Early physical, chemical, and biological impacts of using stockpiled vs directly placed reclamation soils[1]

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Abstract: Stockpiled soil for use in oil sands mine reclamation in northern Alberta, Canada is an important resource as this soil will be used for approximately half of all reclamation in the region. However, there are some concerns regarding the potential physical, chemical, and biological limitations of stockpiled soils relative to directly placed reclamation soils. For example, stockpiled soil may have higher bulk density and lower numbers of viable plant propagules compared to directly placed soils. The first year post-placement impacts of using stockpiled and directly placed soils were assessed in an operational field study at an oil sands mine. The stockpiled soils also included a tillage treatment to reduce compaction risk on some plots while the directly placed soils included both types of common reclamation soils, i.e. peat-mineral mix and forest floor-mineral mix. In general, the stockpiled soils had significantly higher bulk density, soil strength, and volumetric water content compared to the directly placed soils. The tillage treatment reduced soil strength up to a depth of 15 cm but had little impact on chemical or biological properties. Bioavailable soil nutrients tended to be similar among all treatments but nitrogen was greatest in peat-mineral mix and phosphorus was greatest in forest floor-mineral mix. Planted tree survival was similar across all treatments but natural trembling aspen seedling establishment was greater on directly placed soils with no aspen establishing on the stockpiled soils. For the plant community, forest floor-mineral mix soil had the greatest cover of native forbs, followed by the stockpiled soils and then peat-mineral mix. Overall, it appears that there are immediate impacts on the physical, chemical, and biological properties of using stockpiled soils but it is not yet known what the long-term impacts on ecosystem development will be.

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