

Northern ToSIA

Assessing sustainability of forest based activities in rural areas of the Northern Periphery



Marcus Lindner

Multidimensional sustainability impact assessment with ToSIA - a framework to bridge from science to policy and practice

SUFAREL videoconference 14th March 2012



Northern ToSIA

Assessing sustainability of forest based activities in rural areas of the Northern Periphery



Outline

- Sustainability challenges in the Northern Periphery (and elsewhere)
- The ToSIA tool and its application in the Northern ToSIA project
- Assessing sustainability impacts of alternative bio-energy supply chains



Sustainability:

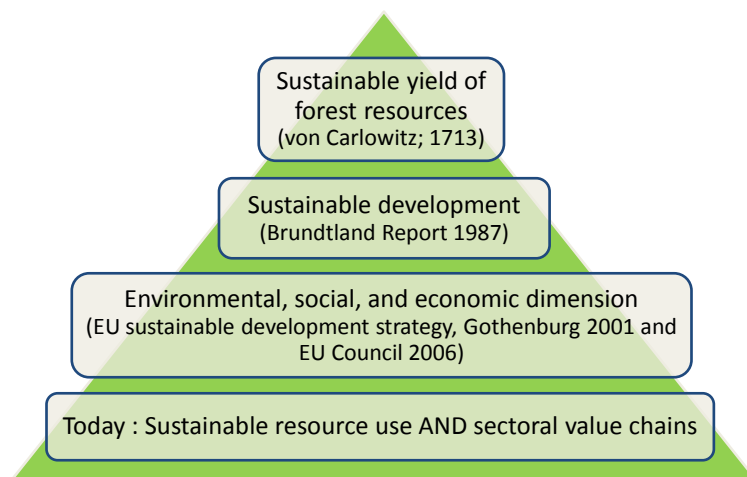
In 1987 the Brundtland Report provided a key statement on sustainable development, defining it as:

"[...] development that meets the needs of the present without compromising the ability of future generations to meet their own needs."



3

The sustainability concept evolved over the centuries



5

Northern ToSIA

Sustainability Challenges in the Northern Periphery

Environmentally friendly resource management

Securing social wellbeing in the region



Gällö in Jämtland, Sweden



Northern ToSIA

Environmentally friendly resource use



Fotos: Anne & Horst Helwig
www.helwig-naturfoto.de



Northern ToSIA



People: the social dimension

- Recreational use increases in importance
- Forest sector offers employment
- Cultural values, ...

Stora Enso to shut down two factories in Finland and one in Sweden - 1,400 jobs to go

Paper mill closure costs 250 jobs



Northern ToSIA



Value added:

