

Unearthing fine root production by plant functional groups in drained peatlands through in-growth cores

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Introduction

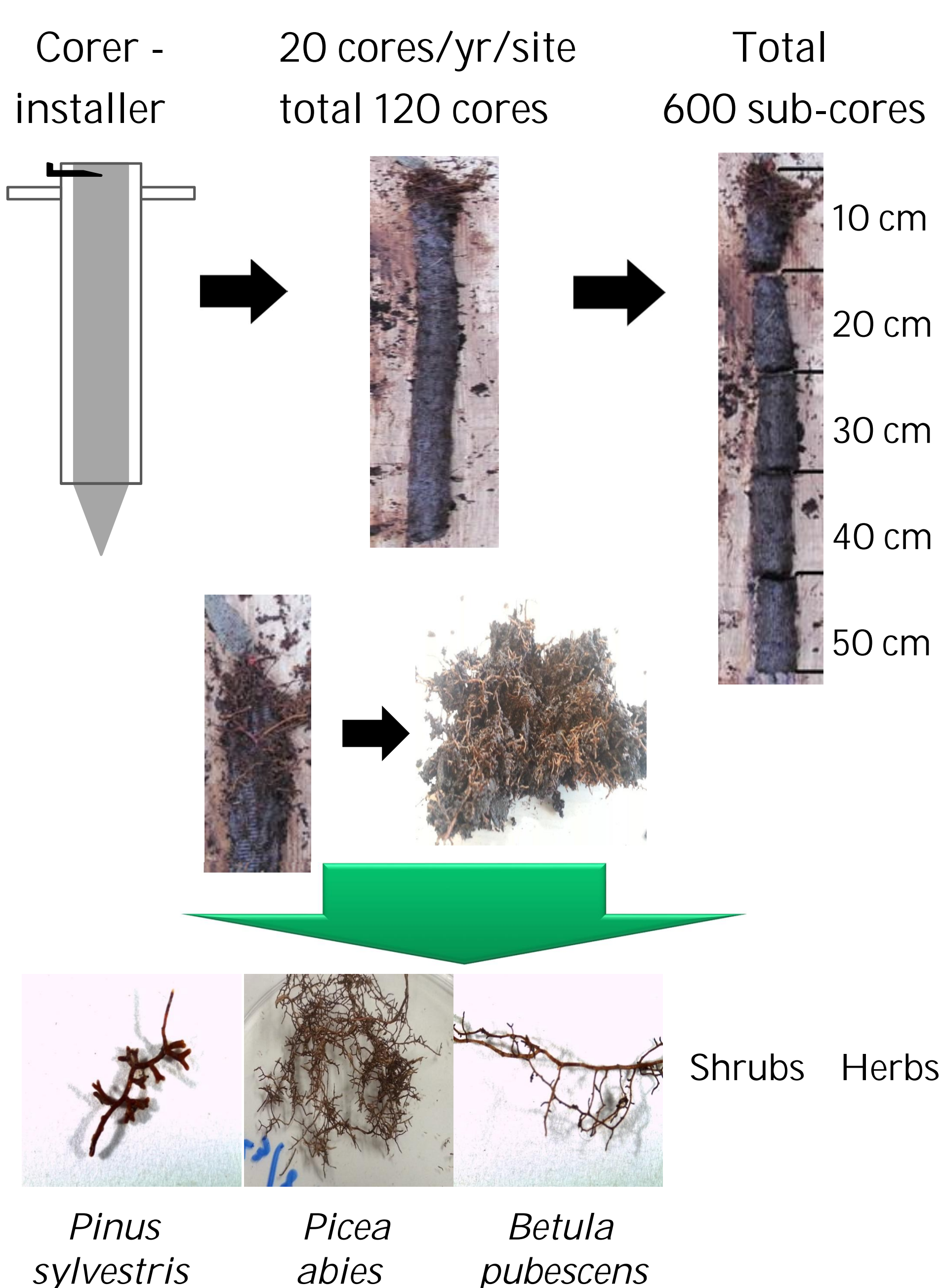
Fine roots mediate significant carbon fluxes in boreal peatlands that are likely to be affected substantially by land use and climate warming. Fine root production data by plant functional groups such as herbs, shrubs and trees are still largely missing. Recently, we introduced a modification to the ingrowth core method for peatlands that reduces disturbance and facilitates a high number of replicates (Laiho et al. 2014). Here, we examine the applicability of this method with three years' data and estimate the production by different species and functional groups in two drained peatland forest sites representing different nutrient status: rich and poor.

