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# Long-term experiment Wüstebach – examining impacts of deforestation on the organic matter, elemental and water cycle


**IBG-3 - Agrosphere Team**

Agrosphere Institute, Forschungszentrum Jülich GmbH, Jülich, Germany

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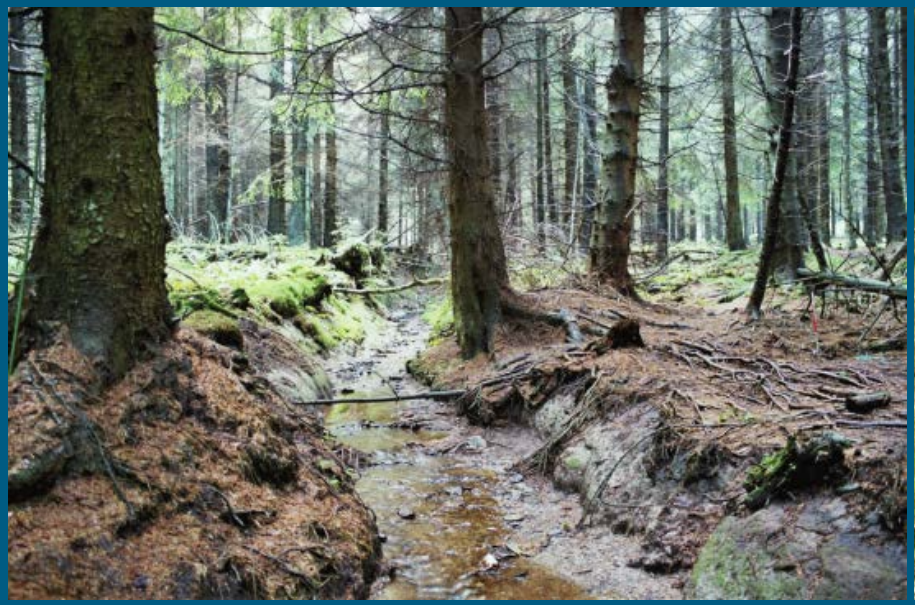
# Deforestation / Clear felling / Clear cutting



- Extreme event in the life cycle of a forest ecosystem
- Unnatural in the scale at which it is performed

! Opportunity to study forest ecosystem response and recovery

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# Examples of testable effects reported in the literature

**Temperature**

- Summer T up to 6$^{o}$C higher in 1$^{st}$ year after clear felling.

**Moisture**

- Decrease in surface (T increase) and increase at depth (Infiltration rates up & vegetation uptake reduced)

**Erosion**

- Varied response, but if significant erosion goes up.

