Forest Carbon Dynamics

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The basics: Photosynthesis & Decomposition

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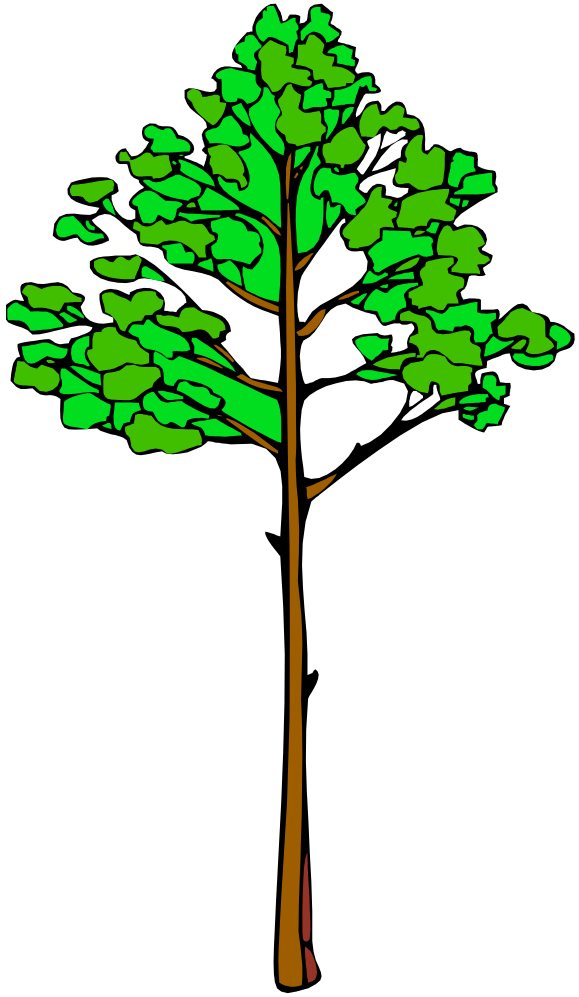
Photosynthesis: Plants take up atmospheric CO_2 that is stored as biomass

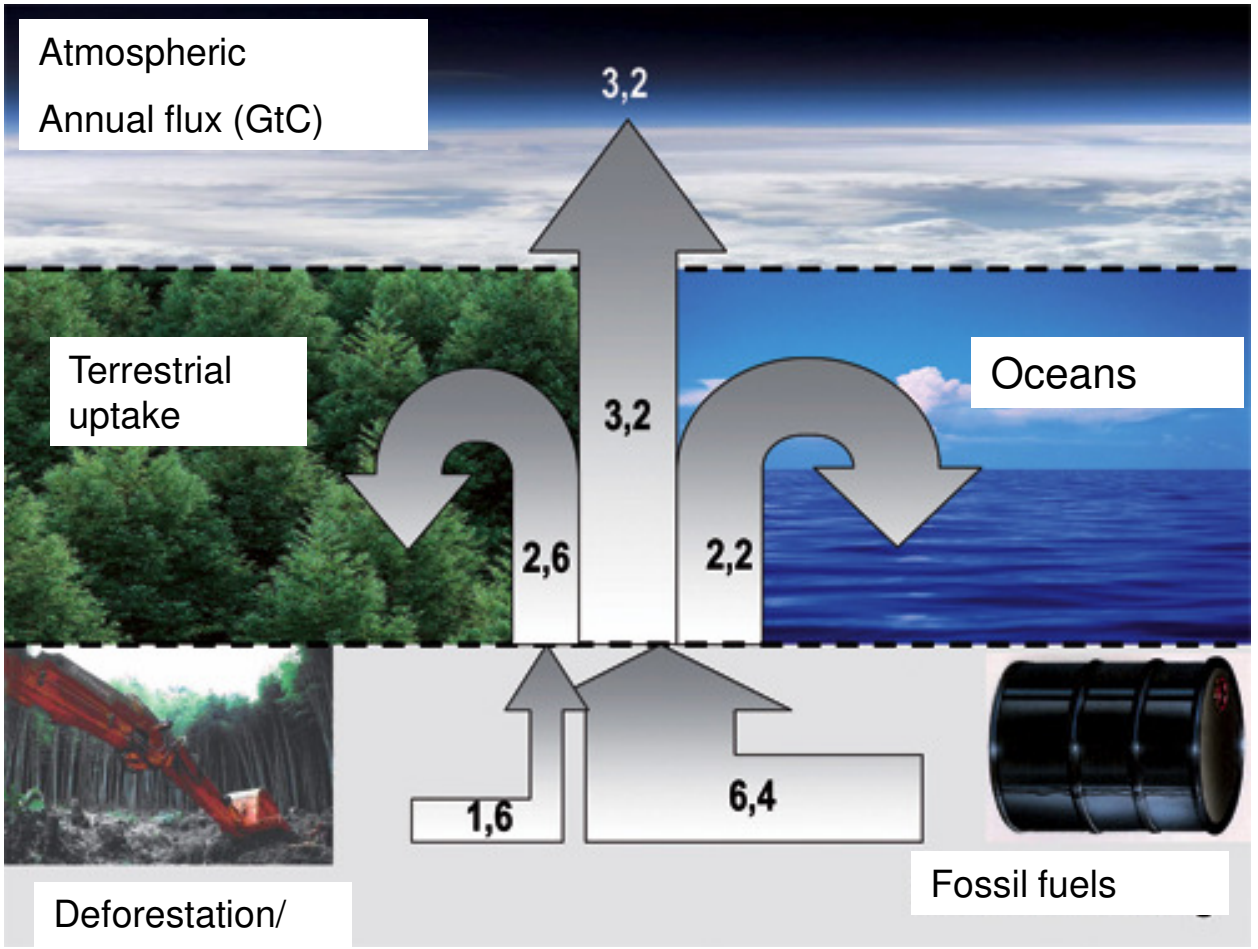
Natural decomposition (or combustion) of biomass release CO_2 back to the atmosphere

The basics: Carbon pools

- Living biomass
  - Photosynthesis - take up CO_2
- Dead organic matter
  - Input from live biomass
  - Decompose and release CO_2
- Soil carbon
  - Input from dead organic matter
  - Decompose and release CO_2



How can forests be used to mitigate climate change?



