Reforming carbon accounting to support nature-based solutions

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Overview

Our position:

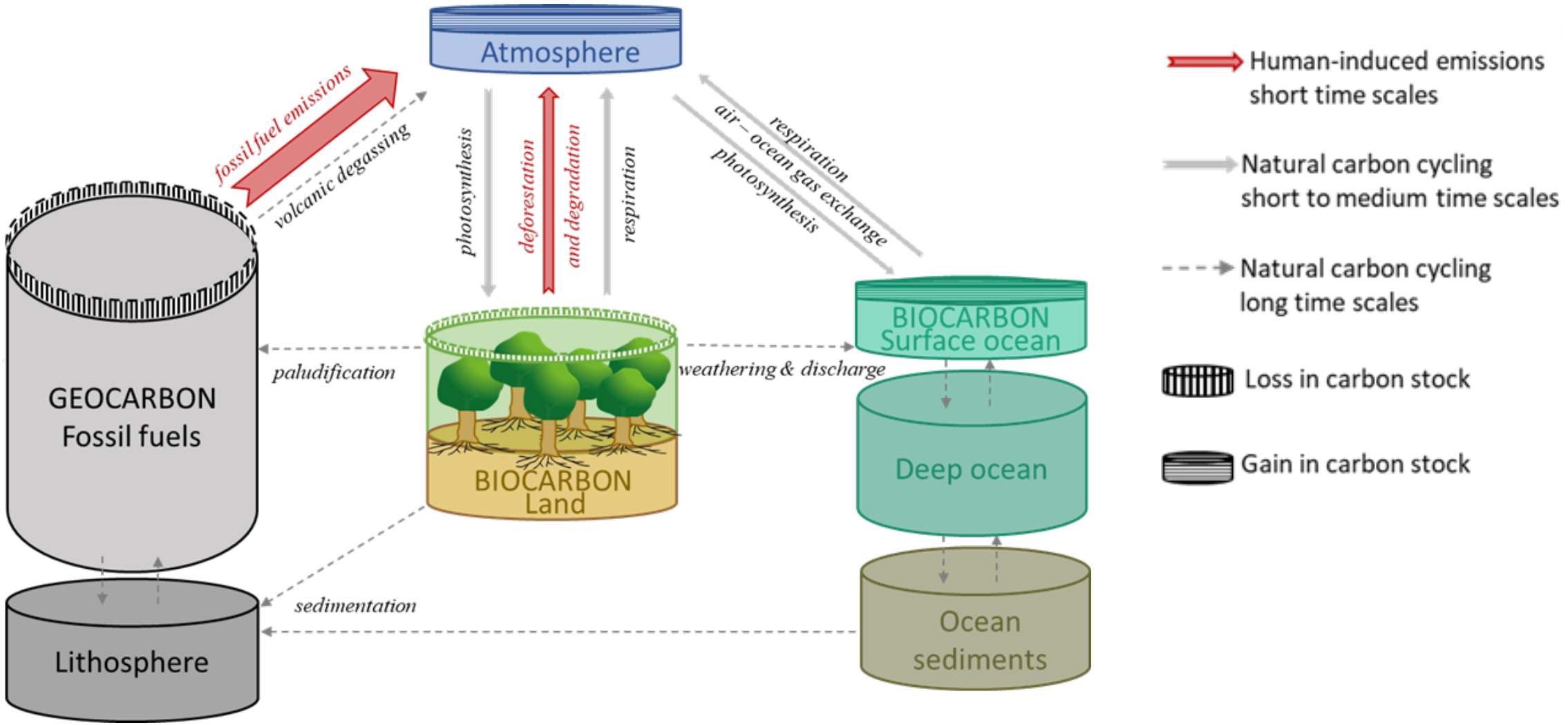
Current carbon accounting as used for LULUCF is not fit-for-purpose for assessing climate mitigation activities and prioritising nature-based solutions.