**Carbon content**

- Initial lower, slow increase (>50 years) to values prior to clear cut

**Dissolved Organic Matter**

- Long term increase after clear cut

**Net Ecosystem Exchange**

- Forest become a source instead of sink in first 10 year after clear cut

**Nitrogen**

- Significant to extreme increase in nitrate, ammonium and $N_2O$ losses

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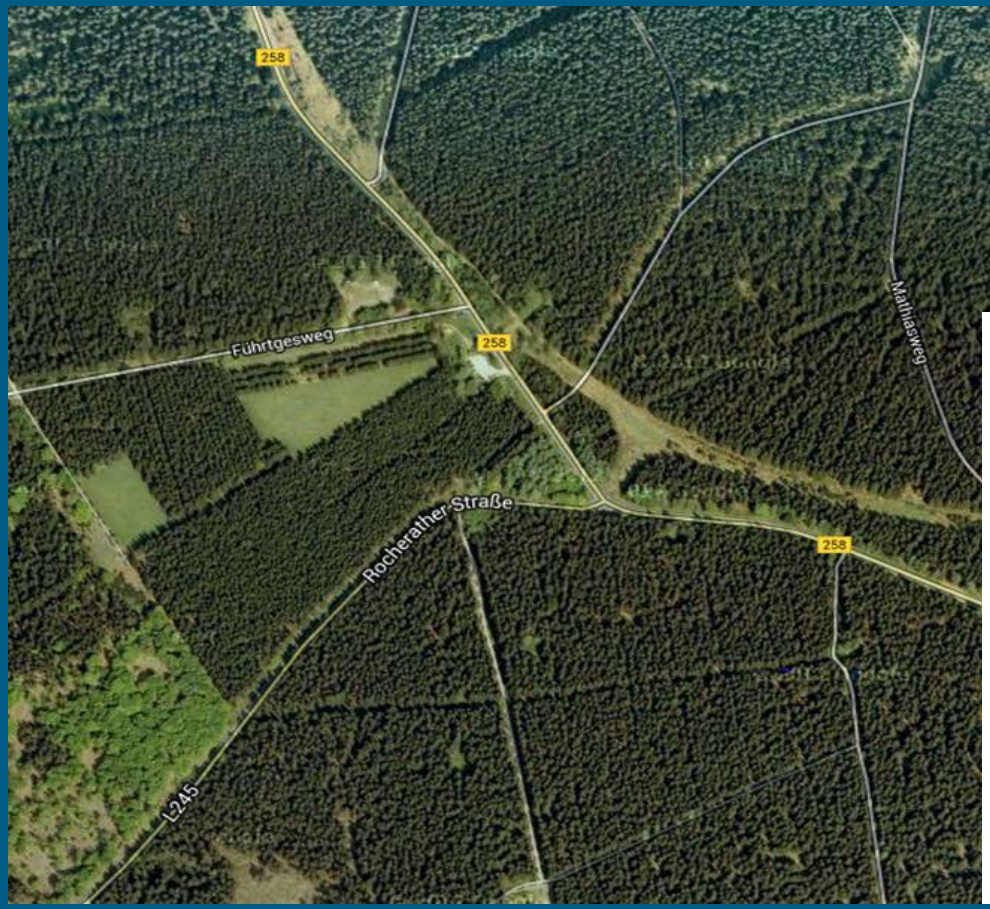
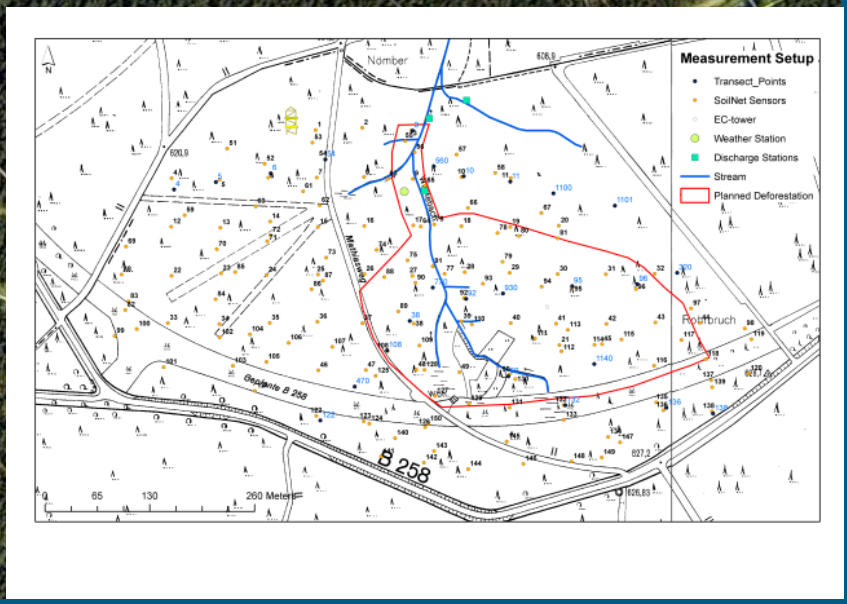
# September 2013
# Expected start of deforestation of part (ca. 9 ha) of Wüstebach Tereno field site



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- **Lot of experimental studies looking at effects of deforestation**
- **Not always pre- and post deforestation data**
- **Not always enough geostatistical and geospatial information**

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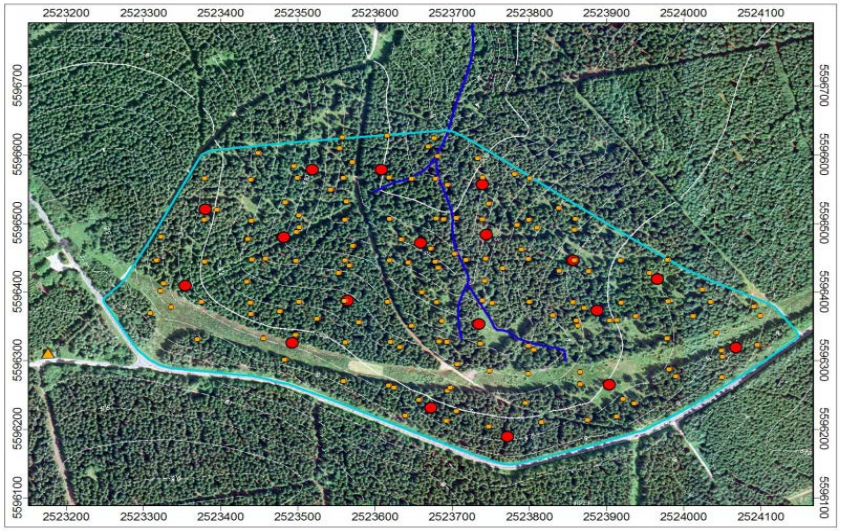
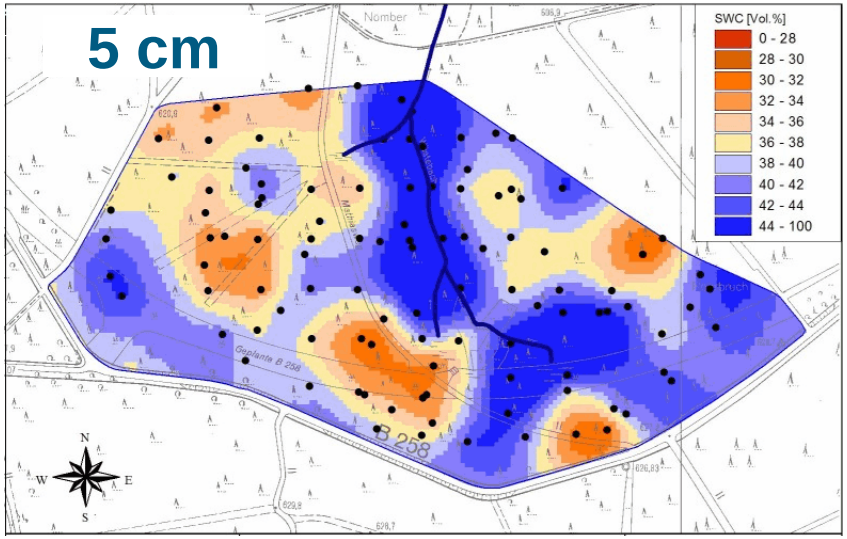
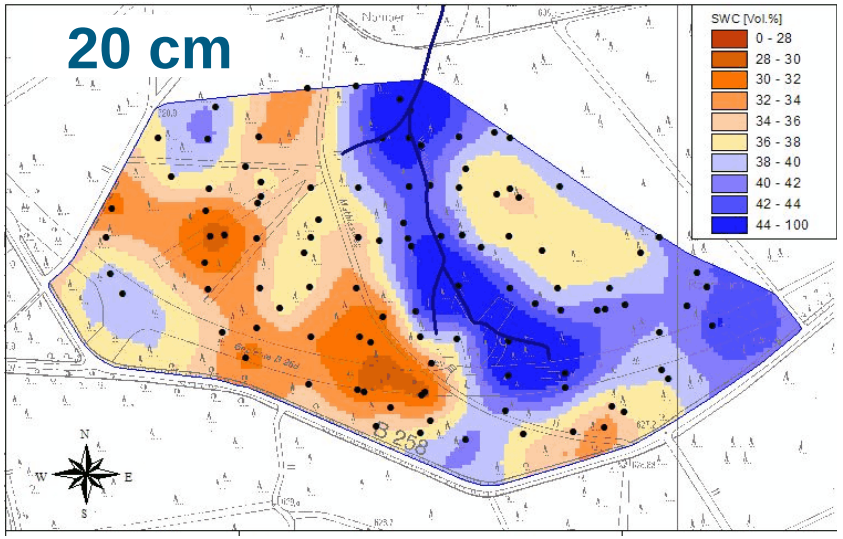
# Wireless soil moisture sensor network (SoilNet)




