Peatlands and the Historic Environment

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A Bronze Age axe discovered during peat cutting on Orkney
(Photo: Frank Bradford)

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Summary

This report summarised the importance of peatlands for the historic environment, based principally on a review of the available literature alongside the current views from a range of stakeholders acquired through a questionnaire survey. Existing literature was found to be relatively abundant for the English peatlands, with a series of large-scale wetland surveys funded by English Heritage. Information from Northern Ireland, Scotland and Wales was less plentiful, but a number of archaeological projects that include peatlands are currently being undertaken. The value of peatlands for the historic landscape comprises four, in practice partially overlapping, categories:

- Sub-peat archaeology, where peat deposits conceal the pre-peat landscape including any remains associated with human activity;
- Archaeology preserved within the peat matrix itself, where sites and artefacts are preserved in the peat forming environment and benefitting from waterlogged, acidic and anoxic soil conditions that play a critical role in the long-term preservation of a range of organic (and to a lesser extent: inorganic) archaeological materials;
- Archaeology located on the surface of the peat, including the industrial archaeology and historic record of peat cutting and the surviving landscapes of late medieval and early modern human activity;
- The palaeoenvironmental archive preserved within the peat, including pollen, plant and insect remains, and other ‘proxies’ that can be studied to reveal aspects of past changes in climate, environment and vegetation; this includes the origin and development of the peatlands.

On the basis of previous research in English peatlands, the report estimated that the total number of archaeological sites preserved beneath, within and on the surface of peatlands is c. 22,500. On the basis of this estimate, the highest number of sites (c. 11,000) would be found in Scotland, followed by England (c. 7,000), Northern Island (c. 3,500) and Wales (just over 300 sites).

The literature review and stakeholder questionnaire identified a number of gaps in our knowledge of the importance of UK peatlands for the historic environment. These included:

- A poor understanding of the spatial distribution and density of archaeological sites in peatlands;
- Limits to the chronological span of sites, and a dearth of information on Roman and post-Roman peatlands where the upper layers have been removed by peat extraction or erosion;
- A poor understanding of the formation processes of peat;
- Limits in the understanding of the preservation of peat, and of archaeological remains within the peat matrix, in particular in relationship to hydrogeological processes;
- The absence of (geophysical) techniques that can identify archaeological remains buried beneath or within the peat;
- A lack of understanding of the impact of management practices on the peatland as a historic environment;
- A poorly developed understanding of the value of peatlands as historic landscapes amongst the public and other stakeholders.

One of the respondents to the questionnaire summed up this situation eloquently, by noting that: “We probably have more gaps than we have knowledge.”

The main threats to peatlands as historic landscapes are regarded as substantially the same as those threats to the ecological functions of peatlands including:
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- Destruction through peat extraction and the related loss of archaeology and the palaeoenvironmental archive;
- Erosion of peatlands due to over-grazing, or foot and vehicle access, directly destroying the peatland archaeology and the palaeoenvironmental archive;
- De-watering of the peatland through drainage or water abstraction, thereby oxidising organic archaeology and the palaeoenvironmental archive leading to their deterioration and eventual destruction;
- Reclamation of peatlands for agricultural purposes, resulting in the desiccation and degradation of peat matrix and eventual destruction of archaeology and the palaeoenvironmental archive;
- Afforestation of peatlands changes the soil chemistry and hydrology of the peatlands and, together with root damage, leads to damage and eventual destruction of peatland archaeology and the palaeoenvironmental archive;
- Burning (controlled and wild fires) of peatlands leads to peat loss, resulting in exposure and destruction of archaeology and the palaeoenvironmental archive.

The report noted that climate change will have far-reaching consequences for the UK peatlands. Whilst the situation is complex, perhaps the greatest impacts will be in the south of the UK, where precipitation is expected to fall significantly during summer months, leading to the drying out of peatlands and subsequent oxidation of archaeology and the palaeoenvironmental archive. For all UK peatlands, the prediction of more frequent extreme weather events will have largely unpredictable consequences. It can also be noted that measures to mitigate against global warming, for example in the form of wind turbine developments on peatlands, may also impact on the resource.

