Proposal for sampling protocol for the next LUCAS Soil Module

Updated after webinar on 10/12/2025

European Commission

SML requirements – adapt LUCAS soil protocol

Annex II – 2. Field sampling survey

- When **soil composite samples** are taken, they shall be a mixture of at least **5 subsamples**
- When sampling in non-forested areas, residues shall be removed from the surface
- When sampling in forested areas, the forest floor, if relevant subdivided into **litter and organic layers, shall be sampled separately and the thickness and weight** shall be recorded
- Samples or subsamples for the composite sample shall be taken to a depth **of at least 30 cm** where possible
- **Bulk density samples** shall be undisturbed samples taken at the relevant depth, including below **30 cm for subsoil**
- **Biodiversity** samples taken on at least 5 % of the points
- Information such as **soil type** and if possible **genetic horizons** shall be recorded.

Proposal for a next LUCAS soil sampling protocol

PROTOCOL FOR ALL LAND COVERS EXCEPT WOODLANDS

WOODLAND PROTOCOL

Pictures taken from Soil Atlas of Europe, 2005

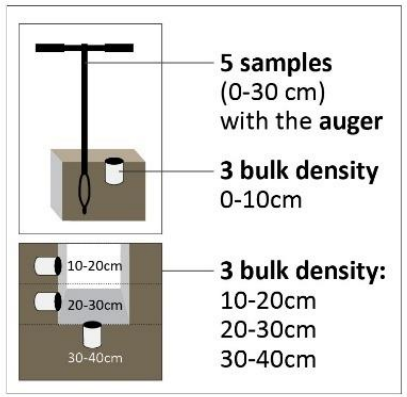
General steps before starting the sampling

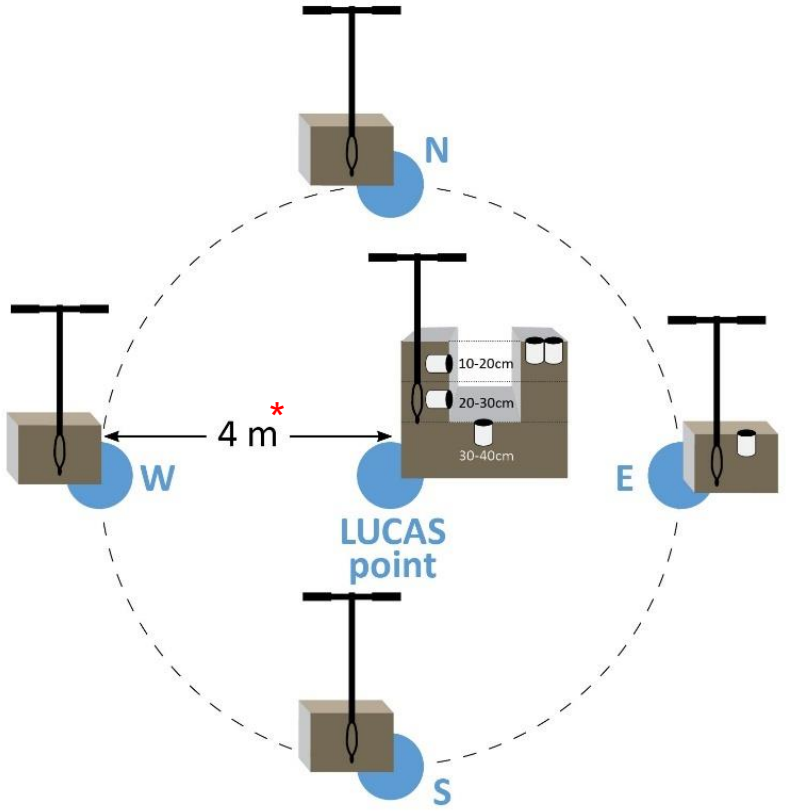
- Clean the sampling material with water, removing residues of soil
- In case it is a biodiversity point, clean the material with alcohol and wear gloves during sampling
- If the soil is organic or peat soil, it shall not be sampled when saturated with water

Protocol for all land covers except woodlands

The following samples shall be taken:

- **Standard sample**: using the soil auger, a composite sample of 5 sub-samples
- In case needed, **a biodiversity sample** shall be collected from same composite sample
- 3 **topsoil bulk density samples** (0 – 10 cm)
- 1 **bulk density** sample (10-20 cm)
- 1 **bulk density** sample (20-30 cm)
- 1 **bulk density** sample (30-40 cm)

