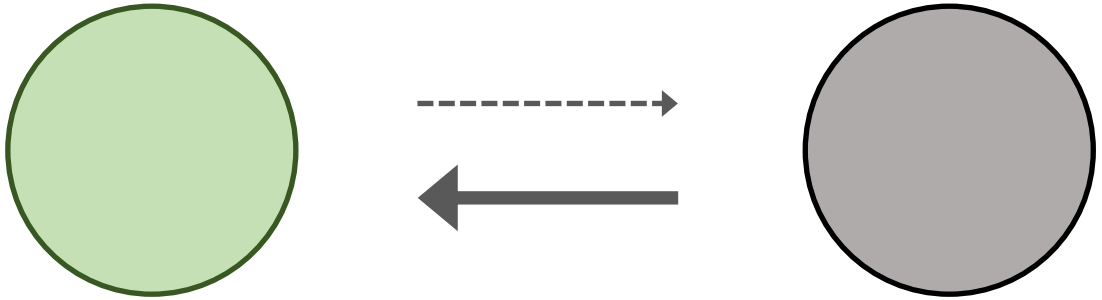
Temporary Carbon Storage in the Global Carbon Budget

Eric Marland

with Gregg Marland (AppState), Keith Stockmann (USFS), and others.

“It may be possible, in the case of a worldwide emergency, to plant enough trees and other fast-growing plants to incorporate the excess CO_2 and retard the annual atmospheric increase. This would have to be viewed as an emergency scheme to provide a short-term response to hold the CO_2 at bay while the shift to nonfossil fuels was implemented. The newly grown plants would have to be regarded as a “carbon bank” and …”

Freeman Dyson and Gregg Marland, 1979

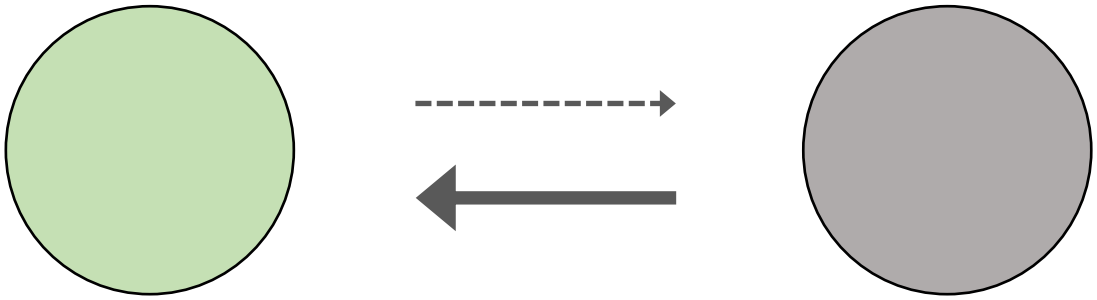


Active Carbon Pool

Atmosphere
Surface Oceans
FF Products and Fuels
Biosphere
- Trees
- Wood products
- Landfills*
- Soil carbon*

Inactive Carbon Pool

Coal
Oil
Natural Gas
Mineralized carbon
Landfills*
Injected CO_2
Soil carbon*
Deep Oceans
Other storage

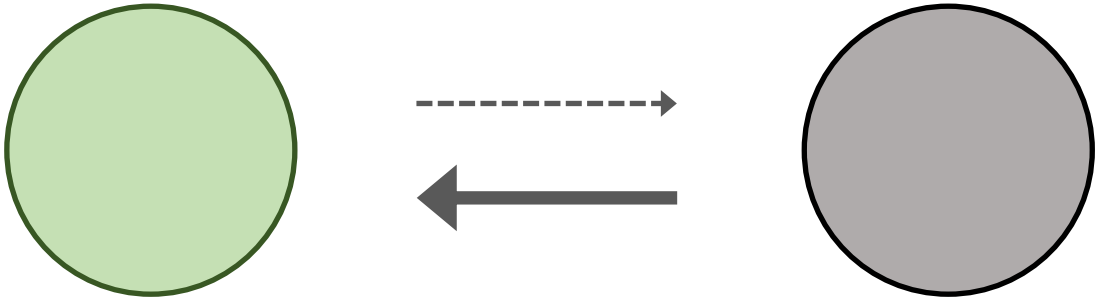


Active Carbon Pool
(revertible)

Inactive Carbon Pool
(non-revertible)

1. Reduce flow from right to left
2. Increase flow from left to right
3. Redistribute within active reservoir

But mostly, reduce atmospheric CO_2,
as much as possible, quickly.



