NCEA
Natural Capital and Ecosystem Assessment

England Peat Map

Vegetation Field Survey Protocol

May 2025

Natural England Research Report NERR149 Annex 2

Lead Author: Chris J. Miller

Contributors: Christoph Kratz, Andrew Webb, Alex Hamer, Sam Dixon

www.gov.uk/natural-england

NATURAL ENGLAND

About Natural England

Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected, and England's traditional landscapes are safeguarded for future generations.

Further Information

This report can be downloaded from the Natural England Access to Evidence Catalogue. For information on Natural England publications or if you require an alternative format, please contact the Natural England Enquiry Service on 0300 060 3900 or email enquiries@naturalengland.org.uk.

Copyright

Acknowledgements

This project is funded by the UK Government through Defra's Natural Capital and Ecosystem Assessment programme.

Citation

Miller, C.J., Kratz, C., Webb, A., Hamer, A. Dixon, S. 2025. 'England Peat Map Vegetation Field Survey Protocol' in Kratz, C and others. 2025. England Peat Map Project Final Report. Natural England Research Report NERR149. Natural England.

Contents

1. Introduction

The following survey protocol was provided to field surveyors for the England Peat Map project. The surveys captured data from across England, recording information such as percentage vegetation cover and peaty soil depth from sites selected according to a comprehensive sampling strategy.

The vegetation survey took place on sites with peaty soils using a 10x10 metre quadrat. It was not intended for this vegetation survey to be repeated, although some plots were revisited for quality control purposes.

2. Preparation

2.1 Desk preparation

2.1.1 Vegetation

Prior to the vegetation survey taking place a list of suitable sites for survey need to be identified. All sites need to be within England, within the peaty soils layer or known to contain peaty soil, and have one or more of the following vegetation classes present, growing on top of a peaty soil*: *Sphagnum* dominated bog; *Eriophorum* dominated bog; *Molinia* dominated bog; *Calluna* dominated bog; Scrub/tree dominated bog; Short vegetation dominated fen; Tall vegetation dominated fen; & Scrub/tree dominated fen (see Appendix 1 for more details). It is recommended that other data sources such as soil association maps & habitat maps are consulted to confirm the presence of peaty soils prior to visiting a site.

*we define **peaty soil** as ≥ 20% organic matter
(≥ 25% for soils with > 50% clay content)

Due to the survey requirements larger sites are preferable. Whilst each vegetation quadrat is 10x10 metres, a 20-metre buffer around the quadrat is required before another quadrat can be placed, which equates to an area of 0.25 ha i.e. 50 metre x 50 metre. The vegetation class only needs to occur within the 10x10 metre quadrat it does not need to occur within the buffer area.

2.1.2 Designated Sites/Sensitive Features

Prior to a survey being undertaken checks need to be made to ensure that there are no sensitive features on site which might be damaged by the survey being conducted. Where appropriate, consent/assent/advice should be secured prior to a survey taking place e.g. SSSI consent.

2.1.3 Landowner Permission

Prior to a survey taking place permission must be obtained from the landowner using the approved access permission letter, FAQ's and privacy notice. A suitable time and date for the survey to take place also needs to be agreed with the landowner in advance.

2.2 Equipment

Table 2 EPM vegetation survey equipment List

Item	Veg Survey Quantity
Tape measure 20 metres (minimum)	2
Tape measure 5 metres (minimum)	2
Ranging poles, canes or similar, to mark corners and secure tape measures, 1 metre min	4
GPS (sub metre accuracy)	1
Map or app with quadrats identified (alternative depending on method)	1
Field survey forms or app	1
Lensatic Compass & Ordnance Survey Map	1
Set of peat probes (see notes below)	1
Camera - (good quality smartphone/tablet camera or other camera with a standard wide angle lens (approx. 28mm SLR equivalent)	1
QA survey only: second recording device (smartphone/tablet)	1
Locator flags/canes	5
Gloves (if required by surveyor)	1

Our preferred tool for measuring peat depth is the Hisco Utility Probe which can be obtained either direct from Hisco or via UK based distributors such as Van Walt (www.vanwalt.com/equipment/peat-probes/) and NHBS (www.nhbs.com/peat-probe).

Whilst the Hisco probe does not have a threaded tip, which is advantageous in identifying the presence of soft (non-peat) sediments, it does perform well across a range of peat types and is commercially available.

