German scenario case studies on changing wood supply and bio-economy pathways

Holger Weimar, Franziska Schier, Christian Morland
Thünen Institute of International Forestry and Forest Economics

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Changing wood supply and bio-economy pathways
Two scenario case studies in national projects in Germany

WEHAM-Scenarios
(finished)

• **Background & Objectives**
  – Forest development and timber supply scenarios based on NFI (timeframe -> 2052)
  – Stakeholder evaluation of alternative raw material supply and wood markets developments
  – Market Modelling: How might the German forest-based sector respond to changing timber supply potentials?

BEPASO
(ongoing)

• **Background & Objectives**
  – Bioeconomy pathways and social acceptance (timeframe -> 2050)
  – Possible (economic) impacts from future bio-economy developments obtained from broad stakeholder participation (experts, society, scientists)
  – Market Modelling: How might supply and demand structures of traditional and emerging wood products change in face of growing competition for raw materials?
The Global Forest Products Model (GFPM)

Basic structure

- 180 countries, 14 products
- Input data:
  - production, trade, values
  - forest area, growing stock
  - GDP, population
- Output: Production, trade, consumption, prices, forest development
- Objective function: Maximizing the total welfare in the forest sector

Fig.: Product structure GFPM according to Buongiorno et al. 2003, own illustration
Case Study 1: WEHAM-Scenarios
Application of GFPM

Input

GFPM

C/NC Industrial Roundwood
Fuelwood

Roundwood „removed“

Fuelwood
Sawnwood (C/NC)
Veneer/Plywood
Particle/Fibre Board
Chem./Mech. Pulp
Paper & Paperboard

Roundwood “removed“

Wood demand scenarios

→ WEHAM-Output serves as a upper bound
→ Fuelwood demand is to meet

Timber harvesting potential (C/NC)
Case Study 1: WEHAM-Scenarios
Basic structure: modified GFPM -> C/NC

- 180 countries, 16 products
- C/NC industrial roundwood + C/NC sawnwood
- Re-programming the model calibration for input data
- Re-estimation of supply, demand and import/export elasticities

Fig.: Product structure GFPMcnc according to Schier et al. 2018, own illustration
Case Study 1: WEHAM-Scenarios

Scenario application (Step 0: WEHAM)

Potential fellings of coniferous roundwood (mill. m³/year)

Blue -> BAS-REF Scenario
Limited production of Conif. roundwood, increasing prod. of Non-Conif. roundwood

Red -> HPS-FÖR Scenario
Increasing production of C and NC roundwood

Green -> NPS-RES Scenario
Nature oriented forest conversion implies more production of Conif. RW, but limited NC Roundwood
Case Study 1: WEHAM-Scenarios
Scenario application (Step 1: Dead wood)

Potential fellings of coniferous roundwood (mill. m³/year) minus quantities necessary for scenarios dead wood supply

Blue -> BAS-REF Scenario
Limited production of Conif. roundwood, increasing prod. of Non-Conif. roundwood

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Scenario application (Step 2: Fuel wood)

Potential fellings of coniferous roundwood (mill. m³/year)
minus quantities necessary for scenarios dead wood supply
minus quantities necessary for scenarios fuel wood demand

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Case Study 1: WEHAM-Scenarios
Scenario application (Step 0: WEHAM)

Potential fellings of non-coniferous roundwood (mill. m³/year)

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Case Study 1: WEHAM-Scenarios
Scenario application: Max. potential for GFPM

Max. potential of coniferous roundwood

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Max. potential of non-conif. roundwood

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Case Study 1: WEHAM-Scenarios
Scenario application: Max. potential for GFPM

Potential fellings of coniferous roundwood

Calculated potential of coniferous roundwood as upper bound for domestic annual production

-> How does this interact with market demand for material use?
Case Study 1: WEHAM-Scenarios
Scenario application: Max. potential for GFPM

Potential fellings of coniferous roundwood

Calculated potential of coniferous roundwood as upper bound for domestic annual production

Unused potential defined as “standing storage”

Production of coniferous roundwood estimated as modelling results

Potential fellings of coniferous roundwood as upper bound for domestic annual production.
Case Study 1: WEHAM-Scenarios
Scenario application: Max. potential for GFPM

Potential fellings of coniferous roundwood

Calculated potential of coniferous roundwood as upper bound for domestic annual production

“Standing storage”: Unused potential of previous years increases potential of following years

Production of coniferous roundwood estimated as modelling results
Case Study 1: WEHAM-Scenarios

Scenario application: Results (example)

Production and consumption of coniferous roundwood

Production of industry develops positively in two scenarios. Nature oriented scenario (below): reduced domestic supply leads to decrease of industry production and consumption.

Note: Exogenous scenario settings for fuel wood consumption and dead wood supply lead to reduced potential!

Demand of domestic industry is also supplied by rising imports.
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Case Study 2: BEPASO

Project structure

STATUS QUO Bio-Economy → Model-based impact assessment → Stakeholder dialog → Synthesis and advice

Bio-economy pathways and social acceptance (focus on Germany, forestry & agriculture)

Project goal (for forest sector modelling):
Including „new values from wood“ into traditional wood products market modelling to adapt wood products market analysis and scenario assessments

-> What does that mean?
Case Study 2: BEPASO
Modified product structure

- "New" values from wood:
  - Dissolving Pulp as intermediate product
  - Cellulose-based chemical derivatives & cellulose-based fibres as end products
- 180 countries, 19 products
- Re-programming the model calibration for input data
- Estimate market elasticities for GDP and price
- Precondition to model impacts of bio-economy scenarios
Case Study 2: BEPASO
First test simulation results with dissolving pulp

→ Global production increases about 10 million tons in 25 years.
→ Production increases mostly in Asia, only slight increases in Europe. However, that seems to low as plans for capacity development in Europe (Scandinavia + AT) are actually at least at about 0.5 mill tons until 2020.
• Split of roundwood and sawnwood into C/NC is necessary for specific national analyses with GFPM (in Germany)

• Global model is used in order to show reactions with international markets

• Estimation of elasticities necessary when including new products

• Applications for specific national analyses were successful and showed (besides scenario settings) also interaction with international markets

• Further modifications of the model are possible but depend on scenario description. In future, focus will be also on European and/or global analyses
Thank you for your attention!

Dr. Holger Weimar
Tel: +49 (0)40 73962-314
Mail: holger.weimar@thuenen.de

Thünen Institute of International Forestry and Forest Economics
Leuschnerstr. 91
21031 Hamburg, Germany
Web: www.thuenen.de

The Johann Heinrich von Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries – Thünen Institute in brief – consists of 14 specialized institutes that carry out research and provide policy advice in the fields of economy, ecology and technology.
Annex

Sources: