

SMAP Block Pattern Soil Moisture Protocol

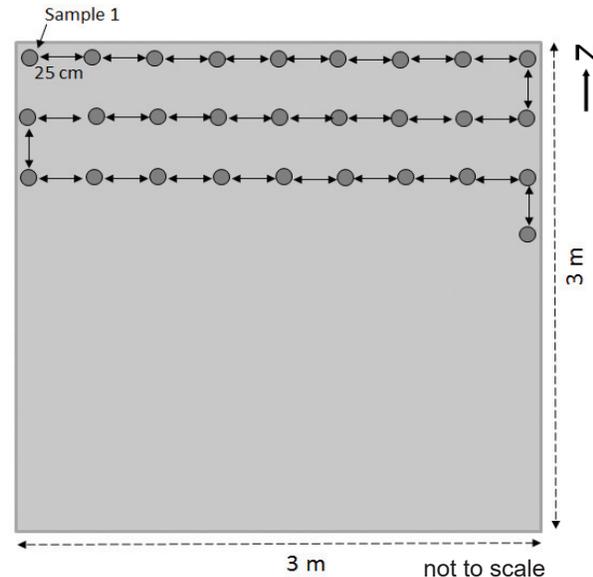
Field and Lab Guide

Task

Collect a surface soil sample for comparison to SMAP satellite data.

What You Need

- [Site Definition Sheet](#)
- [Soil Moisture Data Sheet – SMAP Block Pattern](#)
- 500 mL graduated cylinder
- Balance or scale with 0.1 g sensitivity and at least 400 g capacity (600 g recommended)
- zip lock bag
- 1 soil moisture sample can
- 1 soil moisture sample can lid or plastic wrap and rubber band for water tight covering of the can
- Permanent marker for writing on ziplock bags and/or sample cans
- 250 Watt infrared heating lamps that reach temperatures of 65 – 90° C (Soil drying oven is also an option)
- Thermometer capable of measuring to 110° C (if using a drying oven)
- Hot pads or oven mitts for handling dried soil samples
- Meter stick
- Ruler marked in millimeters
- Trowel
- Hammer
- Wood block
- Pen or pencil
- flag
- Science Log



In the Field – Preparation of the Soil Moisture Site

1. Complete the [Site Definition Sheet](#). (if not already done).
2. Complete the top portion of the [Soil Moisture Data Sheet – SMAP Block Pattern](#).
3. Locate your sampling point within your site, 25 cm from the previous sample point, and cut or pull away any grass or ground cover.

In the Field – Sample Collection

Collect the soil sample

Daily Measurements (using a sealable bag):

- dig the trowel 5 cm into the soil and place your sample into the pre-marked sealable bag (Figure 3).
- be sure to seal the bag well.

Note: If you have a soil drying oven collect all soil samples in a can and dry samples in oven; do not dry plastic bags in a soil drying oven.

Every 10th Sample (using a sample can)

- smooth the soil surface by scraping across it with you trowel
- push the can all the way into the soil so that the bottom of the can is even with the ground surface (Figure 4).
- use the trowel to dig the filled sample can out of the soil by putting it underneath the can and lifting it out without spilling any of the sample in the can (Figure 5).
- level the top of the sample by scraping across it with the trowel. If rock or other object sticks out of the top of the sample, return the sample to the ground, wipe the can clean and take a new sample. (In this case this second sample may be closer than 25 cm, but must be in undisturbed soil.)
- seal the sample using the can's lid or by covering it with plastic wrap and use a rubber band to ensure that no moisture will evaporate from the sample before it is weighed.
- if the soil is hard, place a wooden block on top of the can and pound it into the soil with a hammer (Figure 6).
- if the soil is so hard that pounding it into the ground will bend the sample can, take a sample using a trowel and sealable bag and wait to take the can sample until the ground has softened.

Place a flag or other marker in the spot from which the sample was taken so that it is clear where to take future samples.



Figure 3, placing soil in zip lock bag



Figure 4, pushing sample can into soil



Figure 5, use trowel to dig up sample can



Figure 6, gently tap sample can with wood block and hammer

In the Lab

1. Calibrate the balance according to the manufacturer's directions. If using an electronic balance, check that the balance is measuring in grams and is zeroed properly.

