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Assessing the forest based bioenergy GHG balance at different geographical and temporal scales

Hannes Böttcher et al.

IEA Bioenergy Task 38 - Expert Working Meeting
How to present the timing of emissions from bioenergy in LCA and GHG accounting
April 12-13 2012, Chicago

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Overview

- Böttcher H, Freibauer A, Scholz Y, Gitz V, Ciais P, Mund M, Wutzler T, Schulze E-D (2012) Setting priorities for land management to mitigate climate change. Carbon Balance and Management 7:5
  - Per ha view
  - Comparison of different land use options
- Böttcher H, Verkerk PJ, Gusti M, Havlik P, Grassi G (2012) Projection of the future EU forest CO2 sink as affected by recent bioenergy policies using two advanced forest management models. GCB Bioenergy
  - Landscape view (EU forests)
  - Impact of bioenergy mandates on wood removals and carbon sink

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Setting priorities for land management to mitigate climate change

Hannes Böttcher et al.

Carbon Balance and Management 7:5

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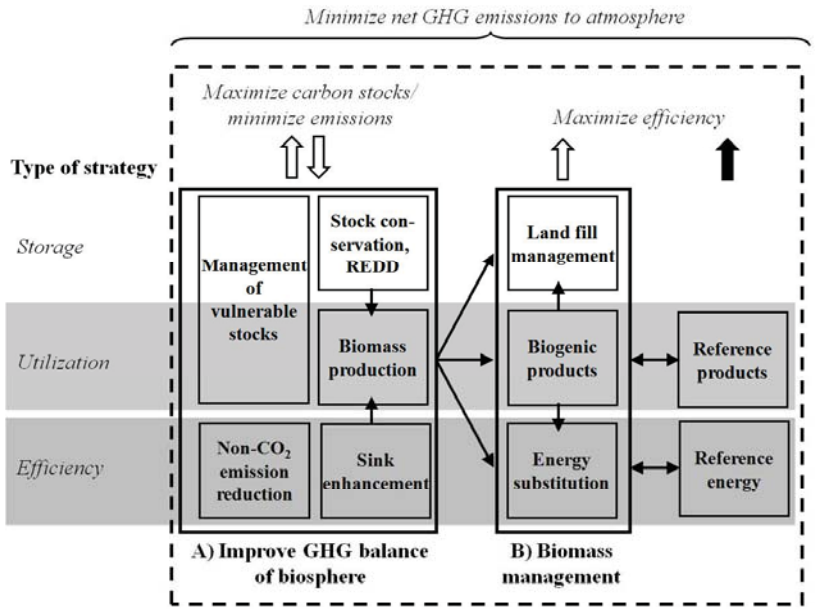
Pathways of terrestrial biosphere management