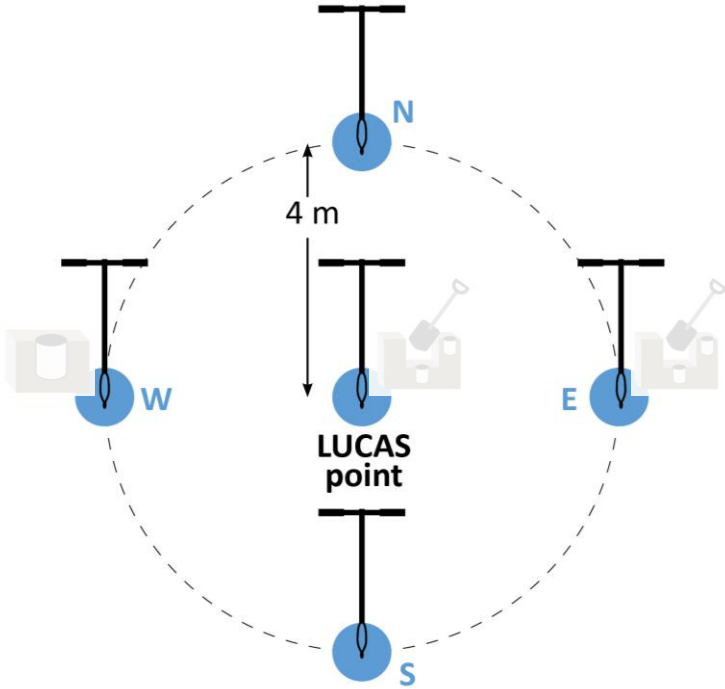




*Radius increased from 2 to 4 m to be more in line with MS schemes

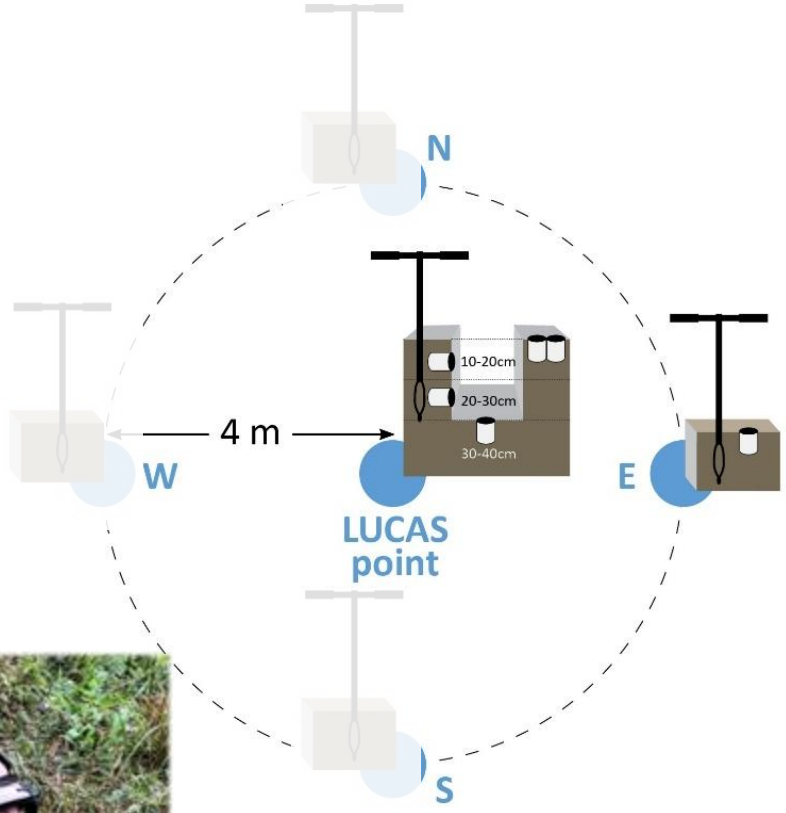
Protocol all land covers except woodlands

1. Always remove vegetation residues, grass and litter using a spade or by hand.
2. Take 5 sub-samples with the auger (0 – 30 cm) to form a composite sample



