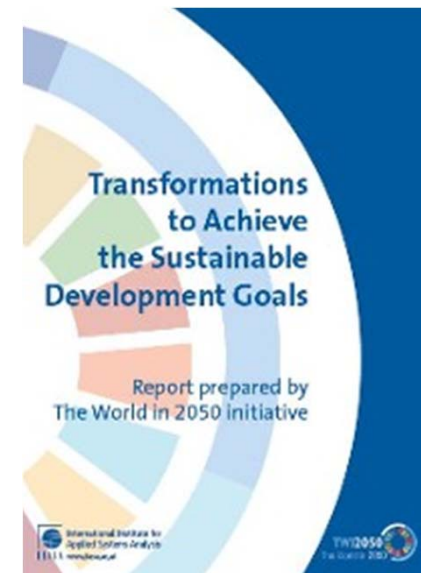
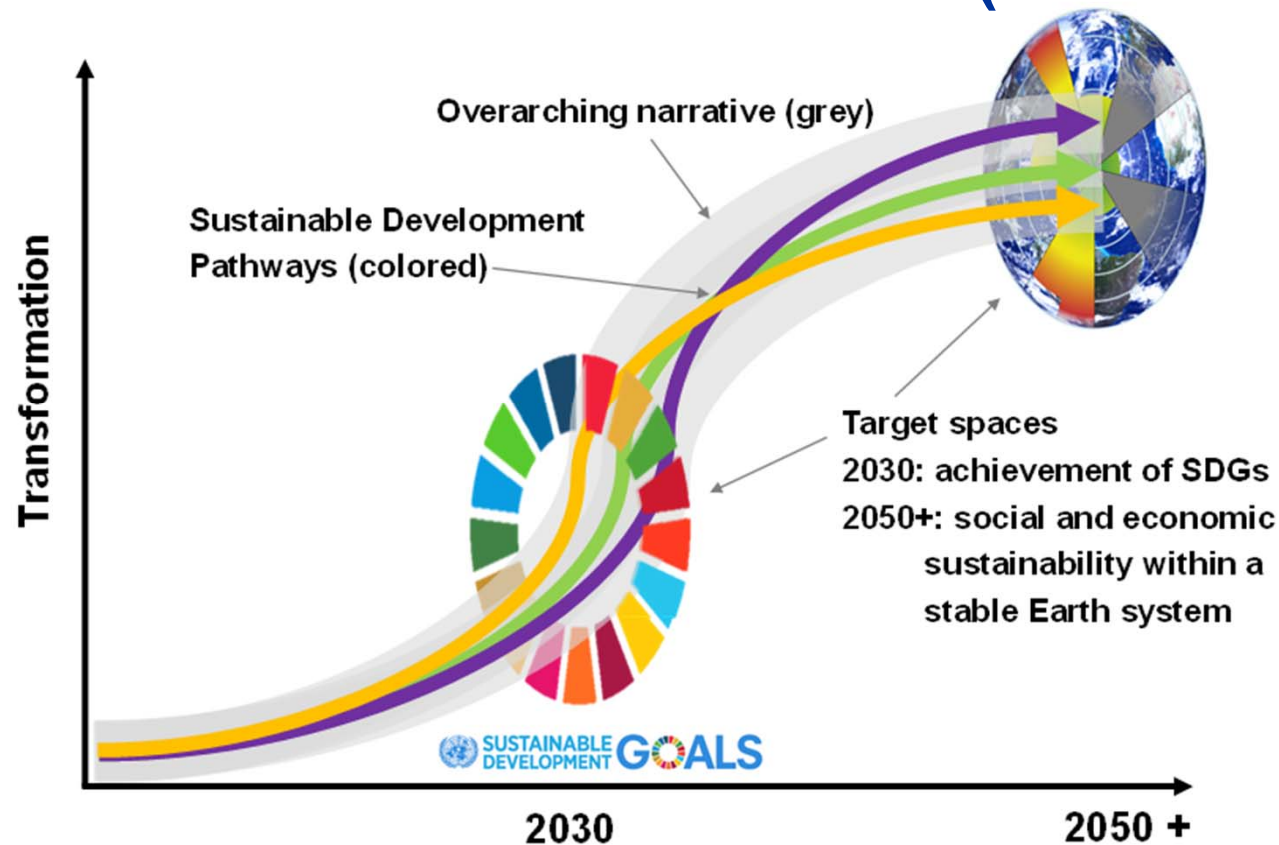


