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Impacts of different definitions of removals

Glen Peters (CICERO)

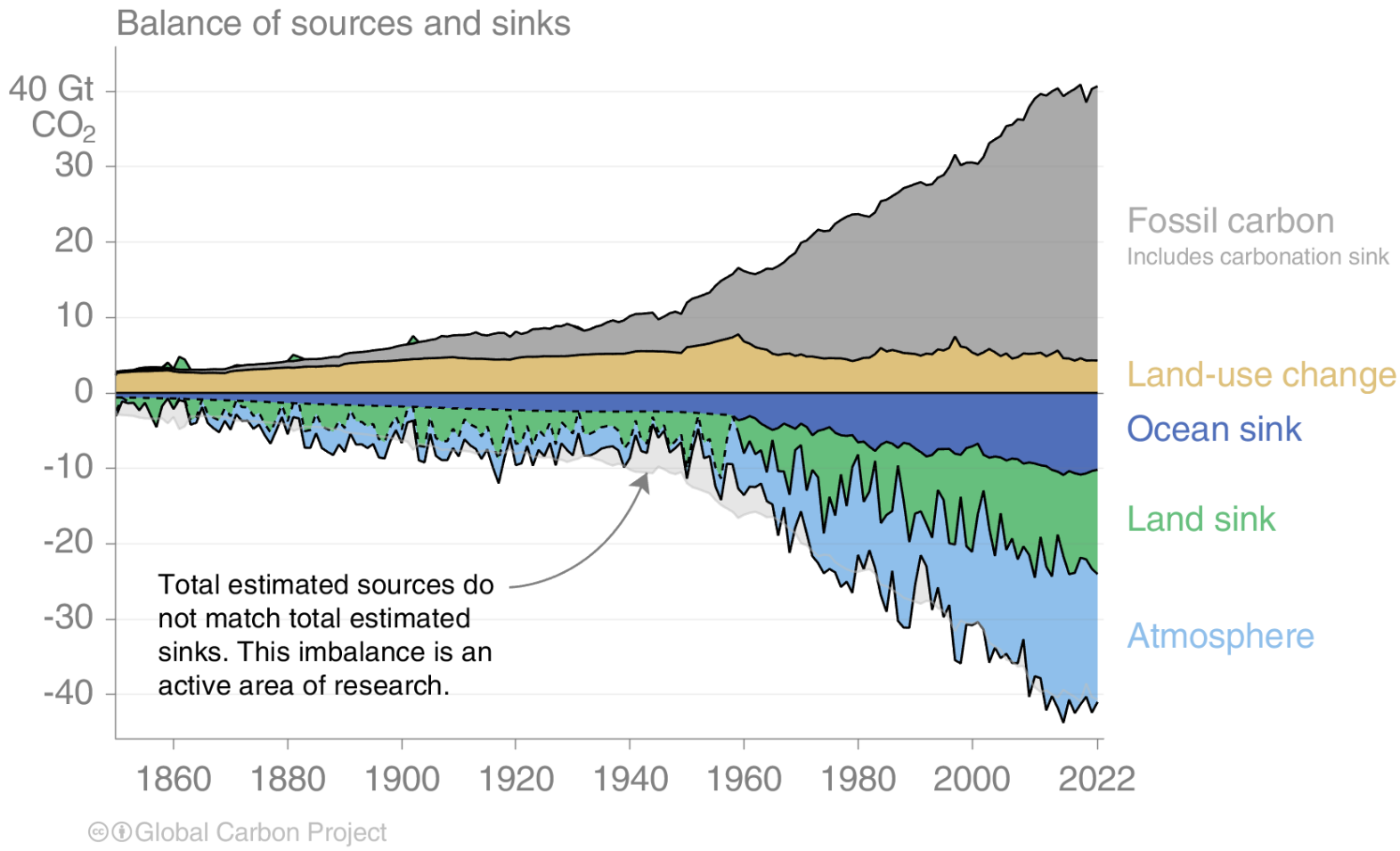
IPCC Expert Meeting on Reconciling anthropogenic land use GHG estimates

9-11 July 2024, Ispra, Italy

The risks of working in parallel

Global Carbon Budget

I am going to focus on the land components of the Global Carbon Budget (land-use change, land sink)
Don't forget there are fossil emissions and an ocean sink, this matters too!



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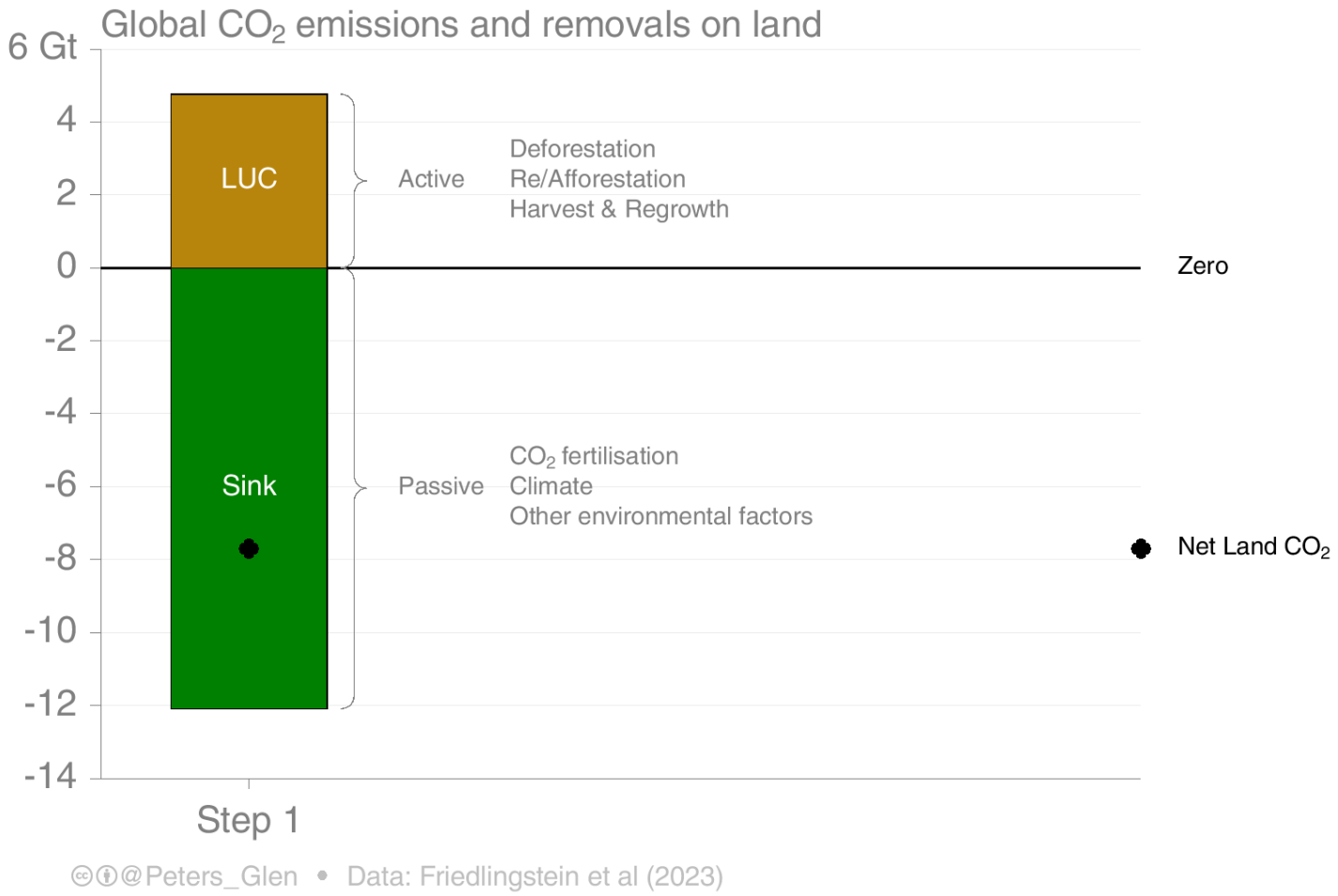
Mapping between different definitions

The Global Carbon Budget has always separated land CO_2 emissions into *active* and *passive* components

