

THE STATE OF
**Carbon
Dioxide
Removal**

Insights from the SoCDR report

Finn Müller-Hansen (Potsdam Institute for Climate Impact Research)

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#StateofCDR | www.StateofCDR.org

The State of CDR report

- Ambition: provide an overview of policy-relevant data, the state of the science and current trends in carbon dioxide removal (CDR)
- Collaboration between 5 lead institutions with co-authors from many other



Stiftung Wissenschaft und Politik
German Institute for International
and Security Affairs

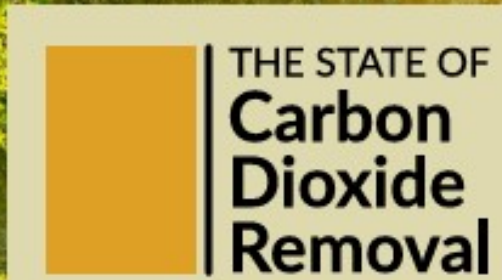


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Applied Systems Analysis

- 2nd Edition published in 2024
- 3rd Edition of the report currently in preparation, launch scheduled for June 2026



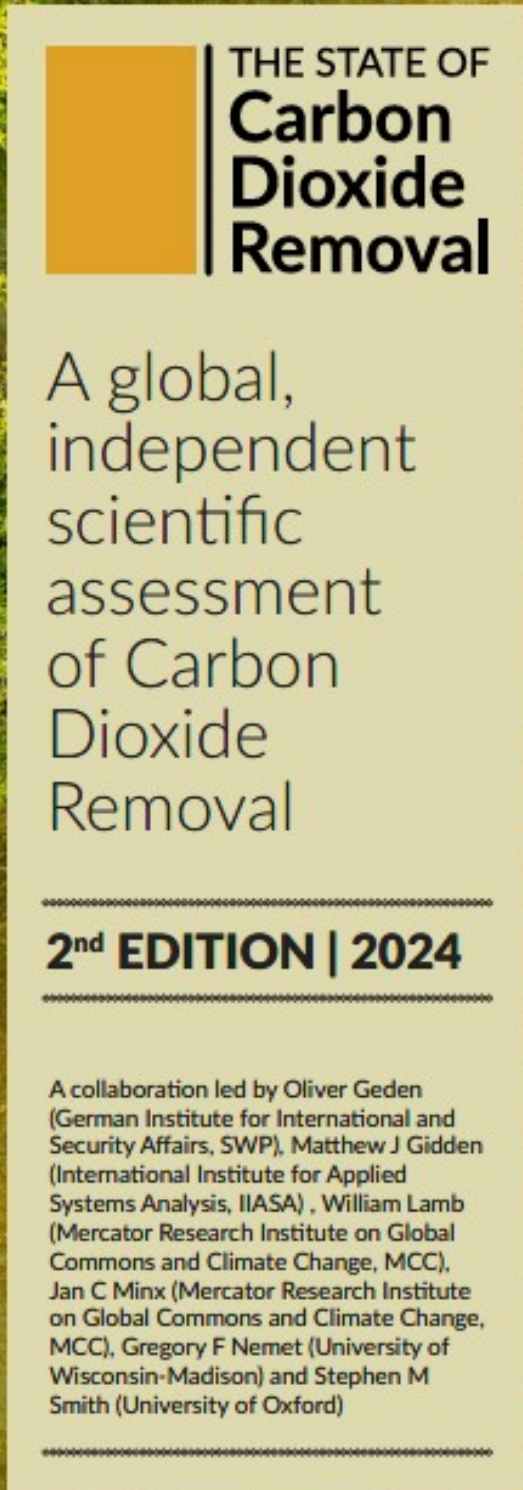
A global,
independent
scientific
assessment
of Carbon
Dioxide
Removal

2nd EDITION | 2024

A collaboration led by Oliver Geden
(German Institute for International and
Security Affairs, SWP), Matthew J Gidden
(International Institute for Applied
Systems Analysis, IIASA), William Lamb
(Mercator Research Institute on Global
Commons and Climate Change, MCC),
Jan C Minx (Mercator Research Institute
on Global Commons and Climate Change,
MCC), Gregory F Nemet (University of
Wisconsin-Madison) and Stephen M
Smith (University of Oxford)

