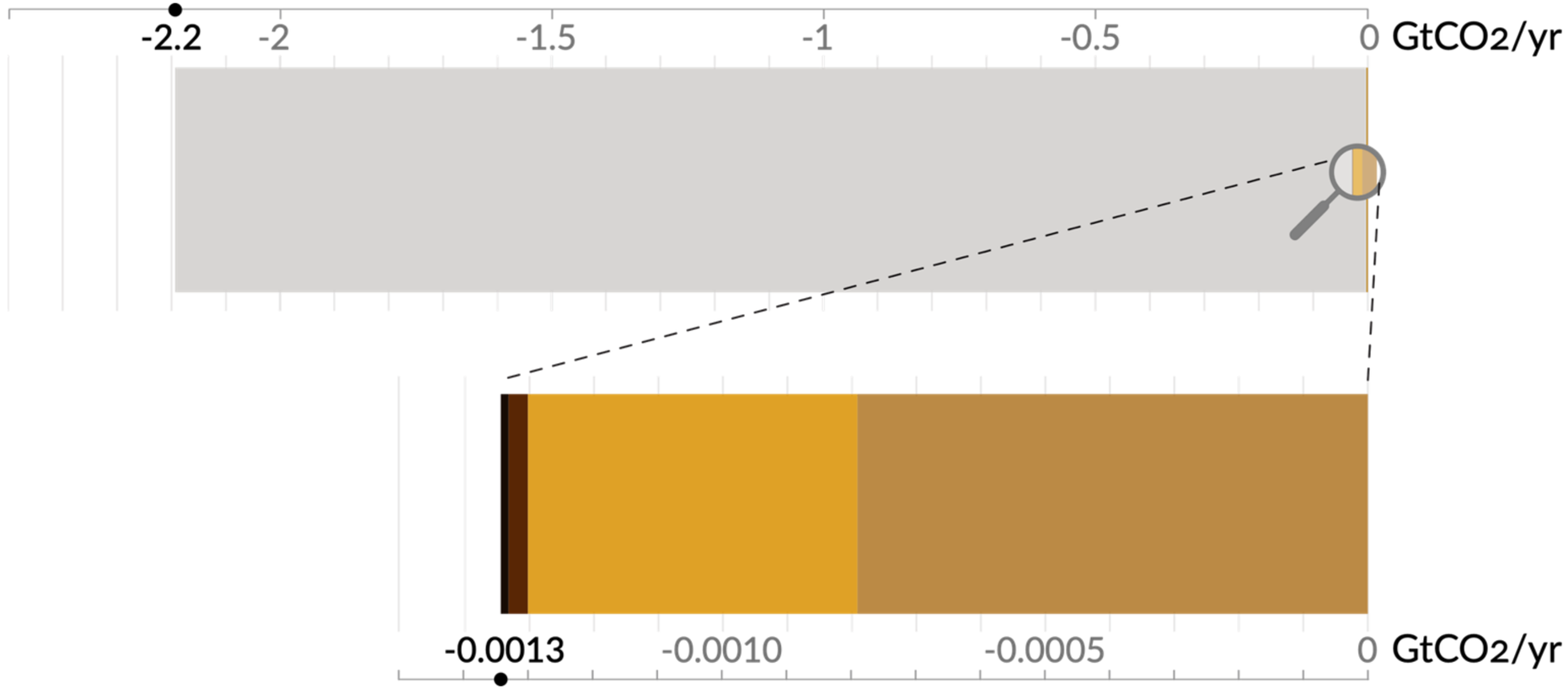
CORE

THE GREENHOUSE GAS REMOVAL HUB

Seeing the wood for the trees: is CDR from land being overestimated?

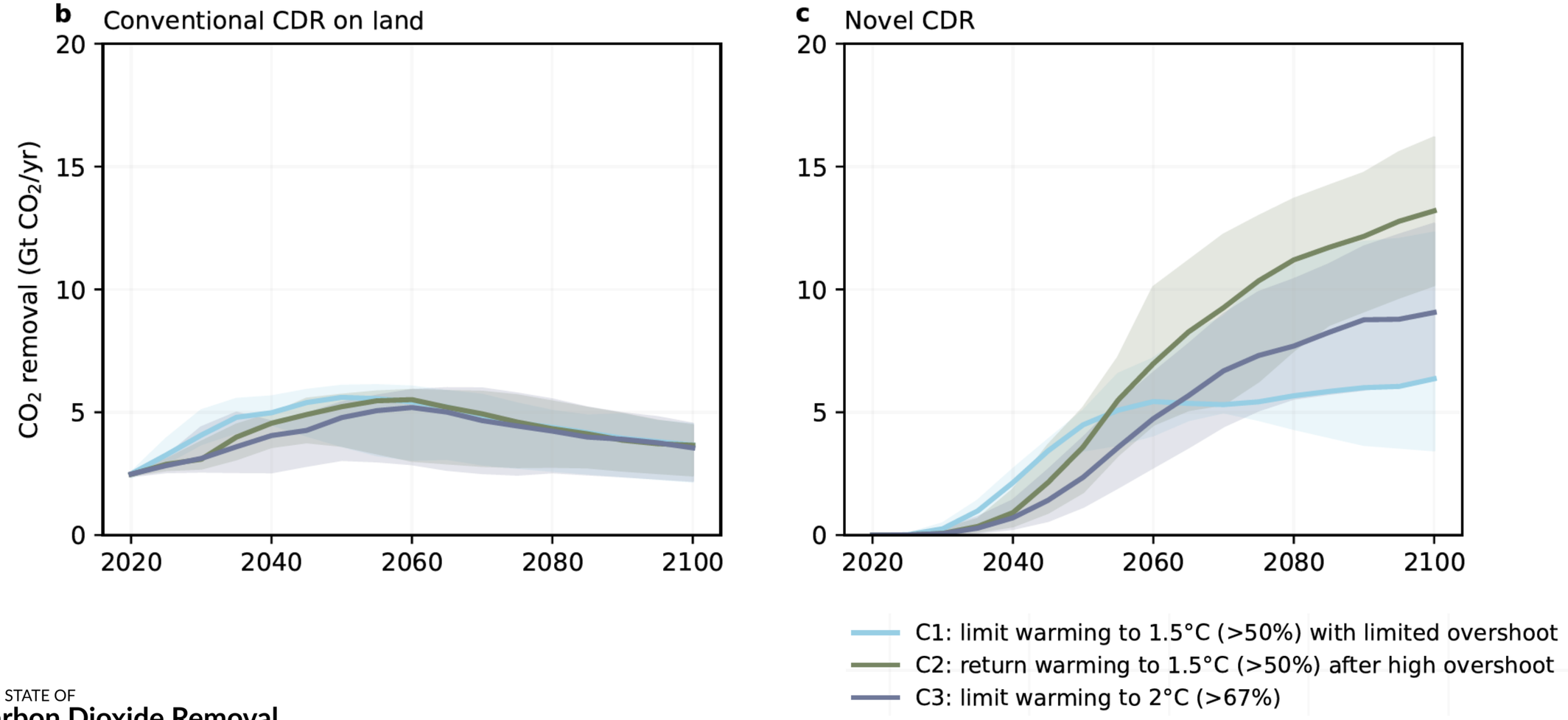
21 February 2025 | Steve Smith, University of Oxford

