Forest Knowledge Know-how METLA Well-being

Sequester or substitute? Consequences of the increased production of bioenergy in Finland

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Tackling climate change:
the contribution of forest scientific knowledge
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Bioenergy favoured in policies – carbon sequestration in forests not

Outline for the study on Finnish case

Background

- GHG balance of Finland and Finnish forests
- Policy goals for bioenergy in Finland

Research method

- 2 scenarios for wood based energy studied using 2 models

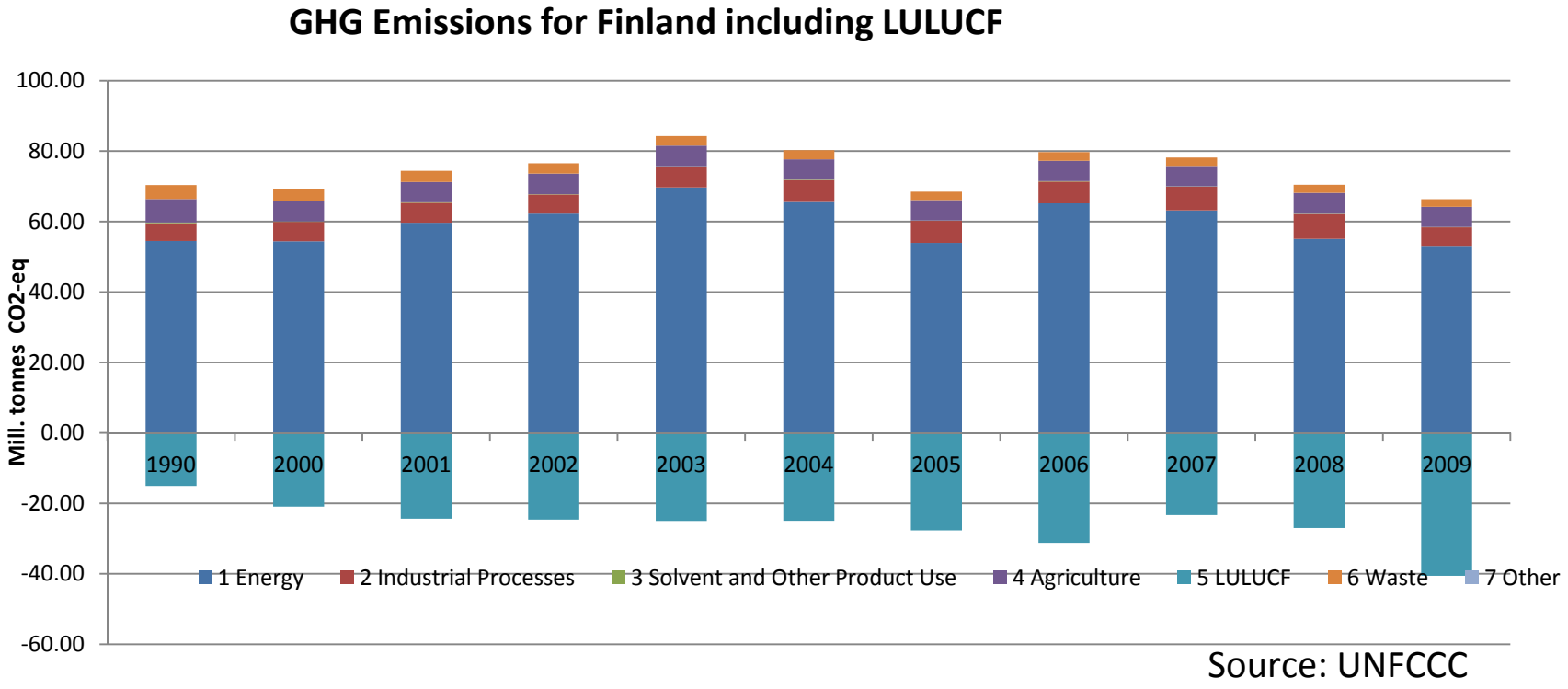
Some a priori observations

Results & conclusions

Background

GHG emissions of Finland

- Kioto target for Finland is to go back in emissions to 1990 level, to 71 Mt CO_2-eq.
- Energy production (much peat, coal, etc.) causes ~ 80% of non-LULUCF emissions.
- Forests are important sink, absorbing ~35 mill. t.CO_2 /a.