- 150 Sensor points
- Installed on geo statistical relevant criteria
- Use design for sampling




Bogena et al. (2010)

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# Geochemical soil sampling campaign Wüstebach - prior to deforestation (24th – 28th June 2013)

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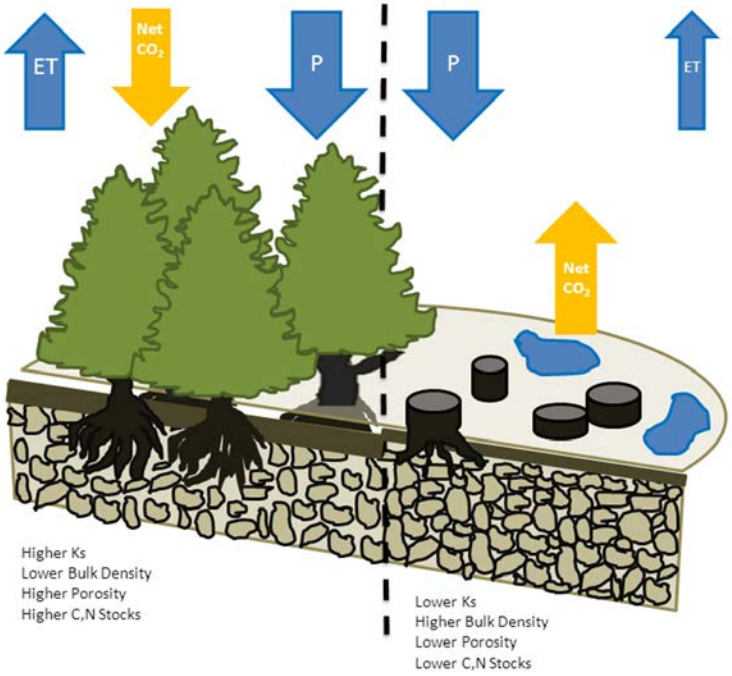
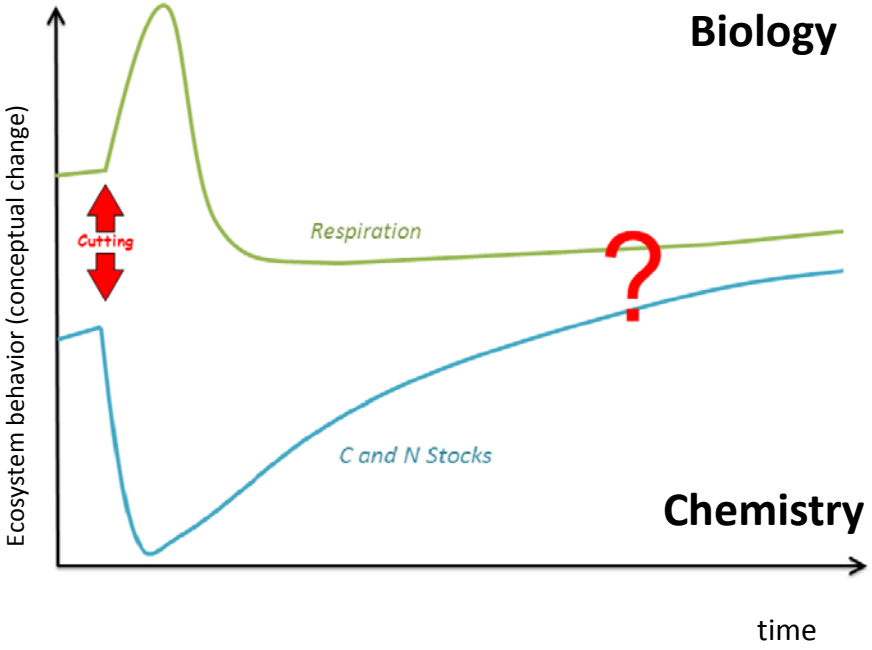
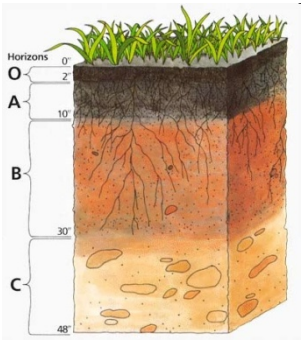
# Schematic diagram of research topics

