CES – Bio-Fuels Working Group

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A new Nordic Energy Research project, Climate and Energy Systems (CES) – Risks, Potential and Adaptation, was initiated in 2007 with a 4-year-funding from Nordic Energy Research (NER), the Nordic energy sector, and individual partners. The project focuses on three main renewable energy resources; hydropower, bio-fuels and wind power, and how future climate change within the next 20–30 years can impact these resources.

Main objectives of the Bio-Fuels Working Group

In the future, an increase in the utilization of various sources of bioenergy will increase in Nordic countries. This raises a question what is the biomass production potential of forests now and in the future and how sustainable the energy production based on biomass are owing to possible large-scale harvestings of forest biomass. Furthermore, complex interactive effects between climate, bioenergy production in forests and the management of forests exist.

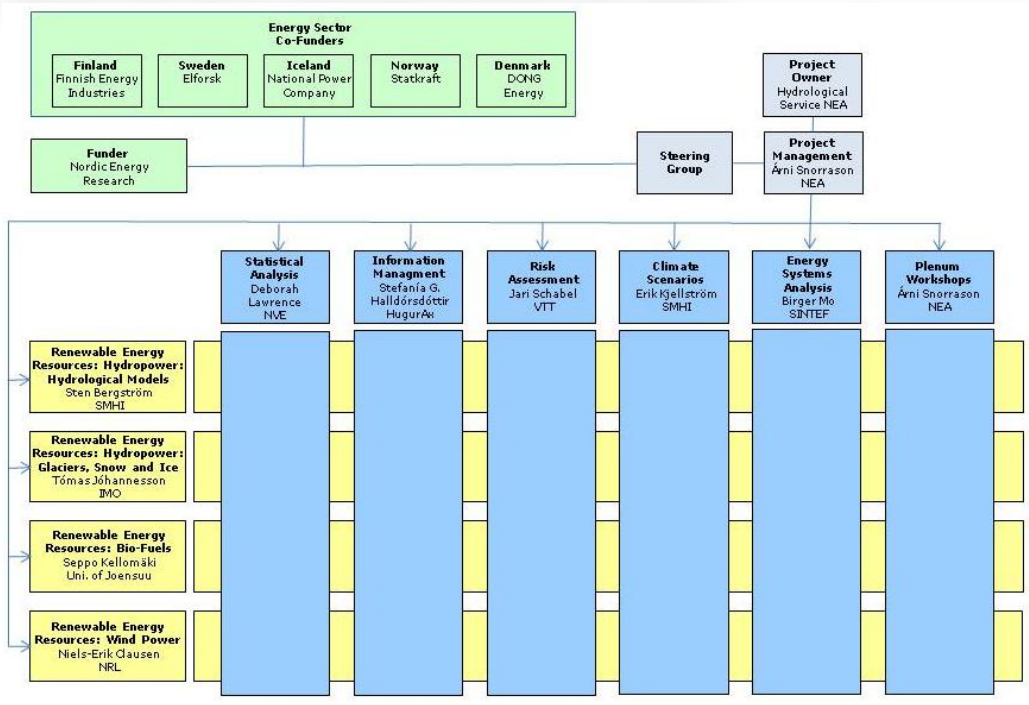
These effects has to be identified and properly understood, if availability of forest bioenergy is estimated. In addition, the sustainability of the production in the management of forests will be ensured by assessing the environmental side effects and risks of the production. This analysis identifies the management regimes optimal in production of forest biomass for energy, with minimizing risks and adapting the production systems to the climate change. By doing this, estimation of the total role of forest biomass in energy production and its effects in substituting fossil fuels and mitigating the climate change can be assessed.

The key objectives are summarized as:

- Understanding of the natural variability and predictability of bioenergy production at different scales in space and time in the context of climate change.
- Assessment of potential production of forest biomass for energy .
- Assessment of the risks of the production of forest biomass for energy.
- Assessment and development of forest management regimes to produce forest biomass along with timber to substitute fossil fuels and to mitigate climate change.

Participants and organization of project

The project is organized as a matrix structure with working groups, WG, on the renewable energy resources. Cross-cutting issues are also delegated to WG. These WG will be supported and served by a Steering group with one representative from each of the partners.