Source: UNFCCC

Finnish forests and Durban 2013-2020

- Kioto: Little weigth on forest management sink (Art. 3.4).
  Yet it compensated Finnish LUC emissions (Art 3.3) of 5-6 Mt/CO2/a.
- Durban: Reference levels defined for forest management sinks 2013-2020, in accordance with decided policies.
- If country's sink exceeds reference, credit ceiling 3.5% x 1990 emissions
- Forest sink not allowed and not enough to compensate Finnish LUC emissions.

	Forest management SINK in 2010 Mt CO_2-eq	REFERENCE level SINK with HWP Mt CO_2-eq	Maximum CREDIT FOR BEATING THE REFERENCE. M t CO_2-eq
Finland	31.9	20.5	2.5

EU-RES 2020 in Finland

Obligations for renewables energy sources by 2020:

- 38% of the energy consumed RES-based.
- 20% of the traffic fuels based on RES.

Wood biomass important for reaching the goals:

- Double the *forest chips* use in heat and power to 25 TWh
- 3 large biorefineries should make 7 TWh biodiesel mainly from *forest chips*

3 Sources of forest chips

Small trees
-from thinnings
-most expensive

Stumps: - tied to final fellings of timber, mainly spruce

Branches and tops
- cheapest to collect
- tied to final fellings of timber

35 TWh of *forest chips* required by the goal will not be available with current roundwood harvest levels

The gap can be filled with *pulpwood*.