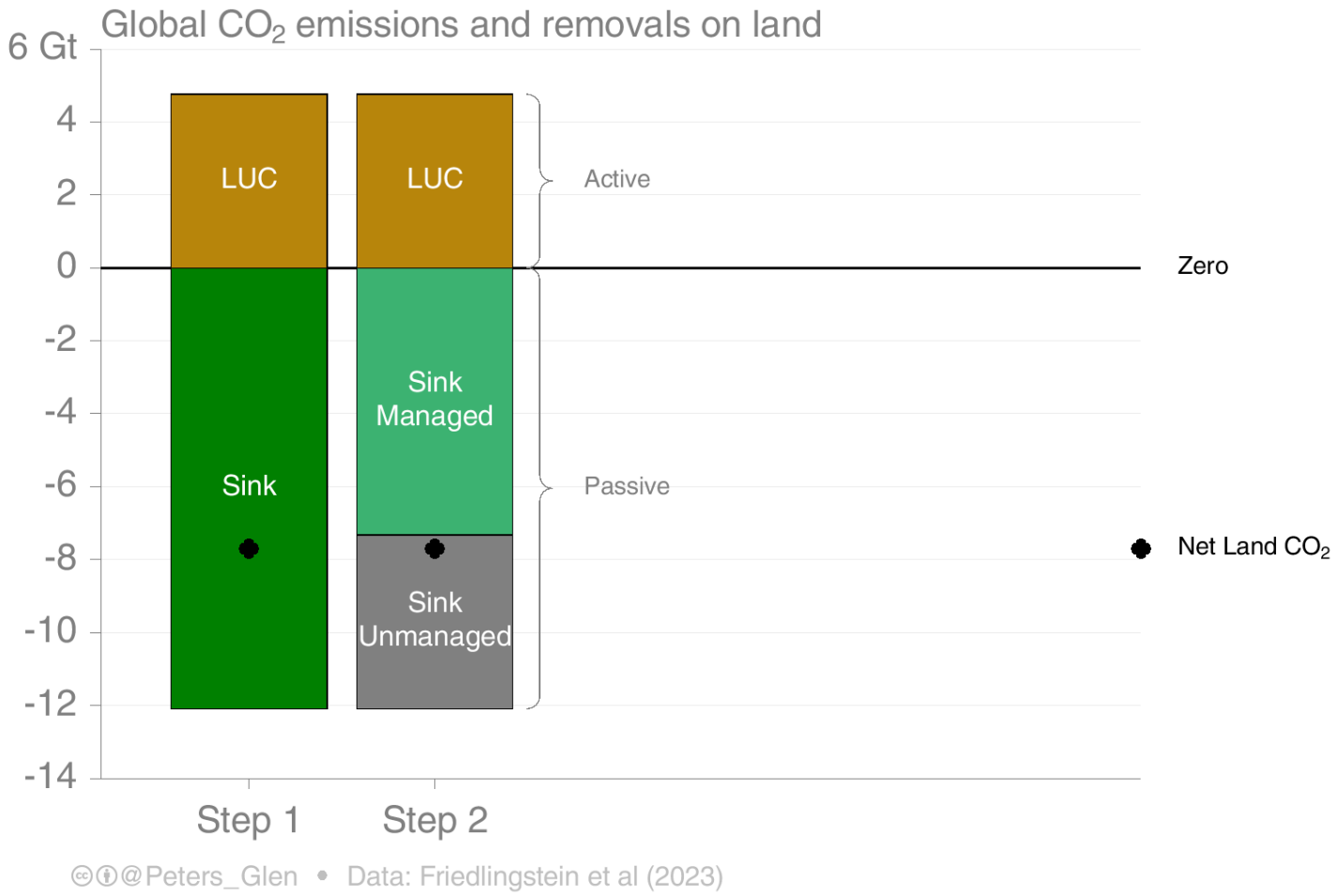
Active: There is a physical change on the land (e.g., land use *change*); *Passive*: Everything else



Mapping between different definitions

National GHG Inventories use the ‘managed land’ proxy (a practical solution) to define “anthropogenic”

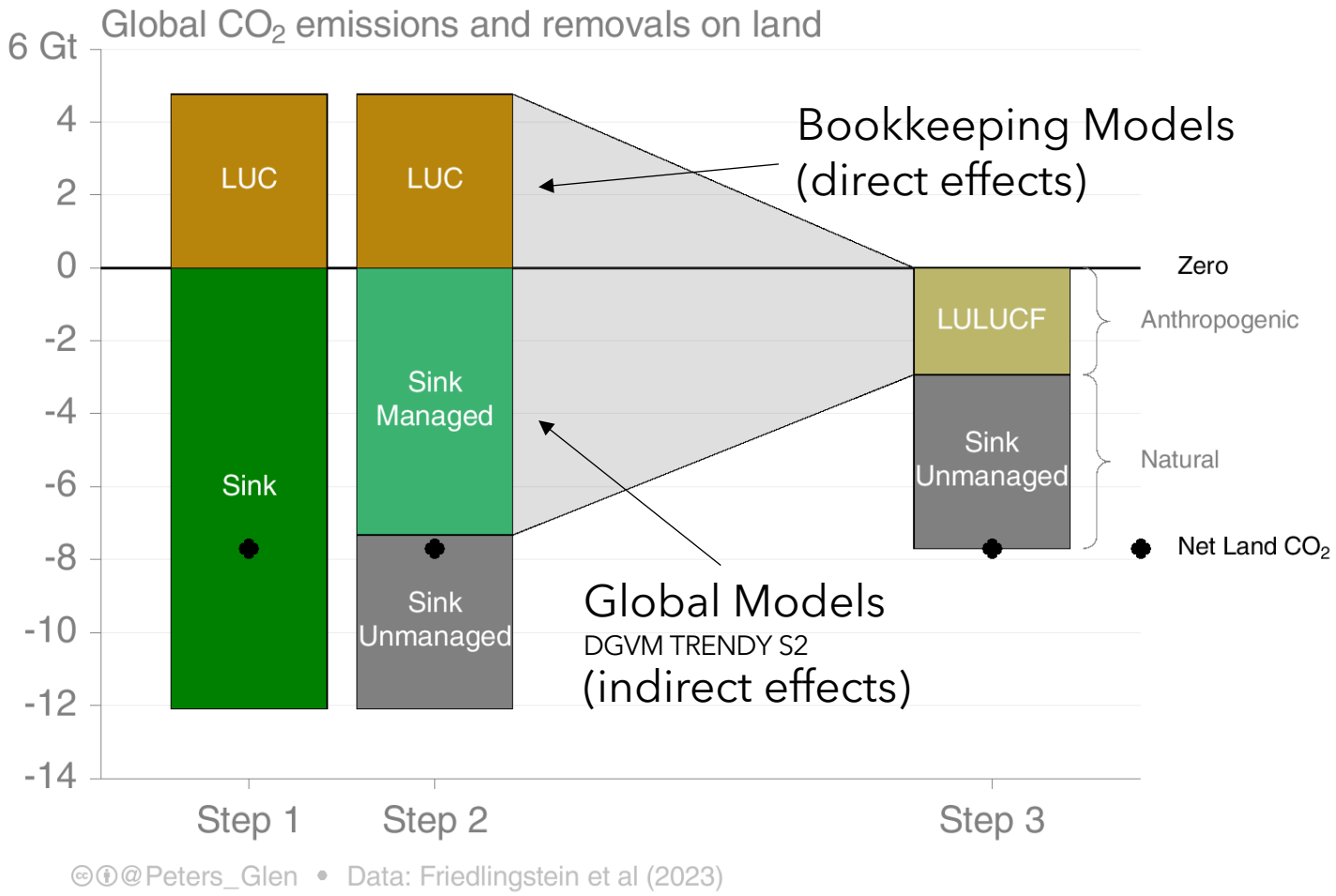
We can separate the passive sink into managed and unmanaged components



Mapping between different definitions

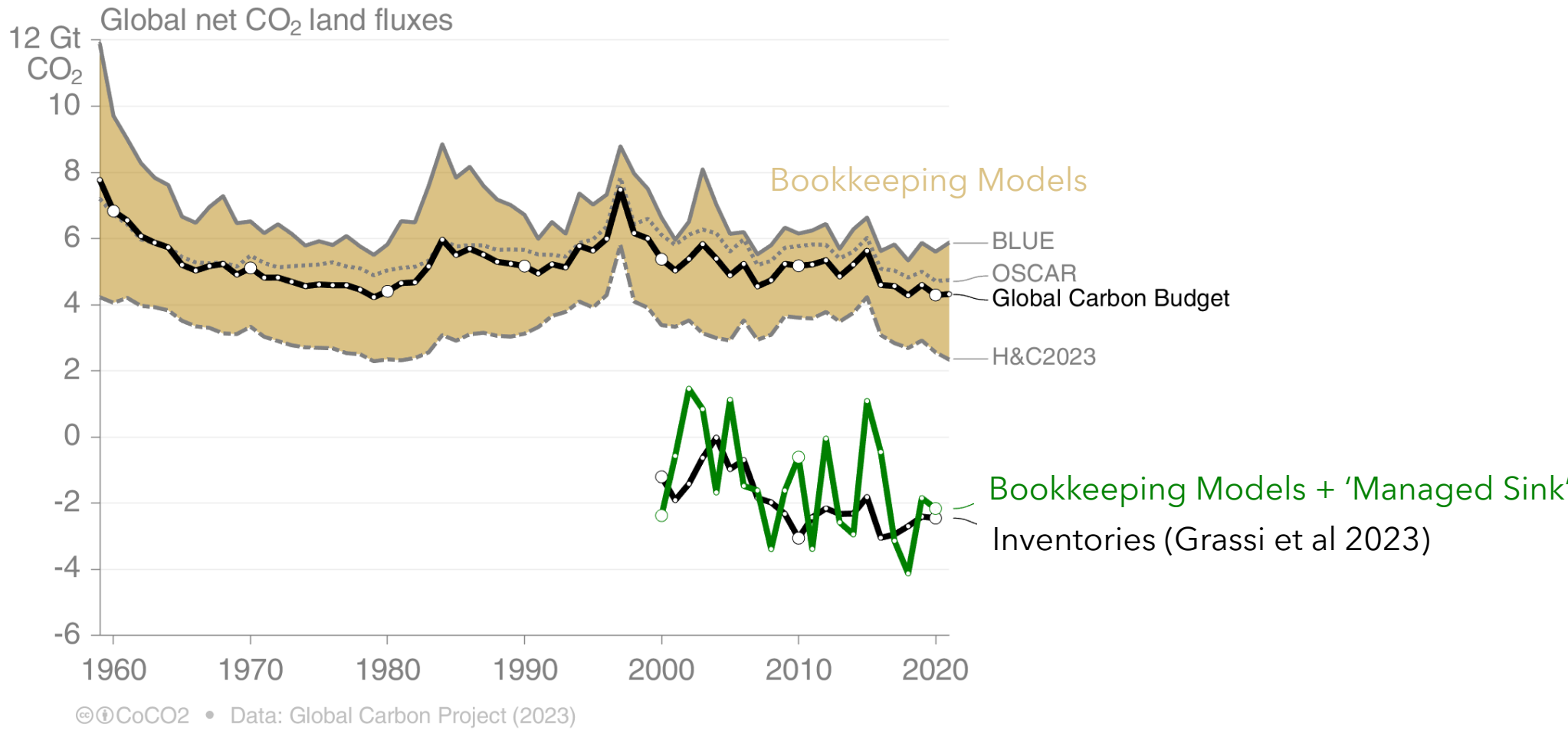
We can then merge the *active* and *managed passive* sinks to map to the National GHG Inventories

In IPCC language, we then have the *anthropogenic* and *natural* sinks



The mapping works well!