The report outlined current historic environment legislation in the UK which is, in principal, available to protect the most valuable peatlands. However, the successful management of peatland archaeology and palaeoenvironmental archives requires the development of consistent policies and guidance which are shared by all stakeholders. The report advocates good communication, advocacy and a consistency of approaches. Where conflicts exist between the historic environment and other ecosystem functions of peatlands, these tend to concern the methods by which certain goals are achieved and not the goals themselves. Indeed, a peatland that is a living, wet and flourishing ecosystem offers the best protection for the historic environment and the palaeoenvironmental archive, beneath and within the peat. Despite this, areas of potential conflict include:

- The seasonal lowering of the water table for reasons of peatland management;
- Disturbance of the peat matrix for habitat creation and of in-situ peat removal during restoration management;
- The loss of visible, surface, evidence of peatland exploitation;
- The degradation of the peat surface.

The areas of common interest are far greater and include:

- Shared knowledge of the extent and condition of peat, and understanding of peat depth and properties in 3-D, which can assist peatland management for both ecological and archaeological purposes;
- An evidence basis for past change from archaeological and palaeoenvironmental research that can assist in developing peatland management plans and practices;
- The promotion of functioning, peat building systems with high water tables which serves the ecology and historic environment functions of peatlands equally well;
• Removal of scrub and higher vegetation (plantations) returns peatlands to their natural state and helps to protect the archaeology and palaeoenvironmental archive of peatlands;
• Sensible peatland management provides opportunities for generating a new understanding and promotion of the cultural value of the historic environment.

Finally, the report advocates increased dialogue between stakeholders involved in peatland protection to improve the quality of integrated peatland management. Such dialogue should focus on three areas:

• The inclusion of appropriate archaeological and palaeoenvironmental assessments in advance of restoration/rehabilitation works. Examples of best practice exist, for example on Dartmoor, where peatland restoration works are preceded by meetings involving archaeologists and nature conservationists. It should be noted that palaeoenvironmental assessments have the potential for informing key review areas, notably climate change and carbon audits; hydrological functioning and trajectories of peat forming communities in the past which could be replicated in the future;
• The methodologies for defining the state and condition of peatlands need to be discussed, and appropriate ‘fit for purpose’ strategies developed that also seek to protect the archaeology and palaeoenvironmental archive; this could be achieved by means of monitoring additional peatland properties, such as redox potential and water quality;
• The management practices that involve physical disturbance to the peat matrix need to be reviewed; this can be achieved by maintaining adequate records and plans of where peat has been removed from and to where it has been moved.

1. Introduction

This report is one of a series of technical reviews commissioned by the IUCN UK Peatland Programme and aimed at presenting our current state of knowledge of the historic environment of peatlands in the UK. In addition to a literature review, it draws on information provided in response to a questionnaire circulated to a sample of historic environment and palaeoecological specialists drawn from curatorial, commercial and academic sectors. Though the number of respondents was relatively small (N=30), they represented the range of sectors targeted (Table 1.1).

Table 1.1. Respondents to the stakeholder survey

<table>
<thead>
<tr>
<th>Category of organisation</th>
<th>Name of organisation</th>
</tr>
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</table>
| Public Bodies            | Environment Agency – Environment Centre Wales  
                          | Northern Ireland Environment Agency  
                          | Historic Scotland  
                          | English Heritage  
                          | CADW |
| Archaeological Trusts    | Dyfed Archaeological Trust, AOC Scotland |
| Local Government         | Association of Local Government Archaeological Officers (ALGAO UK)  
                          | Aberdeenshire Council  
                          | Shetland Amenity Trust  
                          | Somerset County Council  
                          | Stirling Council |
| Higher education         | Universities of Aberdeen, Birmingham, Stirling, Queen’s University  
                          | Belfast, Wales (Lampeter) |
| Nature Conservation Trusts | Yorkshire Wildlife Trust  
                          | Royal Society for the Protection of Birds |
| National Park Authorities | Exmoor, Dartmoor, The New Forest, Yorkshire Dales and the |
The stakeholder survey posed six questions:
- Are you aware of recent work and/or revision of data on the peatland historic environment within your region?
- What gaps in our knowledge of the historic environment & peatlands have you identified?
- What do you perceive as the cultural value of peatlands?
- What are the risks to the peatland historic environment?
- Where do we need to strengthen policy and what practice guidance do we need?
- Who do you currently collaborate with (e.g. agency, institute) and who would you like to work with in the future?

