



04

pH protocol

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Why measure this?

pH controls which nutrients are available to plants and soil microbes. Knowing your soil pH helps you decide whether amendments like lime are needed, and tracking it over time shows whether your site is recovering toward conditions that support native species.

What it captures

pH affects the amount of nutrients and chemicals that are soluble in soil water, and therefore the amount of nutrients available to plants and microbes. pH is correlated with exchangeable base cations. Soils with low pH values (less than 5) have low cation exchange capacity (the soil's ability to hold and release nutrients) and nutrient availability, and potentially have high anion exchange capacity.

The soil-to-solution ratio is 1:2.5 (20 g soil : 50 mL water), which is the international standard for pH measurement in water (Anderson and Ingram 1994).

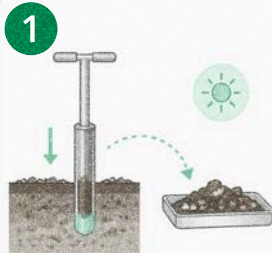
Sampling

- Collect soil samples from a depth of 0-5 cm. pH is measured at 0-5 cm because acidity varies sharply near the surface due to organic acid inputs from decomposing litter. This differs from bulk density and SOM/SOC, which use 0-10 cm.
- Collect at least 5 samples per hectare. See the Sampling Protocol for plot layout and general replication guidance.
- Sample during the same season each time. pH can vary seasonally, so consistent timing ensures comparable results across monitoring periods.

Materials needed

- Soil corer
- Clean small containers (one per sample)
- Kitchen scale or balance (grams)
- Spoon
- Distilled or deionized water (water with a neutral pH, free of minerals)
- Timer
- pH meter
- pH standard buffers of pH 4 and 7
- Field notebook
- Pencil
- Permanent marker
- Sieve with ~2 mm openings
- Lint-free tissue

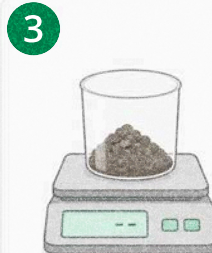
Procedure



Collect soil with a corer at **0-5 cm depth** and air dry it for three days.



Sieve the dried soil through a **2 mm** sieve.



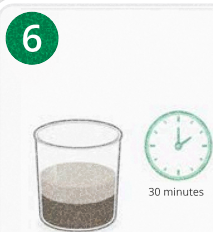
Weigh 20 grams of the sieved sample into a clean container.



Add **50 milliliters** of distilled or deionized water to the container with the soil.



Stir the mixture for 10 minutes.



Let the mixture sit for 30 minutes.



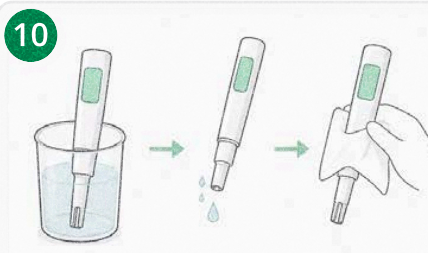
Stir the mixture again for 2 minutes.



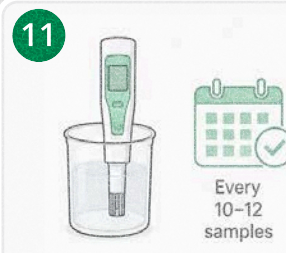
Calibrate the pH meter with **buffer solutions** (pH 4 and 7) before the first measurement. See Appendix for detailed calibration steps.



Insert the electrode into the supernatant (the liquid that remains on top of the settled soil) and record the pH.



Rinse the pH meter electrode with deionized water and blot dry with a lint-free tissue between samples.



Check pH calibration with **buffer** standards every 10-12 samples.

pH meter calibration

Read the pH meter manual before first use. Each pH meter brand has different calibration methods; below is one example.

1. Turn the pH meter on.
2. Pour into separate 50 mL small containers enough of each pH buffer solution to cover the electrode tip (~10 mL).
3. Press the calibrate key.
4. Rinse the electrode with deionized water and blot dry with a lint-free tissue. Do not wipe or rub the electrode – the glass sensing bulb is fragile, and rubbing can scratch the surface and degrade accuracy.
5. Insert the electrode into the first buffer and gently swirl the container.
6. Wait for the pH icon to stop flashing and the arrow icon to start flashing. The meter should display the temperature-corrected pH buffer value.
7. If the displayed value is incorrect, manually enter the value by pressing the up/down arrow keys to adjust each digit and the digits key to move to the next digit.
8. Press the calibrate key.
9. Repeat steps 4-6 with the second buffer.
10. Press the calibrate key and then press the measure key to save and end the calibration.
11. Proceed to measure the pH of your soil samples.

Interpreting results

pH is reported as a unitless value on a 0-14 scale. Record the first stable reading.

pH range	Classification	What it means
< 4.5	Strongly acidic	Very low nutrient availability; consider liming
4.5-5.5	Moderately acidic	Common in tropical soils
5.5-6.5	Slightly acidic	Optimal range for most tropical species
6.5-7.5	Neutral to slightly alkaline	Good nutrient availability
> 7.5	Alkaline	Check for carbonates (sizzle test with HCl)

Important considerations

- Record the pH when the reading stabilizes. This may take 30-60 seconds per sample.
- See also: Sampling Protocol (00), SOM & SOC Protocol (03). pH is closely correlated with soil organic matter content and nutrient availability.

References

Anderson, J.M. and Ingram, J.S.I. (1994). Tropical Soil Biology and Fertility: A Handbook of Methods. 2nd ed. CAB International.

Toro, L., et al. (2025). Integrating belowground recovery into tropical forest restoration design and monitoring. BioScience. <https://doi.org/10.1093/biosci/biaf097>

Questions or Feedback?

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Many thanks to our partners for their contributions to the belowground restoration monitoring protocols series



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