If we perform the mapping, there is a close agreement with National GHG Inventories
This is despite all the uncertainties, lack of managed land maps, variability in land models, etc



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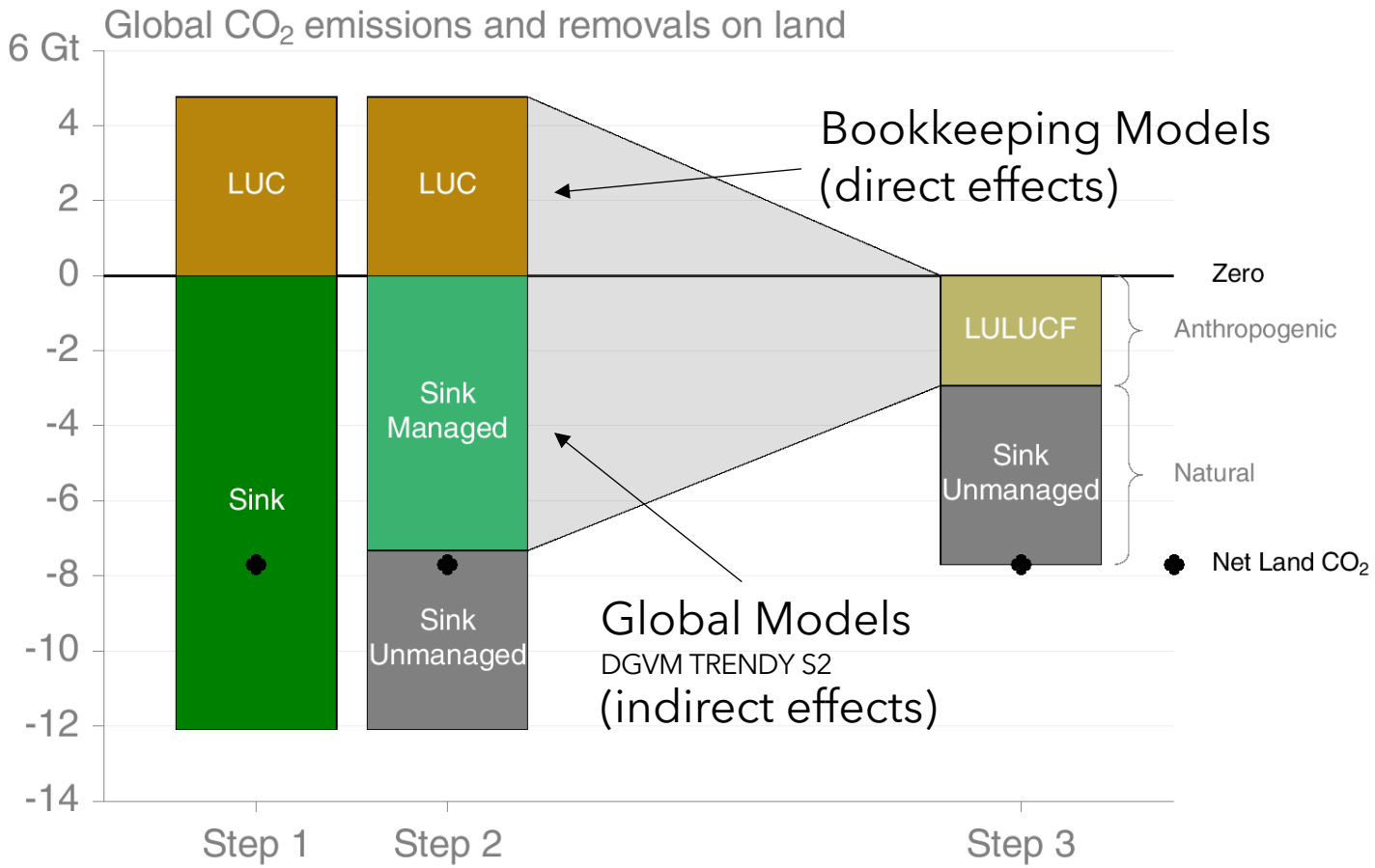
Redefining land CO_2 removals

This mapping gives the impression there is an *equivalence* between the approaches