99.9% of current CDR is conventional



Conventional CDR | Other novel CDR | Enhanced rock weathering | Bioenergy with carbon capture and storage (BECCS) | Biochar

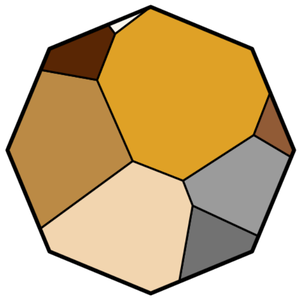
Conventional CDR remains crucial in future mitigation pathways



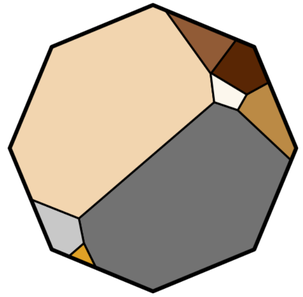
And current NDCs contain plans for only conventional CDR

Research & innovation	Demonstration & upscaling	Deployment & proposals

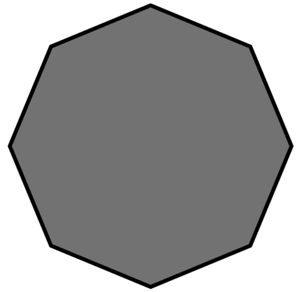
Grant funding
$ million per year (2018-2022)
total: $685 million



Investments
$ billion per year (2018-2022)
total: $2.8 billion



National proposals of CDR
$GtCO_2$ (2030)
total: -2.6 $GtCO_2$

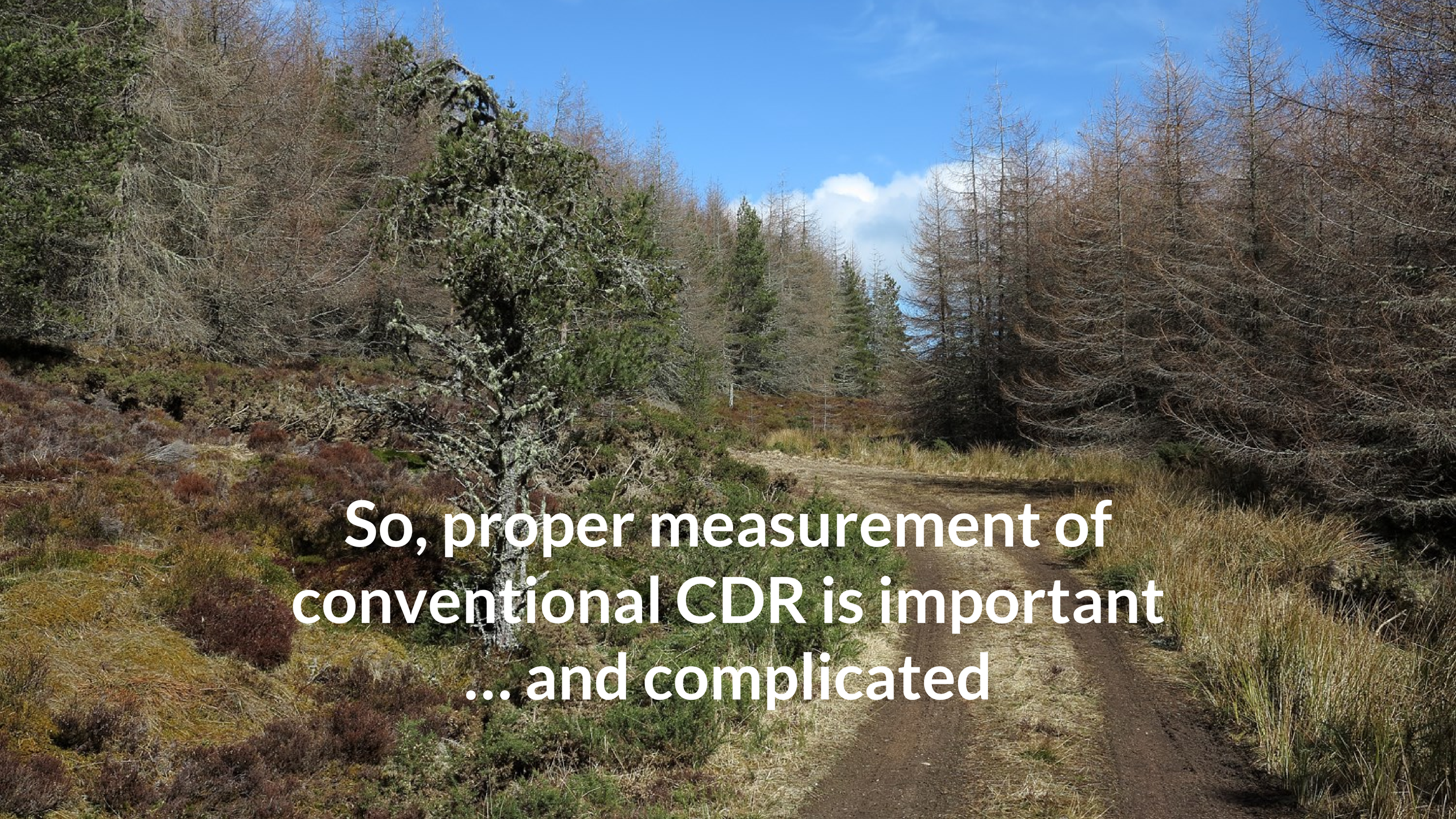


Conventional CDR methods

- Afforestation/reforestation & forest management
- Peatland and coastal wetland restoration
- Soil carbon sequestration