Outline:

1. Understanding carbon dynamics in the global carbon cycle
2. Limitations with current carbon accounting for LULUCF that leads to perverse outcomes
3. Reforming carbon accounting using an international standard information system – SEEA EA
4. Example of a carbon stock account used to assess mitigation benefits of forest management scenarios
5. Applications of carbon accounts for mitigation policies and prioritising nature-based solutions

Global carbon cycle

understanding natural and human drivers



[drawn to scale except for the large carbon stocks in the lithosphere and deep ocean]

Current carbon accounts are not fit-for-purpose to assess mitigation actions

Limitations with current carbon accounting:

1. Reporting net emissions

natural forest growth in the entire national forest estate is used to numerically "offset" the emissions from the area logged each year.

2. All carbon stocks are considered "fungible"

carbon stocks contained in reservoirs of different longevities and stabilities, and hence risks of loss, are considered equivalent and transferable.

3. Forest reference level

set using existing harvesting levels, so that these emissions are not revealed.

Perverse outcomes:

- Conversion of carbon-dense forests and peatlands into fast-growing plantations.
- Harvesting and regrowing forests to maintain young fast-growing trees, but foregoing the carbon stock gain from allowing forests to attain their carbon carrying capacity.
- Harvesting forests for wood products and bioenergy does substitute for fossil fuel use but the depletion of ecosystem carbon stocks creates a carbon debt for many decades to centuries.
- Carbon stocks in long-lived stable primary forests are not the same as carbon in short-rotation plantations or wood products.

Limitation 1: reporting net emissions

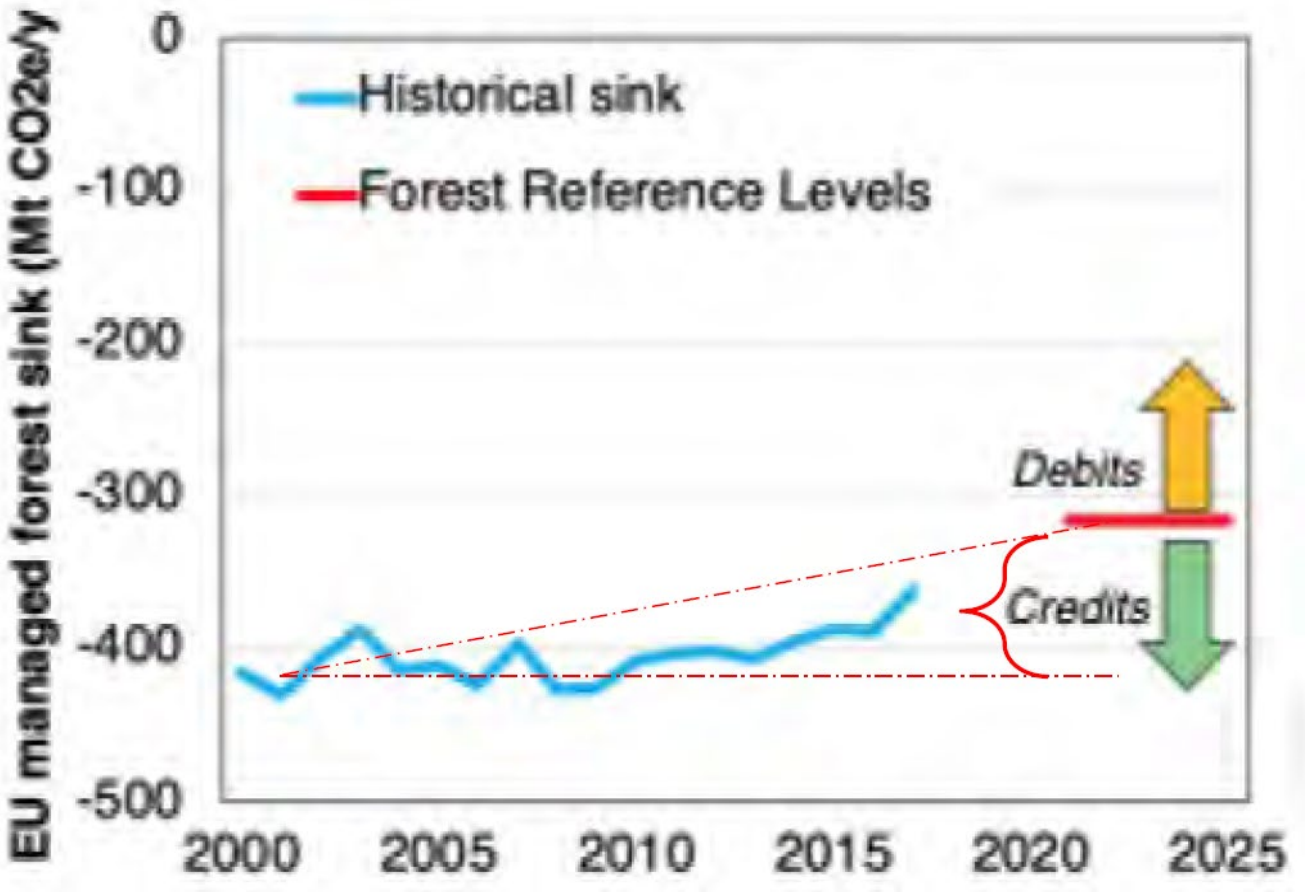
Limitation 2: carbon stocks are not fungible