Protocol all land covers except woodlands

3. Take 3 separate topsoil bulk density samples. Two at the LUCAS point and one at the East point

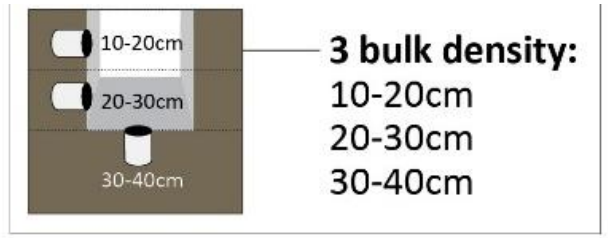


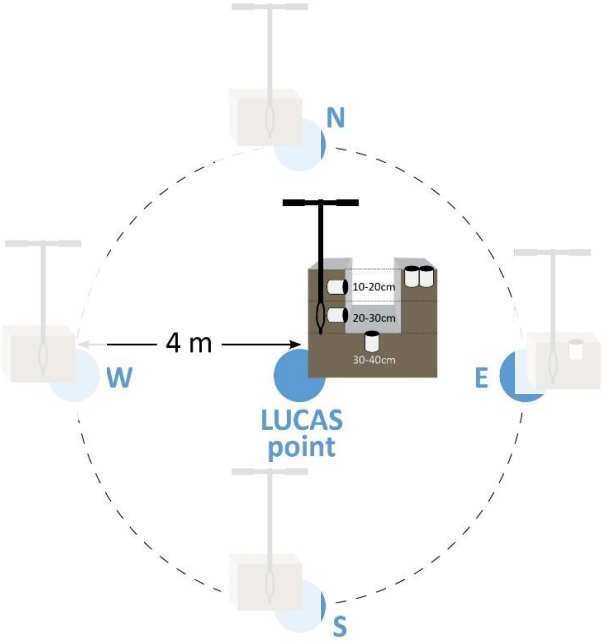
Procedure:

1. Dive the ring into the topsoil (0 – 10 cm)
2. Put the lid on it
3. Use the mallet and a wooden block
4. Remove the ring with the shovel
5. Put the sample in the bag
6. Do this two other times (East, West)

Protocol all land covers except woodlands

4. At the LUCAS point take:
   1 **bulk density** sample (10-20 cm)
   1 **bulk density** sample (20-30 cm)
   1 **bulk density** sample (30-40 cm)





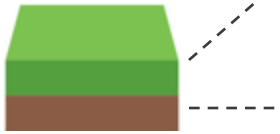
Procedure:

1. Dig a square hole with the spade that is 30 cm deep and from which each side is 2 spades wide
2. Collect 3 samples by diving the ring twice horizontally at 10-20 and at 20-30 cm and once at the bottom of the hole (30-40 cm).
3. Use the mallet and the wooden block
4. Put the lid on the ring
5. Remove the ring carefully using the shovel
6. Put the individual samples in the plastic bags

Protocol for woodlands

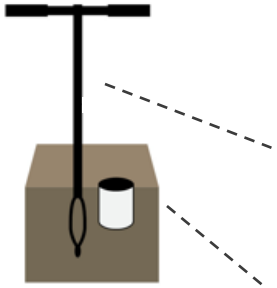
When sampling in forested areas, the forest floor, if relevant subdivided into **litter and organic layers, shall be sampled separately and the thickness and weight** shall be recorded

Overview of protocol for woodlands



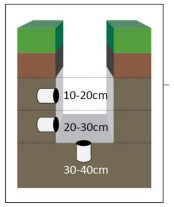
The following samples shall be taken:

- **1 litter layer sample** made of 5 sub-samples (if litter layer > 1 cm thick)
- **1 organic layer sample** made of 5 sub-samples (if organic layer 2 – 30 cm thick)

