

Environmental impacts of land use in various sectors and product groups

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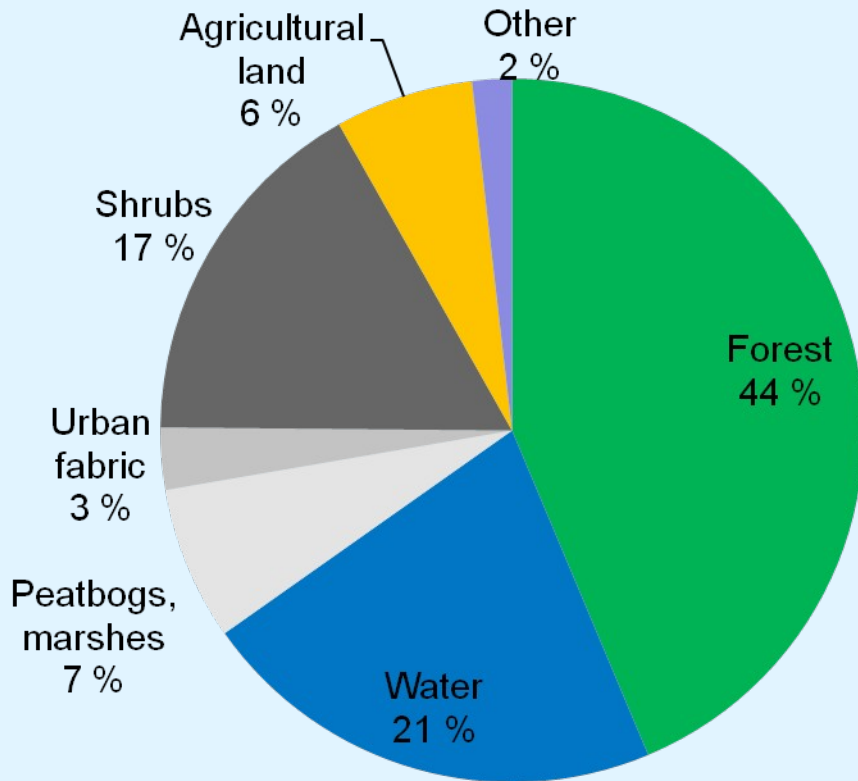
Structure of the presentation

- ENVIMAT: Environmentally extended input-output (EEIO) model with life cycle impact assessment (LCIA)

$$E = C \cdot F \cdot (I - A)^{-1} f$$

- An inventory of land-use/sector (m²a/M€)
- Land use → environmental impacts
- Sectoral impact → product LCAs
- Conclusions