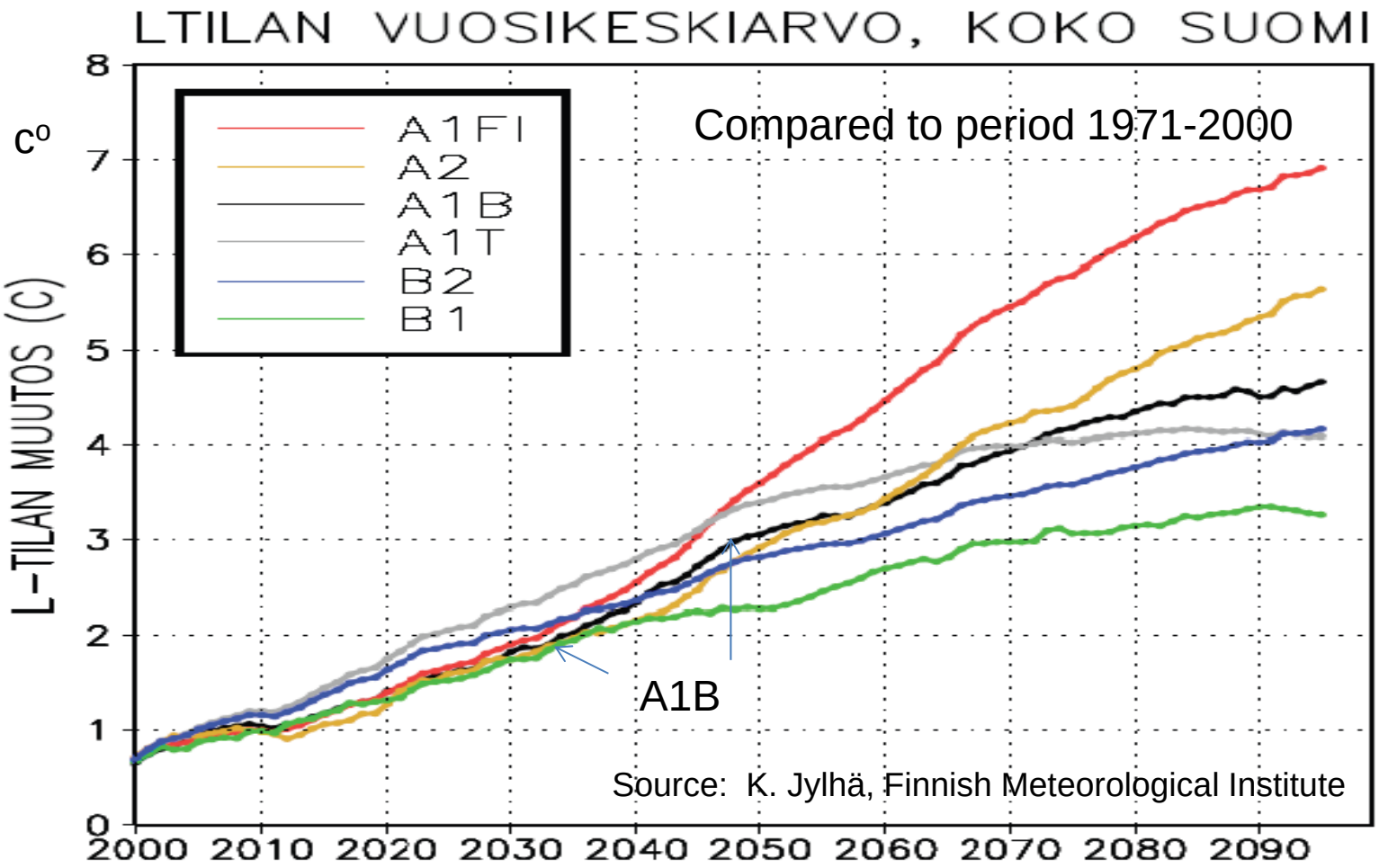
Study setting and method

Two bioenergy scenarios
with the climate change as in A1B

- **Low Bio**: stagnating use of bioenergy
  - price of CO_2 emission permits down to 0 €/t-CO_2 by 2020
  - subsidies and taxes favouring bioenergy removed

- **High Bio**: 2020 bioenergy goals met
  - price of CO_2 emission permits increases to 25 €/t-CO_2 by 2020
  - taxes on coal and peat increase as planned by the government
  - subsidy for chipping small trees for energy
  - subsidy for wood-based electricity, if CO_2 price below 23 €/t-CO_2

Projected change in average annual temparature in the IPCC scenarios in Finland; A1B assumed



2 simulations models used

- **Spatial partial equilibrium model for the Finnish forest sector, SF-GTM, appended with heat, power and biodiesel production**
  - finds market prices and quantities of wood products and biomass, forest industry production, use of solid fuels for heat and power

    →Wood biomass prices & quantities to MELA2009 model

- **Regionalized forest simulations model, MELA2009**
  - simulates the changes in forest structure optimizing forest management under given prices
  - calculates the stock of carbon in the forest and forest land

A problem with synchronization - to be tackled in the future-

- **SF-GTM**
  - 1 year steps
- **MELA2009**
  - 10 year steps;
  - uses the averages 2007-2016, 2017-2026,.. from SF-GTM

  -> the carbon loss due to bioenergy harvests from rapidly growing forests maybe exaggerated in the first period

Some prior observations

the expected impacts of *increasing* the use of wood based energy: High BIO vs. Low BIO

Expected impact on emission from fossil fuels

- 1 MWh_f of peat/coal emits circa 0.381 t CO_2eq →

  Additional 12 TWh of wood replacing peat & coal in heat & power
  - reduces fossil GHG emissions by about 4 Mt/year
  - cuts the Finnish Non-LULUCF emissions by over 5%

- 1 MWh_f of fossil diesel emits circa 0.245 t CO_2eq →

  7 TWh of biodiesel
  - reduces fossil GHG emissions by roughly 1.8 Mt/year
  - decreases the Finnish GHG emissions from traffic over 10%