Active Carbon Pool

Risk of unintentional reversion

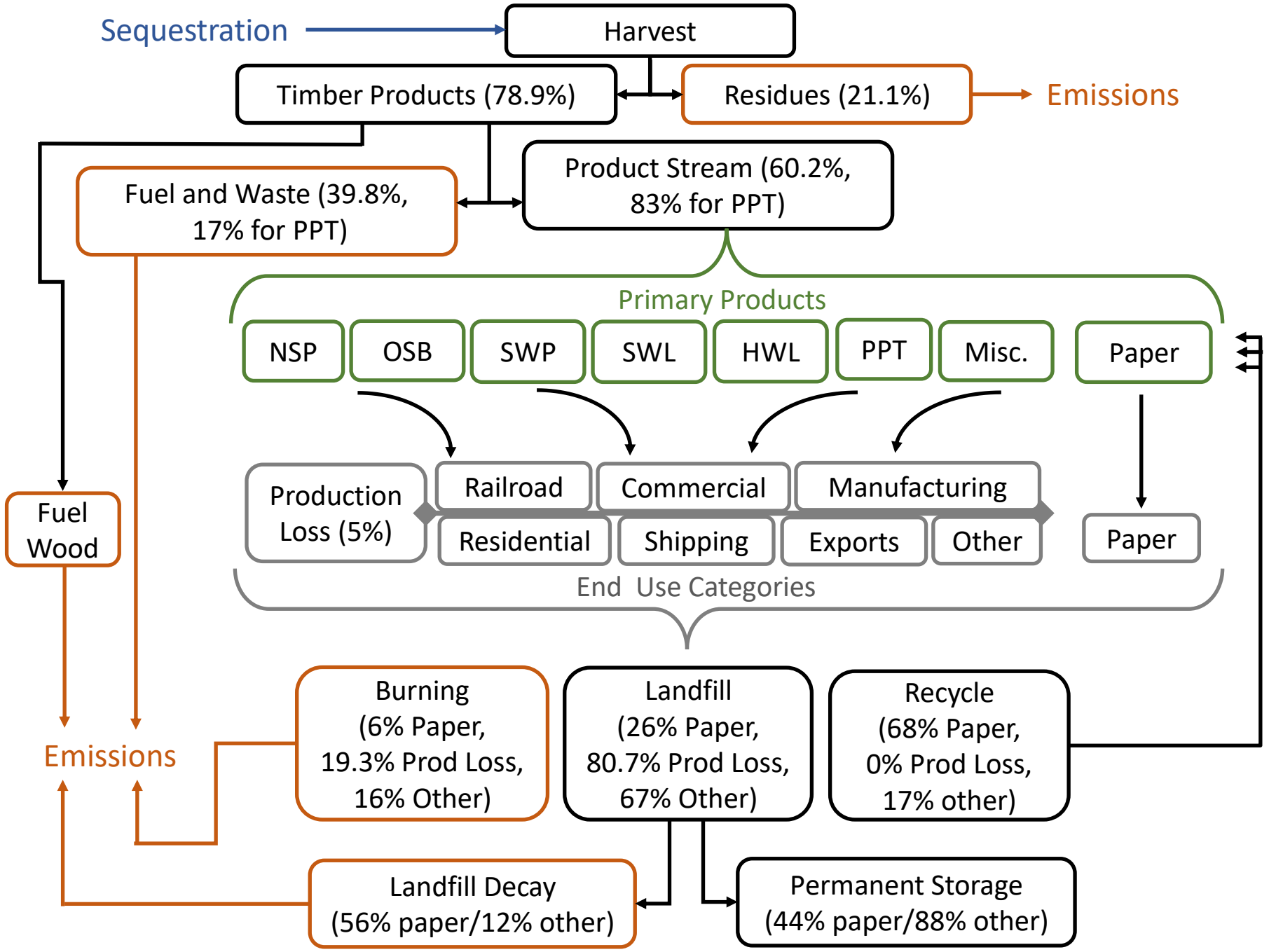
Temporary Storage?