Adopted from St.meld. nr. 39 (2008-2009)

Cancun (COP 16) and forest!

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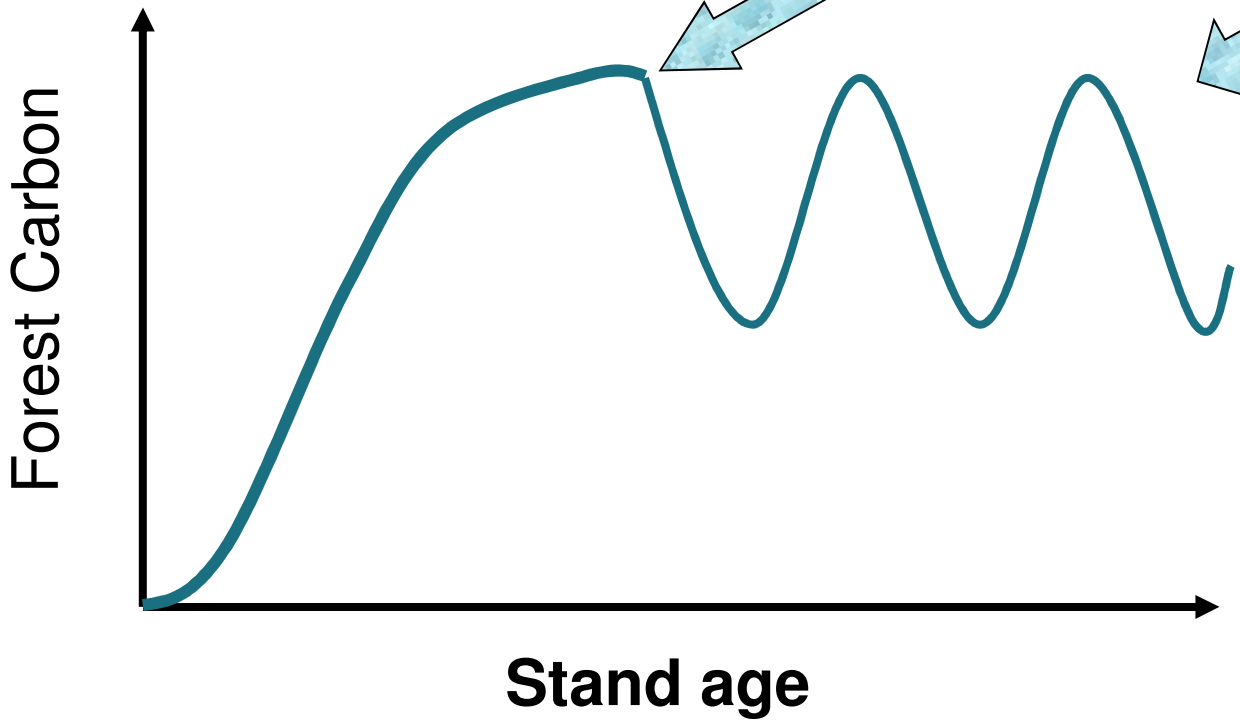
"70. Encourages developing Parties to contribute to mitigation actions in the forestry sector by undertaking the following activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances:

i. Reduce emissions from deforestation
ii. Reduce emissions from forest degradation
iii. Conservation of forest carbon stock
iv. Sustainable forest management
v. Enhancement of forest carbon stocks"