An overview of land cover & use

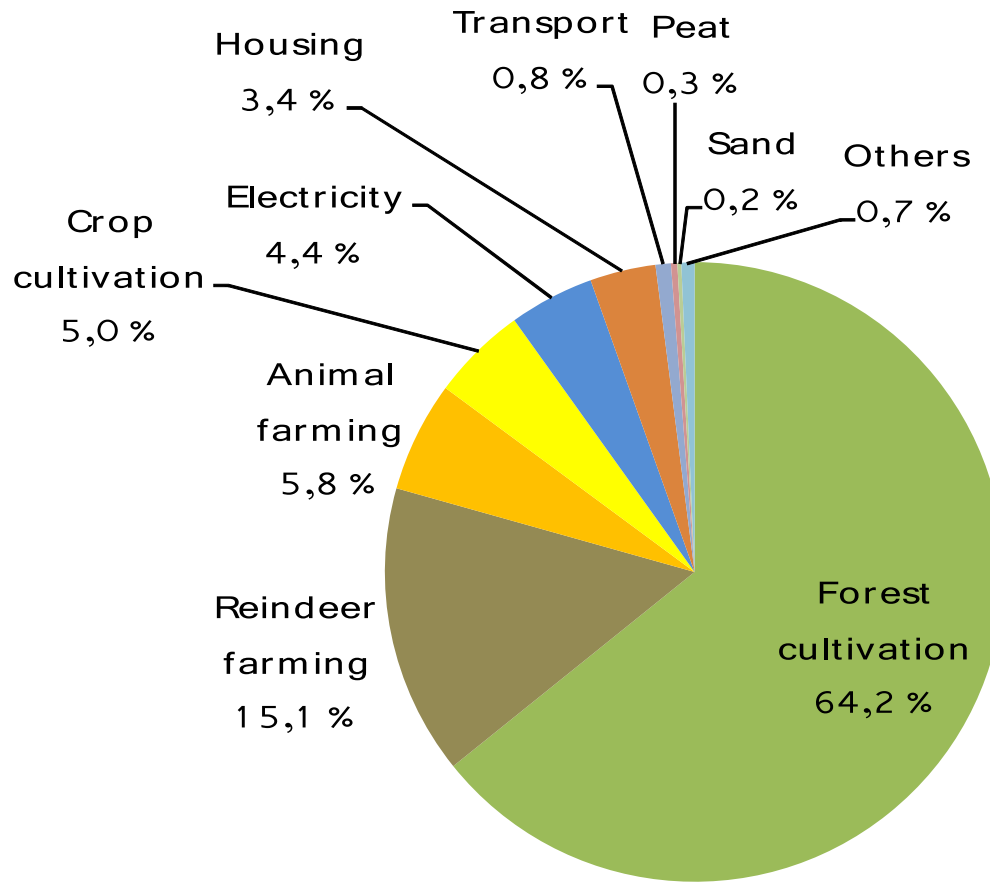


- **Forestry dominates**
- **Little agricultural land**
- **Urban fabric (residential, commercial and industrial)**
- **Extensive reindeer industry**

Corine 2000: Land cover dataset

Land use allocated to industries

70 % of inland area allocated to economic activities

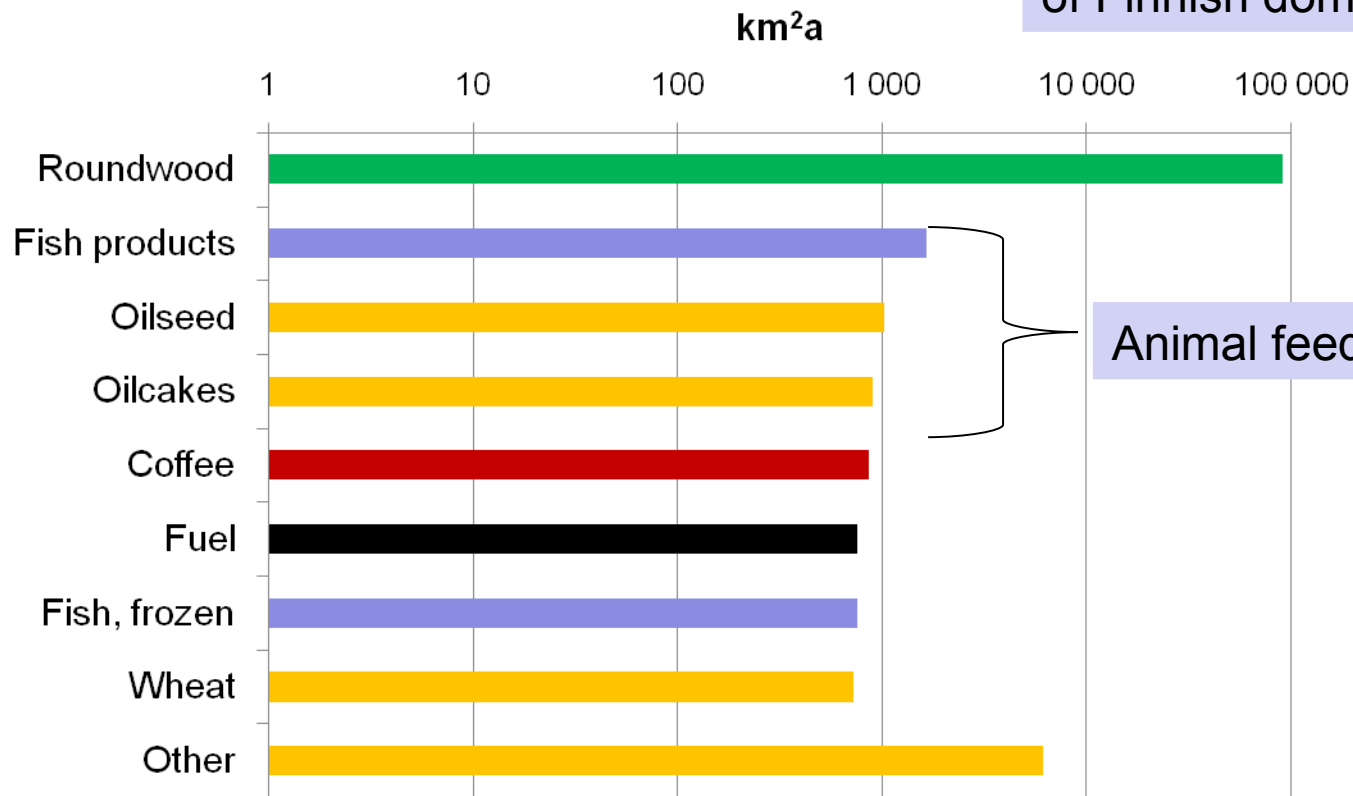


Not a typical EU-country!