- Forest-based sector is important for the regional economy



Gällö in Jämtland, Sweden

Foto: FVA Baden-Württemberg, Department of Forest Utilisation

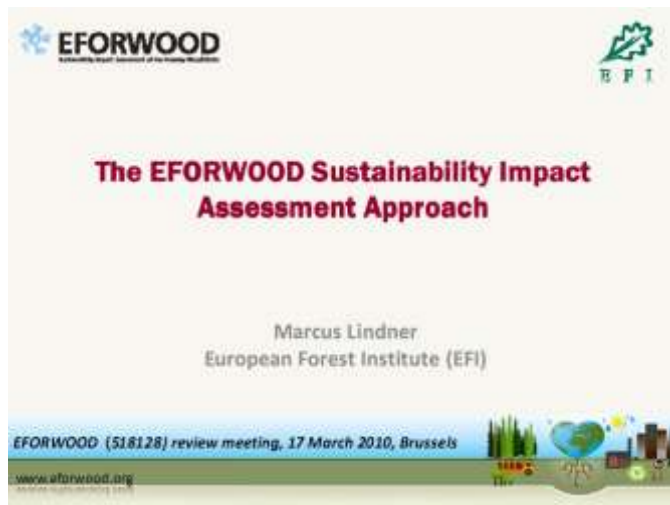


Vision of a Green Economy

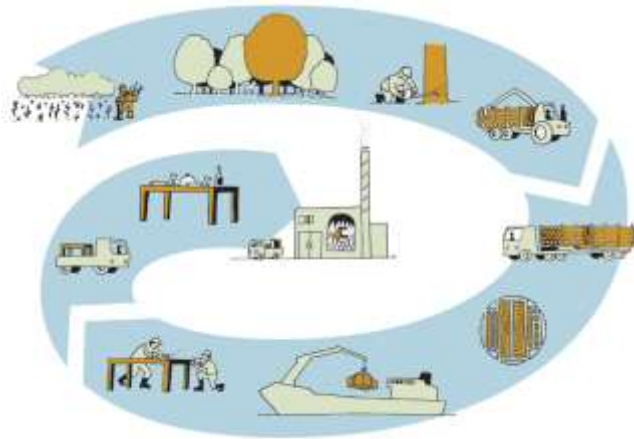


UNEP (2011)

- Supporting the Transition to a global green economy
- - Modelling tools
 - Improved governance structures
 - Proper financing



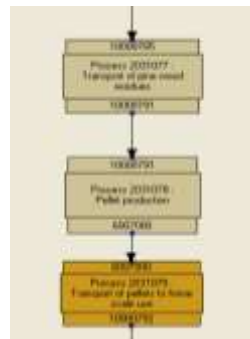
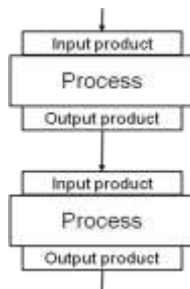
Northern ToSIA