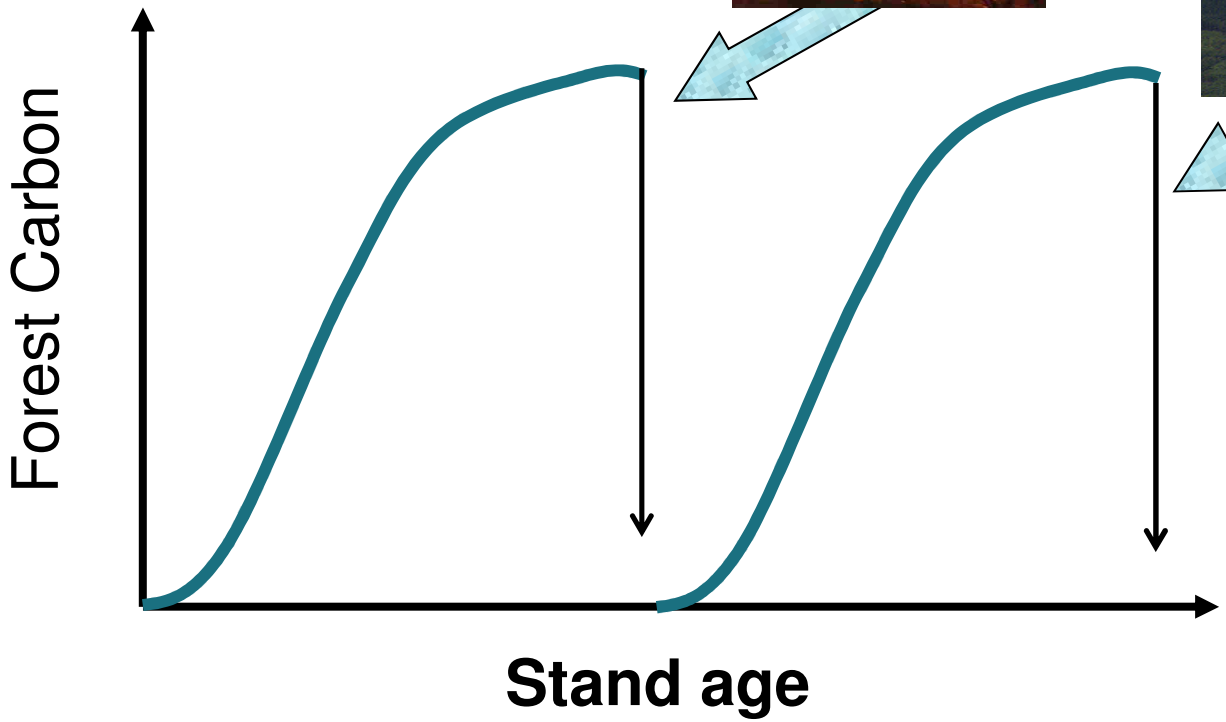
Stand-level carbon dynamics

- Small scale disturbance



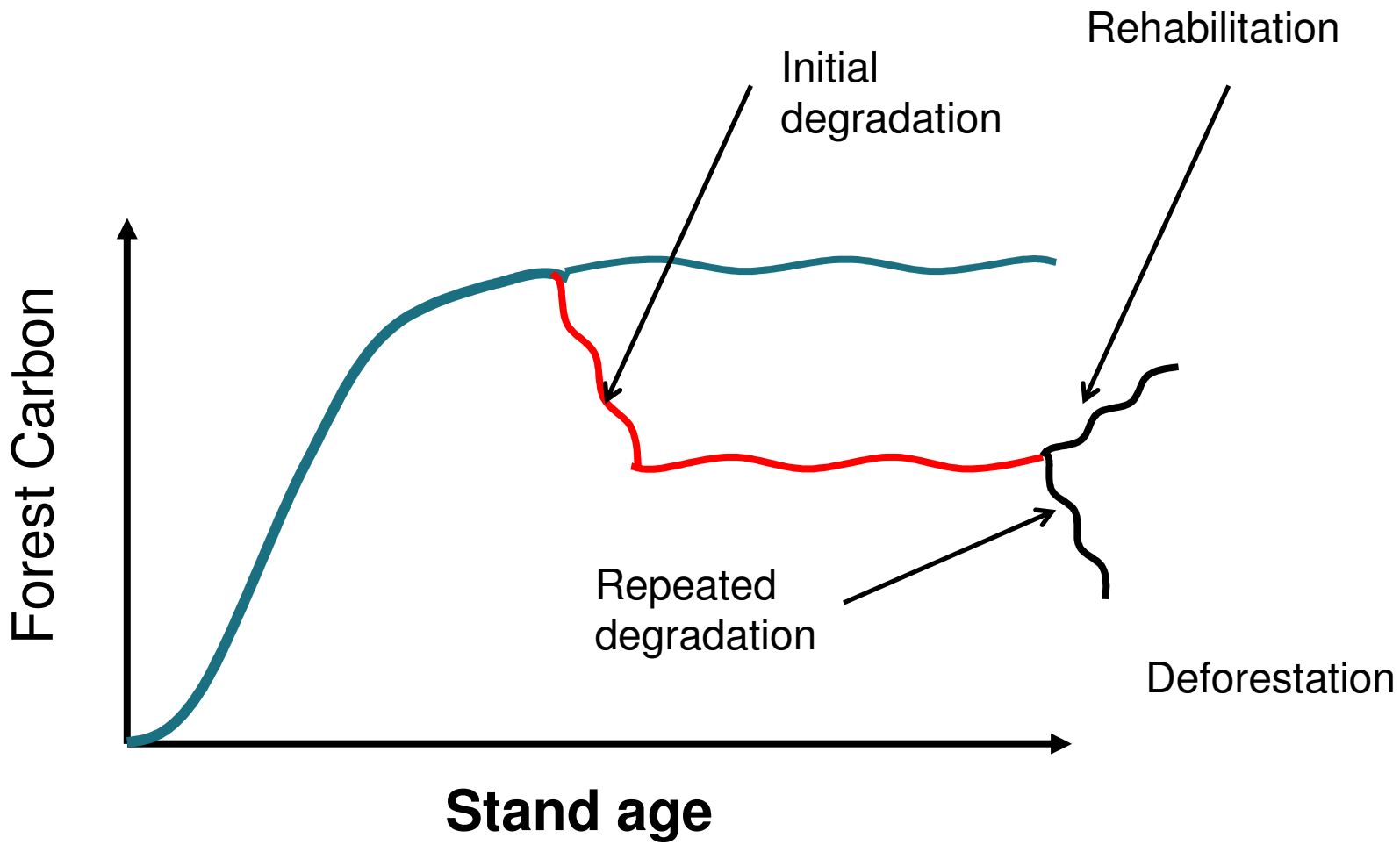
Stand-level carbon dynamics

- Stand replacing disturbance



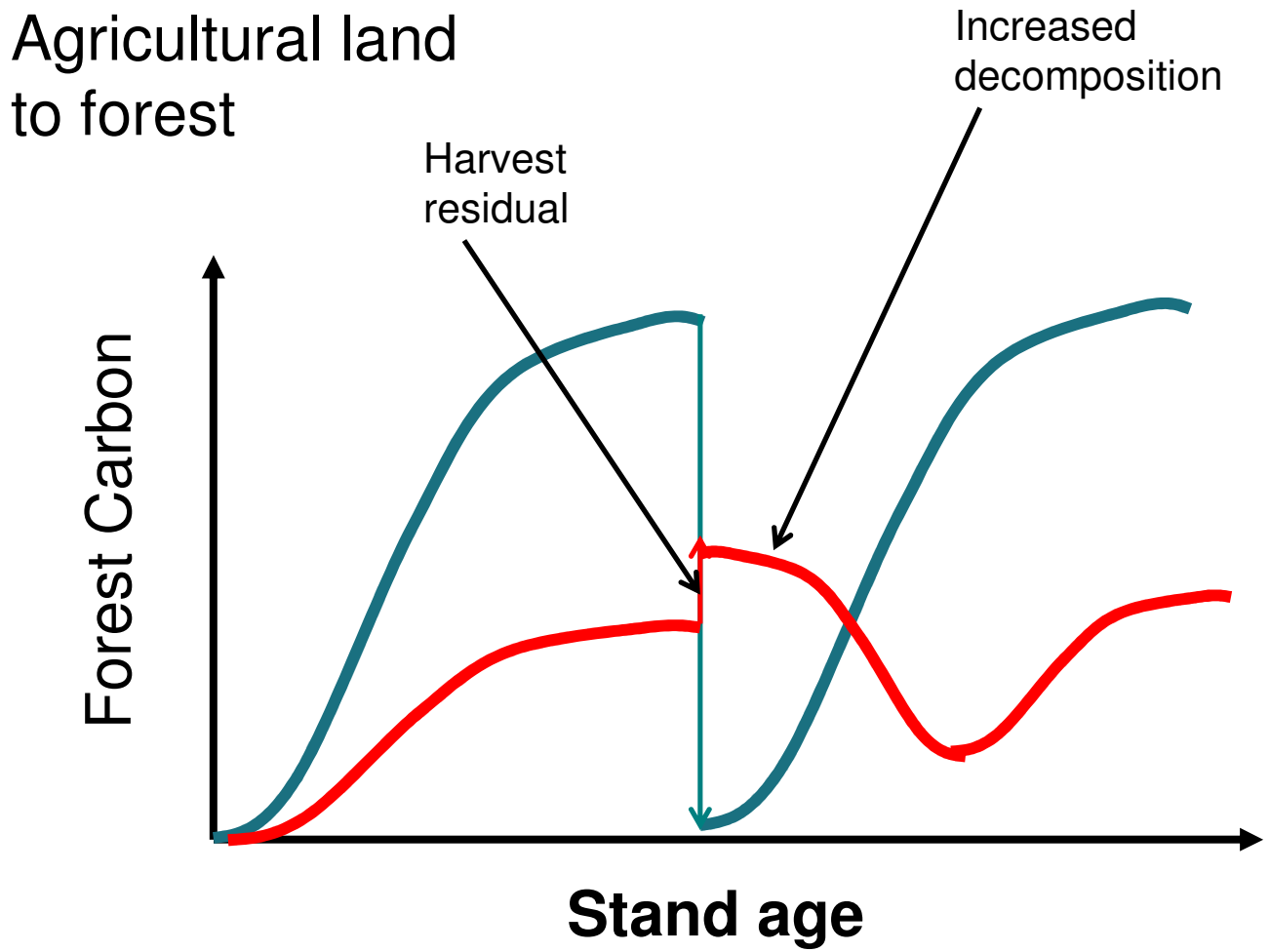
Stand-level carbon dynamics