There is not: ***the mapping changes a feedback to an emission / removal***



Mapping between different definitions

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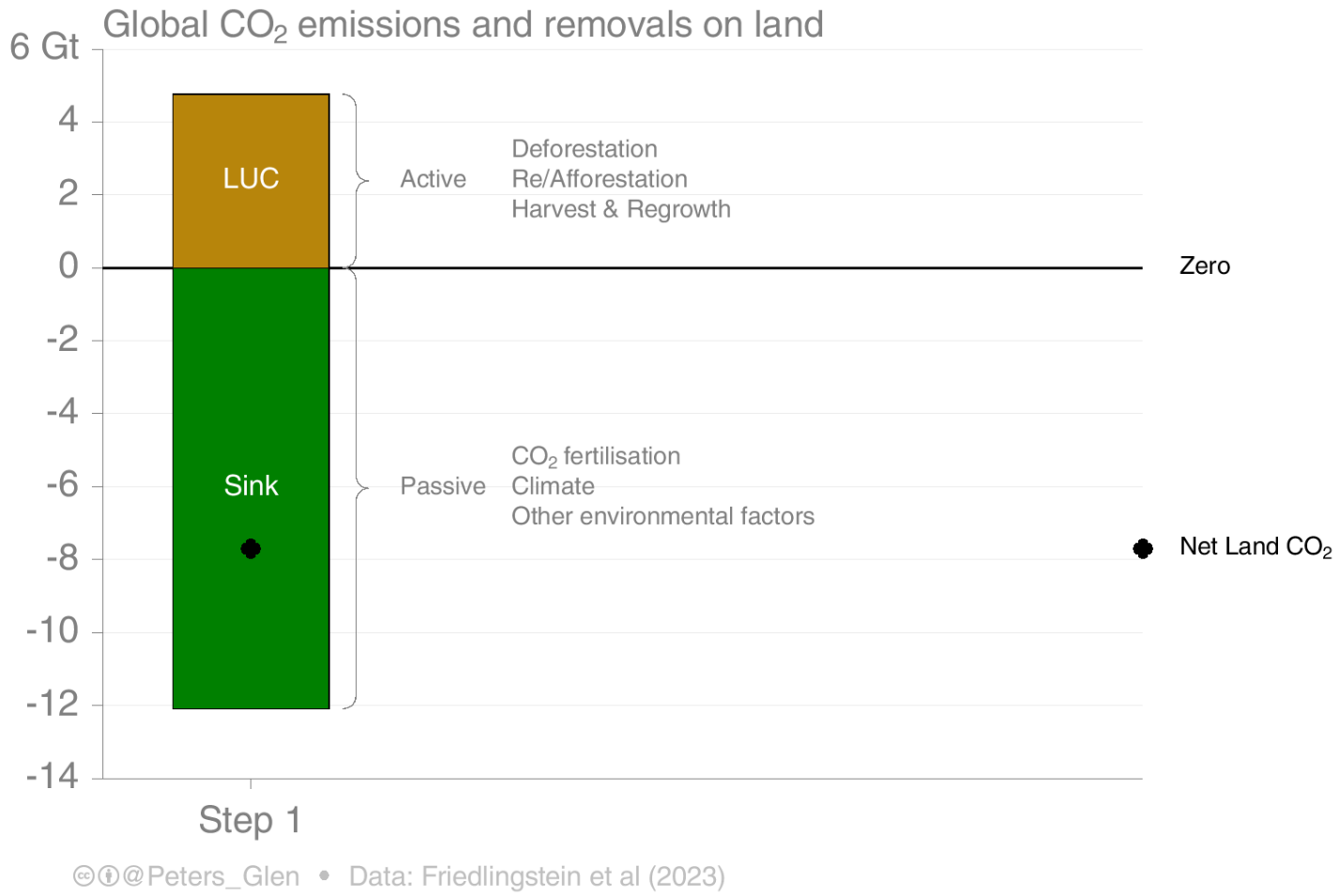
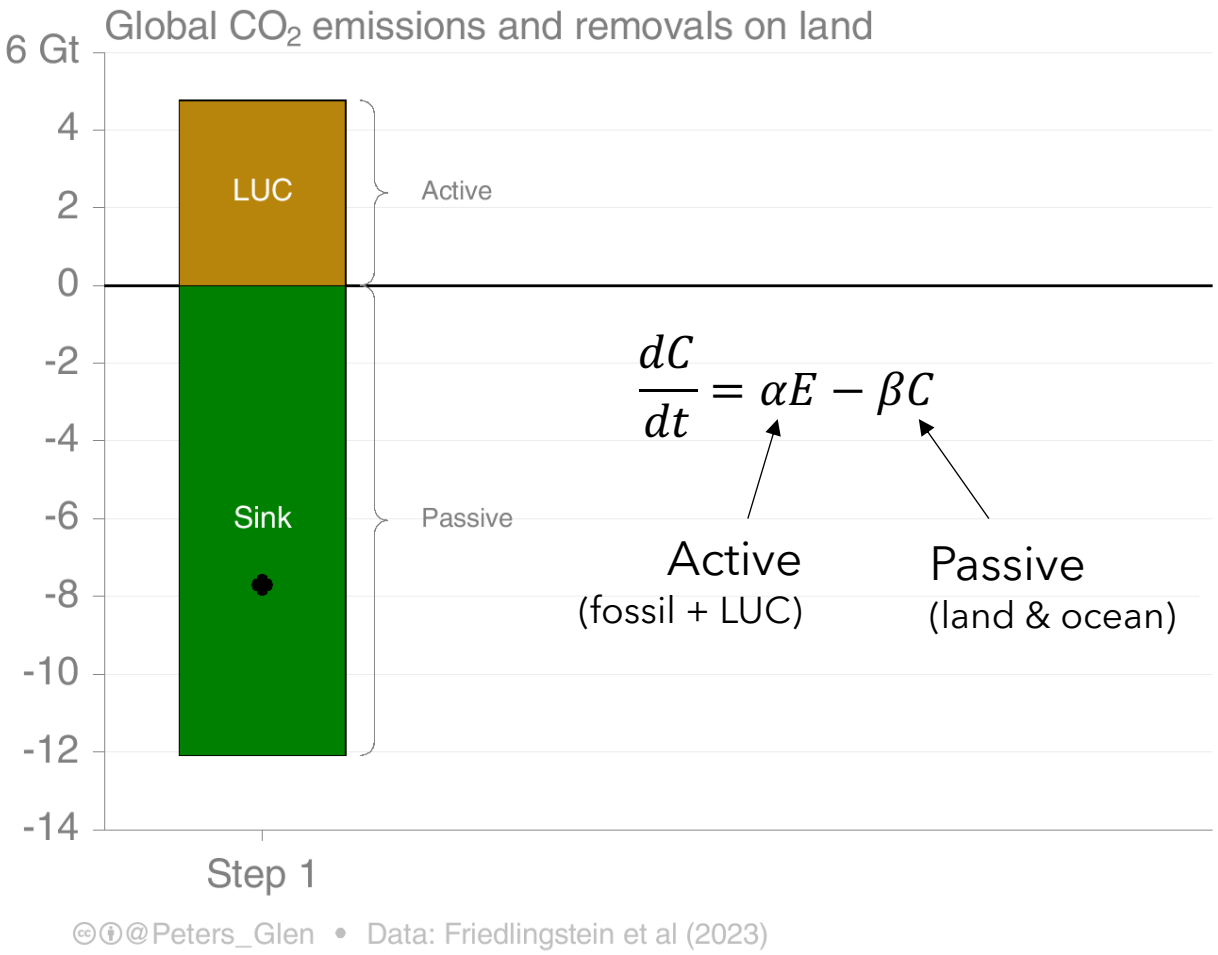
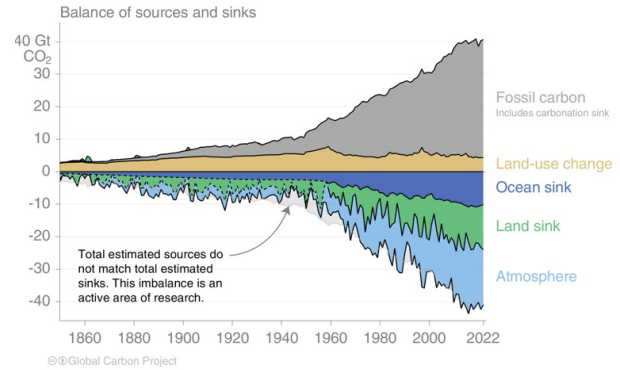


A simple carbon cycle model

The *active* land (and fossil) CO_2 emissions are the inputs to the carbon cycle

The *passive* land (and ocean) CO_2 removals are a response of the system





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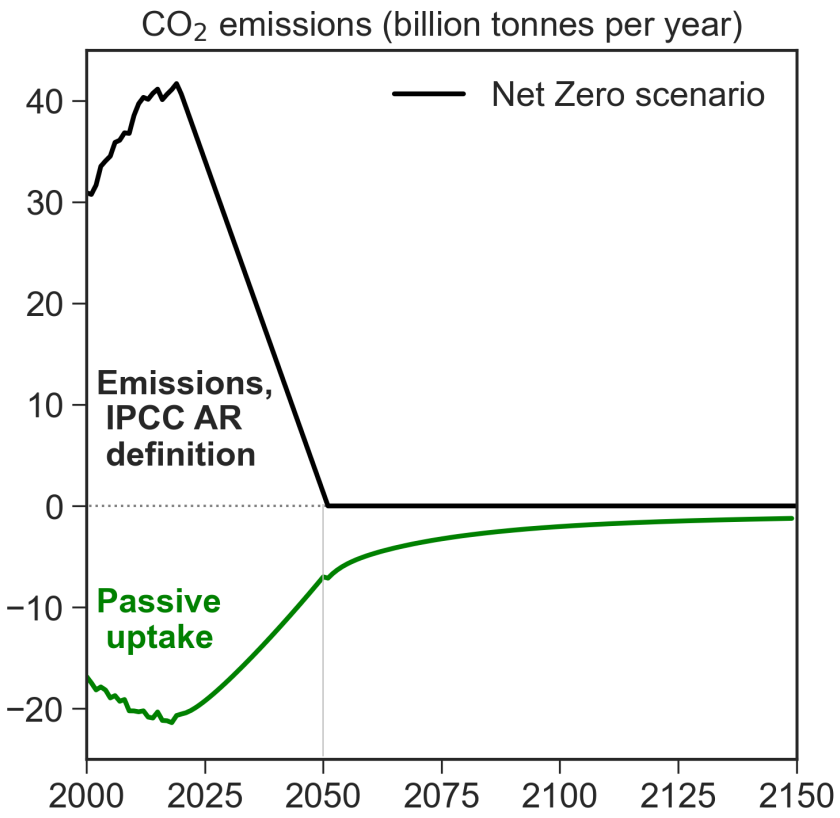
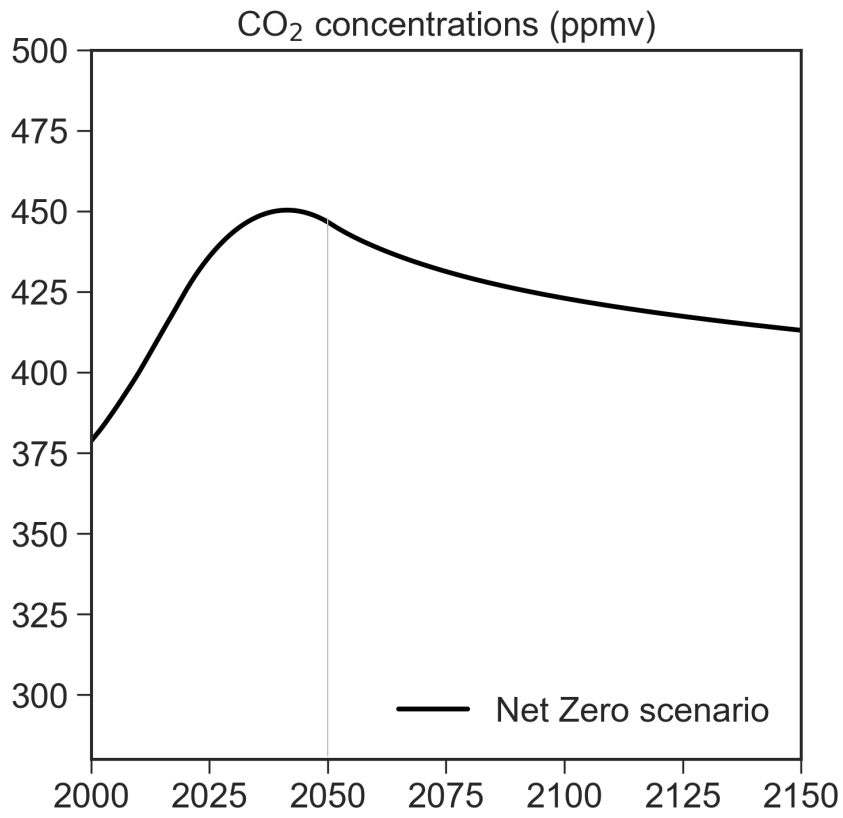
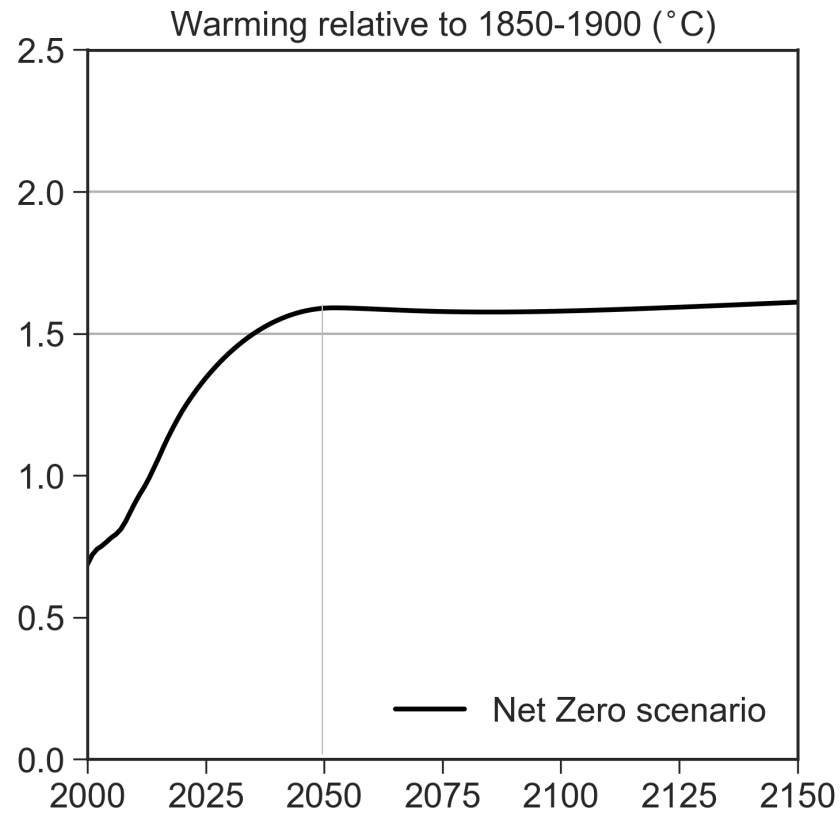
It matters, a lot!

