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IS DITCH NETWORK MAINTENANCE INVARIABLY NEEDED AFTER THINNING?

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SUMMARY

Water levels and tree growth were studied in three Scots pine stands that were partly thinned. Ditch network maintenance (DNM) was neglected to test the recent result that a moderately stocked tree stand as such would deal with adequate drainage. Thinnings decrease stand volume and canopy coverage which may jeopardize drainage. Avoiding DNM would, however, bring about considerable environmental benefits. In the first year(s), water levels on thinned plots were slightly higher but this effect levelled off in three years. Increased growth rates and specific foliar mass indicated better tree vitality following thinning and no signs of deterioration were observed.

KEYWORDS: peatland forestry, thinning, ditch network maintenance, water table, evapotranspiration

INTRODUCTION

Forest management on drained peatlands in Finland applies intensive silvicultural activities, such as thinnings and ditch network maintenance (DNM) operations, for maintaining stand vitality that has been reached by initial ditching. Management guidelines suggest DNM to be applied once or twice before final cutting, preferably in the connection with commercial thinnings. Present peatland forest management, however, is pressurized by the demands of cost-efficiency and environmental aspects, mainly quality-control of run-off waters. Minimizing the number of DNM operations in management regimes may answer to these demands to some extent.

It is conceivable that some DNM operations included in the present management system are unnecessary because recent studies have shown that a growing tree stand of approximately 125-150 m^3ha^{-1} is able to maintain adequate drainage and stand productivity regardless of the functional status of the ditch network (Sarkkola *et al*. 2010). This is due to the effective evapotranspiration of the growing stock. Thinnings, however, may decrease stand volume and the foliar mass of the retained stand remarkably, which in turn means weaker evapotranspiration. Applying thinnings and neglecting concomitant DNM operations may thus constitute a risk for losses in tree growth.

In Finland, where almost 5 million hectares of peatlands have been drained for forestry, this discussion is fairly topical. The aim of this study was to examine the interactions of tree

growth and water table levels in Scots pine (*Pinus sylvestris* L.) stands following thinning when no DNM is applied.

MATERIALS AND METHODS

We applied thinnings in parts of three Scots pine stands of low (DsT, Dwarf-shrub type) to medium (VT, *Vaccinium vitis-idaea* type) productivity in southern Finland (Table 1). In two of the stands (Parkano, Joroinen; 'type A') the thinnings were carried out according to standard forestry practices and in one (Vesijako; 'type B') we used circular openings around the sample trees to demonstrate various thinning intensities (no thinning, normal thinning – openings with 5 m radius, and heavy thinning – openings with 7.5 m radius) (Fig. 1). Water table levels were monitored in the thinned and unthinned parts before and after thinning and the basal area growth of selected sample trees was measured with girth bands. In Vesijako we also monitored the specific size (dry mass) of needles born before and after the treatment. Here we present preliminary results from one to three years following the thinning treatment. Weather data from the corresponding time periods was picked up from the database of Finnish Meteorological Institute (Venäläinen *et al*. 2005).

Table 1. Site properties and tree stand characteristics.

Location	Tsum d.d.[a]	Site type	Type[b]	Treatment	n[c]	Stem nr, ha^{-1}	Basal area, m^2ha^{-1}	Dominant height, m	V_{st} [d], m^3ha^{-1}	V_{cut} [e], m^3ha^{-1}
Parkano 62.02N, 22.72E	1122	DsT	A	Unthinned	3	1030	20	15	137	-
				Thinned	3	639	18	17	140	36
Joroinen 62.31N 27.75E	1160	VT1	A	Unthinned	3	1033	22	17	164	-
				Thinned	3	707	17	16	129	37
Vesijako 61.37N 25.11E	1239	VT1	B	Unthinned	9	1130	27	20	n.e.	-
				Thinned (5)	10	520	16	21	n.e.	n.e.
				Thinned (7.5)	10	220	8	21	n.e.	n.e.

[a] Temperature sum, day degrees (>5˚C) average 1961-1990
[b] Type of experiment design, see figure 1.
[c] Number of replicates
[d] Standing stem volume at start of monitoring
[e] Stem volume removed in thinning

RESULTS AND DISCUSSION

In general, the water table level depended on stand volume in all three experiments, both before and after thinnings. The strongest correlation appeared during the late growing season, i.e., from mid-June to mid-September, as suggested by Ahti and Hökkä (2006) and at that time the water table was clearly higher in the thinned parts of the stands when compared to the unthinned parts (Fig. 2). Throughout those periods that are also known to be critical for fine root growth, water table remained deeper than the required minimum levels of 30 cm. The weather conditions did not vary notably among the different years (data shown only for Parkano in figure 2 d). The initial deviation in water levels between thinned and unthinned stands appeared to level out already after two years (Fig. 2 b) – probably due to the rapid foliage recovery of the retained trees.

