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A Guide to Soil Decompaction

Options to ameliorate compacted soils to improve target species growth

Soil compaction frequently results from industrial disturbance on mineral soils, whether due to infrastructure or equipment traffic. Soil compaction tends to be most severe on sites with high clay content and high soil moisture, and when operations occur during non-frozen conditions. Natural processes such as freeze-thaw cycles are typically not enough to loosen deeply compacted soils (10–20 cm deep), in which case mechanical treatments will be required.

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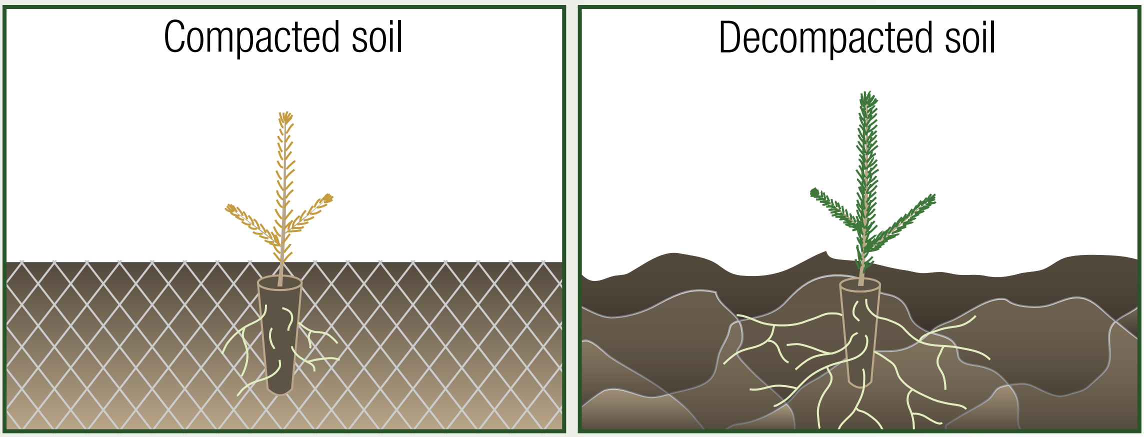
On sites with compacted soils, decompaction will be necessary to ensure trees can successfully establish and grow. Decompaction breaks up the soil and improves water flow, aeration, nutrient accessibility, root growth and microsite availability (Fig. 1). However, as with all site preparation techniques, a vegetation management plan that includes weed management and seeding or planting will be critical to ensure that target species occupy the available microsites before competing vegetation.

Figure 1. Decompaction improves root growth and tree establishment.



Decompacting a site

The appropriate decompaction technique will depend largely on the characteristics of a reclaimed site, including clay content, soil moisture and the severity and depth of compaction (Table 1). The size and shape of a site will also affect the accessibility and manoeuverability of equipment. A site assessment is a critical step for selecting the most effective decompaction method(s) for a particular site (Fig. 2).

Figure 2 Decompaction methods

Winged subsoiler

This pull-behind implement decompacts soil without inverting the topsoil. It creates large gaps that allow deep penetration of water into the soil, improving both soil moisture and further decompaction through freeze-thaw processes. It should not be used on very wet soils, as it will not break up clods effectively.

Straight ripper shank

One or two vertically mounted shanks are pulled behind a dozer. This implement is most effective on dry soils with a low clay content and may be used to pre-treat extremely dry, compacted sites prior to using a winged subsoiler. Cross-ripping is recommended on sites that are severely compacted.

Standard mounding

Soil is scooped and placed in a mound adjacent to the newly created hole. This method is recommended for wet sites, as excavators are better able to access them, and the mounds create raised microsites favourable for plant growth.

Rough and loose mounding

Soil is scooped and placed partially within the newly created hole. This approach creates a very heterogeneous soil surface.

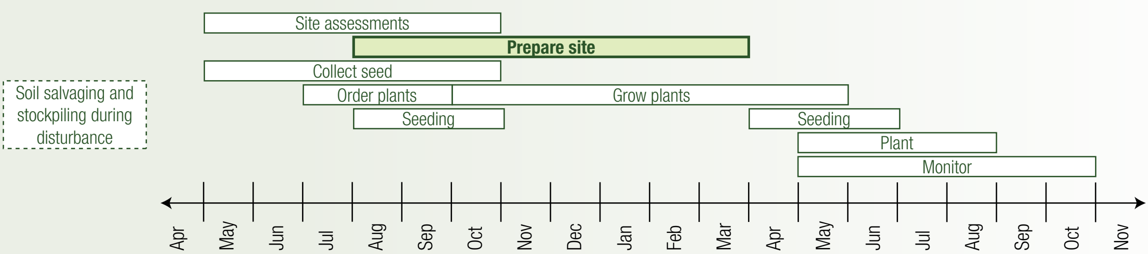
Table 1. Primary soil decompaction methods and appropriate conditions for use.

Technique	Equipment	Moisture	Clay content	Timing	Pattern
Winged subsoiler	Dozer or excavator attachment	Medium to very dry	All	Partially frozen to unfrozen	Straight, overlapping passes (> 60 cm deep). Does not invert topsoil. Should not be used on wet sites.
Straight ripper shank	Dozer attachment	Dry	Low	Frozen to unfrozen	Overlapping passes (cross-ripping on highly compacted soils).
Standard mounding	Excavator	Very wet to dry	All	Frozen to unfrozen	Soil mound is placed next to the excavated hole. Attention to planting microsite is critical on mounded sites.
Rough and loose mounding	Excavator	Very wet to dry	All	Frozen to unfrozen	Soil mound is placed partially in the excavated hole, creating a very heterogeneous surface.

Risks of decompaction

Decompaction equipment, timing and depths must be carefully planned to avoid damaging soils. The winged subsoiler, for example, will do little to break up soil clods in wet soils, and decompacting very dry soils increases the risk of mixing the topsoil with lower soil layers. Operations on wet, unfrozen soils may also cause additional soil compaction rather than alleviating it. Finally, decompaction must be planned in coordination with vegetation management, – seeding and/or planting, or the exposed microsites and mineral soil will be quickly overtaken by competing vegetation (Fig. 3).

Figure 3. Timeline for decompaction including site assessment.



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Also available under the title : Guide de la décompactage des sols – Options pour améliorer les sols compactés en vue de bonifier la croissance des espèces cibles.

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