The methodology used in year 2005 for greenhouse gas inventory of Finnish forest soils

Timo Kareinen*, Risto Sievänen, Hannu Ilvesniemi, Timo Penttilä, Aleksi Lehtonen, Mikko Peltoniemi

Introduction

Assessment of stock changes of dead wood (DW), litter (L), and soil organic matter (SOM) pools on Forest Land is part of national greenhouse gas inventory of LULUCF (Land Use, Land Use Change and Forest) sector. The area of Forest land in Finland was 20.5 Mha in 2004 and peatland forests covered 22.8% of it. The methodology is based on model-based estimation of changes instead of direct measurements of stocks, and is consistent with IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry. LULUCF is one of the key categories in Finnish inventory and the methods are Tier 2 or higher.

Method

The approach (fig.1) combined input of dead organic matter with the soil and litter decomposition model Yasso (Liski et al. 2005) that was used to asses the rate of decay. First, annual litter input was estimated and then the decomposition of all the organic matter stocks was calculated. The inventory was made separately for mineral and organic soils (fig. 2). Only drained peatlands were considered, undrained peatlands were assumed to be in stable state and not affecting the GHG balance. Stock changes of DW, L and SOM pools were estimated with Yasso, except in case of peat decomposition, which was assessed using site specific emission coefficients and estimates of the annual below ground litter inputs.

Stocks of L and SOM were calculated with the aid of compartments of Yasso (*fig. 2*) as follows: fine woody litter, coarse woody litter, extractives, celluloses and lignin-like compounds were considered as L, and humus1 and humus 2 were considered as SOM. DW was assessed in a separate run same way as L, except that the dead organic matter input consisted only from stems and stumps thicker than 10 cm.

Annual litter production consisted of litter from living biomass (trees, ground vegetation), natural mortality of trees and harvesting residues. In mineral soils the litter production of the ground vegetation was not yet included in the estimated change.

The parameterisation of Yasso included assessment of the decomposing properties of different biomass compartments and also the temperature effect on decomposition rate in south and north. Initial state of the model was estimated with a long initiating period, starting from the year 1000. In mineral soils the inventory simulation with actual estimated litter input started from 1940 and in drained peatlands from 1990.

GHG balances were reported as 5 years moving averages, emphasis being in the long-term trends of changes.

Data

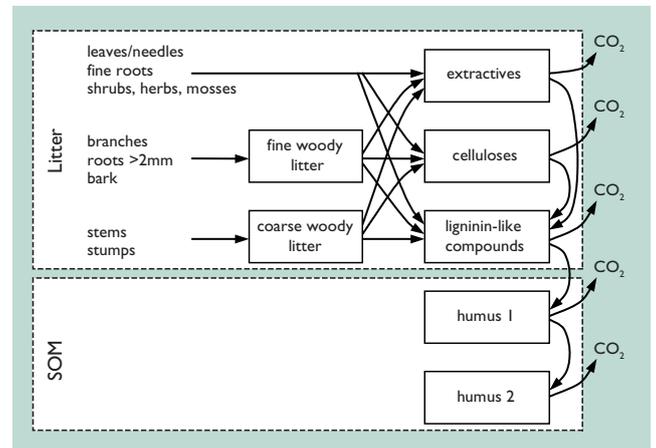Litter production, covering years 1940-2004 for mineral soils and years 1990-2004

Figure 2. Schematic presentation of the Yasso model (Liski et al. 2005).

for peatlands, was estimated from forest data provided by National Forest Inventories (NFIs). Natural mortality was estimated on the basis of the follow-up of some 3000 permanent sample plots from 1985 to 1995. Fellings in years 1990-2004 were reported by roundwood purchasers and Metsähallitus.

Results

Mineral soils seem to be minor sinks of carbon whereas drained peatlands seem to be minor sources (fig. 3). When also carbon fixation by net growth of trees is included, Finnish forestlands become clear sinks of carbon (7,1 Tg C in year 2004).

Figure 3. Results of Finnish inventory of carbon stock changes in forest soils.

References

Liski, J., Palosuo, T., Peltoniemi, M. & Sievänen, R. 2005. Carbon and decomposition model Yasso for forest soils. Ecol. Modelling 189(1-2): 168-182.
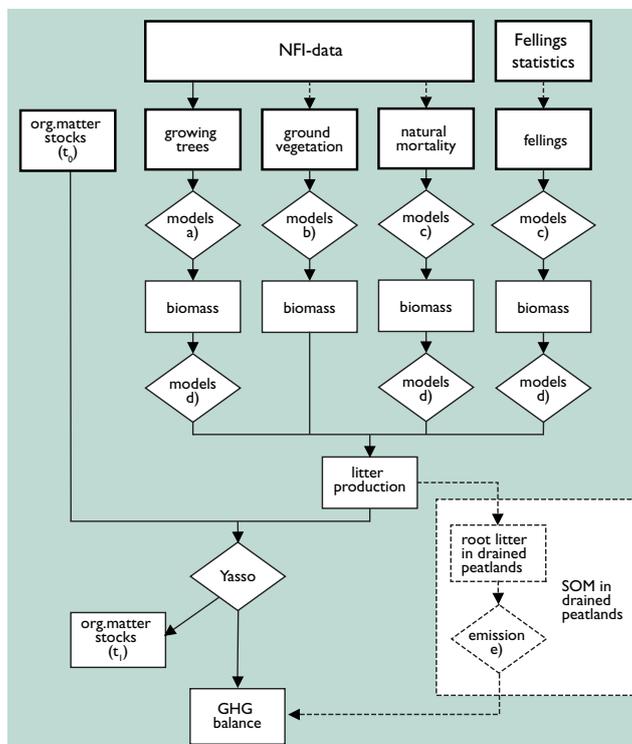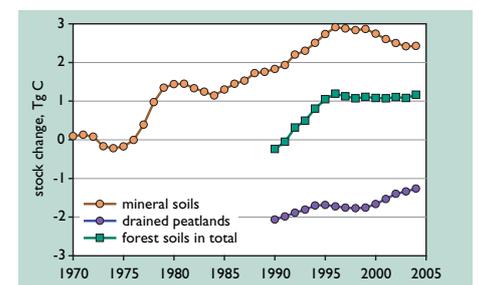
Figure 1. Schematic presentation of calculation routine used in Finnish GHG inventory. Classification of organic matter is presented in fig. 2. **Models a)** tree level functions for biomass compartments, **models b)** functions for biomass of shrubs, herbs, grasses and mosses, **models c)** area level functions for biomass compartments (BEFs), **models d)** litter production of each biomass compartment, **emission e)** functions using emission factors.

Finnish Forest Research Institute,
PO Box 18, FI-01301 VANTAA, FINLAND

*Timo.Kareinen@metla.fi