Alternatives to the Hisco probes can be used provided they meet the following criteria, the type of probe used is recorded, and the specification of the probe is provided:

- The probe should be rigid, lightweight, and inflexible which you can easily add extensions to, and preferably it has a threaded cone shaped tip.
    - Rigid/inflexible probes are preferred as they are more likely to follow a true path straight downwards and not be diverted off to one side if you encounter an obstruction e.g. a piece of timber buried in the peat.
    - Slightly narrower probes are better for pushing through dried out agricultural peat which can be quite hard whereas wider diameter probes perform better in wetter peat where it can be harder to tell where the peat/mineral soil interface is.
    - Smooth sided probes are preferred over textured probes as they are easier to push through the peat making it easier to feel the resistance caused by the probe entering a mineral soil.

Further guidance on how to take a peat depth measurement can be found in the EPM Peat Probe Guidance.

2.3 Health & Safety

2.3.1 Requirements

The survey organisation is required to have:

- Health and safety procedures with a commitment to high standards of health and safety.
- A method for ensuring safe systems of work in the form of suitable and sufficient written risk assessments and associated method statements.
- Adequate training, and where appropriate qualifications.
- Evidence of proven track record of high health and safety standards.
- Resources available to implement effective health and safety systems relevant to the contract.
- Resources available to implement effective health and safety systems.

2.3.2 Lone Working

Where it is reasonable and sensible to do so lone working should be avoided. Where lone working does take place a risk assessment should be carried out to determine if additional measures are required. Consideration should be given to the task being carried out/if the

individual has specific health requirements/ circumstances are outside the norm. Additional measures should be proportionate to the risk.

2.3.3 Lowland Raised Mire/Fen sites

Due to the risks associated with working on lowland raised mire/fen sites surveyors are required to work in pairs (but still with their lone worker procedure/buddy running in the background). At least one of the surveyors should have experience of working in similar terrain and be capable of identifying safe routes and safe survey areas well away from open water or unconsolidated ground (i.e. saturated *Sphagnum* bogs) when working on these sites. It is recommended that surveyors use sticks or walking poles to assess the firmness of the ground when on these sites, and that they carry (and practice using) throwlines to help with an emergency rescue. Where practical, it is recommended that at least one of the surveyors has formal first aid training.

2.3.4 Open Water/Sphagnum Pools

Due to the risks associated with deep water surveyors are required to avoid areas of either open or *Sphagnum* covered deep water and select an alternative survey point.

2.3.5 Over Head Power Lines

The surveyors should not conduct peat depth measurements within a horizontal distance of at least 10 metres from an overhead power line. These distances should be measured from the line of the nearest conductor to the work, projected vertically downwards onto the floor, and perpendicular to the route of the line.

2.3.6 Unexploded Ordnance

The survey organisation is required to conduct a preliminary unexploded ordnance risk assessment to determine the potential level of risk across all the survey locations. The assessment needs to include all factors which have contributed towards the assessment. It also needs to include recommendations for further action. If required a detailed risk assessment should be produced and all actions implemented.

The survey organisation is also required to provide its staff/sub-contractors with suitable training on unexploded ordnance and have clear procedures in place on what to do if unexploded ordnance is discovered while conducting the survey.

2.3.7 Underground Services

It is the responsibility of the survey organisation to conduct enquiries about the presence of any underground services within or near to each survey point. A risk assessment and method statement, covering the risk of underground services and what mitigating controls

are being implemented, is required. If the risk is too high, an alternative survey point should be selected.

If cables/services are damaged all work must stop immediately and the utility owner should be contacted as soon as possible.

2.4 Biosecurity & invasive non-native species

All surveyors are required to follow the biosecurity procedures detailed in ‘Biosecurity Guidance. A good practice guide to minimising the risk of moving non-native species, pests and diseases’, Natural England, 2017 (Unpublished).

The surveyors are required to record and submit online incidental sightings of Invasive Non-Native Species either through a webpage or using an appropriate smartphone app e.g. iRecord.

3. Field Protocol

3.1 Vegetation

3.1.1 Vegetation Quadrat Location

Within each vegetation survey site surveyors have the freedom to select the most appropriate quadrat(s) if the following requirements are met:

- The quadrat is on peaty soil (visually check soil surface)
- The vegetation class definition is met (see below and Appendix 1)
- The quadrat needs to align to a 10x10 metre grid orientated on the British National Grid i.e. the 6 figure Easting/Northing for the centroid of the quadrat need to end in a 5, and the Easting/Northing for the SW corner of the quadrat needs to end in a zero e.g. Centroid = 31472**5**.8, 49478**5**.6; SW corner = 31472**0**.8, 49478**0**.6. The grid in the field survey app will aid setting these quadrats.
- There needs to be a minimum of 20 metres between each quadrat in all directions. The 20 metres is measured from the boundary of one 10x10 metre quadrat to the start of the next 10x10 metre quadrat.
- Quadrats need to be a minimum of 20 metres in from the edge of the peaty soils layer.
- Ideally more than 3 quadrats of a particular vegetation class need to be collected from a single site. However, it is acknowledged for certain vegetation classes/sites this may not be possible.