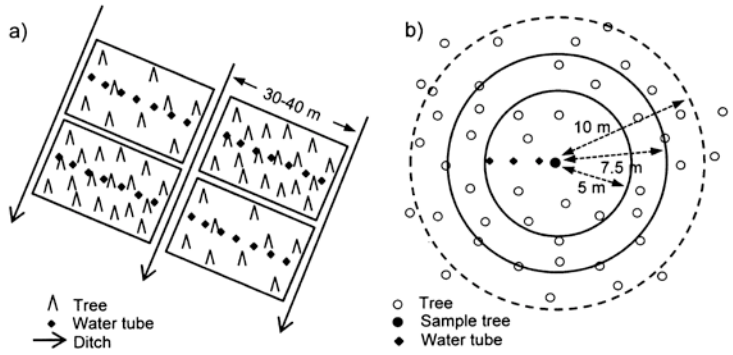

Figure 1. Design of type A and type B experiments.

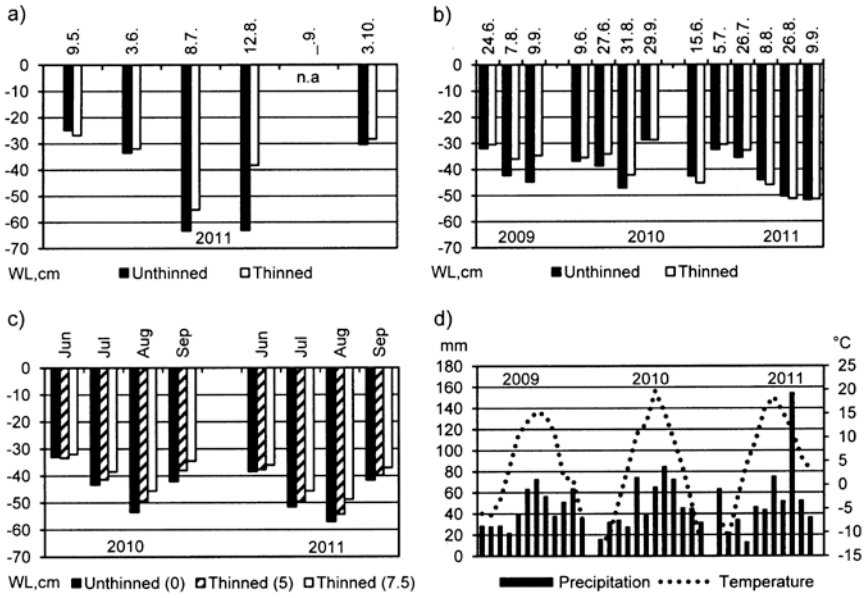

Figure 2. Average water table levels (WL) by treatment, in a) Joroinen (2011), b) Parkano (2009-2011), and c) Vesijako (2010-2011) experiments. Figure d presents monthly mean temperature and precipitation in Parkano.

According to the first-year-results of girth band measurements, basal area growth of the sample trees showed some increase following thinning despite a slight rise of the water level (Fig. 3). Specific foliar mass (mass of 100 needles) in the sample trees of Vesijako experiment increased by 12% and 17% after normal and heavy thinning, respectively (data not shown).

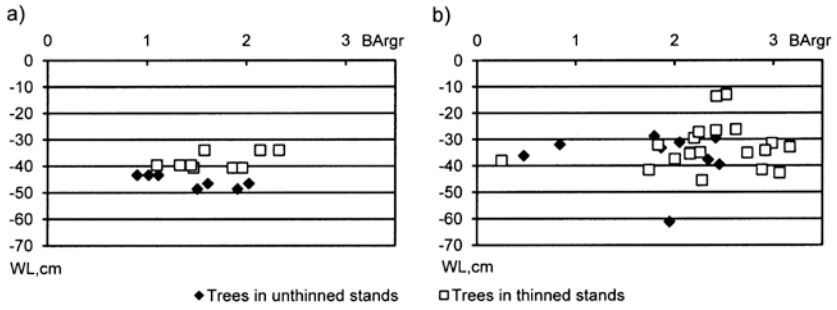

Figure 3. Basal area relative growth rate, BArgr, of sample trees during the first year after treatment in a) Joroinen, and b) Vesijako experiments. WL = water table level.

Trees responded to thinning by showing increased vitality (i.e. increased specific needle mass and basal area growth) despite the slightly higher water levels due to decreased stand volumes. Longer monitoring periods and better regional representativeness are needed before evaluating whether DNM could be omitted following thinnings in peatland pine stands.

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