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Regeneration after stump harvesting in southern Finland

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ABSTRACT

In southern Finland, large-scale stump harvesting from regeneration areas began in the early 2000s. At that time, stump harvesting and additional soil scarification for planting was performed simultaneously. The aim of this study was to investigate the regeneration result, particularly the outcome of the natural regeneration of birch after stump harvesting, compared to the result achieved on a conventionally soil prepared area without stump lifting.

The study material consisted of 37 stump-harvested areas 4–9 years old, and 10 conventionally soil prepared regeneration areas of a corresponding age. In the case of Norway spruce planting, the result did not differ between stump-harvested and conventionally soil prepared areas, but the share of pure coniferous stands after pre-commercial thinning was estimated to be 30% after stump harvesting and 50% in conventional regeneration areas.

In stump-harvested areas, the share of disturbed soil surface seemed remarkably higher and the time for seedling emergence longer than in conventionally soil prepared areas without stump lifting. The number of Scots pine seedlings was somewhat higher after stump harvesting than after conventional soil preparation, but there was great variation between regeneration areas. As for Norway spruce, there were fewer natural seedlings on stump-harvested areas. The number of birch seedlings was somewhat higher after stump lifting, but there was huge variation between regeneration areas. Most birch-rich regeneration areas were discovered after the stump harvest; the maximum mean density was over 60,000 birch seedlings ha⁻¹. Birch regeneration was most abundant on fine textured, moist mineral soils or peat layered spots. The mean temperature in May and June during the first summer, and rainfall in May and June during the second summer after the stump harvest, correlated positively with the abundance of birch seedlings.

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1. Introduction

In southern Finland stump harvesting from regeneration areas began as a large-scale operation in the early 2000s. Today, stumps are lifted on about 10% of clear felling area in Finland (17,000–20,000 ha in 2010, Juntunen, 2012). In the 1990s, stump harvesting and additional soil preparation for planting was performed simultaneously. Today, in order to achieve higher site-preparation quality, it is recommended that the stumps be lifted as part of a separate operation and the soil be prepared for planting afterwards, or that mechanised planting be used (Rantala et al., 2010).

Lifting stumps from the soil causes much greater disturbance to ground layer vegetation and soil surface than conventional soil preparation. In the case of conventional soil preparation (for instance mounding), 20–30% of the soil surface is disturbed. In stump-harvested areas, two to three times this amount of the soil surface is disturbed (40–90%). According to Kardell (1992), the proportion of disturbed soil surface was 68% after stump harvesting

with a Pallari stump harvester. In a small Finnish study, the corresponding figure varied from 65% to 90% (Strandström, 2006). Kataja-aho et al. (2011a,b) estimated that around 30% of the forest floor was left undamaged after stump removal.

In Kardell's (1992) experiments (which correspond rather well to circumstances in southern Finland) the proportion of ground surface without vegetation diminished by around 10% units in 1 year and maximum ground vegetation cover was achieved in the ninth year after stump harvesting. In southern Finland, ground vegetation covered the ploughing tracks within 5–6 years of soil preparation (Kellomäki, 1972; Palviainen et al., 2007), which also reflects the succession rate with conventional mounding. This means that the proportion of disturbed ground surface is large and is open longer on a stump-harvested area than on a conventionally soil prepared one.

Large mineral soil surfaces and disturbances in the humus layer enhance the possibilities for natural regeneration (Raulo and Mälkönen, 1976; Kotisaari, 1982; Saksä, 1992). According to Kardell (1992) the number of naturally regenerated seedlings within 7–8 years after stump harvesting was 1.5 times greater than on conventionally soil prepared areas (harrowing). Most of the

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