Forest-Wood Chains (FWC):
from tree regeneration to end-of life of wood products



Northern ToSIA

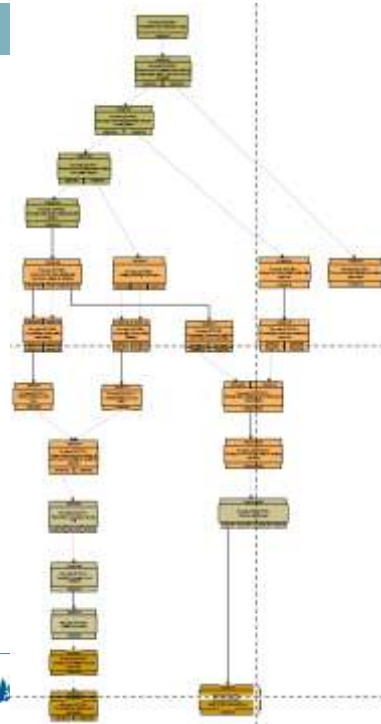


Real world



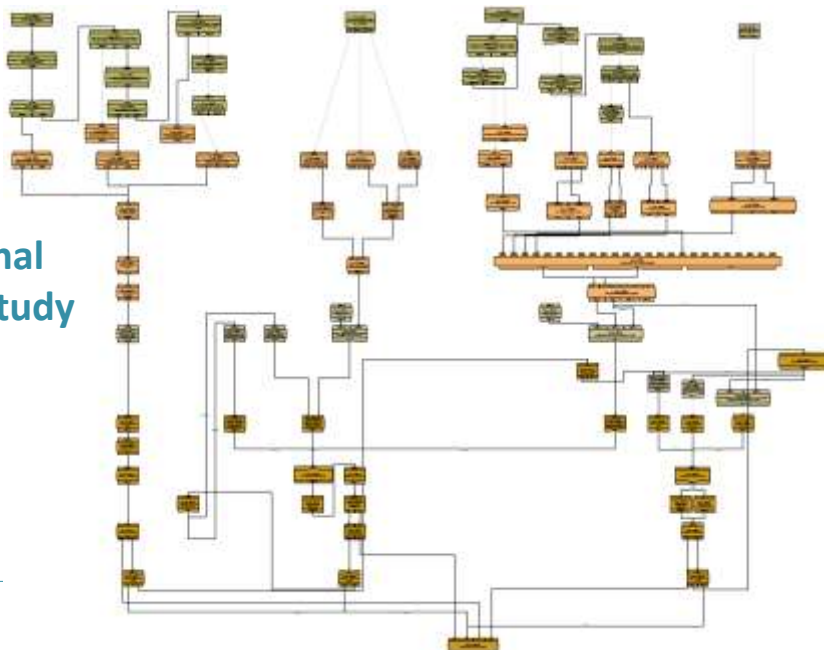
Northern ToSIA

Simple Forest Wood Chain Example



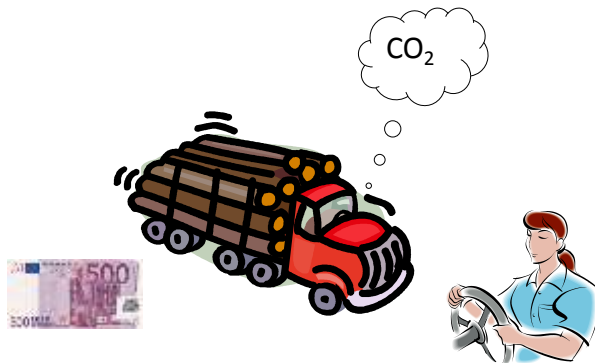
Northern ToSIA

Regional case study



How to calculate FWC sustainability?

ToSIA calculates material flows and links them with an indicator based impact assessment

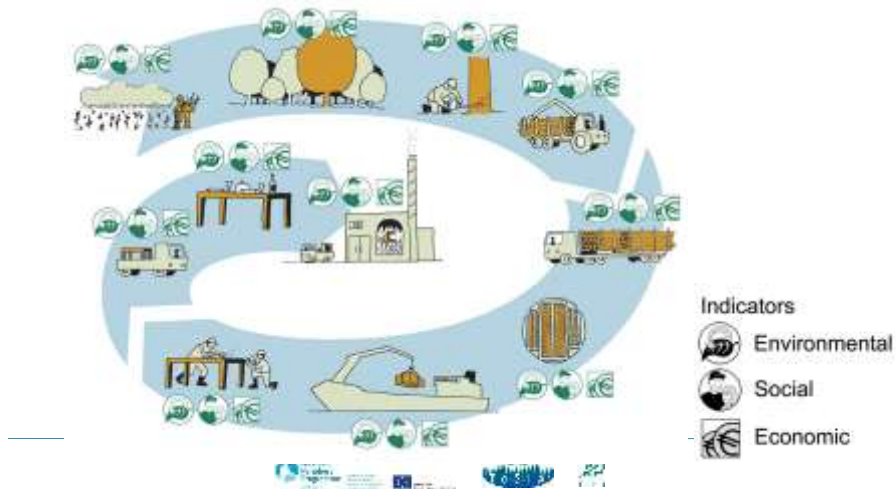


Every FWC process affects sustainability



Northern ToSIA

ToSIA links sustainability indicators to FWC processes



Northern ToSIA

Sustainability Indicators



Economic



Environmental



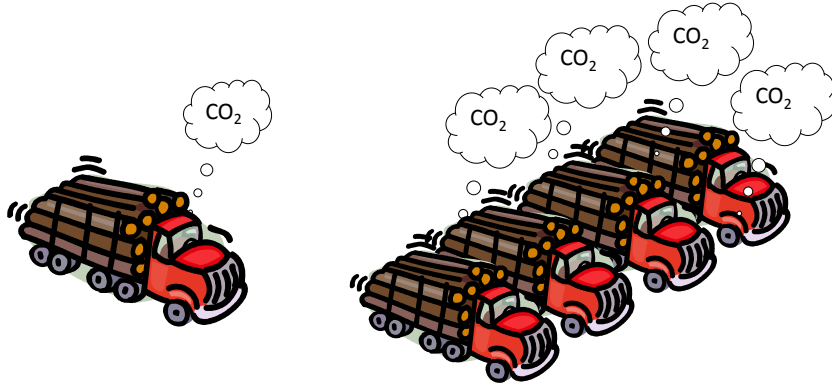
Social

- Gross value added
- Production costs
- Resource use
- Total production
- Labour productivity
- Investment, Research & Development
- Trade Balance
- Enterprise structure

- Energy generation and use
- GHG emissions & carbon stocks
- Transport distance and freight
- Forest biodiversity
- Forest resources
- Water and Air Pollution
- Generation of waste
- Forest Damage
- Soil condition
- Transport
- Water use

