

Sustainable and Environmentally Friendly Wood Material Production for Future Industrial Needs SUSWOOD

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Background

- **Even-sized (low-thinning) forest management method is considered to be the most productive and profitable silvicultural practice. However, recent studies have shown that even-sized forests do not always convey the expected productivity and profitability.**
- **Climate change, environmental protection, multiple-use of forests and land-use disputes all affect sustainability of raw wood-material production.**
- **Information on sustainable supply of raw wood materials by assortments (i.e., sawn wood, pulp wood, firewood and energy wood) and by species is essential for traditional and new forest clusters (i.e., pharmaceutical, chemical and biotechnology industries).**
- **In addition, more information is needed to evaluate the sustainability of energy production from energy wood and the impact of energy wood utilization on forest ecosystem, environment and society.**

Objectives

How alternative (different) forest management systems can be used to cope with the transition of traditional forest clusters and their socio-economic implementations?

What are the potentials of alternative (different) forest management systems to meet the needs for sustainable production of raw wood material as well as maintaining forest ecosystem functions?

We have raised several hypotheses like

- **Maintaining equilibrium of forest population dynamics (i.e. growth, mortality and reproduction) is essential to ensure sustainable forest productivity.**
- **Appropriately introduced competition effects via forest management can increase resistance to abiotic (i.e., storm and draught) damages to forest growth, structure, and productivity.**
- **Uneven-aged forest management systems are environmentally friendly and they increase sustainability in forest productivity.**
- **The restructuring phase of the forest industry cluster will lead towards uneven-aged forest management systems due to changing demand conditions and changes in competitiveness.**
- **The socio-economic impacts of the implementation of uneven-aged forest management systems are significant at regional and local scales leading to pressures in spatial and social structures and infrastructure.**

How to do this?

We need to develop statistical models and simulation software using high performance computing techniques for testing the these hypotheses.

Outline of the model

Effects of different forest management systems on sustainability and flexibility of raw wood material supply, (i) on local and regional development of resource-producing areas, and (ii) on forest ecosystem and environment.

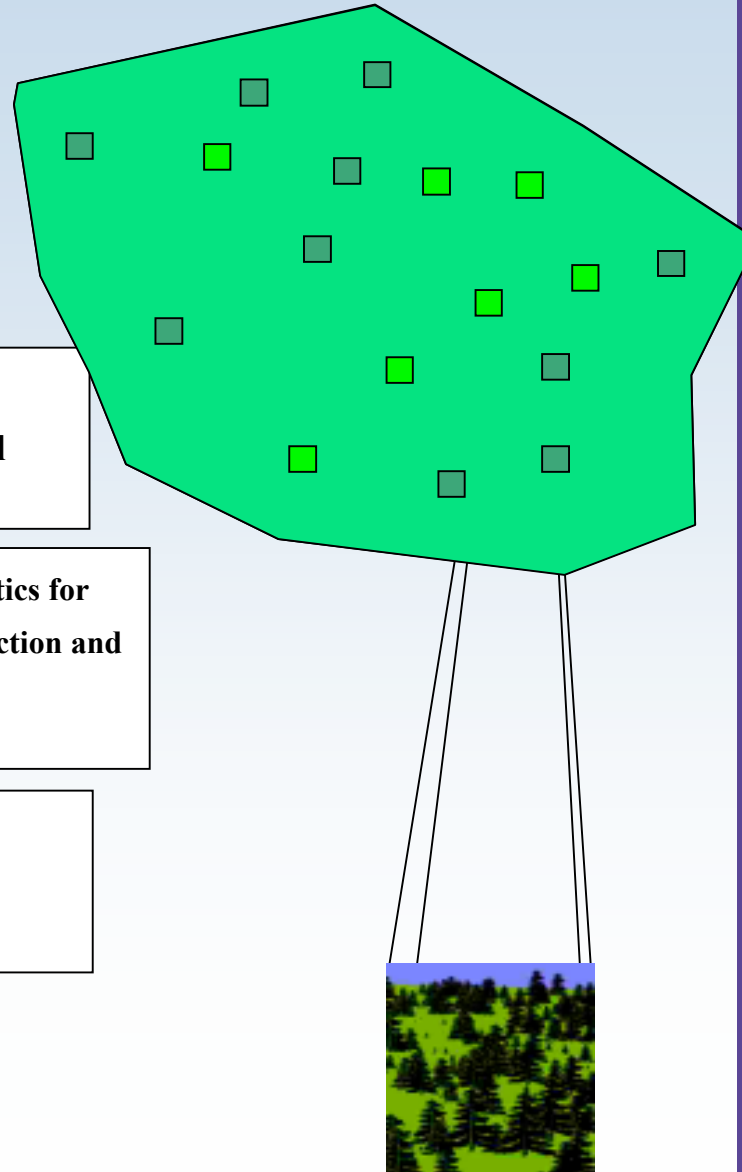
Information needs for socio-economic, forest production and sustainability studies.