- Degradation – has to be long-term



Stand-level carbon pool dynamics

- Stand replacing disturbance



Forest Management and CO_2 in the Atmosphere

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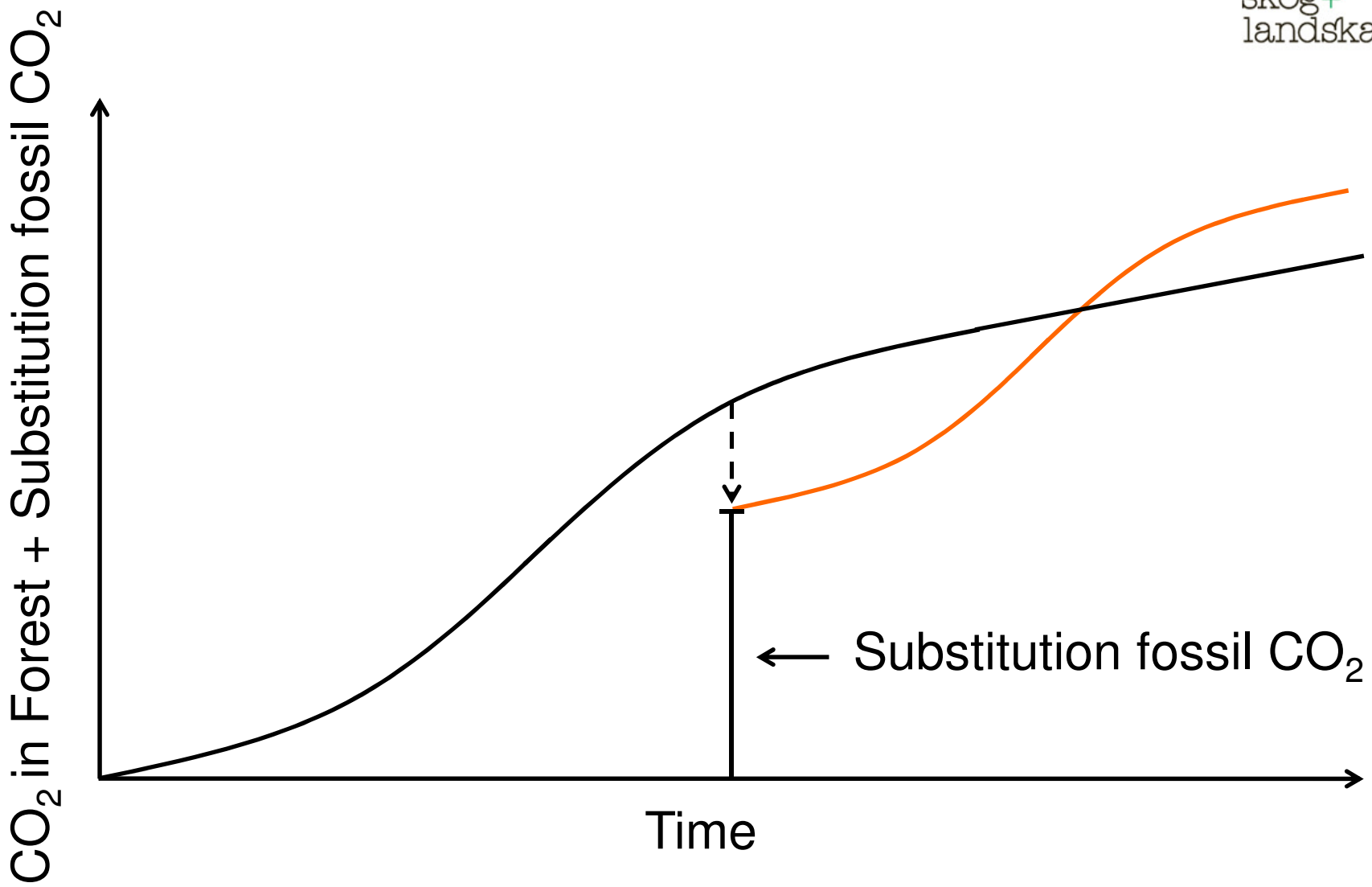