- Employment
- Wages and salaries
- Occupational safety and health
- Education and Training
- Innovation
- Consumer behaviour & attitude
- Corporate social responsibility
- Provision of public forest services
- Wages and salaries
- Quality of employment

Material flow effects on FWC sustainability calculation



Overall sustainability is quantified by multiplying relative sustainability impacts

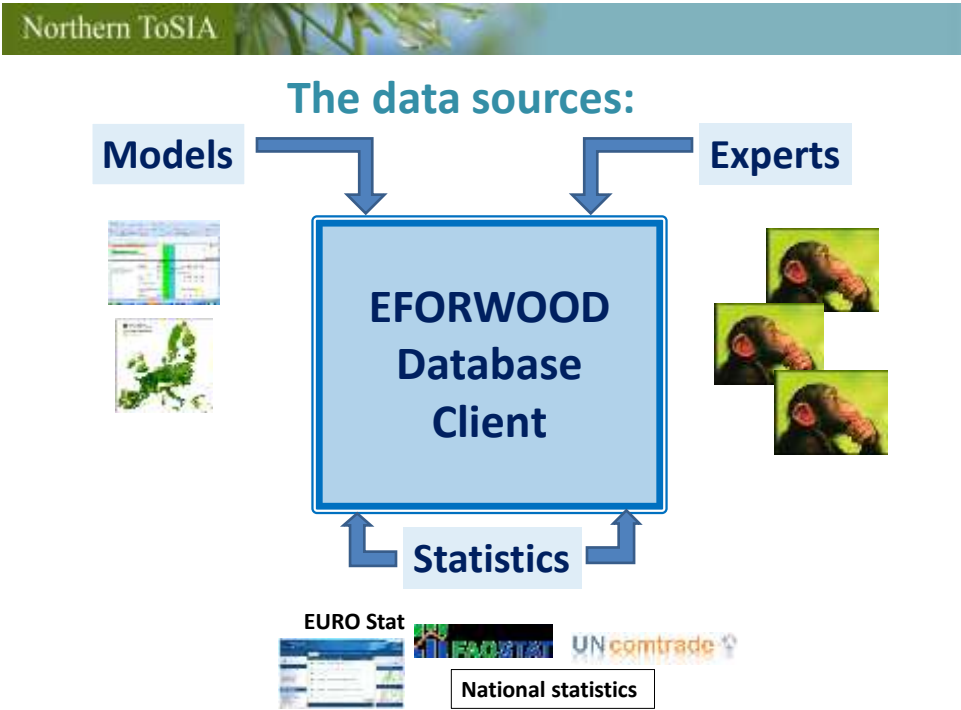


ToSIA is a tool to answer **WHAT IF? - questions.**

What if:

- ❖ Bioenergy use triples?
- ❖ Natura 2000 policy strengthens?
- ❖ Paper industry shifts production away from Europe?





Tool for Sustainability Impact Assessment (ToSIA)

ToSIA

Welcome | Data Preparation | Chain runs | Comparison | Analysis | About

Welcome

This is ToSIA (Tool for Sustainability Impact Assessment), the decision support tool for forestry sector. With this tool forest-based industry, national and international policy makers and researchers can analyse the sustainability effects of changes due to deliberate actions (e.g. in policies or business activities) or due to external forces (e.g. climate change, global markets). ToSIA analyses environmental, economic, and social impacts of changes in forestry-wood production chains, using a consistent and harmonised framework from the forest to the end-of-life of final products. It allows user to analyse different kind of sustainability effects in a balanced way. The first versions of ToSIA are the products of the EFORWOOD project financed by the 8th Framework Program of the European Commission.

```

    graph TD
      Start([Start]) --> D1{1}
      D1 -- No --> Info[Information]
      D1 -- Yes --> Chains[Chains]
      Chains --> D2{2}
      D2 -- No --> Info
      D2 -- Yes --> Comparison[Comparison]
      Comparison --> D3{3}
      D3 -- No --> Info
      D3 -- Yes --> Analysis[Analysis]
      Analysis --> Exit([Exit])
      Info[Information] -.-> D1
      Info -.-> D2
      Info -.-> D3
  
