Regional Environmental Soil Hydrology (ReESH) Project

Thank you for contributing to the Regional Environmental Soil Hydrology (ReESH) Project

Project Objective:

Soil water potential (Ψ_S) is a fundamental measure for the hydrological status of terrestrial ecosystems; yet, continuous *in situ* Ψ_S measurements are rarely available. Rather, sites typically rely on continuous volumetric soil water content (Θ) measurements that are converted to Ψ_S *via* highly uncertain pedotransfer functions based on soil characteristics (Novick et al. 2022). Our goal with is project is to improve the use and representation of Ψ_S throughout the AmeriFlux network by creating site-specific data products, and parameter estimates, to transform Θ to Ψ_S and reduce the reliance on ambiguous pedotransfer functions. We are pledging to quantify the saturated and unsaturated hydraulic conductivities, soil water retention capacities (i.e., parameter fitting for van Genuchten model), soil characteristics (i.e., sand, silt clay fraction), and fine root biomass across multiple pits and multiple depths matching the vegetation and soil diversity in your flux tower footprints.

Sampling Equipment Checklist:

- ⊗ Rings*
- ⊗ Hammering ring holder*
- ⊗ Rubber bands*
- ⊗ Permanent marker*
- ⊗ Dead blow hammer*
- ⊗ Spatula*
- ⊗ Ruler*
- ⊗ Sample protocol*
- ⊗ Shovel (flat hose or spade)
- ⊗ Post hole digger
- ⊗ Cordless hammer drill (optional)
- ⊗ 7-inch diameter augur bit (optional)
- ⊗ Cell phone or GPS for recording survey locations

*** Denotes equipment included in your REesh project sampling kit.**

Site Selection:

We ask that site PIs dig four holes to collect a total of twelve cores. Samples are to be collected at depths of 0 m (i.e., surface), 0.1 m, and ≥ 0.5 m (or as deep as lower Θ sensor). For any reason a 0.5 m sample is not possible (e.g., shallow bedrock) explicitly denoted the depth of lower sample. Soil sampling should be conducted near the *in situ* Θ sensors or in similar soils. Try to sample as close to sensors as possible without disrupting measurements or creating long-term perturbations in the soil profiles that alter site hydrological dynamics (e.g., creating pools near soil moisture sensors).

Labeling Sample Rings:

Sample rings will need to follow explicit naming convention in order to track samples from shipping, sampling, and processing. All samples will flow the same pattern of:

AmeriFluxSiteCode_UniquePitID###_SampleDepthInCentermeters

e.g., USMMS_TDR1_000 (surface sample) or USMMS_TDR1_010 (10 cm sample)

This example uses a nearby TDR probe as a unique pit ID. If you do not have a unique identifier for your pits, please use a simple number notation when labeling (e.g USMMS_1_000).

You can label rings by writing directly on the stainless-steel collar, or by using the provided lab tape. Following sampling, sample names and coordinates must be input on the personalized field sheet and submitted to the post-sampling survey.

Sampling Instructions:

1. Once desired sample location is found, record the GPS coordinates. After noting the location, gently **remove any loose litter to expose the soil.** You do not need to remove living vegetation prior to sampling.

2. Rubber bands can be attached to the rings to tighten their fit to the hammering ring holder. Rings are attached to the hammering ring holder with the beveled, i.e., sharpened, edge down. This step is optional but recommended.

3. Make sure the ring is placed at the right depth and level with the soil surface. Rings should be hammered through soil profile such that soil begins to slightly protrude from top of the ring.

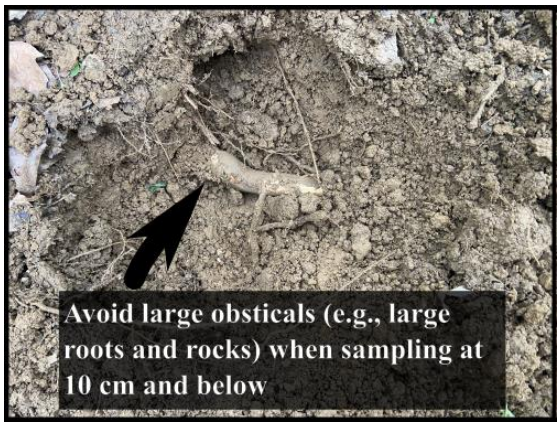
4. Excavate, undercut, and remove the ring. To prevent loss of the sample, it is best to avoid lifting the ring directly. The goal of sampling is to produce a completely filled ring, with minimal missing space and compaction. If the sample is too small and does not completely fill the ring, it will not produce accurate results. Samples that are too compacted it will alter final measurements.

5. If the ring is not completely filled, you can gently pack it with soil to the appropriate density. Overfilled rings can be cleaned by using the spatula to remove any excess sample or long roots can be trimmed. Place the caps on the sample ring by gently pushing to not to compact the sample during this step.

Reminder: Label the stainless steel [*sitename*]_[*samplelocation*]_[*depth*] 000cm.

6. Excavate soils using shovel or spade to 0.1 m and follow the above sampling technique for surface measurements. The ≥0.50 m sample uses a similar method.

Note: Soils often have large obstacles such as rocks and roots that may require a few attempts to find an ideal location.



7. The post-hole digger will be used to sample the excavated hole to ≥0.50 m depths for deep soil samples. Attaching the ring to the hammering ring holder with a rubber band provides the easiest approach for retrieving the ring from deeper holes. The shovel handle can be used to hammer the hammering ring holder at the bottom of the pit. Be sure to have some soil protruding from the top of the ring prior to removing the ring from the bottom of the pit.

8. Use the post hole digger to pinch and remove the ring along with its surrounding mass of dirt. Carefully clean the ring with spatula then cap it just as the surface and 10cm samples.

Make sure you have recorded the sample name, ring serial number, and coordinates for each sample.

9. Repeat sampling procedure at four locations within the AmeriFlux tower footprint.

Importance of Sample Integrity

The quality of the samples you provide directly impacts the data we return to you. Large gaps at the top of your sample, roots, and macropores introduce uncertainty into our measurements. We understand that retrieving a perfect sample can be quite difficult. However, we ask that you do your best when inspecting the integrity of your samples. Sometimes resampling is necessary to insure the best results. If you must repack samples to obtain a full core, please do your best in approximating the natural bulk density.

Returning to the lab:

1. Kindly, remove any excess field soils from sampling rings, tools, and action packer before packing soils for shipping back to Indiana University.
2. Use the provided packing supplies to securely pack the rings filled with soil along with the tools we provided in the sampling kits prior to shipping as samples destroyed during shipping will not processed.
3. Seal the action packer so that **Action packer handles cannot open.**
4. **Weigh the action packer filled with soils, tools, and pack supplies**, you will need this information for the post-sampling survey.
5. Now, the field samples and action packer are packed, fill out the post-sampling survey that was attached to the notification that we had shipped your sampling kit.
6. You will shortly receive an email for Katherine Devich (kdevich@iu.edu) that will contain new shipping label. Please print and place the newly printed shipping label into UPS label sleeve, provided in action packer, and prepare the shipment following your organizations shipping and receiving procedures.

Questions or further clarification feel free to contact Daniel Beverly dbeverl@iu.edu or Alex Crookshanks aecrooks@iu.edu .