For each sample collected in the sealable bag:

2. Weigh the soil sample in the bag (Figure 7). Record the mass to the nearest 0.1 g as the wet mass in box a on your [Soil Moisture Data Sheet – SMAP Block Pattern](#).
3. Open the sample bag and if necessary roll the edges down to create a larger open area. If the soil sample is in clumps, break them down with your hand outside the plastic bag (do not touch the soil sample directly).
4. Dry the sample by placing the open bag 20-40 centimeters underneath the 250 watt infrared heating bulb or your specific drying source (Figure 8).
5. When the samples are dry, remove them from underneath the heating lamp and fill in drying time and drying method on the [Soil Moisture Data Sheet – SMAP Block Pattern](#).*
6. Weigh the dry sample and bag and note the dry mass on the [Soil Moisture Data Sheet – SMAP Block Pattern](#) in box b.
7. Note the weight of the sealable bag on the [Soil Moisture Data Sheet – SMAP Block Pattern](#) in box d.



Figure 7, determine wet mass of soil sample and bag

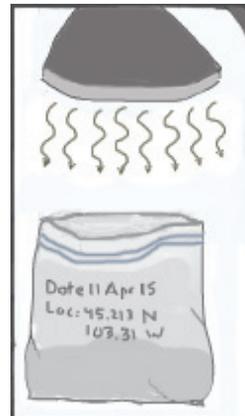


Figure 8, drying soil under a heating lamp

For each sample collected in a can:

8. Every tenth soil sample is taken with a can. Immediately transfer the soil from the can into a bag labeled with its container mass, and container number, sample collection date, and site name. (Be sure to transfer all of the soil, leaving nothing in the can so that you will get an accurate measurement).
9. Find the volume of the clean dry can using a graduated cylinder. Fill the graduated cylinder with water and record the initial volume. Because of water's adhesive property, water in a graduated cylinder forms a meniscus; be sure to record the volume from the bottom of the meniscus (see Figure 9). Clean off the rim of the graduated cylinder as well as the protective ring to avoid unaccounted water drops from entering the can.
10. Pour the water into the can until it fills the can to the brim. Make sure the can has a flat surface (Figure 10).
11. Record the final volume left in the graduated cylinder and use the equation below to find the volume of the can (V_{can}):

$$V_{can} = V_i - V_f$$

Where V_i is the initial volume in the graduated cylinder and V_f is the final volume.



Figure 9, reading the meniscus

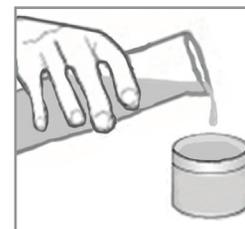


Figure 10, measure volume of sample can

* Weigh the sample after drying it for the recommended 2-3 days. In order to determine if all the water has been removed, dry the sample for an additional period of time (e.g. one to several hours) then weigh it again. If the mass of the sample has not changed then the sample can be considered completely dry. If the mass has changed by 0.3 grams or more, then dry the sample for another day and weigh it again. Repeat this last part until there is no difference in mass.

12. If the water in the graduated cylinder does not fill the can entirely, then repeat steps 9 and 10 until the can is full. Record the first volume of the graduated cylinder as volume 1. Pour the water into the can. Fill the graduated cylinder again and record this value as initial volume 2. Repeat if necessary recording initial volume 3, etc. Fill the can to the brim and record the final volume of the graduated cylinder. Use the equation below to find the volume of the can:

$$V_{\text{can}} = V_1 + V_2 - V_f \text{ or } V_{\text{can}} = V_1 + V_2 + V_3 - V_f$$

13. Measure the volume of the can 3 times and record the results on the [Soil Moisture Data Sheet – SMAP Block Pattern](#).
14. Perform steps #3-7 for drying the sample that has been transferred to a sealable bag.

Note: If you have an oven then do all soil collections and drying using sample cans. Measure sample bulk density for every tenth sample collected.