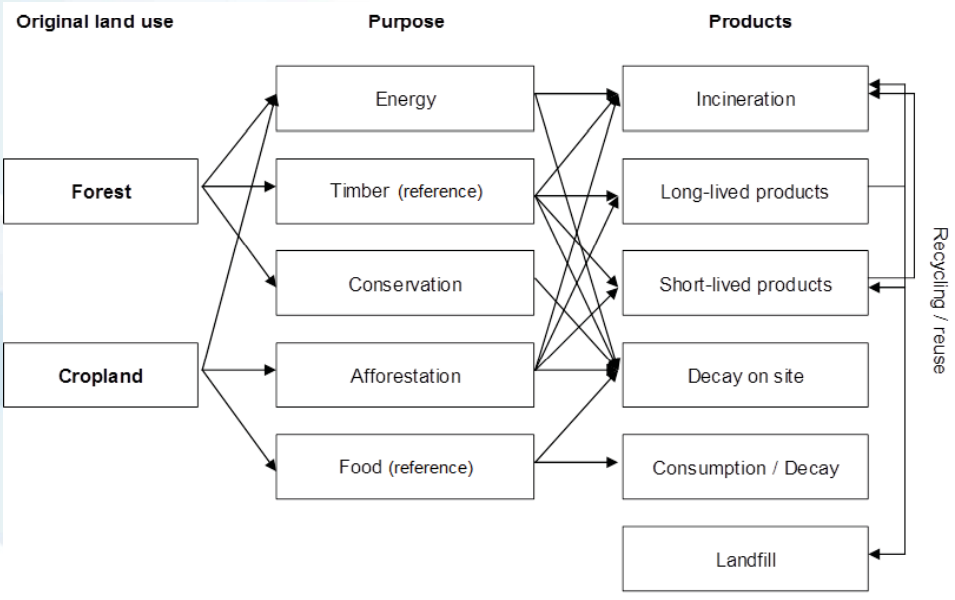


Obersteiner et al. 2010 COSUST

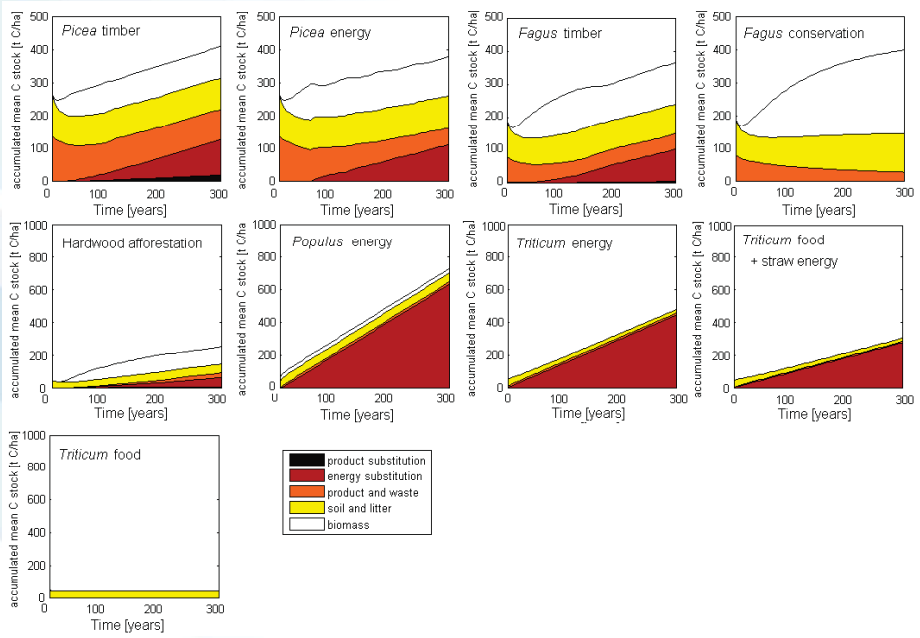
Specifications

- Very wide system boundaries (biomass, soil, products, product and energy substitution)
- Wide range of options (agriculture, forestry, afforestation)
- Realistic numbers for a concrete region (Thuringia)
- Employing a carbon budget model at a per ha level
- Including economic assessment of options

Concrete management options considered in first study



Moving average carbon stocks and substitution for different options



Conclusions study 1

What is climate effective land management at a per hectare level?

- When using harvested products as materials prior to energy use there is no climate argument to support intensification by switching from sawn-wood timber production towards energy-wood in forestry systems
- A legal framework would be needed to ensure that harvested products are first used for raw materials prior to energy use
- Only an effective recycling of biomaterials frees land for long-term sustained C sequestration by conservation
- Reuse cascades avoid additional emissions from shifting production or intensification

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Projection of the future EU forest CO_2 sink as affected by recent bioenergy policies

Hannes Böttcher et al.

