

# Microbial Biomass and Activity in a Subarctic Soil Ten Years After Crude Oil Spills

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## ABSTRACT

This study documents the residual effects of summer and winter experimental oil spills on soil 10 yr after application. Measurements included adenosine triphosphate (ATP) levels, in vitro carbon dioxide evolution, cellulose and wood decomposition, soil N, and total and non-oil C. About 18 and 14 kg petroleum residues per m<sup>2</sup> remained in the soil in the winter and summer spills, respectively, and no reinvasion of plants had occurred in areas heavily impacted by the spills. Soil ATP levels averaged about 100 mg m<sup>-2</sup> in the control soils and were about threefold higher than in the oiled soils, indicating reduced microbial biomass in the oily soils. There were no differences in in vitro CO<sub>2</sub>-C evolution rates in the three soils, suggesting that there were similar levels of available substrate in both oiled and control soils. Cellulose and wood decomposition rates in the field were much lower in the oiled plots than in the unoiled soil. Nonpetroleum organic C levels averaged about 12 kg m<sup>-2</sup> and were not significantly different between control and oiled soils, indicating that in the field little decomposition of organic matter had occurred in the oiled plots. Total N levels averaged about 5.5 kg m<sup>-2</sup> in the oiled plots, which was significantly higher than the 4 kg N m<sup>-2</sup> in the control plots. This was possibly due to N deposition of parts of plants killed by oil and to N<sub>2</sub> fixation coupled with reduced N losses from the oiled soils. Ammonium-N accumulated in the oiled soils at much higher levels than in the control soil. Results of this study showed that crude oil spills in subarctic forests can have long-lasting effects on soil biological properties.

*Additional Index Words:* Taiga, Organic matter decomposition, Soil respiration, Soil N cycling, Adenosine triphosphate.