Physics




Biology




**OM Fate ?**

# Sampling strategy


HUMAX & COBRA

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# Sampling campaign

- 175 points were sampled (150 soilnet and 25 transects).
- 6 sample depths (Ol, Of, Oh, Ah, B1, B2)
- 1050 samples in total. (3 sets)
- 30 people involved in daily sampling (ca. 70 people over the week)
- First results available for moisture content and pH
- : Analysis underway for soil C, N, P, CEC, $^{13}C$, $^{15}N$, Fe, Al, REE
- Also DOC, DON, enzymes, black carbon, microbial biomass
- Archived frozen cores for available for additional analysis, e.g. erosion rates (e.g. cosmogenic nuclides), turnover times (e.g. $^{14}C$) and for others research ideas

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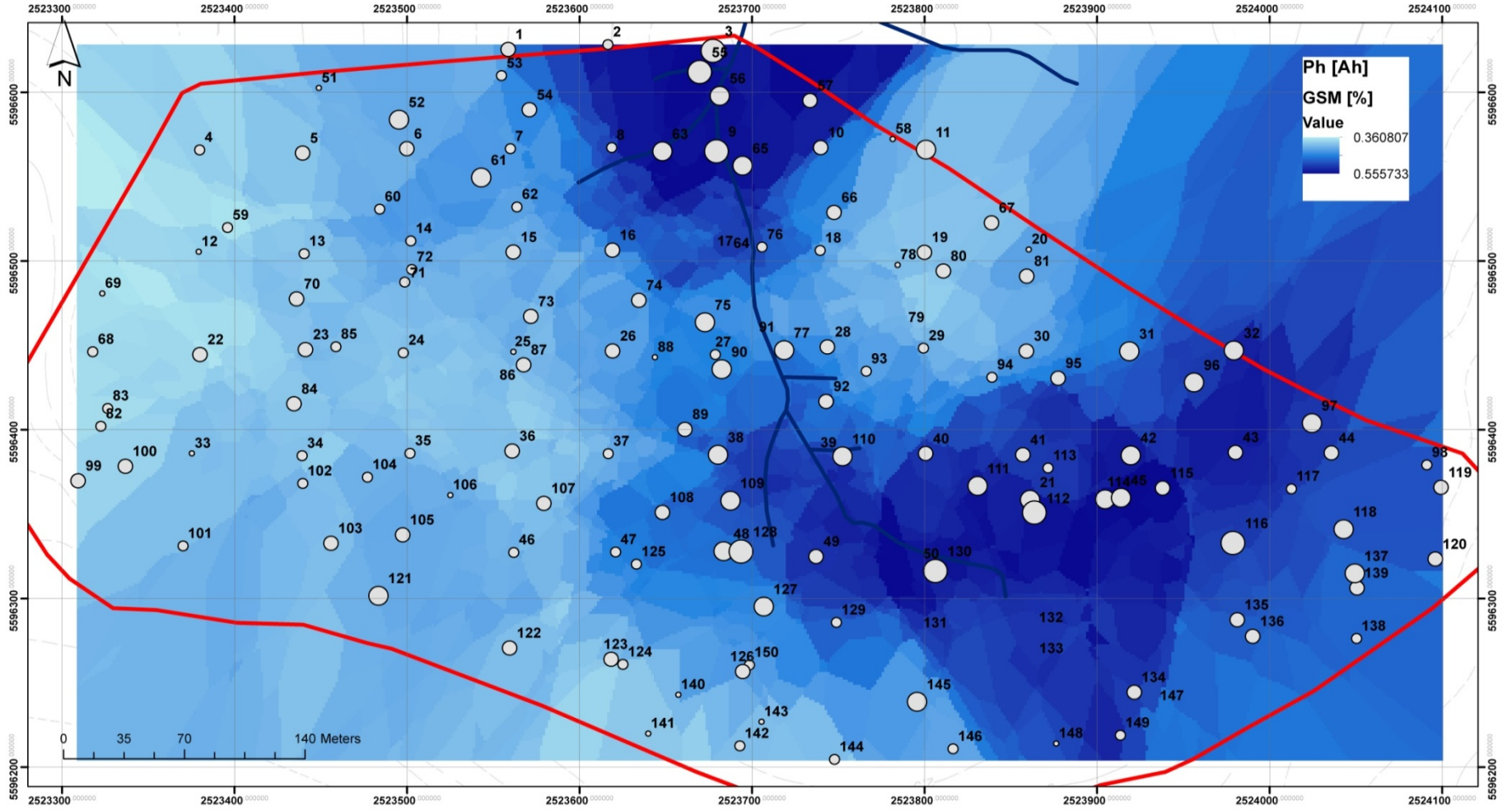
# First results