Expected impact on forest carbon stock

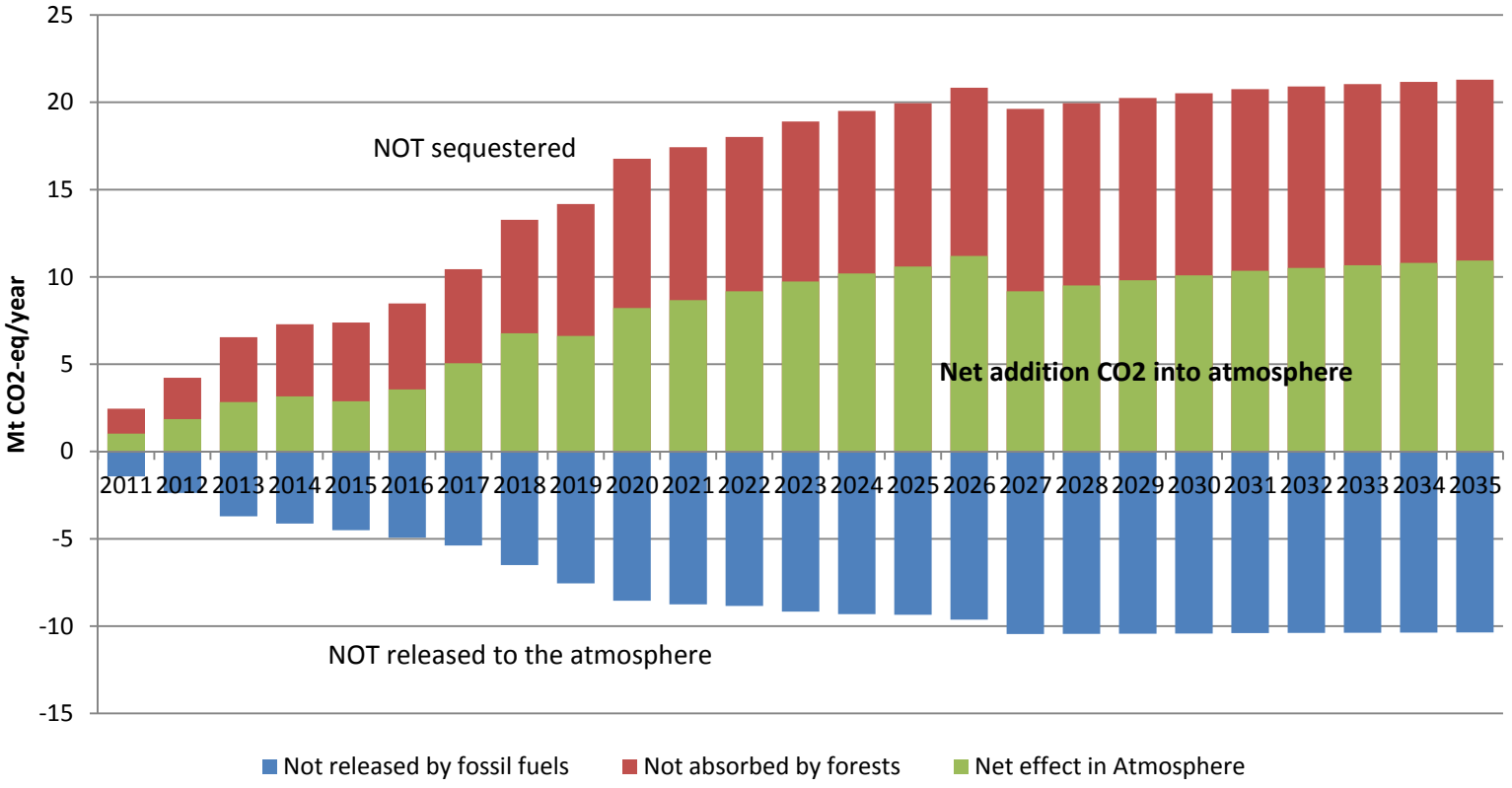
- **unlikely to decrease** forest carbon **stock from current level**
  - Due to high growth and low use of forests, future forest carbon stock may still be even higher than now.

- **likely to reduce** the **future** forest carbon **stock compared to the case without additional demand for energy wood**