Topics covered in the report

- Research and development
- Demonstration and upscaling
- The voluntary carbon market
- Policymaking and governance
- Perceptions and communication
- Current levels of CDR
- Paris-consistent CDR scenarios
- The CDR gap
- 2nd edition: Monitoring, Reporting & Verification
- 3rd edition: Costs & Potentials



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We consider 15 CDR methods, varying in readiness, potential and durability

- Definition of CDR according to 3 principles:

1) CO₂ capture from the atmosphere

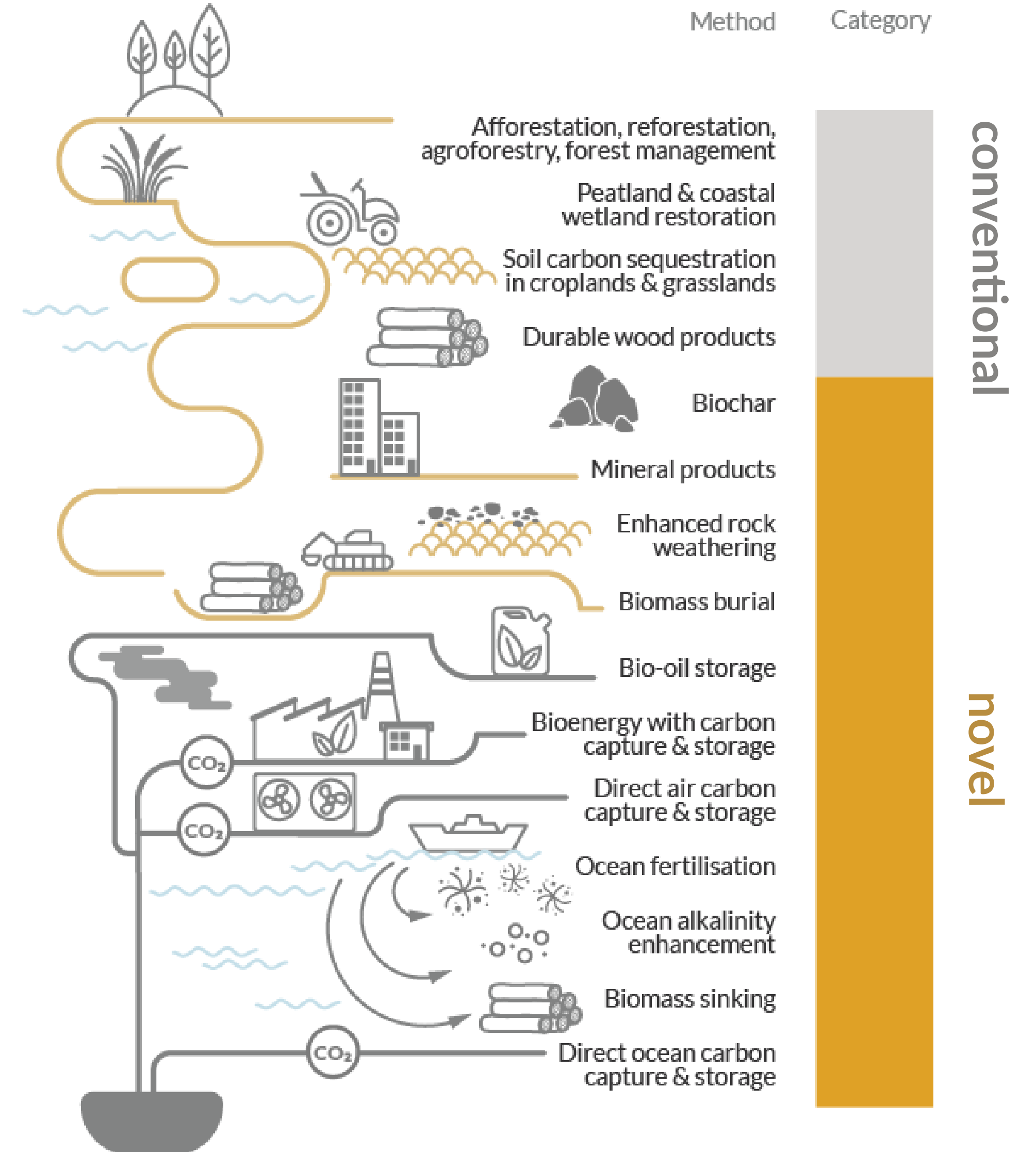
Counterexample: CCS from fossil fuel exhaust