Inactive Carbon Pool

Only intentional reversion

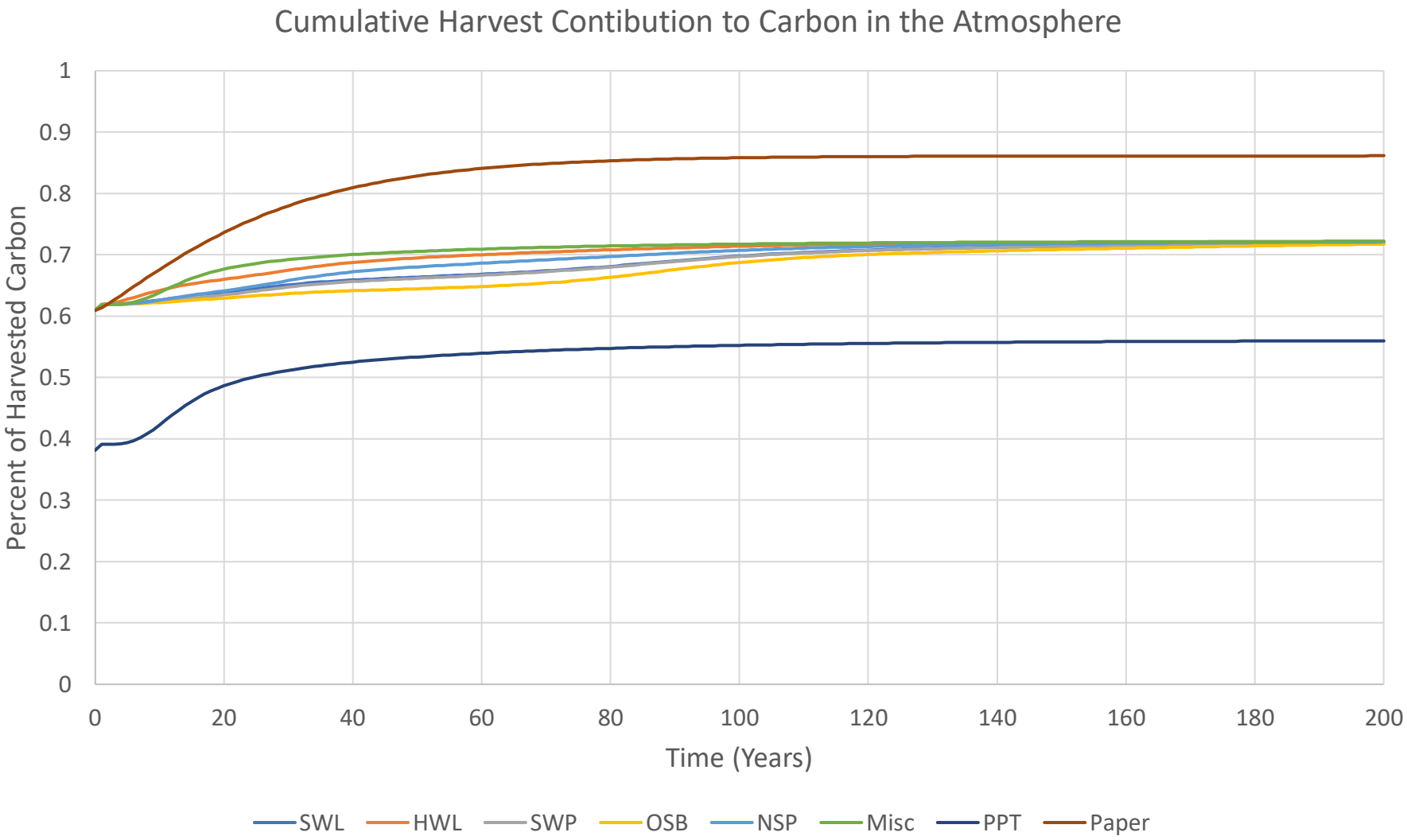
Permanent Storage?

- Redistribution efforts are necessarily ongoing.
- Any storage in an active pool is short term until it wasn't.
- Incentives can motivate short term projects to become longer.
- All storage options are important for effective mitigation.
- Total carbon storage is what makes a difference.



