



EUROPEAN FOREST INSTITUTE

ECONOMIC, SOCIAL, AND ENVIRONMENTAL SUSTAINABILITY IMPACTS OF BY-PRODUCT UTILIZATION SCENARIOS IN FINLAND, FRANCE, GERMANY AND POLAND

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INTRODUCTION

- Industrial residues (sawmilling and panel residues and black liqueur) form 38.6% of the total harvested forest resources in Europe (Mantau 2012)
- For example, in the sawmilling process, 50-55% of the processed wood ends up by products consisting of bark (10-12%), wood chips (28-32%) and saw dust (10-15%) (Karhunen, 2010)
 - **Uses and use rate clearly affects the economic profitability of the wood product industries, and implementation of the circular economy.**
- By-products are mainly utilized in pulp- and panel production or energy (Mantau, 2015), but new possibilities exist in the chemical and biofuel industry (Routa et al., 2017)



Source: Maaseudun Tulevaisuus (2016)

INTRODUCTION

- The most optimal allocation of by-products in terms of sustainability is still unclear, because:
 - The uses such as pulp, energy and bioproducts all have different advantages and disadvantages
 - Various sectors are competing of the same raw materials (Giurca and Späth, 2017), and favouring one industrial sector over another, could result in climate benefits, but for example decrease employment or the value of export
 - Excluding energetic uses of by-products in a region with scarce renewable energy sources, could lead to increased harvesting rates or use of fossil fuels (Suominen et al. 2017)
- In the end, the sustainability impacts of any by-product allocation model, are therefore depending on existing country-specific circumstances and potential;
 - forest resources and their use
 - industrial structure
 - export and import rate
 - market forces

OBJECTIVES

The aim of this study is to assess the economic, social and environmental sustainability impacts of different by-product allocation scenarios in different circumstances; in Finland, France, Germany and Poland

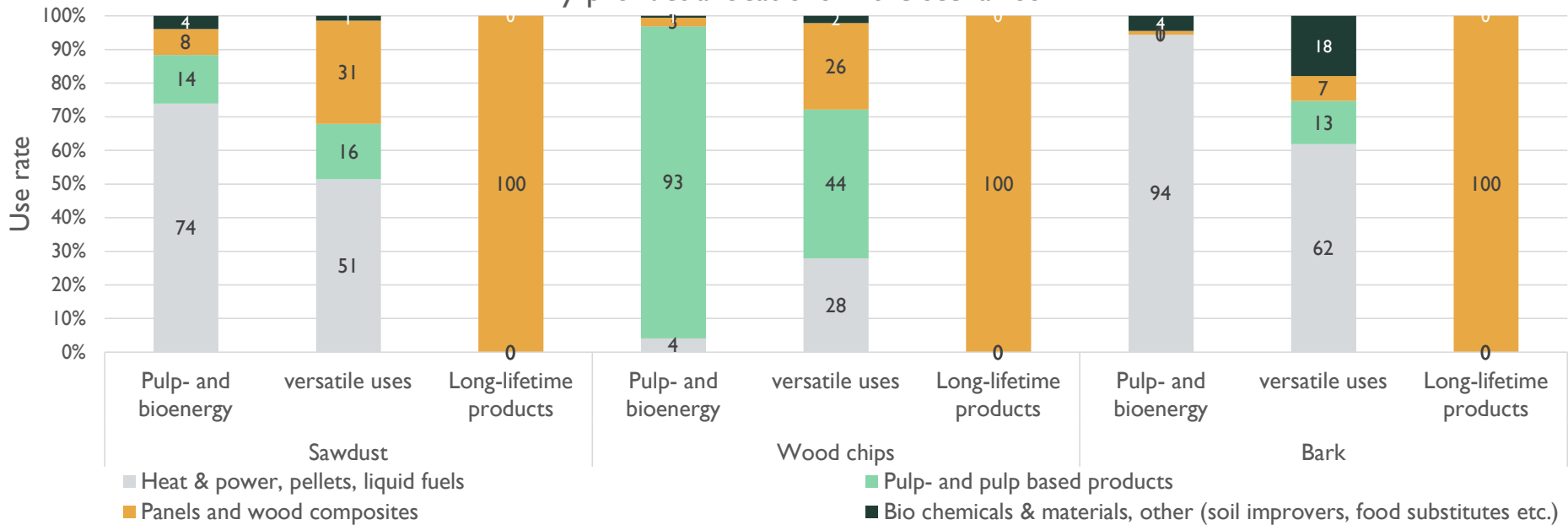
- Previously in the study of Kunttu et al. (unpublished), three desired future scenarios of by-product allocation were determined in Finland
- Now, by combining by-product allocation scenarios to existing forest value chains, the sustainability impacts of the alternative scenarios are compared to the baseline situation in each country

MATERIALS AND METHODS – WHAT ARE DESIRED FUTURE SCENARIOS?

- The formed scenarios represent;
 - I. Pulp and bioenergy: By-products are mainly used for pulp and energy production. This scenario reflects the current Finnish industry structure
 - II. Versatile uses: by-products have a great variety of uses including new bioproducts. Experts highlighted the economic risk diversification, as well as fossil fuel and -material substitution potential in this scenario.
 - III. Long-lifetime products: By-products are only used for wood composites-, and particle- and fiberboards, aiming to maximize the long-term carbon storage in harvested wood products.

MATERIALS AND METHODS – WHAT ARE DESIRED FUTURE SCENARIOS?

By-product allocations in the scenarios



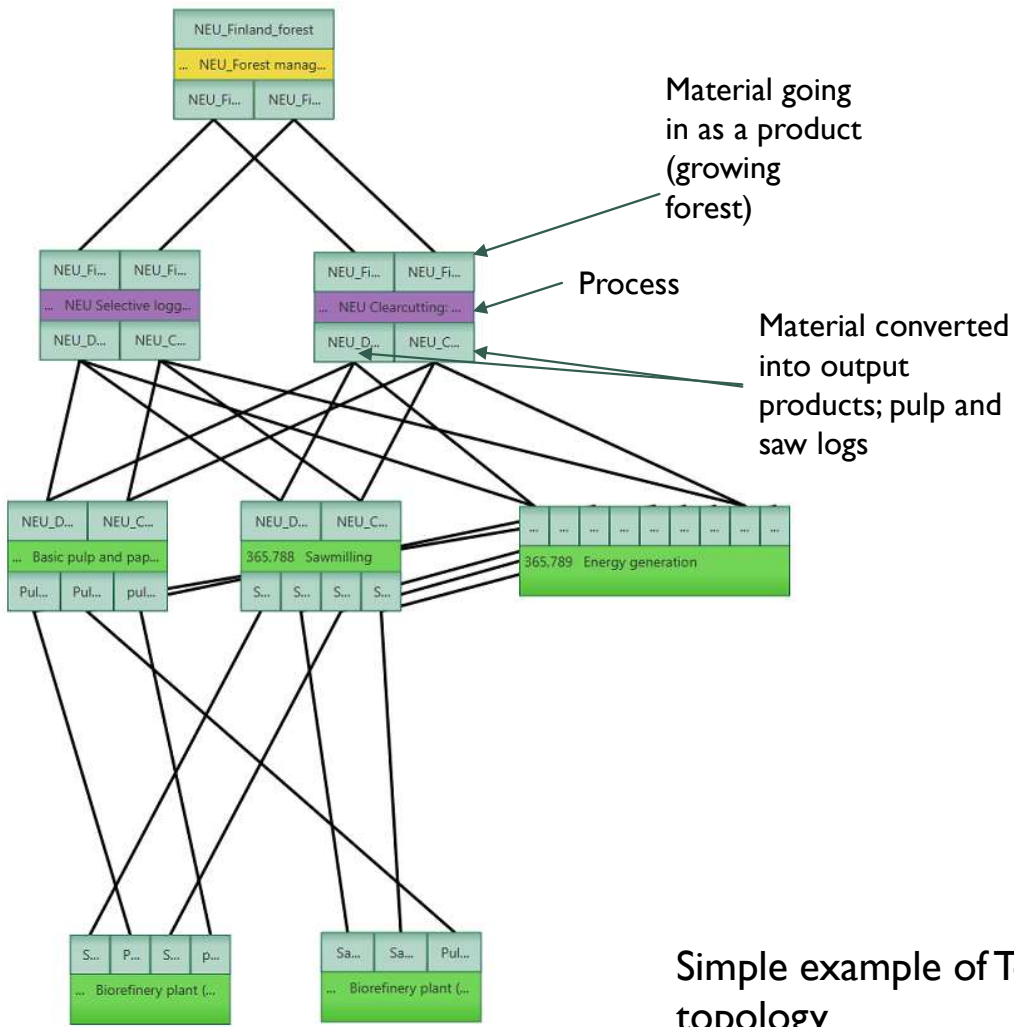
MATERIALS AND METHODS – REGIONS AND FOREST VALUE CHAINS

Finland	France	Germany	Poland
Extensive forest resources and dominating pulp industry, high interest on biorefineries	Nearly half of the harvested round wood is utilized as fuel wood and the interest on material circulation is high	Nearly half of the industrial roundwood is processed into sawnwood, which means great potential in by-products. The interest on material circulation is high	Only 12% of the harvested roundwood is used for fuel wood, the rest is for industrial purposes. Extensive furniture production – long-lifetime products

Source; Eurostat 2017

MATERIALS AND METHODS – TOSIA AND INDICATORS

- The analysis will be carried out by ToSIA (Tool for Sustainability Impact Analysis), which is a process-based tool calculating material flows in forestry value chains and quantifying sustainability indicators. It compares alternative options in value chains, for example changes in production systems (Lindner et al. 2010)
- The forestry value chains in this study cover the processes;
 - from forest management to end-use of final products, in terms of local use or export (or combustion for energy). The value chains focus is on by-product flows; by-product formation and their further use
- Selected quantitative sustainability indicators in ToSIA:
 - Environmental: carbon storage in harvested wood products, greenhouse gas emissions, energy generation/energy use rate
 - Economic: production costs, value of export
 - Social: employment



Simple example of ToSIA value chain topology

MATERIALS AND METHODS – VALUE CHAIN ASSUMPTIONS

When forming alternative scenarios, some assumptions are needed

- Does the re-allocation of by-products;
 - increase the regional use of end-products, or export rate
 - decrease/increase the demand of imported wood
 - increase/decrease total harvesting rates

EXPECTED RESULTS

- Scenario Pulp and bioenergy
 - Considering existing industrial structure, possibly feasible in Finland and France resulting in higher value of export and reduced production costs, possibly higher emissions and decreased carbon storage
- Scenario Versatile uses
 - Considering existing industrial structure, possibly the most feasible in Germany resulting in increased employment, and higher value of export
 - Elsewhere, for example in Poland, may result in decreased carbon storage
- Scenario Long-lifetime products
 - Considering existing industrial structure, possibly the most feasible in Poland resulting in reduced production costs
 - Elsewhere may radically decrease the energy generation/use rate

UTILIZATION OF THE RESULTS

- Support the understanding of how re-allocation of wood in different countries affects the sustainability: what are the benefits and what kind of negative trade-offs may exist
- This will help decision makers as well as local industries to
 - set a common frame for bioeconomy development, but create tailor made national strategies
 - adjust their wood utilization to improve resource efficiency, employment, or for example self-sufficiency, depending on the existing demands.
 - avoid negative trade-offs when adopting new/modified wood utilization models

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