Forest Management and CO_2 in the Atmosphere

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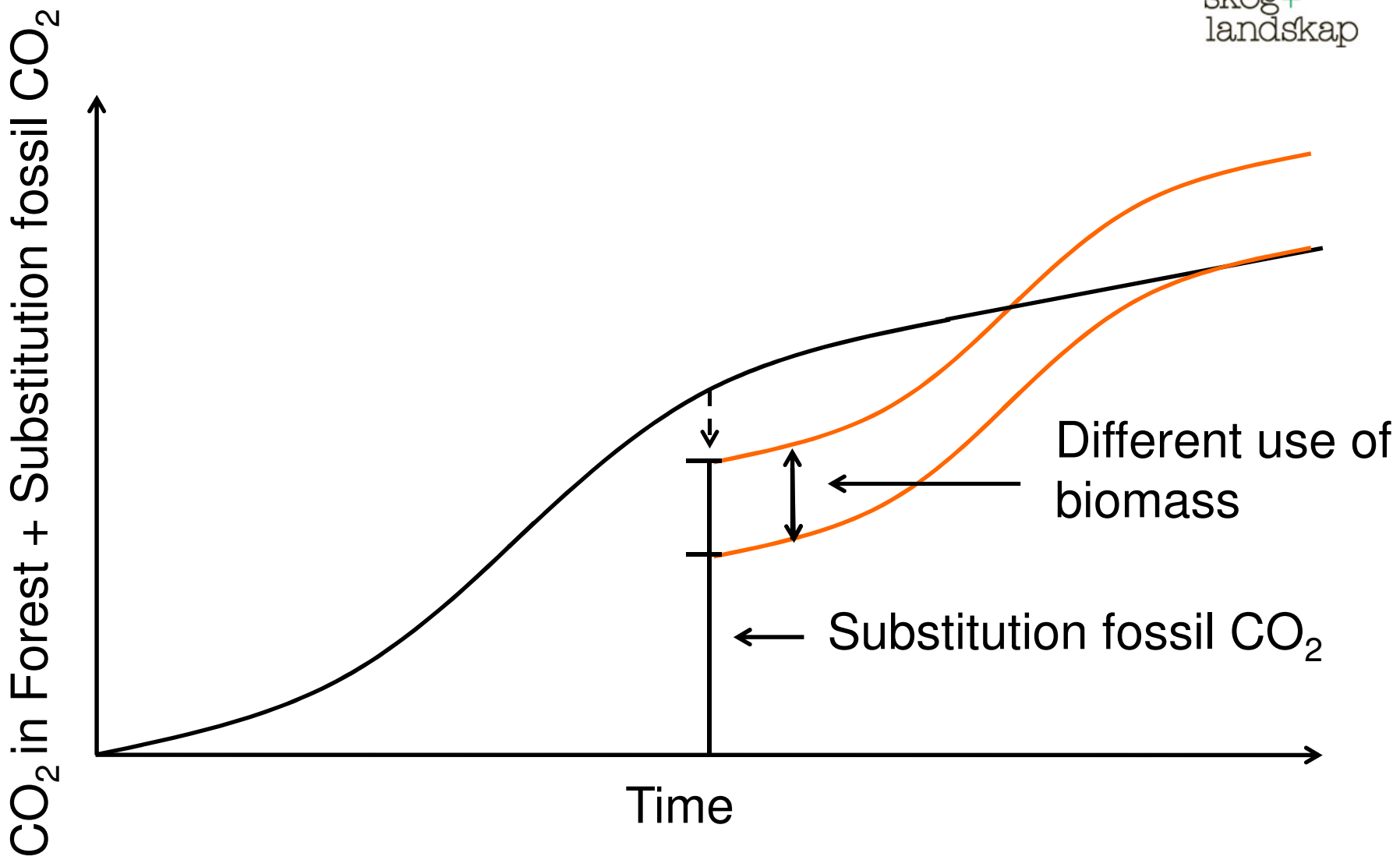

