Environment and Rural Affairs Monitoring & Modelling Programme (ERAMMP)

ERAMMP Document-51:
Field-Survey Handbook (Procedures)
Soil Sampling 2021

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UK Centre for Ecology & Hydrology

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Abbreviations Used in this Document

Comp	Compressed
ERAMMP	Environment and Rural Affairs Monitoring & Modelling Programme
GMEP	Glastir Monitoring and Evaluation Programme
O	Organic [as used, this report only]
SQ	Square
UKCEH	UK Centre for Ecology & Hydrology

Abbreviations and some of the technical terms used in this document are expanded on in the programme glossaries: https://erammp.wales/en/glossary (English) and https://erammp.cymru/geirfa (Welsh)

Contents

1 SOIL SAMPLING PROCEDURE

1.1 Equipment

Rucksack or box (1) that can be kept in the van with spares. Field kit bag (2) to carry the coring device and tools for coring in the field. Main body of the coring device (3) in which the plastic cores are inserted. The handle (4) and crossbar (7) are used for extracting the core. (Figure 1.1.1) The plastic block or equivalent (6) can be placed on top of the metal lid (5) to reduce noise and vibration when driving the core into the ground with the hammer. (Figure 1.1.2)

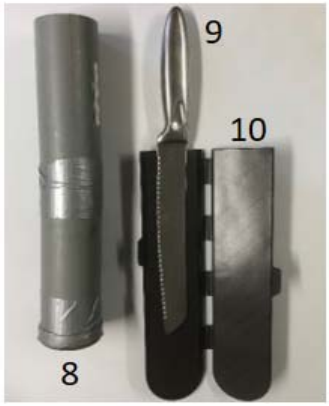
The knife (9) is used for cutting through roots prior to coring, or for cutting peat cores.

We have two types of guard, a magnetic (10) and a plastic (8).

1) Bag for van & spares

2) Bag for field kit

3) Corer
4) Handle
5) Metal cap
6) Hammer block
7) Crossbar



8) Knife guard
9) Knife for peat & roots
10) Magnetic knife guard

Figure 1.1.1 Coring equipment

The rulers (11) and (12) can be used to measure the depth from the base of the cross bar to the ground if the core won't go in 15cm. (Figure 1.1.2).

A trowel/long handle spoon (13) for sampling unconsolidated material, e.g. sand or gravel (see methods) is provided.

Two hammer options 3lb (14) and a 4lb (15) hammer depending on user preference.

A lever or crowbar (16) to extract cores that are difficult to pull out. (Figure 1.1.2)

Scissors (20) to remove excess grass or vegetation from the surface of the core.

An extruder (21) can be used to push out any core that gets stuck in the coring device (3).

11) 30cm ruler
12) 15cm ruler
13) Trowel
14) 3lb hammer
15) 4lb hammer

16) Lever or crowbar
17) Gloves
18) Cloth for cleaning cores
19) Pliers
20) Scissors for cutting grass
21) Extruder for pushing cores out
22) Screwdriver

23) Tape

Permanent marker
24) 2*thin
25) 2*fat

Figure 1.1.2 Tools

Trays (small or big) for working with loose soil, e.g. sand, soil with lots of stones or wet, boggy, peaty soil – to capture any loose material without contamination.

Figure 1.1.3 Tray for collecting soil

Electric Cool Box (28): which should be kept cool by charging whenever the vehicle is being driven (connected to the vehicle lighter socket (27)) or plugged in with the mains cable (26) at the accommodation to keep the samples cool. An extension cable is provided for the more convenient use. (Figures 1.1.4)

Fridge (Figure 1.1.5): Optionally a small fridge can be provided for the accommodation so that cores can be kept cool that haven't been posted or returned, please ask if you want one.

26) Mains cable
27) Car cigarette lighter cable
28) Cool box
29) 3 cold blocks

Figure 1.1.4. Cool box for cold storage (mobile)

Figure 1.1.5 Fridge for use at accommodation

Table 1.1 - Packing list for tools

Tool	✓
Electric Cool Box	
Mains cable and car cigarette lighter cable for cold box	
Extension cable	
Cold blocks (3)	
Corer + metal cap + handle + crossbar + hammer block (heavy and lightweight version)	
Hammer (3lb)	
Hammer (4lb)	
Scissors	
Knifes + knife guards	
Wood muddler/Extruder	
Lever/Crowbar	
Trowel/long handle spoon	
Tray (large)	
Ruler (15cm)	
Ruler (30cm)	
Pliers	
Screwdriver	
Gloves	
Cloths	
Tape	
Permanent markers	
Bag/plastic box for van & spares	
Bag for field kit	
Avalanche rod for peat (3m)	

1.1.1 Soil plastic core samples

In each X plot three 15 cm cores will be taken (one white (P), one grey (B) and one black (C)). The aperture of the coring device is 50mm and is slightly narrower than the cores so they slide out in the lab. The X plot quadrats have four guide lines laid out north, south east and west of a central point. The cores will be taken in line with the west line out from the centre post of the quadrat. This positions the core 15 cm outside the central 2x2m quadrat used for vegetation sampling.