The report provides an introduction to the reasons why peatlands are important for the historic environment. It summarises research undertaken in the last 50 years and considers where the gaps in our current knowledge lie. It considers the categories of threat to peatlands and the impacts these may have on archaeological remains (sites and finds), including their vulnerability to climate change. The report then offers an overview of relevant legislation, policies and guidance for the protection and management of the historic environment in peatlands, noting that legislation alone cannot prevent damage to peatlands. Finally, the report considers the harmonies and conflicts between the different interests that have a stake in the management of peatlands in the UK. It concludes that, whilst minor areas of potential conflict exist, best practice management of peatlands as historic environments aims for the same objective: a peatland that is a living, wet and flourishing ecosystem. This offers the best protection for both the historic environment record and the palaeoenvironmental archive sealed beneath and within the peat.

2. Background: peatlands and the historic environment record

The peatlands of the UK and Northern Ireland are an integral and important part of our historic environment, which can be defined as all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed flora (Drury & McPherson 2008). Some of the most evocative archaeological discoveries of the last century come from peatlands. For example, the world’s oldest surviving footpath, the Sweet Track in the Somerset Levels (Figure 2.1), and the best preserved ancient human remains in the UK, such as the bog body known as Lindow Man (Figure 2.2) from Cheshire, were found in peatlands. An estimated 22,500 archaeological sites may survive beneath or within peat. The largest surviving prehistoric terrestrial landscapes in the UK and Ireland are sealed beneath the peat of areas such as the Humberhead Levels National Nature Reserve in eastern England.
The waterlogged, acidic and anaerobic conditions that characterize peatlands are ideal environments for the long-term preservation of organic and some inorganic archaeological remains. An archaeologist working in ‘dry land’ conditions may be fortunate to find 10% of what was once there, whereas an archaeologist working in peatlands may find 90% of the material culture of ancient communities (Figure 2.3). Peatlands are also valued for the information they hold on past changes in climate, environment and vegetation, which can be revealed through the study of pollen, plant and insect remains, and other ‘proxies’; peatlands are therefore referred to as ‘palaeoenvironmental archives’. Finally, we value peatlands for their landscape character, including features indicative of historic land-use, e.g. as royal hunting grounds, mining or peat cutting. Identification and public presentation of such inheritance can benefit local economies through the development of associated tourism.

Figure 2.1. Conserved part of the Sweet Track, a raised footpath built to cross the part of the Somerset Levels in 3806BC (©Trustees of the British Museum)

Figure 2.2. Lindow Man – the Iron Age bog body retrieved during peat cutting in Lindow Moss, Cheshire, in 1984 (©Trustees of the British Museum)

Figure 2.3. Estimated percentage survival of different archaeological materials in dryland (left) and wetland (right) environments (after Coles 1986). NB. In the context of this diagram, ‘wetland’ can be taken as equivalent to peatland
3. Summary of the known and estimated heritage resource in UK peatlands

Key stakeholder quote:
“Archaeological surveys of peatland are not common here [Scotland] at present.”

3.1 Working definitions
The extent and nature of the peatlands in the UK has been defined by The State of UK Peatlands Review (Shepherd 2010) as “…areas of land where the majority of land has been subject to the accumulation of quaternary surface deposits with a peaty texture under waterlogged conditions, or areas currently supporting peat-forming vegetation.” A further distinction between shallow and deep peaty soils has been set artificially at 40cm of peaty material for England and Wales, or 30cm when found directly over rock or at 50cm for Scotland. Therefore, this report includes peat soils in raised bogs and fens as well as blanket bogs in both upland and lowland contexts (Figures 3.1 and 3.2). Although we are aware of more specific definitions of peat-type on the basis of vegetation, hydrology or nutrient status (Charman 2002), for the purposes of this document, the phrase ‘peatland’ will be used collectively for both upland and lowland areas.

