Comprehensive carbon footprint analysis of the value chains of forest industry

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Forestcluster

Objectives

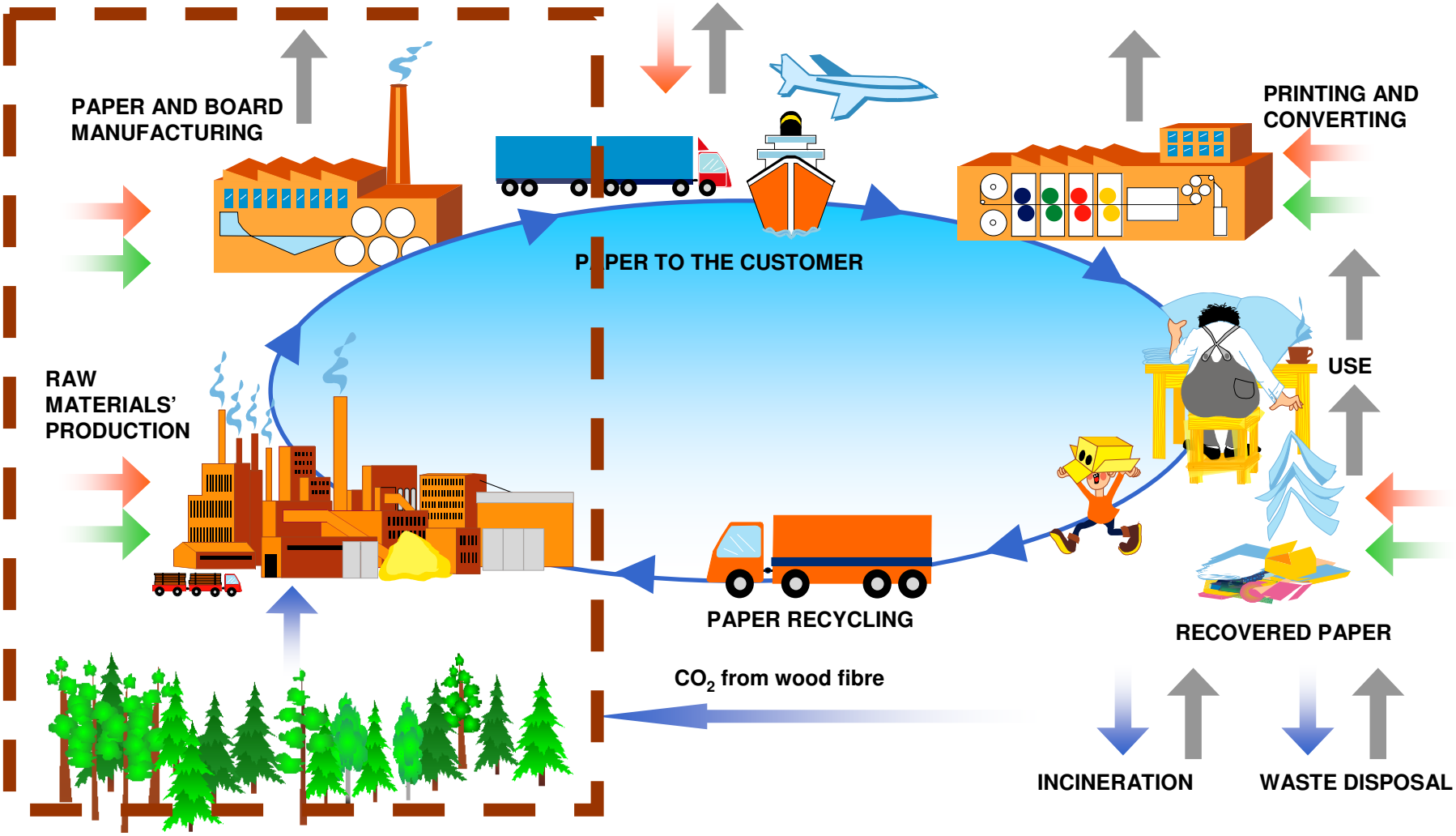
- to look for new value chains for forest industry, which
  - are based on domestic wood supply
  - increase the quantity and improve quality of raw material in a sustainable manner
  - increase the value of end product
  - improve the cost-efficiency of activities and processes
  - are environmental-friendly and resource-efficient
- to develop comprehensive methods to analyze
  - consumption of resources and energy
  - carbon footprint

  of the whole value chain

Carbon footprint of the value chains - implementation of the analysis

- Forestcluster's research program: **"Intelligent, resource-efficient production techologies" (EffTech)**
  - "New value chains"-project
- Joint effort of Metla and VTT
  - Metla: expertise in forests and wood supply chain (resources, management, carbon sequestration)
  - VTT: expertise in sustainability assessment (life cycle analysis, carbon footprint, eco and energy efficiency, sustainability)
- Active participation of Forestcluster's industrial partners throughout the project
  - steering group
  - expert group

What is a life cycle?



