Plant litter and its relevance in forest soil C cycling

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Introduction

The ecological impact of litter derived from the tree stand and understorey vegetation is considerable in forest ecosystems. Litter has an effect on the nutrient budgets of plants and nutrient cycling, and provides a physical substrate and nutrient source for soil microbes. The litter layer of the forest floor protects the underlying humus and mineral soil against drought and represents a considerable store of energy. The processes involved in the decomposition of litter, and subsequent release of nutrients, form a link between the litter and the productivity of the growing site (Lianne et al. 1981, Nilsson et al. 1999). The chemical composition of the litter stimulates or inhibits the growth of plants seedlings (Nilsson et al. 1999). The litter and its physical and chemical properties regulate to a considerable extent the carbon cycling of the site, humus formation, soil structure and fertility (Lianne et al. 1981). Litter is the most important source of nutrients and organic matter in forest soil. If the litter input to the soil and its chemical composition are known relatively exactly, then it is possible to calculate the nutrient budgets of forest ecosystems and determine carbon accumulation in the soil (Berg & Meetemeyer 2001).

The aims of this study

- To elucidate the plant composition of the litter (L) layer in Scots pine and Norway spruce stands.
- To determine the concentrations of total carbon and main C-containing fractions in L layer of spruce and pine stands.

Material and Methods

For details about sampling etc., see abstract: *Carbon stocks and carbon fractions in organic layer (F + H) of forest soil*

The L layer was separated into the following fractions:

- Dead dwarf shrub leaves and stems
- Yellow/brown dead parts of mosses and lichens (Fig. 1.)
- Dead grasses and herbs
- Needles of Scots pine and Norway spruce
- Branches
- Cones, cone scales, seeds
- Bark
- Dead wood
- Other

All the litter fractions were dried at 70 ^{o}C/2d and milled before analysis.

For details about chemical analyses, see abstract: *Carbon stocks and carbon fractions in organic layer (F + H) of forest soil*

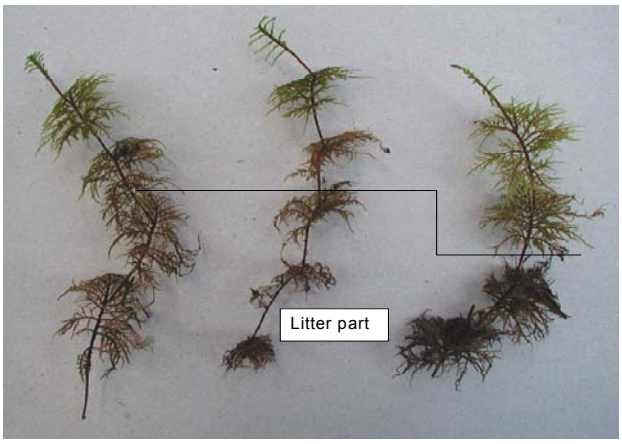

Fig. 1. An example showing the litter part of moss sample. Photo: Maija Salemaa

Results

The total amount of tree litter in the litter layer (L) was significantly higher in southern than in northern Finland (Fig. 2.). Tree litter in the Scots pine stands varied from a minimum of 80 g/m^2 in Pallasjärvi to a maximum of 392 g/m^2 in Tammela, and in the Norway spruce stands of 100 g/m^2 in Pallsjärvi to 485 in Punkaharju g/m^2. The minimum amount of needle litter was 38 g/m^2 in Pallasjärvi and maximum amount 82 g/m^2 in Tammela. In the Norway spruce stands the minimum amount of needle litter was 15 g/m^2 in Tammela, and the maximum 60 g/m^2 in Sodankylä. In all the stands the main fractions of coarse tree litter consisted of branches, cones and bark (Fig. 4.). The amount of dwarf shrub litter in the pine stands was 53 – 16 g/m^2 and in the spruce stands 59 – 0,6 g/m^2. The total amount of dwarf shrub litter was higher in northern Finland in both the pine and spruce stands compared to southern Finland (Fig. 3.).