```

Information

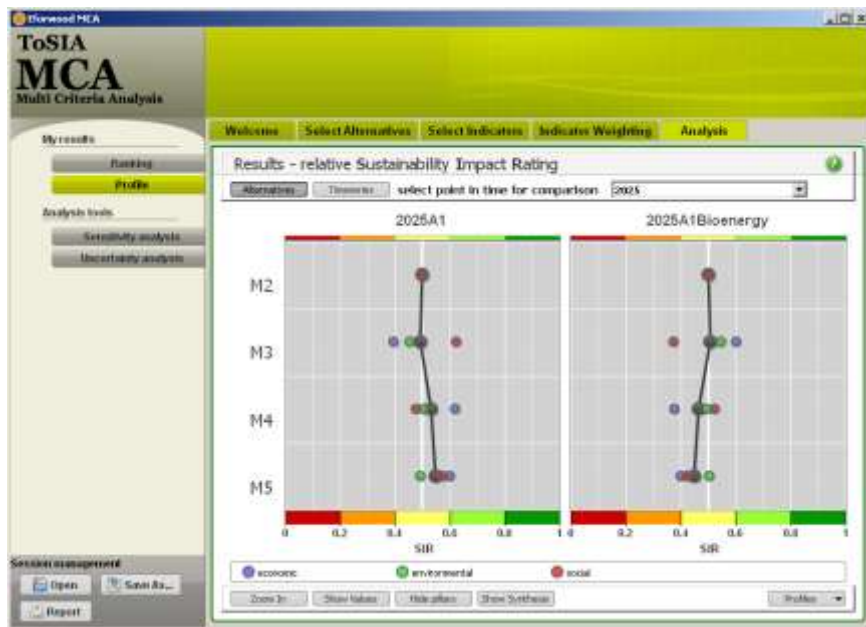
1. Use default data
2. Do comparisons
3. Do analysis

ToSIA useflow diagram

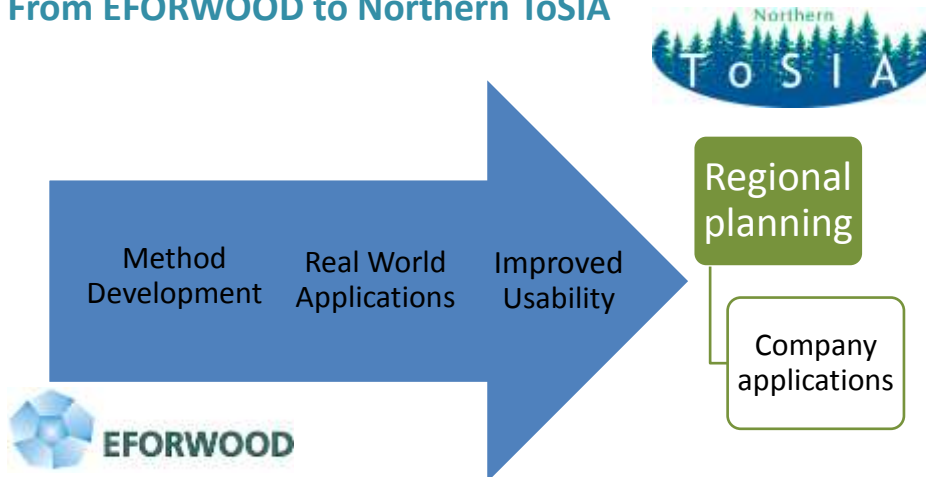


Northern ToSIA

MCA



From EFORWOOD to Northern ToSIA



Northern ToSIA objective

Long-term goal:
Improving sustainable forest resource use in the Northern Periphery



Project objectives:

- To test and develop the ToSIA tool in regional and company case applications
- To develop the tool applicability and necessary instructions for use in the Northern Periphery
- To disseminate the tool and user experiences for the whole Northern Periphery area

Northern ToSIA case study example



Alternative bio-energy supply chains in North Karelia, Finland

- Sustainability impacts of centralized vs. distributed forest bio-energy utilization
 - Tuupovaara Energy Co-operative (small scale DHP, distributed)
 - Outokumpu Energy (medium scale DHP, centralized)