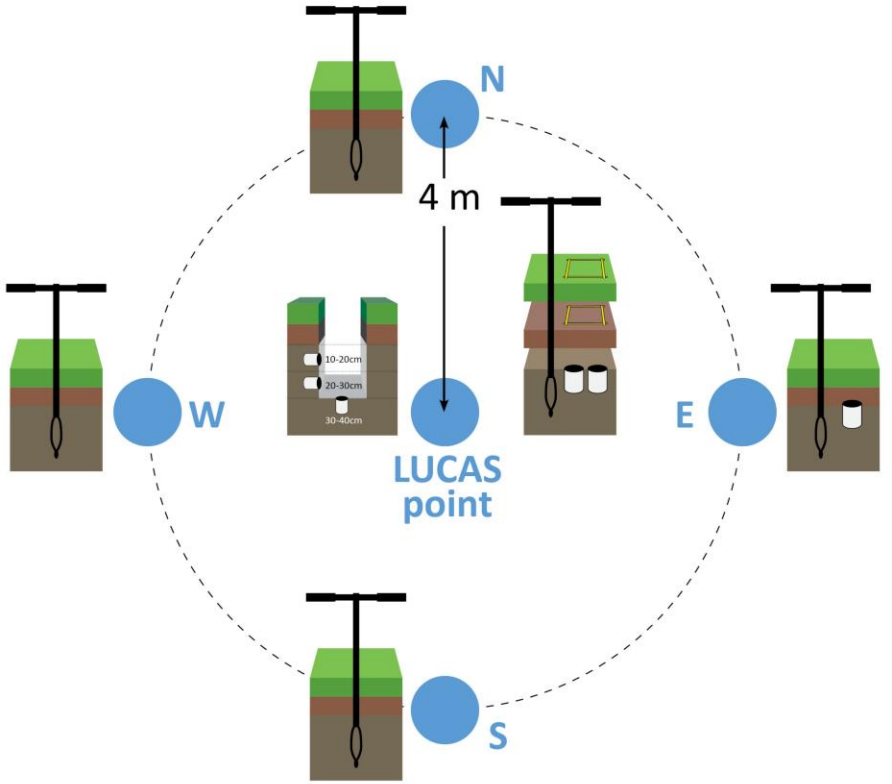


At one of the points, the litter and organic layer is collected with a frame (noting depth and weight). Needed for stocks calculation

- **Standard sample:** made of 5 sub-samples 0 – 30 cm in mineral layer using the soil auger
- **3 topsoil bulk density samples** (0 – 10 cm in mineral layer)

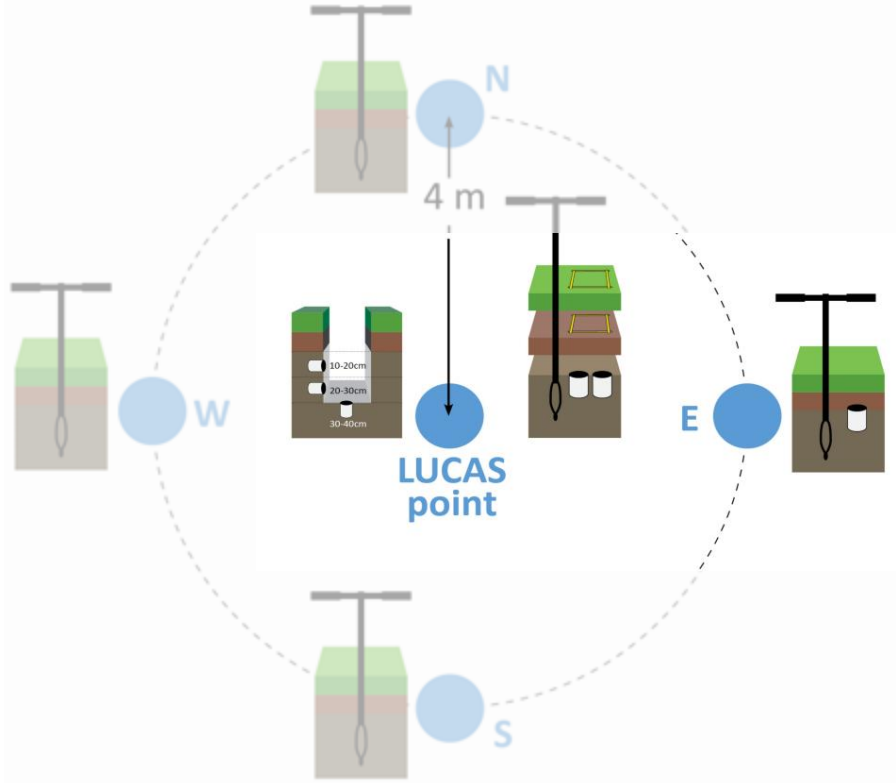


- 1 **bulk density** sample (10-20 cm)
  1 **bulk density** sample (20-30 cm)
  1 **bulk density** sample (30-40 cm)