Imported land area in 2002

- Area (km²a) = Imported amount (t) / Yield (t/km²a)
- LCA databases + FAOSTAT

Area occupied corresponds to 35% of Finnish domestic inland area



Russian wood to P&P

Animal feed

But land use is not an impact...

$$E = C \cdot F \cdot (I - A)^{-1} f$$

- Indicators related to land use occupation

$$C * m2a = \text{impact}$$

- One other type of indicator: IUCN direct threat to species

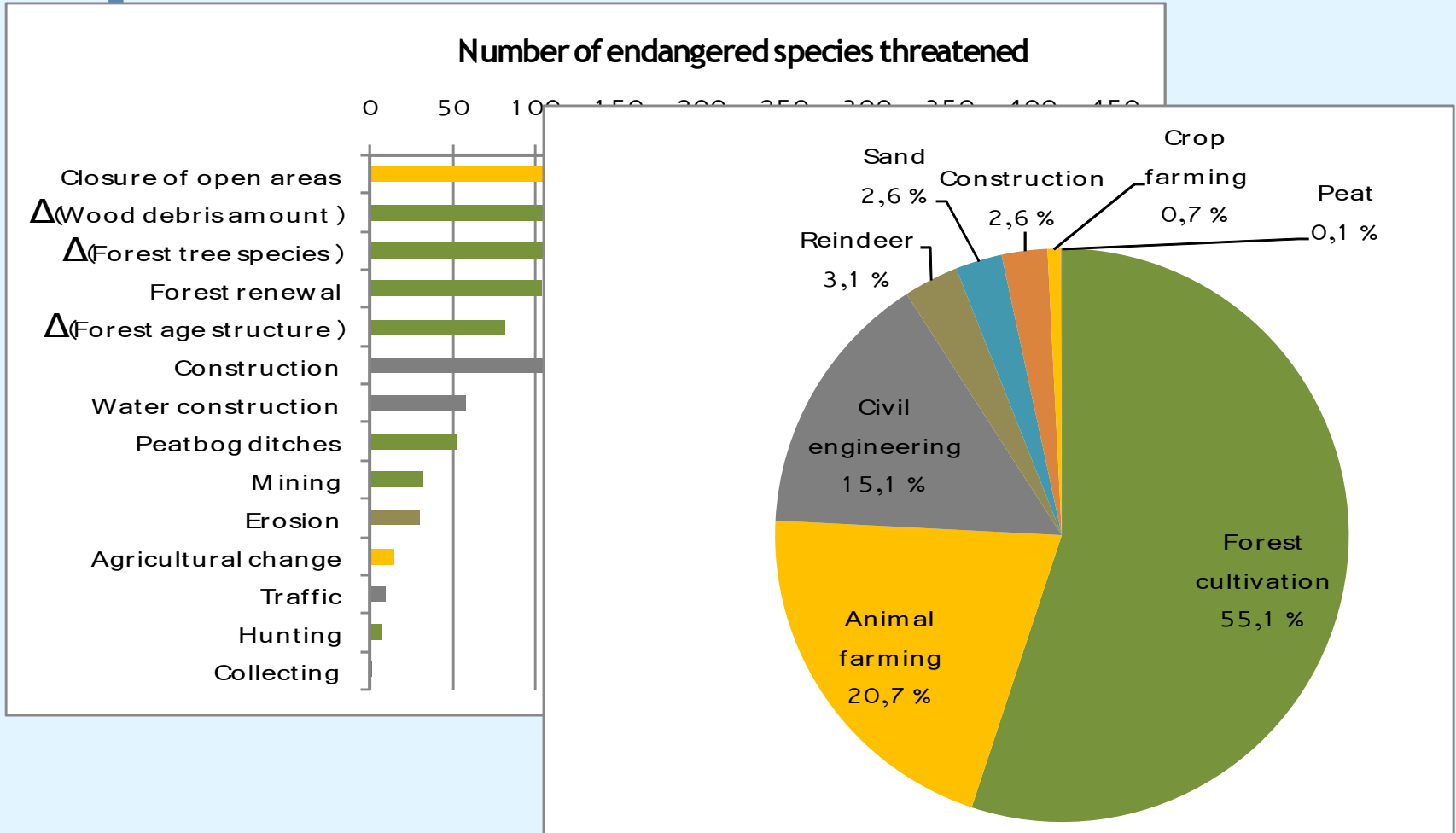
$$F = \text{impact}$$



Some aspects of land use impacts

Land use	Indicator
Resource for humans	Bioproductivity, naturalness
Habitat for other species	Species density, ecosystem degradation
Ecosystem services	C-balance, HANPP, Exergy
Impact to individual species	IUCN Red List, Primary threats

Primary threats to endangered species



Many indicators, same message

Bioproductivity (gha)

HANPP (Mt CO2)

Deviation from natural state (ha)