12/03/2012
28

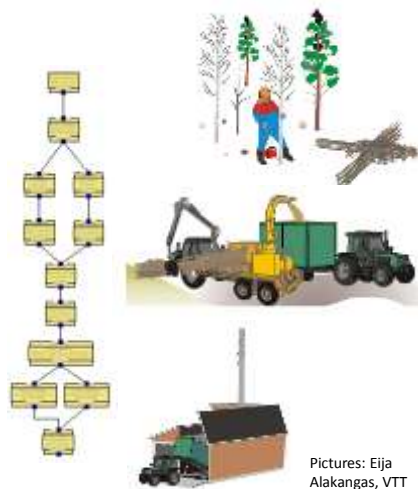


FWC processes: Tuupovaara Energy Co-Operative

- Motor manual whole tree harvesting from young stand
- Forwarding of whole trees
- Roadside chipping (chipping entrepreneur)
- Transport of forest chips to DHP
- Storing of forest chips
- Heat production and delivery



*Annual Heat
Production
ca. 3300 MWh*



Pictures: Eija Alakangas, VTT

12/03/2012

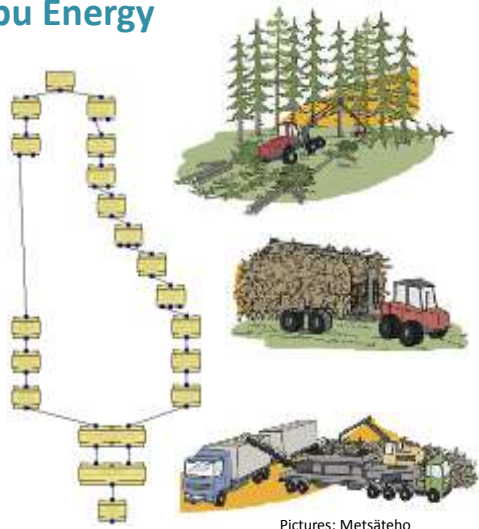


29

Northern ToSIA

FWC processes: Outokumpu Energy

- Mechanical whole tree harvesting from young stand (small harvester)
- Collecting of harvest residues from final felling
- Roadside chipping of whole trees and logging residues (drum chipper)
- Long distance transport of forest chips (chip trucks)
- Storing of forest chips
- Heat production and delivery



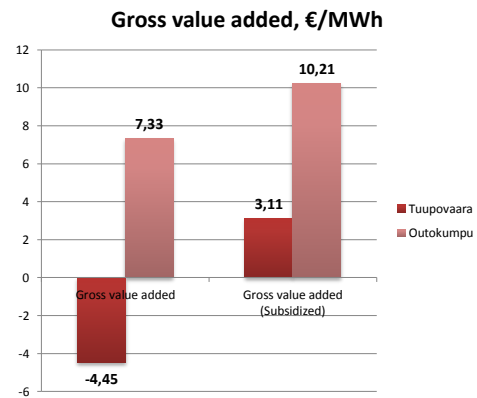
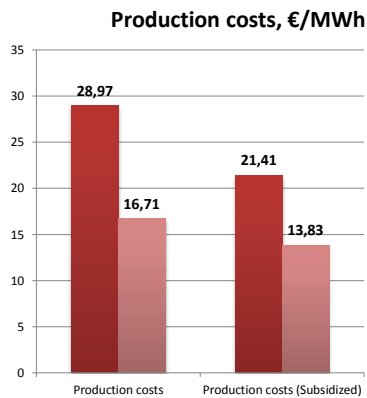
Annual Heat Production
53 000 MWh

