# Estimating Carbon Stocks and Flows in the Wood Product Chain in Austria

## GHG accounting for the forest-based sector


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## Introduction – Problem Statement

A coupled dynamic simulation model covering the entire forest-based sector from forestry over intermediate to end products was developed to simulate carbon stocks and flows alongside the wood product chain. It addresses several scenarios impacting distribution of resources addressing economic as well as political developments. Such trends have an impact on carbon flows and thus on national reporting on greenhouse gases (GHG).

The model considers supply behaviour and development of the Austrian forestry sector as well as previous studies covering this topic (Schwarzbauer 2012; Schwarzbauer et al. 2012). Based on stocks and flows for each product category the coupled carbon model estimates carbon stored in wood products within IPCCs production approach (cf. Stern et al., 2009; according to IPCC, 2006), considering retention with product half-lives.

Four scenarios were chosen to be investigated within the project: basis scenario, increased energetic use, building up stocks of HWPs and optimized cascade use, increased use of substitution products. The scenarios represent plausible different developments of these aspects and have the aim to isolate and uncover different effects on the greenhouse gas balance.

Aim of the project: Analysing and describing essential basics for the estimation of possible developments and dimensions for the offsetting of harvested wood products (HWPs) for political decisions and instruments (e.g. taxation, legislation, government aid, etc.).

## Model Structure

To reduce complexity, Austria is abstracted as one region, which is simulated depending on economic developments in interaction with import and export flows from a hypothetical rest-of-the world region (RoW). Thus the model is very flexible to project future policy development onto the wood production chain in a "what-if"-approach.

The model consists of two coupled sub-models. Part one is modelling wood stocks and flows alongside the wood production chain (four sections), the second part (three sections) utilises data from part one to perform accounting on carbon stocks and flow based on sequestration and substitution effects as well as product half-life times. For a general structure cf. Figure 2.

## Scenarios

Apart from the reference scenario (***Scenario 1***), the model covers three specific policy scenarios for Austria:

***Scenario 2 – Wood for energy***
The NREAP is developed further. Demand for fuel wood rises considerably through increased subsidies. Subsequently, more biomass power plants are used and the energy mix is shifted towards wooden biomass. Wood forest management thus intensifies utilisation.

***Scenario 3 – Intensified cascade use***
Promotion of utilising wood for construction purposes through incentives and legal measurements. Additionally, technological development extending the spectrum of use is encouraged. Wood-for-energy use is reduced and wood waste valorisation is optimised.

***Scenario 4 – Reduced utilisation***
Because of policy decisions, forest areas available for wood supply are set aside for conservation purposes through incentives and subsidies targeting reimbursement for loss of utility and carbon sequestration.