Novel CDR methods

- Ocean fertilisation
- Direct air carbon capture and storage (DACCS)
- Bioenergy with carbon capture and storage (BECCS)
- Biochar
- Ocean alkalinity enhancement
- Enhanced rock weathering


So, proper measurement of
conventional CDR is important
… and complicated

Different approaches to sources & sinks

Physical reservoirs:

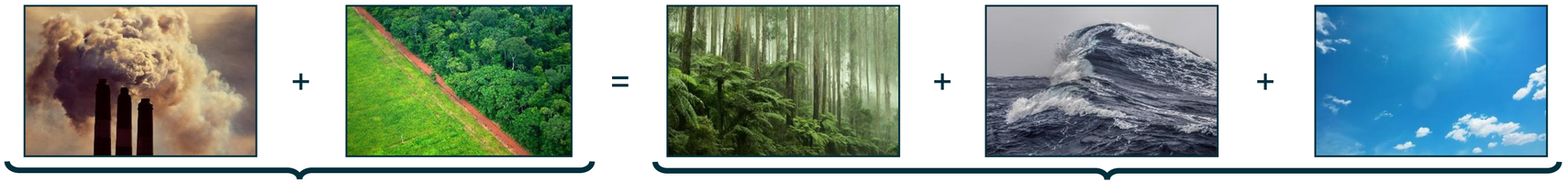
anthropogenic natural

geological terrestrial oceanic atmospheric

IPCC INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2023

Synthesis Report



human perturbations natural/passive responses

IPCC INTERGOVERNMENTAL PANEL ON climate change

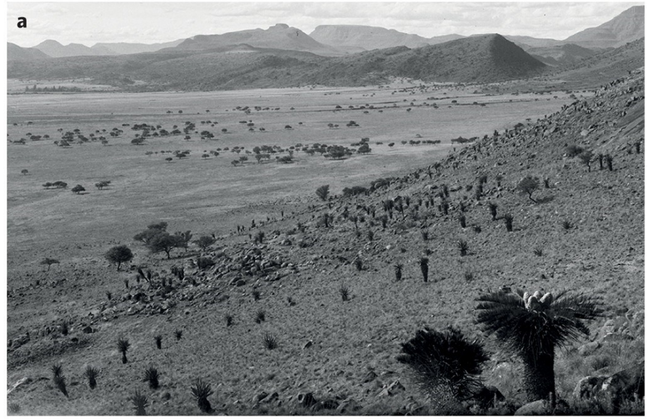
Task Force on National Greenhouse Gas Inventories (TFI)

fluxes on managed lands natural/passive responses

Credit: Thomas Gasser

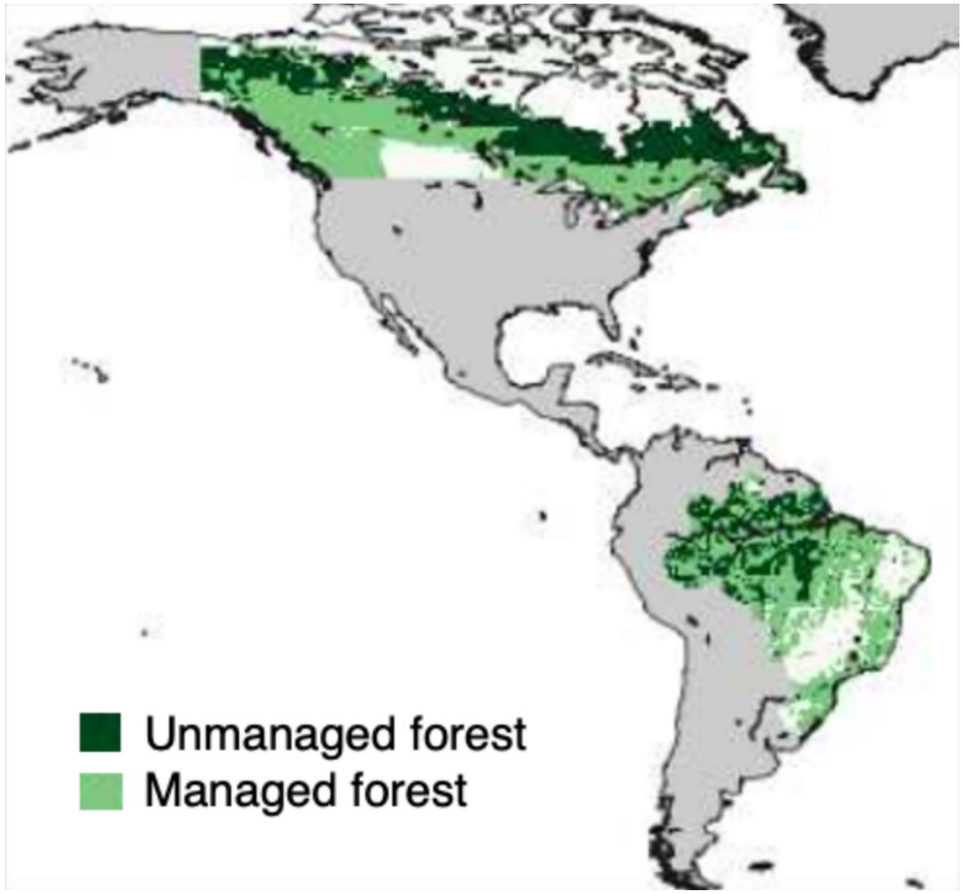
Indirect CO_2 uptake due to past emissions, and "managed land"

1925



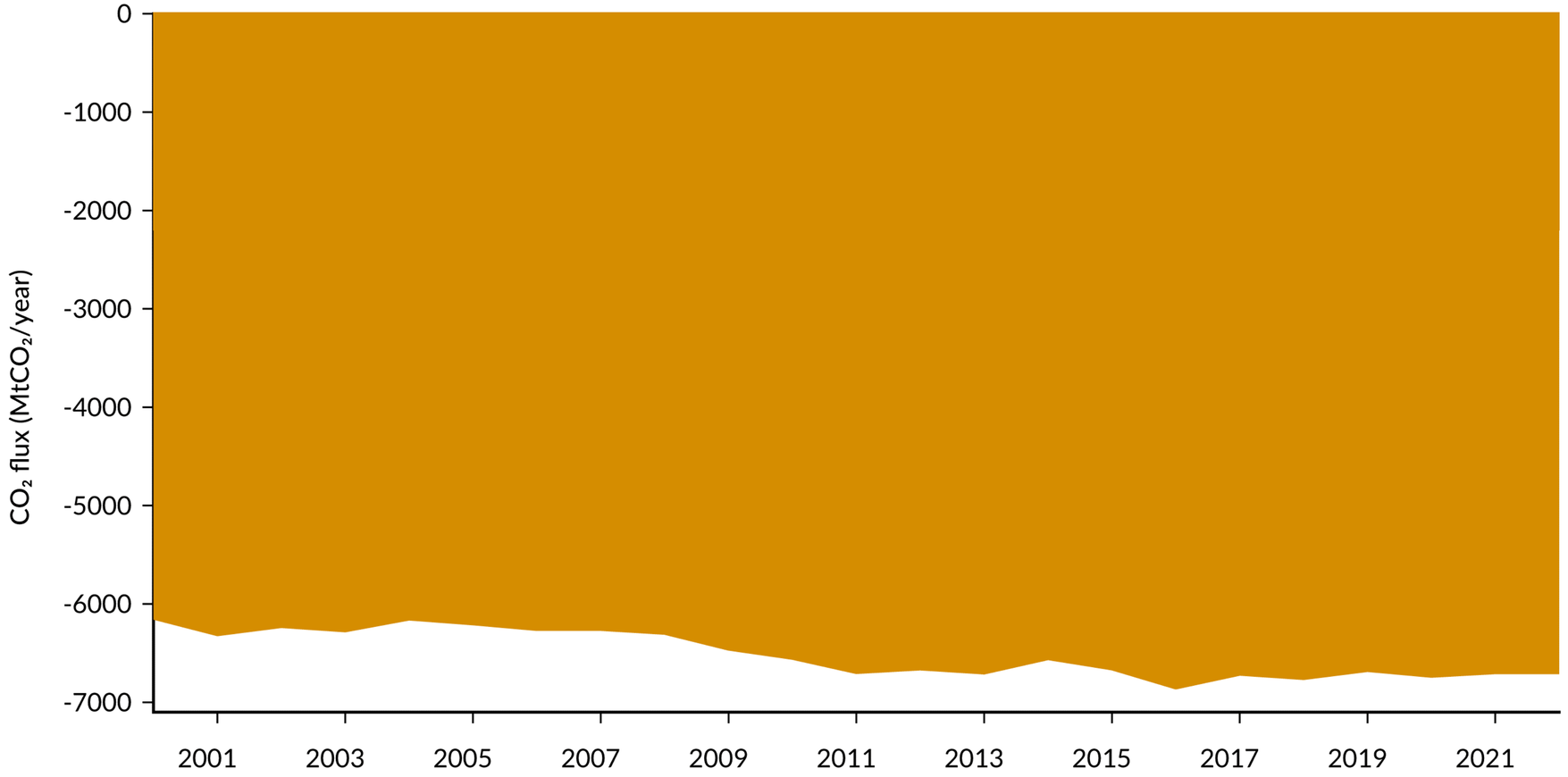
2011

Midgeley & Bond, 2015



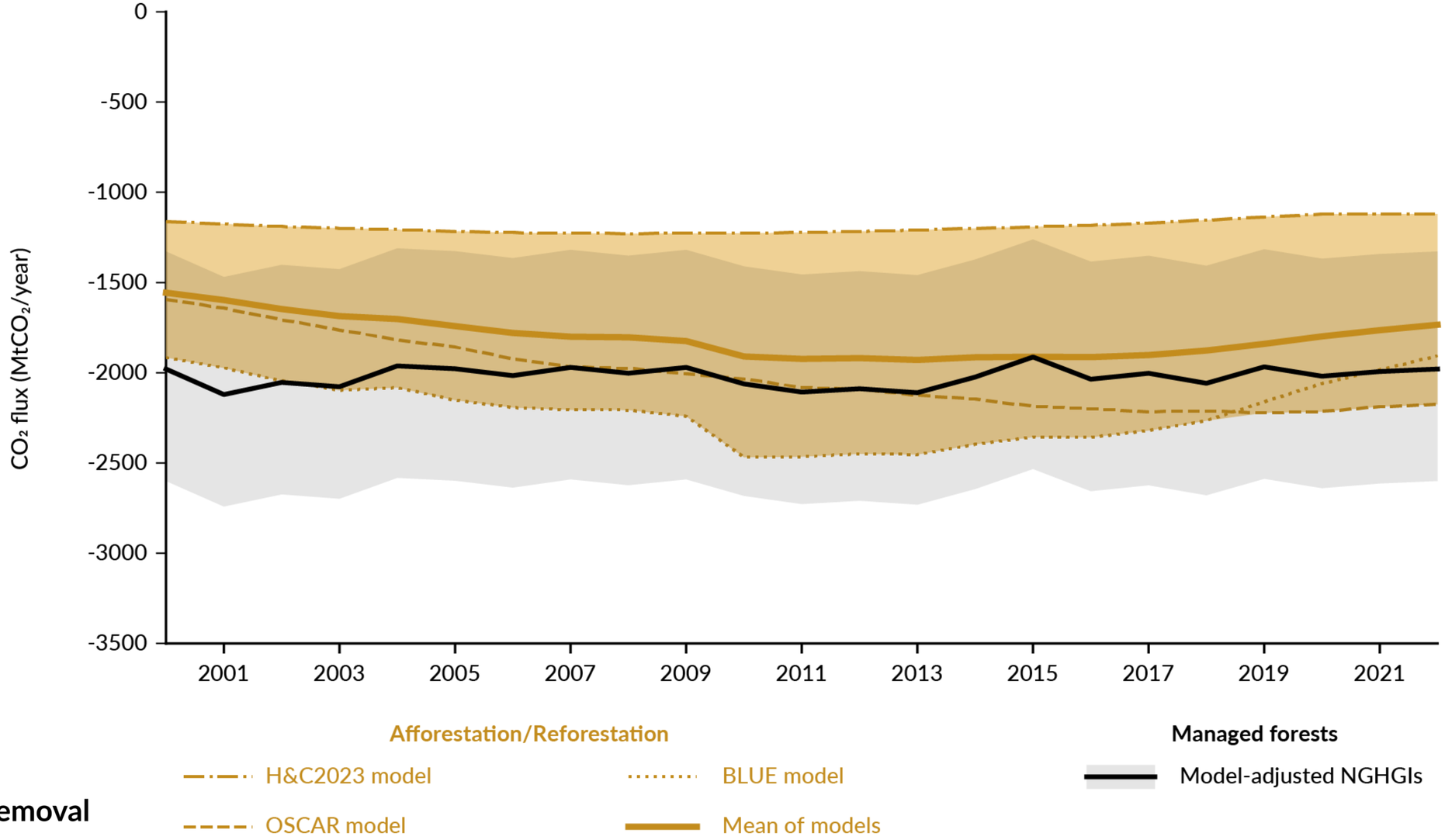
Grassi et al (2023) doi: 10.5194/essd-15-1093-2023

