Natural England Technical Information Note TIN097

Guidelines for monitoring peatland restoration

The aim of this guidance is to provide information to enable peatland restoration projects to develop appropriate monitoring programmes. Degraded peatlands are restored for a wide range of reasons. Restoration objectives can include protecting and enhancing biodiversity, improving water quality, reducing flood risk and protecting cultural heritage or carbon stores. Restoration projects need monitoring programmes to show whether these objectives are being met and to help them to adapt practices to respond to environmental changes.

This document provides guidance on how to identify the most appropriate monitoring techniques for a peatland restoration project. More information on how to implement these techniques is available in the Natural England Commissioned Report NECR086 - *A review of techniques for monitoring the success of peatland restoration.*

This note summarises the general principles for all peatland monitoring programmes and provides a check list to help design the monitoring programme.

The tables in *Appendix 1* list monitoring techniques grouped in terms of the parameters being monitored (for example, vegetation, invertebrates, peat physical integrity etc).

The tables in *Appendix 2* group monitoring methods in terms of restoration objectives and indicate which methods are suitable, considering:

- the scale of restored area
- the resources available
- timescales
- skill levels
- current land use

Once the appropriate monitoring methods have been identified *NECR086* should be consulted for more detail on the method and its application. It also highlights where additional technical input may be required or where involvement of researchers may be beneficial.

Monitoring site at Atkinson Peat Moss

This note includes some general guidance on how to assess monitoring data to inform progress towards objectives, changes in management or changes in the monitoring programme itself. It is beyond the scope of this note and of *NECR086* to explain how to conduct detailed data analysis.

First edition 2 September 2011

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Setting objectives

In broad terms environmental restoration can mean either re-establishing an ecosystem which has been damaged, or changing the environment to enable a desired set of processes or functions to occur. Where there is little or no remnant of the original ecosystem remaining the aim is more often described as "re-creation" rather than restoration. The advice in this note is applicable to both restoration and re-creation.

The restoration goals and objectives of the project need to be agreed and defined before the monitoring techniques are selected, and before any restoration work starts. The causes and mechanisms of degradation should be identified, and potential future degradation addressed. The objectives should then describe the desired end point for the peatland in terms of habitats, functions or uses. To determine these objectives may require consultation among different stakeholder interests.

Peatland monitoring should not assume that the attainment of previous or historic conditions of the peat is inevitably possible. Natural processes and environmental change (especially climate change) may prevent previous conditions being achieved.

The monitoring techniques selected should reflect the objectives, budget and scale of the restoration project. The tables provided in Appendix 1 and 2 should help projects to select the most appropriate techniques. The data produced by the monitoring should be capable of:

- Describing the extent to which the restoration objectives have been met.
- Indicating why changes have occurred (for example, due to restoration or wider environmental factors).
- Showing whether the causes and processes of degradation have been addressed.

Once restoration objectives have been set, and monitoring techniques selected, the programme should identify monitoring targets.

These are the target values that the monitoring data should attain that will indicate when the restoration objectives have been met.

There should be clear and measurable criteria by which to judge restoration success. For example, for SSSI habitats Common Standards Monitoring[1] provides both monitoring parameters and a set of thresholds against which the success of restoration can be judged. The statistical methods that will be used to analyse the data will influence data collection. These issues are discussed in more detail in the following section on *Analysis and asssessment*.

Projects should also consider how the monitoring results will be communicated, their potential audience and their likely reaction. This may influence the parameters monitored and techniques used.

Establishing a monitoring programme

Ideally monitoring should start before restoration takes place and cover both pre-restoration and post-restoration phases. This means that establishing a monitoring programme should be among the earliest steps in a peatland restoration programme. If adequate pre-restoration monitoring is not possible, past survey or environmental data may help, but you should consider how to make the new monitoring programme compatible with the techniques and methodologies used in past surveys.

If possible, sufficient resources should be sought for the whole of the proposed monitoring programme. Projects should also ensure that access to sites will remain possible throughout the programme.

Monitoring should cover a sufficient duration and frequency to allow for inter-annual and seasonal effects which might obscure the impact being

[1] See **http://jncc.defra.gov.uk/page-2199** for more details

assessed. Measurements should be made at a sampling density necessary to account for natural variability in site conditions, and to provide sufficient sample size to enable statistical tests to detect the changes you wish to report (to detect smaller changes in more variable parameters will require more samples). In reality, the number and frequency of measurements is likely to be a compromise between keeping costs down and producing the best scientific information.

Automatic water sampler, Cronkley control catchment

Partnerships with academic institutions and consultancy firms with suitable laboratory equipment and expertise in monitoring are highly recommended and collaborative work with research groups and/or partnerships may enable additional funding streams to be accessed, such as EU LIFE or NERC funding.

Consideration should be given at the start of the programme to the use and dissemination of the monitoring data, and where possible, it should be collected in a form that is compatible, accessible, easily shared with others and not subject to restrictions due to intellectual property issues. This is covered in more detail in the section on *Data sharing*.

Selecting monitoring techniques

The tables in *Appendix 1* list the range of techniques recommended for peatland restoration monitoring and indicate the relevant sections in *NECR086* or other key sources of information:

- Table 1 - *The physical integrity of peat*
- Table 2 - *Biota*
- Table 3 - *Hydrology*
- Table 4 - *Biogeochemistry*

This should help you identify which parameters to monitor along with potential techniques to use.