GCB Bioenergy, in press

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Background I

- EU climate policy has set emission reduction targets of 20% below 1990 levels in 2020 to be achieved through measures implemented by MS
- This target does **not** include LULUCF (land use, including forest management) although EU forests are significant sink
- Reasons for not including LULUCF were
  - Relatively big uncertainties of emissions from land use
  - Fossil fuel emission reduction not be watered down by forest sink
- Still, relevant questions for climate policy
  - **How long will the current sink of EU forests be maintained in the near future?**
  - **Are there reasons for including LULUCF?**

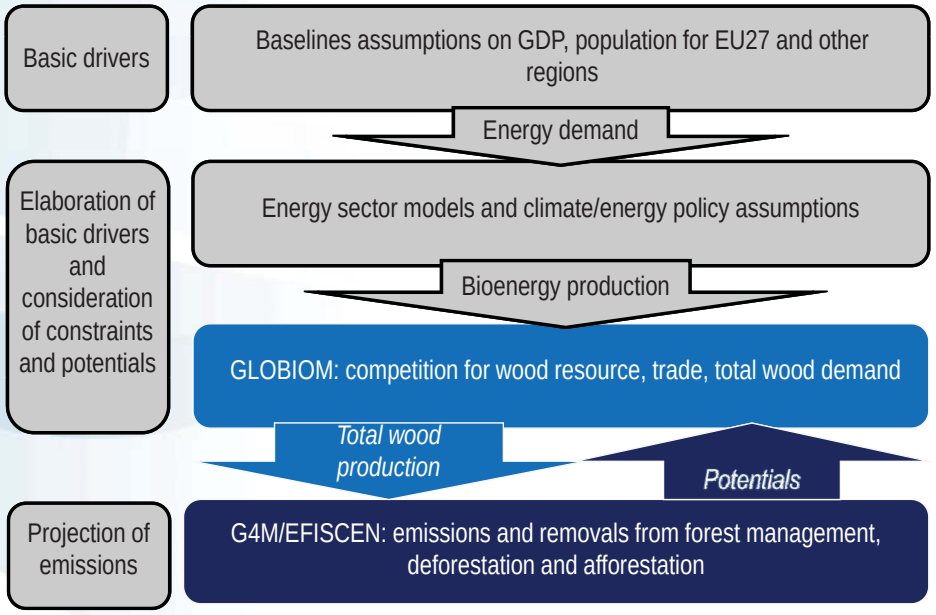
Background II

- EU climate policy has set renewable energy and biofuel targets for 2020 to be implemented by MS
- Increased demand for bioenergy from forests in addition to increased demand for timber and pulp and paper
- Can either be met through increased imports or increased domestic wood extraction in the EU
- Relevant questions for climate/energy policy:
  - **Potential conflict between carbon storage in forests and the increased use of forest bioenergy. What is the order of magnitude for a given policy scenario?**
  - **What if LULUCF/forest management would be included in a emission reduction target?**

Scope of the study

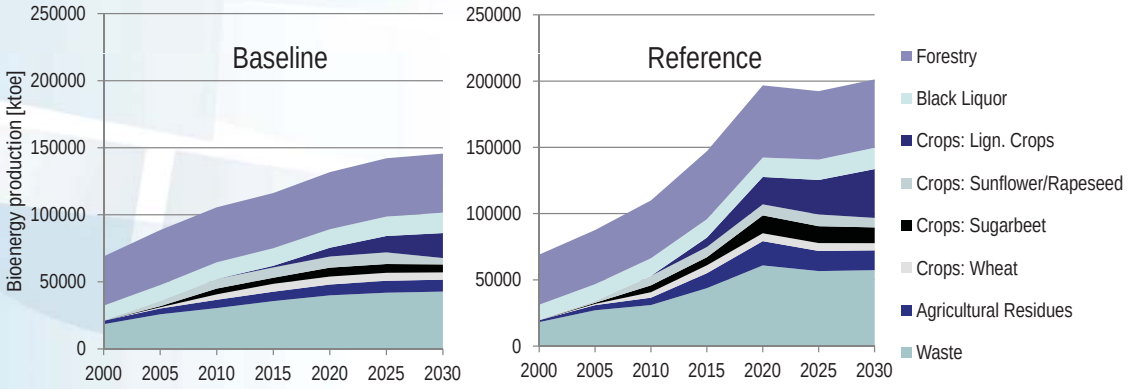
- Estimation of forest management carbon emissions and removals (above- and below-ground biomass)
- Using two forestry models with different approaches (EFISCEN: matrix model, based on NFI data; and G4M: NPP driven, geographically explicit, rather coarse)
- Consultations with EU MS representatives to review approach and input data
- Numbers presented are for EU countries excluding Malta, Cyprus and Greece (lack of data)
- Afforestation not considered here (for consistency reasons), contribution to wood supply expected only after 2020