Indirect effects are large in CDR estimates from national inventories



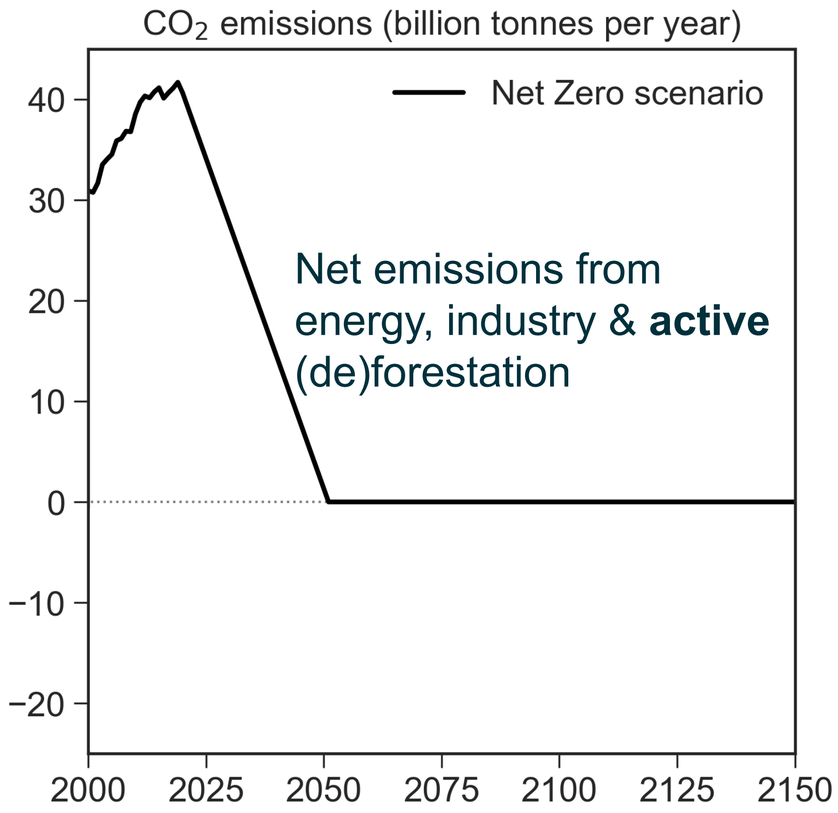
Direct and indirect effects in managed forests (NGHGIs)

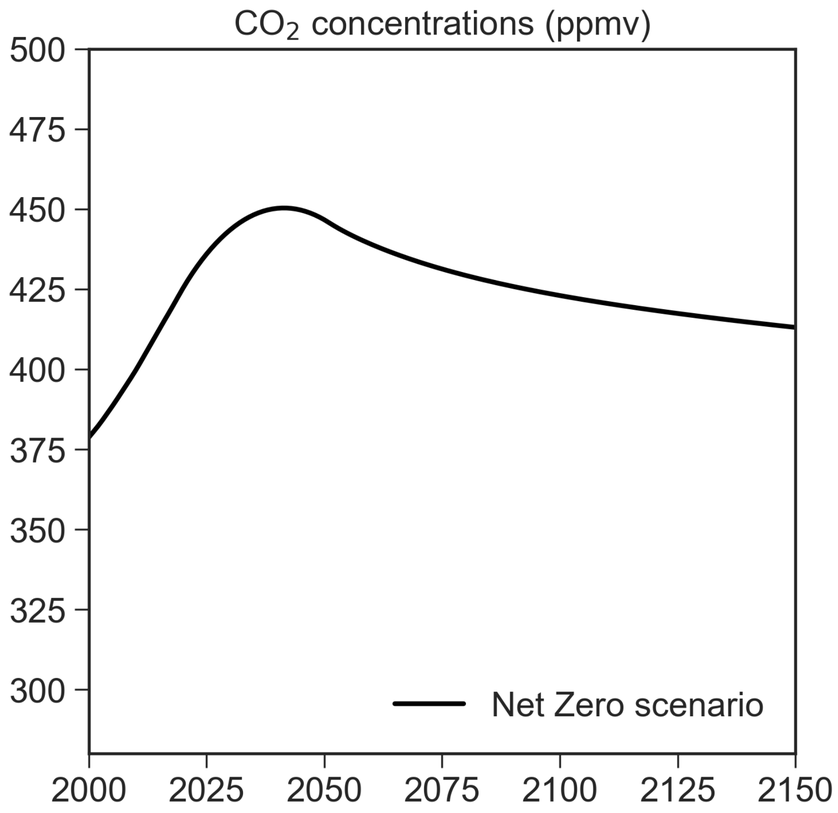
The two approaches can be reconciled (largely)