Sampling procedures for each core are detailed below. If there are problems taking any of the soil samples or a specific comment needs to be made regarding the sampling then a note must be placed in the computer (e.g. “large tree roots - 1st soil core taken 1m E of centre quadrat”). If there is unusual vegetation, cow pat, boulder etc. move minimum distance to get more homogenous sensible location and record problem on a note.

1.2 Taking the cores

1.2.1 X plot sample layout

Location in respect of 2 by 2 m X-plot quadrat (2020-2021 WEST)

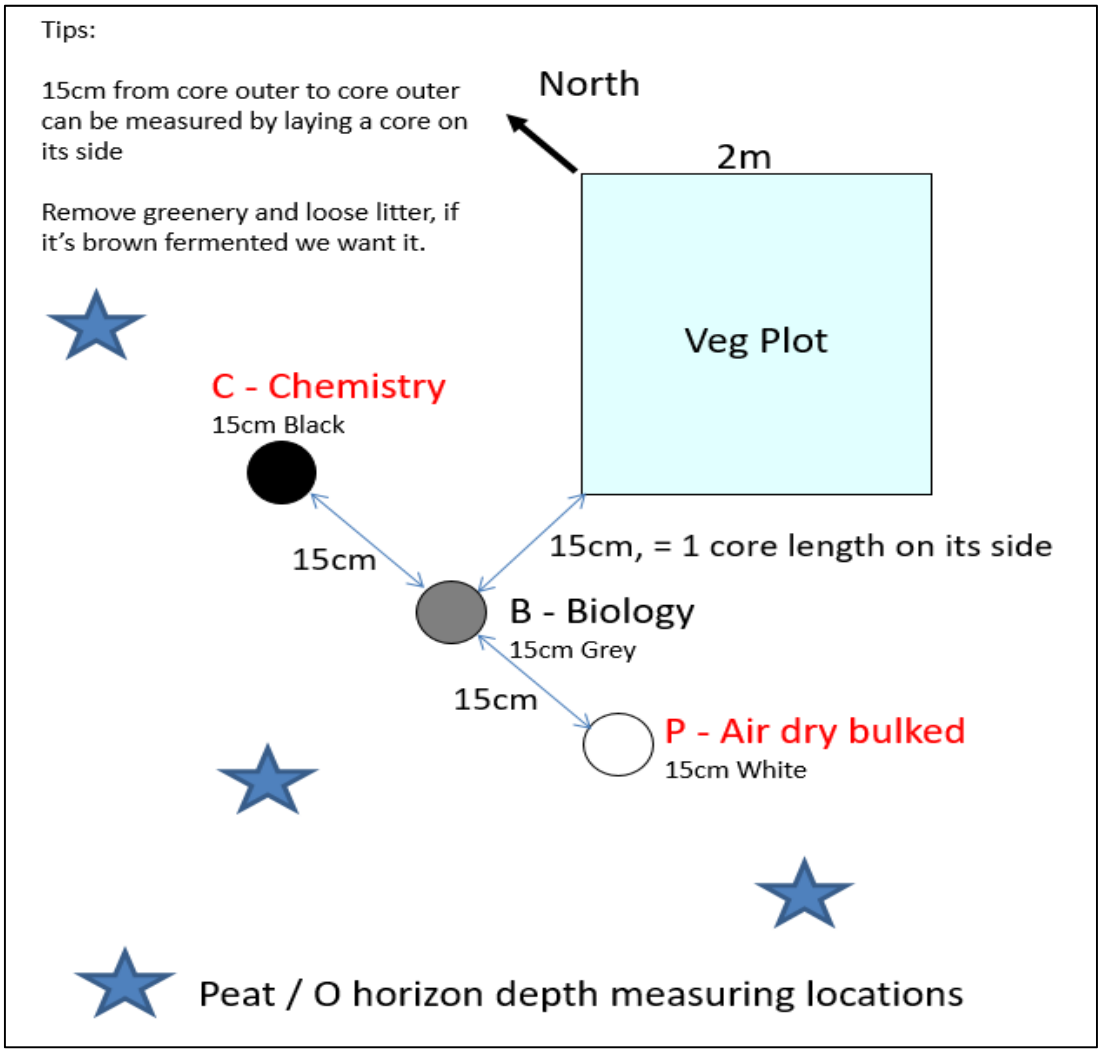


Figure 1.2.1. *The veg plot soil sampling layout is shown above with soil samples taken from* ***WEST*** *corner in 2021*

