

Challenges in reconstructing soils: building the foundation for forest restoration in mine reclamation areas

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3 Soil is an essential component in the growth and maintenance of forests providing anchorage,
4 water, and nutrients. In Alberta's boreal forest landscape, surface soils can differ widely in their
5 chemical and physical conditions, ranging from coarse to fine textured mineral soils in the
6 uplands to organic soils in the lowlands. Open pit mine reclamation in this region is required to
7 selectively salvage surface and subsoils from both low- and upland areas and utilize them in the
8 reconstruction of soil profiles for forest reclamation. Due to the selective salvage process, soil
9 profiles in reclaimed upland areas can be constructed and arranged in variable layers and
10 thicknesses to resemble distinct horizons. As mining operations expand, it is important to
11 understand the differences of soil capping prescriptions and their influence on early forest
12 establishment. In this presentation, we compare the growth of aspen in response to different
13 surface soil materials, their placement depths, and the underlying subsoils. Aspen seedling
14 growth, soil and climatic variables were monitored over a five-year period. Results indicate that
15 high P and K concentrations in surface soils increased aspen growth, while organic-rich surface
16 soils reduced aspen growth, likely due to delayed soil warming and reduced soil temperatures.
17 However, the greater water holding capacity of the organic matter provided a benefit for aspen
18 growth during dry years. The underlying subsoil material also influenced aspen growth,
19 particularly where roots already occupied the subsoils. Growth was greater in a shallow salvaged
20 and weathered P-rich subsoil compared to deeply salvaged less weathered subsoils. Small
21 increases in the silt fraction of subsoils also had a positive impact on growth, likely due to the
22 greater water holding capacity of these otherwise coarse textured sandy soils.