

# The regional forest management scenarios for the sustainable carbon neutrality in Finland

Kalle Karttunen<sup>\*1</sup>, Soili Haikarainen<sup>2</sup>, Saija Huuskonen<sup>2</sup>, Anssi Ahtikoski<sup>2</sup>, Hannu Salminen<sup>2</sup>, Jari Hynynen<sup>2</sup>, Susanna Kujala<sup>3</sup>, Outi Hakala<sup>3</sup>, Hannu Törmä<sup>3</sup>, Jouko Kinnunen<sup>4</sup>, Antti Karhunen<sup>1</sup>, Mika Laihanen<sup>1</sup>, Raghu KC<sup>1</sup>, Tapio Ranta<sup>1</sup>

<sup>1</sup>Lappeenranta-Lahti University of Technology LUT (LUT University), LUT School of Energy Systems, Laboratory of Bioenergy, Lönnrotinkatu 7 50100 Mikkeli, Finland

<sup>2</sup>Natural Resources Institute Finland, Latokartanonkaari 9, 00790 Helsinki, Finland

<sup>3</sup>University of Helsinki, Ruralia Institute, Kampusranta 9 60320 Seinäjoki, Finland

<sup>4</sup>Statistics and Research Åland P.O. Box 1187 AX-22111 Mariehamn Åland, Finland

\*Corresponding author: [kalle.karttunen@lut.fi](mailto:kalle.karttunen@lut.fi) TEL:+358443739377

## INTRODUCTION

The aim of the study is to promote ways to reach the goals of the carbon neutrality at the South Savo region in eastern Finland by examining the solutions for emission reductions and forest use. The study has taken the first step for reaching the carbon neutrality at the regional level in Finland considering also the regional economic effects. Earlier studies have shown that a more intensive use of forest decreases the carbon sequestration potential but increases the regional socio-economic benefits. The carbon dioxide neutral region means that the region's internal activity does not change the carbon content of the atmosphere. The carbon neutrality should be secured either by emission reductions, by controlling the use of forest or by using other compensation to buy emission reductions.

## MATERIAL AND METHODS

The study has started by updating the regional energy balance and its carbon influence (I). Second, the carbon impact on forest use will be calculated (II). Finally, the regional economic effects of alternative carbon neutrality solutions will be estimated (III).

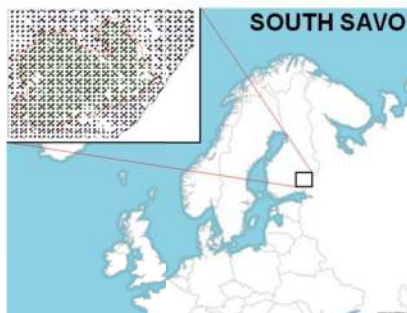
Scenarios	Emissions (I)	Forest management (II)	Regional economy (III)
BAU	Usual development	Current intensity (2016-2018)	Usual development
1	Carbon free 2050	Intensive	Economy first
2	Carbon free 2030	Carbon sink dominated	Climate first
3	Carbon free 2030-2040	Compromise	Compromise

The study method has been developed by combining alternative forest management simulations with computable general equilibrium (CGE) modelling (RegFinDyn). Permanent National Forest Inventory plots have been used as an input of forest management simulations. The aim is to include the carbon solutions to the CGE model as well.

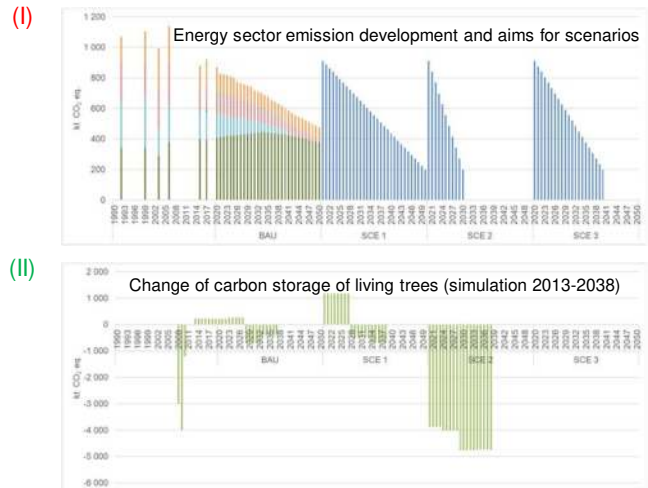
## REGIONAL ECONOMY

The CGE simulations estimate the effect of changes in energy balance and in forest management on the regional economy and further on the regional emissions. The CGE model keeps track of the direct emissions of the regional production and consumption. The emissions caused by changes in land use and changes in timber stock are calculated outside the CGE model with separate tools.

## STUDY AREA FINLAND



## RESULTS AND CONCLUSION



Regional emission development showed that even though the energy emissions have been decreased, the carbon neutrality aims are far away. On the other hand, the change of carbon storage of living trees could include important role in regional carbon balance to compensate emissions. The regional emissions are just about 0.4% of the carbon storage of living trees, which was in the beginning of simulation 197 000 kt CO<sub>2</sub> eq (2013). After the simulation (2038) it was 1% larger in BAU (current cutting intensity), 17% smaller in SCE 1 and 46% larger in SCE 2. Study will be continued in SCE 3.

(III) This study indicated the potential of carbon storage of living trees to achieve regional carbon neutrality but also difficulty to control it. The study showed the need for compromised forest management simulations (SCE 3) not only to achieve the carbon freedom but also compromised regional economy.

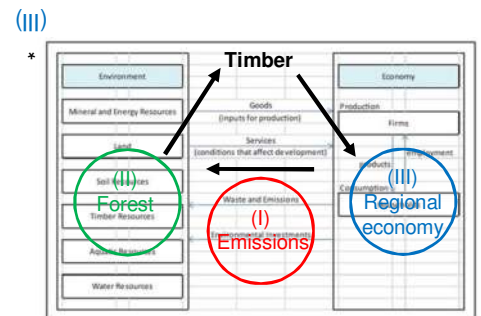


Figure 3. Interactions between the environment and the economic system as captured in IEM.

## Data sources

-Project information: <https://www.researchgate.net/project/Carbon-free-South-Savo>

-Published article: <https://doi.org/10.1016/j.biombioe.2018.07.024>

-Bajernee et. al. 2016: <https://doi.org/10.1177/1070496516658753>