Potential litterfall of Scots pine branches in southern Finland

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Introduction

Litter input drives dynamic soil models that are used to understand the flows and stocks of soil carbon. In the estimation of above-ground litterfall, much of the uncertainty lies in the turnover rate of branches. The objective of this study was to develop a model for estimating the branch litterfall of Scots pine stands.

Methods

Here the potential litterfall of branches was modelled as a function of tree diameter. First, the vertical biomass distribution (Fig. 1) of branches was predicted on the basis of branch biomass data collected from 195 trees sampled in southern Finland. Second, to predict annual branch mortality and potential litterfall, this information was combined with data on measured changes in height of the crown base from 583 Scots pines. Thereafter, estimated litter fall was compared with measured litter fall (Table 1.).

Table 1. Litterfall collection on Scots pine stands in Southern Finland. Biomass equations by Marklund (1988) were used for estimation of the total branch biomass.

Stand	Age of stand	Stand measurement year	Branch litter-collection, years	Number of litter traps	Size of each trap	Basal area	Stocking	Estimate branch biomass	Average annual branch litter	Minimum annual branch litter	Maximum annual branch litter	Relative branch litter
	(years)				(m^2)	(m^2 per ha)	(n per ha)	(Mg per ha)	(Mg per ha)	(Mg per ha)	(Mg per ha)	(%)
Aulanko	43	1995	1986-1999	10	0.05	19.4	587	9.2	0.078	0.012	0.198	0.85
Eckerö	156	1991	1986-2000	10	0.5	26.7	584	15.5	0.144	0.065	0.236	0.93
Heinola	143	1991	1986-1988	10	0.5	13.7	136	7.4	0.142	0.052	0.288	1.92
Kuorevesi	120	1991	1986-1999	10	0.5	24.3	288	9.5	0.180	0.068	0.327	1.89
Noormarkku	102	1986	1986-1998	10	0.5	29.2	580	12.2	0.144	0.013	0.245	1.18
Punkaharju	135	1990	1986-2000	15	0.5	23.8	260	11.3	0.133	0.058	0.326	1.18
Vilppula	209	1992	1986-2001	10	0.5	24.6	237	10.2	0.199	0.050	0.406	1.95

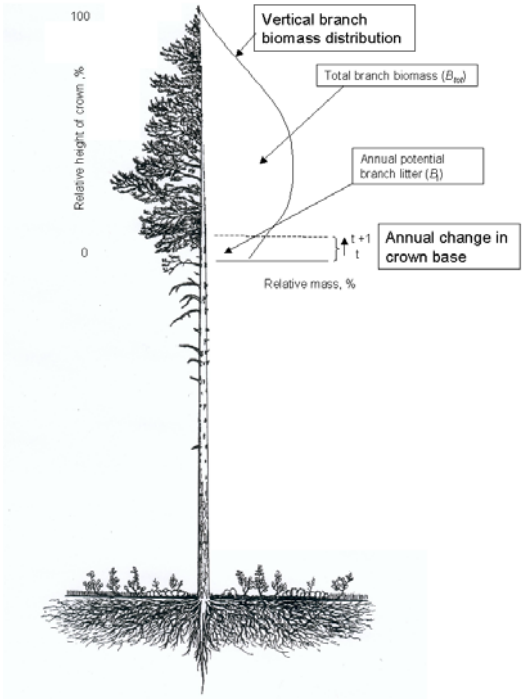

Figure 1. Estimation of potential litterfall of branches $\left[{}^{B_i}/_{B_{tot}}\right]$, based on vertical distribution of branch biomass and annual change in height of the crown base.

Results

Depending on stem size (dbh), the proportion of annual litterfall of branches from the total biomass of branches varied from 7% to 0.5%, being highest in small trees (Fig. 2). According to the results of this study, the litterfall of branches depends on tree size and stocking density (Fig. 3). When the estimates were tested against data on collection of branch litter, it was found that the method underestimates litterfall in very old stands but agrees with the measurements in other stands.

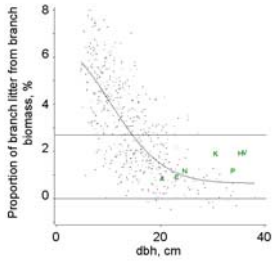

Figure 2. Proportion of potential branch litterfall of the total branch biomass of trees as a function of tree diameter. Black dots are trees, while letters (A, E, H, K, N, P and V) indicate litter-collection stands, according to the first letter of the stand (Table 1). The vertical reference line (at 2.7 %) is based on biomass data by De Angelis (1981) as applied in (Liski et al., 2002).

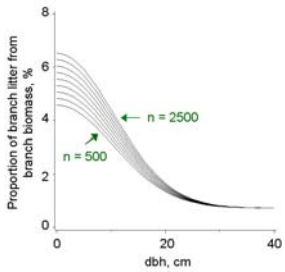

Figure 3. Models for potential branch litter as a function of diameter, when stocking varies from 500 to 2500 trees per ha.

Conclusions

This model of branch litter production improves the accuracy of the estimated litter input to the dynamic soil model. Thus, the precision of soil carbon estimates is also improved when this model is applied.

References:

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