The tables in *Appendix 2* should then be used to help select the monitoring techniques for a specific project. There are separate tables for each of the main restoration objectives identified:

- Table 5 - *Carbon sequestration or storage*
- Table 6 - *Species recovery or maintenance*
- Table 7 - *Habitat recovery or maintenance*
- Table 8 - *Water flow management*
- Table 9 - *Water quality improvement or maintenance*
- Table 10 - *Maintain paleo-environmental information*
- Table 11 - *Maintain or increase recreation suitability or landscape integrity*

In each of the above tables the suitability of each monitoring technique is assessed against a range of attributes describing the restoration project in terms of scale, available resources and land use. This should enable projects to identify a range of techniques which address their restoration objectives and suit the scale and nature of the project.

Interpreting the tables

The peatland restoration project concerned should select column headers which apply to it. Only those techniques with a '✓' in these columns are likely to be suitable. Where there are no available techniques suited to the project for a given objective, it may be worth seeking collaboration with others to provide expertise, resources or expand the scale of the project.

Spatial scale

- A 'site' is a small area that is targeted for restoration, for example, about 10 Ha.
- A 'unit' is a larger area that represents a distinct type of landscape feature, such as an entire blanket bog or raised bog or a SSSI assessment unit.
- A 'landscape' scale restoration project is one that is considered to be targeting a large area, such as a whole moorland, or catchment.

Resources and timescales

Low resource methods are considered to be those not requiring expensive equipment or sophisticated laboratory techniques.

'Short term study?' indicates techniques suited to projects where there is a limited time (weeks or a few months) to collect monitoring data. Techniques with no tick either need longer time periods to collect good quality data or would have excessive resource requirements for only a short period of data collection.

Methods that can be implemented, and the data interpreted, without specialist training are indicated by a '✓' in the 'Low training/ experience' column.

Land use

Some land uses may restrict the application of a particular method. These columns identify monitoring techniques that are compatible with livestock grazing and grouse moor management, due to the likelihood of damage to equipment left in the field.

Analysis and assessment

To evaluate whether the restoration objectives have been met the monitoring data must be interpreted against criteria. These criteria may be based on:

- Direct comparison with a 'reference' site which already meets your objectives.
- Comparison with accepted threshold values (for example, from JNCC Common Standards Monitoring[2]).
- The overall direction of change (trajectory analysis) compared to initial conditions or unrestored areas.

If new restoration techniques are being explored, or applied to a new area, then an experimental approach will provide more information on their efficacy. This will involve applying the same practices across several plots or areas, and also providing a corresponding number of plots with no restoration as "control" treatments.

To interpret the significance of changes observed in the monitoring programme will require statistical techniques. It is necessary to decide which techniques to use early during design and conception stages of the monitoring protocols. This is because statistical tests often require certain types of data to be collected to be valid.

Interpretation of monitoring data will be enhanced by available information on environmental trends in the surrounding area. This might include weather station data, biological records or atmospheric pollution data.

The restoration management put in place may not succeed in delivering the project's objectives. Also, even with the best-designed monitoring scheme, the data collected may not be capable of capturing unpredictable changes, or helping explain changes, owing to the complexity of ecosystem interactions.

[2] See **http://jncc.defra.gov.uk/page-2199** for more details

Assessment of monitoring information during the course of the project can indicate where restoration management is failing to deliver objectives, and enable new restoration approaches and treatments to be applied ("adaptive management"). Where this happens, it may be necessary to review the monitoring programme to ensure that the monitoring techniques are still appropriate.

If monitoring information indicates that restoration objectives are not likely to be met, this information can be used to help revise the restoration objectives themselves.

Data sharing

While analysis of monitoring data can inform the management of a single restoration project, analysis of data from a wide range of restoration projects can provide a wider overview of peatland responses, which can be used to inform methods, guidance, policy and future research.

Monitoring information can contribute to established networks designed to assess long term or widespread environmental impacts. Consideration should be given to how your monitoring relates to existing national programmes such as the Environmental Change Network[3], the Environmental Change Biodiversity Network[4], the Acid Waters Monitoring Network[5], UK air quality monitoring networks[6]. Biological records can be submitted to local Biological Record Centres or national recording schemes, which can then contribute to the National Biodiversity Network[7]. There is a current JNCC project which aims to coordinate and promote research into GHG and C flux measurements from managed and restored peatlands, and a report[8] describes the recommended techniques.

Monitoring data can be used to develop and test simulations and models which predict the impacts of restoration management. Improving these models should provide greater certainty about the impacts of restoration management in other sites, and help justify and target future restoration.

However, coordination and analysis has been frustrated in the past by incompatible data being collected using different methods, storage of data in inaccessible forms, copyright restrictions and the lack of a suitable maintained data repository.

View towards Cow Green Res. from Cronkley Fell

Following the methods outlined in this document and described in more detail in *NECR086* and other sources will help to encourage consistent and compatible data. Appendix 3 of *NECR086* also describes a proposed structure for a general-purpose monitoring database and you are encouraged to ensure that data is recorded in an electronic form compatible with this structure, to aid possible future collation.

This information note will be updated when further information and guidance on data sharing is agreed and available.

[3] **www.ecn.ac.uk/**
[4] **www.ecn.ac.uk/targeted_monitoring/intro.htm**
[5] **http://awmn.defra.gov.uk/**
[6] See **http://uk-air.defra.gov.uk/networks/**
[7] **www.nbn.org.uk/**

[8] **http://jncc.defra.gov.uk/page-2132**

Selected references

BONNETT, S.A.F., ROSS, S., LINSTEAD, C. & MALTBY, E. 2009. *A review of techniques for monitoring the success of peatland restoration*. University of Liverpool. Natural England Commissioned Report NECR082.