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Carbon footprint

Amount of **green house gases** produced along product's life cycle

- Includes fossil greenhouse gas emissions (e.g. CO_2 and CH_4)
- Results are reported as carbon dioxide equivalents
- Can be calculated for products or companies

Carbon footprint of wood supply

1.Emissions

- Silvicultural practices
  - regenation
  - precommercial thinnings
- Harvesting
- Forwarding
- Biomass recovery
- Secondary haulage

photos: Arto Rummukainen & Pentti Niemistö/Metla

Carbon footprint of wood supply

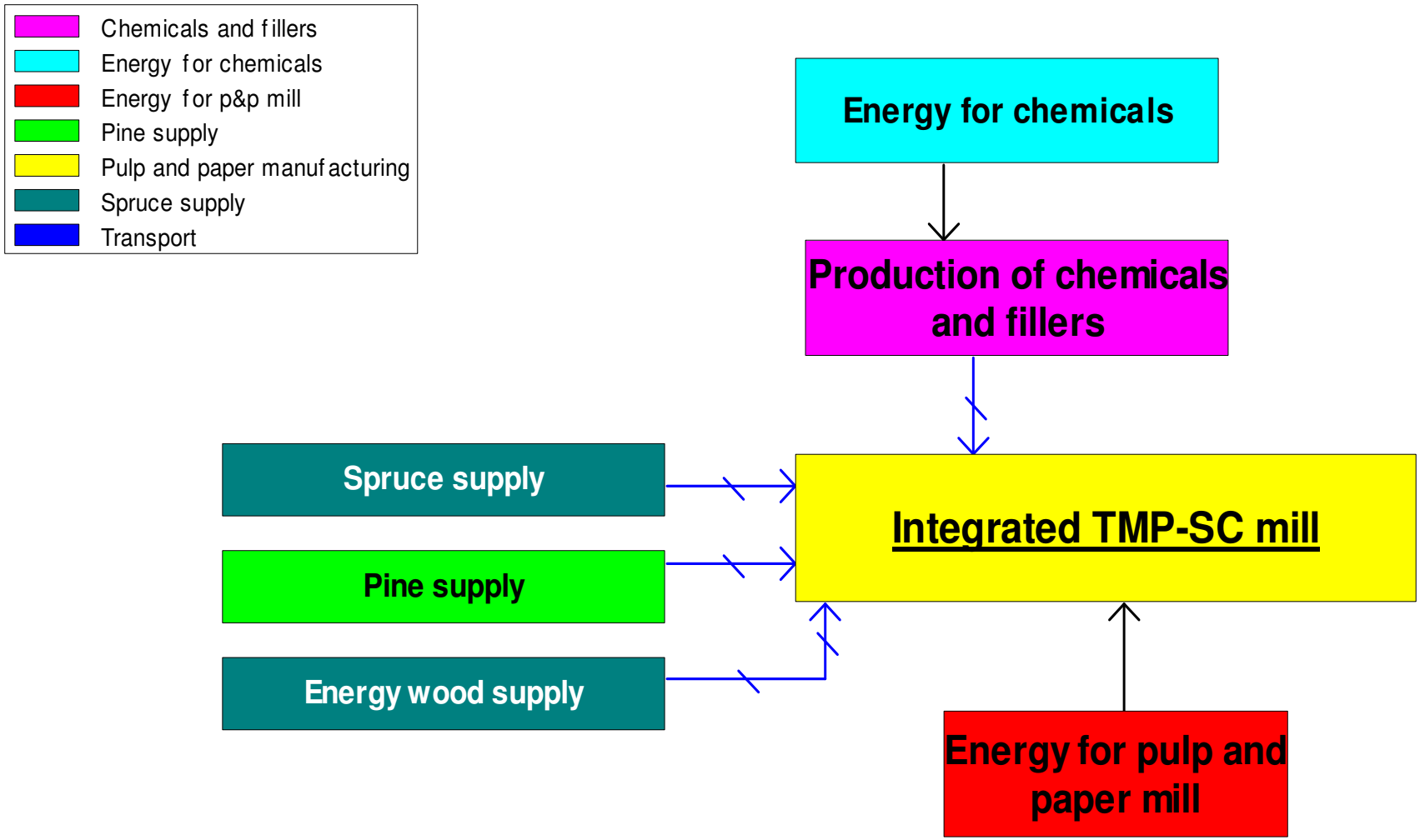
2.Carbon sequestration

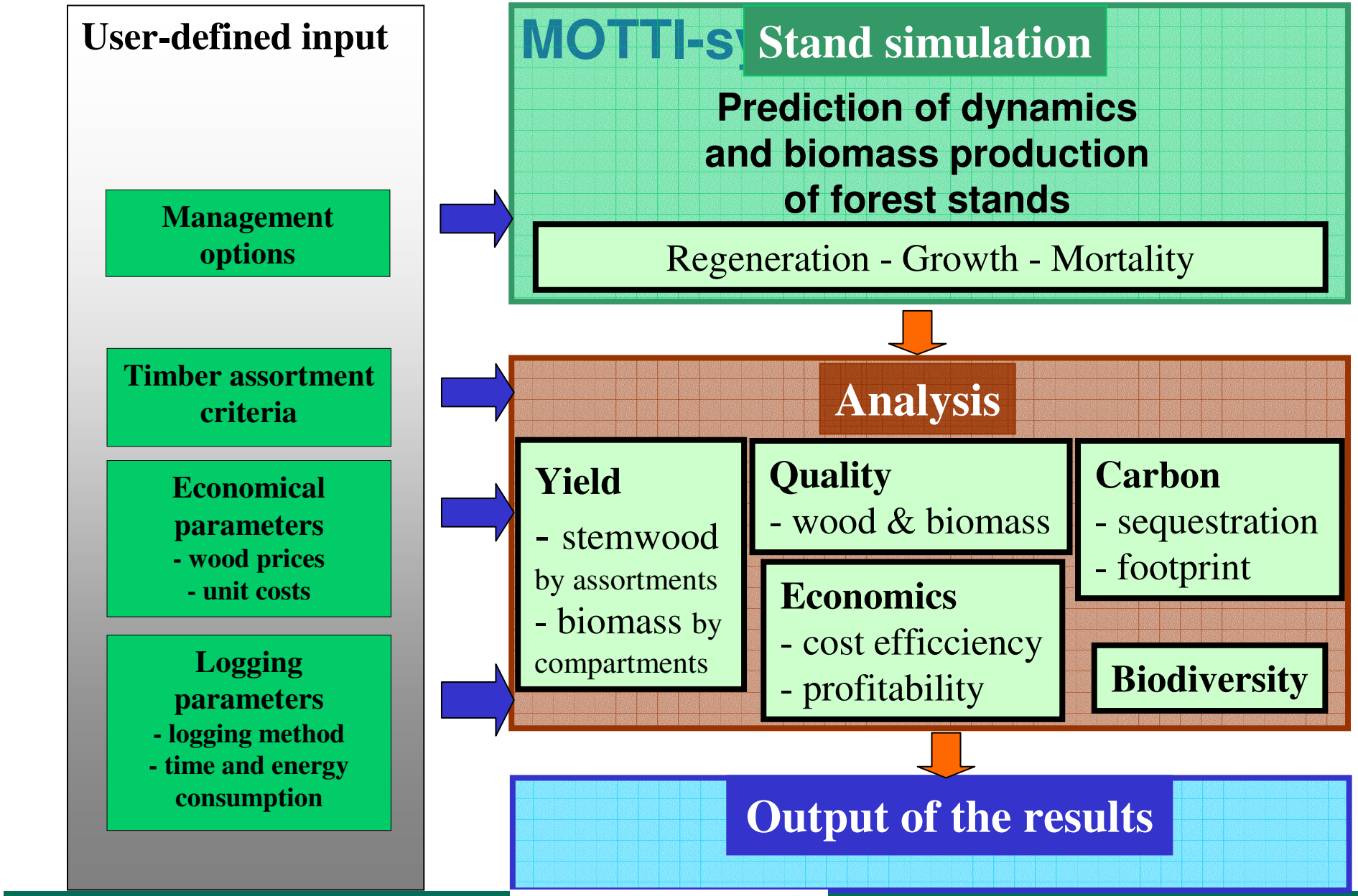
Managed stand

Unmanaged stand

photos: Erkki Oksanen/Metla

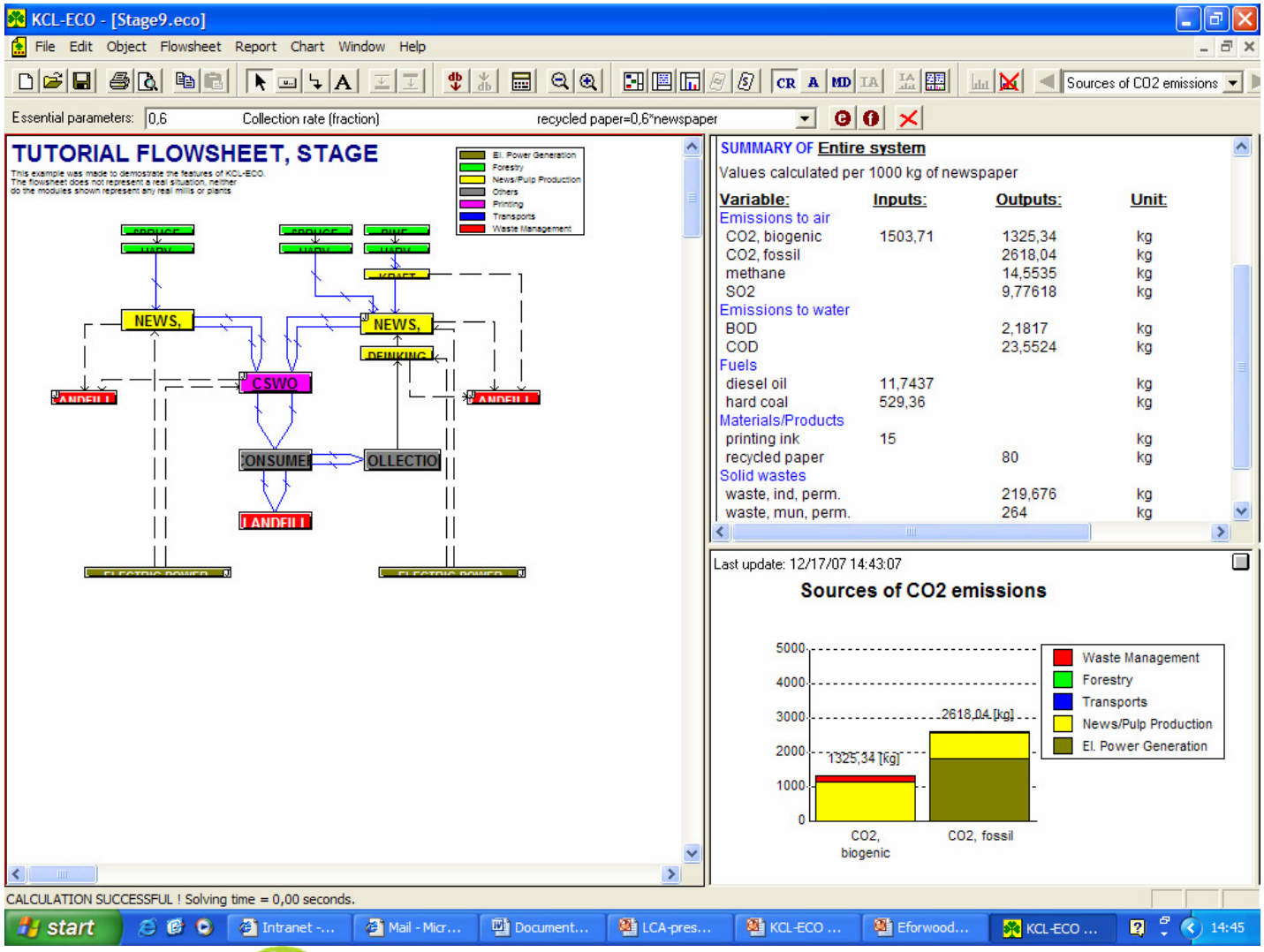
Carbon footprint of a pulp and paper mill




User-defined input
Management options
Timber assortment criteria
Economical parameters
- wood prices
- unit costs
Logging parameters
- logging method
- time and energy consumption
MOTTI-sy
Stand simulation
Prediction of dynamics and biomass production of forest stands
Regeneration - Growth - Mortality
Analysis
Yield
- stemwood by assortments
- biomass by compartments
Quality
- wood & biomass
Carbon
- sequestration
- footprint
Economics
- cost efficciency
- profitability
Biodiversity
Output of the results

KCL-ECO Software in LCA-calculations

Unit processes of SC-paper life cycle: cradle to gate -approach



Case study:
Value chain of paper industry utilizing domestic spruce as raw material

