

IBFRA Insight Process:

Sustainable boreal forest management – Challenges and opportunities for climate change mitigation: Preliminary results

Presentation given by process leader

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Team of scientists from USA (Alaska), Canada, Norway, Sweden, Finland, Russia and IIASA (Austria).



How can forestry in the boreal region contribute to climate change mitigation?

- By enhancing the C stock in forest ecosystems
- By providing raw material for long-lived C-containing products
- By providing raw material for products substituting fossil C, concrete, energy-intensive products such as steel, etc.

Data on changes in tree C stocks

Long-term data, high resolution

Norway, Sweden, Finland

Lower resolution

Alaska (USA), Canada, Russia



**No major changes in forest area
1990-2015!**

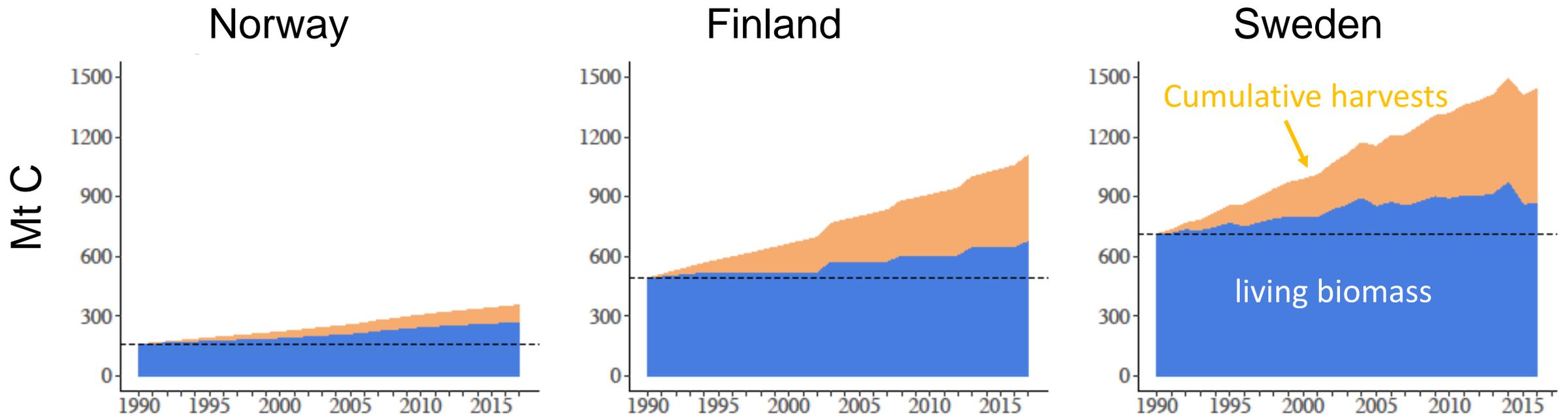
Basic data on forest area and forest C stocks in living tree biomass as per country/state

Country/State	Forest area, Mha	C stock in living trees, Mt (as of 2015-2017, but 2009 in Alaska)	Average C stock in living trees per area, t C ha ⁻¹ (as of 2015-2017)
Alaska (USA)	23.3*	811*	35*
Canada	160.3**	7 682**	48**
Norway	12	490	41
Sweden	28	1 160	41
Finland	26	670	26
Russia	811*	30 090*	37*