# Integrated Carbon Management for Reaching Carbon Neutrality (by Mid Century?)



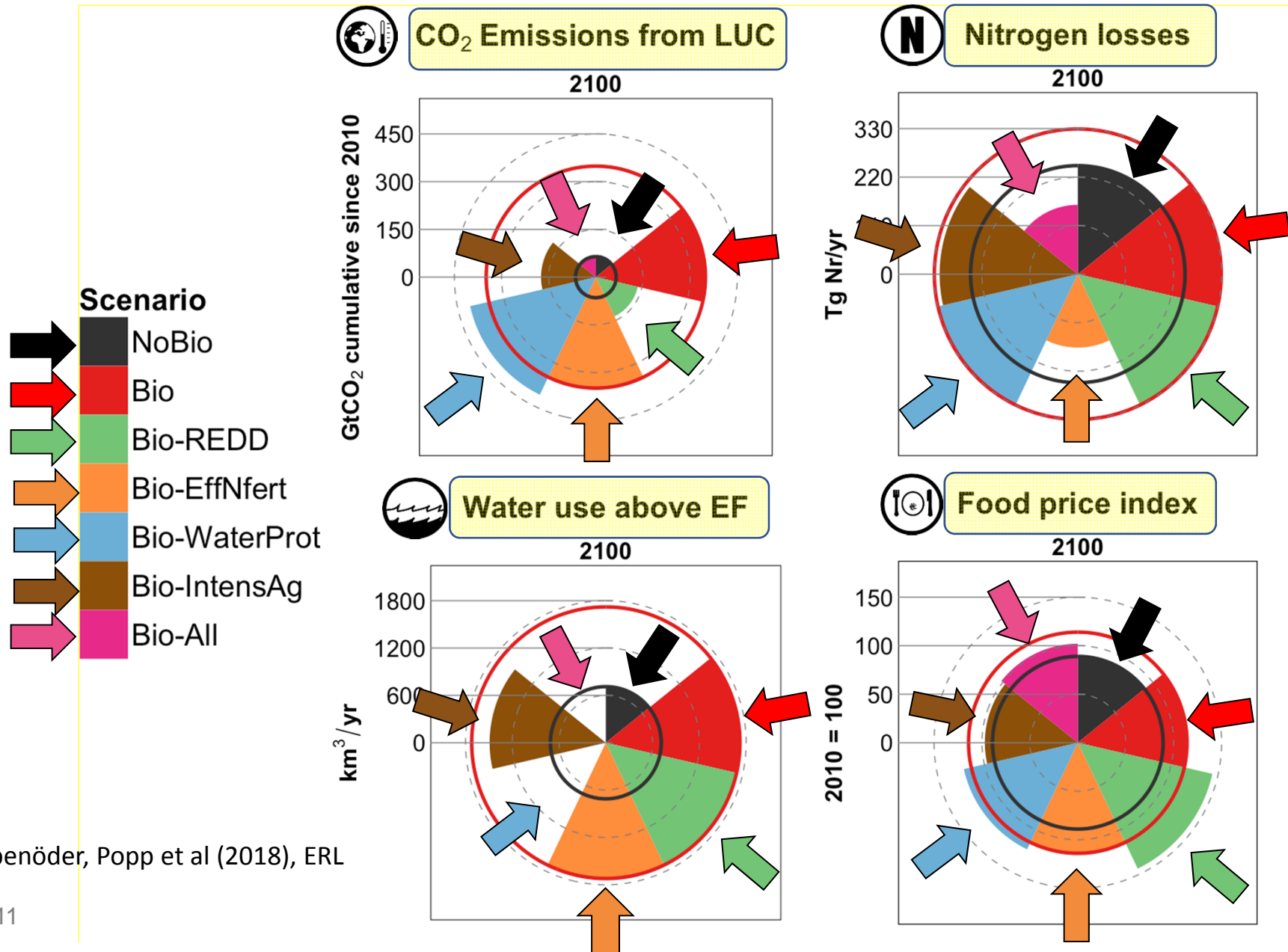
# From mitigation pathways to sustainable development pathways