3.1.2 Vegetation classes:

- *Sphagnum* sp. dominated bog (regardless of species);
- *Eriophorum* sp. dominated bog;
- *Molinia caerulea* dominated bog;
- *Calluna vulgaris* dominated bog;
- Scrub/tree dominated bog;
- Short vegetation dominated fen;
- Tall vegetation dominated fen**; and
- Scrub/tree dominated fen*.

Scrub/tree dominated bog should only be surveyed when tree/scrub is in leaf i.e. Spring-Autumn.

Recently mown tall fen vegetation should not be surveyed & Grazed tall fen vegetation ≤50 cm in height should be classified as short fen.

Apart from for *Sphagnum* dominated bog, dominant is defined as vegetation with an aerial foliar cover (visible from above) of 60% or more.

Short fen vegetation is defined as vegetation ≤50 cm in height (across 60% or more of the quadrat), and tall fen vegetation is defined as ≥100cm in height (across 60% or more of the quadrat), fen sites that fall between these height categories are unsuitable.

Sphagnum dominated bog is defined as where there is ≥ 60% cover of Sphagnum compromising at least 15% aerial foliar cover. There also needs to be < 5% aerial foliar cover of *Calluna vulgaris*. Further detail describing each vegetation class can be found in Appendix 1.

3.1.3 Record Survey Information

Record the following:

Table 3 Survey information to record and methods to use

Variable	Method/comments
Peaty soil visual check	Visually check the soil surface to confirm presence of peaty soil before placing quadrat
Vegetation Class	*Sphagnum* sp. dominated bog; *Eriophorum* sp. dominated bog; *Molinia caerulea* dominated bog; *Calluna vulgaris* dominated bog; Dry grass or scrub dominated bog; Short vegetation dominated fen; Tall vegetation dominated fen; or Scrub/tree dominated fen.
Date	Record date of survey.
Surveyor ID	The app uses your AGOL (ArcGIS Online) username as ID. In the event of the app being unavailable please record your AGOL username or initials if username not known. Do not share IDs between surveyors. Ensure each surveyor uses their own unique ID.
Peat probe type	Type of peat probe: select from peat probe, avalanche probe, cable rod, stick, other.
Peat Depth Resolution	Resolution in cm at which depth was measured, e.g. nearest 5cm, 1cm etc.

3.1.4 Quadrat Layout

The vegetation survey will be carried out in a 10x10 metre quadrat orientated along cardinal directions i.e. North, South, East, West.