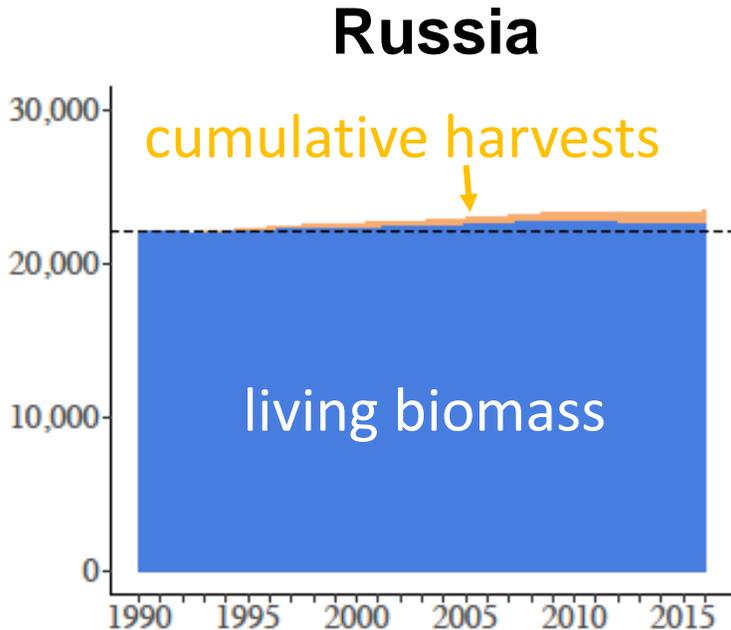
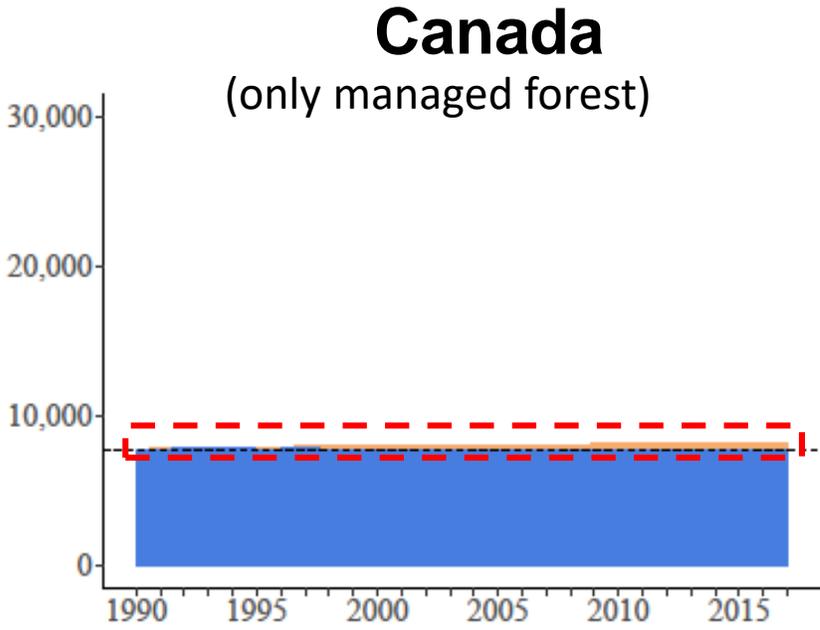
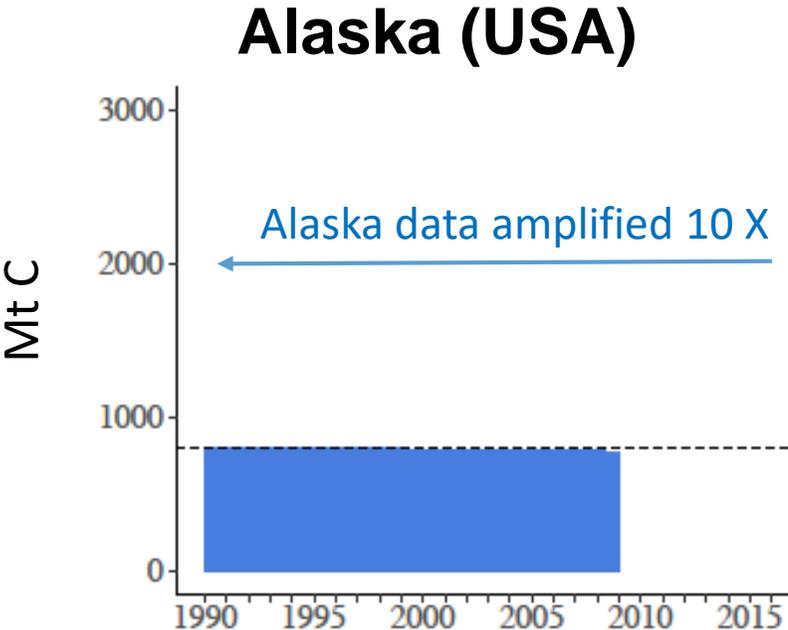
* Boreal forest only

