

Direct Measurement of Volumetric and Gravimetric Soil Moisture

Gravimetric and volumetric soil moisture are related to infiltration and plant survival. Volumetric soil moisture is:

$$\theta(\text{Volumetric Soil Moisture}) = \frac{V_w}{V_T}$$

Where V_w is the volume of water and V_T is the total volume.

$$\theta_g(\text{Gravimetric Soil Moisture}) = \frac{M_w}{M_s}$$

In the field

1. Using a core with a known volume of 147.26cm³ hammer the core (using a piece of wood) into the soil at the depth at which you want to measure bulk density.
2. Place soil sample into a ziplock bag labeled with, sample #, depth (cm) and date. If you are trying to measure soil moisture and bulk density simultaneously, then you need to measure the mass of the sample as soon as possible so it does not dry.

In the lab

Make sure all calculations, weights, and data are entered into an excel spreadsheet.

1. Weigh of the container (pie tin or something else) that you are using to measure the sample in.
2. Place the sample in the container and take the total weight.
3. Subtract the weight of container from the weight of both wet sample and container combined.
 - i. For example, if your container weighs 3g, and the soil + container weigh 12.5g, calculate 12.5g – 3g for a total of 9.5g. This means the actual soil weight is 9.5g.
4. Once the sample has been weighed, place it in an oven on 105°C for at least 24 hours
5. Remove from oven and weigh the dry soil.
6. Subtract the weight of container from the weight of both wet sample and container combined.
 - i. For example, if your container weighs 3g, and the soil + container weigh 9.5g, calculate 9.5g – 3g for a total of 6.5g. This means the actual dry soil weight is 6.5g.
7. **Gravimetric soil moisture:** The mass of water is calculated as the difference between the wet mass of the sample (minus the container mass) minus the dry mass of the sample (minus the container mass). This mass is divided by the dry mass (minus the container mass) to get gravimetric soil moisture.
8. Volumetric soil moisture can be calculated by assuming water has a density of 1 g/cm³. Under this assumption, the mass of water and volume of water are the same. Thus, the mass of water can be divided by the core volume (147.26 cm³) to get the volumetric soil moisture.