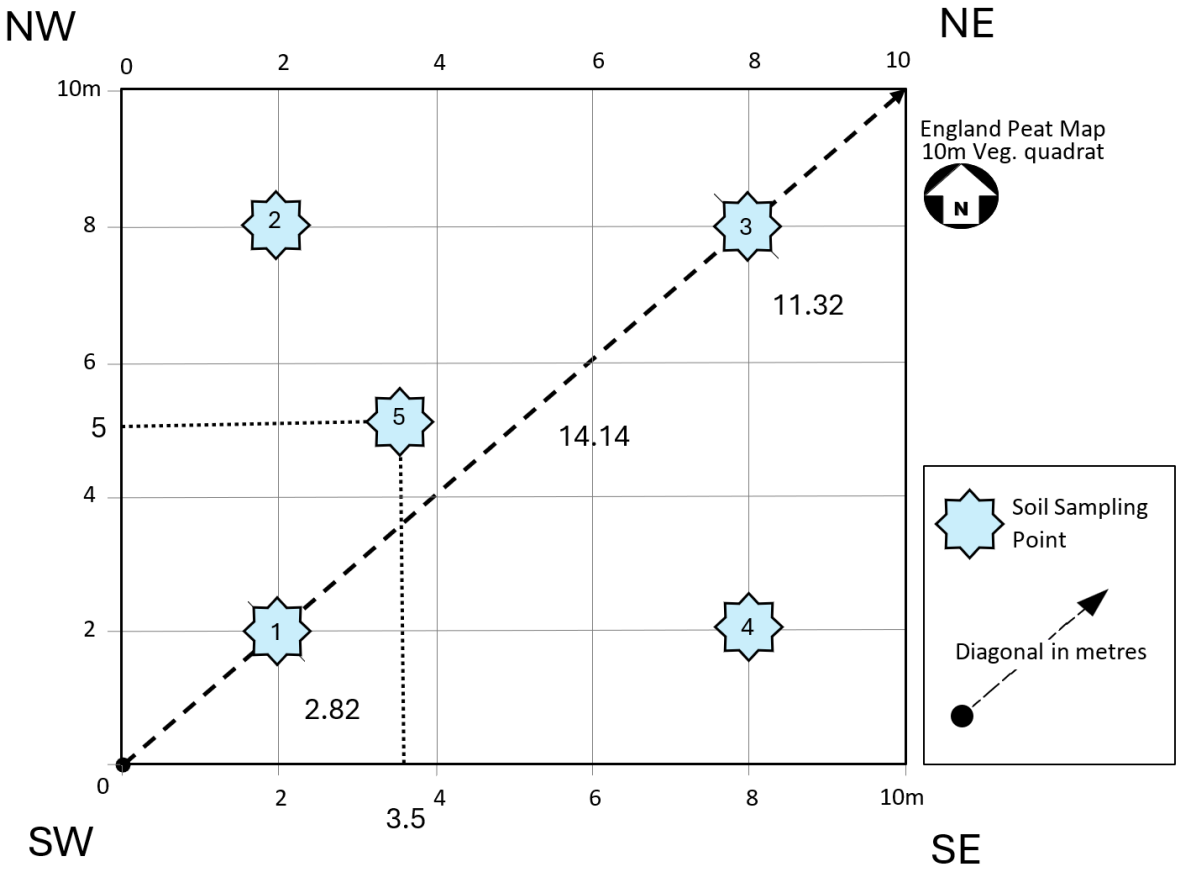

Figure 1. Vegetation survey quadrat layout

Use ranging poles to mark out the corners of the 10-metre square as follows:

1. Start at the South-West (SW) corner of the quadrat. Mark the SW corner with a ranging pole and record the GPS co-ordinates. (Figure 1)
2. Attach the end of both 20-metre tape measures to the SW corner ranging pole. One surveyor stays at this point, securing the ends of the tape measures and sighting using a compass* (how-to-use-a-lensatic-compass). Make sure the compass is kept clear of mobile phone/tablet/GPS as this can affect the bearing taken.
3. Measure out 14.14 metres exactly NE (45º N) and place a second ranging pole at the NE corner. Measure with one 20 metre tape measure but carry and pay out the other one at the same time.
4. Using the GPS sense check the placement of the NE ranging pole (due to errors in the GPS position it will not be 100% accurate).
5. At 2.82 metres and 11.32 metres along the tape place a marker flag to mark out soil depth sampling points 1 and 3 respectively (Figure 1).
6. Now pay out both tape measures to 20 metres and tie each of them to the NE pole at the 20-metre mark.

7. With a third ranging pole, stretch out one of the 20 metre tape measures due West to form a right angle at 10 metres, and place the pole. This is the NW corner. Sight with compass to confirm the orientation.
8. Repeat with the fourth ranging pole, going South. This is the SE corner. Sight with compass to confirm the orientation.
9. Using the two 5-metre-long tape measures together locate and mark out soil depth sampling points 2,4 and 5 (Figure 1). In relation to the South-West corner of the 10-metre square, these points are (coordinates in metres): point 1 (2m,2m), point 2 (2m,8m), point 3 (8m,8m), point 4 (8m,2m), and point 5 (3.5m, 5m).

Vegetation and ground feature recording are done for the 10-metre square as a whole. Depth surveying is carried out at all five sampling points.

3.1.5 Record Position

Having set up the quadrat, record the GPS position of the SW corner.

Table 4 Position variables to record and methods to be used

Variable	Method/comments
GPS position SW corner	**Optional**: If a GPS is not connected to the Field Maps app or if a better resolution location is available from an external device then: Use a GPS to record the actual 12 figure grid reference at the southwest corner of the quadrat
GPS accuracy	Record the precision in metres of the GPS signal at the time of the reading
GPS Unit	Record the make and model of the GPS unit used

3.1.6 Photographs

Take four landscape orientated photographs of the quadrat using a good quality smartphone, tablet camera or other camera with a standard wide-angle lens (approx. 28mm SLR equivalent). Care should be taken to ensure that the photos are not out of focus or blurry and that no people are included in the photo. Only photograph enough of the horizon to locate the quadrat. The main focus of the photos should be the vegetation in the quadrat. When using the EPM app the photos need to be labelled with the direction of view only e.g. “N”. If you are not using the app the photos need to be labelled with the survey site identifier and the direction of view e.g. “EPM.4.v1N”. This can either be carried out digitally or by preparing an A4 sheet with the quadrat identifier and the direction of view in advance, and holding it in the field of view of the photo:

- **Looking North**: stand in the middle of the Southern quadrat boundary and align the image so that the NW and NE corners of the quadrat are at the top left and top right corners of the image (Figure 2). If required place the A4 sheet with photo information in view.
- **Looking South**: stand in the middle of the Northern quadrat boundary and align the image so that the SE and SW corners of the quadrat are at the top left and top right corners of the image.
- **Looking East**: stand in the middle of the Western quadrat boundary and align the image so that the NE and SE corners of the quadrat are at the top left and top right corners of the image.
- **Looking West**: stand in the middle of the Eastern quadrat boundary and align the image so that the NW and SW corners of the quadrat are at the top left and top right corners of the image.
- **Additional Photos**: should be kept to a minimum to reduce survey file size. Additional photos may be necessary to illustrate notes or unusual features. In sites with tall trees an additional photo to show the canopy will demonstrate aerial foliar cover.

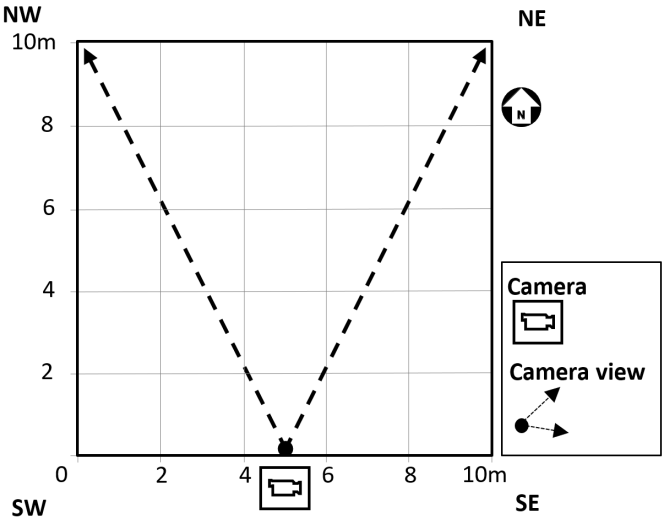

Figure 2. Camera position when taking a photo looking North

3.1.7 Vegetation cover and Ground Features

Within each 10x10 metre quadrat to the nearest 5% record the percentage surface cover (aerial foliar cover) of the taxa and ground cover types listed in Table 6. To help guide cover estimates a visual representation of cover thresholds can be found in Appendix 2. Taxa/features <5% need to be recorded as <5% with the exception of Sphagna. For Sphagna cover should be recorded as <1% or 1-4% or greater. Absence of taxa/features should be recorded as 0.

Table 5 Variables to be recorded for 10x10 metre EPM squares

Variable	Method/comments
Cover of the following taxa (each as a group, not individual species unless specified): • all Forbs – Herbaceous flowering plants (excl. grass/sedge/rush) • Purple Moor Grass (*Molinia caerulea*) incl. dead leaves • all other Grasses • Broad Leaved (≥2mm) Cotton Grass • Fine Leaved (<2mm) Cotton Grass • all other Sedges • all Rushes • all Reeds • all Sphagna • Sphagna in Understorey (i.e. not visible to sky) • all other Bryophytes if part of canopy • Heather (*Calluna vulgaris*) • all other Dwarf Shrubs • all Trees and Shrubs • Bracken (*Pteridium aquilinum*) incl. dead leaves • all Crops	Record the percentage surface cover i.e. **aerial foliar cover** for each taxon in or above the quadrat, whether or not rooted within it. Only record live, above-ground growth apart from for Purple Moor Grass & Bracken during the autumn/winter where recording dead leaves is required. Record cover to the nearest 5%. Taxa/features <5% need to be recorded as <5% with the exception of Sphagna. For Sphagna cover should be recorded as <1% or 1-4% or greater. Absence of taxa/features should be recorded as 0. Grasses = Poaceae family (excl. Purple Moor Grass (*Molinia caerulea*) and species included in Reed definition) All Reeds = Common reed (*Phragmites australis*), Reed canary-grass (*Phalaris arundinacea*), Reed sweet-grass (*Glyceria maxima*), Bur-reed (*Sparganium* sp.), Reed-mace (*Typha* species), Wood Small Reed (*Calamagrostis epigejos/canescens/stricta/scotica)* All other Sedges = Cyperaceae (excl. *Eriophorum sp*.) All Rushes = Juncaceae family Dwarf Shrubs includes Heather (*Calluna vulgaris*), Heathers (*Erica sp.*), Bilberry/Cranberry etc. (*Vaccinium sp.*), Crowberry (*Empetrum nigrum*), Bearberry (*Arctostaphylos uva-ursi*), Dwarf/Western Gorse (*Ulex minor/gallii*), Juniper (*Juniperus communis*), *Bog Myrtle (Myrica Gale)* etc. All Trees & Shrubs includes Birch (*Betula pubescens*), Scots Pine (*Pinus Sylvestris*), Gorse (*Ulex europaeus*) etc.