LINDSAY, R. 2010. *Peatbogs and Carbon: A Critical Synthesis*. RSPB Scotland. **www.rspb.org.uk/Images/Peatbogs_and_carbon_tcm9-255200.pdf**.

BROWN, A.F. & SHEPHERD, K.B. 1993. *A method for censusing upland breeding waders* Bird Study, 40: 3, 189-195.

Further information

Natural England Technical Publications are available to download from the Natural England website: **www.naturalengland.org.uk**. In particular see:

- NECR086 *A review of techniques for monitoring the success of peatland restoration*

For further information contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.

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This note was developed from text provided for Natural England by SWIMMER, Institute for Sustainable Water, Integrated Management and Ecosystem Research University of Liverpool, Nicholson Building, Brownlow Street, Liverpool, L69 3GP. Dr. Samuel A.F. Bonnett, (SWIMMER) Dr. Conor Linstead (SWIMMER), Prof. Edward Maltby (SWIMMER), and Dr. Sarah Ross, Penny Anderson Associates.

Jonathan Walker, Aletta Bonn and Sharon Davison at *Moors for the Future* are acknowledged for their input and guidance on the web survey and technical report; and Penny Anderson and Katharine Longden at Penny Anderson & Associates for support at the Natural England workshop on peatland restoration.

The production of this note is the responsibility of Natural England Project Officer Matthew Shepherd, with inputs from Dave Glaves, Andy Nisbet and AH. Editor Susie Smith. Formatting Paul Lacey. Photographs E. Kate Turner, University of Durham.

Appendix 1 monitoring techniques

Table 1 Techniques for monitoring the physical integrity of peat

Change in peat surfaces and depths	**Section 4.2.2.**
Erosion pins - Surface lowering due to erosion	Pg. 32
Peat depth - Rod pushed into peat down to bedrock	Pg. 33
LIDAR - Laser scanner to identify areas to restore	Pg. 34
Aerial photography - Identification of habitats for restoration	Pg. 35
Micro- and Nano-topography - Identification and distribution of bog surface features, relating to management and water table.	Not covered – see Lindsay (2010)
Bulk density	**Section 4.2.3.1.**
Wardenaar corer - Modified peat cutting corer	Pg. 36
Monoliths - Simple volume of peat cut with spade	Pg. 36
Theta probe - Estimation based on mass/volume water	Pg. 36
Ground penetrating radar - Density of peat	Pg. 37
Humification	**Section 4.2.3.2.**
Analytical chemistry - Expensive/time consuming/detailed	Pg. 37
Von Post humification index - Rapid field assessment based on texture	Pg. 37
Spectrophotometry - Colorimetric analysis of humic acids	Pg. 38
NaOH extraction - Used to extract humic acid from peat	Pg. 38
Luminescence spectroscopy - Sensitive to peat composition but costly	Pg. 39
HyMap and spectroradiometry - Physicochemical properties of peat spatially	Pg. 39
Paleoenvironmental condition and visitor access	**Section 4.2.4.**
Pollen and macrofossil analysis - Past plant species/community/habitat	Pg. 39
Visitor / access monitoring - Toolkit of approaches for monitoring access and engagement, being developed by Natural England.	Not covered – for more details contact **rob.keane@naturalengland.org.uk**

For further details see section 4.2 of NECR086.

Table 2 Techniques for monitoring biota

Plant species	**Section 4.3.1.3.**
Total counts - True density of plant species	Pg. 48
Frame quadrats - Standardized area for counting within	Pg. 49
Visual estimates of cover - Percentage of occupied ground area	Pg. 49
Frequency - Number of times a plant is present (scale dependant)	Pg. 50
Biomass - Dry weight per unit area	Pg. 51
Point quadrats - Group of needles on metal frame to determine cover	Pg. 51
Transects - Line usually along environmental gradient	Pg. 52
Nested quadrats - Overlapping plots of increasing size to determine frequency at different scales	Pg. 53
Monitoring of plant populations - Age, size/height and developmental states	Pg. 54
Plant communities and habitats	**Section 4.3.1.4.**
Common Standards Monitoring - UK-wide JNCC system for setting conservation objectives and assessing feature condition on designated sites.	(see **http://jncc.defra.gov.uk/page-2199**)
Phase 1 habitat survey - Record of broad vegetation/habitat type	Pg. 55
National Vegetation Classification - Plant communities in Britain	Pg. 55
Higher Level Stewardship - Vegetation types to inform scheme land management options	Pg. 55
CORINE Biotope Classification - European habitat classification scheme	Pg. 56
Fixed point photography - Digital photographs taken at same point over time	Pg. 56
Remote sensing - Aerial and satellite imaging/mapping	Pg. 58
Vegetation structure	**Section 4.3.1.5.**
Canopy and sward heights - Using pin probes, sward sticks, falling discs, stereography or ultrasonic rangefinders at sample points	Pg. 59
LIDAR - Aircraft/satellite laser reflectance from surface	Pg. 59
Birds	**Section 4.3.2.**
Common Bird Census - [Background variation in bird numbers from] mapping territories from successive visits	Pg. 63
Breeding Bird Survey - Less time-consuming than CBC; Transect counts in fixed area (1 km square)	Pg. 63

Table continued...

