

Soil pH measurement for the Bryophyte Habitats Survey

Soil pH is one of the most useful 'spot tests' that can be carried out in studies attempting to relate the occurrence of native plant species (including bryophytes) to environmental conditions. The soil pH value can provide otherwise hidden information about the presence or absence of carbonates (responsible for the important calcicole-calcifuge contrast) and about the availabilities of a range of essential and non-essential or toxic elements. pH measurement comes into the Bryophyte Habitats Survey in several places as follows:

- pH measurement of bulked soil or sediment samples
- pH measurement of tree bark samples
- Field pH measurements (combined with conductivity measurements) within quadrats located in wet habitats such as streams, lakes, flushes, bogs and fens.

These instructions mainly apply to the first option where surface soil (or sediment or peat) has been collected in small quantities from each of a number of replicate quadrats and placed together in a single polythene bag. Collections of accumulated dust and/or plant debris from quadrats on rocky substrata can be dealt with in the same way. A separate list of people ('pH boffins') who have undertaken to measure the pH of your soil samples is posted separately on the website. Bark pH is being measured centrally by the scheme coordinator to whom air-dried samples¹ should be sent together with the completed record cards/forms.

Soil preparation

If you intend sending soil samples by post or storing them for more than a day or two it is essential to dry them. Wet soils kept in sealed polythene bags are likely to undergo rapid microbiological changes that may alter the pH value. Air-drying can be achieved by spreading the soil thinly on clean newspaper or paper towel on a bench in a shed or conservatory with reasonable ventilation. Once air dry the soils will keep indefinitely and can be returned to dry, labelled polythene or paper bags for storage or dispatch. Avoid the temptation to remove stones while the soil is drying as these may be an important chemical component in achieving pH equilibrium in some cases. Thoroughly mix the soil so that a good 'average' sample is taken for analysis.

Theory

All the usual methods of measuring soil pH make use of soil-water slurries. Besides using distilled water, there are more specialist methods using dilute salt solutions (CaCl₂, KCl, NaF). The use of CaCl₂ solution instead of distilled water reduces ionisation which can suppress seasonal differences in pH within a soil. The method employing distilled water alone is widely used in soil science and has the advantage of simplicity where it is to be used by many people with limited access to a laboratory. The ratio of water to soil is of some importance because the pH value obtained rises progressively as the proportion of water to soil is increased. Nevertheless, within quite wide limits, the effect of variations in water to soil ratio is slight and can be ignored. The method described below uses a 1:1 water to soil

¹ Bark shavings are best placed in newspaper packets like those used for bryophyte samples and spread out to air dry at home.

mixture by volume. See link (3) if you want to know how a pH meter and its electrode works.

Meter care and calibration

Follow the instructions supplied with your meter. The electrodes have a finite life and should not be used if they no longer give reliable results when checked with buffers. Electrode life can be extended by keeping the tip in an acidified (to pH 4.0) KCl solution. Keeping the electrode permanently in distilled water will shorten its life.

Measurement technique

1. Place a level scoop (e.g. dessert- or table-spoon according to quantity of soil available) of fresh or dried soil into a clean beaker or disposable cup. Make sure it is labelled with the sample number.
2. Add one scoop of distilled water, stir for 15 seconds and then leave to stand for 30 minutes before measurement.
3. Calibrate the meter against two buffers before running a set of samples. Use pH 7.0 and pH 4.0 for acid soils, and use pH 7.0 and pH 9.0 for alkaline samples. Take care that the meter reads accurately on both buffers before measuring any samples. Wash all traces of buffer from the electrode with distilled water between buffers and before measuring samples.
4. Insert electrode so that the tip is in the soil slurry rather than the solution above, but take care that you do not scratch or crack it against stones. Stir the electrode carefully without permitting it to touch the gritty bottom (which may damage the thin glass surface). Read the pH value when it has stabilised. Wash the electrode before measuring a new sample.
5. Repeat if you have any doubts about the reading obtained. When in use your pH meter should be calibrated against buffers at least daily.

Useful links:

(1) Soil pH measurement with a portable meter.

<http://njaes.rutgers.edu/pubs/publication.asp?pid=FS767>

(2) Use of reaction (pH) in soil taxonomy.

<http://soils.usda.gov/technical/technotes/note8.html>

(3) History and principles of pH meter

<http://www.seafriends.org.nz/dda/ph.htm#History>