Net zero fossil+active-land CO_2 emissions leads to a declining CO_2 concentration & constant temperature (black)

Passive CO_2 uptake declines as CO_2 emissions decline







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Source: Allen et al 2024 (in review)

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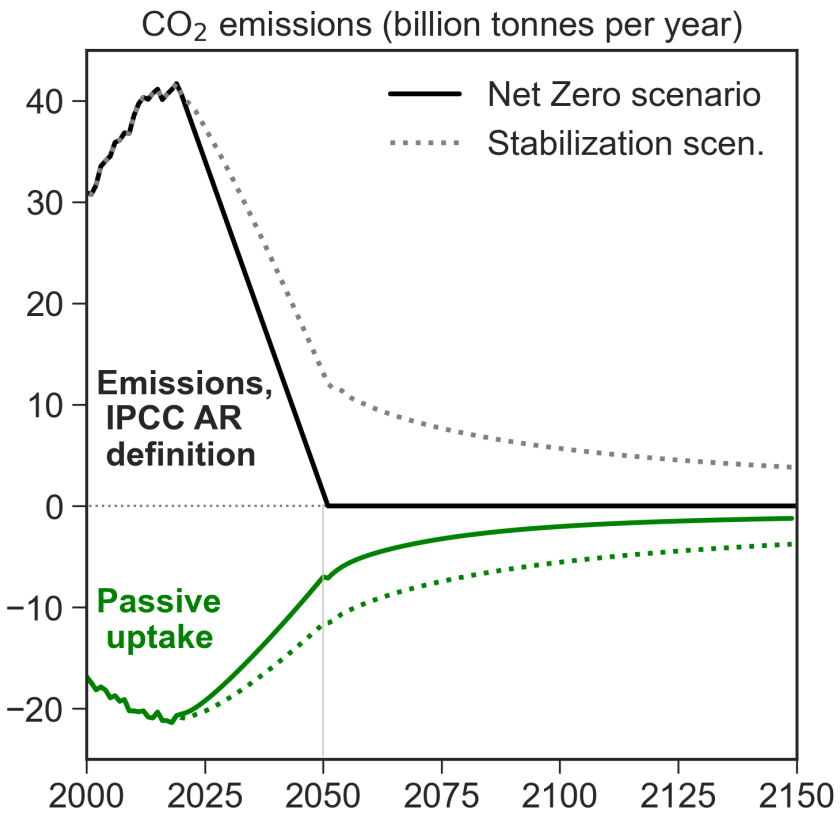
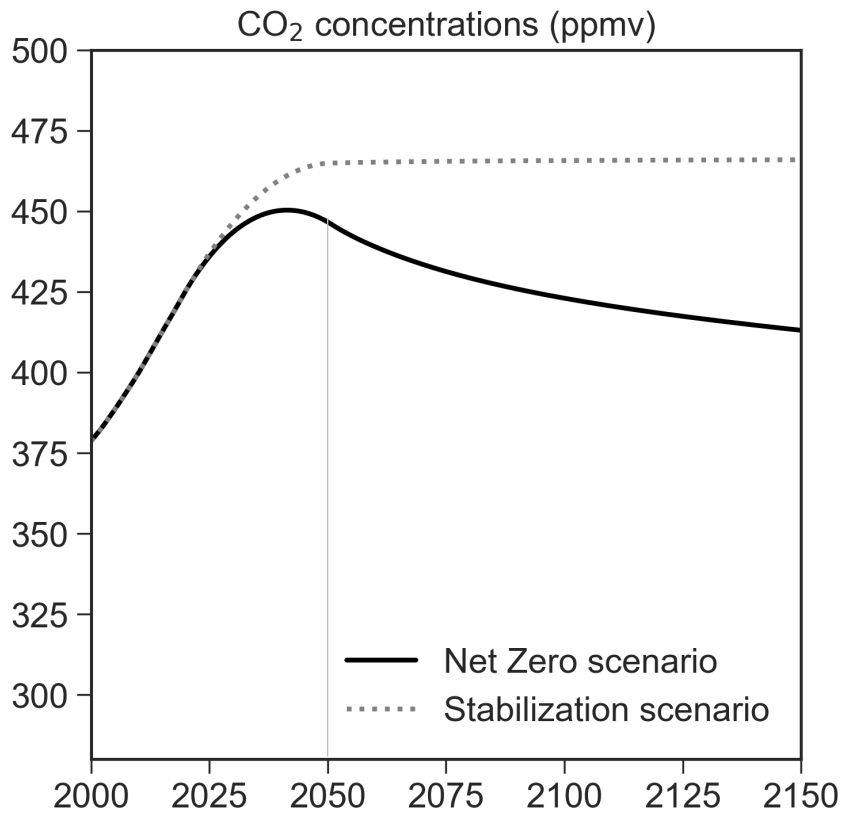
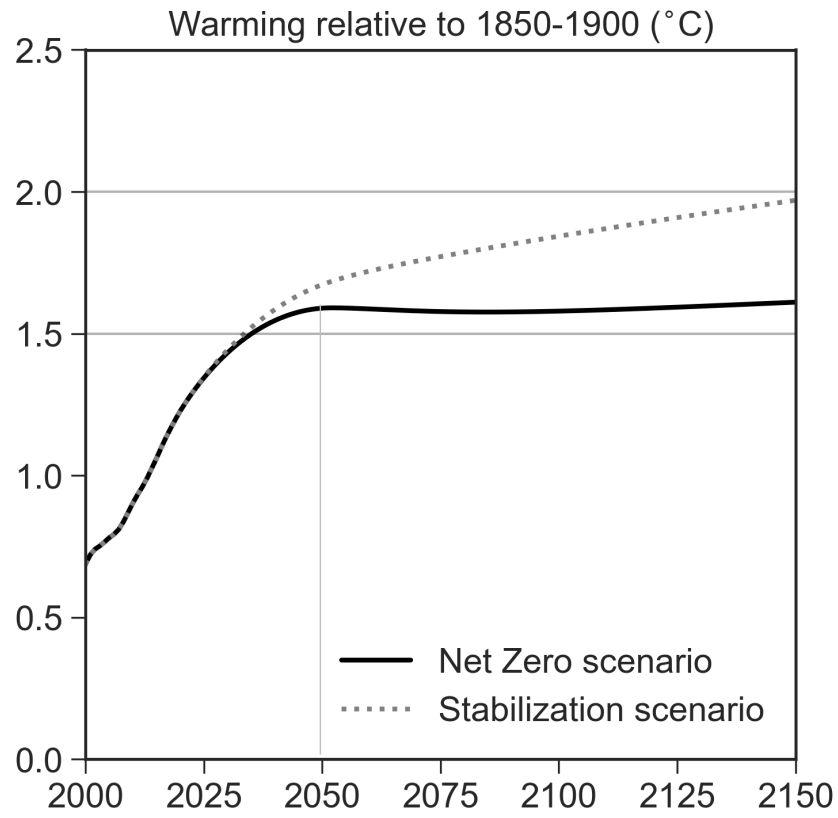
It matters, a lot!