Pictures: Metsäteho

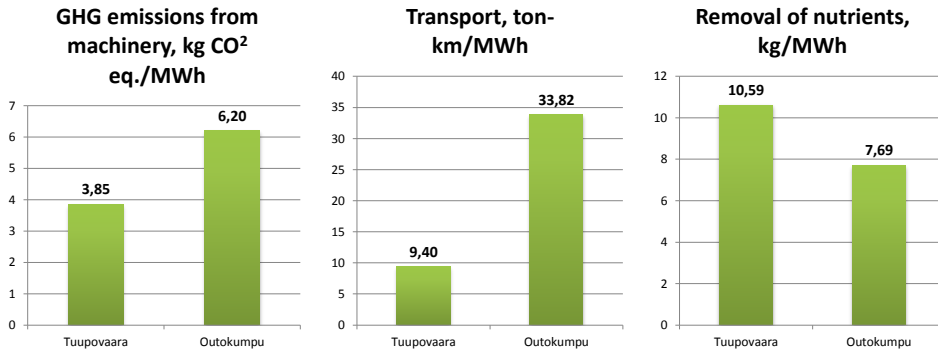


Northern ToSIA

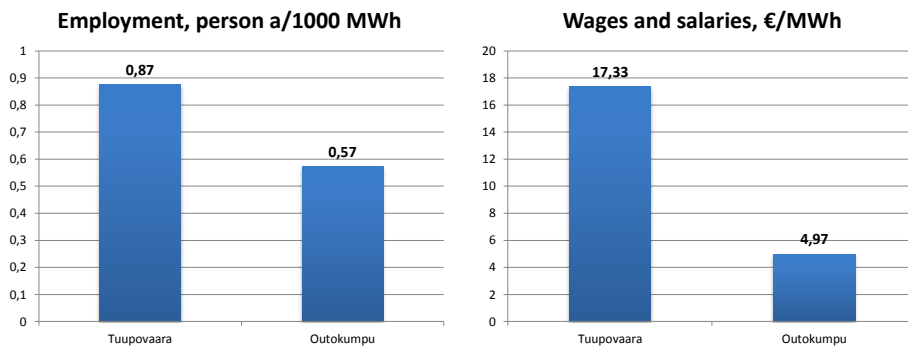
Economic indicators:



Ecological indicators:



Social indicators:

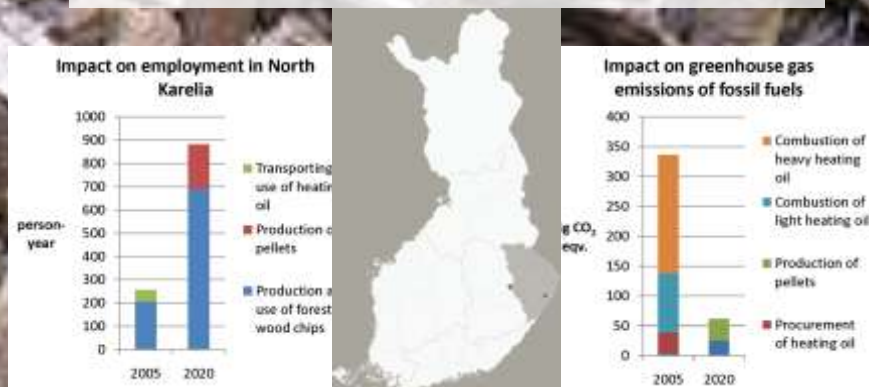


Northern ToSIA regional case studies

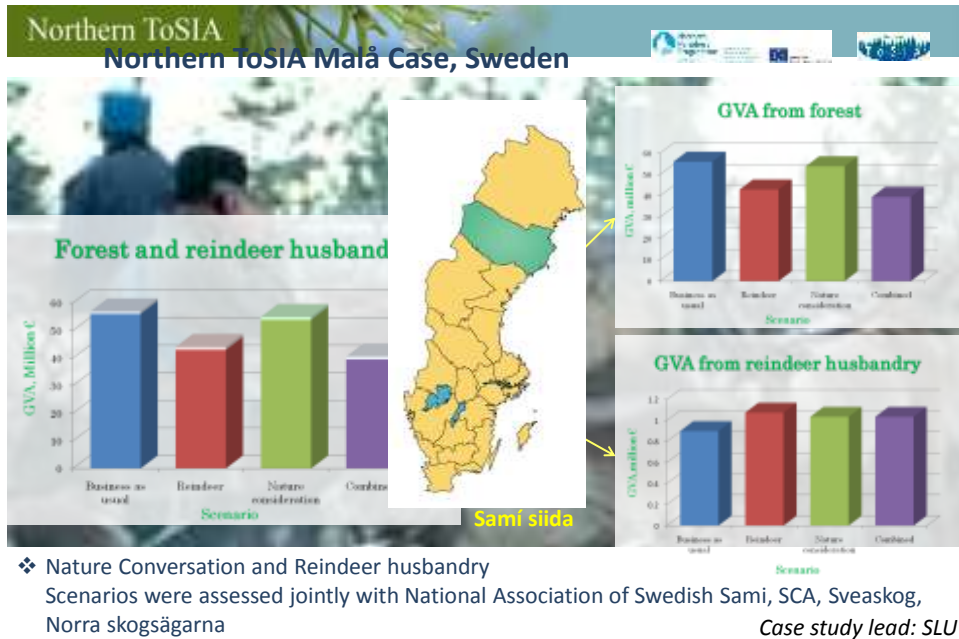


Regional Climate and Energy Programme:

Heating oil free NK by 2020: What are the regional impacts?



❖ A regional bioenergy production & use scenario was analysed in cooperation with the Regional Council of North Karelia (Eastern Finland) and Wood Energy Net (WENET)



Northern ToSIA

Success stories... Leaving footprints

- Regional Council of North Karelia, Finland: [Energy and Climate Programme](#) Preparation used ToSIA results
- Cairngorm National Park, Scotland: Proposed use of ToSIA approach for [National Park Plan 2012](#)
- Malå Sami Village: interest for continued communication between [Sami and forest industry](#)...

Source: Fotolia, 2011

Discussion (1) Experiences with ToSIA applications

- ToSIA provides a methodology to analyse sustainability impacts of policy and technology changes
- It allows comparing a suit of different resource uses and value chains against each other
- Ranking of alternative resource uses/value chains requires processing of results with a multi criteria analysis-tool
- Quantified indicator results for alternative resource use options can be evaluated by different stakeholders according to their preferences for different sustainability dimensions
- ToSIA can thus serve as a platform for communication and argumentation with stakeholders

12/03/2012



41

Discussion (2) ToSIA compared to other tools

- ToSIA is broader than LCA, as it can incorporate different types of indicators. The advantage of LCA is that suitable data have been collected for many sectors already. => LCA can be integrated into assessments with ToSIA
- ToSIA is more flexible than SIA tools like SIAT or SEAMLESS-IF, which depend on complex model linkages, whereas ToSIA can be used with different types of input data. It is currently applied in several studies with varying scope.
- An advantage of ToSIA is the established linkage with decision support tools based on MCA and CBA.

12/03/2012



42

Northern ToSIA



Northern ToSIA

Contact: Marcus.Lindner@efi.int

Recent publications:

- Lindner, M., Suominen, T., Palosuo, T., et al. 2010. ToSIA – A Tool for Sustainability Impact Assessment of Forest-Wood-Chains. *Ecological Modelling* 221, 2197–2205.
- Lindner, M., et al. 2012. Conducting sustainability impact assessments of forestry-wood chains – examples of ToSIA applications. *European Journal of Forest Research* 131, 21-34.
- Päivinen, R., Lindner, M., Rosén, K., Lexer, M.J., 2012. A concept for assessing sustainability impacts of forestry-wood chains. *Europ. J. of For. Res.* 131, 7-19.
- Verkerk, P.J., Anttila, P., Eggers, J., Lindner, M., Asikainen, A., 2011. The realisable potential supply of woody biomass from forests in the European Union. *Forest Ecology and Management* 261, 2007-2015.
- Verkerk, P.J., Lindner, M., Zanchi, G., Zudin, S., 2011. Assessing impacts of intensified biomass removal on deadwood in European forests. *Ecological Indicators* 11, 27-35.
- Werhahn-Mees, W., Garcia-Gonzalo, J., Palosuo, T., Röser, D., Lindner, M., 2011. Sustainability impact assessment of increasing resource use intensity in forest bioenergy production chains. *Global Change Biology Bioenergy* 3, 91-106.
- Wolfslehner, B., [...], Lindner, M., et al. 2012. Exploratory multi-criteria analysis in sustainability impact assessment of forest wood chains – the example of a regional case study in Baden-Württemberg. *Europ. J. of For. Res.* 131, 47-56.