** Managed boreal forests

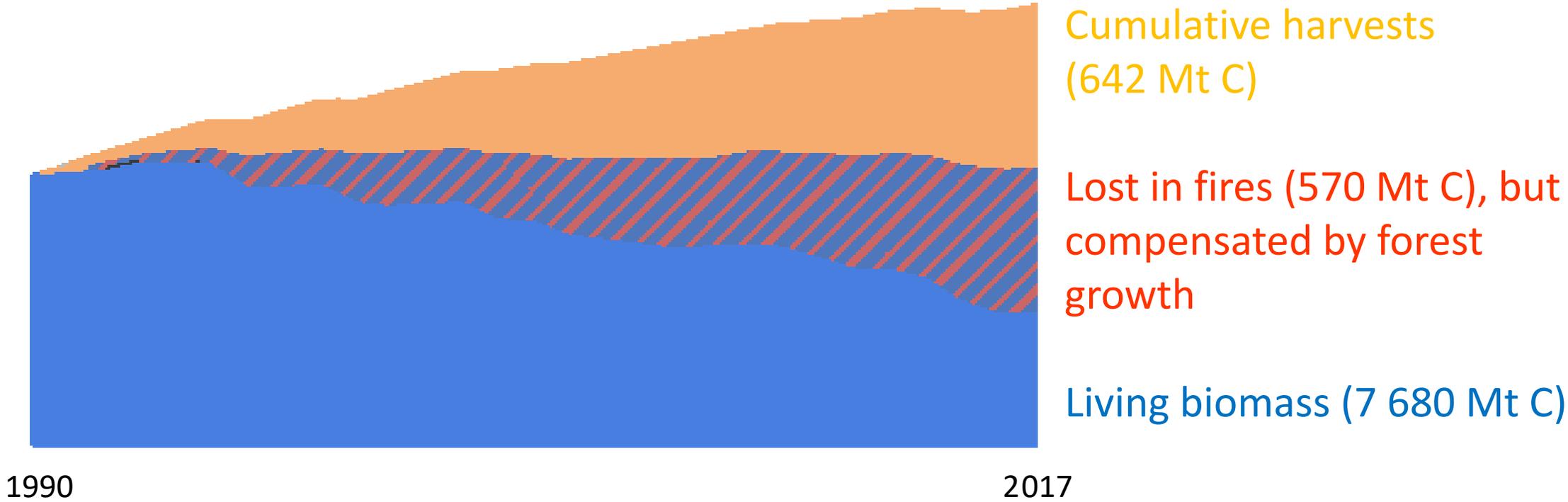
Changes in tree C stocks and harvests 1990-2015(-17): Countries with forest management for wood harvests on > 70 % of forest land. Fires are effectively suppressed.



Changes in tree C stocks and harvests 1990-2009(-17): Countries/states with no or relatively low level of wood harvests and where fires cause large C losses



Detailed analysis of impacts of harvests and fire on living biomass C in Canadian managed boreal forests 1990-2017.