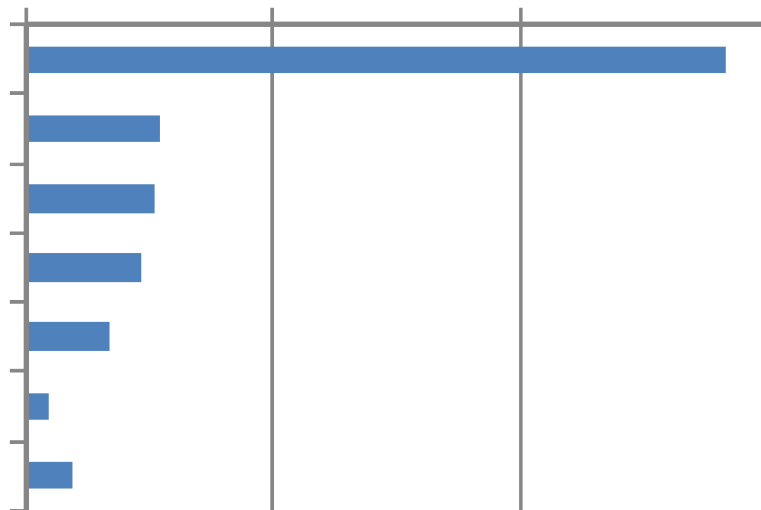
Forestry
Animal farming
Crop farming
Housing
Reindeer
Roads
Electricity
Sand
Other

-20 0 20 40 60 80

Forestry
Animal farming
Crop farming
Housing
Roads
Sand
Horticulture
Other

0 2 000 000 4 000 000 6 000 000

Forestry
Reindeer
Animal farming
Crop farming
Housing
Roads
Other



Comparison with the National biodiversity assessment

- **Main threats: loss of wood debris, closure of pastures, ...**
- **Some indicators track some of these impacts: EF biocapacity is not very good, since increased forest intensity increases capacity but leaves less NPP for fungi etc.**

From sector impacts to product LCAs

$$E = C \cdot F \cdot (I - A)^{-1} f$$

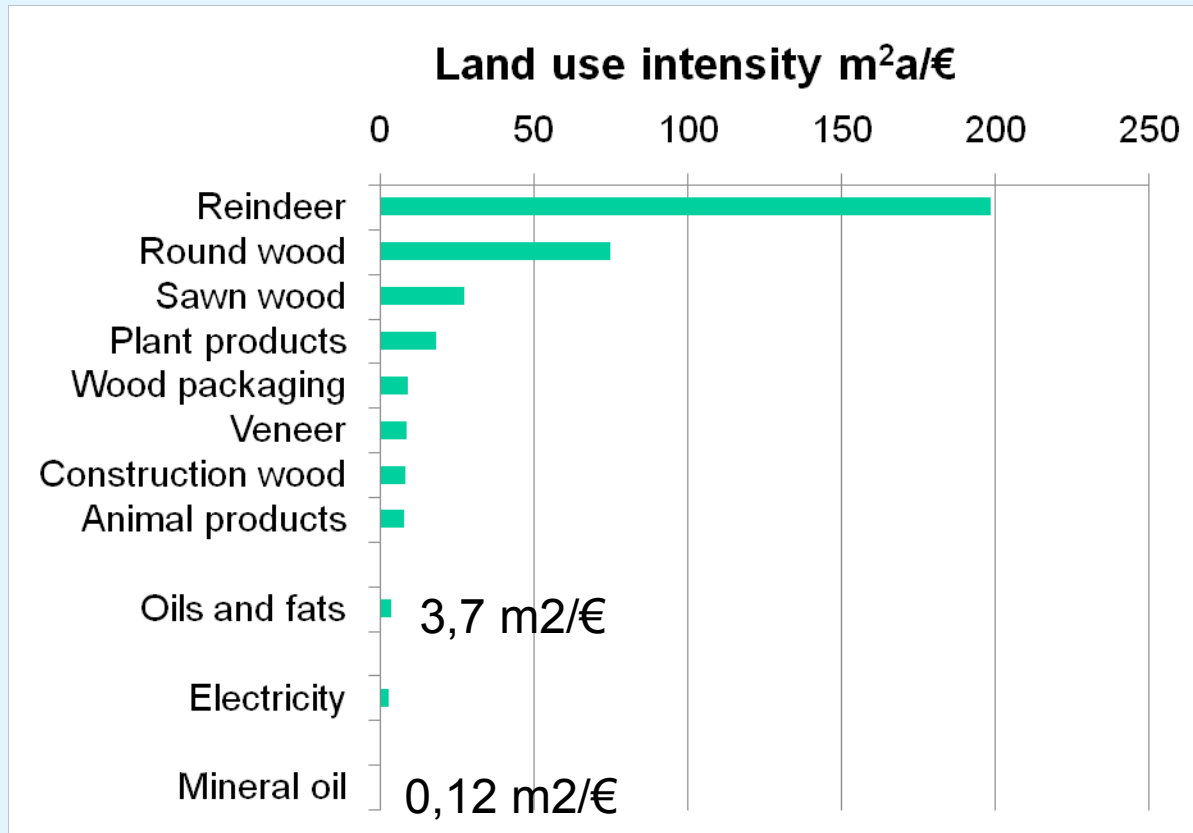
- Tracking of product chains to the final demand (either domestic demand or exports)
- Footprints of products