Protocol for woodlands

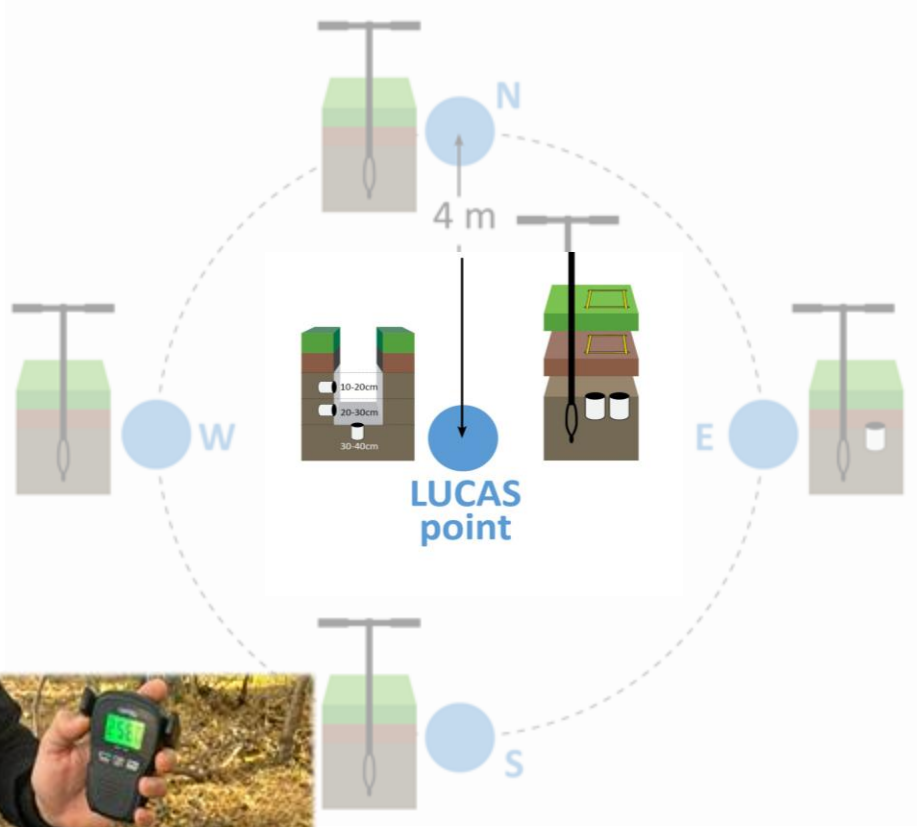
At the LUCAS point, assess the depth of the organic layer (scraping)



IF **organic layer is not present or shallower than 2 cm:** the organic layer does not need to be sampled separately but needs to be discarded before taking the standard sample

IF **organic layer > 30 cm deep:** no distinction shall be made between the organic and mineral layer

Protocol for woodlands with organic layer 2 – 30 cm **LUCAS** point



1. **Collect the litter layer** using the 20 x 20 cm quadrat.
   - Remove all the litter from inside the quadrat
   - Weigh the sample using the fishhook scale (tare the scale first!)
   - Note the depth and the weight of the litter layer

2. Collect the entire organic layer from inside the 20 x 20 cm quadrat
   - Weigh the sample using the fishhook scale (tare the scale first!)
   - Note the depth and the weight of the organic layer

This information is needed to calculate stocks

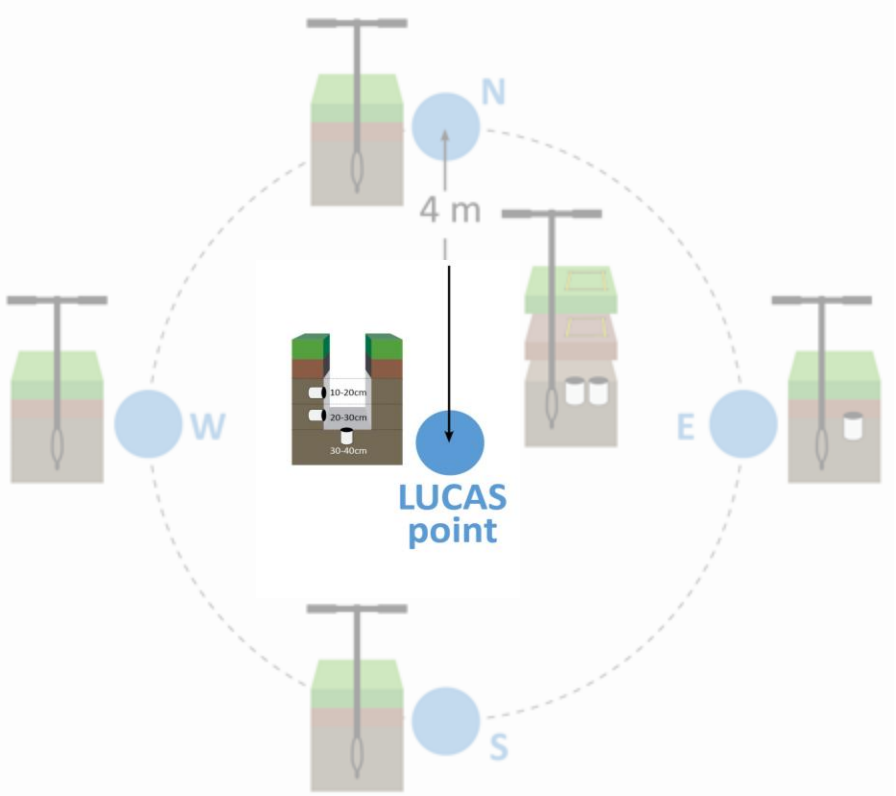
3. Take a **standard soil sample** with the auger 30 cm in the mineral soil inside the quadrat