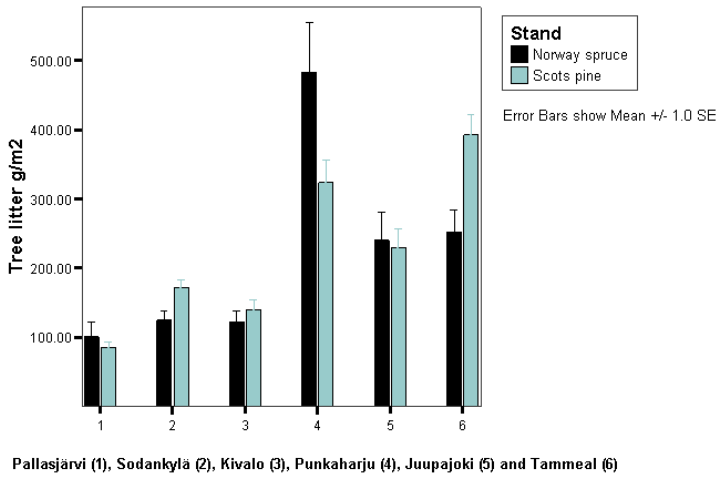

Fig.2. The amount of tree litter in the L layer of the Norway spruce and Scots pine stands.

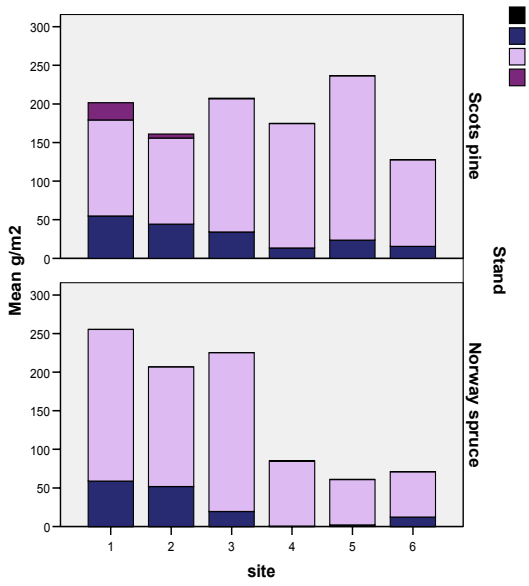

Fig 3. Amount of understorey litter in the L layer of the Norway spruce and Scots pine stands. Site 1 =Pallasjärvi, 2 = Sodankylä, 3 = Kivalo, 4 = Punkaharju, 5 = Juupajoki and 6 =Tammela

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The total C concentration of needle litter was 55 % in the Scots pine stands and 51% in the Norway spruce stands. The carbon concentration of the understorey litter (excluding the brown/yellow dead moss fraction) was 53 % in the spruce stands and 54 % in the pine ones.

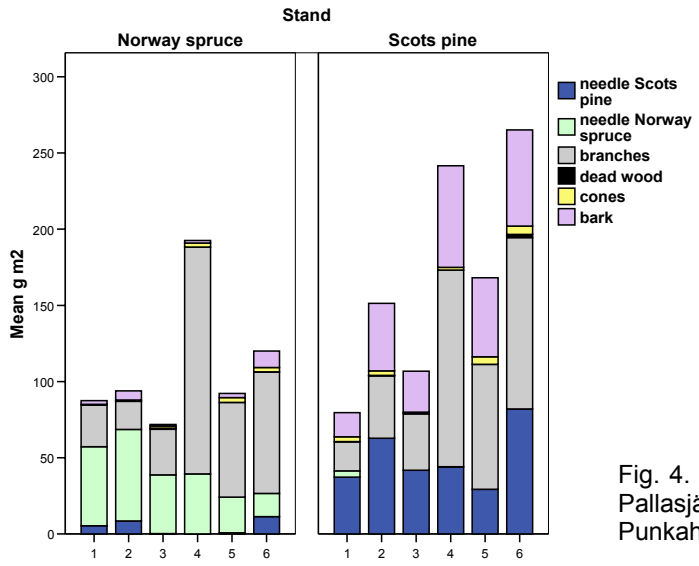

Fig. 4. Individual fractions of tree litter. Site 1 = Pallasjärvi, 2 = Sodankylä, 3 = Kivalo, 4 = Punkaharju, 5 = Juupajoki and 6 = Tammela

References

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