Forest Management and CO_2 in the Atmosphere

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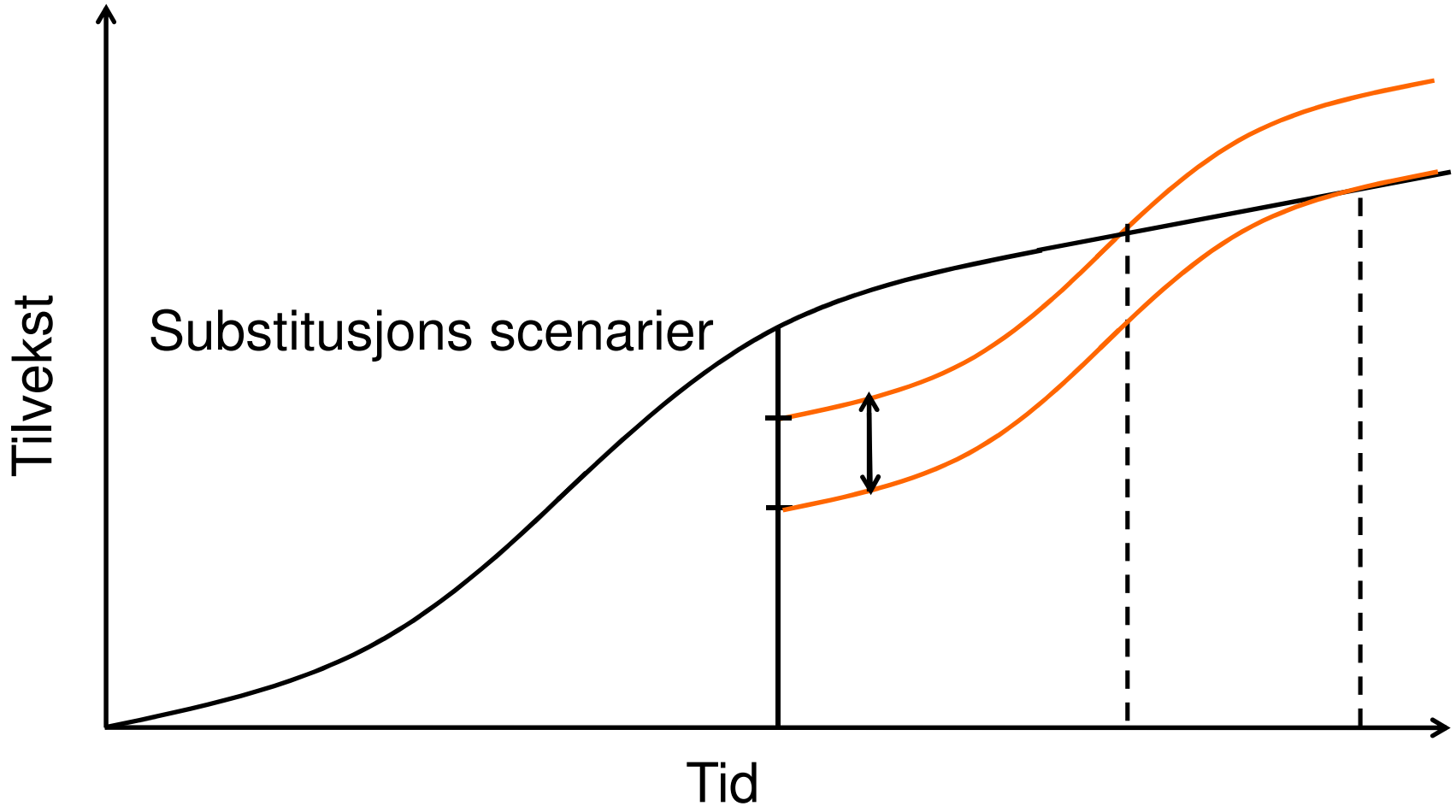

Forest-level carbon dynamics

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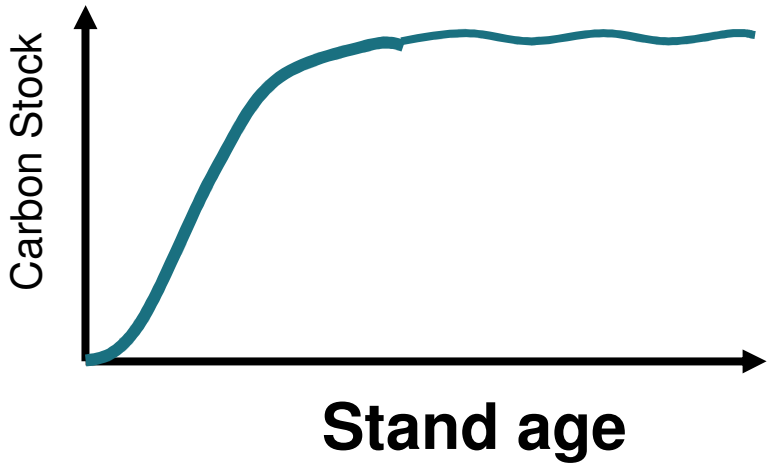
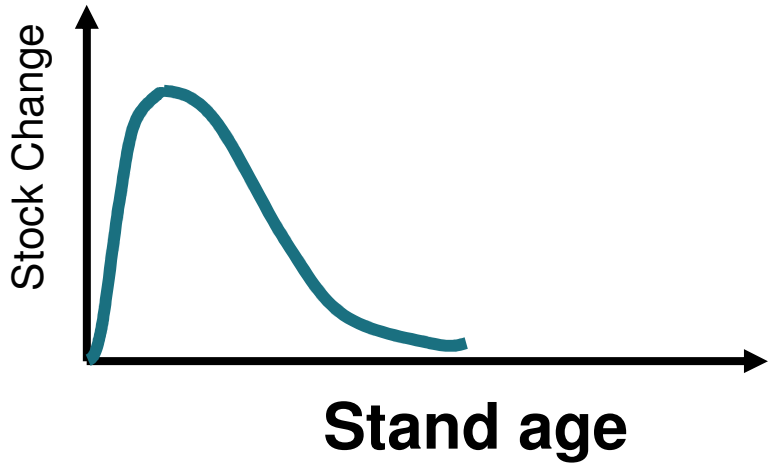
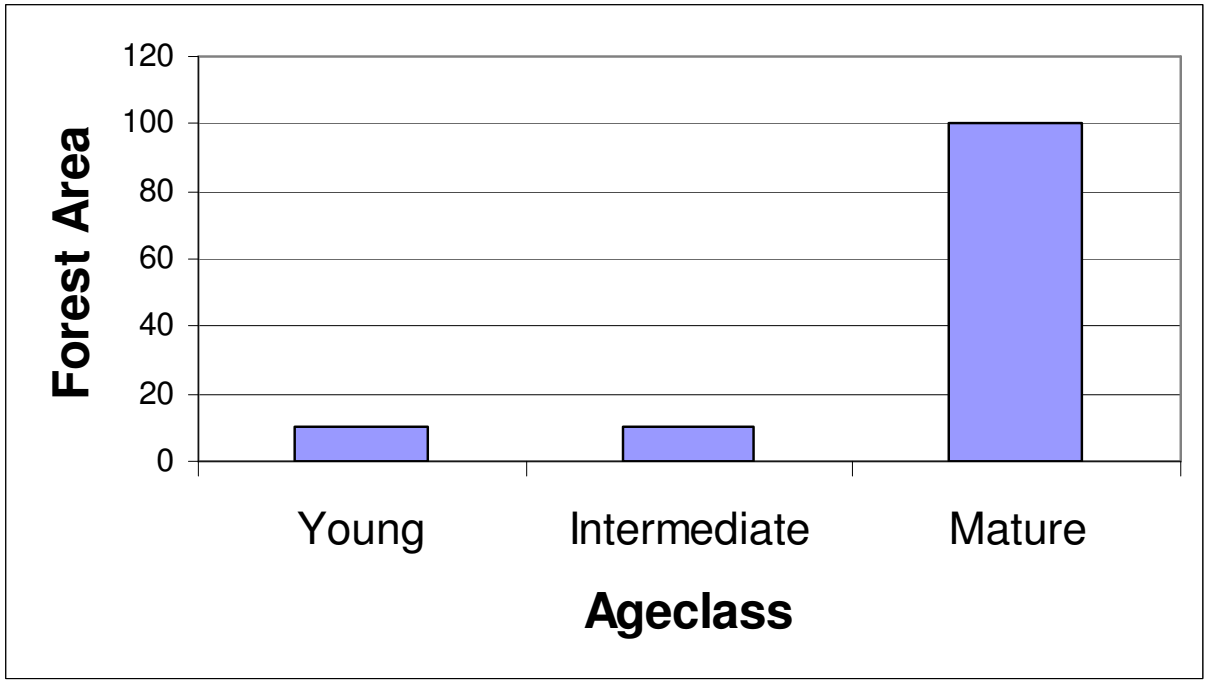
- REDD+ is on the national forest level not the stand level
- The forest is the sum of all the stands
- REDD+ and international climate agreements have a relatively short time horizon
- The overall forest carbon stock change is strongly related to the start condition