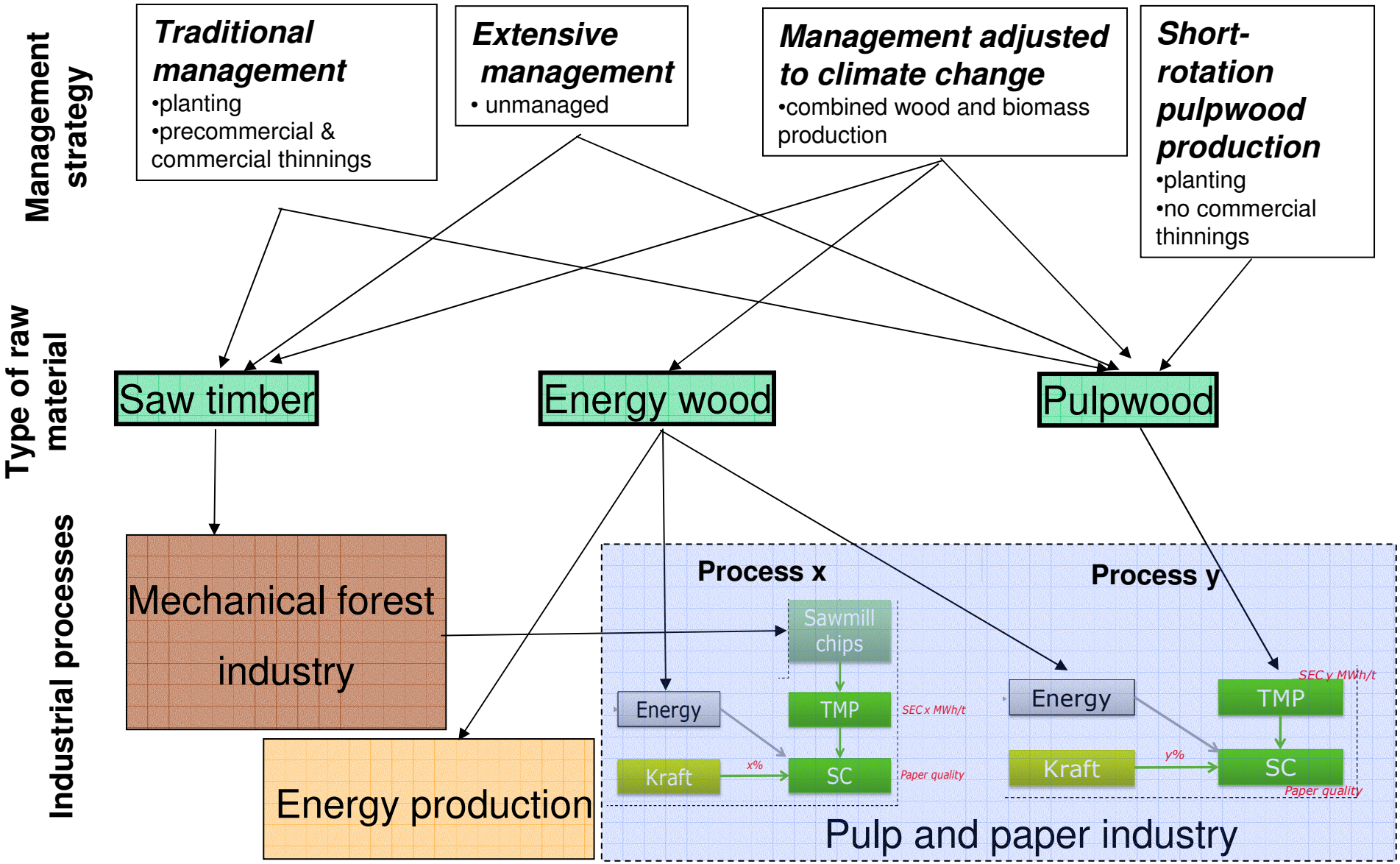
- alternative wood supply scenarios calculated for a hypothetical uniform forest area located in southern Finland
  - consists of even-aged pure spruce stands
  - even age-class distribution of forest stands