Objectives

The study aims at determining

- the optimal incubation time for the ingrowth cores,
- how to calculate the production values from multiple years' biomass data, and
- vertical distribution of fine root production and the contributions of different plant functional types in two contrasting sites.

Methods



Method1: dividing masses by years of incubation
Method2: subtracting masses of consecutive years

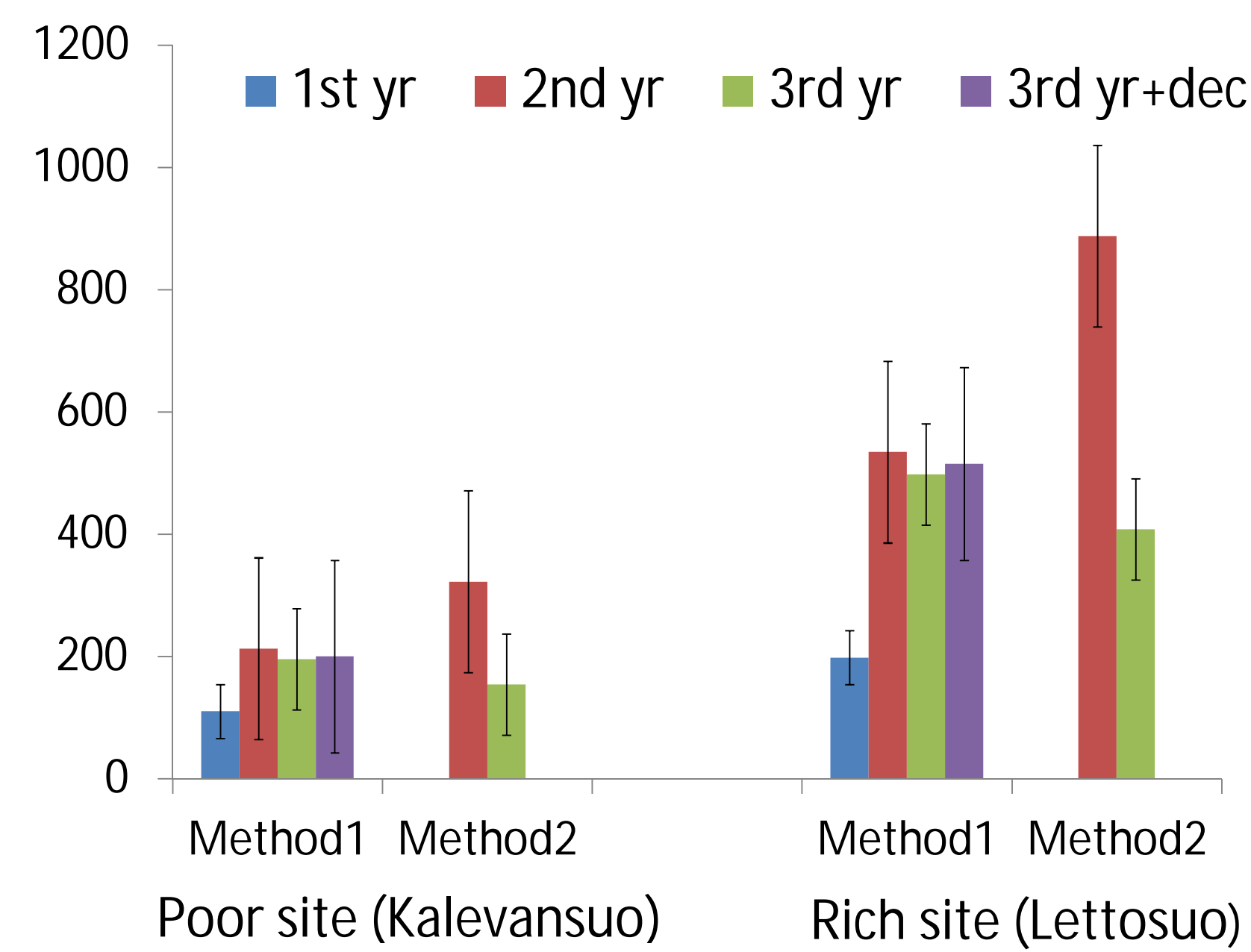


Fig 1: Mean fine root production ($\text{gm}^{-2}\text{yr}^{-1}$) estimated by method1 and method2