Statistical methods to summarize stand level statistics

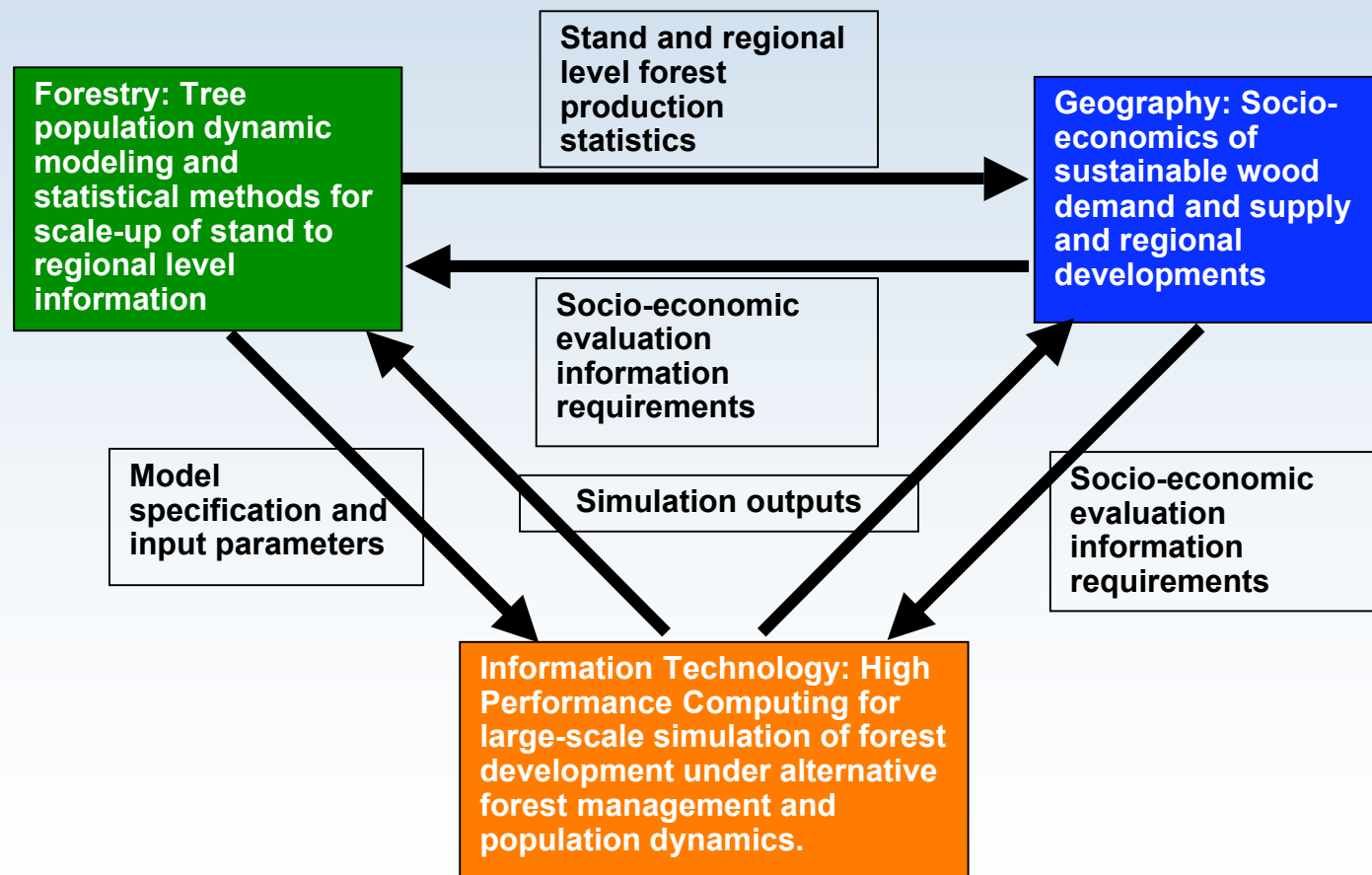
Forest stand level statistics for evaluating forest production and sustainability

Statistical methods to summarize tree level statistics

**Single-tree modeling and simulation;
High Performance Computing simulation tools**



Tasks and interconnections



Expected results: Forestry

- *Statistical models for tree population dynamics under changing climate conditions, and using the models for spatio-temporal simulations.*
- *A comprehensive comparison of tree population dynamics under even- and uneven-aged forest management systems and their significance in sustainable timber supply.*
- *Statistical methodological development for analyzing simulation results and scale-up from single-tree to regional level statistics.*

Expected results: Geography

- *An analysis of forest sector and forest related socio-economics development in Finland.*
- *Case studies of the impact of transition from domestic production to foreign investments in the forest sector on socio-economics.*
- *New information on the impact of alternative forest management systems on regional socio-economics development.*
- *Risk/benefit analysis of alternative forest management systems on sustainable raw wood material supply.*

Expected results: IT

- *Applications of High Performance Computing (HPC) techniques in large-scale forest ecosystem simulations. The SUSWOOD project represents a major step forward in utilizing HPC techniques in forest ecosystem simulations.*
- *HPC software and computer codes to be published under open source license. While in other areas of natural sciences (physics, chemistry, etc.) software repositories are abundant, these are still lacking in forest ecosystem simulations and hence this project constitutes a significant development towards such open source repositories.*

Kiitos!