

TREE BIOMASS AND SOIL C DENSITIES AND STOCKS FOR THE HIETAJÄRVI INTEGRATED MONITORING CATCHMENT IN EASTERN FINLAND

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INTRODUCTION

Carbon (C) densities and stocks of tree biomass and soil organic carbon are becoming increasingly available at both the stand and national scale. However, there are few results integrating both biomass and soil C at the catchment scale. The aim of this poster is to describe the living tree biomass and soil C densities and stocks for a catchment in eastern Finland. The catchment comprises areas of both upland soils and peatland.

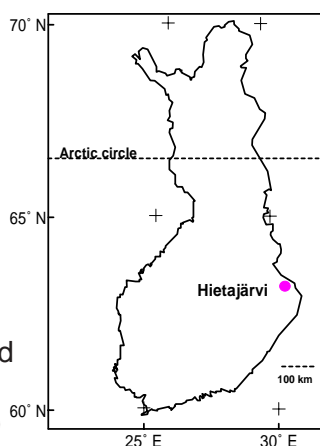
MATERIAL AND METHODS

The Hietajärvi catchment is located in the Patvinsuo National Park, North Karelia (63° 10' N, 30° 43' E, 165 m a.s.l.).

It has a total area of 464 ha, of which 23% is covered by lakes and small ponds, 30% by peatland (forested and open), and 47% by upland forest soil. The forests, are mainly mature or old Scots pine stands and the area has been protected from management, slash and burn cultivation, and tar production since the beginning of the 20th century. Besides peatland (Histosols), the soils are mainly Haplic and Ferric Podzols.

We estimated the C density and stock of each forest stand unit in the catchment using a forest inventory map produced by Metsähallitus (Forest and Park Service Park) in 1994.

Detailed stand measurements and soil sampling were carried out by Metla at 43 plots (30 upland forest, 5 forested peatland, and 8 open peatland) also in 1994.



The 43 plots were centred on the intersections of a 100 x 100 grid throughout the catchment. At each selected plot all living trees were measured and soil samples collected. Total C concentrations were determined using a LECO CHN-600 analyser.

The forest stand C density ($t\ C\ ha^{-1}$) at each plot was calculated from estimates of biomass and a relationship between biomass C density and stand (stem) volume ($R^2=99\%$) determined. Using the stem volume values from the forest inventory, we then calculated the stock of C in each stand unit, assuming a C content of 52%. Soil C density values ($t\ C\ ha^{-1}$ to 30 cm depth) for each plot were calculated from C concentration measurements, layer thickness, estimated bulk density values and stone contents. We used appropriate bulk density and stone content values from intensively monitored plots (Hietajärvi) for the upland plots and published values for the peat samples. The sampled plots were classified as recessional moraine, till, sorted fine sand/silt, coarse sand/gravel esker deposits, or peat and the mean C density of each calculated. These mean values were then multiplied by the area of each type of deposit to determine the C stocks.

RESULTS

Living tree stand biomass C densities ranged from 0 to $95\ t\ ha^{-1}$. The smallest C densities were associated with the peatlands and the highest with upland forests, which had the highest stand volumes (average $173\ m^3\ ha^{-1}$). Soil C densities varied from 33 (coarse sand/gravel esker deposits) to 49 (recessional moraine) $t\ ha^{-1}$ for upland soil. Peatland areas had the highest soil C densities, averaging $134\ t\ ha^{-1}$.

Stocks of C in the living tree biomass for the entire Hietajärvi catchment totalled 12,757 t, 91% of which was accounted for by upland forests. The catchment stock of soil C to a depth of 30 cm was more than twice that of the living tree biomass C stock, which totalled 28,445 t, 66% being accounted for by peat.