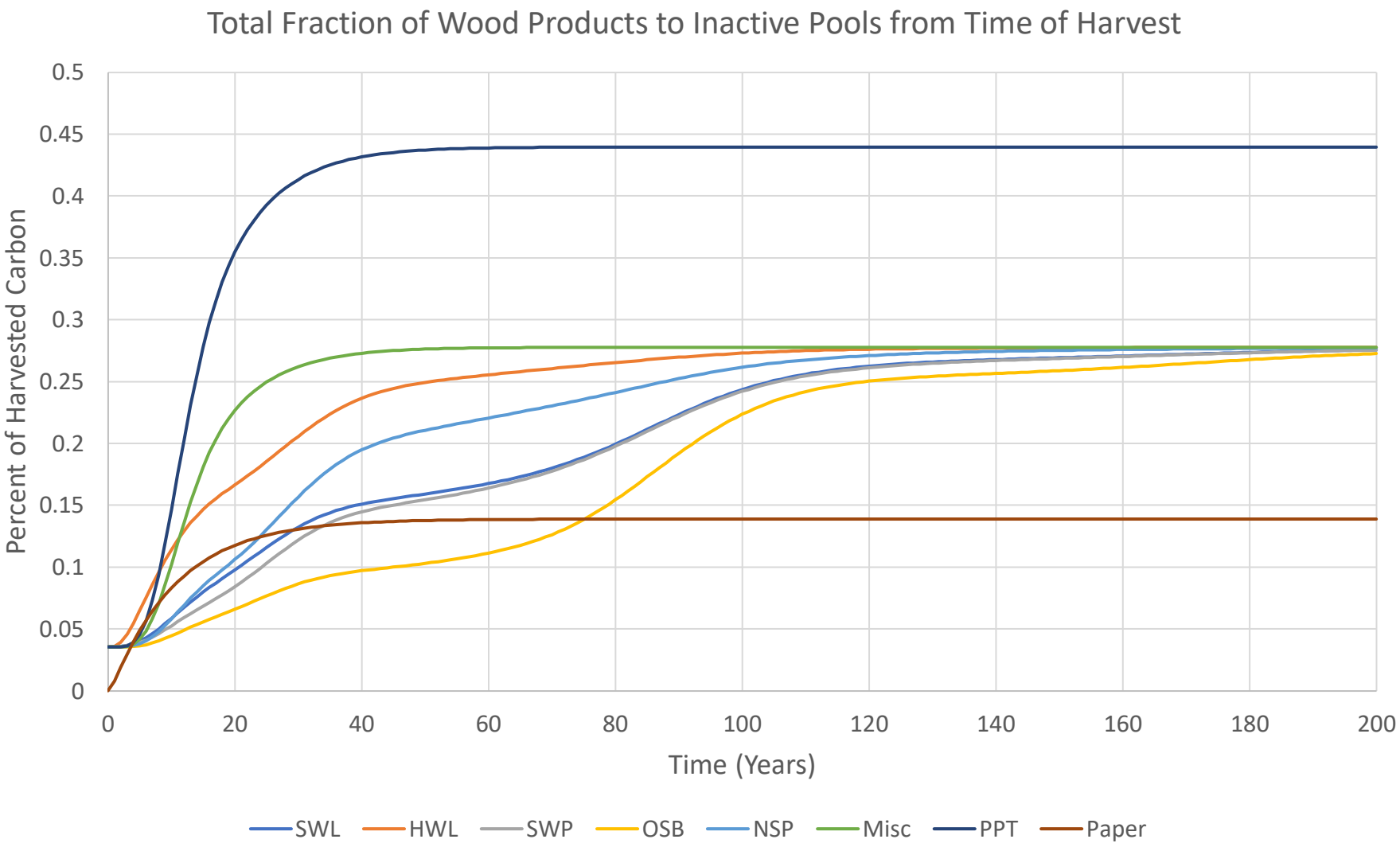
Harvested Wood Product Flows – data from the USFS on US Forests

Forest Carbon Contributions to the Atmosphere from Time of Harvest



Based on USFS data on waste, processing, removals, recycling, etc.

Forest Carbon Contributions to the Inactive Pools from Time of Harvest



Based on USFS data on waste, processing, removals, recycling, etc.