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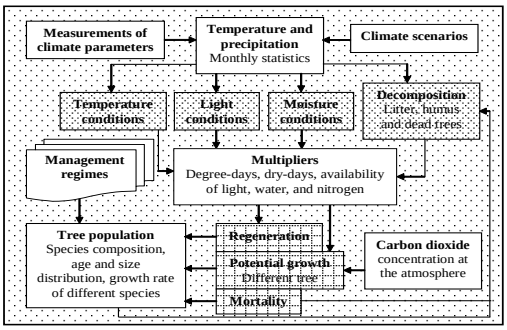
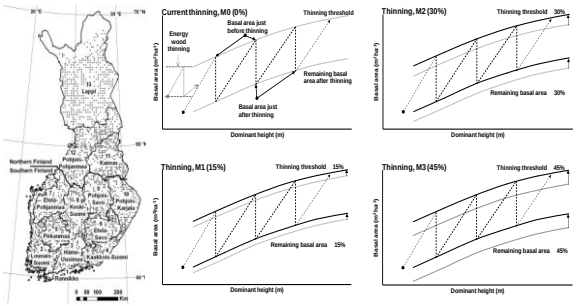
Model based analysis

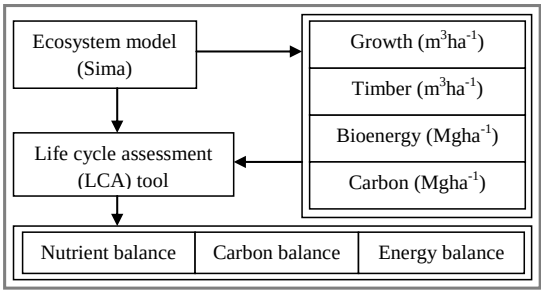
The ecosystem model - Sima (Kellomäki et al., 1992a, b; Kolström, 1998) was used to simulate the effects of various thinning regimes on the forest growth, bioenergy and timber production and carbon stocks under the current and changing climate in Finland during a 100-year period.



The study integrated Finnish National Inventory tree data and climate change scenario data provided by Finnish Meteorological Institute. Datasets were interpolated to the same grid for estimation of forest growth, bioenergy and timber production and carbon stocks in current climate and for changing climatic conditions. In addition, the effect of varying thinning regimes were studied on these parameters.



As the potential bioenergy production along with timber production and carbon stocks are studied, the environmental side-effects and risks of the production are also assessed. Furthermore, the sustainibility of the production will be studied for the whole life cycle of bioenergy.



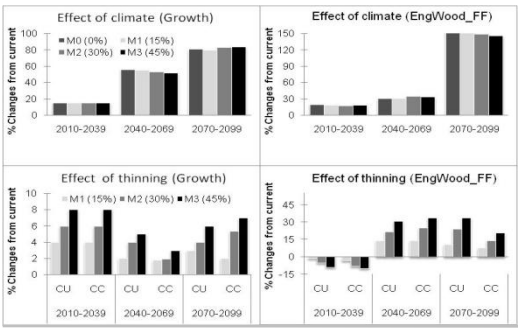
Analysis

The calculations were done for growth, timber, energy wood and carbon stocks to get absolute values (mean) for all thinning regimes under current and changing climate. Relative changes in these factors were studied against current climate and current thinning regime. Therefore, comparisons were focused on, either the effect of climate or effect of thinning regimes under current and changing climate.

Effect of climate (CU:CC): compared with similar thinning regime (1:2)	
1. Current climate (CU) - varying thinning regimes (0%, 15%, 30%,45%)	**2. Changing climate (CC)** - varying thinning regimes (0%, 15%, 30%,45%)
Effect of thinning (3:4): compared with current thinning regime under current climate (CU:CU) and changing climate (CC:CC)	
3. Current (CU) & changing climate (CC) - current thinning regime	**4. Current (CU) & changing climate (CC)** - changed thinning regimes

Results

Bioenergy production potential increased due to the climate change both in energy wood thinnings and in final fellings (FF). In addition, compared with current thinning regime, increased thinning thresholds enhanced carbon stocks in Finland under current and changing climate. This also enhanced timber production during 2040-2069 (2nd period) and energy wood production at final felling during 2040-2069 and 2070-2099 (3rd period).



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