Soil Pit - Benchmarking

Note: To properly examine the soil, dig a soil pit to a depth and width of one shovel.

1. Soil Colour & Mottling

Ecological Process:

Observing soil colour helps us understand:

- Nutrient (Mineral) Cycle: Darker soil indicates higher organic matter, crucial for nutrient cycling and soil fertility.
- Water Cycle: Colour variations reflect moisture levels, influencing water infiltration and retention, and indicating potential waterlogging.
- Community Dynamics: Changes in soil colour reflect ecosystem changes, impacting plant and microbial diversity.

Why Perform This Monitoring:

Soil colour matters because it's a quick tool to assess:

- The amount of organic matter present (darker colours indicate more organic matter). Knowing the amount of organic matter in the soil is crucial because it enhances soil structure, water retention, and nutrient availability, boosting soil health and plant health.
- Whether the subsoil has been waterlogged (colours like grey, red, and brown spots can indicate prolonged waterlogging or suggest varying levels of oxidation due to fluctuating moisture conditions).

Tools and Materials:

- Shovel
- Water
- Tarp/drop cloth
- Measuring tape
- Materials to record data and observations (pencil, data sheet, phone)

Soil Colour Assessment:

(What To Sample)

- Once you've dug your soil pit, collect samples of both the topsoil (uppermost layer) and the subsoil (beneath the topsoil layer). Gather a handful of each for comparison.

(How to Sample)

- Penetrometer Reading: Before digging the soil pit, take a penetrometer reading to measure the compaction in psi (pounds per square inch) at the site.

- Excavate Soil Sample: From the soil pit, use a shovel to gather a handful of soil and place the sample on a tarp to observe its colour. After excavation, collect a penetrometer reading for comparison with the first reading.
- Moisten Soil: Add a small amount of water to moisten the soil sample, ensuring it's not overly wet.
- Make Observations:
    - Note the colour of the soil (e.g., deep dark brown, black, tan). Darker colours typically indicate higher levels of organic matter.
    - Observe for colour mottling patterns, including spots or streaks of particular colours (usually reddish, yellowish, or white), which may indicate waterlogging or fluctuating moisture levels. In the soil pit, check for these mottling patterns and use a measuring tape to record their depth and length.
- Compare Topsoil and Subsoil: Dig deeper to compare the colour of the topsoil with the subsoil. If both layers appear the same colour, it suggests that organic matter levels in the topsoil may need improvement. Additionally, observe and record the density comparisons of both the topsoil and subsoil layers. After excavation, collect a penetrometer reading for comparison with the topsoil reading(s).
- Take Pictures: Document the soil samples and soil pit with a phone for comparison over time, including geolocation if possible.
- Observations: Log observations in a field data sheet, follow these steps:
    - Date and Location: Note the exact location (managed or unmanaged area) where the soil sample was taken. Take a picture using your phone with geolocation enabled.
    - Soil Sample Details: Note the type of soil sample (topsoil, subsoil) and any relevant characteristics (moisture level, texture).
    - Colour Observations: Describe the colour of the soil sample after moistening it. Use descriptive terms like dark brown, black, tan, etc.
    - Comparison: Record any comparisons made between topsoil and subsoil colours, noting similarities or differences.
    - Photographs: Take pictures of the soil samples, including geolocation.
    - Additional Notes: Include any additional observations, such as vegetation.

2. Soil Smell

Ecological Process:

Observing soil colour helps us understand:

- Nutrient Cycle: Soil smell reflects microbial decomposition processes that release nutrients from organic matter, supporting plant growth.
- Water Cycle: Soil smell can indicate waterlogging or poor drainage.
- Community Dynamics: Different soil smells correspond to diverse microbial communities, which can vary based on factors like oxygen availability and moisture levels.

Why Perform This Monitoring:

- Understanding soil smell provides insights into soil health and conditions, indicating

microbial activity, moisture levels, and aeration status. It helps in diagnosing soil problems and planning appropriate land management strategies.

Tools and Materials:

- Shovel
- Nose
- Materials to Record Data and Observations (Pencil, Data Sheet, Phone)

Soil Smell Assessment:

(What To Sample)

- Collect samples of both topsoil (uppermost layer) and subsoil (beneath the topsoil layer).

(How to Sample)

- Digging Soil Sample: While digging the soil pit, after completing the soil colour assessment, use a shovel to excavate a soil sample from the desired location and conduct a soil smell test.
- Smell Assessment: Take a handful of soil and bring it close to your nose.
- Observe and note the smell.
  Is it:
  - Pleasant, sweet, and earthy (indicative of healthy, active soil)?
  - Rotten or sour (suggesting poor drainage or waterlogging)?
  - Mineral-like (indicating low organic matter content)?