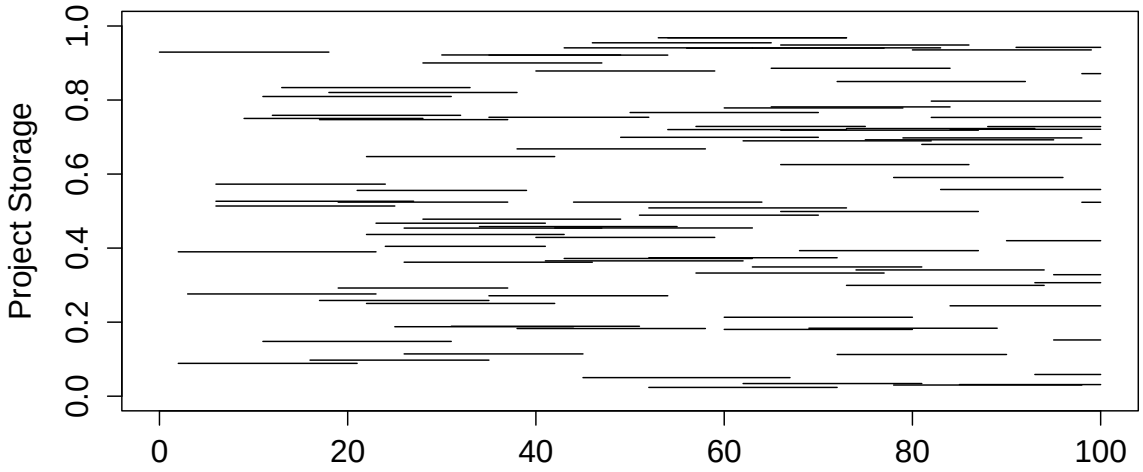
Scale and Assessment of Projects and Programs

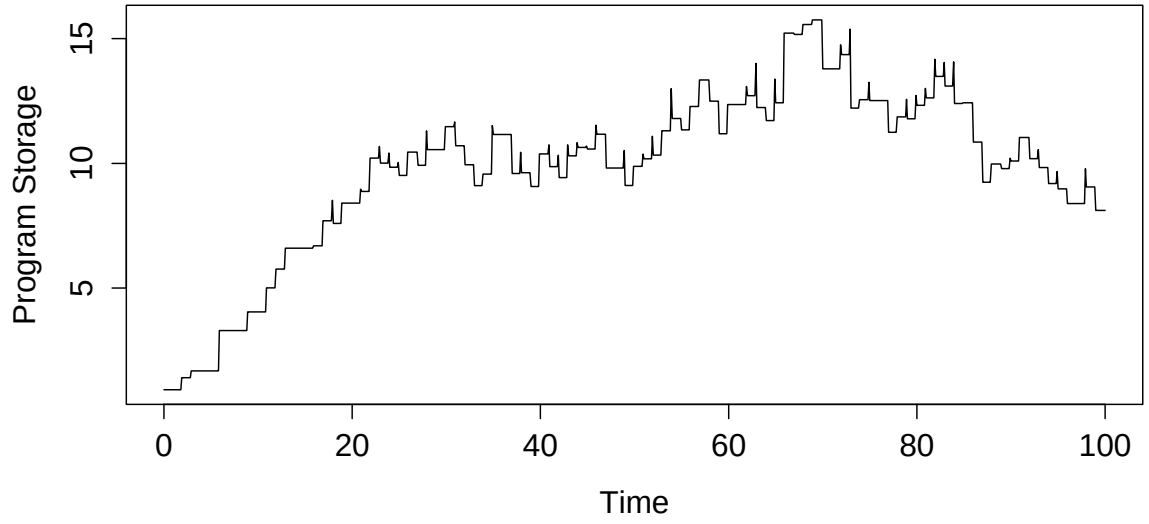
"If carbon storage doesn't last at least until global temperature stabilisation is achieved, then it will not contribute to temperature stabilisation goals ..."

Cullenward, 2023 (page 4)

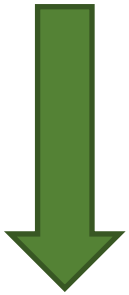
- This is true only if all carbon storage globally is summed.
- This is not true for individual projects, forests, or programs.
- Full inventories are essential to keep track of the total stored carbon.
- A closed system is essential. Global assessments do not scale down.