Criteria for ecosystem condition:

1. *Stability*
2. *Longevity*
3. *Resilience*

	Natural ecosystems	Semi-natural ecosystems	Plantations
			
Condition of carbon reservoir	**High**	**Moderate**	**Low**
Risk of loss of carbon stock	**Low**	**Moderate**	**High**

Limitation 3: setting baselines



The baseline for assessing emissions reduction for LULUCF is the Forest Reference Level (FRL) derived from the combined:

1. Average net emissions under business-as-usual or an historic period (2000 – 2009)
2. Includes age-related forest dynamics
3. Natural disturbance provision that subtracts average emissions from natural disturbances.

→ Projected level of net emissions for 2021 - 25

Reporting annual net emissions:
Carbon loss from forest harvesting is only counted if > FRL (Debits)

Assessing mitigation benefits:
Carbon loss due to harvesting ≤ FRL is not counted as an emission (Credits)

European Commission JRC Report 2021. The use of woody biomass for energy production in the EU.

Reforming carbon accounting

System of Environmental Economic Accounting - Ecosystem Accounting

Adopted by the UN Statistical Commission in March 2021

Elements of the carbon accounting system:

1. Accounts for **stocks and flows**

2. All land and associated ecosystems **spatially referenced**

3. All stocks disaggregated into categories of carbon reservoirs, e.g. **biocarbon and geocarbon**

4. Classification of the **quality/condition** of carbon reservoirs in terms of stability, longevity and resilience of their carbon stocks