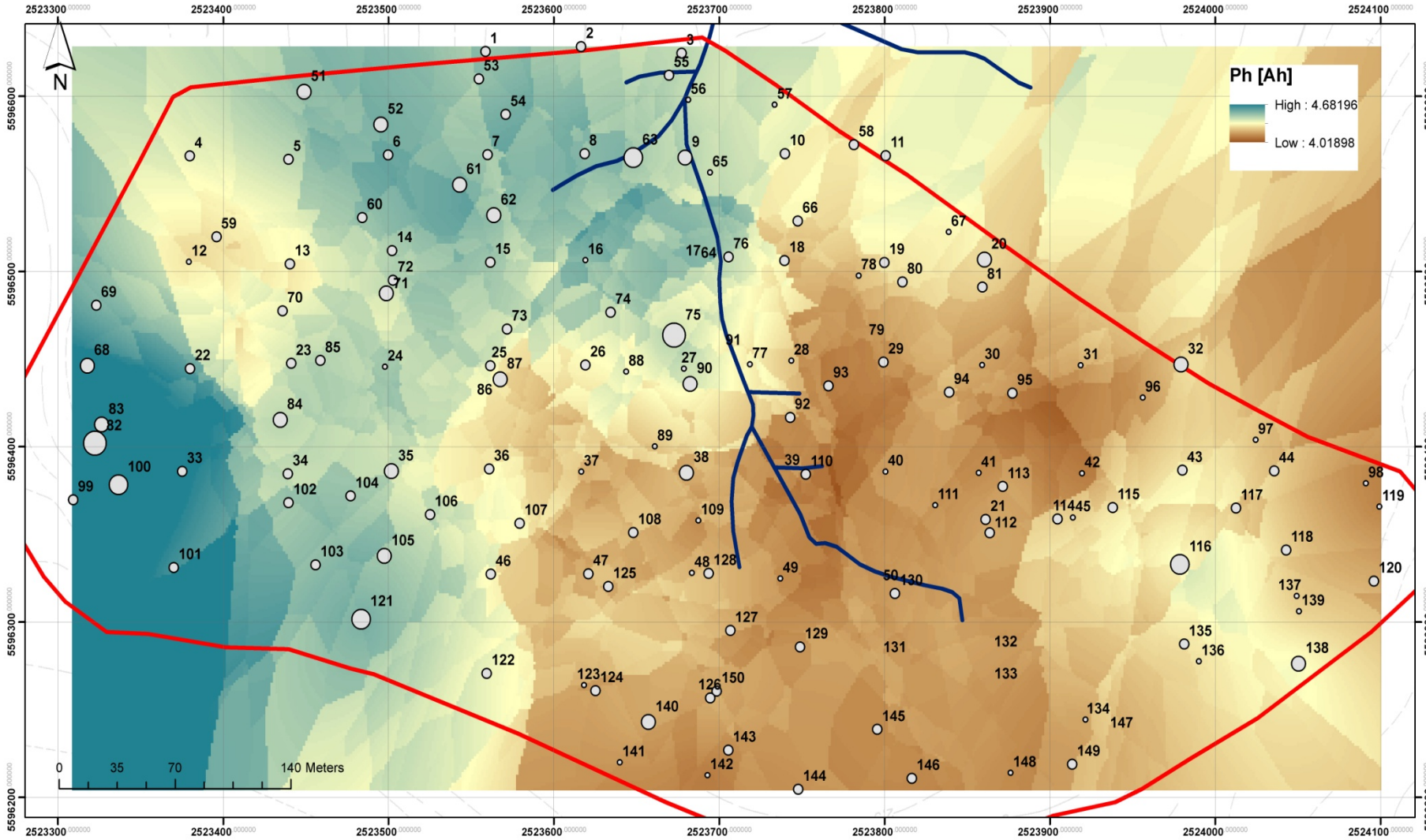
## Gravimetrical Water Content [Ah] Wüstebach