Scale and Assessment of Projects and Programs





Small scale transience

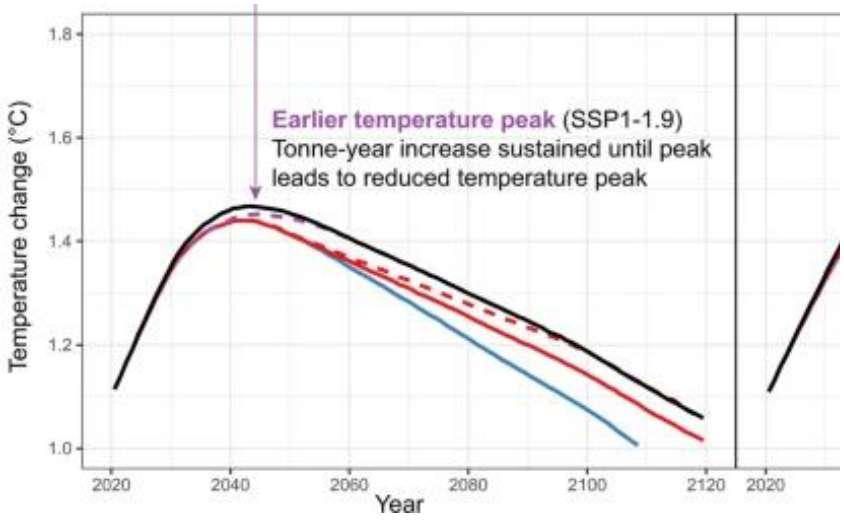


Large scale longevity

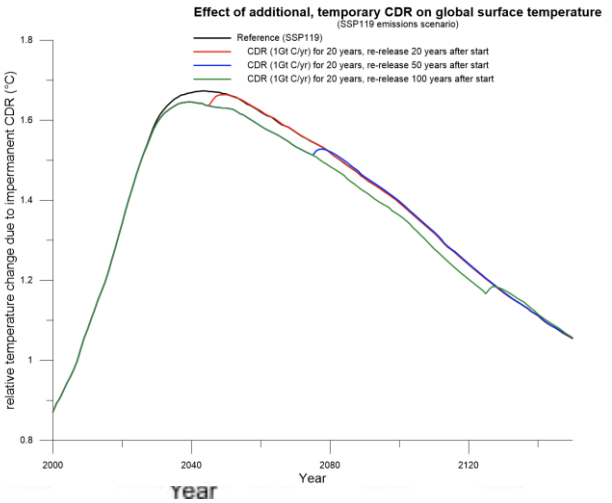
Short term storage may help flatten and shorten the peak temperature rise by holding carbon out of the atmosphere while other measure are put in place.

We saw that this worked with COVID by social distancing and masking until a vaccine was ready.

It is effective.



(Matthews et al., 2023)



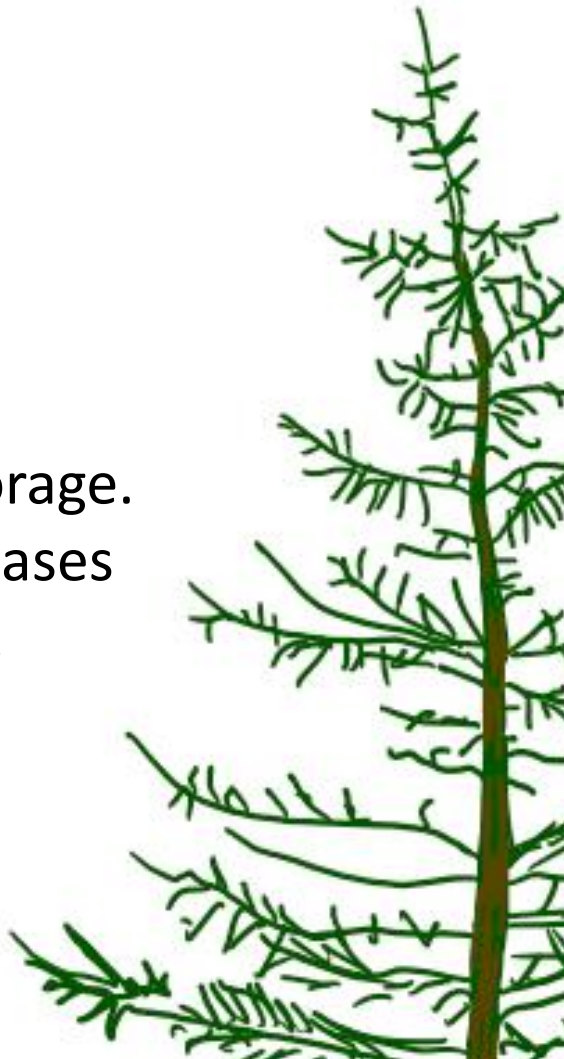
(Reisinger, 2023)

Current Carbon Stocks

- We need to maintain the carbon stocks we have.
- We need to increase stocks where possible.
- We likely need to incentivize these tasks.

Forest Carbon Stocks

- Forest Products contribute to permanent storage.
- Shifting to longer-lived Forest Products increases the stock size and lifetime of carbon storage.
- Reversion risks and uncertainty can be (and need to be) addressed.



Policies and Goals

- Storage is only ever known as temporary or permanent retrospectively.
- Temporary storage can become or support long term stocks.
- Assessment should take place at an appropriate scale.
- Policy needs to focus on the broader goal.

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