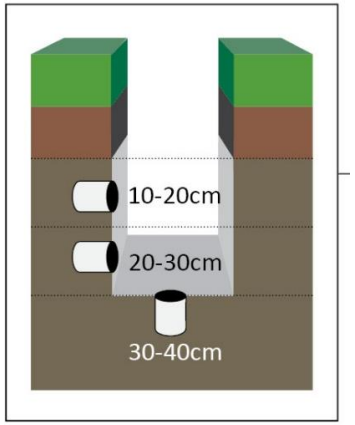
Protocol for woodlands with organic layer 2 – 30 cm **LUCAS** point:

4. Dig a 30-cm deep hole into the mineral soil and collect:
   1 **bulk density** sample (10-20 cm)
   1 **bulk density** sample (20-30 cm)
   1 **bulk density** sample (30-40 cm)

The space that was freed from removing the organic and litter layers can be used

Assess **stone content** in the organic and mineral layer





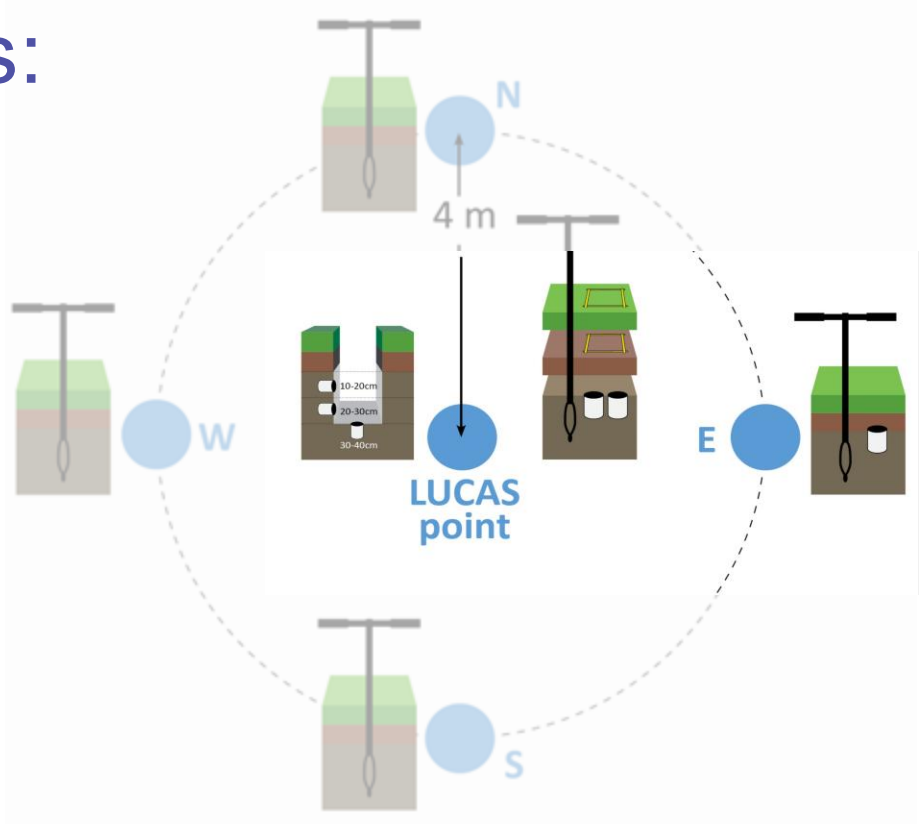
Protocol for woodlands with organic layer 2 – 30 cm **EAST, WEST, NORTH** and **SOUTH** points:

1. Collect the **litter layer** (about 2 handfuls)

If litter layer < 1 cm thick: discard litter layer but remove before taking the other samples