### Bio-geochemical Soil Sampling Campaign



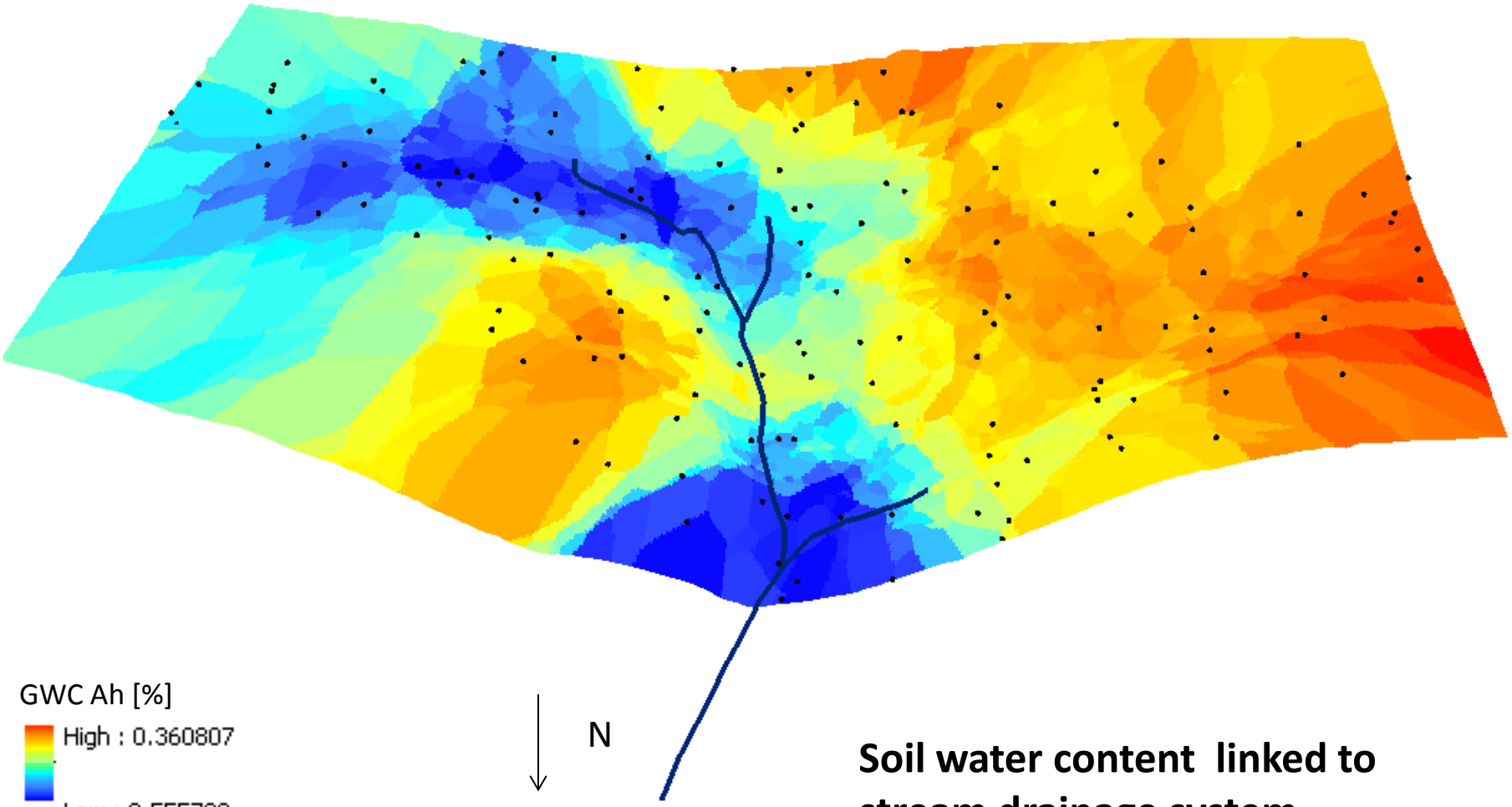
# Spatial Variability pH [Ah] Wüstebach

## Bio-geochemical Soil Sampling Campaign



# Spatial Variability Gravimetrical Water Content [Ah] Wüstebach

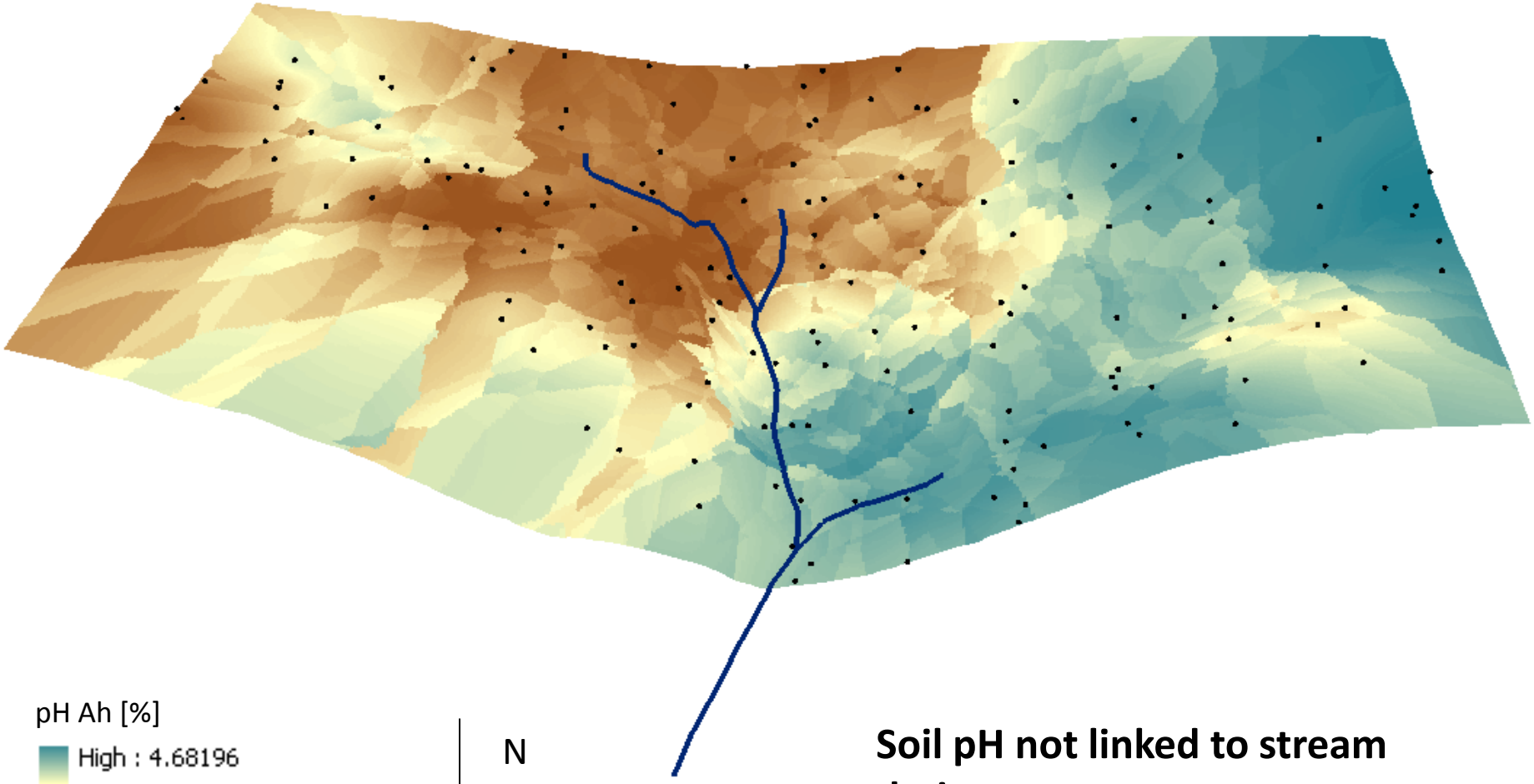
## Biogeochemical Soil Sampling Campaign




**Soil water content linked to stream drainage system**

# Spatial Variability pH [Ah] Wüstebach

## Bio-geochemical Soil