  = > constant annual harvested removals of wood and biomass

photo: Erkki Oksanen/Metla

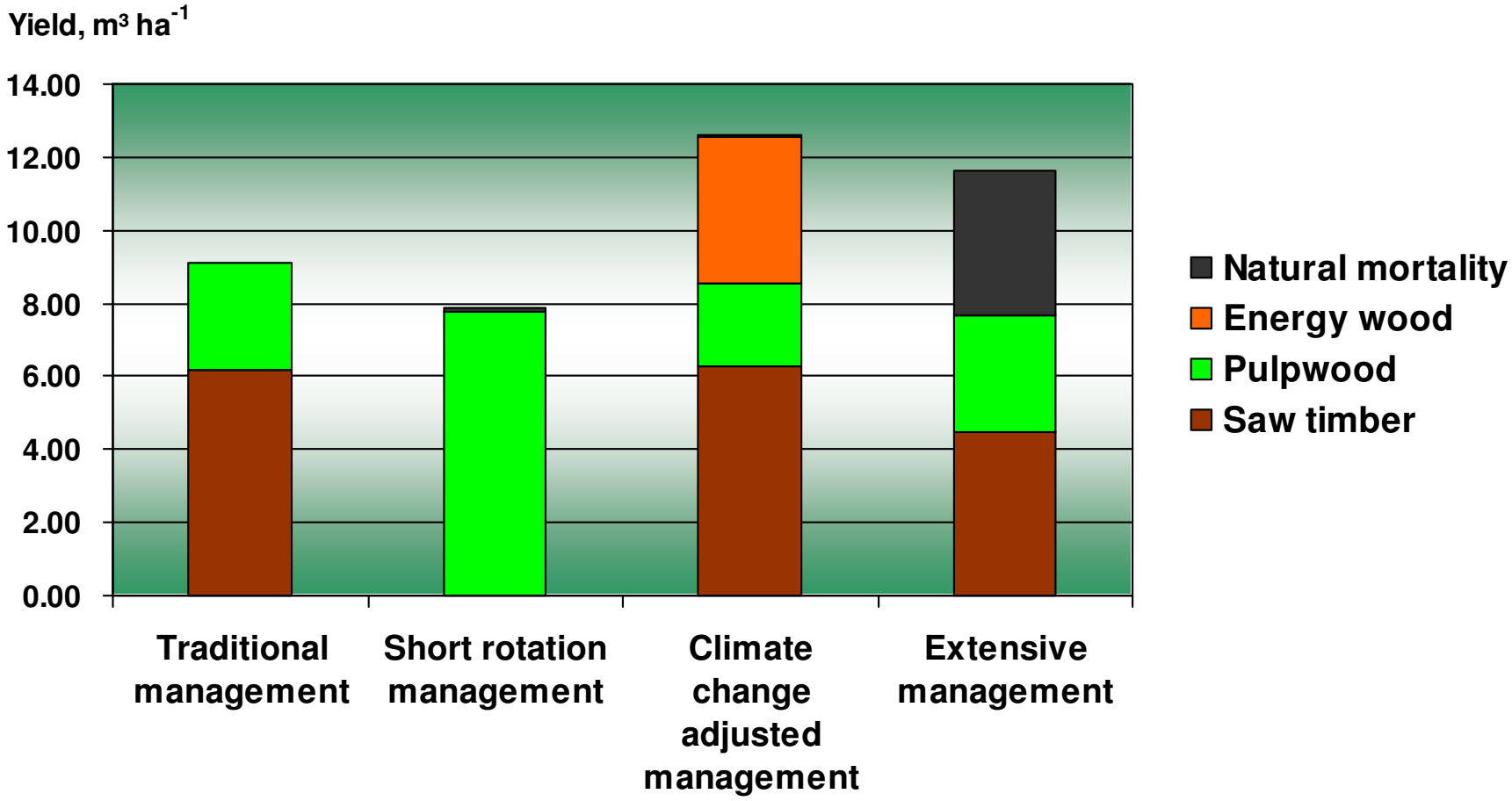
First case of wood product/process chain