Constant Search Effort - Common method for moorland birds and waders, uses 1 km squares.	Not covered, see Brown and Shepherd (1993)
Counting leks - Count of male community display arenas	Pg. 63
Mist-netting - Catch and count birds in fine 'mist' nets	Pg. 64
Point counts - Fixed location counts of registrations (seen or heard)	Pg. 64
Transects - Count of seen or heard birds along line transects	Pg. 64
Invertebrates Section	**Section 4.3.3.**
Trapping techniques	Section 4.3.3.2.
Pitfall traps - Open-top traps level with peat surface	Pg. 70
Water traps - Coloured bowls containing water	Pg. 71
Light traps - Light attracts insects into a trap	Pg. 72
Flight traps - Block flying insects with a fine black netting	Pg. 73
Aerial attractant traps - Traps with suitable baits	Pg. 74
Emergence trapping - Emerging insect larval groups caught in mesh boxes	Pg. 74
Suction sampling - Sucking up from a known area of vegetation into net	Pg. 75
Butterfly transects - Regular counts of butterfly species observed along a 10m by 2-4km transect.	Not covered, see **www.ukbms.org/methods.htm**
Direct counting	Section 4.3.3.3.
Sweep netting - Passing a sweep net through vegetation	Pg. 76
Beating - Tapping branches with a stick	Pg. 76
Plankton netting - For catching plankton in open water areas	Pg. 76
Extraction - Wet and dry funnel extraction techniques	Pg. 77
Microorganisms	**Section 4.3.4.**
Microscopy - Bacterial diversity (only 10 % actually observed)	Pg. 81
Testate amoeba - Reconstruct hydrological changes	Pg. 82
Chloroform fumigation - Microbial biomass as C or N	Pg. 82
Substrate-Induced Respiration (SIR) - Physiological response of microbial biomass	Pg. 82
Community Level Physiological Profile (CLLP) - Quantifies mineralization of C substrate additions	Pg. 83
Phospholipid Fatty Acid Analysis (PLFA) - Quantitative description of microbial community	Pg. 83
Extracellular enzyme activities - Functional information about microbiota	Pg. 84
Nucleic acid analysis - Structural composition of microbial community	Pg. 84

See NECR086 section 4.3.1.

Table 3 Techniques for monitoring hydrology

Surveying	**Section 4.4.2/4.4.3**
Dipwells - Depth to water table level relative to surface	Pg. 86
Piezometers - Hydraulic head and hydraulic conductivity	Pg. 88
Channel flow	**Section 4.4.4.**
Velocity-area method - Discharge of stream relative to stage	Pg. 90
Weir - Increase reliability of discharge-stage relationship	Pg. 90
Precipitation	**Section 4.4.5.**
Rain gauge - Collects rainfall for measurement	Pg. 91
Met Office - Purchased rainfall data	Pg. 91
Evapotranspiration	**Section 4.4.6.**
Lysimeters - Water balance in isolated peat	Pg. 92
Ventilated chambers - Measuring transpiration of vegetation in chamber	Pg. 92
Water table patterns - Interpreted from changes in water surface	Pg. 92
Hydro-meteorological methods - Calculation based on hydro-meteorological monitoring data	Pg. 92
Combination methods - Calculations based on hydro-meteorological monitoring data and empirical relationships	Pg. 92
Regional estimates - Calculations based on regional modelling (MORECS)	Pg. 92
Geochemical methods	**Section 4.4.7.**
Water chemistry (field) - Identification of water sources	Pg. 93
Water chemistry (lab) - Identification of water sources	Pg. 93
Tracers (field) - Identification of water sources or travel times	Pg. 93
Tracers (laboratory) - Identification of water sources or travel times	Pg. 93

NECR086 section 4.4.

Table 4 Techniques for monitoring biogeochemistry

Peat and water chemistry	**Section 4.5.1.**
pH - Hydrogen ion concentration (acidity/alkalinity)	Pg. 95
Redox - potential degree of reduction/oxidation	Pg. 96
Exchangeable ions - Concentration of important nutrients	Pg. 97
Carbon budget	**Section 4.5.2.**
Net primary production - Plant growth rate – cranked wire	Pg. 101
Soil organic matter	
Loss on Ignition - Mass loss following high temperature combustion	Pg. 102
CN analysis - High temp. combustion with CO2 and N IR gas analysis	Pg. 102
Fluvial carbon stock	
Particulate Organic Carbon - Greater than 0.45 µm filter	Pg. 103
Dissolved Organic Carbon - Less than 0.45 um filter	Pg. 103
Greenhouse gas fluxes	**Section 4.5.3.**
JNCC methodology - A 3 level methodology for understanding GHG and C flux from peatlands covering complex or simpler measurements.	See report at **http://jncc.defra.gov.uk/page-2132**
Enclosure - Chambers for gaseous fluxes	Pg. 107
Micrometeorological - Eddy covariance for CO_2 flux	Pg. 112
Proxies - Vegetation and hydrology predict GHGs	Pg. 114

NECR086 section 4.5.

