# NutNet N mineralization study sampling protocol

## Materials

<table>
<thead>
<tr>
<th>1)</th>
<th>On the left you see the contents of the sampling set you received from us that you need to sample one plot:</th>
</tr>
</thead>
</table>
| ![Image](image1.png) | - Plastic gloves  
- Resin bags  
- Metal rings  
- Needle nose plier  
- Short steel core (5 x 12cm = 2 x 4.7 Inches)  
- Blue (bottom) and orange (top) plastic caps  
- Long steel core (5 x 15 cm= 2 x 6 Inches)  
- Rubber bands (not in the picture)  
- Ziplock-bags (not in the picture) |

## Additional material needed (not provided): 
- Hammer  
- Wooden boards (several for all plots)  
- Knife  
- Scissors  
- Table spoon (to fill in soil from bottom)  
- Flags/markers to mark N min cores  
- **Cool box and blue ice bags (not in the picture)**

## Further material you might find useful: 
AMS soil core sampler with 2 inch diameter core (if you have one)

## Where to sample:

Use the following 5 plots per block. Sample where you originally took soil samples

- Control  
- Control & Fence  
- N  
- NPK  
- NPK & Fence
<table>
<thead>
<tr>
<th>Conduct the following steps on each plot</th>
<th>First field visit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2)</strong></td>
<td>Remove vegetation and litter on a 7 x 7 cm area</td>
</tr>
<tr>
<td><img src="image" alt="Step 2" /></td>
<td>Take a 5 x 12 cm soil sample with the “shorter” steel core (provided). One end of the core is sharpened for easier insertion. Push the core gently into the soil so that the entire core is filled and the soil disturbed as little as possible. Use a wooden board and a hammer when working the core into the soil. Try to avoid damage to the steel core.</td>
</tr>
<tr>
<td><img src="image" alt="Step 3" /></td>
<td>Retrieve the filled core gently. In case your core is not completely full (bottom), please add some more soil from the bottom of your hole so that the core is full (use spoon if available). As these cores will be used to analyze water-holding capacity, the cores should be full, so that the soil cannot move too much (and destroy the soil structure) within the core during shipping.</td>
</tr>
<tr>
<td><img src="image" alt="Step 4" /></td>
<td>Cap the core with the plastic caps provided. Use the orange cap labeled with “Top” for the top of the core, the blue cap labeled with “Bottom” for the bottom of the core. Secure the caps with two rubber bands (provided) and place the core into a ziplock-bag (provided) Please label the bags/cores with “site_code”, “date”, “block/plot/subplot”, “notes”. Put the bag into a cool box with blue ice (cold packs; not provided).</td>
</tr>
</tbody>
</table>

Stay on the same plot for the next steps.
3) Clean three more 7 x 7 cm spots from vegetation and litter.

Take the “longer” 5 x 15 cm steel core. Take three samples ...

... to a depth of 12 cm (the black mark on the core is at 12 cm, under the stickers “Top”)

You have to re-use the core 4 times at each plot, so use it gently and try to make sure the stickers “Top” stay on the core.

Composite all three samples in a ziplock-bag (provided). Do not forget to label the bag with the information listed under step 2. You can remove large rocks, gravel to reduce shipping weight. Make sure that the amount of fine material within the composited sample approximates 350 g = 0.77 lb dry weight. If you need more than three cores to come up with the 350 g dry weight, please collect additional cores and put a note on the bag how many cores you took. Put the ziplock-bag into the cool box.

Stay on the plot.
4) Once more: clean a 7 x 7 cm patch from vegetation and litter.

Remove residual soil from the "longer" 5x 15 cm steel core as good as possible.

Insert the core gently with the “Top” label being on top ...

... to a soil depth of 13.5 cm = 5.3 inches (This way 1.5 cm = 0.6 inches should be left empty on top).

Carefully retrieve the steel core so that no soil falls out.

Put on gloves as soon as you handle the resin bags.
Mount a resin bag to the top (labelled with “Top”) ...

... fix the resin bag using a metal ring (provided) and the special needle nose plier provided. It will take a bit of strength to squeeze the ring into place

Make sure that the metal ring assures a tight fit of the resin bag.
Gently remove soil from the bottom of the core so that you also have roughly 1.5 cm = 0.6 inches empty space (concave would be best for fitting the resin bag)

Put the second resin bag in place in the same manor as before. Make sure that the bottom bag is flush with the bottom of the core.

Put the incubation core (now sealed with the two resin bags) back into the “hole” from which you collected the sample. Make sure that “Top” is on top.

This core will be left in the soil for 6 weeks. Mark the location of the core with a brush flag, flag or any other item available to you (markers not provided) for easier re-location after 6 weeks.

Move to next plot and repeat steps 2 – 4
**After completion of first field sampling**

| 5) | Upon arrival at your lab, put the capped steel cores into a plastic bag so that the cores can no longer move (so that the soil structure is not destroyed). Put all the ziplock bags with the composite soil samples into an additional plastic bag and pack everything into a sturdy cardboard box for shipping. Put enough blue ice or cold packs into the box to assure that the samples remain cool on their journey. Pack one copy of the customs soil import permit (sent by email) into the box. Tape one copy of the first sheet of the permit onto the box and pack one copy of the permit with the shipping documents (this way our custom guys hopefully find it). Ship the box to the address on the right using air-mail.

Please also send an email including tracking number of your package to stephan.zimmermann@wsl.ch and anita.risch@wsl.ch so that we can be on the look out and nudge customs if necessary.

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**Second field visit (6 weeks later)**

| 6) | Return to the field 6 weeks after inserting the incubation core. Put on gloves, retrieve the core, make sure that the top and the bottom of the core are still clearly marked and that the resin bags are still sitting tightly in the core. Put everything into a ziplock bag (provided), label the bag with "site", "date", "block/plot/subplot", "notes", put the bag into a cool box, move to the next plot.

| 7) | Upon arrival in the lab, ship cores the same way you shipped the first samples (tightly packed, with cool packs and permits) to the above address by air-mail. Again, please send us an email so that we can facilitate a quick arrival.
**Summary for field work and shipping**

**During the 1st field visit you will:**
- sample soils on control, N, NPK, control + fence, NPK + fence
- collect one sample with the short (5 x 10 cm) steel core that will be capped on each plot
- collect three 5 x 10 cm soils samples with the long (5 x 12 cm) steel core that you will combine into a ziplock bag (350 g dry weight needed) on each plot
- incubate one soil sample in the long steel core with resin bags at top and bottom for 6 weeks

**During the 2nd field visit you will:**
- collect the incubation cores, leave resin bags in place

**In the 1st shipment to Switzerland you will include:**
- the capped short steel cores containing the samples for water holding capacity measurements (capped with the blue and orange caps)
- the soil samples collected in ziplock bags
- enough cold packs to assure that the samples stay cool until they arrive

**In the 2nd shipment to Switzerland you will include:**
- the long steel cores with resin bags still in place
- enough cold packs to assure that the samples stay cool until they arrive

**For you information:**

We will analyze the following parameters from all the soil samples you send

- water holding capacity
- soil texture
- bulk density
- pH
- exchangeable cations
- C13 and N15 values (as well as C and N contents) initial and after 6 weeks of incubation
- Total N mineralization in situ (initial NO3 and NH4, input, output and NO3 and NH4 after 6 weeks of incubation)
- Total N (and C) mineralization in lab under standardized conditions
- Microbial activity (Nico Eisenhauer)