Tree Species Affects Soil Characteristics

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An investigation was carried out in an old-field white spruce *(Picea glauca)* stand growing on farm land that had been cultivated for several years. During this time the soil within the plough layer (Ap horizon) had been ploughed and homogenised up to a depth of over 50 cm. Therefore any systematic change in soil characteristics around the tree trunks could be attributed to the effects of white spruce trees.

Two sets of samples were collected from each tree—one along a major root and the other without a root. For sample collection, trenches 30 cm in depth were dug in two directions. Twenty trees were randomly chosen for sampling soils.

Organic and mineral samples were collected at 50 cm intervals from the tree trunks. The first set of samples was from right next to the trunk and the sample furthest away was gathered 200 cm from the trunk. The organic materials were separated into L, F and H horizons and their thickness recorded. The mineral soil samples were collected from immediately below and 20 cm below the eluvial (Ae) horizon (labelled as upper B horizon). The organic samples were characterised in terms of thickness, biomass, moisture content, pH and various nutrient contents.

Some of the soil characteristics that seem to show a general gradient from the tree trunks include water holding capacity, hydrogen ion concentration, forest floor weights and some acid cations. At each sampling location the F horizon had the highest level of water (holding capacity). The presence of a major root did not appear to contribute to the moisture retention characteristics of soils (either organic or mineral).

Highest levels of forest floor biomass were observed in the H horizon. The respective values for L and F horizons were about 50% of H values at each sampling location. The observed biomass was highest near the trunk, decreasing consistently away from it. In terms of biomass as a function of distance from the tree, there were no significant differences between L and F horizons, but between them and the H horizon there was a significant difference in biomass. Litterfall materials collected at various distance from trees showed no variation in biomass, indicating that the observed gradient in the biomass of H horizons is not due to an accumulation of more litter materials at any one location. The gradient in forest floor biomass and their moisture retention characteristics were reciprocal. The values of hydrogen ion concentrations were calculated from pH values measured using exact weights of organic materials and water. The trends were similar to those of moisture characteristics.

Likewise, the concentrations of acid cations such as iron, aluminium, manganese and copper showed gradients similar to that of forest floor biomass, suggesting a direct relationship in the rate of decomposition of forest floor biomass and concentrations of acid cations with the amount of acidity of stemflow. Highly acidic stemflow prevents the decomposition of the forest near the trees, and hence the greater accumulation of H horizon occurs. Greater acidity of stemflow near the tree trunk also causes greater leaching of acid cations creating thicker Ae horizons. This phenomenon has been observed under white spruce and balsam (*Abies balsamia*) and also has been recorded below kauri (*Agathis australis*) by Gary Orbell (personal communication).
