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# Forest soil rehabilitation with tillage and wood waste enhances seedling establishment but not height after 8 years

**C. Bulmer, K. Venner, and C. Prescott**

**Abstract:** We evaluated soil conditions of rehabilitated log landings in the Interior Douglas-fir biogeoclimatic zone of British Columbia during the first 3 years after treatment and the growth of lodgepole pine (*Pinus contorta* Dougl. ex Loud. var. *latifolia* Engelm.) on these log landings over 8 years. Rehabilitation treatments included combinations of tillage and the addition of either stockpiled topsoil or one of three organic amendments: hog fuel, sort-yard waste, and a wood waste – biosolids compost. The woody amendments were either applied as a surface mulch or incorporated into the soil after tillage. Tillage and addition of wood waste reduced soil bulk density and increased carbon content. Daytime soil temperatures in summer were lower under a hog fuel mulch than for the other treatments. The plots receiving hog fuel also had higher soil moisture content. One year after treatment, soil mechanical resistance for untreated soils, and those that were simply tilled, exceeded 2500 kPa for much of the growing season. Plots receiving wood waste had lower mechanical resistance. Use of wood waste in rehabilitation improved soil conditions and contributed to improved survival rates for planted lodgepole pine seedlings. Height growth after 8 years was not significantly affected by the treatments.

**Résumé :** Nous avons évalué la condition du sol de jetées réhabilitées dans la zone biogéoclimatique du douglas de Menzies bleu en Colombie-Britannique durant les trois premières années après le traitement ainsi que la croissance du pin lodgepole (*Pinus contorta* Dougl. ex Loud. var. *latifolia* Engelm.) sur ces jetées sur une période de huit ans. Les traitements de réhabilitation comprenaient des combinaisons de travail du sol et d'ajout de sol de surface entreposé ou d'un des trois amendements organiques : résidus ligneux broyés, déchets de parc de triage et compost de déchets de bois et de biosolides. Les amendements ligneux ont été appliqués soit comme paillis en surface ou incorporés dans le sol après avoir travaillé le sol. Le travail du sol et l'ajout de déchets de bois ont réduit la densité apparente du sol et augmenté la teneur en carbone. La température du sol pendant le jour en été était plus faible sous le paillis de résidus ligneux broyés comparativement aux autres traitements. Les parcelles traitées avec les résidus ligneux broyés avaient également une teneur en humidité plus élevée. Un an après le traitement, la résistance mécanique du sol dans les parcelles non traitées, ainsi que dans les parcelles où le sol avait simplement été travaillé, dépassait 2500 kPa pendant presque toute la saison de croissance. Les parcelles traitées avec des déchets de bois avaient une résistance mécanique plus faible. La réhabilitation des jetées avec des déchets de bois a amélioré la condition du sol et contribué à améliorer le taux de survie des plantations de semis de pin lodgepole. Après huit ans, la croissance en hauteur n'était pas significativement affectée par les traitements.

[Traduit par la Rédaction]

## Introduction

In British Columbia, soil rehabilitation practices are used to mitigate soil degradation during forestry operations. Rehabilitation usually involves tillage to loosen compacted soils (Plotnikoff et al. 2002) and may include steps to restore organic matter and nutrients lost during road and landing construction (Sanborn et al. 2004). Strategies for restoring soil organic matter include (*i*) conserving and replacing organic-rich surface soils, (*ii*) establishing grass and legume cover crops that enhance organic matter inputs to soil, and (*iii*) adding organic amendments derived from waste logs, stumps, treetops, and branches in close proximity to the site or from external sources.

Without rehabilitation, soils on roads and log landings are often compacted and lacking in fertile soil material (Carr 1987; McNabb 1994). Trees growing on unrehabilitated or partially rehabilitated roads and landings often perform poorly in comparison with those growing on areas where trees have been harvested and replanted without excessive soil disturbance (Smith and Wass 1994; Wass and Smith 1994; Teste et al. 2004). Poor performance of planted trees on compacted soils has been associated with dysfunctional physiological processes affecting water and nutrient availability, hormones, and the movement of carbohydrates to meristematic sites (Kozlowski 1999). Specific soil properties that appear to trigger poor tree growth in compacted soil include high mechanical resistance that prevents the penetra-

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