Variable	Method/comments
Litter	Record the percentage surface cover (i.e. cover of Litter visible to the sky) to the nearest 5%. Litter is loose recognizable dead plant tissues (e.g. undecomposed leaves). Dead plant material still connected to living plants (e.g. dead parts of *Sphagnum* mosses) is not regarded to form litter. (IUSS Working Group WRB, 2022)
Cover of bare soil/sand	Record total % cover of bare soil/sand to the nearest 5%.
Cover of bare peat	Record total % cover of bare peat to the nearest 5%.
Cover of bare rock	Record total % cover of bare rock to the nearest 5%.
Cover of open water	Record total % cover of open water to the nearest 5%. This is only to be recorded for permanent or semi-permanent water such as bog pools and edges of water bodies.
Evidence of recent burning or cutting	Presence of evidence of recent burning or cutting (occurred during or after the most recent winter burning season)
Sward structure	Please Record in order of dominance the vegetation surfaces present (max. 3): • Bare ground, ESS (Early Successional Surfaces) • Low bryophytes, lichen • Very short grass, herbs, heather • Medium grassy, building heather • Low scrub, tussocks, mature heather • Young scrub < 2.5m • Mature scrub, trees > 2.5m • Tree canopy

3.1.8 Peat Depth

Within the 10x10 metre quadrat locate in turn each of the five soil sampling points. Use the retractable tape measures, the tape measures already laid out, and Fig.1 showing measurements along the diagonals to identify: point 1 (2,2), point 2 (2,8), point 3 (8,8), point 4 (8,2), and point 5 (3.5, 5). Use an object (ideally a flag) to mark the location before you start surveying.

Carry out the survey activities described in Table 6.

Table 6 Variables to be recorded at each of the five peat sampling points

Variable	Method/comments
Peaty Soil Presence (whole quadrat only)	Visually check the soil surface to confirm presence of peaty soil.
Organic Soil depth in cm (at five locations per quadrat)	At each soil sampling point use the peat probe to measure the depth of the organic horizon: Push the tip of the probe into the soil, attaching further extensions as required, until you feel resistance increasing markedly over a short depth interval, which can be associated with texture change (e.g. sand grains rubbing against the probe can be felt or heard; stoneless clay gives a much more gradual increase in resistance with no grinding and the probe can still be pushed into it; or the probe getting stopped abruptly (peat on rock)). Note that completely resistant, hollow-sounding material may be woody material which can sometimes be penetrated with further pressure or by probing again close-by. Once you've reached the bottom of the organic layer use a retractable tape measure to measure from the ground upwards to the nearest joint or to the end of the probe. This is the above ground value. Next, carefully remove the probe from the ground. Use known lengths of the probes/joints to calculate the length of the probe to the joint you measured the above ground value to. Subtract the above ground value from that length to obtain the depth of the organic layer. Record the depth at that point.
Bottom reached (at five locations per quadrat)	Was the peat probe long enough to reach the bottom?
Presence of drainage feature within 5 metres (at five locations per quadrat)	Observe whether there are any natural or artificial drainage features such as gullies, grips or drains within a 5-metre radius of each point.

4. Quality Control

4.1 Purpose/Objective

The objective of the quality control process is to:

- Identify errors in the survey data.
- Ensure surveyors are following the agreed processes and procedures.
- Ensure remedial measures are put in place to reduce potential errors e.g. additional training.
- Improve survey accuracy using post survey data correction procedures.

4.2 Survey Point Selection

To minimise survey error a second “blind” survey is conducted on a subset of the points surveyed. At least 10% of each surveyor’s work is “blind” surveyed. The first “blind” survey is conducted as soon as possible after a surveyor has started surveying to ensure early identification of errors. Subsequent “blind” surveys are randomly selected from the pool of surveys a surveyor has completed.