Net zero fossil+active-land CO_2 emissions leads to a declining CO_2 concentration & constant temperature (black)
Balancing active emissions and passive removals gives constant CO_2 concentration & rising temperature (grey dotted)







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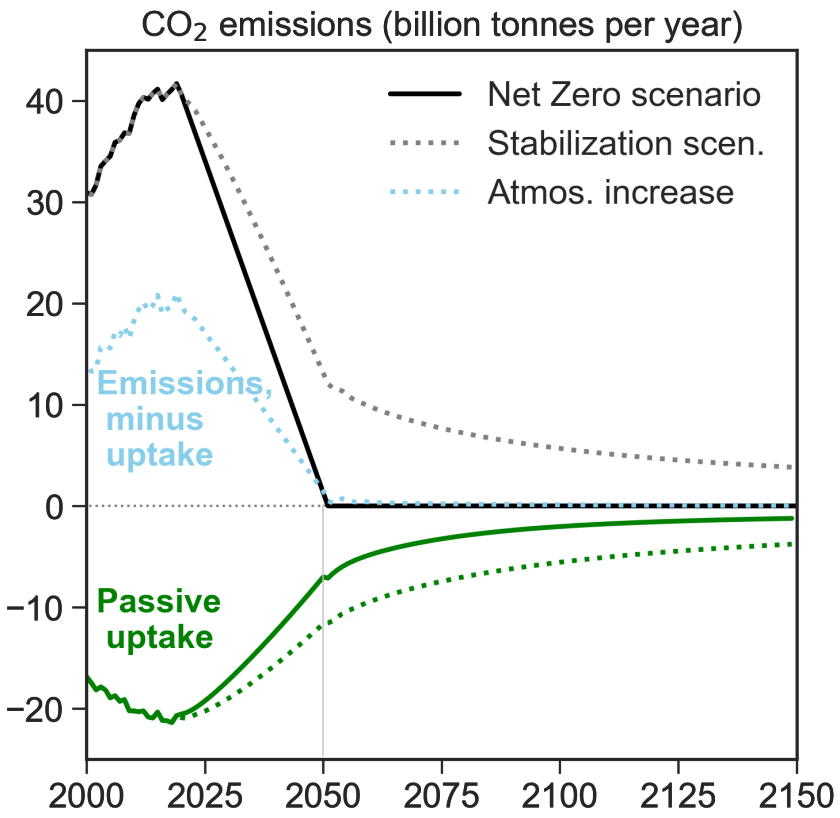
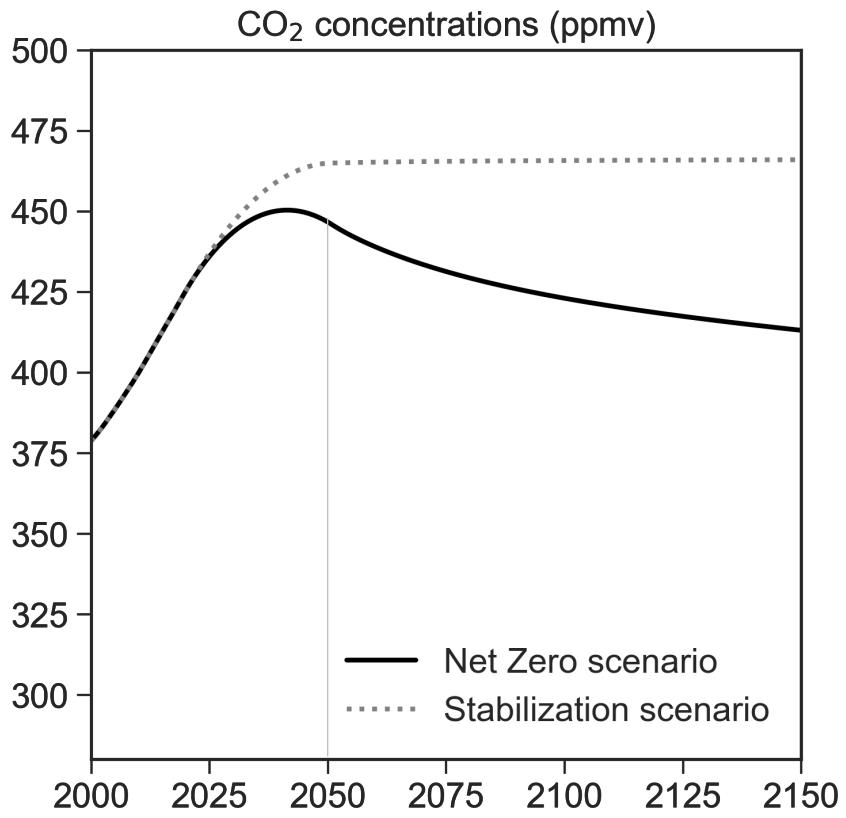
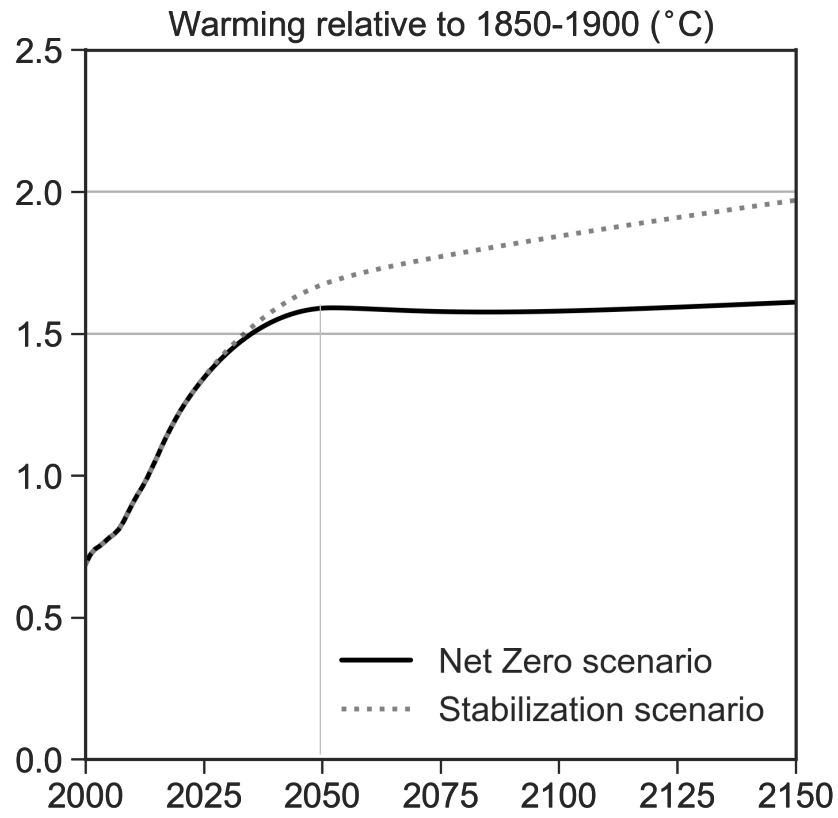






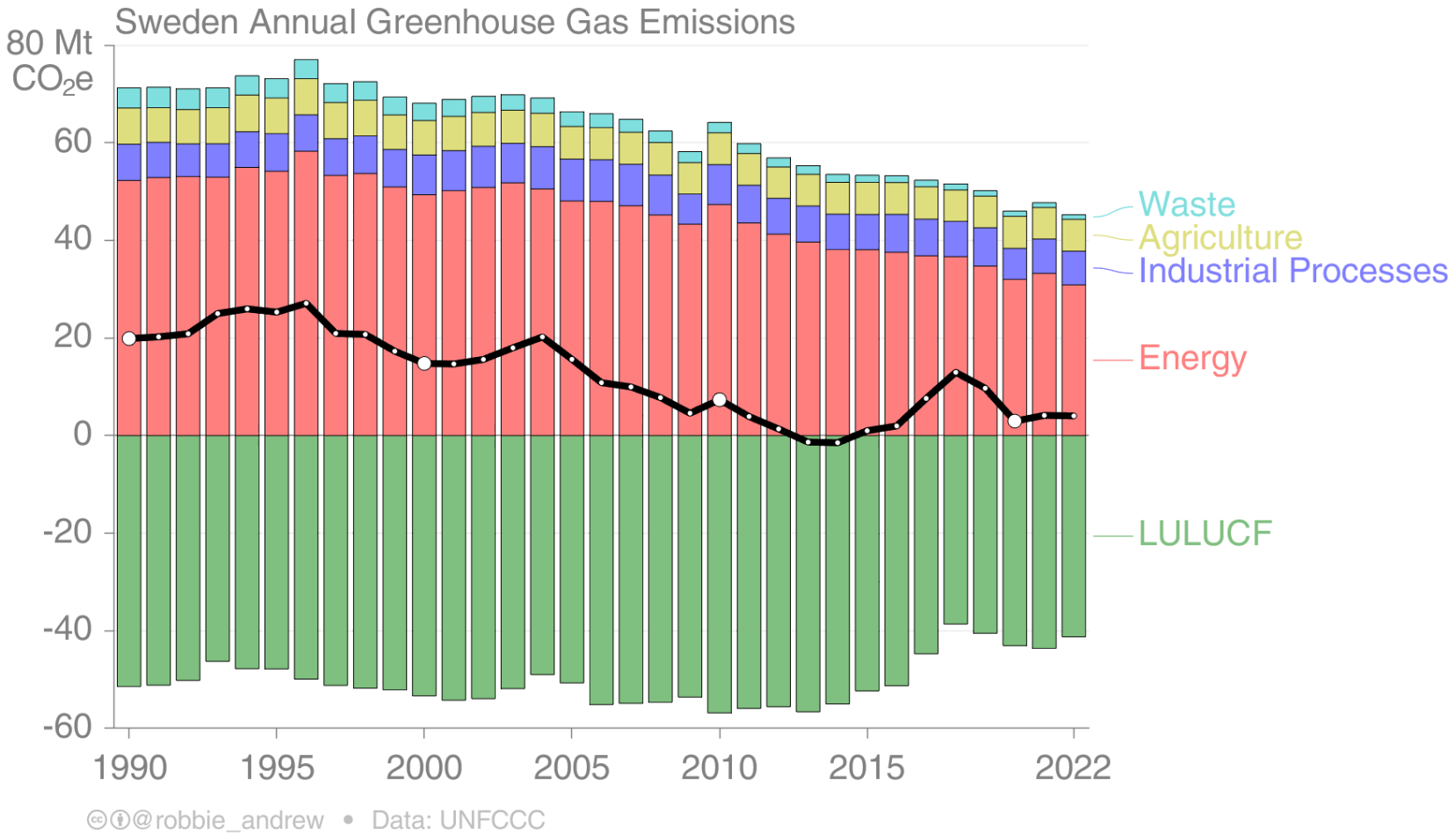
Source: Allen et al 2024 (in review)