Conclusions about changes in tree C stocks

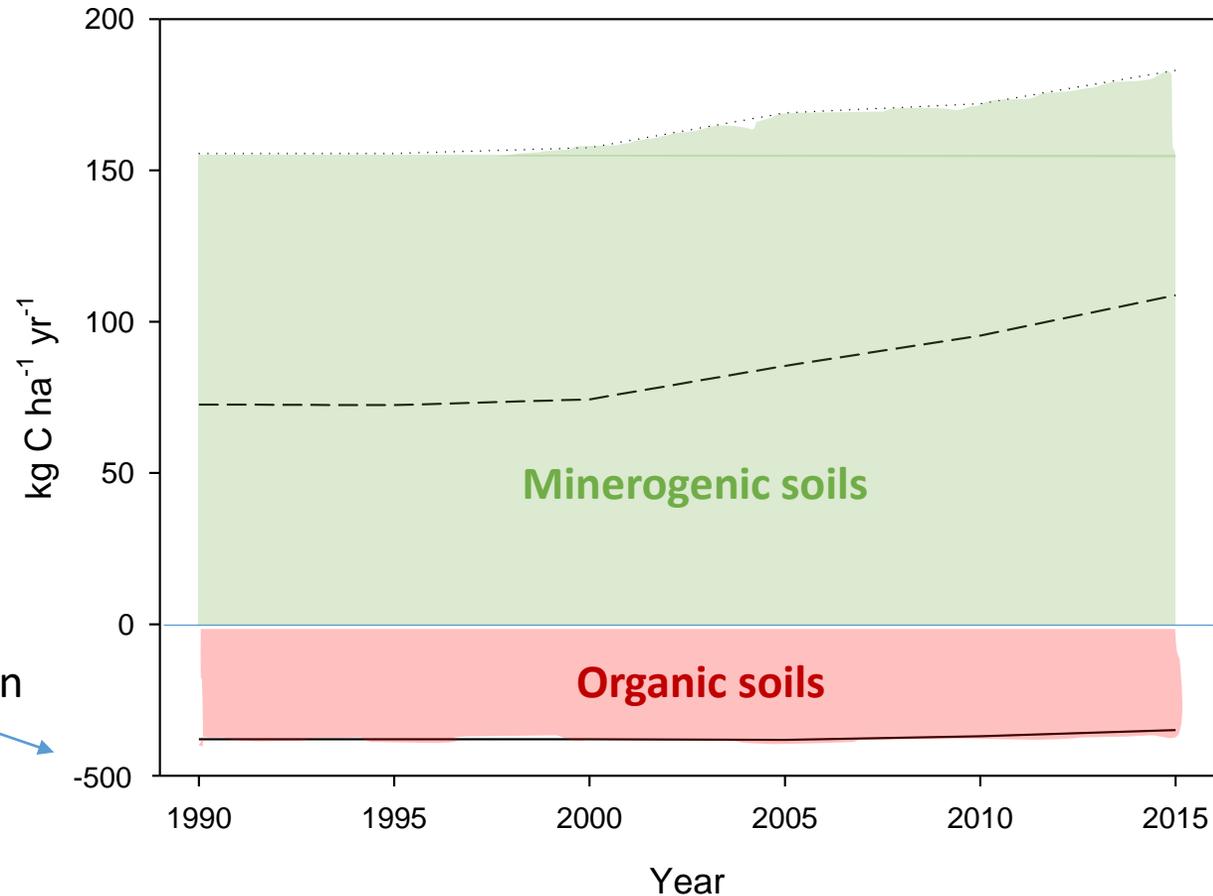
- In the three countries/states (Alaska, Canada, Russia) with low levels of management for wood harvests, the changes in tree C stocks are very small. Fires have a large influence on the C balance.
- In the three countries (Norway, Sweden, Finland) with a high level of management for wood harvests (mainly rotational silviculture), the tree C stocks increased by 20-55 % during the studied period. Fires are effectively suppressed.
- In Norway, Sweden and Finland, the cumulative harvests during the same period amounted to the equivalent of 55-88 % of the initial C stock in 1990.

What about soil C?

Annual C balance of Swedish forest soils 1990-2015 (data from the Swedish Forest Soil Survey)



Note change in scale!



Annual soil C accumulation in minerogenic soils

Average annual soil C accumulation in all soils

Annual soil C loss from organic soils* (methane and nitrous oxide added as CO₂-eqv.)

Organic soils are soils where the superficial organic layer is >0.3 m.
They comprise 14 % of the forest land.