General approach



Driver: Bioenergy production from PRIMES

Primes Ver. 3 Biomass Model, 01/12/2009 and 31/07/2010



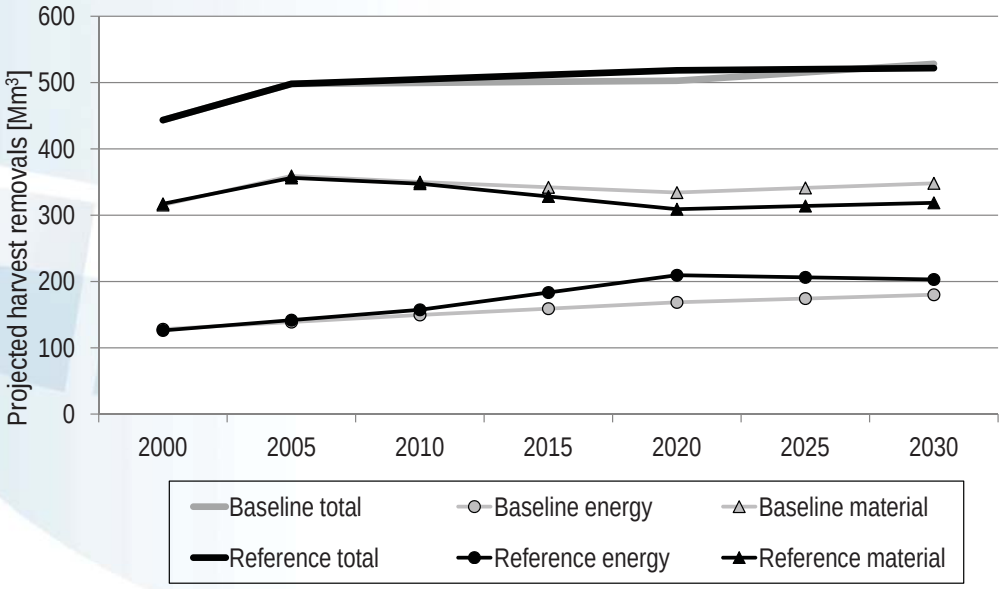
Includes current trends and policies including the recent economic downturn and takes into account bioenergy markets

Includes the baseline +

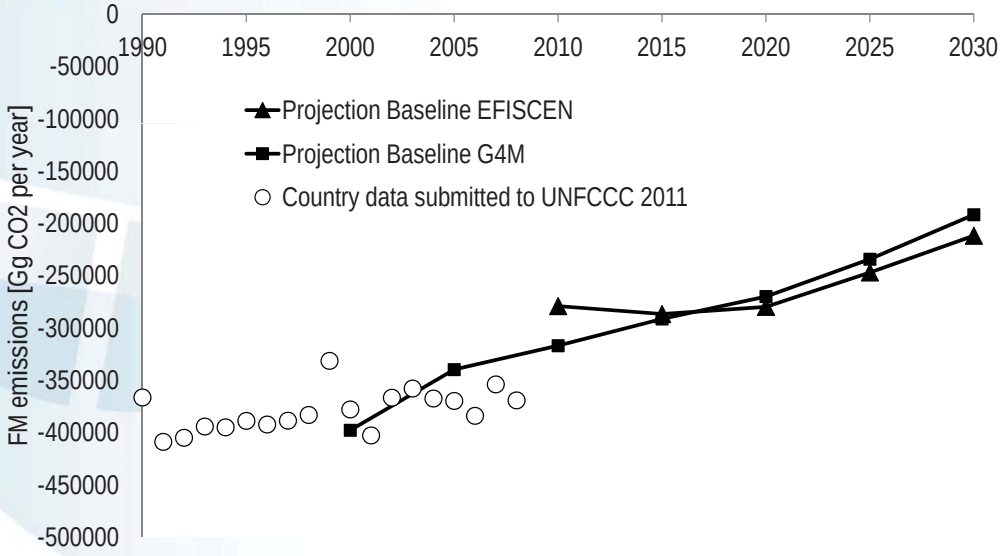
the Climate and energy package i.e. the renewable target of 20% in 2020 in the EU