Appendix 2 identifying suitable monitoring methods by project objectives

Table 5 Project objective: carbon sequestration or storage

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓				✓	✓	Carbon budget	Particulate & Dissolved Organic Matter	TOC analyser
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production /	Biomass
✓	✓	✓		✓		✓	✓	Carbon budget	Soil Organic Matter	CN analyser
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production	Cranked wire
✓	✓	✓		✓		✓	✓	Carbon budget	Soil Organic Matter	Loss on ignition
✓	✓	✓		✓		✓	✓	Carbon budget	Particulate & Dissolved Organic Matter	Spectrophotometry
✓	✓		✓			✓	✓	Greenhouse gas fluxes / Carbon budget	Various	JNCC Level III measurements (see **http://jncc.defra.gov.uk/page-2132**)
✓	✓					✓?	✓?	Greenhouse gas fluxes / Carbon budget	Various	JNCC Level I & II measurements (see **http://jncc.defra.gov.uk/page-2132**)
	✓	✓				✓		Greenhouse gas fluxes	Eddy covariance	Infrared Gas Analyser
✓	✓					✓		Greenhouse gas fluxes	Static chamber	Gas chromatography
✓	✓					✓		Greenhouse gas fluxes	Flow through chamber	Gas chromatography
✓	✓					✓		Greenhouse gas fluxes	Static chamber	Infrared Gas Analyser
✓	✓					✓		Greenhouse gas fluxes	Flow through chamber	Infrared Gas Analyser

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓	✓			✓	✓	Greenhouse gas fluxes	Proxies for peatland greenhouse gas fluxes	Water level, vegetation, subsidence
✓	✓	✓	✓		✓	✓		Hydrology	Water level/hydraulic head	Piezometers
✓	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water level/hydraulic head	Dip wells
✓	✓					✓	✓	Microorganisms	Community	Chloroform fumigation
✓	✓					✓	✓	Microorganisms	Community	Community level physiological profile
✓	✓					✓	✓	Microorganisms	Community	Extracellular enzyme activities
✓	✓					✓	✓	Microorganisms	Community	Phospholipid fatty acid analysis
✓	✓					✓	✓	Microorganisms	Community	Substrate induced respiration
✓	✓					✓	✓	Microorganisms	Community	Testate amoeba
		✓			✓	✓	✓	Peat physical integrity	Bulk density	Theta probe
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Aerial photography
	✓	✓				✓	✓	Peat physical integrity	Bulk density	Ground penetrating radar
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	LIDAR
✓						✓	✓	Peat physical integrity	Humification	Analytical chemistry
✓						✓	✓	Peat physical integrity	Humification	HyMap and sectroradiometry

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓						✓	✓	Peat physical integrity	Humification	Luminescence spectroscopy
✓	✓					✓	✓	Peat physical integrity	Humification	NaOH extraction
✓	✓			✓		✓	✓	Peat physical integrity	Humification	Spectrophotometry
✓	✓			✓	✓	✓	✓	Peat physical integrity	Bulk density	Theta probe
✓	✓		✓	✓	✓		✓	Peat physical integrity	Changes in peat surfaces and depths	Erosion pins
✓	✓		✓	✓	✓	✓	✓	Peat physical integrity	Bulk density	Monoliths
✓	✓		✓	✓	✓	✓	✓	Peat physical integrity	Bulk density	Wardenaar corer
✓	✓	✓	✓	✓		✓	✓	Peat physical integrity	Humification	Von Post humification index
✓	✓	✓	✓	✓	✓	✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Peat depth measurement
	✓	✓				✓	✓	Vegetation	Plant communities	Aerial photography
	✓	✓		✓		✓	✓	Vegetation	Plant communities	Satellite
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Frame quadrats

Table 6 Project objective: species recovery or maintenance

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
	✓	✓				✓	✓	Birds	Bird species	Constant Search Effort (see Brown & Shepherd, 1993)
	✓	✓		✓		✓	✓	Birds	Bird species	Mist-netting
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Counting leks
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Breeding Bird Survey
	✓	✓		✓		✓	✓	Birds	Bird species	Common Bird Census
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Point counts
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Transects
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production	Biomass
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production	Cranked wire
	✓	✓				✓	✓	Hydrology	Channel flow	Weir
	✓	✓		✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (laboratory measured)
	✓	✓		✓	✓	✓	✓	Hydrology	Water source and partitioning	Water chemistry (laboratory measured)
	✓	✓	✓			✓	✓	Hydrology	Evapotranspiration	Water table patterns
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (field measured)
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Channel flow	Velocity-area method
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Water chemistry (field measured)
✓	✓					✓		Hydrology	Evapotranspiration	Ventilated chambers
✓	✓					✓		Hydrology	Evapotranspiration	Lysimeters
✓	✓	✓				✓		Hydrology	Evapotranspiration	Combination methods

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓				✓		Hydrology	Evapotranspiration	Hydro-meteorological methods
✓	✓	✓		✓	✓	✓	✓	Hydrology	Precipitation	Met Office precipitation data
✓	✓	✓		✓		✓	✓	Hydrology	Evapotranspiration	Regional estimates
✓	✓	✓	✓			✓		Hydrology	Precipitation	Rain gauge
✓	✓	✓	✓		✓	✓		Hydrology	Water level/hydraulic head	Piezometers
✓	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water level/hydraulic head	Dip wells
✓	✓			✓				Invertebrates	Trapping techniques	Light traps
✓	✓		✓	✓				Invertebrates	Trapping techniques	Aerial attractant traps
✓	✓		✓	✓				Invertebrates	Trapping techniques	Emergence trapping
✓	✓		✓	✓				Invertebrates	Trapping techniques	Water traps
✓	✓		✓	✓		✓	✓	Invertebrates	Direct counting	Beating
✓	✓		✓	✓		✓	✓	Invertebrates	Direct counting	Plankton netting
✓	✓	✓		✓		✓	✓	Invertebrates	Direct counting	Extraction from peat samples
✓	✓	✓		✓		✓	✓	Invertebrates	Trapping techniques	Suction sampling
✓	✓	✓	✓	✓				Invertebrates	Trapping techniques	Flight traps
✓	✓	✓	✓	✓				Invertebrates	Trapping techniques	Pitfall traps
✓	✓	✓	✓	✓		✓	✓	Invertebrates	Direct counting	Sweep netting

