

Coarse woody debris increases microbial functional diversity in reclaimed soils

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The Challenge

Microbial communities are important indicators of soil quality and ecosystem productivity in both natural and reclaimed ecosystems. The presence of diverse microbial communities promotes decomposition of organic materials and, in turn, the cycling of nutrients.

Coarse woody debris is a reclamation tool that has been used to increase native plant establishment and improve soil development on reclamation sites. It's possible that coarse woody debris may also influence soil microbial communities. Quantifying the impacts of coarse woody debris on soil microbial communities is therefore key to evaluating the utility of coarse woody debris for assisting reclaimed sites.

The Approach

The impact of coarse woody debris on soil microbial communities was tested on two soil types typical of the oil sands region: forest floor mineral soil mix and peat mineral soil mix. Aspen coarse woody debris with a diameter greater than 10 cm was applied to a reclaimed oil sands mine site with coverage approximating 10-20% of the soil surface.

Soil microbial communities were sampled approximately five years after plot establishment. Samples were collected from beside coarse woody debris (within 5 cm) and away from coarse woody debris (at least 100 cm from the nearest coarse woody debris). Microbial functional diversity, biomass, and overall community structure were then tested.

The Results

The forest floor mineral soil mix had significantly greater soil microbial functional diversity than the peat mineral soil mix. This finding is consistent with previous studies and highlights the distinct differences in the two cover soils.

The presence of coarse woody debris had a direct effect on the microbial community structure in the forest floor mineral soil mix. It also increased the microbial biomass and the microbial functional diversity in both the forest floor mineral soil mix and the peat mineral soil mix.

The results suggest that the benefits of coarse woody debris are greater on sites with forest floor mineral soil mix than with peat mineral soil mix.



Fig. 1. An example of aspen growth on a peat mineral mix site with coarse woody debris applied.

Management Implications

- Forest floor mineral soil mix has distinct benefits over peat mineral soil mix as a reclamation cover material because it contains a more productive soil microbial community.
- Applying coarse woody debris to reclaimed oil sands mines has clear benefits for enhancing soil microbial community functional diversity and early ecosystem development, especially on sites covered with forest floor mineral soil mix.
- By enhancing the soil microbial community, coarse woody debris will help increase the decomposition of organic matter and increase nutrient cycling in reclaimed soils.

Further Reading

Kwak, J.H., S.X. Chang, M.A. Naeth and W. Schaaf. 2015. Coarse woody debris increases microbial community functional diversity but not enzyme activities in reclaimed oil sands soils. PLoS ONE 10: e0143857. doi:10.1371/journal.pone.0143857

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