



Practical soil sampling in planted forests – soil bulk density

WHY MEASURE SOIL BULK DENSITY?

- **Monitor the soil resource** - to assess changes in soil physical properties and to calculate the nutrient content of the soil (bulk density x nutrient concentration)

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Year of Soils



EQUIPMENT NEEDED



Sampling equipment. Spade, 10 cm soil cores (x2), peg hammer, spigot block, metal plate, flat trowel, cleaning cloth, cutting knife, table knife, trowel, pruning saw, secateurs, earmuffs, 3 m of retractable tape, geological hammer, 5 L bucket, kneeling pad (optional), soil bags, sample tags, Vivid marker pen.



Repair equipment. Ball peen hammer, files, large metal cylinder.

HOW TO COLLECT

Soil sampling can be undertaken using:

- A pre-defined plot area - sampled through time to measure change (e.g. PSP; permanent sampling plot).
- A proportional sampling method - to target landform/soil classes to monitor a larger area.

Three bulk density cores are typically collected from each area of interest to cover the natural variability of soils. Sample depth for nutrient diagnostic and soil microbial purposes is 0-10 cm. Deeper sampling gives more information on nutrient content.

The sampling point slope or PSP slope must be measured to carry out a slope correction to 'amount per hectare'.

IDENTIFY THE MINERAL SOIL SURFACE

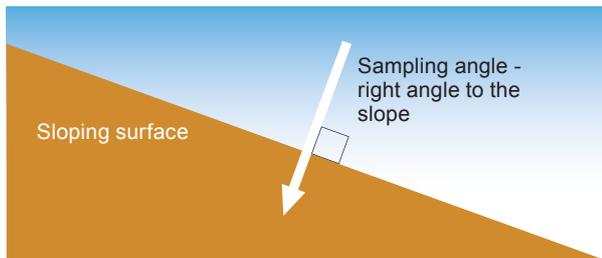
The first step is to identify the mineral soil surface under the forest floor layer LFH (litter, fragmented litter, humified litter).



L, F and H organic horizons from a pine forest. Arrows indicate base of horizons. (Photo, John Adams).

USING BULK DENSITY RINGS

1) Ensure the forest floor is removed and the mineral soil surface is identified.



- 2) Place the steel ring over the sampling position at right angles to the soil surface.
- 3) Place the plastic spigot block over the ring and hit into the ground with the hammer.
- 4) Excavate a hole on one side of the ring to get access to the base of the ring.



5) Place the metal plate on top of the ring and push the flat trowel in under the ring ensuring it is flush with the ring surface.



6) Remove sample and trim the base of the ring. If sampling below 10 cm, ensure the trimmed sample goes into the sample bag for the lower sampling depth.



7) Put a clearly marked label inside the bag and tie another label around the top of the bag.



- 8) For depth below 10 cm, repeat steps 2 and 3. Use a tape measure and a reference point to mark the mineral soil surface to make sure the ring is not hit below 10 cm from the soil surface.
- 9) Repeat step 6 and 7.

Additional points:

- If a tree root is struck, excavate around the ring and cut the root with secateurs or hand saw.
- If a rock is struck, excavate soil around the ring and pull the rock out, noting how much of the rock was within the ring and break this off with a pick axe and place into the sample bag. Alternatively, find a rock of similar size and place within the sample bag.
- If a large rock is struck, excavate the soil from within the ring down to the sampling depth and place in the bag. Leave the rock in place. Very rocky soil types are best sampled by the pit method (Davis et al., 2004).
- Take care with hitting the core into the ground if rocks are expected as this will bend or rip the core tip. If this happens use the repair kit.

References:

Davis, M.R., Wilde, R.H., Garrett, L.G., Oliver, G.R. (2004). *New Zealand carbon monitoring system: soil data collection manual*. Published by Caxton Press, NZ.
 Davis, M., Xue, J., Clinton, P. (2010). *Plantation Forest Nutrition*. New Zealand Forest Research Ltd.