

Impacts of the Kyoto Protocol on climate change mitigation in boreal forests

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Tackling climate change:
the contribution of forest scientific knowledge

Tours, May 22, 2012



Boreal forests in the Kyoto Protocol

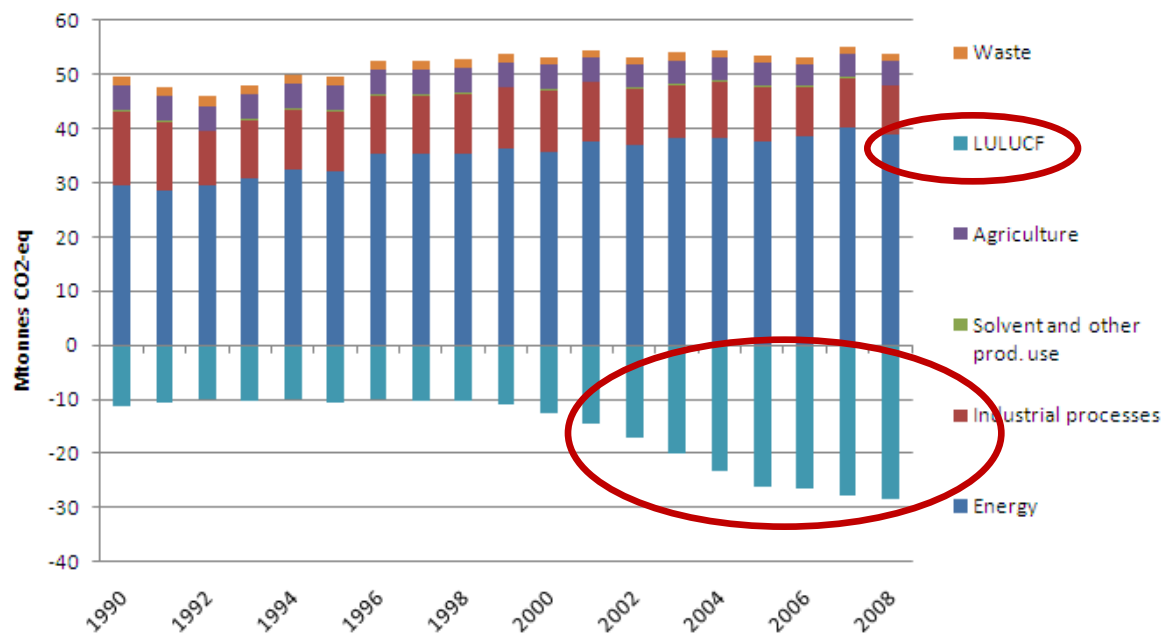
- European and North American forests large net carbon sinks
- Countries committed to reduce greenhouse gas (GHG) emissions can opt to credit carbon sequestration in existing forest – but only up to a preset, country-specific cap (Article 3.4)
- However, wood energy promotion is an important part of climate policies

Research questions

1. Compared to no climate policy, what are the impacts of the Kyoto Protocol on the GHG emissions?
2. Compared to a climate policy with no cap on forest carbon credits, what are the impacts of the Kyoto Protocol on the GHG emissions?

Norway case

- Forest carbon sequestration 25-30 million tons CO₂/year
~ half the domestic GHG emissions
- Kyoto Protocol forest carbon cap 1.5 million tons CO₂/year
- Reference levels:
 - Forest: 1990 carbon sequestration level of 11.4 million tons CO₂/year (under discussion)
 - Non-forest: Zero



