



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-F400

Soil Sampling and Processing

Standard Operating Procedure

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1. Purpose

This SOP describes the procedures for collecting, processing, and storing soil samples for laboratory analysis. It covers field sampling using a soil auger, sample homogenization, sieving, and subdivision for biological assays, carbon analysis, and other soil properties (Food and Agriculture Organization of the United Nations, 2024; Robertson et al., 1999).

2. Scope

- **Applies to:** All field-based soil sampling for EA Program research, including photovoltaic panel studies, agricultural plots, and restoration sites
- **Does not apply to:** Deep soil coring (> 30 cm) requiring mechanized equipment; contaminated site sampling requiring chain-of-custody protocols
- **Location:** All EA Program field sites

3. Responsibilities

Role	Responsibility
Lab PI	Approve sampling plan, ensure training compliance
Field Lead	Coordinate sampling logistics, ensure protocol adherence
Trained Personnel	Collect and process samples according to this SOP
New Students	Complete training before independent sampling

4. Definitions

- **Bulk sample:** A large, mixed sample collected from multiple locations within a sampling unit and combined before analysis; represents the average composition of the unit rather than any single point.
- **Composite sample:** A sample formed by combining and mixing a defined number of subsamples from a plot or area; reduces analytical cost while improving spatial representativeness; the number and pattern of subsamples must be recorded (Robertson et al., 1999).
- **Core (soil core):** A cylindrical soil sample extracted with a push-probe or hammer corer; preserves the depth profile and allows depth-discrete sampling; also used for bulk density determination (see [SOP-F402](#)).
- **Fine earth fraction:** Soil material passing through a 2 mm sieve; sand, silt, and clay particles; the standard fraction for chemical analysis; gravel and coarser material are removed and their mass fraction recorded (Robertson et al., 1999).
- **Grab sample:** A single, point-in-time sample collected from one location; appropriate when spatial variability is low or when individual point values are required; contrasted with composite sampling.
- **Pedogenic horizon:** A layer of soil with distinct physical, chemical, or biological properties developed through soil-forming processes; designated by letter symbols (O, A, E, B, C, R); sampled discretely in profile descriptions (see [SOP-F407](#)).
- **Push-probe (soil probe):** A hollow stainless steel tube pushed into the soil by hand or with a slide hammer to collect an intact soil core; the standard tool for rapid depth-discrete sampling in fine-textured soils without large stones (Robertson et al., 1999).
- **Sampling depth increment:** A defined depth interval (e.g., 0–10 cm, 10–20 cm) from which soil is collected; depth increments must be consistent within a study for results to be comparable (Robertson et al., 1999).

- **Subsample:** One of the individual small samples taken from within a plot that are combined to form a composite; also refers to a representative aliquot drawn from a bulk sample for laboratory analysis.

5. Safety and Hazards

Hazards

- **Physical:** Repetitive strain from augering, sharp edges on sieving equipment, trip hazards at field sites.
- **Biological:** Soil-borne pathogens, tick and insect exposure at field sites.
- **Chemical:** Potential exposure to contaminated soils at some sites.

5.1. Required PPE

- ☐ Closed-toed shoes or field boots
- ☐ Nitrile or latex gloves
- ☐ Sun protection (hat, sunscreen)
- ☐ Safety glasses (when sieving)

Refer to [SOP-F001 Field Safety](#) for general field safety procedures.

6. Equipment and Materials

Item	Notes
Soil auger (Dutch or bucket)	Diameter 5–10 cm; clean between sites
Push-probe (soil core sampler)	For depth-discrete sampling
Rubber mallet or slide hammer	For driving probe into hard soils
Stainless steel bowl or plastic bucket	For compositing subsamples
Stainless steel sieve (2 mm)	For fine earth fraction
Ziploc bags or Whirl-Pak bags (labeled)	For each sample
Permanent markers and labels	Waterproof; include site, depth, date
Cooler with ice	For biological subsamples (enzyme assays, MBC, microbial DNA)
Field notebook	Per SOP-F003
GPS unit	Per SOP-F006
Isopropyl alcohol and paper towels	For decontaminating tools between sites

7. Sampling Design

Before sampling, confirm the sampling design with the PI and reference [SOP-F005 Random Sampling Design](#) for plot layout and randomization (Robertson et al., 1999). Record the following in

the field notebook:

- Site name and GPS coordinates
- Sampling date and personnel
- Target depth(s) or horizon(s)
- Number of subsamples per composite
- Auger/probe diameter
- Any deviations from the sampling plan