Step1: Once the X plot has been located (see method section in Vegetation Plots handbook ERAMMP Document-49) locate the coring positions as shown in the Figure 1.2.1. This should be on the due west line of the X plots 15 cm outside the 2x2m vegetation quadrate.

There are 3 plastic Cores for each plot (1-Black (Chemistry Analysis), 1-White (P-Storage), 1-Grey (B-Biology)): Each core type needs to be taken from a specific location as shown in Figure 1.2.1 (layout for soil sampling in relation to veg plots). These cores will be per-labelled (see below).

Step 2: In peaty soil, use the avalanche rod to test the peat/O horizon depth at 3 locations marked with a star and record in the software if depth is over 2cm (Figure 1.2.2). In each case press as far as it goes without major resistance which should be equivalent to the depth of organic layer. Measure the depth with the tape measure or using the scale on the pole.

Peat or organic layer depth (cm)

If the soil has an organic layer (~30% of soils) we would like to know the depth. After the soil cores are taken, use the Avalanche rod to press into the soil 20cm out from beyond the soil cores to measure the O horizon depth (Figure 1.2.2). The poles extend to 3m, don't push into clay, they are hard to extract.

Figure 1.2.2 Screen shot for peat depth

Step3: Locate the bags with the labels for this X plot and the correct coloured core to go in the bag, they should be brought together in a single bag. The five core type are listed below and labels will be as shown in Figure 1.2.3.

Cores & Labels

Core C (Chemistry): LONG BLACK 15cm long x 5cm dia.

Core P (Physical): LONG WHITE 15cm long x 5cm dia.

Core B (Biology): LONG GREY 15cm long x 5cm dia.

Lay the cores on the ground 15 cm out from the **West** corner of the plot. Long Black core on left, long white core on the right. The Grey biology in the middle:

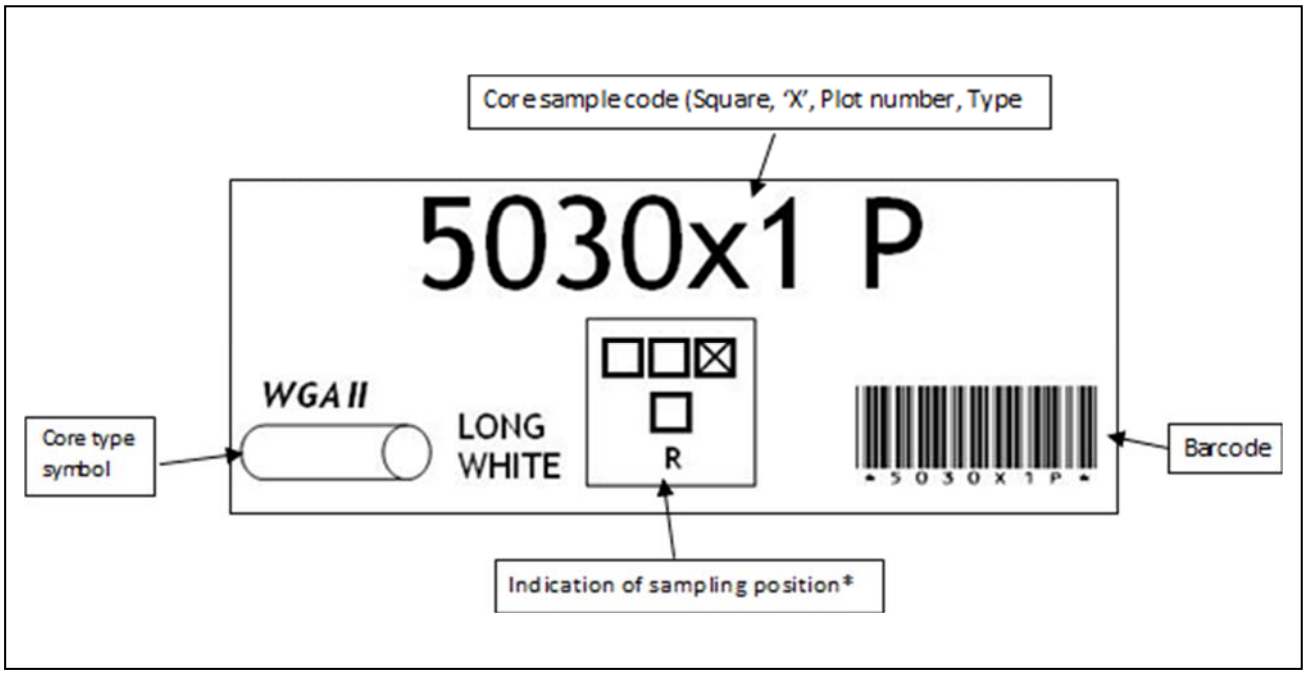


Figure 1.2.3. Sample labels

1.2.2 Sampling procedure for all cores (White, Black and Grey Core Sampling)

Clear the surface of green vegetation and fresh green plant material.

In the forest this means loose leaves and needles, it does not include the fermented needles/leaves (these are included in the sample): See guide at the end on forest floor sampling. (Figure 1.3.3.4). In a peat soil, the top is regarded as the point the sphagnum changes to brown, no green.

Mineral soils cut off the surface vegetation – do not pull out plants.

1.2.2.1 Mineral soil sampling method

1. Ensure the coring device is clean.
2. Insert first core in corer device, hold the corer upright with the bevelled end on the soil surface while you cut round the bottom edge with the knife; cut vertically down into the soil through any roots and push in a little to prevent bouncing when hammered. Use the hammer (3lb, 4lb) to drive the corer into the soil until the horizontal cross bar is flush on the soil surface, the soil should rise in the core accordingly. (Figure 1.3.3.1)
3. If there is not enough depth of soil, move the sampling points slightly and start again.
4. If on the second attempt a full core is still not possible (due to rocks or large roots) then measure the depth from the base of the cross bar to the ground to determine the core depth missing, and log in the computer. Simply measuring the depth of the hole is not sufficient as the corer is several cm longer than the core, so depth will not be equivalent. (Figure 1.3.3.1).
5. Please write a “short” note on the plastic bag as well using your sharpie that allows us to differentiate between compressed (“comp”) soil and “short” soil/short cores in the lab already. This is so we can work out the correct bulk density and do not mistake it with a compressed (“comp”) core.
6. Use the handle to twist and pull the core to one side to break the soil at the bottom, pull the coring device out. (Figure 1.3.3.2). If extraction is difficult twisting the core or using the handle of the hammer, the crowbar or wood muddler can be used (see Figure 1.3.3.2). (We do encourage you to use the two latter one to save the handle of the hammer from any damage (Figure 1.3.3.2).
7. If the soil is too loose and the bottom part of the soil core won`t come out with the corer device use your hand or the long handle spoon to dig out the bottom of the sample from the hole.
8. If the soil is very sandy and likely to fall out, use the trowel to dig underneath and hold the sample in and work over a tray when pulling out the plastic core to keep the sample safe. (Figure 1.3.3.3) Push the core out of the coring device, cap the top with a RED cap as it comes out. (Roger red hat, top) Slide the remaining core out with the soil end in the air, trim the soil and fit the BLACK cap on the bottom.

1.2.2.2 Organic soil

1. For organic soils clear the surface of vegetation and fresh plant material.
2. The coring device may not work in organic or fibrous soil. In these circumstances (with an organic layer extending more than 15cm) place the plastic core directly on the soil surface while you cut round the bottom edge with the knife; cut vertically down into the soil through any roots.

3. Push plastic core firmly into the ground, continue to use the knife to cut ahead of the core, and push the core into the cut until the soil has come to the top of the core; you can use hammer to knock the core in.
4. Cut under the core with the trowel, use pliers to twist the plastic core free from the soil if necessary, being careful not to lose soil from either end of the plastic core (especially in dry/sandy soils). The trowel can be used to dig the plastic core out or to stop soil falling from the bottom. If soil falls out, put it back in. (The trays can be useful while working with this type of soil by keeping the fallen out soil on a safe place, without contamination. (Figure 1.1 1)
5. Carefully scrape/remove any lumps of soil from the exterior of the plastic core.
6. If needed, cut the bottom end of the core sample until it is level with the end of the plastic core (Figure 1.3.3.3)

In **very peaty, boggy** soil cut the block out with the knife rather than using the core and try to hammer it in, since this causes a very big compression in the sample and/or ends up having only water in the plastic core. Make sure the cut core is as close to the required size as possible both in length and diameter.