Products with most land use intensity

- **Land use**
- **Biocapacity**
- **Direct threats**

- **Comparison of oil and biobased products**

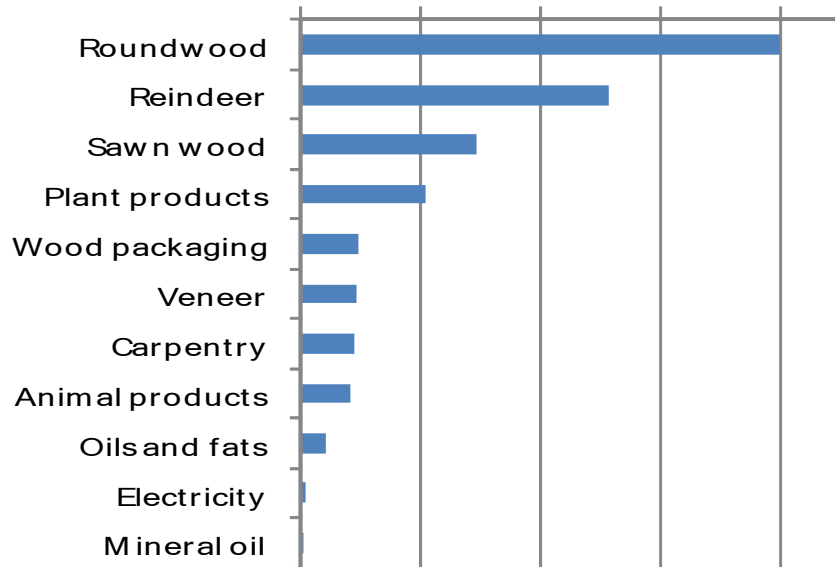
Land use intensity



Biocapacity and threats to biodiversity

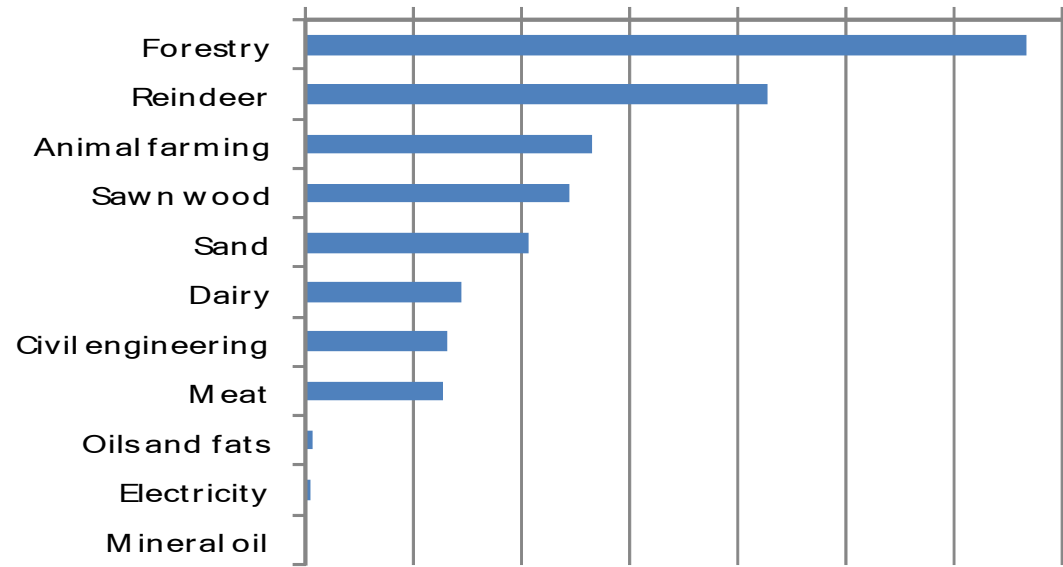
Bioproductive land (gm2/€)

0 50 100 150 200



Endangered species threatened (1/M €)