Scenarios

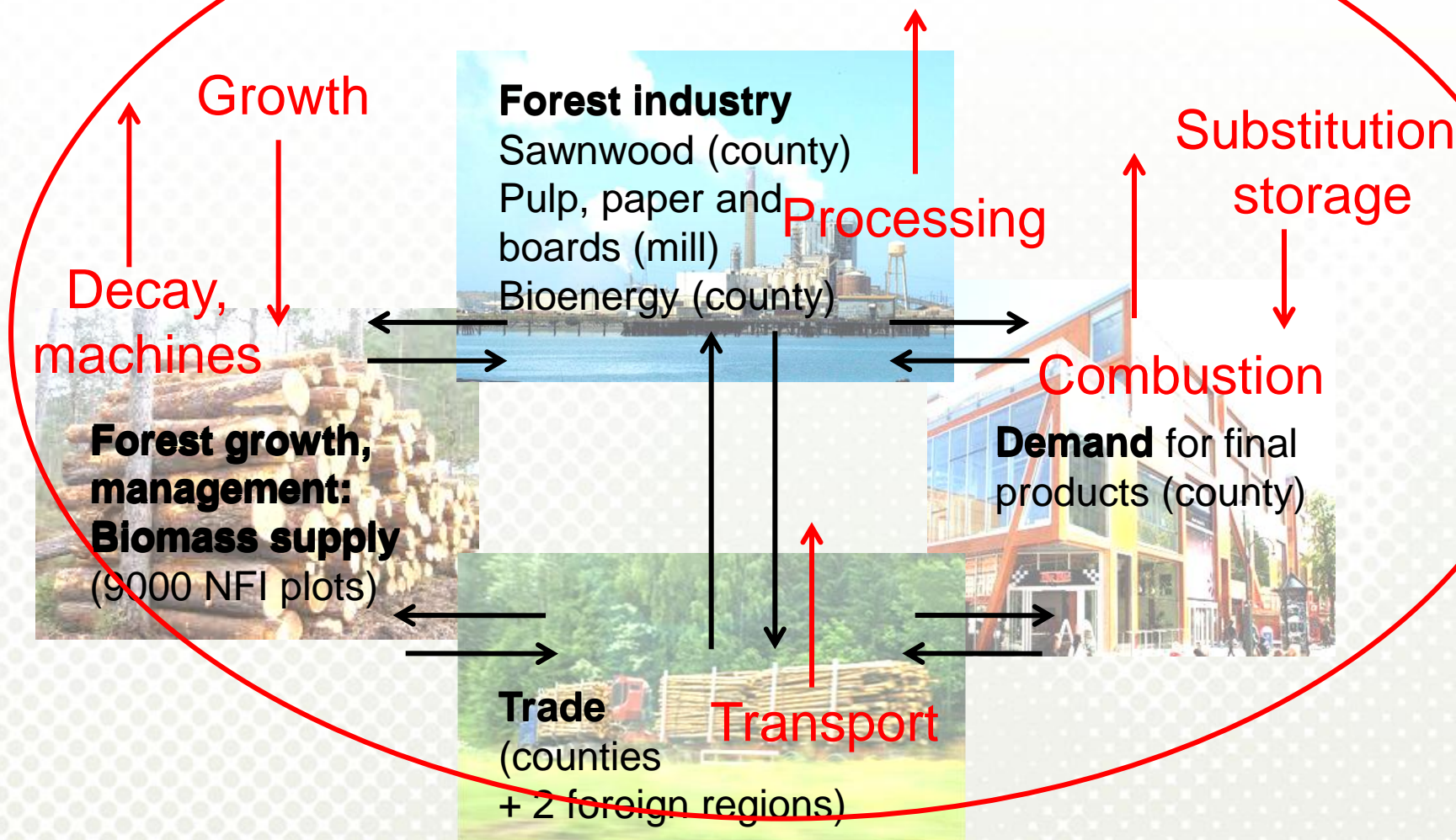
- ✓ Base scenario with no climate policy
- ✓ Kyoto Protocol (KP) policy with cap on forest carbon sequestration of 1.5 mill tons CO₂eq/year above the 1990 reference level
- ✓ Full Carbon policy (FC) with no cap on forest carbon sequestration

- Carbon prices (tax/subsidy) from 12.50 to 100 €/ton CO₂eq
- GHG fluxes deviating from Base scenario levels subject to payment
- Both KP and FC credit substitution in the wood market and carbon storage in wood products fully