4.3 Field Survey Procedure

- Locate position of original survey with sub-metre accurate GPS and plot photos.
- Repeat original srvey without reference to the survey data (apart from GPS location and plot photos which are used to establish position only).
- Once complete, using a second device, compare the survey with the original.
- Where there is significant deviation between the original and the new survey, record notes as to possible reasons why e.g. field has just been ploughed.
- If you encounter a survey point that does not meet the spacing rules, create a survey point but select Peaty Soil Visual Check as “No”, add a comment stating “Spacing” and then click submit. A full QA survey is not required.
- If you encounter a survey point where you do not believe the vegetation class definition is met, please carry out a full QA survey.

4.4 Post Survey Procedure

To ensure prompt and effective surveyor feedback follow the following post survey procedure:

- Upon receipt of the original and “blind” survey compare all survey fields with each other and discrepancies highlighted.
- Investigate any significant discrepancies promptly to understand the root cause. Record these, along with any remedial action that needs to be taken, and clearly communicate this to all involved. Any required remedial measure(s) need to be promptly implemented to prevent the discrepancy from reoccurring.

5. References

IUSS Working Group WRB 2022. World Reference Base for Soil Resources. International soil classification system for naming soils and creating legends for soil maps. 4th edition. 4th edn. International Union of Soil Sciences (IUSS), Vienna. Available at: https://wrb.isric.org/.

McBride, A., Diack, I., Droy, N., Hamill, B., Jones, P., Schutten, J., Skinner, A. and Street, M. (eds) 2011. The Fen Management Handbook. Scottish Natural Heritage, Perth. Available at: https://doi.org/10.1108/00330330510628024.

Rodwell, J.S. 2006. National Vegetation Classification : Users' handbook. Joint Nature Conservation Committee, Peterborough. Available at: https://hub.jncc.gov.uk/assets/a407ebfc-2859-49cf-9710-1bde9c8e28c7.

Appendix 1: Vegetation Category Definitions

***Sphagnum* sp.** dominated bog is where there is ≥ 60% cover of Sphagnum comprising at least 15% aerial foliar cover. There also needs to be < 5% aerial foliar cover of *Calluna vulgaris*. It can include the following species: *Sphagnum austinii, S. balticum, S.beothuk, S.capillifolium, S.cuspidatum, S.denticulatum, S.divinum, S. fuscum, S.medium , S.papillosum, S. pulchrum, S. rubellum, S. subnitens,* or *S.tenellum*. More degraded bog sites may be dominated by *Sphagnum fallax*, *S.fimbriatum*, or *S.palustre*.

***Eriophorum* sp. bog** is dominated by Common Cottongrass (*Eriophorum angustifolium*), Slender Cottongrass (*Eriophorum gracile*), Broad-leaved Cottongrass (*Eriophorum latifolium*), or Hare's Tail Cottongrass (*Eriophorum vaginatum*).

***Molinia* caerulea bog** is dominated by Purple Moor Grass (*Molinia caerulea*).

***Calluna* vulgaris bog** is dominated by Common Heather (*Calluna vulgaris*).

Scrub/Tree dominated bog can include species such as: Birch (*Betula* spp.) and Pine (*Pinus* sp.). Plantations should be excluded. Non-Native species should not be dominant.

The vegetation found on fens are incredibly diverse. A total of 45 National Vegetation Classification plant communities are found on Fens (McBride and others, 2011). Therefore, the species found in each vegetation class listed below are included as a guide and are not intended to be definitive. If there is uncertainty in vegetation class identification in the field expert advice should be sought.

Short Fen can include species such as**:** black bog-rush (Schoenus nigricans), bog pimpernel (*Anagallis tenella*), marsh lousewort (*Pedicularis palustris*), fen pondweed (*Potamogeton coloratus*), common butterwort (*Pinguicula vulgaris*), marsh valerian (*Valeriana dioica*), bog bean (*Menyanthes trifoliata*), marsh cinquefoil (*Potentilla palustris*), marsh bedstraw (*Galium palustre*), bottle sedge (*Carex rostrata*), dioecious sedge (*Carex dioica*), lesser tussock-sedge (*C. diandra*), common sedge (*C. nigra*), carnation sedge (*C. panicea*), flat sedge (*Blysmus compressus*) and common cotton-grass (*Eriophorum angustifolium*). Moss species can include *Palustriella commutata*, *Campylium stellatum*, *Scorpidium scorpioides*, *Sphagnum contortum*, *S. teres*, *S. warnstorfii*, *S.fallax*, *S. squarrosum*, and *S. palustre*.