2) Durable storage

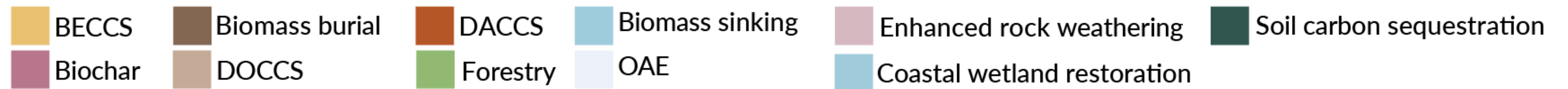
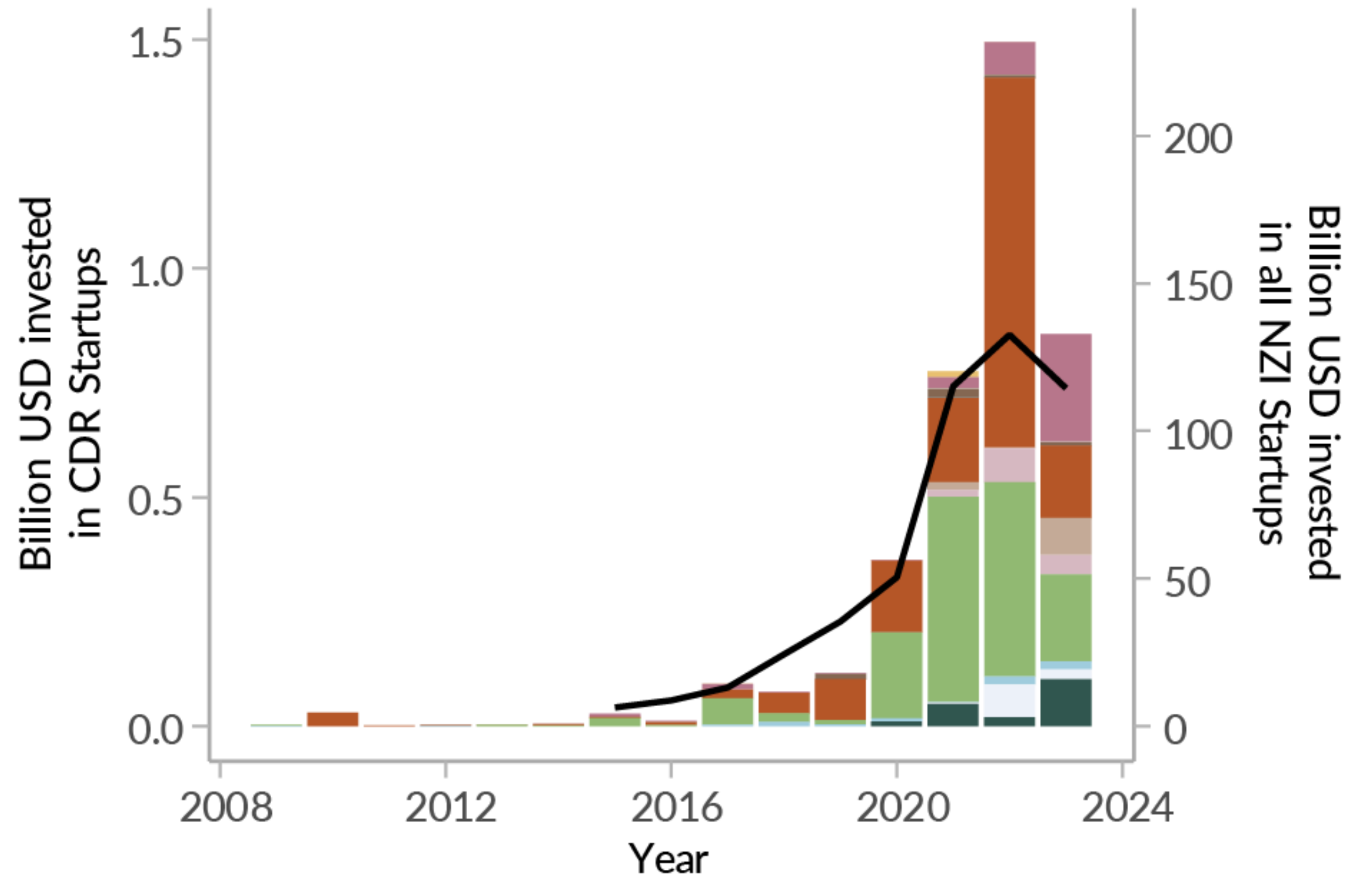