0 0,05 0,1 0,15 0,2 0,25 0,3 0,35



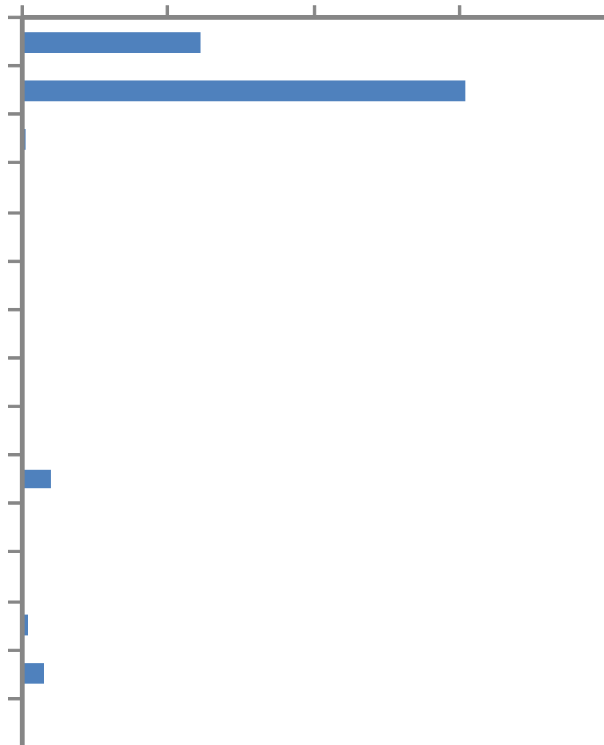
Export of land use

SECTORS

Land occupation (km²)

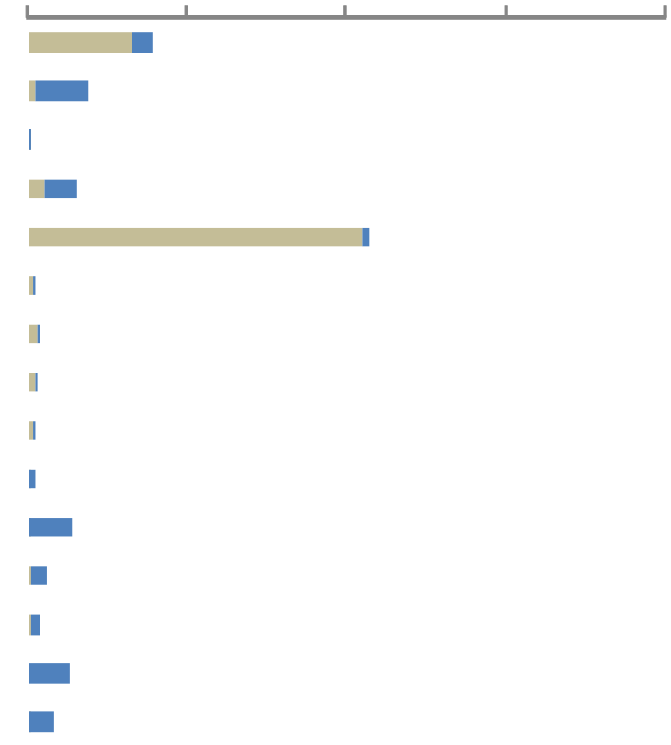
0 50 000 100 000 150 000 200 000

Agriculture
Forestry
Mining
Food industry
Forest industry
Chemical industry
Metal industry
Electric industry
Other industry
Energy production
Construction
Trade and restaurants
Transport
Real estate activities
Other service activities