Total wood production

Result of country consultation, historic data and GLOBIOM projection.



Results: Baseline development



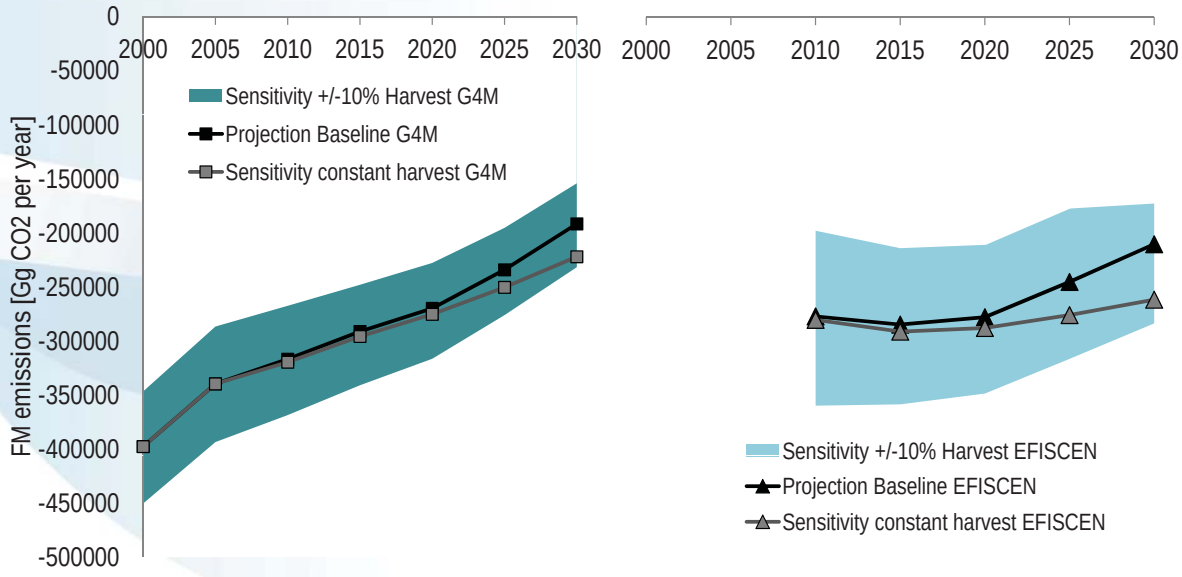
Reference scenario

Differences between baseline and reference scenario for prescribed harvest and forest management carbon sink.

	2010	2015	2020	2025	2030
Total wood production GLOBIOM	1%	2%	3%	1%	-1%
Sink G4M	0%	-1%	-4%	-1%	8%
Sink EFISCEN	-4%	-8%	-11%	5%	18%

- Differences in model sensitivity
- Dynamics over time (regrowth effect after increased harvest)