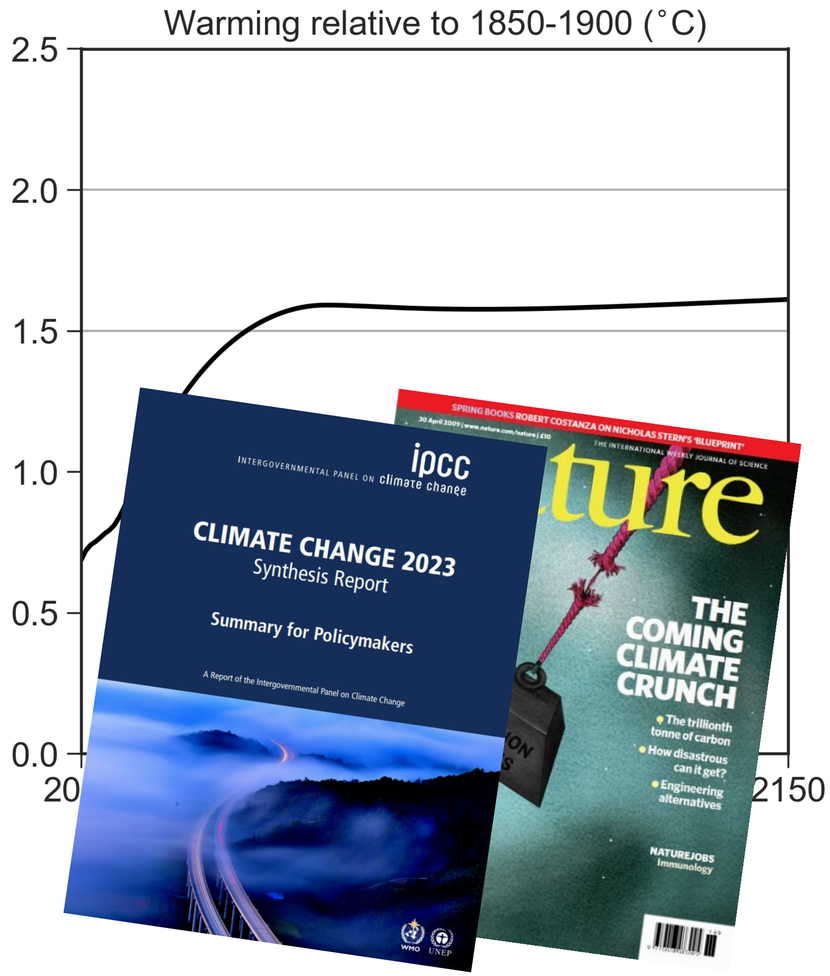


THE STATE OF
Carbon Dioxide Removal

Recap: what it takes to stop global warming



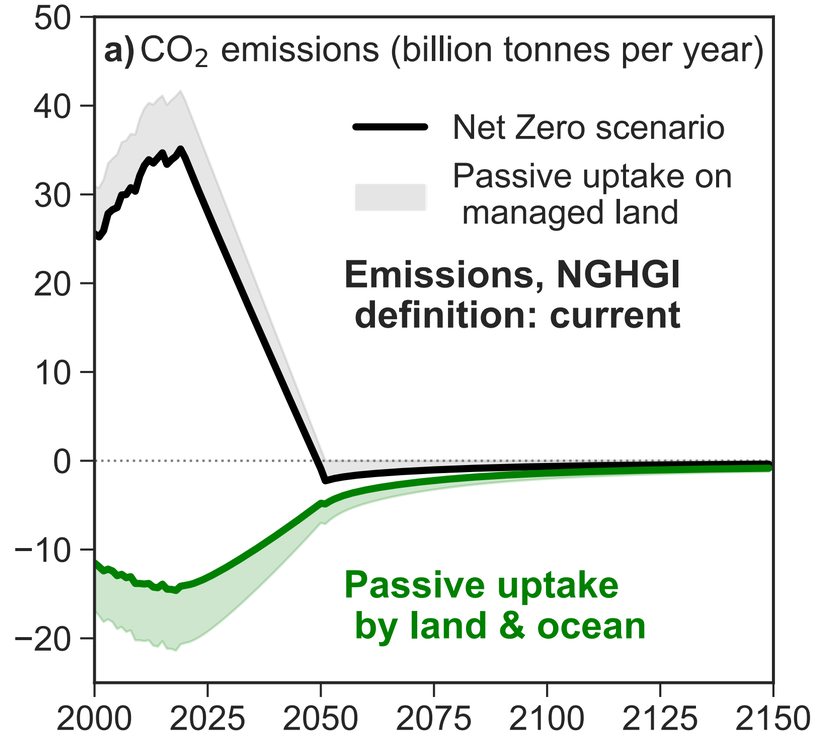


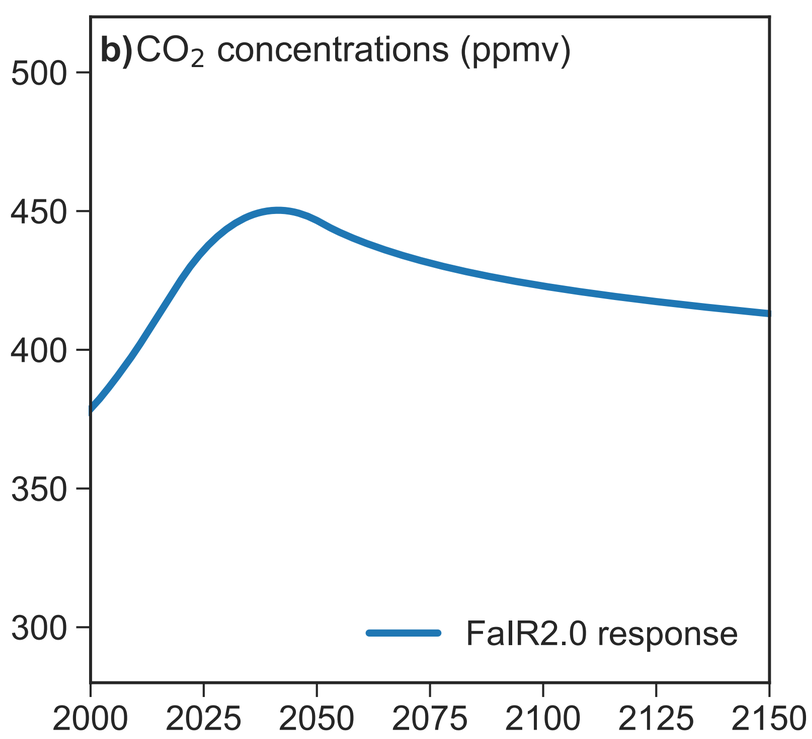


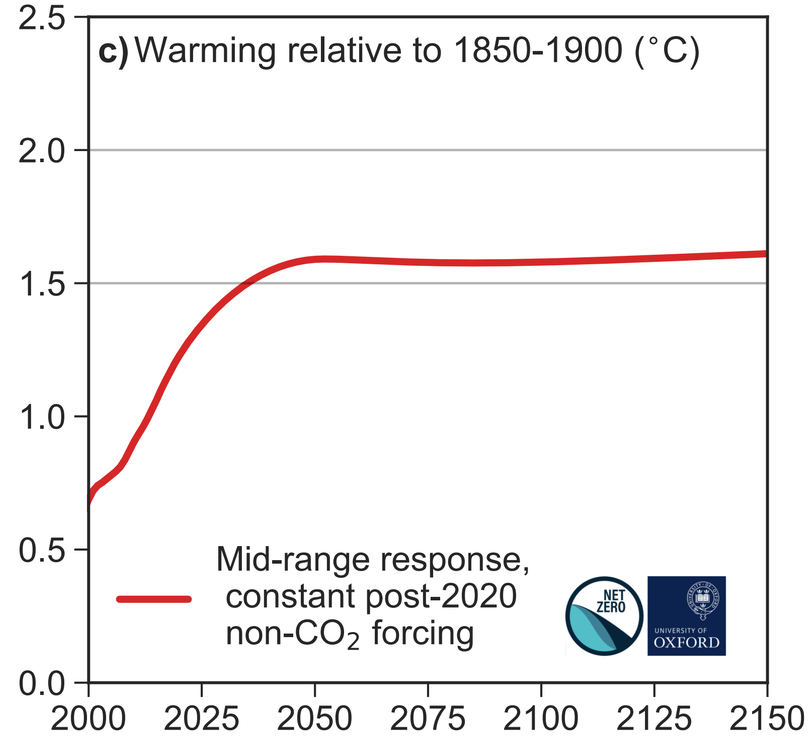
Allen et al. (2024) Geological net zero and the need for disaggregating for carbon sinks

Recap: what it takes to stop global warming

Re-classifying uptake on passive land as removals (National GHG Inventory approach) & adjusting targets consistently