Figure 3.1. A machine-cut peat face from a lowland peatland. The complex stratigraphy of the peatland is clearly visible (Photo: N. Bermingham)
Figure 3.2. Upland blanket peat on Langdale Moor, Cumbria, displaying erosion scars (Photo: Oxford Archaeology-North)

3.2 Sources of archaeological data for peatlands
Sources of information for the historic environment of peatlands are substantially those which are available for the archaeological resource in general. National records of known archaeological sites in the UK are held in the National Monuments Record (NMR). In England, English Heritage is responsible for the NMR whilst the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) manages the National Monuments Record of Scotland (NMRS). Similarly in Wales, the National Monuments Record of Wales (NMRW) is held by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW). In Northern Ireland, this responsibility lies with the Northern Ireland Environment Agency and Department of Built Heritage. Local records, known as Sites and Monuments Records (SMRs) or Historic Environment Records (HERs) are held by public bodies throughout the UK. These records list the location, type and period
of a given archaeological site, along with a brief description and information on more detailed sources of information such as site reports and other publications. In England, Scotland & Wales, these records are typically held by County Councils, District Councils, National Parks or Unitary Authorities. In Northern Ireland, records include the Northern Ireland Site & Monuments Record (NISMR) and Monuments & Buildings Record (MBR). These sources have not been interrogated in detail for this report, but available summaries of the data have been consulted.

Other information is available from field survey, research projects and other related initiatives. Table 3.1 illustrates the major field surveys, syntheses and other research projects concerned with the historic environment of peatlands in the UK, though the table is not comprehensive. It also includes desk top surveys and ecological or biodiversity projects most relevant to the archaeological and palaeoenvironmental peatland resource. Many of these projects and initiatives are ongoing.

Table 3.1. Peatland archaeological surveys and research in the United Kingdom.

<table>
<thead>
<tr>
<th>Large scale field surveys</th>
<th>Research Projects</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>England</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somerset Levels Survey (1973-89)</td>
<td>Predictive Modelling of Archaeological Site Locations in Raised Mires (Univ. of Birmingham, EH)</td>
<td>MIRE Project Exmoor</td>
</tr>
<tr>
<td>Humber Wetlands Survey (1994-2001)</td>
<td>Upland Peat Projects (EH) (see also Quatermaine et al. 2007)</td>
<td>Mires on the Moors</td>
</tr>
<tr>
<td></td>
<td>Wetland Archaeology: Carse of Stirling Archaeological Assessment (AOC 1999; see also Ellis 2001)</td>
<td>Historic Scotland - Scottish Palaeoecological Archive Database (SPAD) (upgrade 2005-2008) RCAHMS</td>
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<td></td>
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<td>Peat mapping Shetland</td>
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<td></td>
<td></td>
<td>The Scottish Wetland Archaeology Programme (AOC/Historic Scotland, Cavers 2006)</td>
</tr>
<tr>
<td><strong>N. Ireland</strong></td>
<td></td>
<td>Peatland archaeology in Northern Ireland: an evaluation (Plunkett &amp; Foley 2006)</td>
</tr>
<tr>
<td>Wales</td>
<td>The Uplands Archaeology Initiative (RCAHMW) 1990’s-present</td>
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<td>---------------------------------------------------------------------</td>
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<tr>
<td></td>
<td>Funerary &amp; Ritual Project (Evans, 2006)</td>
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</table>

England has benefitted from English Heritage (EH) funded surveys of the four largest areas of lowland peatlands in England (the Northwest Wetlands Survey, the Humber Wetlands Project, the Somerset Levels Project and the East Anglian Fenland Project: referred to collectively as the EH Wetland Surveys) (Figure 3.3). These provide significant information on the historic environment record of these peatlands, although our knowledge is mediated by variations in survey methodologies: for example in the case of the Somerset Levels (SSL) Project, 100% of the area was visited once, whilst the 6-9% of the levels affected by peat extraction was visited on numerous occasions. For the Fenlands Survey, 60% of the areas were investigated by fieldwalking once only. Little excavation was carried out by the North West Wetlands Survey (NWWS) and hence there is no information available on the state of preservation of any archaeological remains in these peatlands. The total spatial remit of these EH Wetland Surveys was 887k ha, although the actual area studied in the field has been estimated at about 4450k ha (Van de Noort et al. 2002). A number of assessments of the current status and future management of wetlands in England followed (e.g. Coles 1995; Van de Noort et al. 2002; Olivier & Van de Noort 2002).