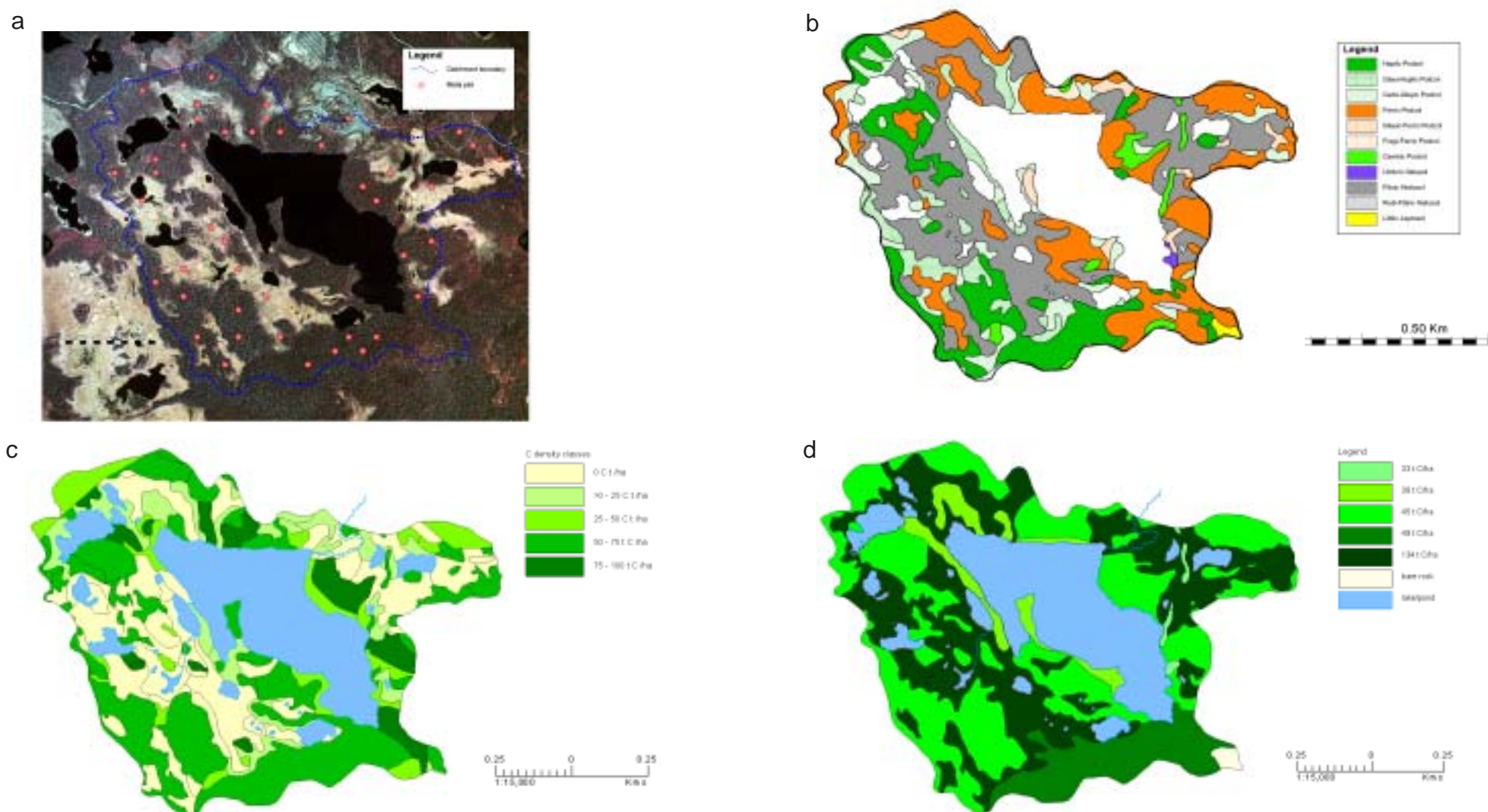


Figure 1. a) The Hietajärvi catchment from the air showing location of extensive plots and catchment border; b) Soil type map (FAO soil classification) of the Hietajärvi catchment (surveyed by P. Krasilnikov and M. Starr, June 1994); c) Tree biomass C density ($t\ C\ ha^{-1}$) by forest stand unit; d) Soil C density ($t\ C\ ha^{-1}$ to 30 cm depth; upland soil includes humus layer) based on map of surface deposits.

DISCUSSION AND CONCLUSIONS

Upland soil C densities decreased with depth, reflecting the depth distribution of soil C mass concentrations. Soil C densities for the peatland areas, in contrast, increased with depth, which shows that the depth distribution of soil C in natural peatlands is mainly determined by bulk density and not C mass concentrations. Earlier surveys on permanent monitoring plots indicate that there are

considerable amounts of dead standing and fallen trees, snags and coarse woody debris on the forest floor. We intend to estimate the C density and stock of this necromass in the future.

The biomass and soil C densities can be compared to deposition, litterfall, soil leaching and stream water runoff C fluxes that have been determined at Hietajärvi.