5. All carbon pools within ecosystems, e.g. above- and below-ground biomass, dead biomass and soil carbon

6. Reporting of **gross flows**, i.e. gains (additions) and losses (reductions) of carbon stocks

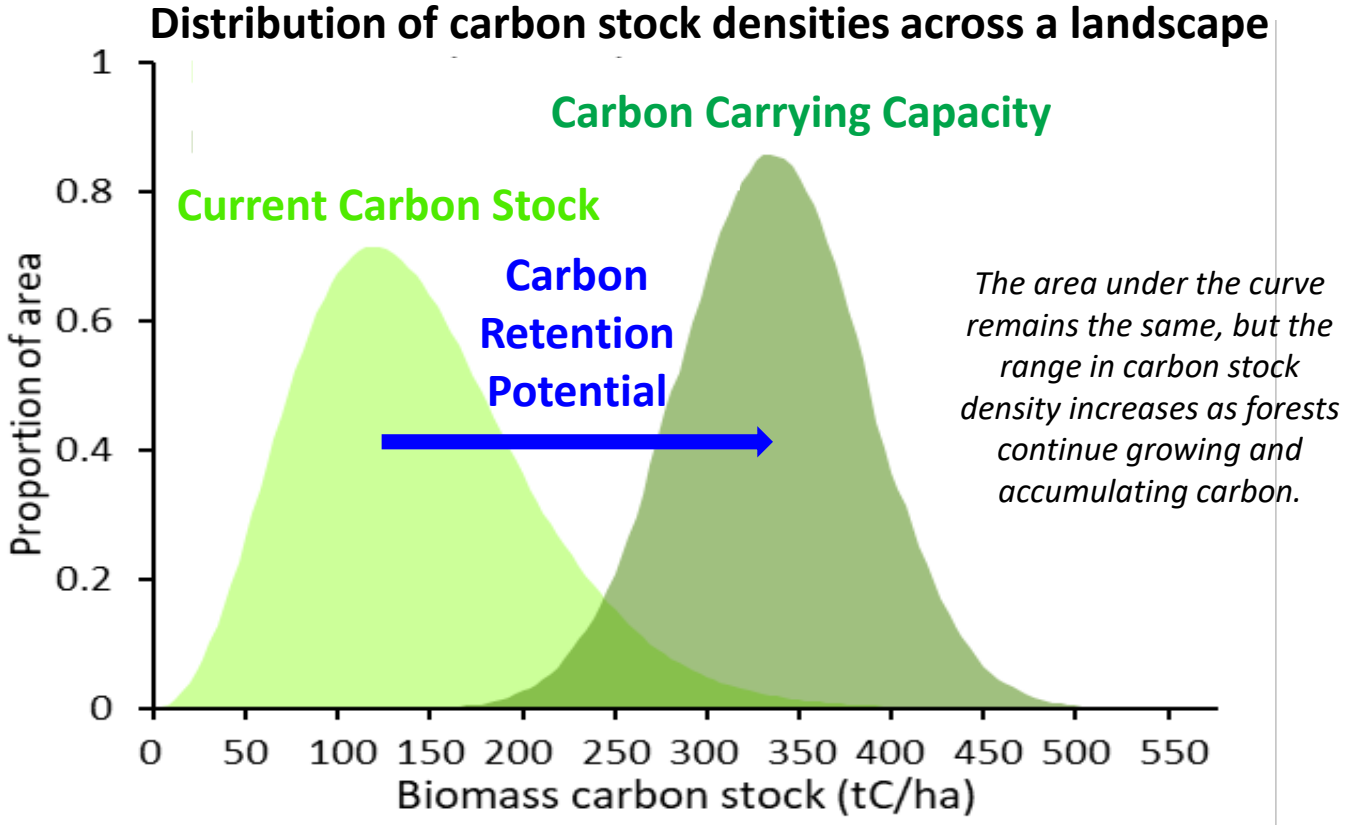
7. Ecosystem carbon stocks assessed against a **reference level** that represents **ecosystem integrity**

8. Physical measures of carbon stocks and flows within ecosystem assets are linked to the **economic system** through land use and ownership, valuation of ecosystem services, and sectors that benefit.

Carbon account

	Atmosphere	Oceans	Biocarbon														Total Biocarbon	Geocarbon
			Aquatic	Marine	Terrestrial													
					Natural ecosystems				Semi-natural ecosystems				Plantations		Agriculture			
					Rainforest	Protected Native Forest	Woodland/ Shrubland	Peatlands	Selectively harvested rainforest	Harvested native forest	Grazed woodland	Drained peatland	Hardwood	Softwood	Annual	Perennial		
Opening stock of carbon ($C\ t_0$)	12.139					111.570	0.322			30.210			4.258	0.577	0.037	0.211	147.185	
Additions to stock																		
Natural expansion (growth)	0.010					1.368												
Managed expansion (growth)	0.479									0.632			0.116	0.008				
Discoveries																		
Upward reappraisals																		
Reclassifications																		
Total additions to stock	0.489					1.368				0.632			0.116	0.008			2.124	
Reductions in stock																		
Natural contraction (emissions)						0.008				0.002								
Managed contraction (emissions)										0.414			0.041	0.024				
Managed contraction (harvest transfer)										0.181			0.087	0.048				
Downward reappraisals																		
Reclassifications																		
Total reductions in stocks						0.008				0.597			0.128	0.072			0.805	
Closing stock of carbon ($C\ t_1$)	**12.628**					**112.930**	**0.322**			**30.245**			**4.246**	**0.513**	**0.037**	**0.211**	**148.504**	
Net ecosystem carbon balance ($C\ t_1$ - $C\ t_0$)						1.360				0.035			-0.012	-0.064			1.319	

Reference Levels should include Carbon Carrying Capacity



The area under the curve remains the same, but the range in carbon stock density increases as forests continue growing and accumulating carbon.