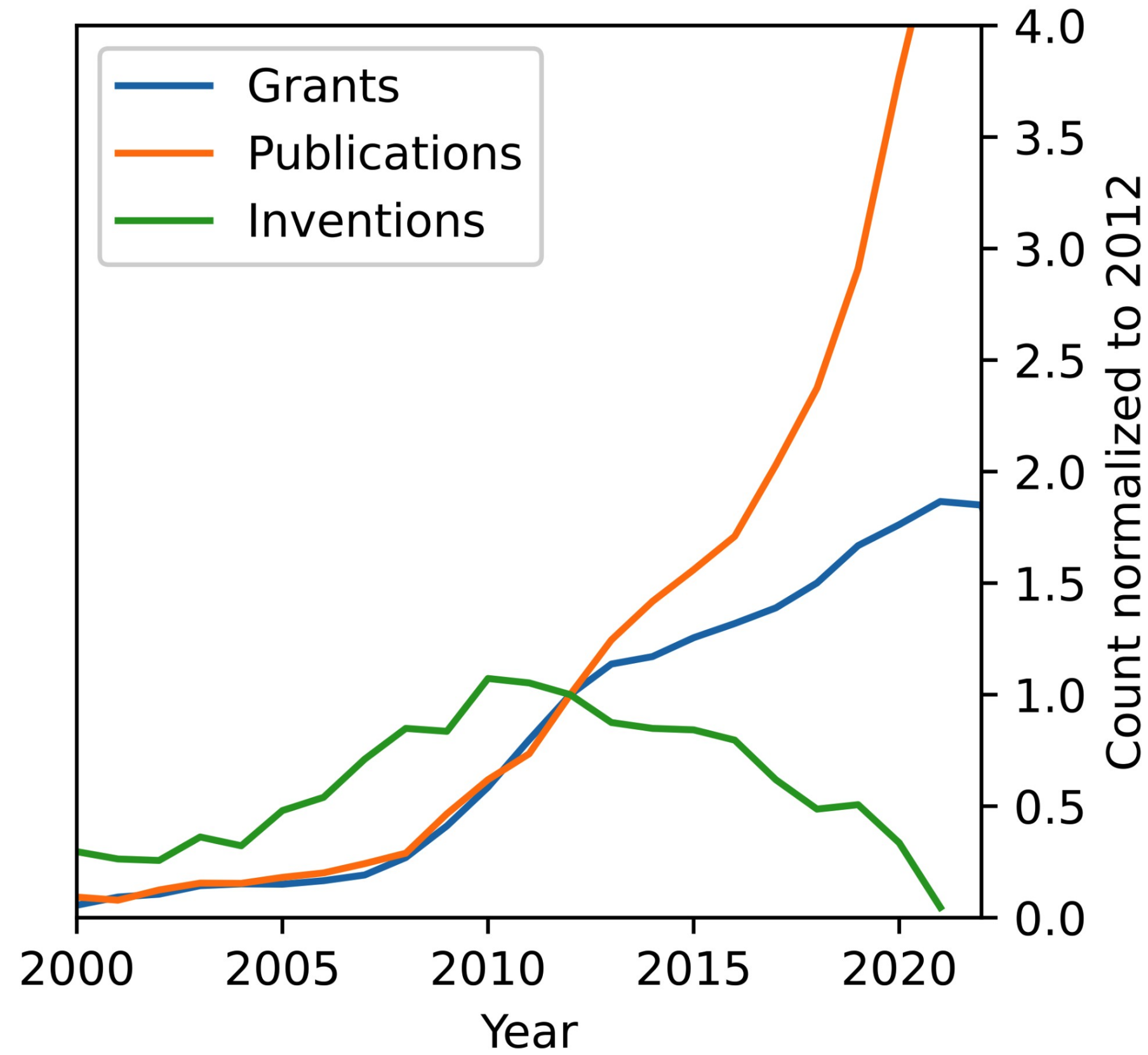
Counterexample: Biofuels