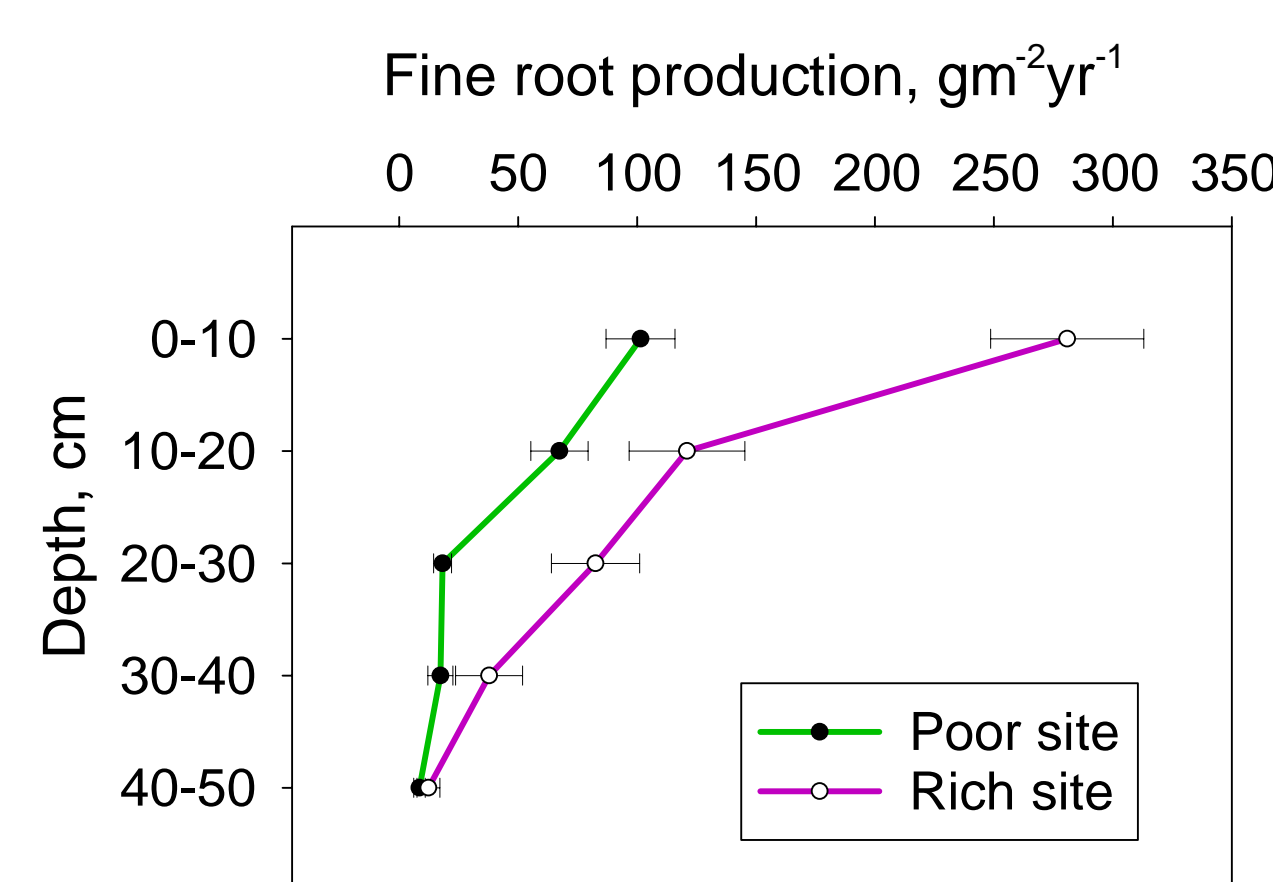


Fig 2: Vertical distribution of total fine root production in both sites, based on the 2nd year method1 estimates ('best estimate')