Alternative wood supply chains from spruce stands in Southern Finland



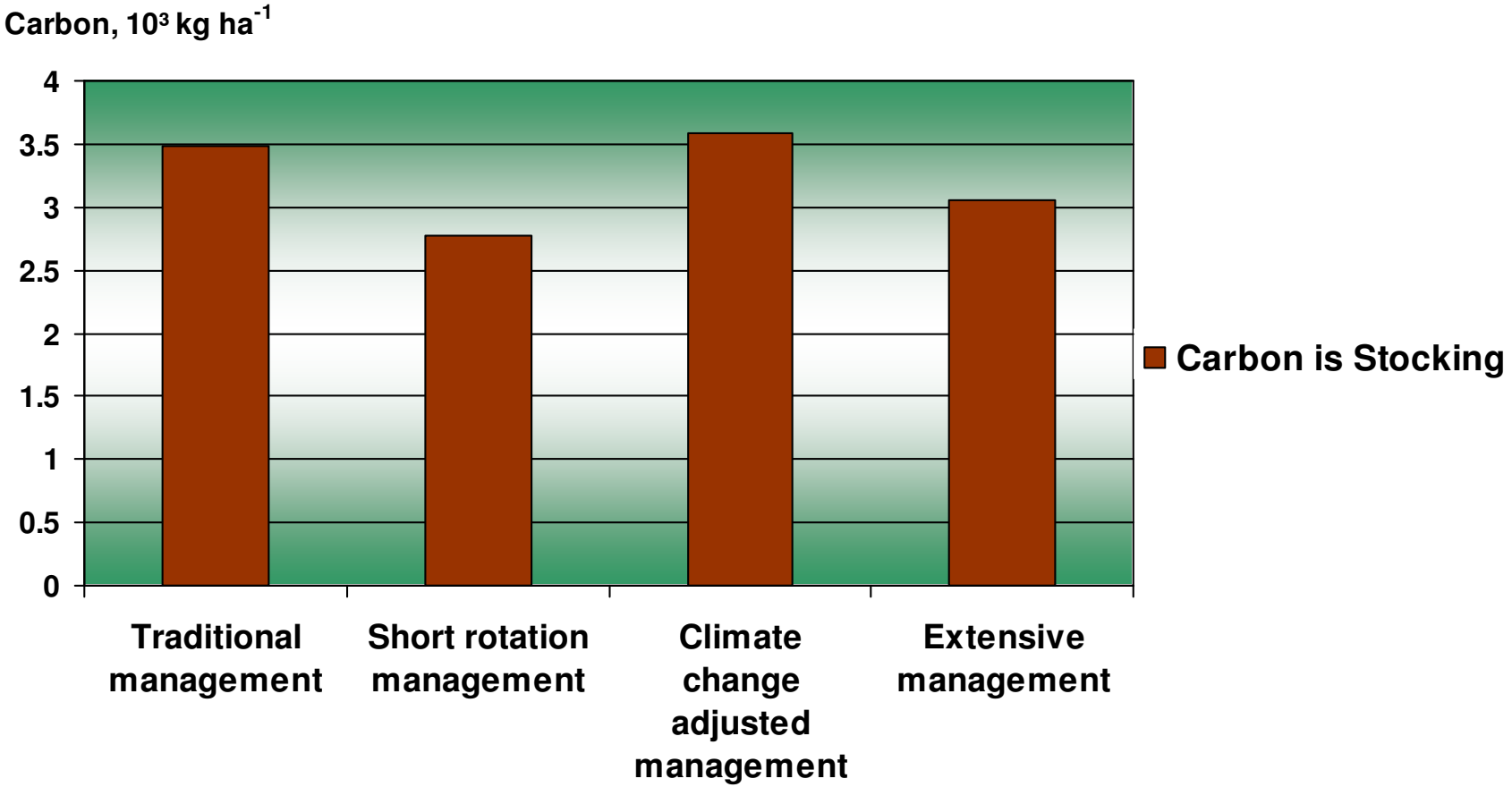
An example of the analysis results

Mean annual wood production



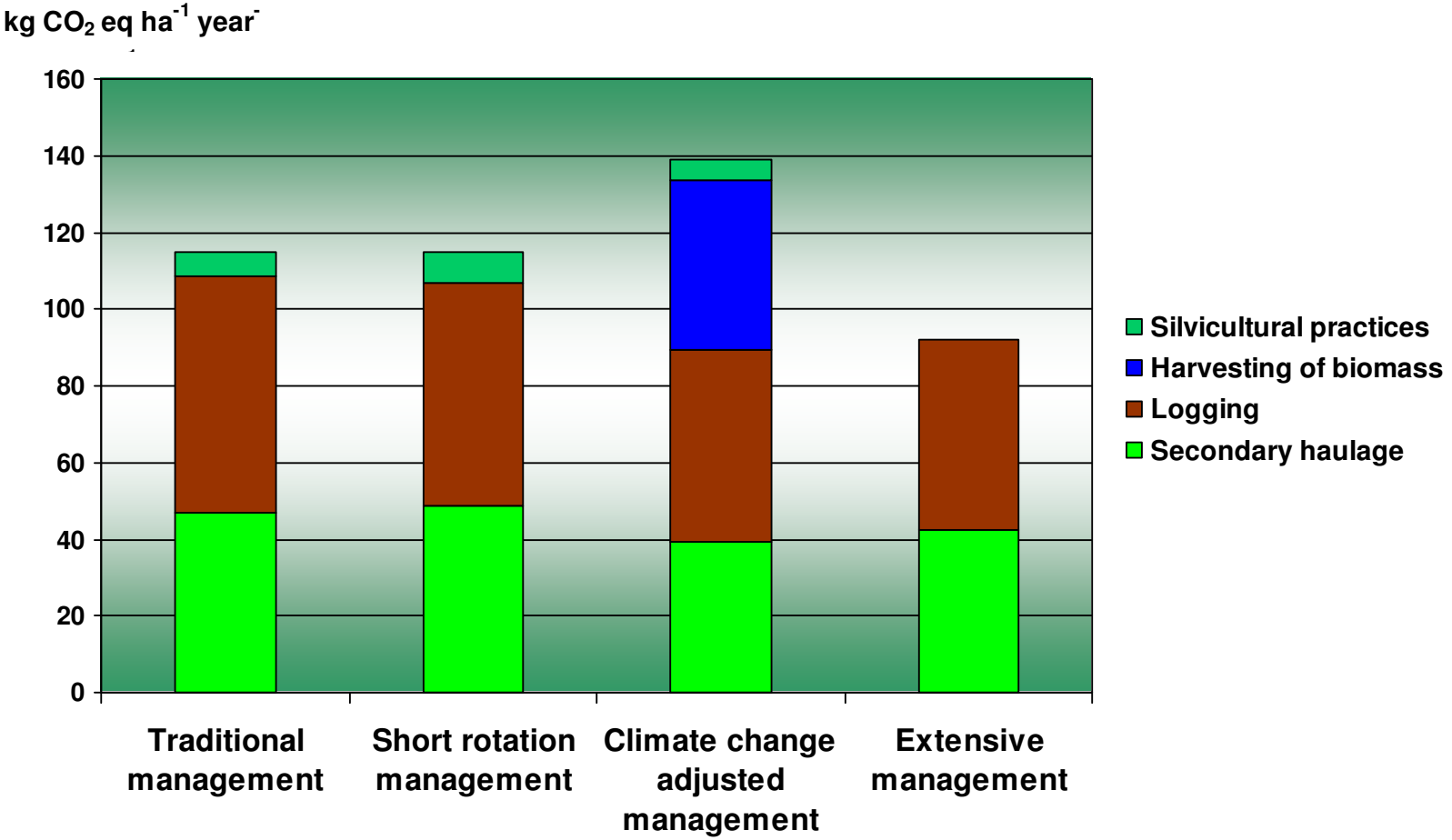
An example of the analysis results

Mean annual carbon accumulation in growing biomass

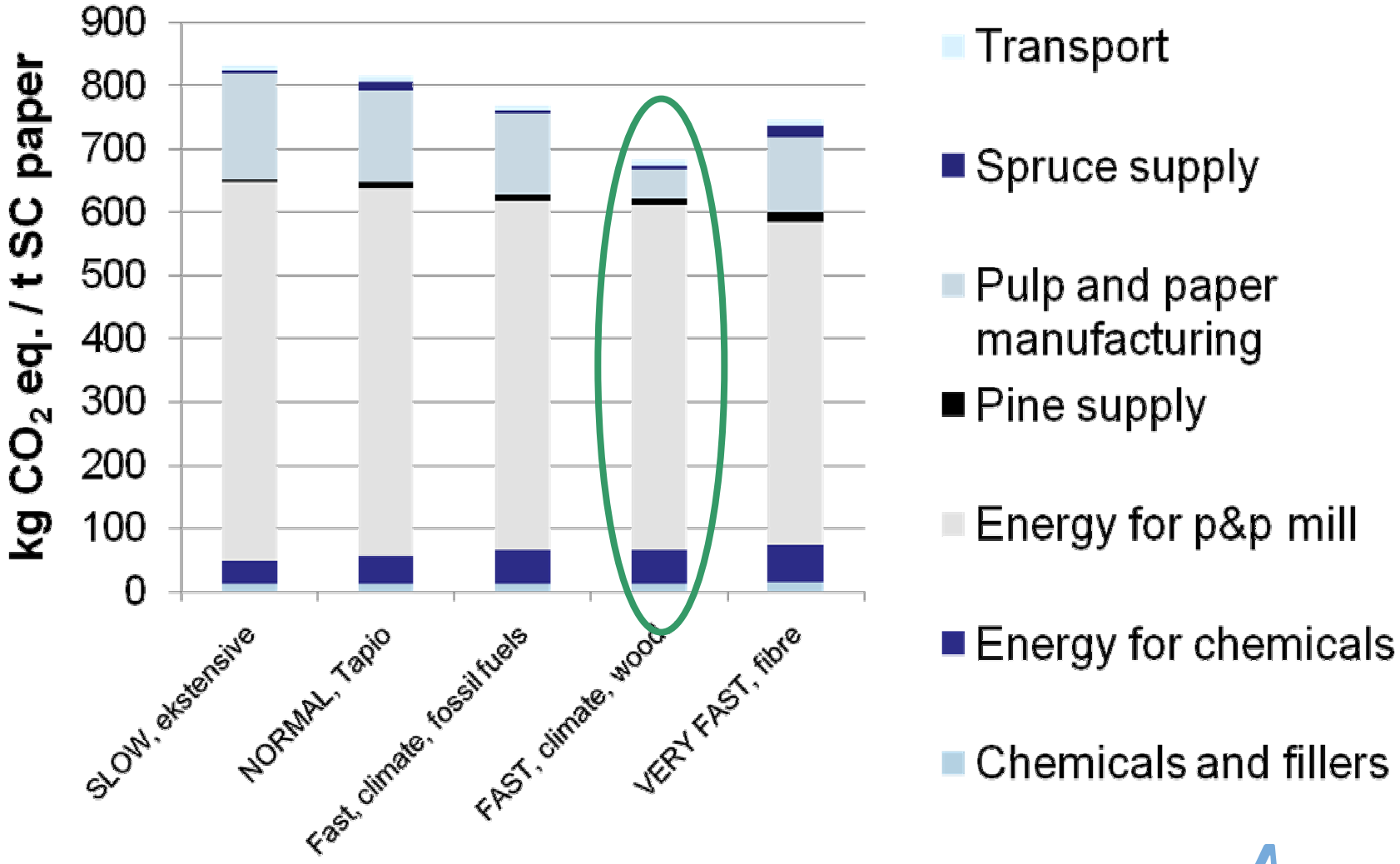


An example of the analysis results

Mean annual CO_2 emissions from management operations



Life cycle results for SC paper: cradle to gate



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CO_2 eq. = CO_2 fossil + 25*CH_4 + 298*N_2O

VTT

Conclusions

- we developed a comprehensive and flexible method for carbon footprint analysis
- demonstrated the impact of different activities within the value chains on the carbon footprint
- we created a network and new operations model for smooth co-operation
  - work continues in the 2nd stage of EffTech program: upscaling the analysis to national level


Thank You!
...and to the research team:
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photo: Erkki Oksanen/Metla