3) Additional to natural processes

Counterexample: Unmanaged forest growth



CDR innovation indicators: research grants stable, publications growing, inventions and start-up funding declining

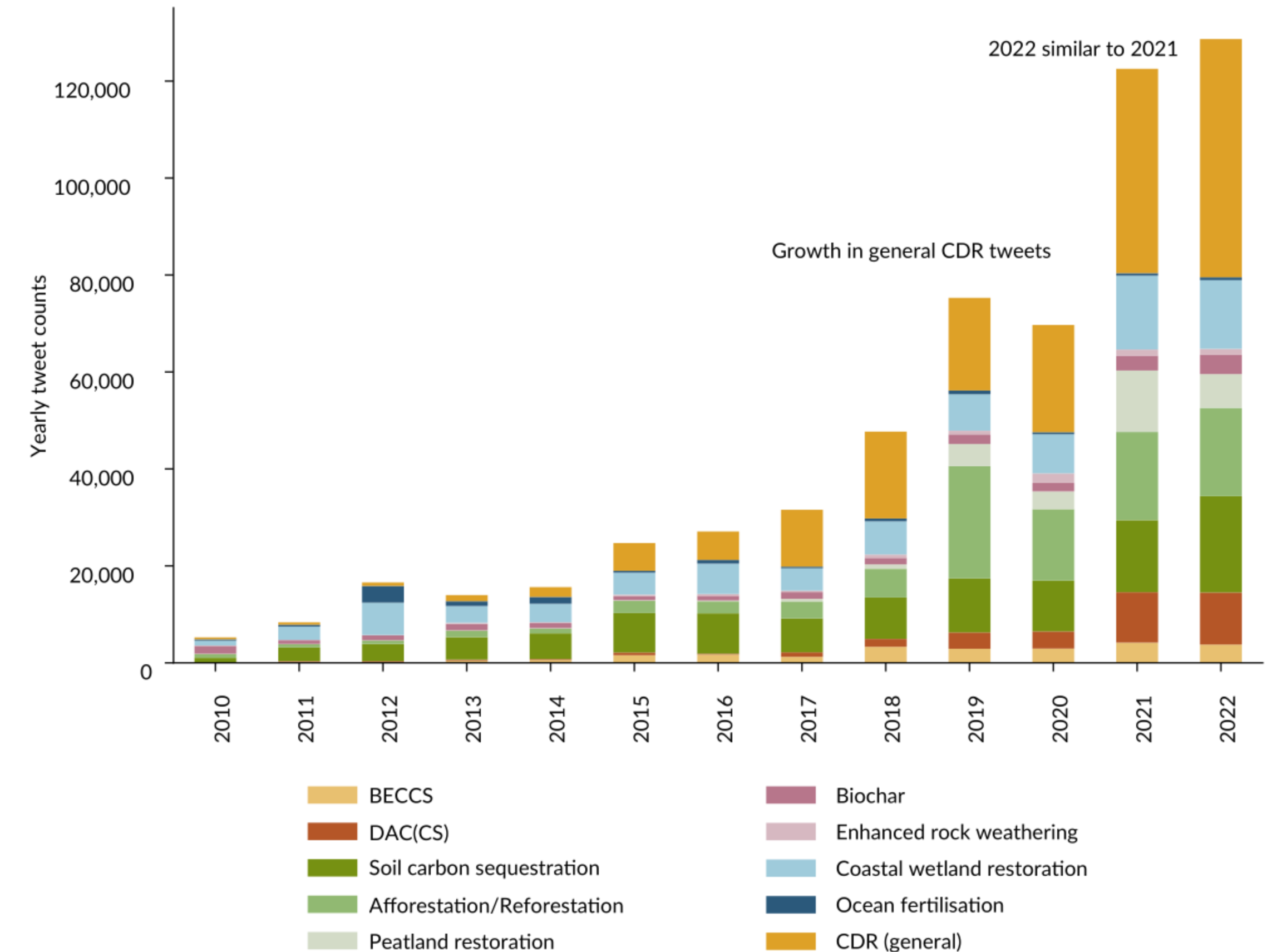


Public perceptions and communication important for CDR deployment

- Engaging with and communicating to specific societal groups, for instance farmers as potential adopters needed to implement some CDR methods
- Overall public support important (“social license to operate”)
- Lay people conditionally support many CDR methods
- Low awareness makes communication challenging
- Preview from 3rd Edition:

Communication about CDR is decreasing since 2023, both on social media (Twitter/X) and in newspapers

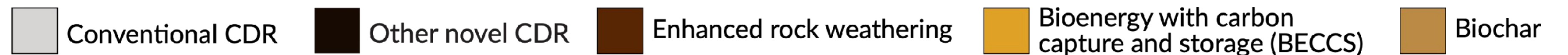
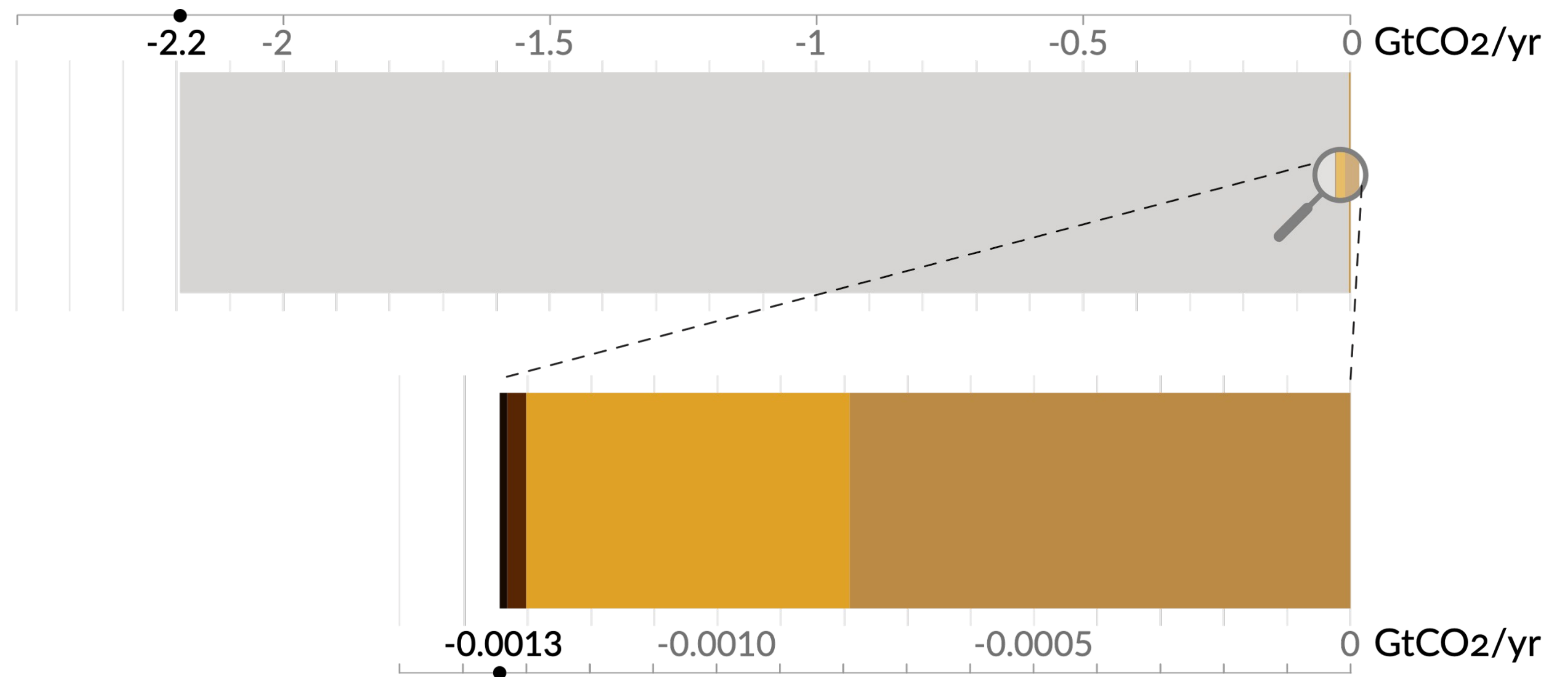
→ Related to overall decline in attention to climate change topics