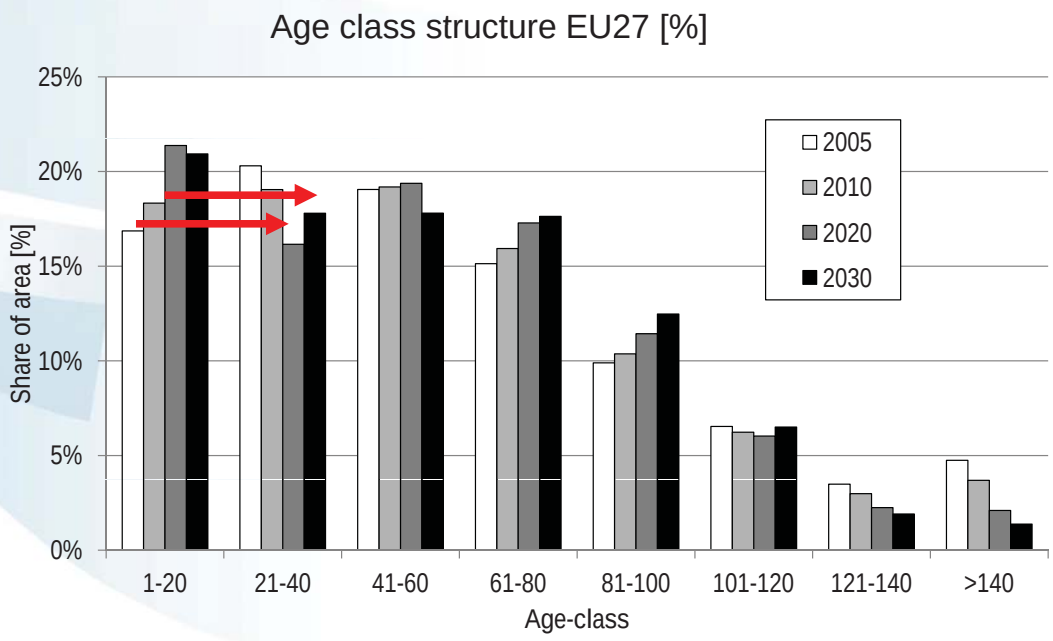
Results: Sensitivity of forestry models



Drivers of the sink development

- Sink decline of about 25% according to EFISCEN and 40% according to G4M, in 2030 relative to 2010
- In total the decrease could amount to between 65 to 125 Mt CO_2 annually
- By comparing scenarios the trend can approximately be attributed
  - Forest ageing
  - Increased harvest
- If future harvest rates are kept constant the sink will still decline at a slower rate (in the case of EFISCEN by 5% and G4M 30% in 2030 compared to 2010)
- This is due to forest structure change, shifts in the age class distribution and increasing stocking densities

Driver: European forest age class structure



Explanation of differences to reported data

- Methods in countries to estimate FM emissions and removals differ a lot
  - Detailed analyses in some countries
  - Indirect estimates in other countries
  - Not all countries report all categories
  - Uncertainty of LULUCF reported data 35%
- A consistent method (as applied here) cannot reproduce results of different approaches!
- Need for more exchange on assumptions and input data

Uncertainties

- Approach applied is to a large degree data-driven - quality of results depends heavily on quality of data used
- Challenges of harmonization:
  - Harmonization with datasets used by member states was not possible in all cases
  - Different figures on basic input data like forest area and historic wood demand
- GLOBIOM model projection of future wood demand and production with various assumptions
  - Production in the rest of the world
  - Consumption in the rest of the world

Conclusions study 2

- Forest sink in EU (excl. afforestation) expected to decline by 15% in 2020 and 25-40% in 2030 compared to 2010
- Drivers are demand for wood for energy and material use and shifts in the forest structure
- Assumptions of the reference scenario further decrease the FM sink compared to the baseline in medium run (until 2020)
- This effect is currently not accounted for (20% target excludes land use)
- Impact on EU forest carbon stocks depends on whether the demand growth will be met by internal production or increased imports – indirect effects!

Info and Acknowledgements

- FM emission data of this project served as a basis for the EU FM reference level estimates (see Durban and EU decision on LULUCF)
- Planned COST Action on Land use emission projection

Funding: Development and application of environmental Life Cycle Impact assessment Methods for imProved sustAinability Characterisation of Technologies (LC-IMPACT)

LC-IMPACT
www.lc-impact.eu