  Observe:
  - Moisture content: Assess if the soil is wet or dry.
  - Aeration: Consider how well aerated the soil appears to be (e.g., observe pore space, water infiltration, plant roots, biological activity (i.e., earthworm activity)).
  - Organic matter: Evaluate the soil's organic content (poor, fair, good) based on smell and colour.
- Recording Observations: Record your observations in a data sheet. Note the exact location (managed or unmanaged area) where the soil sample was taken. Take a picture using your phone with geolocation enabled. To log observations in a field data sheet, follow these steps:
  - Date and time of assessment.
  - Location and type of area (managed or unmanaged). Take pictures of the soil samples and attach them to the datasheet. Include geolocation.
  - Smell description.
  - Additional notes on soil conditions (moisture, texture, aeration).

(Where to Sample)

- Unmanaged Area
- Managed Area: Best Field/Most Consistent
- Managed Area: Worst Field/Most Inconsistent/Challenging

3. Soil Aggregate Stability

Ecological Process:

Observing soil colour helps us understand:

- Nutrient Cycle: Stable aggregates protect organic matter and enhance nutrient retention and availability.
- Water Cycle: Stable aggregates improve water infiltration and reduce runoff.
- Community Dynamics: Aggregates provide habitat for soil organisms, promoting biodiversity and ecosystem resilience.

Why Perform This Monitoring:

- Aggregate stability, the measure of how well these soil particles stay bound together under stress, is essential for soil health and erosion resistance.
- Soil aggregates are crucial for maintaining soil structure, organic matter retention, water infiltration, and providing habitat for soil organisms.

Tools and Materials:

- Shovel
- Fresh Water
- Container (Mason Jar)
- Stopwatch/Timer
- Mesh Material (Chicken Wire)
- Materials to Record Data and Observations (Pencil, Data Sheet, Phone)

Soil Aggregate Stability Assessment:

(What To Sample)

- Collect samples of topsoil (uppermost layer).

(How to Sample)

- Collect Sample: Collect dry topsoil, approximately the size of a golf ball, before irrigation or rain events. Allow soil to air dry if necessary.
- Assessment Setup: Place the soil sample on the mesh material within a container filled with fresh water.
- Assessment: Start the stopwatch and observe the water clarity and the integrity of the soil aggregate. After 5 minutes, evaluate the cloudiness of the water and the size of the aggregate.
- Rating Aggregate Stability (ROC Rating):
    - Poor: Water turns cloudy quickly, and the aggregate disintegrates significantly.
    - Fair: Water is somewhat cloudy, and about 50% of the aggregate remains intact.
    - Good: Water remains clear, and the aggregate stays intact.
- Observations:
    - Observe and record initial soil moisture level (test on dry soil).
    - Changes in water clarity and aggregate size (cloudy vs clear).

    - Keep an eye on whether and how quickly water becomes cloudy.
    - After five minutes, look to see if the aggregate or the soil sample stays intact or whether it decreases significantly in size.
    - Make an observation and notice if there are plant roots and microbial life present at the testing site.
- Recording Observations: Record your observations in a data sheet. Note the exact location (managed or unmanaged area) where the soil sample was taken. Take a picture using your phone with geolocation enabled.
- Log observations in a field data sheet, including:
    - Date and time of assessment.
    - Location and type of area (managed or unmanaged). Take pictures of the soil samples and attach them to the datasheet. Include geolocation.
    - Observations and ROC Rating.

(Where to Sample)
- Unmanaged Area
- Managed Area: Best Field/Most Consistent
- Managed Area: Worst Field/Most Inconsistent/Challenging

4. Slake Test App

The Soil Health Institute (SHI) recommends measuring aggregate stability using the Slakes app as part of a minimum suite of measurements to assess management induced changes in soil health.

Tools and Materials:
- Phone (Android or IOS Smartphone)
- Soil Aggregates
- Petri Dishes
- Tap Water
- Smartphone Mount (Tripod or 4-6” Can or Jar)

Slake Test App:

(What To Sample)
- Collect samples of topsoil (uppermost layer).

(How to Sample)
- Download the App: Download the aggregate stability test app from the app store.
- Collect and Dry Aggregates: Remove an intact clod from the top 2 inches of the soil. Gently break apart into pea-sized aggregates and dry overnight.
- Set-up:
    - Mount your smartphone approximately 4–6 inches above an empty clear plastic dish.
    - Select 3 aggregates and place them in the dish.

    - Fill a second dish with water.
- Start ‘Test’:
    - Tap 'Start Aggregate Stability Test' in the app to enter the sample ID and capture the initial image of dry soil in the dish.
    - Move the water-filled dish into the camera view.
    - Gently transfer aggregates to the water-filled dish and take a picture to start the test.
- Complete Test and Receive Results: After 10 minutes, the app will automatically capture the final image and display the aggregate stability index value for the sample.
- Export & Interpret Data: On the My Results Tab, tap 'Export Test Results.' Log observations in a field data sheet, including:
    - Date and time of assessment.
    - Location and type of area (managed or unmanaged). Take pictures of the soil samples and attach them to the datasheet. Include geolocation.
    - Observations and aggregate stability index value.

(Where to Sample)

- Unmanaged Area
- Managed Area: Best Field/Most Consistent
- Managed Area: Worst Field/Most Inconsistent/Challenging