Changing definitions, changes everything…

- IPCC WG's, UNFCCC text, based on the 'active' / direct definition
- NGHGIs would lead to significant changes in IPCC text
  - Lower global emissions
  - Different reduction rates (e.g., 2030, 2040, …)
  - Different net zero years
  - Smaller Remaining Carbon Budget (RCB)
  - Change in key carbon cycle parameters (e.g., TCRE, AF, …)
  - Different regional allocation of GHG emissions
- We need to protect the passive sink, but not to offset emissions

Sweden (who is *not* offsetting emissions with removals)

Sweden is an example of a country that is essentially net zero GHG using NGHGI definitions of managed land.
If all countries did this, it would lead to rising global temperatures (not stable temperatures)



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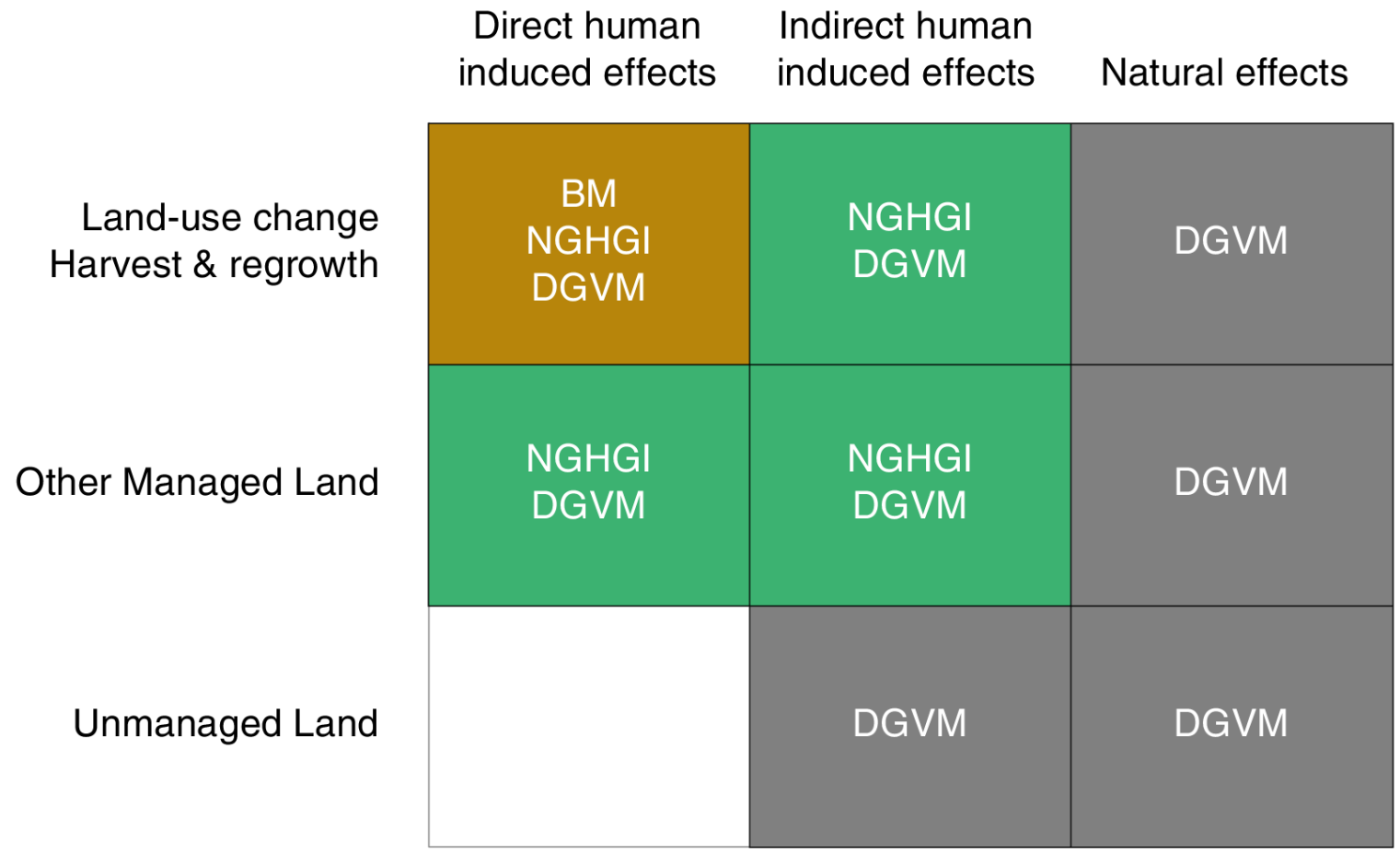
Moving forward

The status quo

We understand the effects, how they map to models, and how to map between them

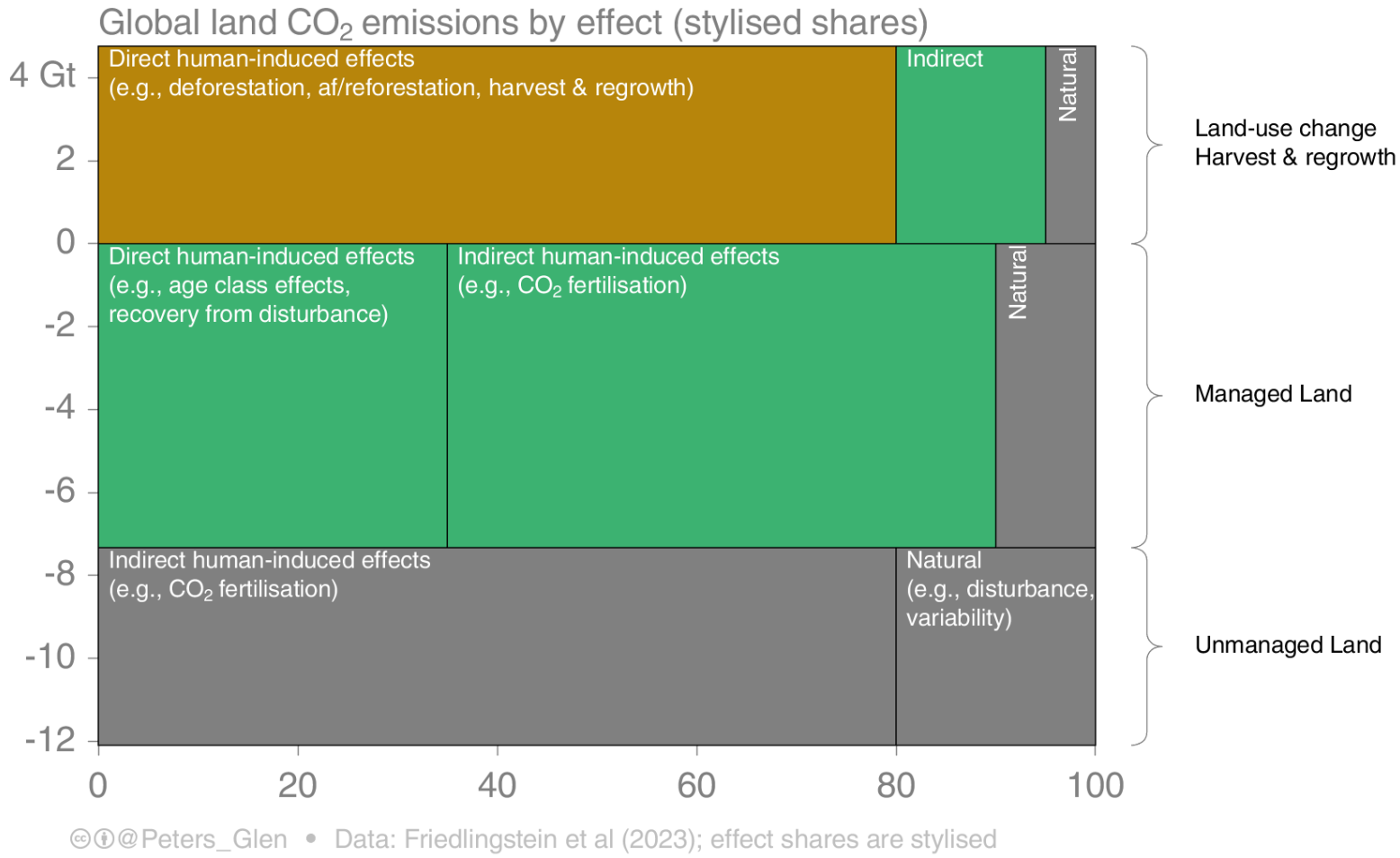


@Peters_Glen

Moving beyond the status quo

We need to understand how the direct, indirect, and natural effects vary across land categories & models

Can we better define ‘anthropogenic’ if we report with more disaggregation?