8. Procedure

8.1. Field Collection

1. Navigate to the sampling location per [SOP-F006](#).
2. Record the GPS coordinates of each sample location.
3. Inspect the surface for hazards. Clear surface litter only if required by the protocol; record whether litter was cleared.
4. Insert the auger or push-probe vertically to the target depth. For depth-increment sampling:
 - Collect the 0–10 cm increment first. Remove and place in a labeled sample container.
 - Re-insert the auger and collect the 10–20 cm increment. Place in a separate container.
 - Repeat for additional depth increments as required by the sampling plan.
5. For composite samples, collect subsamples at each designated subplot location (typically 5–10 per plot) and combine in the bowl or bucket before homogenizing.
6. Record the following for each sample:
 - Sample ID per the project labeling scheme
 - GPS coordinates
 - Depth increment
 - Observed soil conditions (color, texture, moisture, visible roots, stoniness)
 - Any anomalies (disturbance, compaction, visible contamination)

8.2. Field Homogenization

7. Break up clods and remove surface litter, roots greater than 5 mm, visible rocks, and obvious debris by hand (Robertson et al., 1999).
8. Mix the soil thoroughly in the bowl or bucket until the color and texture appear uniform.
9. If the sample is to be composited across subsamples, combine all subsamples before mixing.

8.3. Sieving (Field or Lab)

Sieving can be performed in the field (when fresh soil is required for biological assays) or in the lab after air-drying (for chemical analysis) (Food and Agriculture Organization of the United Nations, 2024; Robertson et al., 1999):

1. Pass the soil through a 2 mm stainless steel sieve.

2. Weigh and record the mass of coarse fragments (> 2 mm) retained if the project protocol requires correction for coarse fragment content.
3. The fine earth fraction (< 2 mm) is the standard fraction for all chemical and biological analyses.

8.4. Sample Subdivision for Multiple Analyses

Divide the sieved fine earth fraction into the required subsamples before further drying or freezing (Robertson et al., 1999):

Subsample type	Treatment	Storage
Microbial biomass C/N	Field-moist; process within 24 h	Cooler 4 °C then lab
Enzyme assays	Field-moist; process within 24 h or freeze	Cooler/freezer (-20 °C)
Mineral N (KCl)	Field-moist or frozen; extract within 48 h	Cooler 4 °C
Soil moisture (gravimetric)	Field-moist	Sealed bag
Carbon/nitrogen (EA-IRMS)	Air-dry, then grind	Room temperature
pH, texture, other chemical	Air-dry	Room temperature

Biological Subsamples

Do not freeze biological subsamples unless the analysis protocol explicitly permits it.

8.5. Tool Decontamination Between Sites

Wipe the auger, probe, and bowl with isopropyl alcohol and let dry before moving to the next sampling location. This prevents cross-contamination of soils between sites and is particularly important for sites with invasive species or contamination concerns (Food and Agriculture Organization of the United Nations, 2024).

9. Quality Control

- Collect field duplicates at a rate of 1 per 10 samples to assess sampling variability (Robertson et al., 1999).
- Record all deviations from the sampling plan in the field notebook.
- Verify auger depth calibration at the start of each sampling day.
- Ensure sieve integrity (no torn or damaged mesh) before processing.

10. Waste Disposal

Waste Type	Disposal Method
Used gloves	Standard trash
Decontamination rinse water	Pour on ground away from sampling plots
Coarse fragments	Return to field site or dispose in trash

11. References

- Robertson et al. (1999)
- Food and Agriculture Organization of the United Nations (2024)

Food and Agriculture Organization of the United Nations. (2024). *Standard operating procedure for soil microbial biomass (Carbon): Chloroform fumigation-extraction method*. FAO. <https://www.fao.org/soils-portal/soil-survey/soil-analysis/en/>

Robertson, G. P., Coleman, D. C., Bledsoe, C. S., & Sollins, P. (1999). *Standard soil methods for long-term ecological research*. Oxford University Press.

12. Related SOPs

SOP	Title	Relationship
F001	Field Safety	Required prerequisite
F005	Random Sampling Design	Plot layout and randomization
F006	GPS and Site Navigation	Sample location coordinates
F007	Field Decontamination	Tool decontamination between sites
F402	Soil Bulk Density	Companion core-based method
F407	Soil Profile Description	Horizon-based sampling context
L400	Soil Moisture	Required for dry-weight correction

13. Training Record

Before sampling independently, personnel must:

1. Read this SOP in full
2. Complete [SOP-F001 Field Safety](#) training
3. Participate in a supervised sampling session
4. Demonstrate proper auger technique, homogenization, and sieving
5. Be signed off by the field lead or PI