Current levels of CDR:

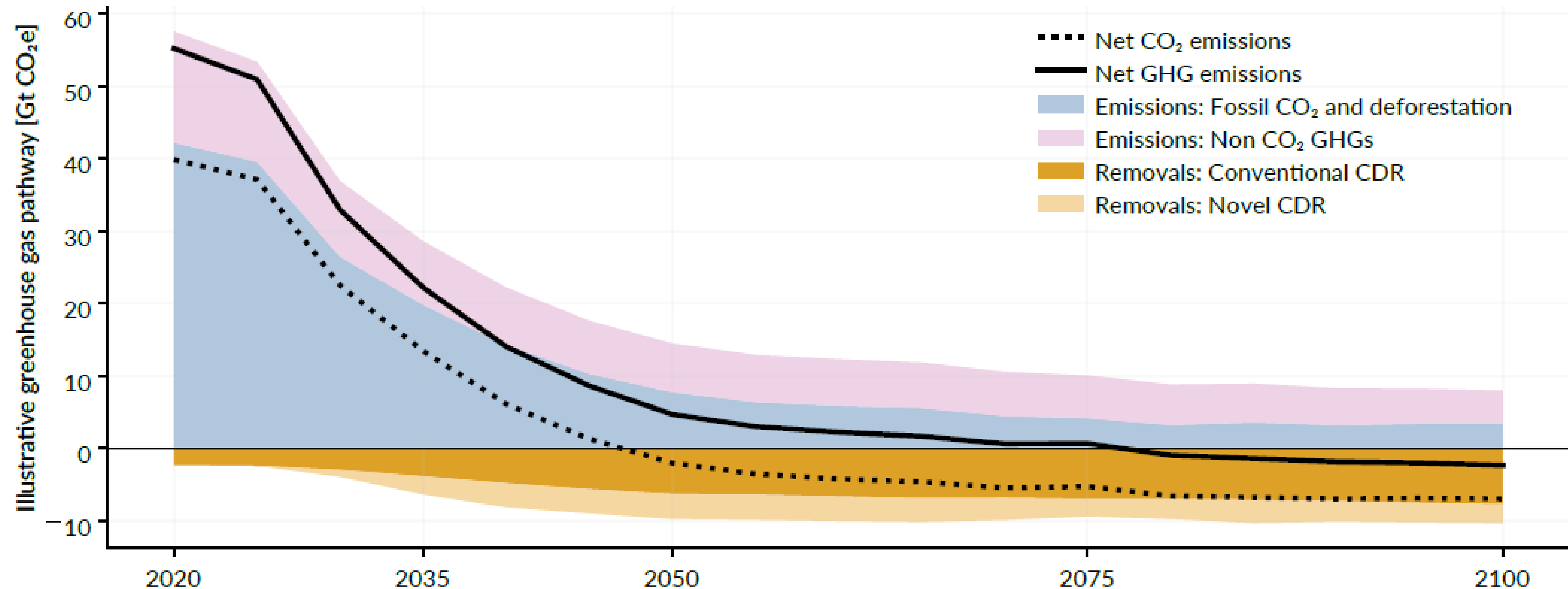
Only a tiny fraction of all carbon dioxide removal results from **novel methods**

- Total amount of carbon dioxide removal estimated at 2.2 GtCO₂/yr
- Most current CDR is through afforestation/ reforestation and storage in wood products
- Estimates come with high uncertainties
- Novel methods make up less than 0.1% of total removals (1.3 MtCO₂ in 2023), mainly from biochar and BECCS



Future needs:

All Paris-consistent climate scenarios use CDR at Gt scale, **but at various levels**