Stand-level stock change





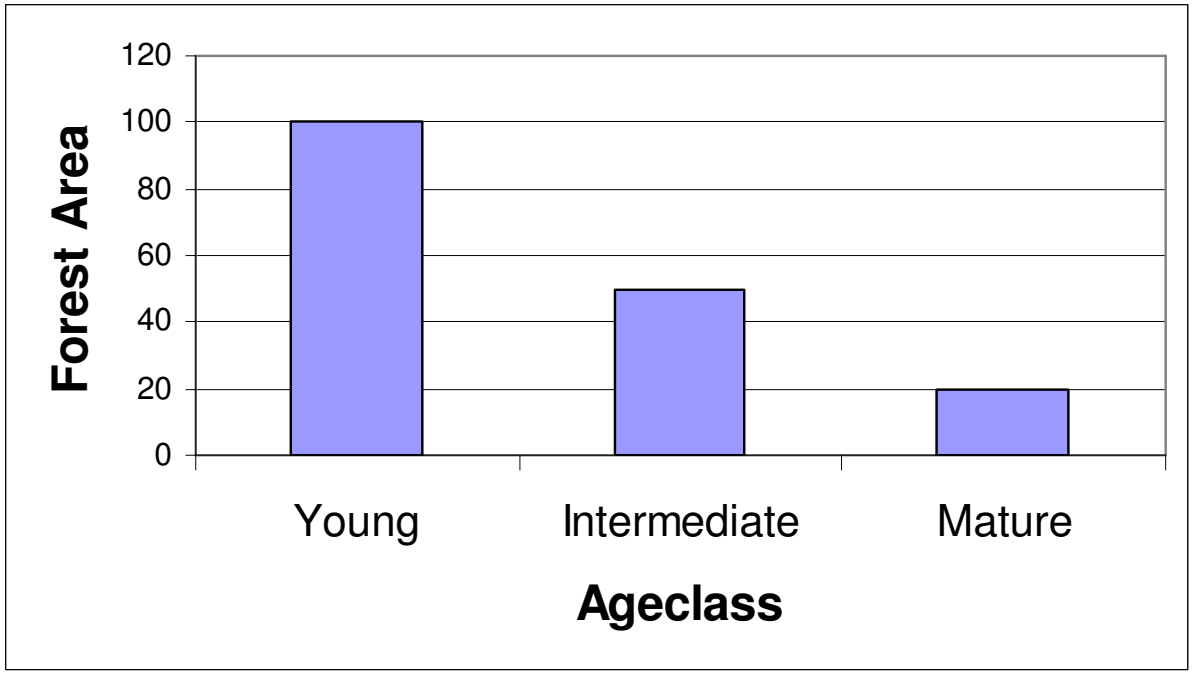
The Age class effect



> **Old natural forest**
>
> > **high stock**
> >
> > **stock change ~ 0**

Typical for large forest areas in REDD+ countries

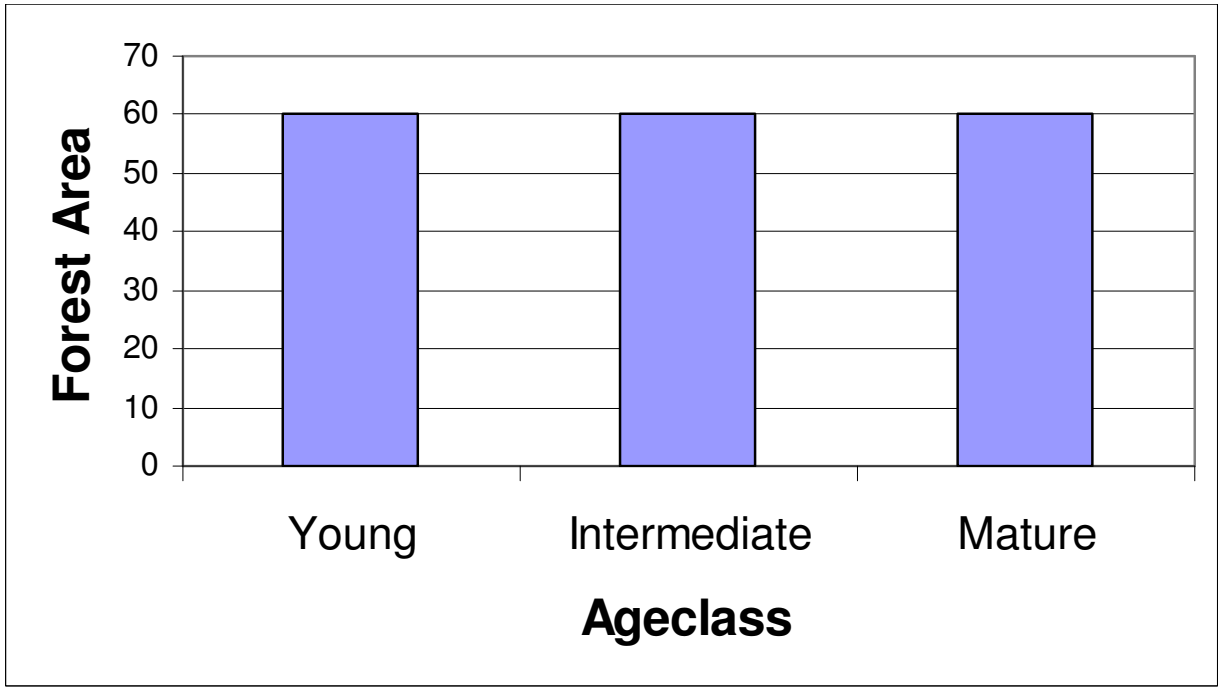
The Age class effect



> **Young forest**
>> **low carbon stock but**
>> **high stock change**

> **Typical for previously over-harvested forest (Norway!)**

The Forest Age Class Effect



> The “classic” managed forest – equal area in each ageclass
  > Harvest equal increment
  > Stock change ~ 0

Link to MRV

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- How about we just monitor carbon stock change without any other consideration
  - Managed forest and protected forests can have same stock change – depending on the age class distribution!