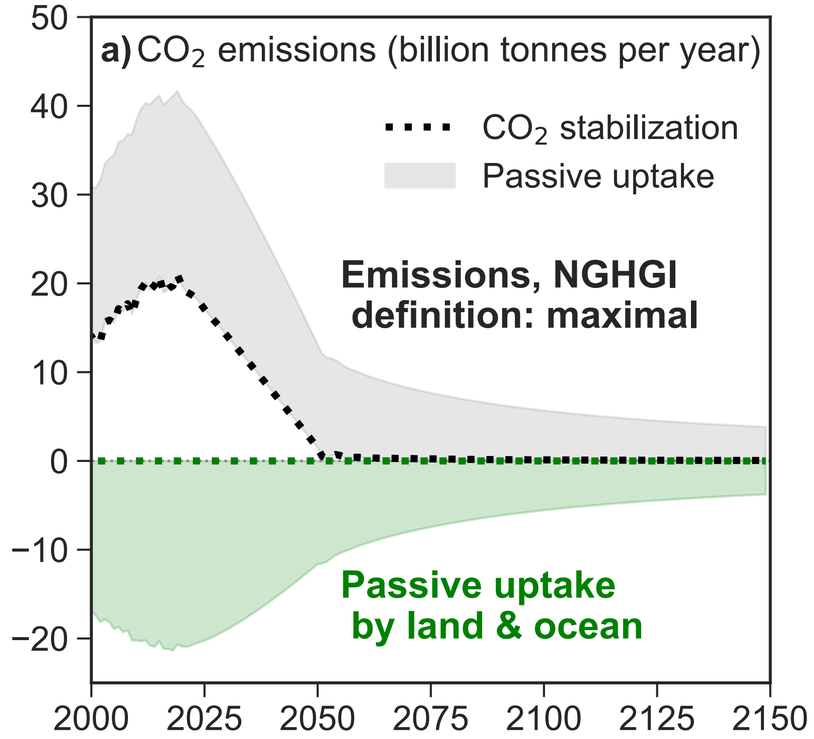


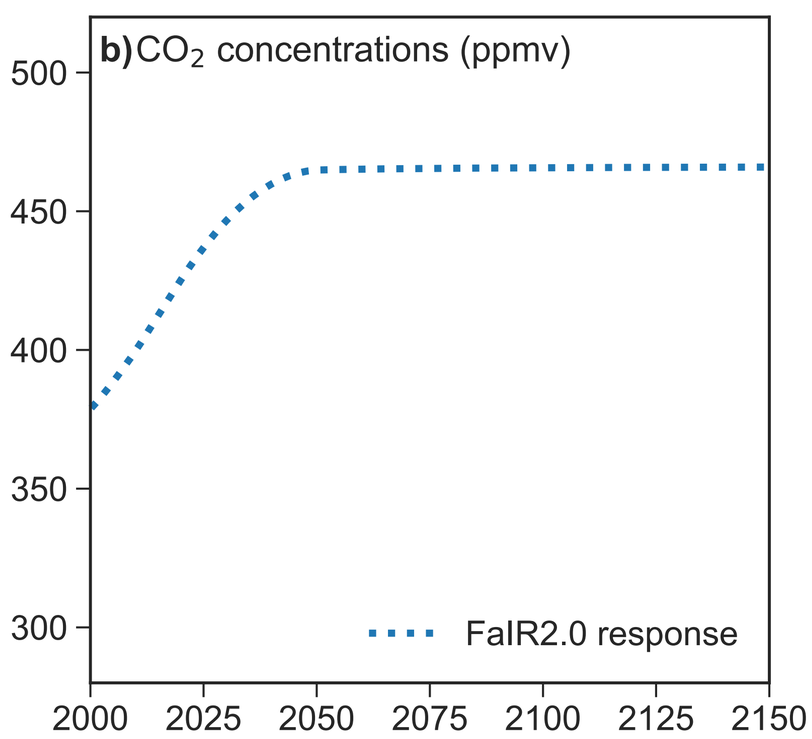


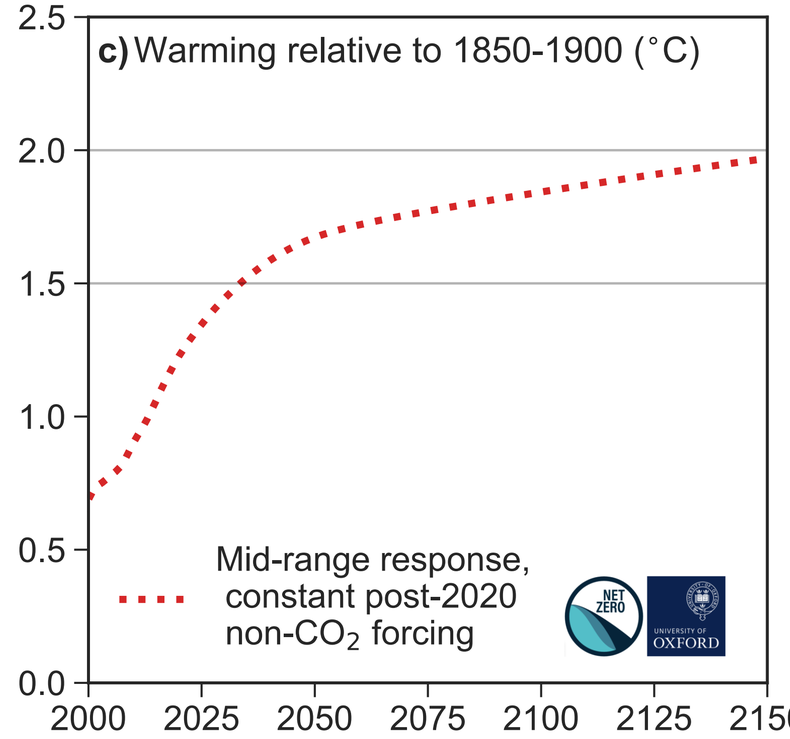
Allen et al. (2024) Geological net zero and the need for disaggregating for carbon sinks

A maximalist inventory approach pushes us a long way off course

Re-classifying all passive uptake as removals & aiming for net zero nominal emissions, or concentration stabilization

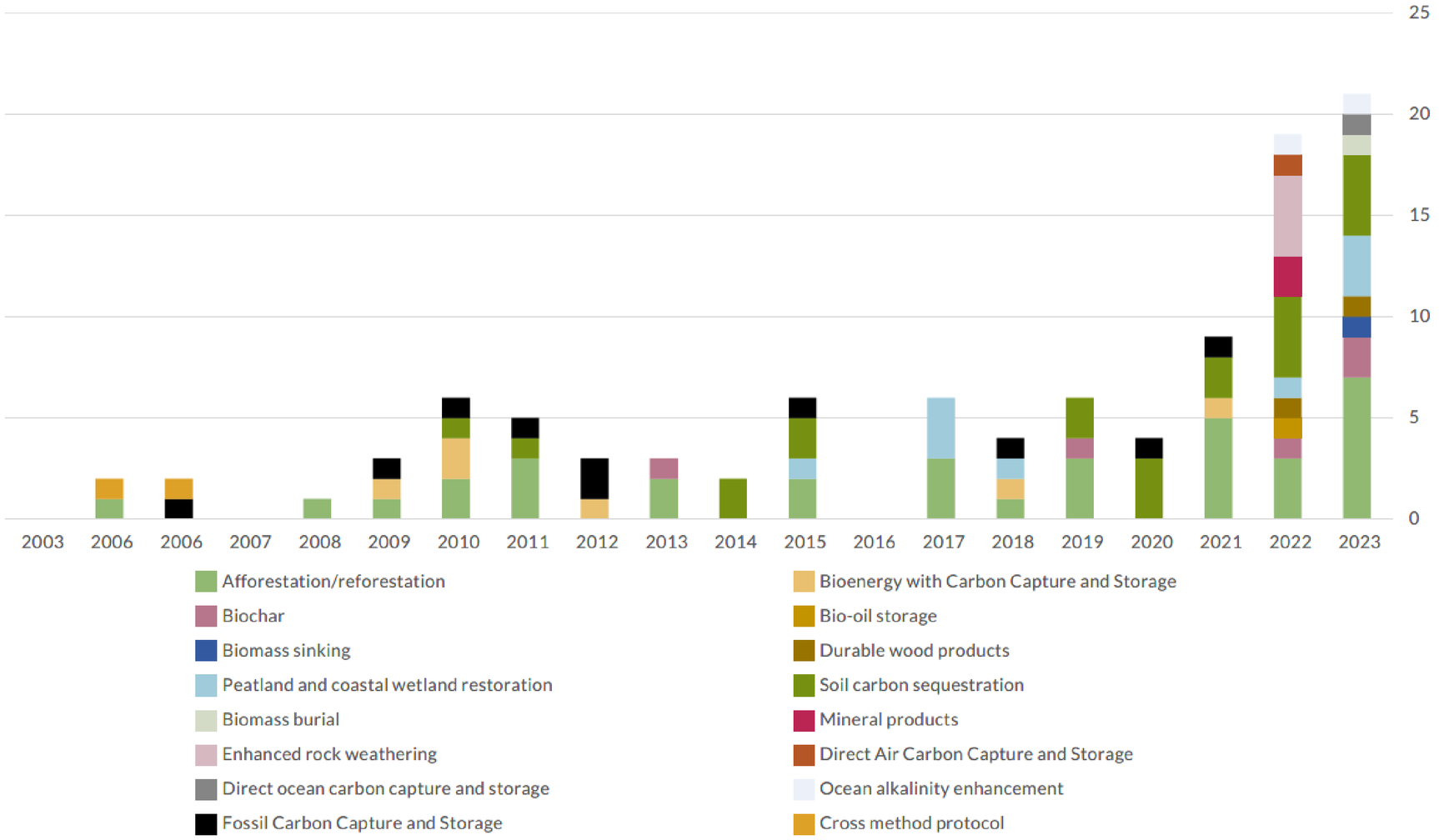






Allen et al. (2024) Geological net zero and the need for disaggregating for carbon sinks

MRV protocols for CDR are proliferating, even for conventional land methods



To conclude…

- **Reforestation, afforestation, and other forms of conventional CDR on land will remain important, alongside novel technologies**
- **Two different approaches to reporting land-based emissions and removals are being used – in inventories and in global pathways**
- **There isn't a right or wrong per se, but the inventory approach overstates CDR.**
  - ***MRV protocols for projects follow the inventory approach (?)***
- **Existing natural sinks need protecting!**

CO2RE

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Thanks

Steve Smith

www.co2re.org

www.netzeroclimate.org

www.stateofcdr.org