## “The World in 2050” Framework (www.twi50.org)



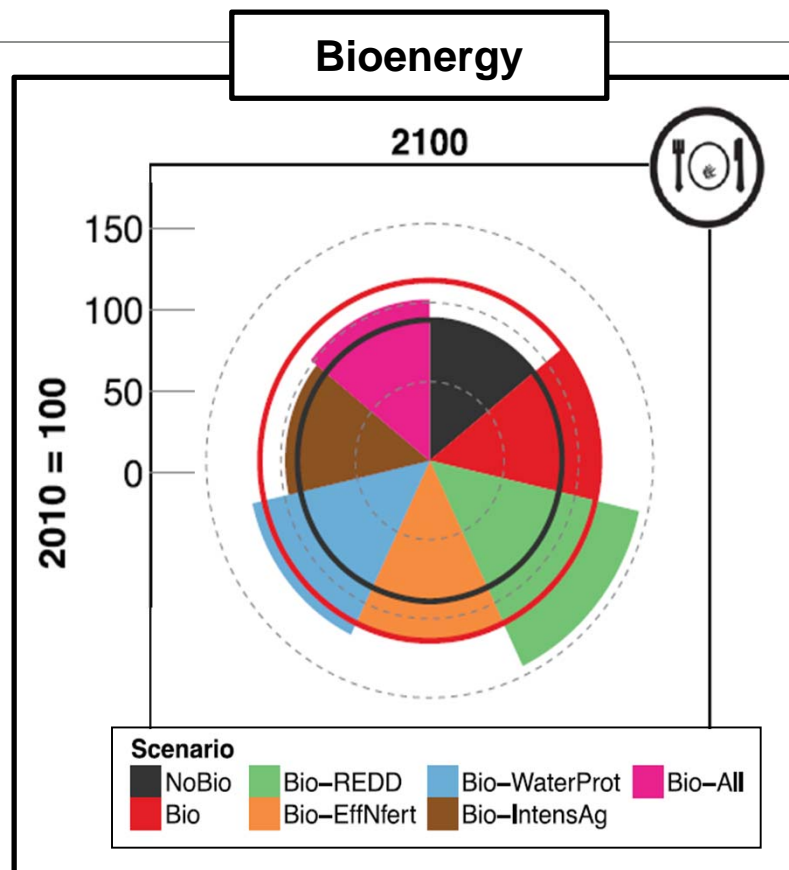
<http://www.iiasa.ac.at/web/home/research/twi/Report2018.html>

# Sustainability of land-use based mitigation

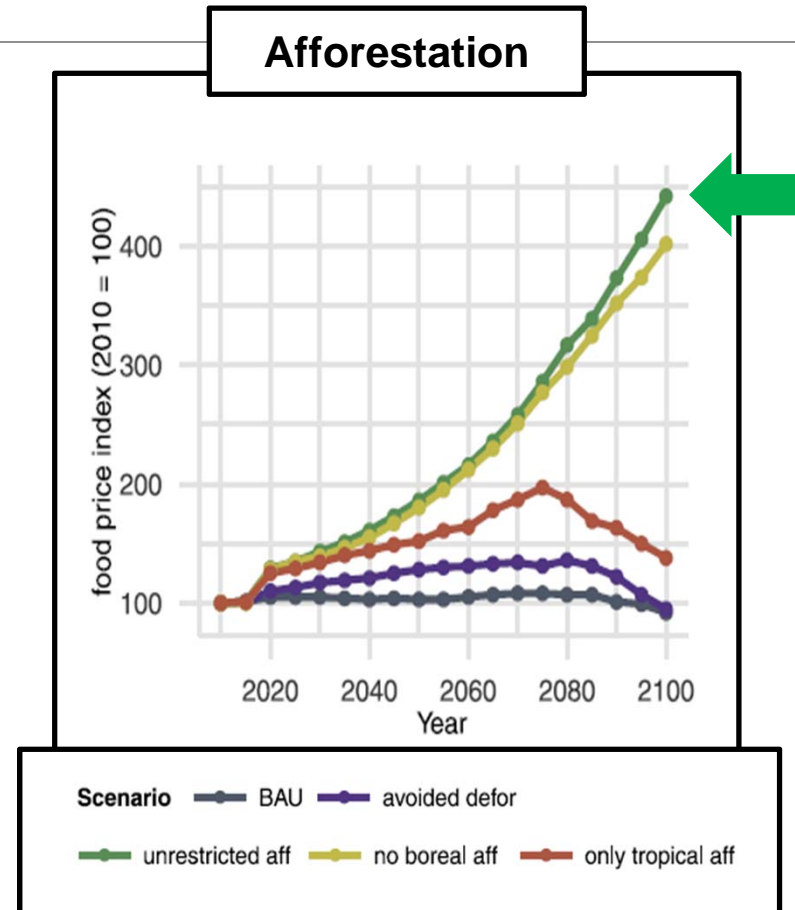


Humpenöder, Popp et al (2018), ERL

# Sustainability of land-use based mitigation



Humpenöder et al. ERL, 2018



Kreidenweis et al. ERL, 2017

Serious consequence for food prices due to increased competition for land.

# Discussion

SENSES project on scenario communication and visualization ([senses-project.org](https://senses-project.org))

Primer on Climate Change Scenario Approaches:

<https://climatescenario.org/primer/>