1.2.2.3 Scree or rocky soils

Some plots may land on scree slopes or fine gravel. It is not possible to use the coring device. We are still interested and if possible use the trowel to dig out the fine material and place in the core collecting the gravel and any material in between. If the stones are too big then don't collect the material. Label clearly as scree.

After finishing soil sampling **fill and cover up the sampling holes** since it can cause injuries to livestock e.g. sheep. Do not fill it with soil from different area or stones, dung since that can affect future surveys` results. Instead hammering in the top of the hole. (Figure 1.3.3.4)

When each sample is obtained, ensure the caps cover the sample, RED on top, BLACK on the bottom.

Carefully seal the sample in its bag and return to the plastic bag with the label on.

Remember to take a "short" (due to rocks, roots etc) or a "comp" (compressed) note on the plastic bag if your sample does not have the full 15cm length. This is so we can work out the correct bulk density in the lab and do not mistake them with each other.

Write the SQ number on the outside of the bag for frozen samples and how many plots were surveyed within the SQ.

1.3 Soil sample scanning, storage and dispatch

When the soil sampling is finished, and the cores are sealed in the correct bags, scan the labels with the tablet (See Vegetation Handbook - 'plot specific headers' for X plots). Make sure you scan the correct ones into each option (see below). If there are any issues with this procedure (e.g. too heavy rain, camera issues etc.), you can manually type in the appropriate barcode from the label. Alternatively, scan the labels later at the accommodation.

Take all cores back to the accommodation or laboratory in cool box vehicle storage, if in accommodation, store in plug in cool box or in the small fridge provided.

1.3.1 Instructions for posting

- **Pack the same SQ cores in the same bag.**
- **Envelopes might split during postage so please parcel tape them if necessary.**
- **Post the soil samples as soon as possible, so the lab can organise their work efficiently.**
- **Do not post on Thursday or Friday or over the weekend, instead refrigerate the cores until Monday. Take to the nearest post office.**

Instructions from post office which explains why we wrap the samples:

- A leak-proof primary receptacle (Plastic core)
- A leak proof secondary receptacle (Sealed plastic bag), and
- An outer packaging of adequate strength for its capacity, mass and intended use, and with at least one surface measuring 100mm x 100mm. (Tyvek envelope)
- If there is any liquid (or the possibility of) then an absorbent material must be placed between the primary receptacle and the secondary receptacle so that any release or leak will not reach the outer packaging. (Use absorbent cloth)

The packaging described is that used for exempt patient specimens.

1.3.2 Black and white cores

These cores are to be sent to **UKCEH Bangor**. They should be stored in a cold room (4 ^{o}C).

UK Centre for Ecology & Hydrology
Environment Centre Wales
Deiniol Road
BANGOR
LL57 2UW

1.3.3 Grey biology cores

Grey cores must be placed in envelopes and posted directly to **UKCEH Lancaster**. In Lancaster they are to be frozen in a normal freezer at -20°C as soon as possible

UK Centre for Ecology & Hydrology
Lancaster Environment Centre
Library Avenue, Bailrigg
LANCASTER
LA1 4AP

Figure 1.3.3.1 *– Sampling for cores:*

If the core doesn't go in fully due to a hard layer or rock/root record the height from the crossbar to the ground surface in the software and take a "short" note on the plastic bag. This is so we can work out the correct bulk density and do not mistake it with a compressed ("comp") core.

Figure 1.3.3.2 *– Tips & tricks for pulling out the corer from hard/dry soil*

Figure 1.3.3.3 *– Trim the core and measure the depth of hole if needed.*

If the core didn't fully penetrate to 15cm, record the depth from the bottom of the cross bar to the ground surface in the software and take a "short" note on the plastic bag. This is so we can work out the correct bulk density and do not mistake it with a compressed ("comp") core.

Figure 1.3.3.4 *– Cover up the sampling hole so no animals are harmed*

Brush the loose leaves and needles to the side, we don't collect this.

Litter – Relatively fresh organic residues, identifiable plant material, such as leaves, wood or twigs resting on the surface of the forest floor. Some discolouration or other signs of early decomposition may be visible, but the origins of plant residues are still easy to discern.

This is the material to be collected in the core:

F (Fermented, fibric, fragmented) – Decomposition of plant material is apparent, but the origins of plant residues are still distinguishable. Often, roots are present.

H (Humic) – Well-humified plant material so that plant residues are not recognizable, with the exception of some roots or wood. This material is in advanced stage of humification in which fine substances predominate over plant residues.

Source: ***http://forestfloor.soilweb.ca/definitions/soil-horizons/***

Figure 1.3.3.5 *– Guide to the organic layer sampling in forests*

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