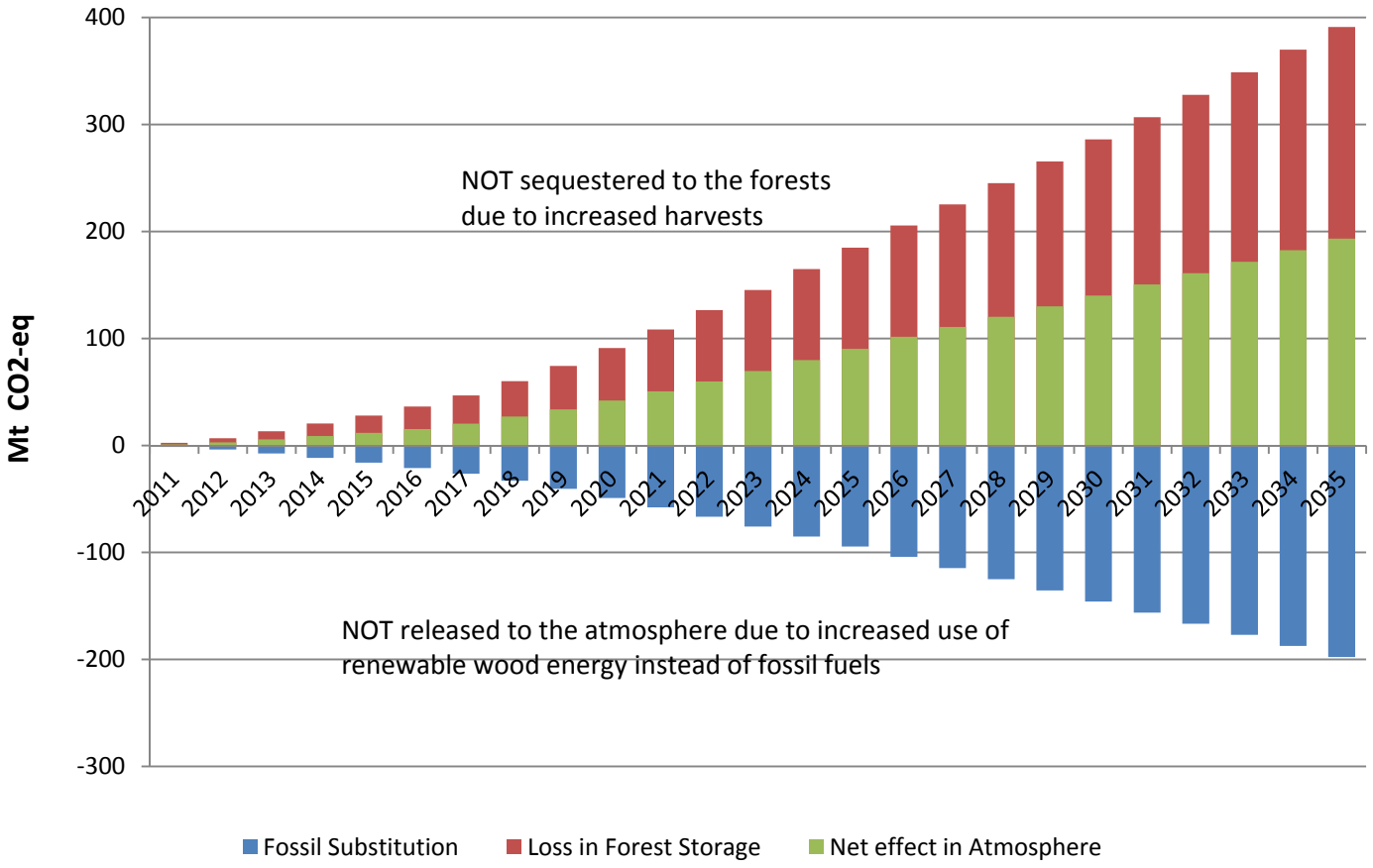
Preliminary results

- not to be cited -

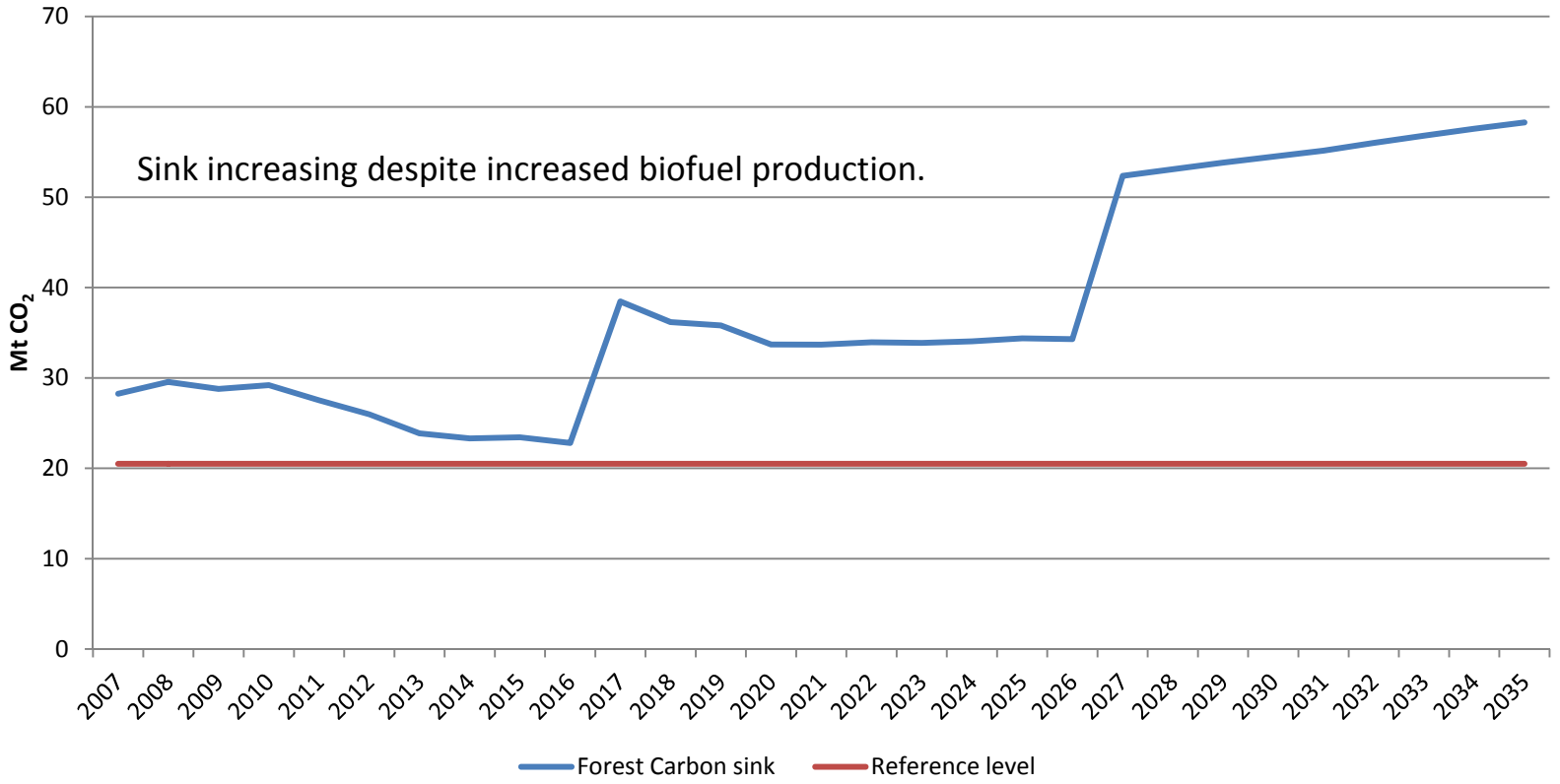
Annual change in CO2 absorbed from/released to the atmosphere High BIO compared to Low BIO



Cumulative difference in sinks and sources of CO_2 in the High BIO compared to Low BIO