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓				✓		Invertebrates	Direct counting	Butterfly transects (see **http://www.ukbms.org/methods.htm**)
✓	✓					✓	✓	Microorganisms	Community	Chloroform fumigation
✓	✓					✓	✓	Microorganisms	Community	Community level physiological profile
✓	✓					✓	✓	Microorganisms	Community	Phospholipid fatty acid analysis
✓	✓					✓	✓	Microorganisms	Community	Substrate induced respiration
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Aerial photography
✓	✓		✓	✓	✓		✓	Peat physical integrity	Changes in peat surfaces and depths	Erosion pins
✓	✓	✓	✓	✓	✓	✓	✓	Soil and water chemistry	pH	pH meter
	✓	✓				✓	✓	Vegetation	Plant communities	Aerial photography
	✓	✓		✓		✓	✓	Vegetation	Plant communities	Satellite
	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	CORINE Biotope Classification Scheme
	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	Higher Level Stewardship vegetation type
✓			✓	✓		✓	✓	Vegetation	Plant species	Total counts
✓	✓					✓	✓	Vegetation	Plant communities	LIDAR
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	Canopy and sward heights
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	Fixed point photography
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	Common Standards Monitoring. See **http://jncc.defra.gov.uk/page-2199**

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	National Vegetation Classification System
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Nested quadrats
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Point quadrats
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Frame quadrats
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	Phase 1 habitat survey
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Transects

Table 7 Project objective: habitat recovery or maintenance

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
	✓	✓				✓	✓	Birds	Bird species	Constant Search Effort (see Brown & Shepherd, 1993)
	✓	✓		✓		✓	✓	Birds	Bird species	Mist-netting
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Counting leks
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Breeding Bird Survey
	✓	✓		✓		✓	✓	Birds	Bird species	Common Bird Census
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Point counts
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Transects
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production	Biomass
✓	✓	✓		✓		✓	✓	Carbon budget	Soil Organic Matter	CN analyser
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production	Cranked wire
✓	✓	✓		✓		✓	✓	Carbon budget	Soil Organic Matter	Loss on ignition
✓	✓	✓	✓			✓	✓	Greenhouse gas fluxes	Proxies for peatland greenhouse gas fluxes	Water level, vegetation, subsidence
	✓	✓				✓	✓	Hydrology	Channel flow	Weir
	✓	✓		✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (laboratory measured)
	✓	✓	✓		✓	✓	✓	Hydrology	Water source and partitioning	Tracers (field measured)
	✓	✓	✓			✓	✓	Hydrology	Evapotranspiration	Water table patterns
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (field measured)
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Channel flow	Velocity-area method

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Water chemistry (field measured)
✓	✓					✓		Hydrology	Evapotranspiration	Ventilated chambers
✓	✓					✓		Hydrology	Evapotranspiration	Lysimeters
✓	✓	✓				✓		Hydrology	Evapotranspiration	Combination methods
✓	✓	✓				✓		Hydrology	Evapotranspiration	Hydro-meteorological methods
✓	✓	✓		✓		✓	✓	Hydrology	Precipitation	Met Office precipitation data
✓	✓	✓		✓		✓	✓	Hydrology	Evapotranspiration	Regional estimates
✓	✓	✓	✓			✓		Hydrology	Precipitation	Rain gauge
✓	✓	✓	✓		✓	✓		Hydrology	Water level/hydraulic head	Piezometers
✓	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water level/hydraulic head	Dip wells
✓	✓			✓				Invertebrates	Trapping techniques	Light traps
✓	✓		✓	✓				Invertebrates	Trapping techniques	Aerial attractant traps
✓	✓		✓	✓				Invertebrates	Trapping techniques	Emergence trapping
✓	✓		✓	✓				Invertebrates	Trapping techniques	Water traps
✓	✓		✓	✓		✓	✓	Invertebrates	Direct counting	Beating
✓	✓		✓	✓		✓	✓	Invertebrates	Direct counting	Plankton netting
✓	✓	✓		✓		✓	✓	Invertebrates	Direct counting	Extraction from peat samples
✓	✓	✓		✓		✓	✓	Invertebrates	Trapping techniques	Suction sampling

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓	✓	✓				Invertebrates	Trapping techniques	Flight traps
✓	✓	✓	✓	✓				Invertebrates	Trapping techniques	Pitfall traps
✓	✓	✓	✓	✓		✓	✓	Invertebrates	Direct counting	Sweep netting
✓	✓					✓	✓	Microorganisms	Community	Chloroform fumigation
✓	✓					✓	✓	Microorganisms	Community	Community level physiological profile
✓	✓					✓	✓	Microorganisms	Community	Extracellular enzyme activities
✓	✓					✓	✓	Microorganisms	Community	Phospholipid fatty acid analysis
✓	✓					✓	✓	Microorganisms	Community	Substrate induced respiration
✓	✓					✓	✓	Microorganisms	Community	Testate amoeba
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Aerial photography
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	LIDAR
✓	✓		✓	✓	✓		✓	Peat physical integrity	Changes in peat surfaces and depths	Erosion pins
✓	✓	✓		✓		✓	✓	Soil and water chemistry	Exchangeable ions	Atomic absorbtion
✓	✓	✓		✓		✓	✓	Soil and water chemistry	Exchangeable ions	Chromatography
✓	✓	✓	✓	✓	✓	✓	✓	Soil and water chemistry	pH	pH meter
✓	✓	✓	✓	✓	✓	✓	✓	Soil and water chemistry	Redox potential	Platinum electrode
	✓	✓				✓	✓	Vegetation	Plant communities	Aerial photography

