

New Methods for Life Cycle Assessment of Wood-Based Products and Bioenergy Solutions

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New methods development - LCI and GWP_{LULUC}

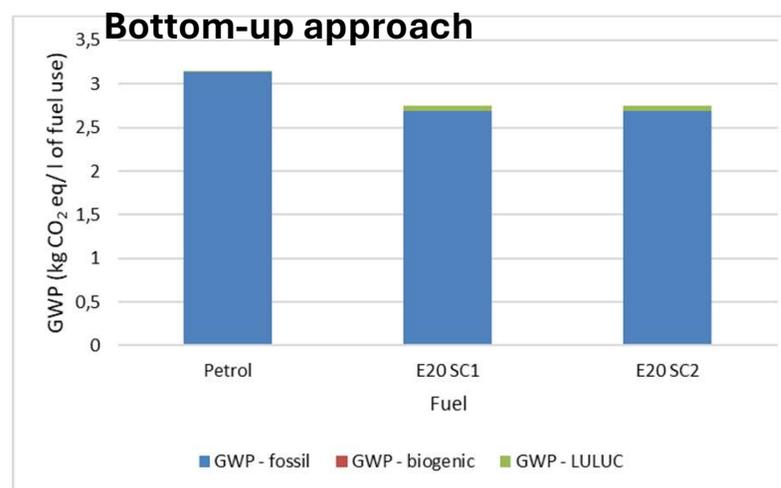
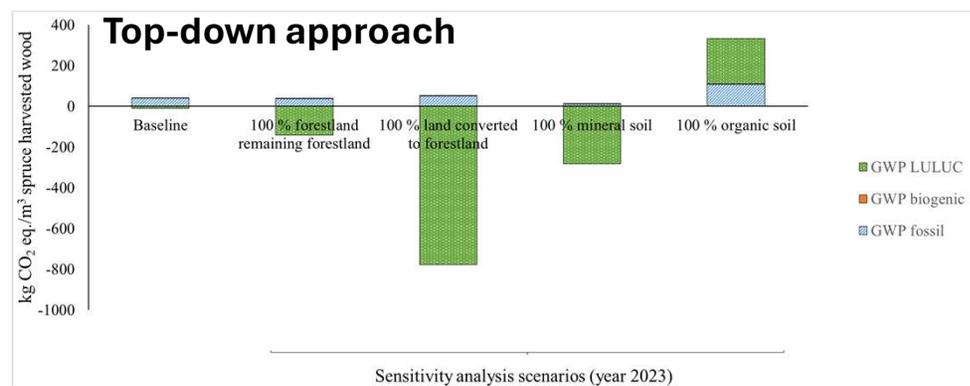
Life cycle inventory (LCI) for Finnish Forestry

Inventory summary data	
Products, 1m3	Sawlogs
	Pulpwood
	Energywood - whole tree
	Logging residues
	Fuelwood
Environment	Wood
	Energy, gross calorific value, in biomass
	Carbon dioxide, in air
	Occupation, forest, intensive
	Occupation, traffic area, rail/road
	Transformation, from forest, intensive
	Transformation, to forest, intensive
	Transformation, from traffic area, rail/road
	Transformation, to traffic area, rail/road
Technosphere	Diesel, burned in building machine
	Harvesting, energy wood harvester
	Harvesting, forestry harvester
	Forwarding, forwarder
	Gravel, crushed
	Wood chipping, at forest road



(Luke, Finnish Forest Industries, Ecoinvent (in ecoinvent v1,2))

GWP_{LULUC} Land use and land use change related global warming potential



(Lehtilä et al., 2025; Ghani et al., 2025)

E20: 20% blend of bioethanol with petrol;
SC: Scenario with spruce energy wood residues in different municipalities

Life Cycle GHG emissions of Finnish forest sector 2023

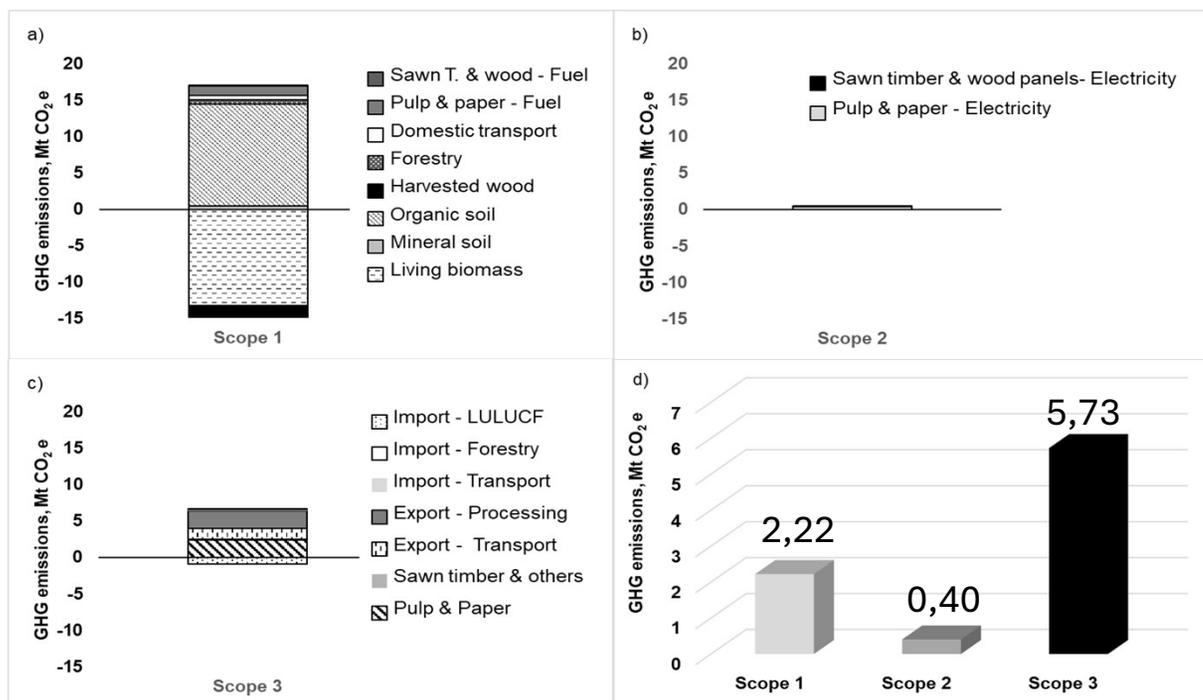
GHG protocol/Organizational carbon footprint

Product-specific LCA

Forestry LCA

National statistics (wood use, transport, import, export)

Emissions data from GHG inventory



(Alam et al., 2026, Submitted)

Scope 1: Direct emissions

Scope 2: Indirect emissions from electricity

Scope 3: Other production chain emissions

- Domestic LULUC (Scope 1)
 - **Living trees (-)**
 - Mineral soils (+)
 - Organic soils (+)
 - **Harvested wood product (-)**
 - Forestry (Scope 1) (+)
 - Domestic transport (Scope 1) (+)
-
- Pulp, paper, board
 - Fuel (Scope 1) (+)
 - Electricity (Scope 2) (+)
 - Other materials (Scope 3) (+)
 - Sawn timber, panels etc.
 - Fuel (Scope 1) (+)
 - Electricity (Scope 2) (+)
 - Other materials (Scope 3) (+)
-
- Wood import (Scope 3)
 - **LULUC (-)**
 - Forestry (+)
 - Transport (+)
 - Export (Scope 3)
 - Processing abroad (pulp -> paper) (+)
 - Transport (+)

What could be done further?

Regional/ Landscape/Company portfolio LCI

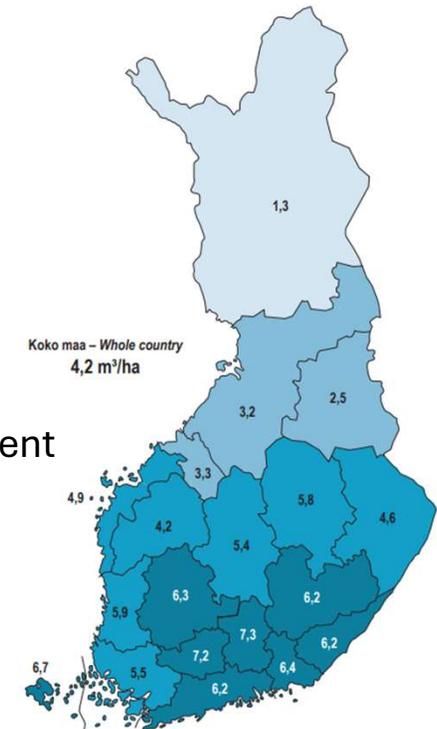
- **Management and harvesting** variation, among regions due to soil types!!
- **Wood transportation**, adapted to Finnish lorry/truck

GWP_{LULUC}

- **Annually updated & aggregated** (i.e., region, soil type, species, etc.) assessment
- **Management practices** specific factors for better assessment

Biodiversity impact - LCA based

- **Choice of indicators** (EU, National and Company level)
- **Current inventory** may partly support modelling of biodiversity impacts!!

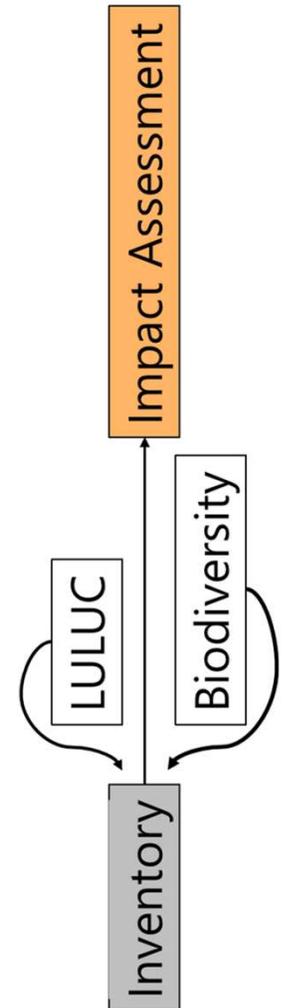


Lähde: SVT: Luonnonvarakeskus - Source: OSF: Natural Resources Institute Finland

Kuva 5.6 Hakuukertymä keskimäärin (m³/ha) puuntuotannon metsämaalla 2021
Figure 5.6 Mean total roundwood removals (m³/ha) on forest land available for wood production, 2021

Questions for discussion

- **What is particularly interesting for companies in this topic?**
 - Environmental aspects from company perspective and decision making
 - Sustainability reporting, certification, product development, marketing
- **How the methods relate to company use cases?**
 - Inventory development, scope level assessment, fossil/biogenic carbon
 - Top down (average GWP LULUC) and bottom up (management change)
- **What additional information are needed?**
 - Aggregated inventory, LULUC, biodiversity, etc.
- **Any other thought of ideas, feel free to share!**



Thanks for your kind attention!

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