  - Forests with large amount of degradation can theoretically have a positive stock change if large areas are in the intermediate age!

Link to reference level for forest carbon stock change

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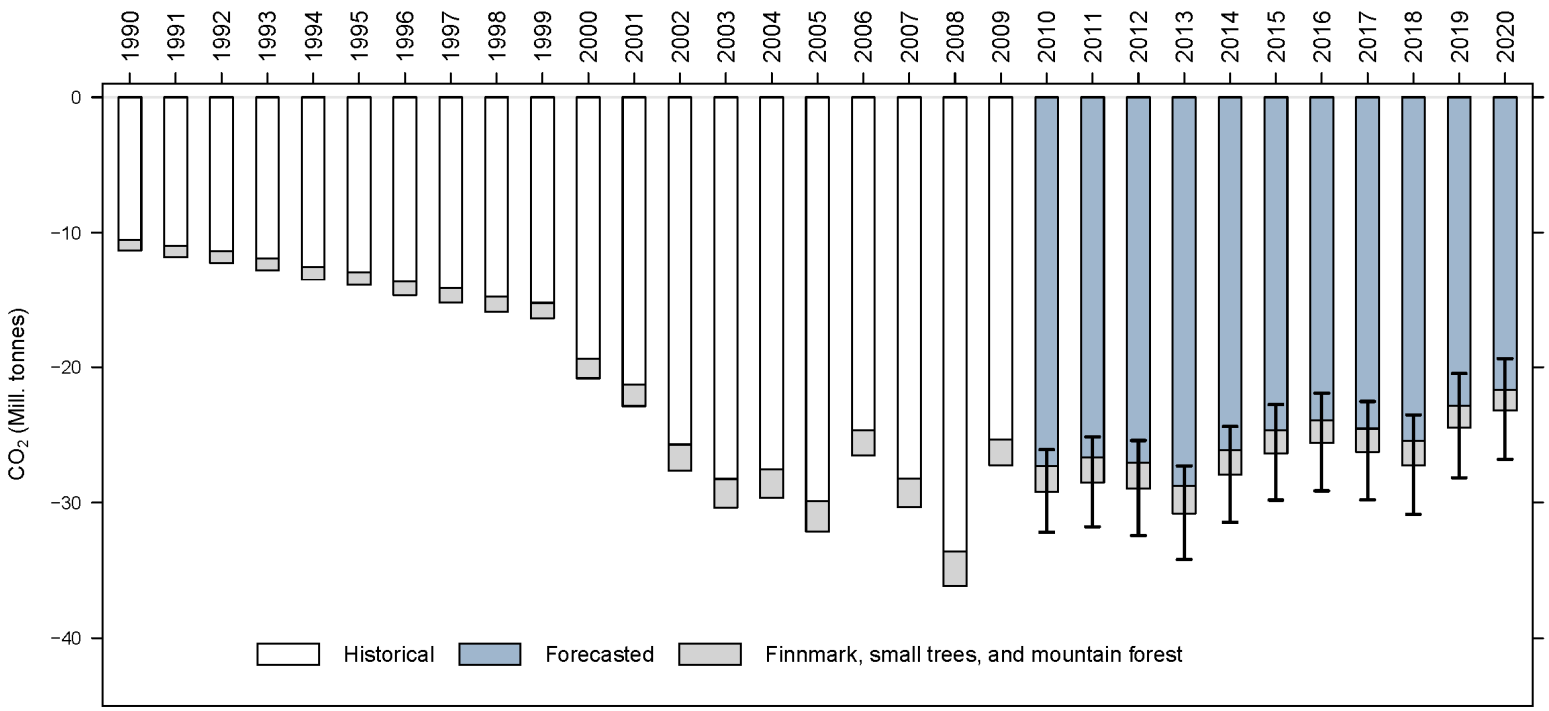
> Kyoto Tier 1 countries must produce reference scenarios that remove the age class effect for a future second commitment period

> REDD+ is not quite there yet as focus has been on reference levels for



Summary

- It is important to understand the basics of carbon dynamics to understand the possibilities of forest to mitigate climate change
- Important to look at different scales (stand versus forest)
- Same short-term forest carbon stock change can occur from different forest management regimes