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
	✓	✓		✓		✓	✓	Vegetation	Plant communities	Satellite
	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	CORINE Biotope Classification Scheme
	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	Higher Level Stewardship vegetation type
✓			✓	✓		✓	✓	Vegetation	Plant species	Total counts
✓	✓					✓	✓	Vegetation	Plant communities	LIDAR
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	Canopy and sward heights
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	Fixed point photography
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	National Vegetation Classification System
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Nested quadrats
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Point quadrats
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Frame quadrats
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	Phase 1 habitat survey
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Transects

Table 8 Project objective: water flow management

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
	✓	✓				✓	✓	Hydrology	Channel flow	Weir
	✓	✓		✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (laboratory measured)
	✓	✓		✓	✓	✓	✓	Hydrology	Water source and partitioning	Water chemistry (laboratory measured)
	✓	✓	✓			✓	✓	Hydrology	Evapotranspiration	Water table patterns
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (field measured)
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Channel flow	Velocity-area method
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Water chemistry (field measured)
✓	✓					✓		Hydrology	Evapotranspiration	Ventilated chambers
✓	✓					✓		Hydrology	Evapotranspiration	Lysimeters
✓	✓	✓				✓		Hydrology	Evapotranspiration	Combination methods
✓	✓	✓				✓		Hydrology	Evapotranspiration	Hydro-meteorological methods
✓	✓	✓		✓		✓	✓	Hydrology	Precipitation	Met Office precipitation data
✓	✓	✓		✓		✓	✓	Hydrology	Evapotranspiration	Regional estimates
✓	✓	✓	✓			✓		Hydrology	Precipitation	Rain gauge
✓	✓	✓	✓		✓	✓		Hydrology	Water level/hydraulic head	Piezometers
✓	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water level/hydraulic head	Dip wells
		✓			✓	✓	✓	Peat physical integrity	Bulk density	Theta probe

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
	✓	✓				✓	✓	Peat physical integrity	Bulk density	Ground penetrating radar
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	LIDAR
✓	✓			✓	✓	✓	✓	Peat physical integrity	Bulk density	Theta probe
✓	✓		✓	✓	✓	✓	✓	Peat physical integrity	Bulk density	Monoliths
✓	✓		✓	✓	✓	✓	✓	Peat physical integrity	Bulk density	Wardenaar corer
✓	✓	✓				✓	✓	Peat physical integrity	Paleo-environment	Macro remains assessment
✓	✓	✓				✓	✓	Peat physical integrity	Paleo-environment	Magnetic susceptibility
✓	✓	✓				✓	✓	Peat physical integrity	Paleo-environment	Pollen analysis
✓	✓	✓	✓	✓	✓	✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Peat depth measurement

Table 9 Project objective: Water quality improvement or maintenance

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓				✓	✓	Carbon budget	Particulate & Dissolved Organic Matter	TOC analyser
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production	Biomass
✓	✓	✓		✓		✓	✓	Carbon budget	Net primary production	Cranked wire
✓	✓	✓		✓		✓	✓	Carbon budget	Particulate & Dissolved Organic Matter	Spectrophotometry
	✓	✓				✓	✓	Hydrology	Channel flow	Weir
	✓	✓		✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (laboratory measured)
	✓	✓		✓	✓	✓	✓	Hydrology	Water source and partitioning	Water chemistry (laboratory measured)
	✓	✓	✓			✓	✓	Hydrology	Evapotranspiration	Water table patterns
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Tracers (field measured)
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Channel flow	Velocity-area method
	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water source and partitioning	Water chemistry (field measured)
✓	✓					✓		Hydrology	Evapotranspiration	Ventilated chambers
✓	✓					✓		Hydrology	Evapotranspiration	Lysimeters
✓	✓	✓				✓		Hydrology	Evapotranspiration	Combination methods
✓	✓	✓				✓		Hydrology	Evapotranspiration	Hydro-meteorological methods
✓	✓	✓		✓		✓	✓	Hydrology	Precipitation	Met Office precipitation data
✓	✓	✓		✓		✓	✓	Hydrology	Evapotranspiration	Regional estimates

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓	✓			✓		Hydrology	Precipitation	Rain gauge
✓	✓	✓	✓		✓	✓		Hydrology	Water level/hydraulic head	Piezometers
✓	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water level/hydraulic head	Dip wells
✓	✓		✓	✓				Invertebrates	Trapping techniques	Emergence trapping
✓	✓		✓	✓		✓	✓	Invertebrates	Direct counting	Plankton netting
✓	✓	✓		✓		✓	✓	Invertebrates	Direct counting	Extraction from peat samples
✓	✓					✓	✓	Microorganisms	Community	Chloroform fumigation
✓	✓					✓	✓	Microorganisms	Community	Community level physiological profile
✓	✓					✓	✓	Microorganisms	Community	Extracellular enzyme activities
✓	✓					✓	✓	Microorganisms	Community	Phospholipid fatty acid analysis
✓	✓					✓	✓	Microorganisms	Community	Substrate induced respiration
✓	✓					✓	✓	Microorganisms	Community	Testate amoeba
✓	✓					✓	✓	Peat physical integrity	Humification	NaOH extraction
✓	✓			✓		✓	✓	Peat physical integrity	Humification	Spectrophotometry
✓	✓		✓	✓	✓		✓	Peat physical integrity	Changes in peat surfaces and depths	Erosion pins
✓	✓	✓	✓	✓		✓	✓	Peat physical integrity	Humification	Von Post humification index
✓	✓	✓		✓		✓	✓	Soil and water chemistry	Exchangeable ions	Atomic absorbtion