Current Carbon Stock

Represents the current age distribution of secondary forest managed for commodity production under combined human and natural disturbance regimes.

Carbon Carrying Capacity

Represents the age distribution of primary forests managed for conservation under prevailing environmental conditions and natural disturbance regimes.

Carbon Retention Potential

Represents the gain in carbon stock when secondary forests are managed for regeneration and restoration to allow continued growth and increasing age classes.

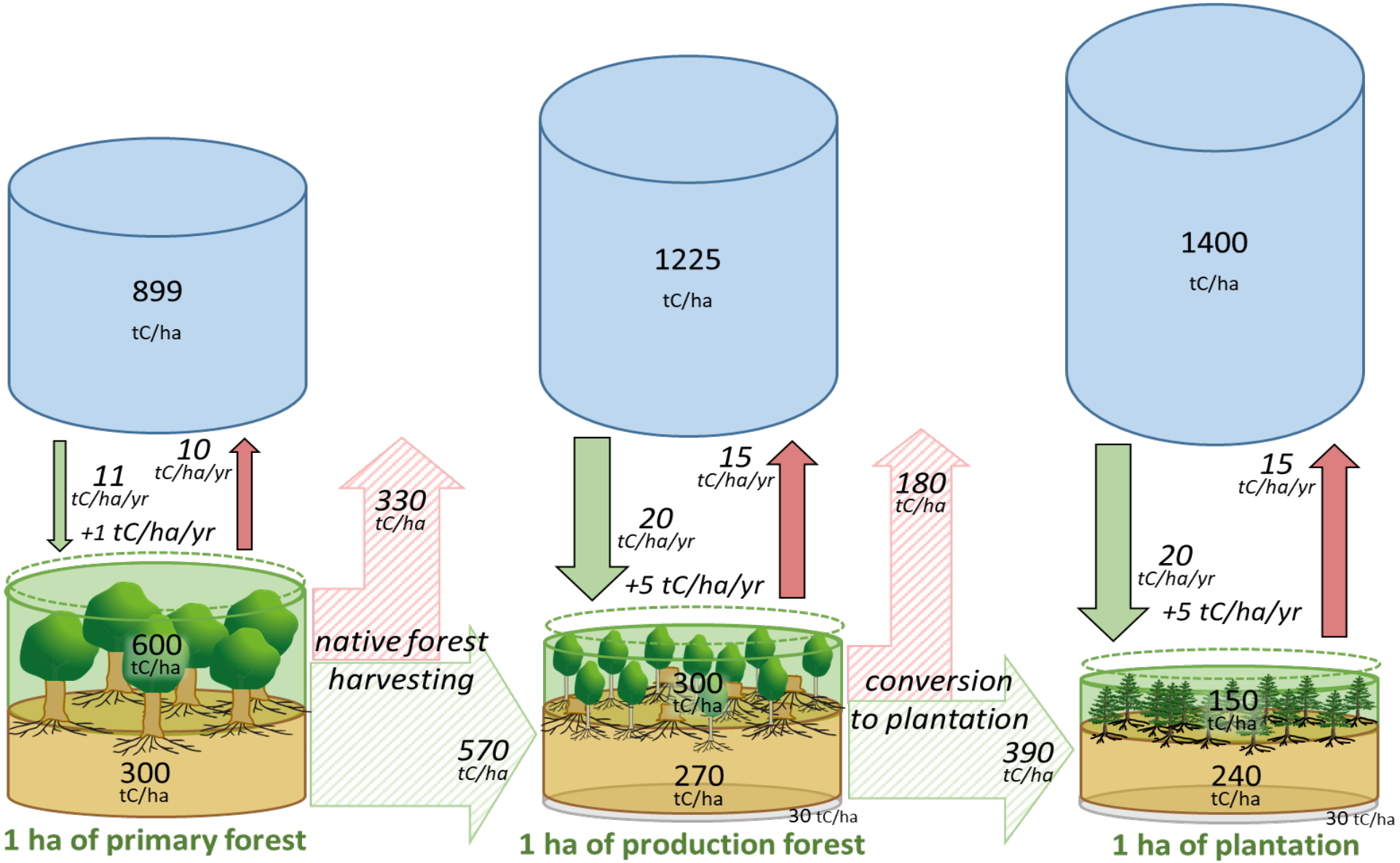
Ecosystem integrity: the basis for environmental assessment