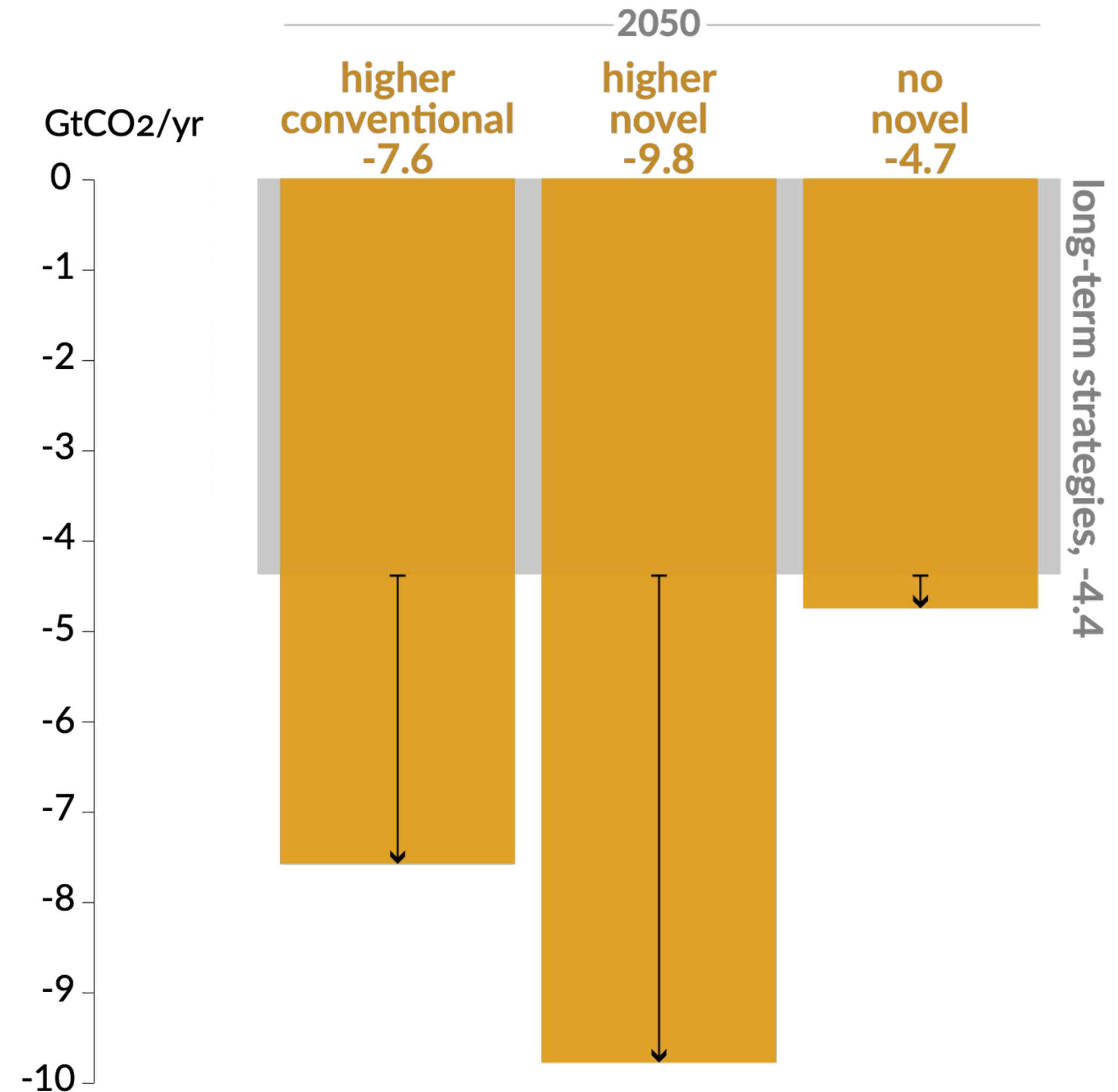


All scenarios use CDR in order to:

- achieve **net-zero CO₂ emissions** to **stop temperature rise**
- **counterbalance** remaining levels of **CO₂ and other GHGs**
- achieve **net-zero GHGs** to **lower temperature**

There is a gap between proposed levels of carbon dioxide removal and **what is needed to meet the Paris temperature goal**

- Carbon dioxide removal (GtCO₂/yr), **proposed levels** compared to **three Paris-relevant 1.5°C scenarios**
- The gap may be larger, as scenarios assume that emissions reductions already happen
- Failure to **strongly reduce emissions from fossil fuels and deforestation** will put the Paris temperature goal out of reach even with strong action on carbon removal



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