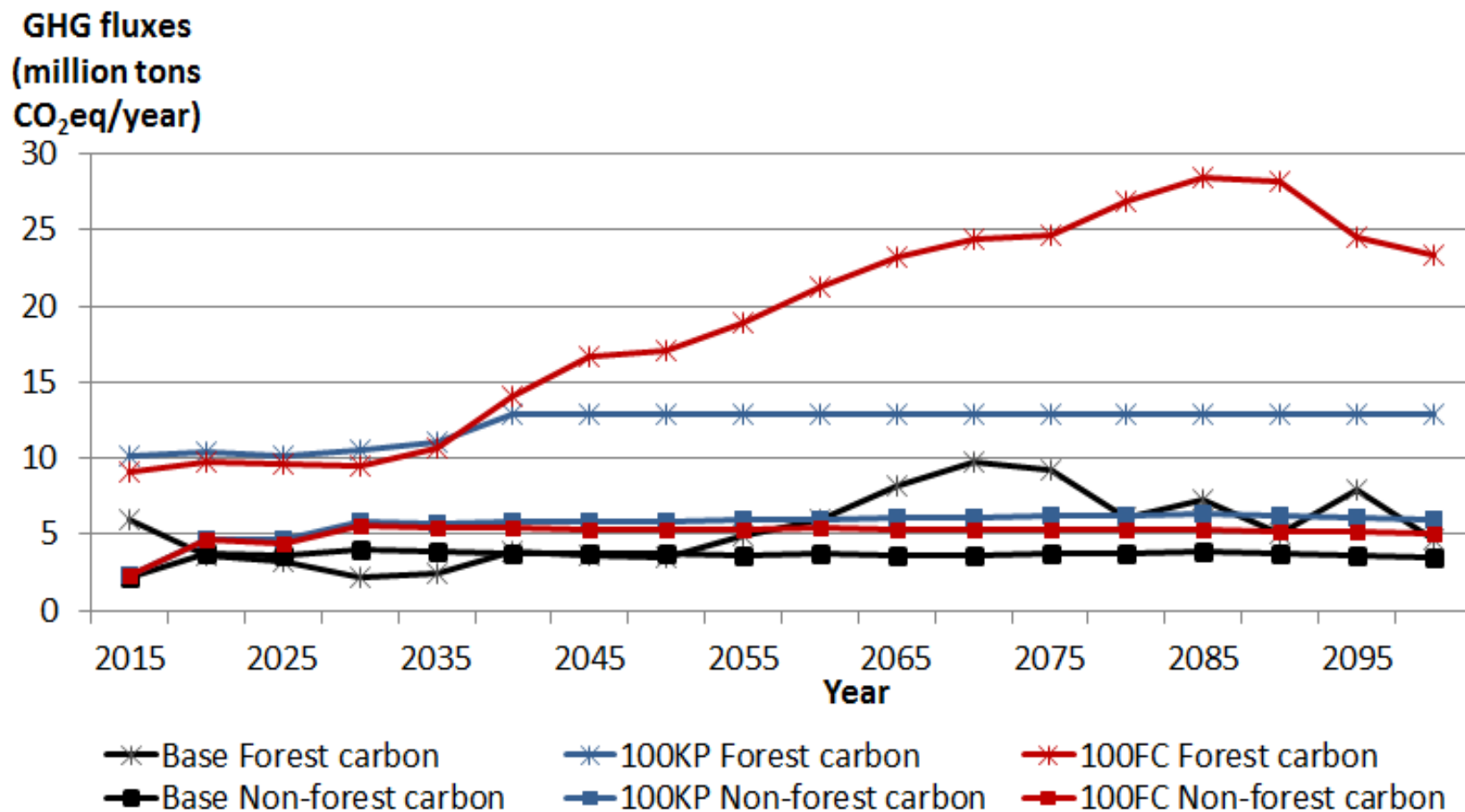
- Policies apply the entire century – but only to Norway