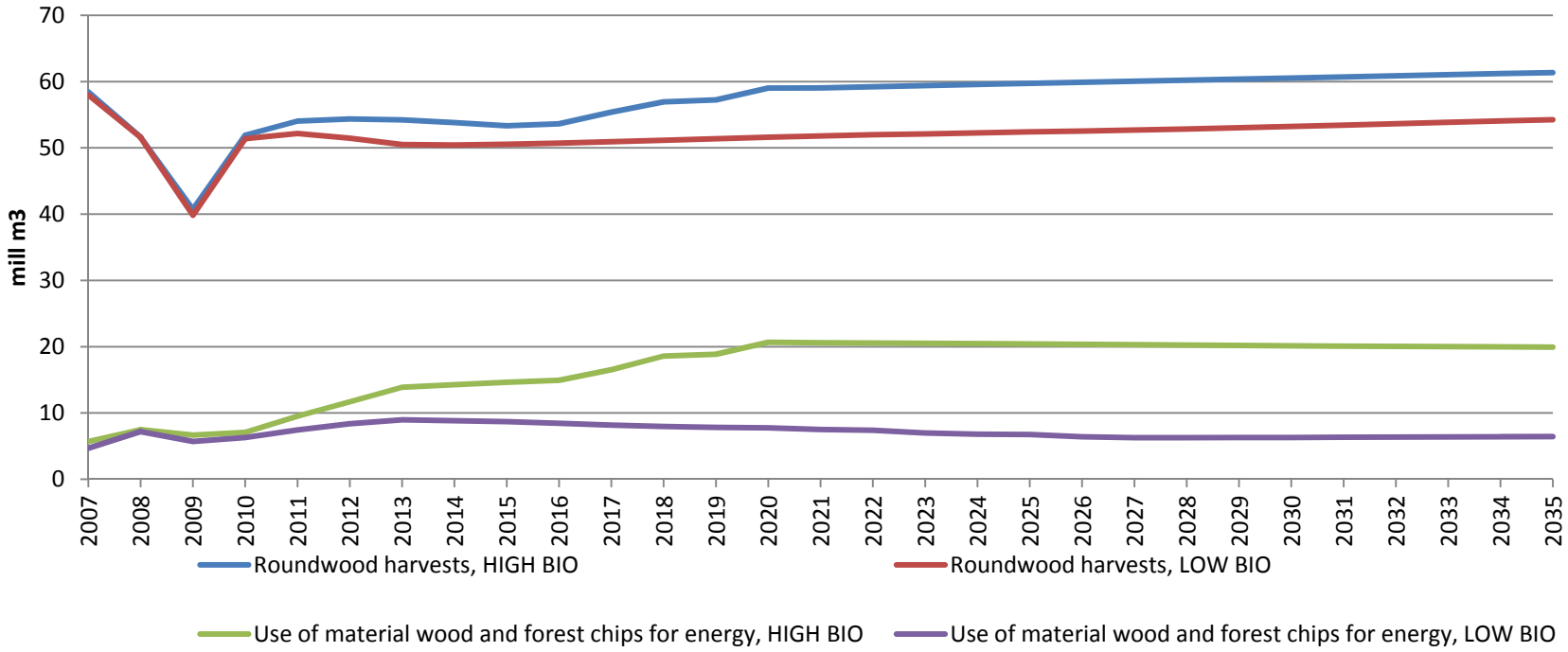
Forest Carbon Sink in High BIO vs. Durban Reference Level 2013-2020



Reference level not jeopardized due to bioenergy

In LOW BIO with no policies favoring bionergy compared to HIGH BIO in 2020:

- Roundwood harvests 12% lower
- Forest owners' timber sales income 10% lower
- 40% less wood used in replacing fossils
- Pulp, paper and paperboard production 2% higher
- Sawnwood production affected in much longer run, with 1% reduction in 2030
- Pulpwood prices 2030 already very low discouraging thinnins as forest management and hence harming long-run sawntimber production



Summary and conclusions

The preliminary combined model runs suggest that

reaching the Finnish targets for wood energy

- **Seems to have negative impact on the atmospheric CO_2**
- **… but is vital for Finland's compliance with EU RES 2020**
- **does not jeopardize the Durban reference level**
- **Dropping the requirement for 3 large biodiesel plants could help to decrease the short-run carbon debt**
  - They require increased harvests of (growing) pulpwood
  - Fossil fuel replacement factor is smaller for biodiesel than in heat & power

However, it is not all about GHGs

Increased use of wood based energy means

- **higher (pulp)wood prices**
  - Higher income for forest owners
  - **motivate forest management**
  - Improve profitability of sawnwood production
- more jobs, although domestic peat down
- Improved trade balance and self-sufficiency, when foreign non-renewables replaced
- **Being prepared** for raising prices of fossils.

Foto: E. Oksanen, Metla

The issue seen in a positive light

- It's the current HIGH growth of Finnish forests making "sink use" appealing
  - Past investments on forest management are bearing fruit.
  - Room for producing both carbon services and renewable energy / other "post - pulp&paper" products
- No support from tax payers' needed to increase forest C stock
- Finally: Sequestration policy vulnerable to risks: wildfires, windfalls, deseases, pests…
- Albedo effect of forests may be important – subject to future study

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Forest
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KNOWLEDGE
Know-how
Well-being
Thank you

Further information

- MELA2009 model, e.g.,:
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- Forest energy module ForENER (modification included to SF-GTM):
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