Tall Fen can include species such as**:** common reed (*Phragmites australis*), bulrush and lesser bulrush (*Typha latifolia* and *T. angustifolia*), great fen-sedge (*Cladium mariscus*), purple and yellow loosestrife (*Lythrum salicaria* and *Lysimachia vulgaris*), yellow iris (*Iris pseudacorus*), angelica (*Angelica sylvestris*), cowbane (*Cicuta virosa*), greater water-parsnip (*Sium latifolium*), meadowsweet (*Filipendula ulmaria*), common valerian (*Valeriana officinalis*), bladder sedge (*Carex vesicaria*), greater tussock-sedge (*C. paniculata*), greater and lesser pond sedges (*C. riparia* and *C. acutiformis*).

Scrub/Tree dominated fen is "dominated by willows (*Salix* spp.), alder (*Alnus glutinosa*) and birch (*Betula* spp.). Scarcer woody species associated with fens include buckthorn (*Rhamnus catharticus*), and alder buckthorn (*Frangula alnus*). The understorey of shade-tolerant fen plants can include uncommon species such as marsh fern (*Thelypteris palustris*) and elongated sedge (*Carex elongata*)" (McBride and others, 2011). Plantations should be excluded. Non-Native species should not be dominant.

Appendix 2: DOMIN cover thresholds

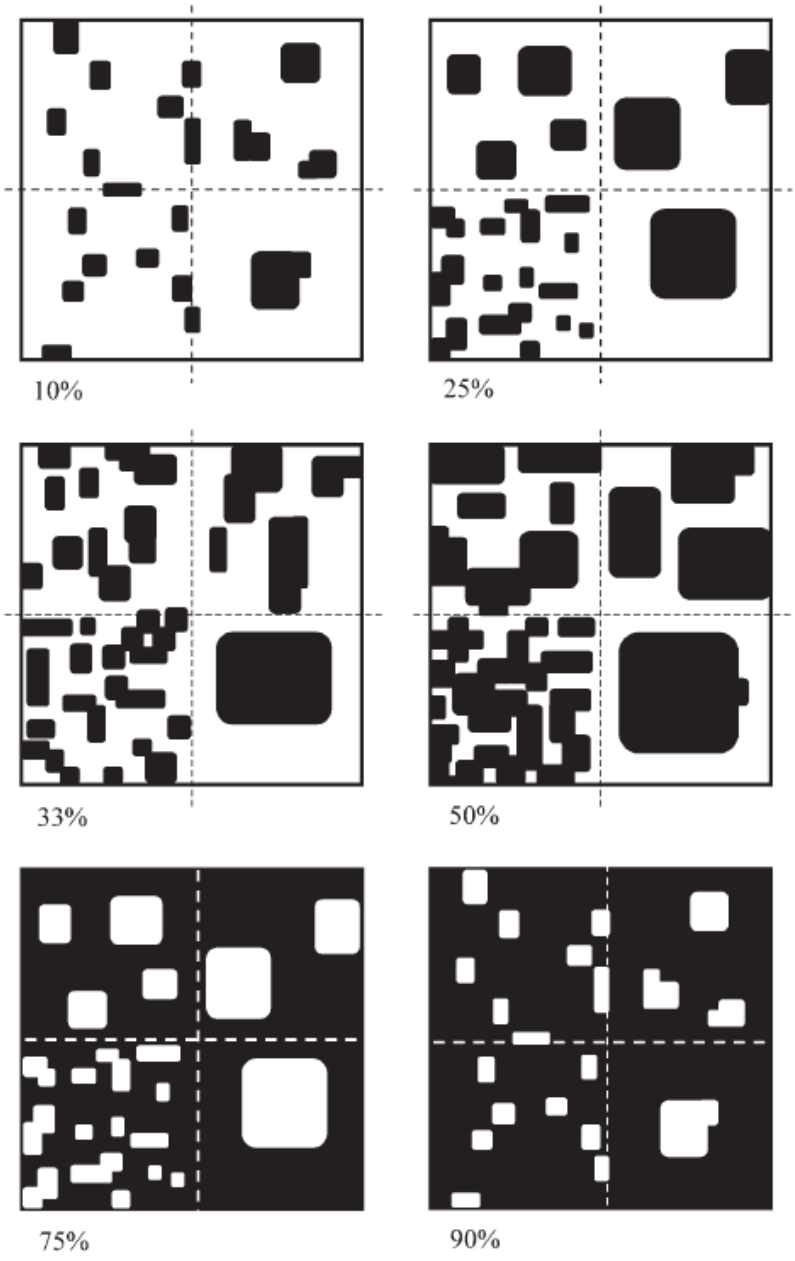

Figure 3. A visual representation of DOMIN cover thresholds (from Rodwell, 2006).

www.gov.uk/natural-england

NATURAL ENGLAND