Sampling Campaign




**Soil pH not linked to stream drainage system**

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## Current state

- Deforestation has started
- Planning for post-deforestation

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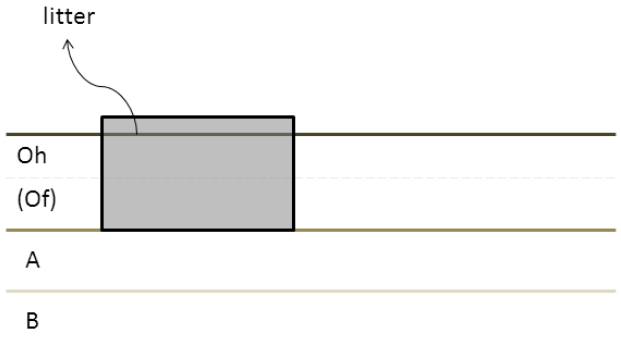
# Thank you for your attention

Roland Bol

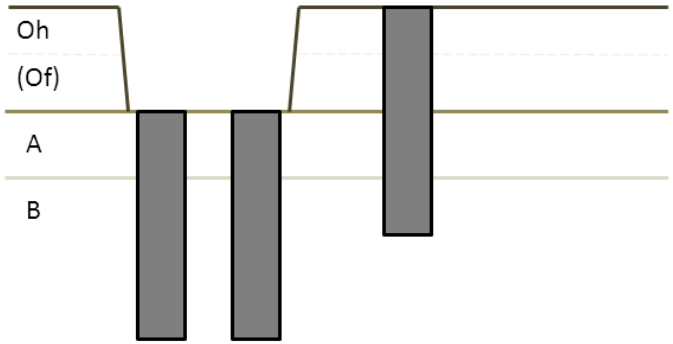
Agrosphere Institute, IBG-3, Forschungszentrum Jülich, Germany