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓		✓		✓	✓	Soil and water chemistry	Exchangeable ions	Chromatography
✓	✓	✓	✓	✓	✓	✓	✓	Soil and water chemistry	pH	pH meter
✓	✓	✓	✓	✓	✓	✓	✓	Soil and water chemistry	Redox potential	Platinum electrode
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	National Vegetation Classification System
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Nested quadrats
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Point quadrats
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Frame quadrats
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Transects

Table 10 Project objective: maintain paleo-environmental information

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓	✓		✓	✓		Hydrology	Water level/hydraulic head	Piezometers
✓	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water level/hydraulic head	Dip wells
✓	✓					✓	✓	Microorganisms	Community	Phospholipid fatty acid analysis
✓	✓					✓	✓	Microorganisms	Community	Testate amoeba
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Aerial photography
	✓	✓				✓	✓	Peat physical integrity	Bulk density	Ground penetrating radar
✓						✓	✓	Peat physical integrity	Humification	Analytical chemistry
✓						✓	✓	Peat physical integrity	Humification	HyMap and sectroradiometry
✓						✓	✓	Peat physical integrity	Humification	Luminescence spectroscopy
✓	✓					✓	✓	Peat physical integrity	Humification	NaOH extraction
✓	✓			✓		✓	✓	Peat physical integrity	Humification	Spectrophotometry
✓	✓		✓	✓	✓		✓	Peat physical integrity	Changes in peat surfaces and depths	Erosion pins
✓	✓		✓	✓	✓	✓	✓	Peat physical integrity	Bulk density	Wardenaar corer

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓	✓				✓	✓	Peat physical integrity	Paleo-environment	Macro remains assessment
✓	✓	✓				✓	✓	Peat physical integrity	Paleo-environment	Magnetic susceptibility
✓	✓	✓				✓	✓	Peat physical integrity	Paleo-environment	Pollen analysis
✓	✓	✓	✓	✓		✓	✓	Peat physical integrity	Humification	Von Post humification index
✓	✓	✓	✓	✓	✓	✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Peat depth measurement
✓	✓	✓	✓	✓	✓	✓	✓	Soil and water chemistry	pH	pH meter
✓	✓	✓	✓	✓	✓	✓	✓	Soil and water chemistry	Redox potential	Platinum electrode
✓	✓	✓	✓		✓	✓	✓	Access and Engagement	Visitor usage and motivation	Natural England access monitoring toolkit – not covered. Contact **rob.keane@naturalengland.org.uk**

Table 11 Project objective: maintain or increase recreation suitability or landscape integrity

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	Aerial photography
	✓	✓				✓	✓	Vegetation	Plant communities	Aerial photography
	✓	✓				✓	✓	Peat physical integrity	Bulk density	Ground penetrating radar
	✓	✓				✓	✓	Peat physical integrity	Changes in peat surfaces and depths	LIDAR
	✓	✓		✓		✓	✓	Birds	Bird species	Mist-netting
	✓	✓		✓		✓	✓	Vegetation	Plant communities	Satellite
	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	CORINE Biotope Classification Scheme
	✓	✓				✓	✓	Birds	Bird species	Constant Search Effort (see Brown & Shepherd, 1993)
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Counting leks
	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	Higher Level Stewardship vegetation type
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Breeding Bird Survey
	✓	✓		✓		✓	✓	Birds	Bird species	Common Bird Census
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Point counts
	✓	✓	✓	✓		✓	✓	Birds	Bird species	Transects
✓			✓	✓		✓	✓	Vegetation	Plant species	Total counts
✓	✓					✓	✓	Vegetation	Plant communities	LIDAR
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	Canopy and sward heights
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	Fixed point photography

Table continued...

Scale			Landuse							
Site	Unit	Landscape	Low resource	Short-term	Low training /experience	Grazing or agriculture	Grouse management	Technique group	Variable / technique	Analysis / measurement method
✓	✓		✓	✓		✓	✓	Vegetation	Plant communities	National Vegetation Classification System
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Nested quadrats
✓	✓		✓	✓		✓	✓	Vegetation	Plant species	Point quadrats
✓	✓		✓	✓	✓		✓	Peat physical integrity	Changes in peat surfaces and depths	Erosion pins
✓	✓	✓	✓		✓	✓		Hydrology	Water level/hydraulic head	Piezometers
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Frame quadrats
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant communities	Phase 1 habitat survey
✓	✓	✓	✓	✓		✓	✓	Vegetation	Plant species	Transects
✓	✓	✓	✓	✓	✓	✓	✓	Hydrology	Water level/hydraulic head	Dip wells
✓	✓	✓	✓		✓	✓	✓	Access and Engagement	Visitor usage and motivation	Natural England access monitoring toolkit – not covered. Contact **rob.keane@naturalengland.org.uk**