

Water Infiltration

3-ring, 3-pour Method

Ecological Process:

Water infiltration is a measure of how quickly water penetrates soil, which is a crucial part of the small **water cycle**. This process affects the soil's ability to capture and hold moisture, influencing groundwater recharge, runoff, and soil moisture distribution. These factors play a vital role in plant growth, nutrient availability, and overall ecosystem health.

Why Monitor this Metric:

Assessing and then monitoring water infiltration gives us insight into the soil's ability to absorb water and hence the effectiveness of precipitation on our soils. Water infiltration can vary greatly across an area (e.g., a field) and is strongly impacted by the activities that take place on the land. It is therefore a great candidate for monitoring for those interested in assessing the impact of the various practices being used or trialed. Water infiltration is also affected by our movements across the land and the compaction we create. Looking at water infiltration can help assess localized and area-wide trends and identify areas of most and least concern.

Tools and Materials:

- 3 metal rings (6" diameter x 6" depth)
- Rubber mallet
- Block of wood (2x4)
- Timer + backup timer (preferably 1 timer for each ring)
- Knife
- Water bottle (preferably 1 for each ring)
- Water jug (large enough to hold water for at least 3 pours at each of 3 rings on all sites you plan to visit)
- Tote/Bucket (to carry everything)
- Shovel
- Pencil/Marker/Pen
- Paper
- Clipboard
- Plastic sheet ~ 18" square
- GPS or phone with geolocation capabilities
- Ruler
- Rag or towel

Measuring Water Infiltration:

The 3-ring, 3-pour Method

We recommend using the 3-ring, 3-pour method to measure water infiltration. Water infiltration can be highly variable in managed landscapes. Using 3 rings helps to account for this. Using 3 pours addresses variability that may occur within the first few inches of soil and the ability of soil to infiltrate water deeper into the soil.

Placing the Rings

- Place each ring on a level patch of ground avoiding any areas of compaction or holes/cracks in the ground.
- If following the ROO baseline establishment protocol, you will select locations near subsampling sites 3, 6 and 9. If not following the ROO baseline establishment protocol, select locations for the three rings that are several meters apart but still close enough together to allow you to easily monitor all three rings. Unless you are specifically interested in investigating the effect of compaction on water infiltration, avoid high traffic areas including wheel tracks, field approaches and pivot paths etc.
- If you're setting up a baseline for your farm/field, ensure that rings are placed in areas where the soil conditions are representative of the area.
- Cut away any plant material that may interfere with the ring's placement - making sure not to disturb any soil.
 - Infiltration rings can be placed between crop rows to minimize disturbance to plants.
- Use a rubber mallet to gently drive the ring into the soil to a depth of three inches. Placing a piece of 2x4 wood on top of the ring helps prevent damage to the ring and the mallet, and keeps the ring level as it enters the soil.
 - Take care to ensure the ring is evenly seated and does not wobble.

Setting Up to Measure Infiltration

- Line a ring by placing a plastic sheet inside it drawing the edges of the sheet up and over the edges of the ring.
 - Using a plastic liner prevents the action of pouring water into the ring from eroding the soil in the pour location and confounding your results. It also ensures that the entire volume of water comes into contact with the soil at the same time.
- Pour the pre-measured water (450 ml) into the ring and carefully remove the liner to initiate the infiltration process.
 - 450 ml of water represents the equivalent of 1 inch of rain in the 6 inch diameter ring.
- Start timing immediately after removing the liner.
- Infiltration can be extremely variable. Some sites are able to infiltrate the full 450 ml in a matter of seconds, other sites may take a half hour or more to fully infiltrate.
- Depending on the rate of infiltration, you may now be able to repeat the above procedure for your remaining two rings.
- Make sure someone is keeping an eye on all three rings and is ready to stop the timer the moment the water is fully infiltrated.
- You will know when infiltration is complete when there is no more "glistening" on the surface of the soil inside the ring.
- Record the time it took for the water to infiltrate on your data sheet.
 - Use a prepared data sheet or a notebook to record the time it takes to infiltrate each

- pour of water in each ring.
- Note your observations and make sure to record the location and date.
- Once infiltration is complete, proceed with the second and then the third pours following the procedure outlined above.

Making Observations

- During the infiltration process, take a closer look inside your ring and note the following:
 - What do you observe? (e.g., critters, plant material, clarity, presence of bubbles)
 - What do your observations indicate? (e.g., bubbles indicate air displacement and porosity, slower second pour may indicate compaction or silt particles forming a seal on the surface between pours)
 - What patterns do you notice between the first, second, and third pours?
- Record your observations as well as any variations in water absorption rate or soil conditions for each pour.

Calling it Quits

- When water infiltration is slow, it may not be a reasonable use of your time to spend an hour waiting in a field for water to completely absorb. If during any of your pours, infiltration is not complete by the time 20 minutes have elapsed (for that pour), consider ending the monitoring of that ring there.
- Record your infiltration time as 20 minutes with a note indicating you “quit” at this point.
- To quantify how much water remained to be infiltrated, use a small ruler to measure the depth of water remaining inside your ring.
- Record this depth on your data sheet along with any observations as to why infiltration might be so slow at this specific location (if applicable, ask the ROO participant for their input).
- If this occurs during pour 1 or 2, do NOT proceed with subsequent pours.
- Compile all recorded data, including infiltration times, observations, and any noted anomalies, into the data sheets for analysis.

One Final Observation

- Using a shovel to free the ring from the soil gives you the chance to see how the water behaved as it infiltrated into the soil.
- Is there any indication of spillage or leakage beyond the ring that might indicate there was “looseness” when it was placed?
- To what depth did the water infiltrate? Did it continue below the bottom of the ring?
- How does the soil appear - does it look more like chocolate pudding or chocolate cake after receiving the equivalent of 3” of rain?