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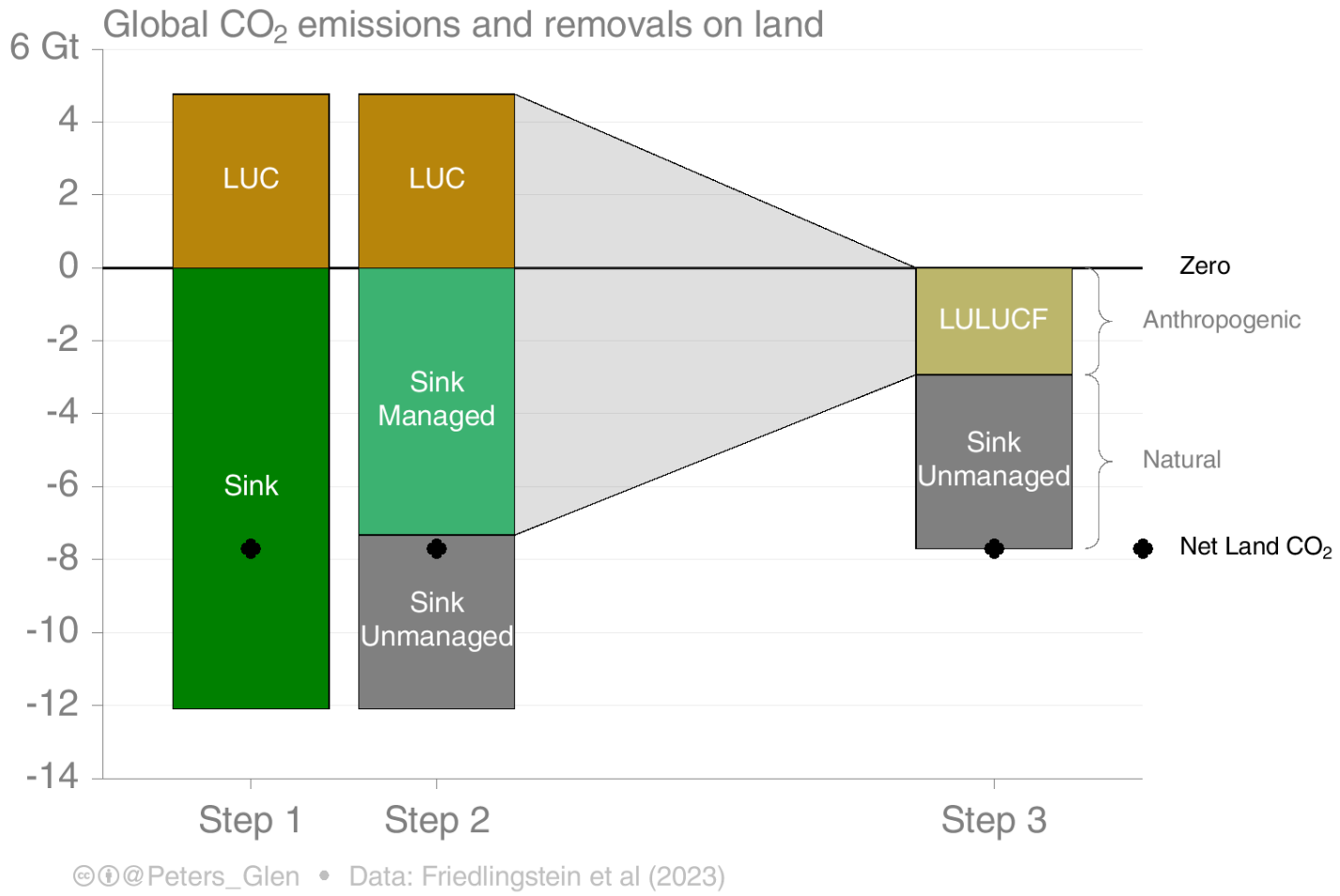
Geological Net Zero emissions

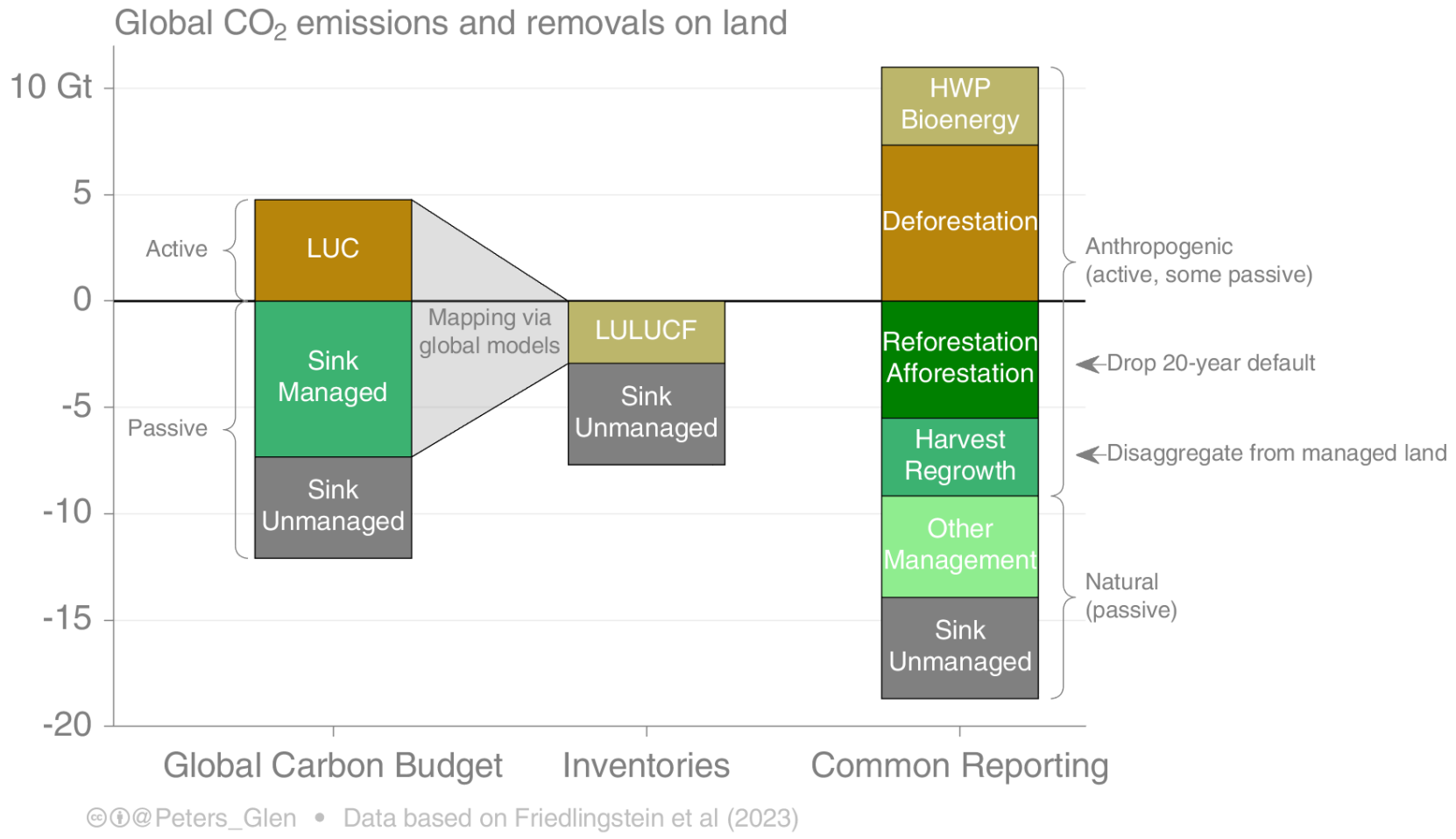
The science of net zero is based on net zero *active* emissions (left): this is physics
Achieving net zero 'anthropogenic' (managed land) will lead to rising temperatures



Moving beyond the status quo

Bookkeeping models & NGHGIs can report more information, but use different definitions

DGVMs represent all land and effects, but don't natively report by process (e.g., deforestation, af/reforestation, etc)



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Moving forward: steps towards a more integrated approach?

- 'Managed Land Proxy' was a practical solution to define anthropogenic removals 20 years ago
  - It is not the "best available science" (Paris Agreement Article 4)
- Inventories: Disaggregate forest remaining forest
  - E.g., detail land conversion beyond 20 years, specify type of management
- DGVMs (S3): Allocate to categories, separate direct & indirect
  - Deforestation, af/reforestation, harvest & regrowth, other management
- Bookkeeping models: Continued disaggregation
  - Deeper comparisons across models & with NGHGIs
- Land could remain a 'proxy', but requires clear definitions

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Questions?

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