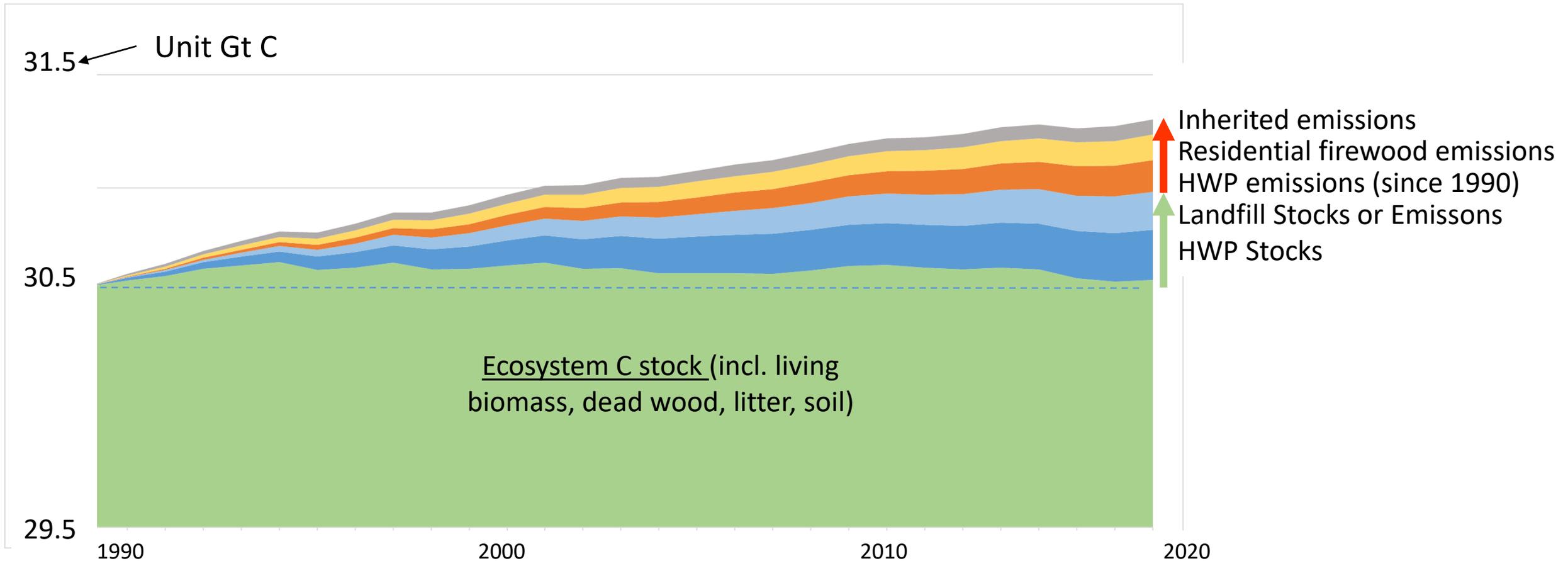
What about harvested wood products (HWPs)?

- Increases in the C stocks in ecosystems plus HWP pools represent a net removal from the atmosphere.
- Additional mitigation benefits are achieved through substitution (i.e. avoided emissions in other sectors through the use of wood products and bioenergy).
- Substitution not yet assessed here, but I will show some preliminary results for Canada.



Ecosystem and HWP C stocks 1990-2017: boreal Canada

- Sum of ecosystem C stocks plus HWP in 2017 is 410 Mt C greater than in 1990.
- If landfills C stocks are reported as stored (167 Mt C) and
- subtracting "Inherited emissions" from pre-1990 harvest (66 Mt C)



Final remarks

- Objectives of the Paris Agreement cannot be achieved without a contribution of land sector C sinks.
- Deforestation rates in boreal countries are very low.
- Forest management for wood production can increase C sinks.
- Large potential to increase C sinks in boreal countries with low management intensity – but these are also at risk from climate change.
- Changes in HWP product use towards more long-lived products and higher substitution benefits also offer large mitigation benefits.

We have so far focussed on the role of forestry in mitigating climate change. IBFRA will also address other aspects of sustainable forest management.