GHG

The forest sector model for Norway NorFor

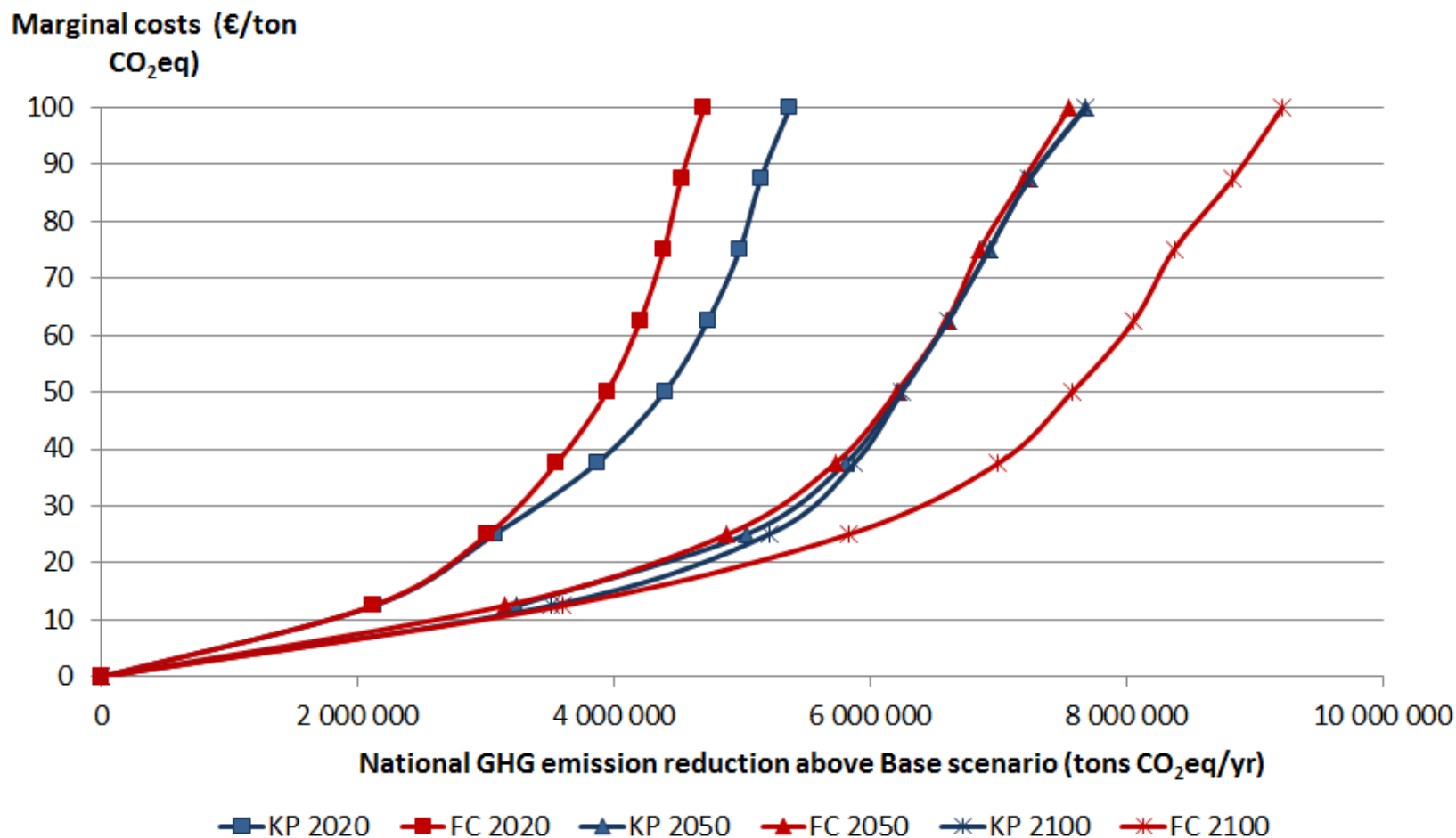


Allocation of GHG fluxes – 100 €/ton CO₂eq



Positive fluxes indicate sequestration

Marginal costs of policies



Discounted, annualized GHG fluxes above Base scenario fluxes

Discussion

- Higher short term emission reduction in the KP than FC
 - Forest owners adapt to the policy application the entire century
 - In the FC, more low-productive stands are replaced, much investments in forest management
 - In the KP, initial harvest levels low in order to maximize NPV of carbon and also less incentives for replacing stands
 - Harvests increase over time in the KP as the cap is met with changes in forest management
- More emission reductions in the wood market in the KP
 - As beyond the cap there is no trade-off with carbon sequestration
- KP potential to 2100 same as for 2050 as cap is met and forest owners are not compensated for further investments

Discussion

- With both policies, adaptations to policies in the wood market
 - Pulpwood reallocated from P&P production to bioenergy
 - Large shifts within the bioenergy market with more bioenergy in water-borne heating systems and less as firewood
 - Solid wood production increases under the KP but declines in the long run under FC
 - Large leakage effects (depending on elasticities)
- Most of the carbon offsets take place in forestry
 - 82-96% in the FC
 - 99% in the first periods under the KP but down to 56% in the second half of the century

Conclusions

1. The Kyoto GHG impacts compared to no climate policy?

Positive in short, medium and long term. Increased use of wood energy in the KP but still more carbon sequestration than in Base

2. The Kyoto GHG impacts compared to full carbon policy?

More offsets in the short run (2020), the same in the medium run (2050), but considerably less in the long run (2100).

A little higher offsets in wood markets in the KP than in FC.

Considerably less investments in forestry and higher long-term harvests in the KP than in FC.

Thank you!

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