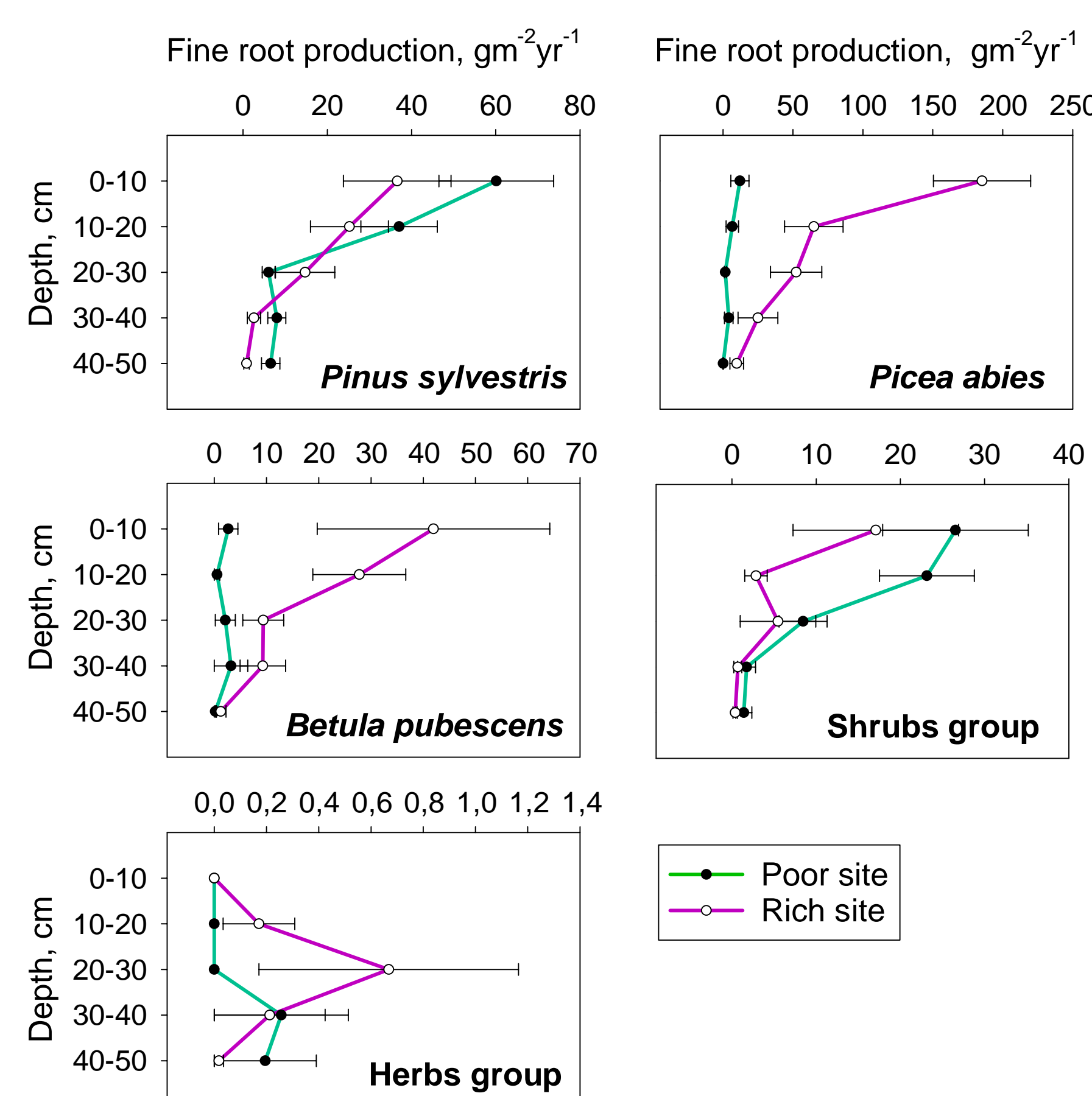


Fig 3: Fine root production by species and functional groups, based on the 2nd year method1 estimates

Table1: Characteristics of the study sites. Peat properties are avg. for 0-20 cm and N, P, K in mg g^{-1}

Sites	N	P	K	C:N	Basal area, $\text{m}^2 \text{ha}^{-1}$		
					Pine	Birch	Spruce
Poor site (bog)	14	0,56	0,31	36	17,6	0,7	<0,1
Rich site (fen)	23	0,79	0,23	24,5	17,4	6,1	4,5

Results

Figure 1

- Method1 showed similar values for second and third year that did not differ significantly ($P > 0.05$) in either site; thus, two years' incubation time is enough
- Accounting for the decomposition of dead roots (assumption: 30 % mass loss during one year following death) had only a small effect on production estimates.
- In contrast, method2 results varied much more between years and may be considered to indicate range of production

Figures 2 & 3

- Higher production in the rich site across the whole depth range studied.
- Poor site showed relatively higher root production (19%) deep down (30-50 cm) compared to rich site (10%).
- Production was significantly different ($P < 0.001$) between sites for all plant functional groups, except herbs and Scots pine.

Conclusions

Our study suggests that the method1 (dividing method) is more feasible than method2 (subtracting method), and that merely second year sampling is enough for estimating fine root production, which inevitably reduces study time.

References

Laiho R, Bhuiyan R, Strakova P et al. (2014) Modified Ingrowth core method plus infrared calibration models for estimating fine root production in peatlands. *Plant and Soil* 358: 311-327.