## Results (Preliminary)

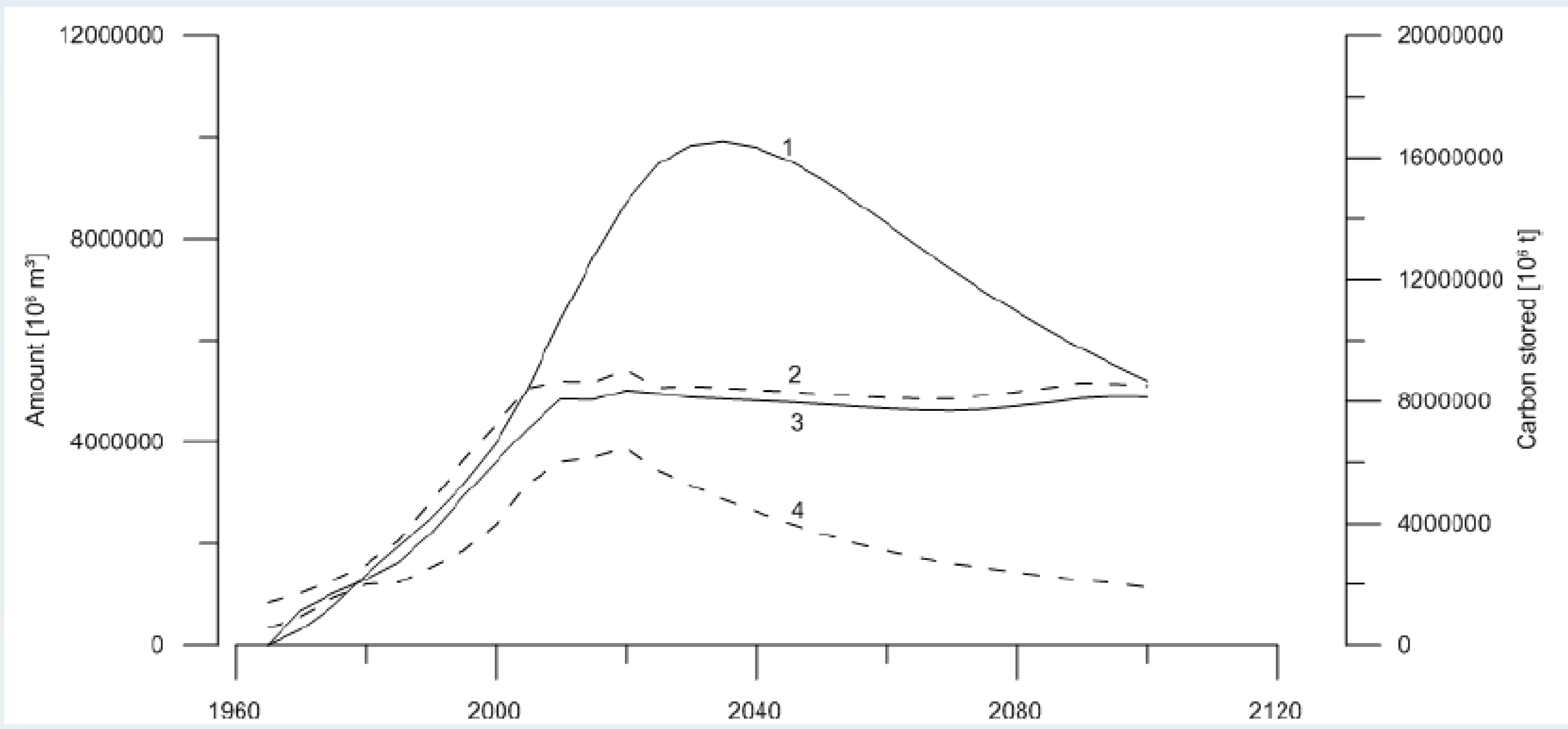


**Fig. 1:** Carbon stored in particle and fibre boards (1) and corresponding amount produced (4), Analogously, for carbon in paper (2) and produced amount (3).

Preliminary simulations were made incorporating historical data from 1965-2100 and investigating the period from 2010-2100. First results show an overall diminishing carbon stock for forest resources due to increased logging behaviour. Because production is peaking and then declining or remaining stable in some sectors, also the carbon stocks are diminishing for those products, after an according half-life time lag respectively. Such delays are easily visible from Figure 1, showing an obvious time lag for the peak in carbon stock from carbon stored in particle- and fibre boards which is due to the relatively long half-life time of 15 years (in contrast to this: Paper with 2.5 years)

## Outlook

To date, only the reference scenario was modelled and there is still further implementation necessary to comply with IPCC requirements. There is still more detailed data needed for a thorough assessment of GHG stocks and flows on the product level. This makes it also necessary to break down stocks and flows from product categories to the very products. A further goal is to consider distributed pools for expected life times for products with regard to their year of production. Also comparison of decay modelling using a Gamma distribution approach to the current approach could yield interesting results.

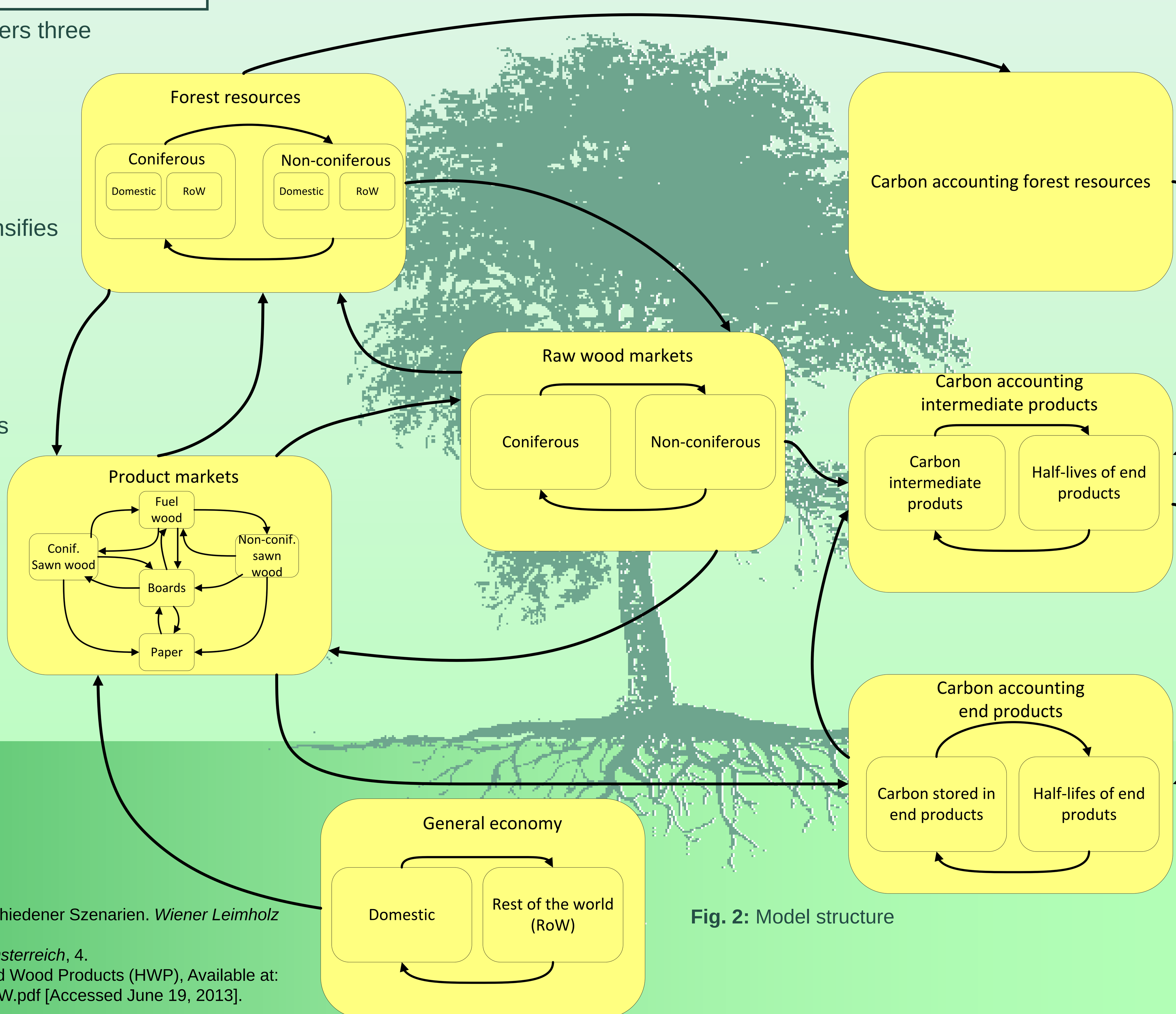


**Fig. 2:** Model structure


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