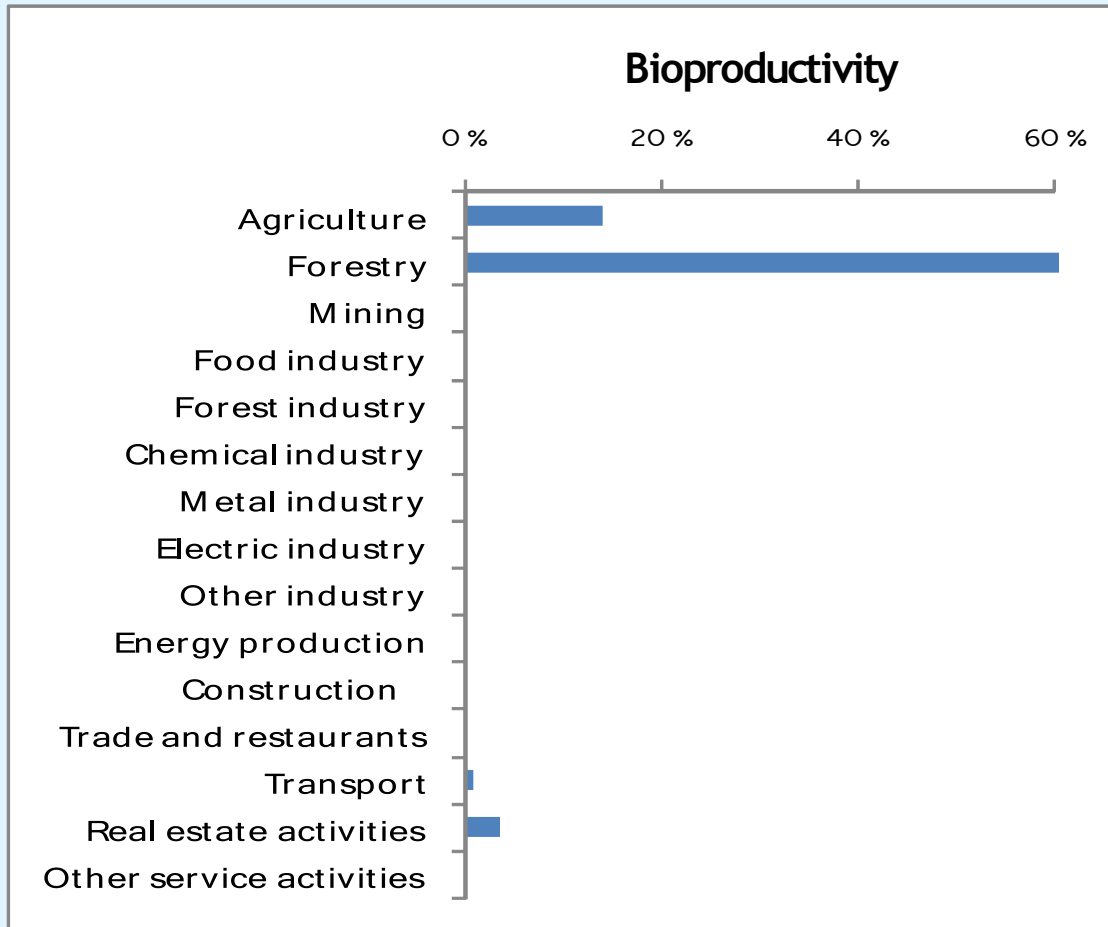


PRODUCTS km²

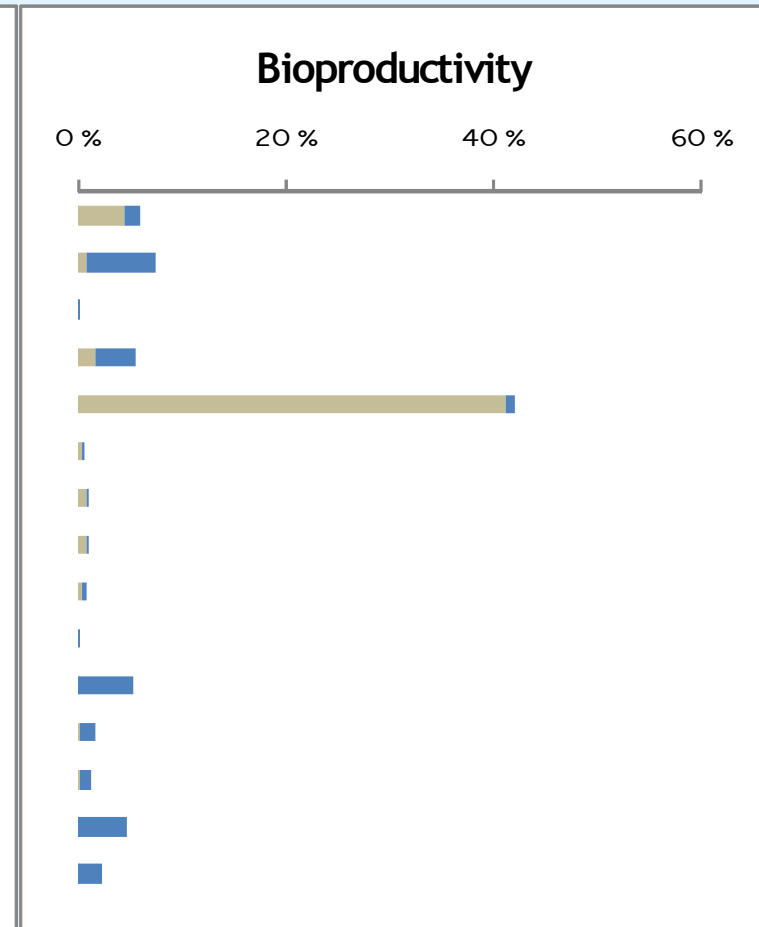
0 50 000 100 000 150 000 200 000



Export of impacts



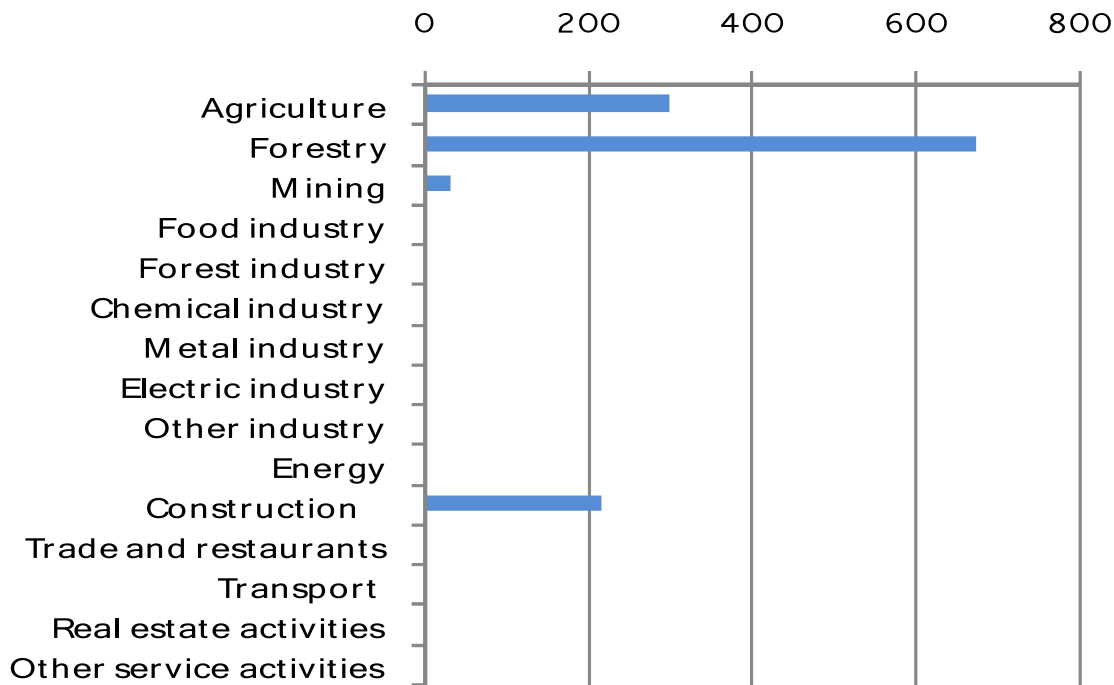
80 % of bioproductivity used



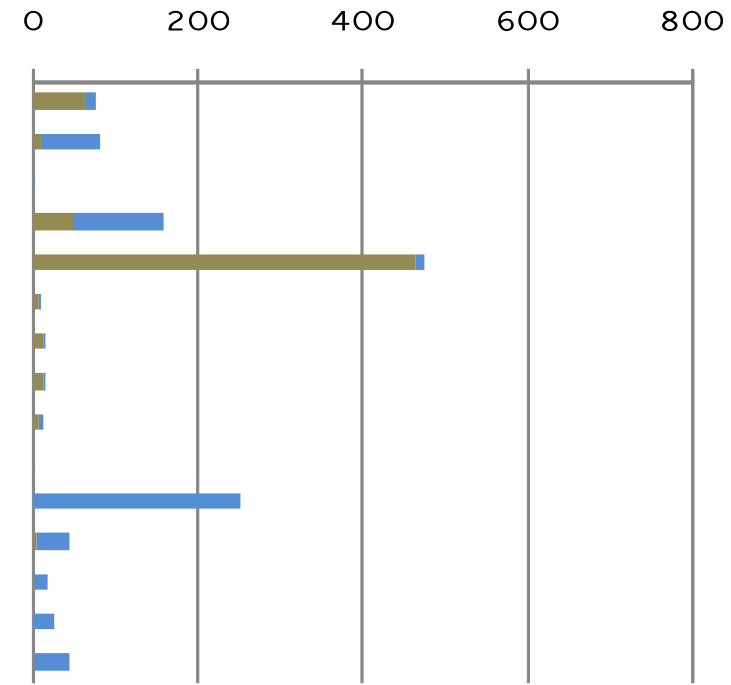
51 % of bioproductivity exported

Export of impacts

N# Endangered species threatened in Finland



N# Endangered species threatened in Finland



52 % of threats caused by export products

Imports and exports

- **About 50 % of impacts are caused by production of exported goods**
- **What about imports?**
- **35 % Land use (ha), 30 % biocapacity (gha)**
- **Almost all of the imported land is for export products (wood)**

Conclusions

- **Finnish forestry has resulted in increases of wood growth (1922-) and larger utilization of NPP**
 - **Good for CO2 balance & ecofootprint**
 - **Bad for biodiversity, HANPP**
 - **Conflict between increasing wood debris and bioenergy**

Much of the endangered biodiversity is on low productivity areas (meadows, pastures, rocky areas, beaches). Here there is no conflict for NPP, ...maybe synergy (meadows).

Conclusions

- The impacts of imports could not be quantified completely
- However it would seem that the Finnish economy is processing large amounts of biotic natural resources from abroad (c.a. 30 % of Finnish land area)
- Much of this is exported as wood products
- Impacts are caused abroad & the demand driving domestic damage is abroad → **national solutions are not adequate**