

Carbon balance of an old hemi-boreal pine forest in Southern Estonia determined by different methods

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The Soontaga Forest Station is located in hemi-boreal 200-years old pine forest (South Estonia; 58°01'N 26°04'E) with a second layer of spruce. The station has the instrumentation to assess the exchange of carbon dioxide (net ecosystem exchange, NEE), soil respiration, tree biomass (above and below ground biomass) and different environmental and meteorological parameters.

In this study we quantified carbon balance by analyzing eddy-covariance CO₂ flux data (carbon exchange) vs chamber-based measurements (ecosystem respiration) and CO₂ assimilation (soil and biomass).

The annual NEE in this mature coniferous forest was -2.3 t C ha yr⁻¹, showing a clear diurnal and seasonal trend. During the daytime in summer the forest sequestered CO₂, while during the night and late night CO₂ emitted from the ecosystem to the atmosphere. Within the growing period, the sequestration of CO₂ by plants was greater than soil respiration. Thus, the ecosystem sequestered carbon. Most of the carbon is bound in tree biomass (above and below ground biomass) but as well into soil, while the sequestration in soil increases with stand age. In addition, the biomass of understory, especially belowground litter, is playing essential part in carbon input.

A modelling approach of long-term C budget in the Soontaga pine forest is presented.