Ecosystem integrity is defined as the system's capacity to maintain composition, structure and function over time using processes and elements characteristic for its ecoregion and within a natural range of variability. The system has the capacity for self-organization, regeneration and adaptation by maintaining a diversity of organisms and their interrelationships to allow evolutionary processes for the ecosystem to persist over time at the landscape level. Ecosystem integrity encompasses the continuity and full character of a complex system.

Example: Carbon accounts to assess forest management scenarios

Data for a wet, temperate eucalypt forest in SE Australia

Carbon **stocks** and *flows* per ha
assuming transfers in a vertical cylinder



Reservoirs:

Atmosphere

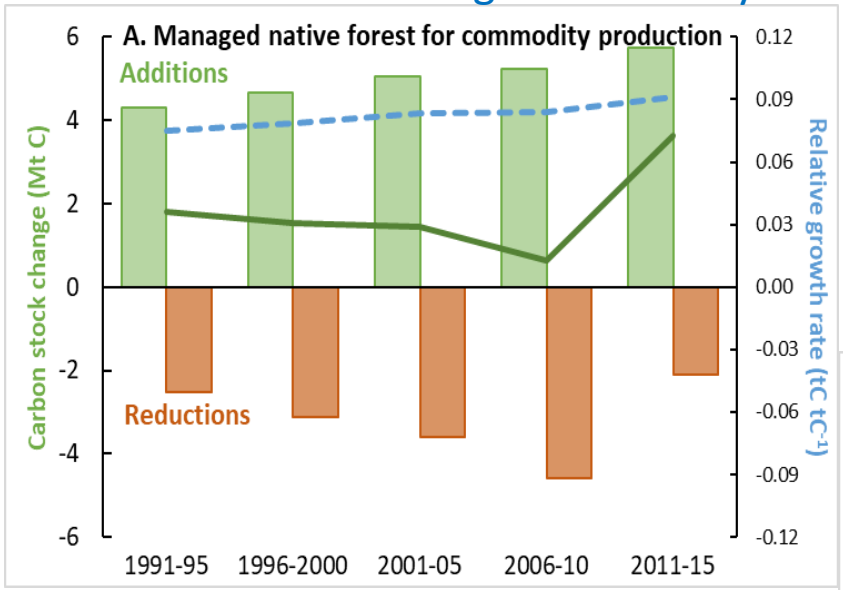
Vegetation

Soil

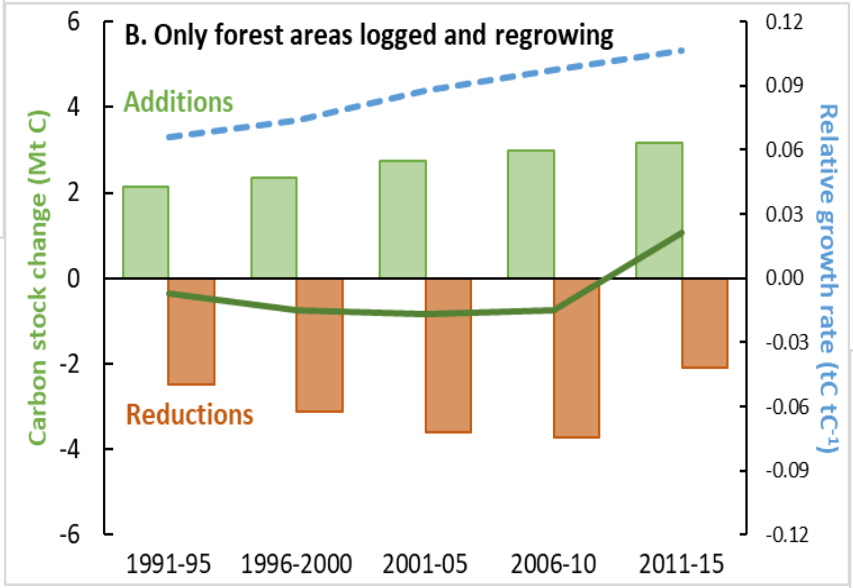
Wood products

Example: Assessing mitigation benefit depends on the accounting rules

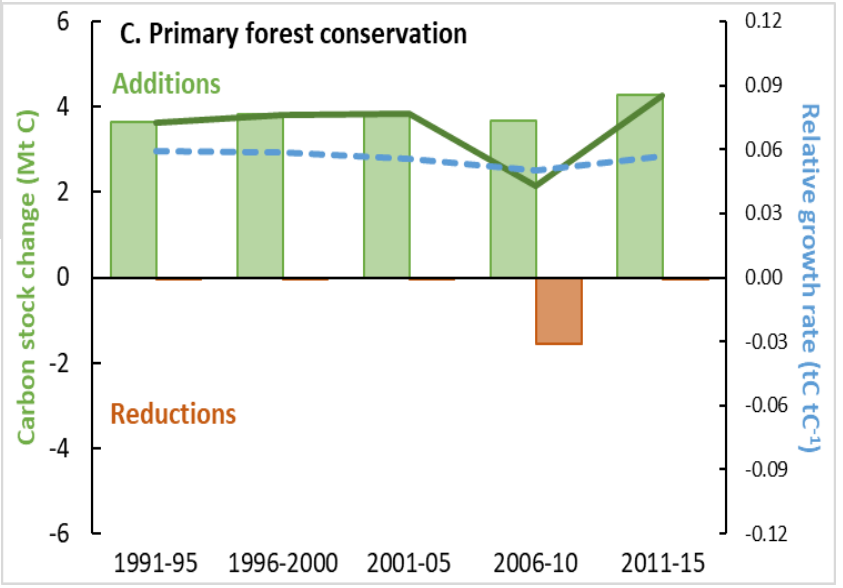
A. Entire estate of managed secondary forest



B. Subset of area logged
- high growth rate



C. Primary forest managed for conservation
- high carbon storage



- Gross flow as additions due to forest growth
- Gross flow as reductions due to fire and logging
- Carbon storage as net stock change or net ecosystem carbon balance
- Annual growth rate or net primary production

Application of carbon accounts in LULUCF for policy

1. Separate biocarbon and geocarbon:
Different accounts, reporting and targets are needed for different components of the carbon cycle because they have different characteristics in terms of the quality of their reservoirs.

2. No offsetting between targets for different components:
Emissions from fossil fuel combustion should not be offset with removals by tree planting.

3. Ecosystem condition integrates biodiversity and carbon:
Biodiversity loss impacts stability of carbon stocks
Climate change impacts biodiversity

4. Selection criteria for prioritizing NbS:
Criteria based on classifications of ecosystem type and condition within the carbon account and understanding of carbon cycle processes.

5. Reformed carbon accounting provides an improved information base for NDCs
Making actions and targets transparent.
Target of increasing the cumulative long-term carbon storage in the biosphere.

6. Creates greater certainty for investment:
Carbon stocks are identified, geolocated and have an associated level of risk.

Prioritising nature-based solutions

1. **Protect**

Avoid carbon stock loss from long-lived, stable reservoirs in fossil fuels and stable ecosystems, such as primary forests.

2. **Restore**

Increase carbon stocks through restoration and recovery of secondary forests.

3. **Manage**

Manage carbon dynamics at time scales relevant for climate change mitigation, i.e. to 2030 and 2050.
A carbon debt is created for decades to centuries by using wood to substitute for other products or energy.