2. Collect the **organic layer** (if it is between 2 – 30 cm deep). About 2 trowels

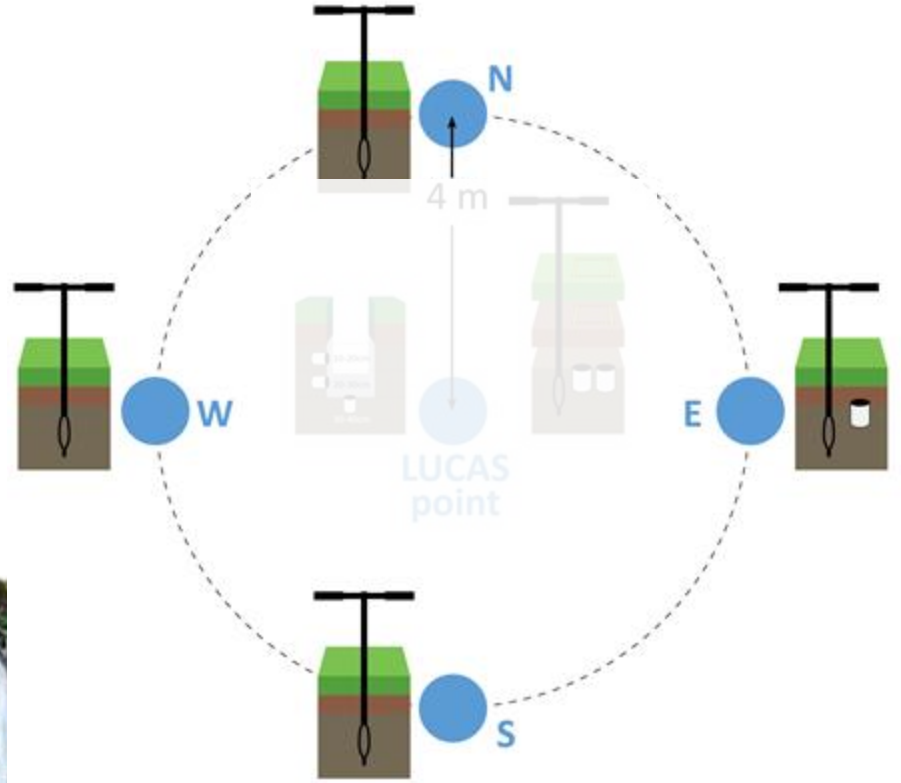
© Photo: Dr. Oliver van Straaten, University of Göttingen



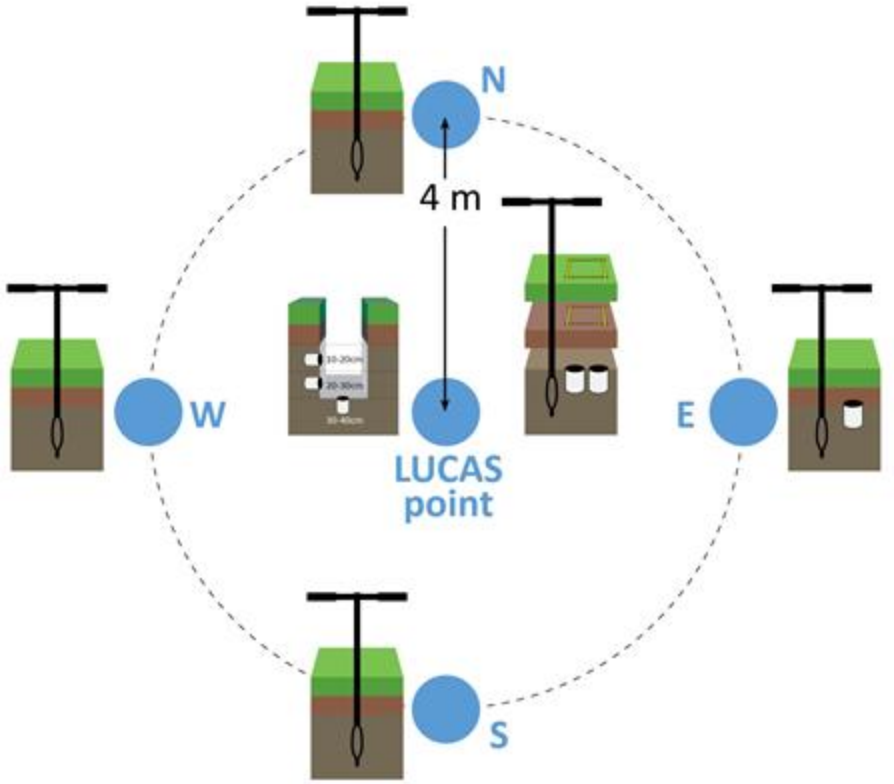
Protocol for woodlands with organic layer 2 – 30 cm **EAST, WEST, NORTH** and **SOUTH** points