# Sampling Strategy

1 Collect litter layer from within 40x40cm frame
→ Possibly distinguish between Oh and Of layers




2 Take 3 HUMAX liners: Two starting at the A horizon, one starting with the litter layer

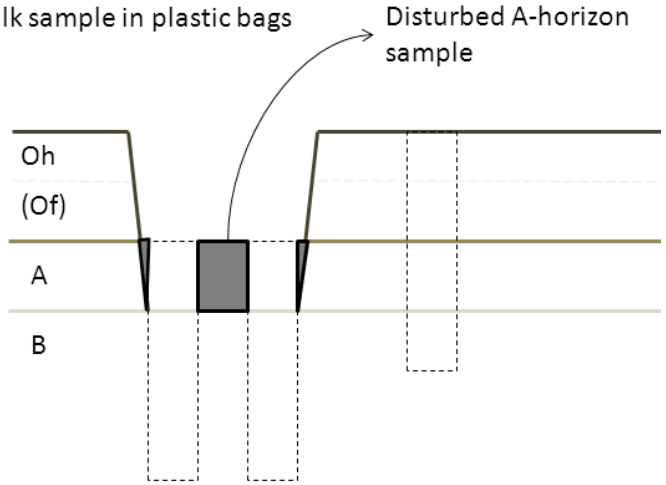



**Step 1:** A 40* 40 cm litter sampling frame will be used to collect all litter. The litter will be stored in plastic bags. All samples will be labeled and registered.
Especially in the wetter region, the litter layer can be distinguished in an Oh (humus) and an Of (fermentation) horizon. For these and other similar cases, the Oh and Of horizon need to be separately stored and registered on the sampling form (see chapter 4).

**Step 2:** Three HUMAX liners will be taken: one HUMAX liner outside and two HUMAX liners inside the 40 x 40 cm sampling frame (area where litter was removed). In most cases both the A and B horizons will be sampled in these 3 liners, however only the liner outside the sampling frame will also contain the litter layer(s). All samples will be labeled and registered.

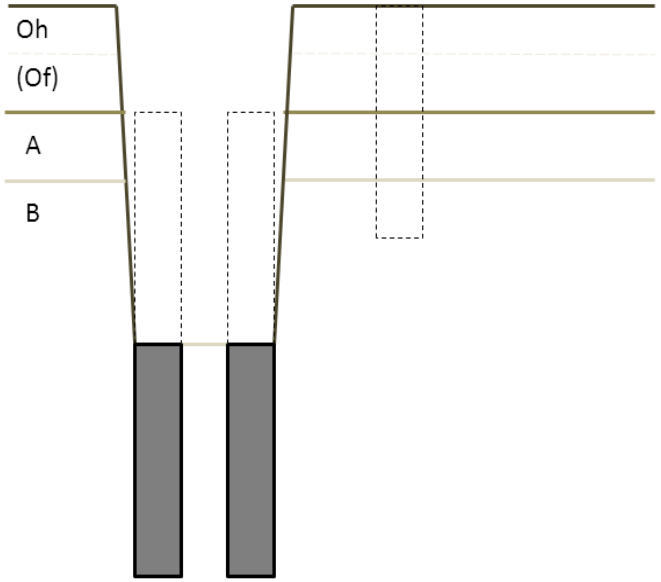
# Sampling Strategy

3 Gather the rest of A material
As a bulk sample in plastic bags




**Step 3:** After the first three liners are taken, the remaining material of the A horizon within the 40 x 40 cm sampling frame will be collected in plastic bags. All samples will be labeled and registered.

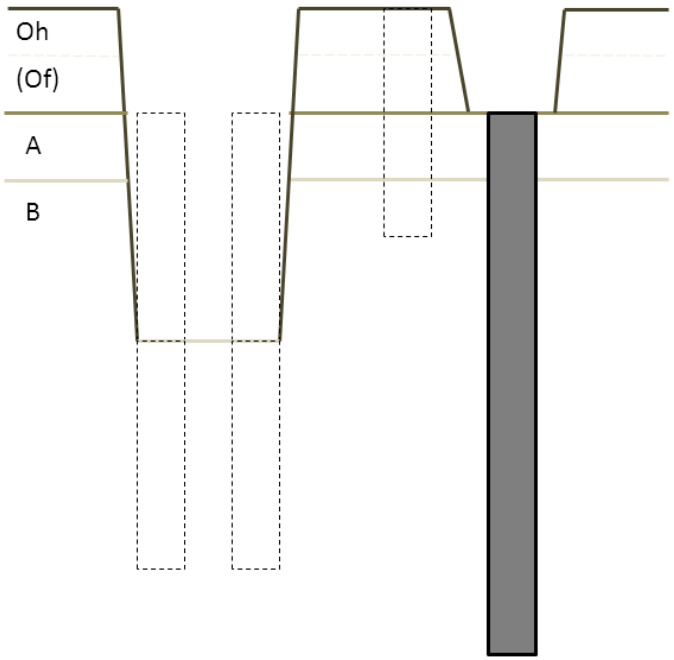
4 Remove soil until end of first HUMAX cores, then take 2 additional HUMAX from the next 30cm depth




**Step 4:** The remaining soil within the 40 x 40 cm frame up to the depth of the first two HUMAX liners will be dug out and two HUMAX liners, covering the next 30 cm will be taken. All samples will be labeled and registered.

# Sampling Strategy

5 **Only at transect points:**
Take away litter layer and drill Cobra core starting at A-horizon




**Step 5:** For the transect points, 1-2 COBRA cores will be taken outside, but in close vicinity of the 40 x 40 cm litter frame. If a second COBRA core can be taken, depends on the possibility to go deeper into the soil. If there is the option to drill deeper, after the first 50 mm COBRA core was taken, a second 30 mm COBRA core will be taken. All samples will be labeled and registered.