4. Take a **standard soil sample** with the auger 30 cm in the mineral soil

5. AT THE **EAST POINT ONLY**: Take a **mineral topsoil bulk density sample** next to where the auger has been done



In summary…



- 1 litter layer sample made of 5 sub-samples (one collected with square noting depth and weight).
Discard if < 1 cm

- 1 organic layer sample made of 5 sub-samples (one collected with square noting depth and weight) if organic layer is between 2 – 30 cm

- Standard soil sample made of 5 sub-samples 0 – 30 cm in mineral layer (auger)

- **3 topsoil bulk density samples** (0 – 10 cm in mineral layer)
- 1 **bulk density** sample (10-20 cm)
- 1 **bulk density** sample (20-30 cm)
- 1 **bulk density** sample (30-40 cm)

Soil biodiversity sampling – 2,000 points

Clean the material with alcohol and wear gloves during sampling

In all land covers except woodlands

- Take 500 g (about 5 heaped trowels) from the standard sample made of 5 sub-samples (0 – 30 cm in mineral layer collected with the auger)

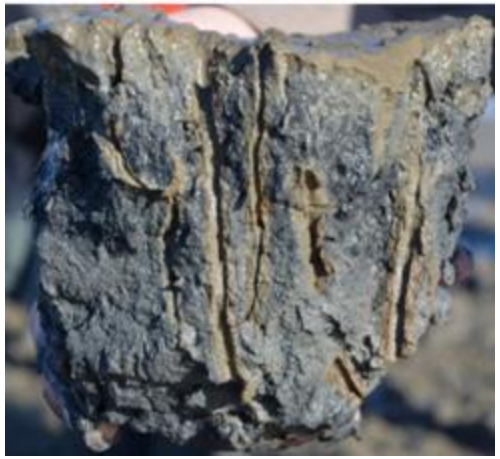
In woodlands

- 300 g (three trowels) of the mineral layer from the standard sample made of 5 sub-samples
- 300 g of the organic layer from the composite sample made of 5 sub-samples
- Keep them in two different bags

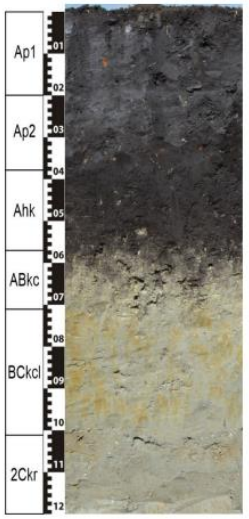
Samples need to be kept fresh (e.g., polystyrene box and ice blocks) and sent (in cold conditions) to the JRC for proper storage at -20 °C.

Site description

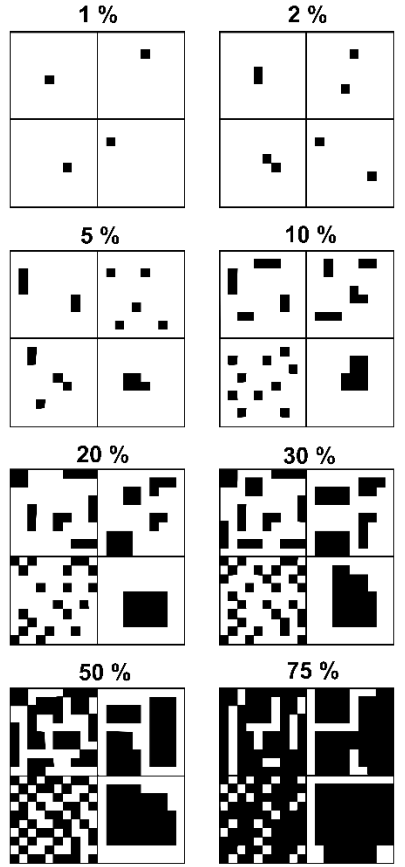
- Stones at the horizontal surface
- Presence of stones in the organic and mineral layer
- Presence of earthworms while taking a sample
- Presence of anthropogenic artefacts
- Presence of black or very dark surface layer
- Signs of water presence (reddish or greenish colors along cracks or root channels)
- Presence of crop residues



Source: WRB lecture notes Gleysols



Source: WRB lecture notes Chernozems



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Thank you

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