Desktop surveys of both archaeological and palaeoenvironmental resources in Scotland have been carried out by Historic Scotland (see SWAP and SPAD) but no national surveys have been carried out. The Scottish Wetland Archaeology Project (SWAP) produced a research agenda for work in Scottish wetlands (defined as lacustrine and peatland systems) with the aim of identifying ‘candidate sites for…major excavation’ and raising the profile of wetland archaeology in the country (Cavers 2006). Little concerted research has been carried out on the archaeological resource of Welsh peatlands, although extensive bibliographies of palaeoenvironmental projects which include work in these areas have been compiled and can be accessed on the Research Framework for the Archaeology of Wales web-site (http://www.archaeoleg.org.uk/intro.html). Although there have not been specific projects to investigate upland peat deposits, structures visible within peat will have been recorded, as will the palaeoenvironmental potential of sites and areas of peat cutting. The Uplands Archaeology Initiative was set up by the Royal Commission in the 1990s and includes pollen studies as well as aerial photographic mapping and field walking of the peat deposits of the uplands. In addition, the CADW-funded ‘Funerary & Ritual Project’ (Evans 2006), included an extensive survey of prehistoric monuments in the Welsh uplands and resulted in further palaeoenvironmental work including the pollen analysis of the peat cores.
3.3 Quantifying the archaeological resource in peatlands in the UK
Quantifying the archaeological resource within the peatlands of the UK and Northern Ireland is problematic. Van de Noort et al. (2002) utilised the results of the Wetland Surveys alongside other SMR data sources to estimate monument density and distribution within peatlands. Whilst these estimates are useful in determining the potential quantity of the resource, they, of necessity, rely on a number of uncertain and untested assumptions regarding site distribution. This is illustrated by the relative densities of sites identified by the NWWS compared with that of the SSL. For the former, an overall density of less than one site per km$^2$ was recorded, of which just 23 of the 253 sites (9%) were described as ‘wet preserved’. This was interpreted as reflecting the dominant pastoral agricultural regime in the NWWS area which restricted the potential to locate sites. In contrast, the results from the Somerset Levels Survey of the Brue Valley and Sedgemoor revealed a significantly higher density of 3.4 sites per km$^2$, of which 59% were ‘wet-preserved’, reflecting their discovery through peat extraction. However, of these sites, the vast majority dated to the Romano-British period, reflecting the loss of more recent sites through peat cutting.

Van de Noort et al. (2002) used data from the Wetland Surveys to estimate a figure of at least 1.2 monuments per km$^2$ in lowland peatlands in England. This produced an overall estimate of around 4,200 monuments in England alone, of which a significant proportion were described as likely to be wet-preserved. However, it was noted that if the higher figures determined by the Somerset Levels Project for the Brue valley were extrapolated, then the estimated number of sites in lowland peatlands in England would be in excess of 7,000. A monument density of at least 2.2 monuments per km$^2$ was estimated for upland peatlands, providing likely national figures of over 1,800 sites in England alone.

In Northern Ireland, a desktop study in 2003 of sites from peatlands recorded 743 registered ‘finds’. It also concluded that the numbers of finds by county were disproportionate, with the
vast majority coming from Antrim and Londonderry, reflecting the 19th century work by the Ordnance Survey and by antiquarian investigations in these areas (Plunkett & Foley 2006). In a more recent survey of the archaeological resource in Northern Ireland, over 12% of archaeological sites in Northern Ireland were identified in wetland contexts, although no distinction was made between peatlands (as defined by the IUCN UK Peatland Programme) and other types of wetland (Gormley et al. 2009). Currently, the Northern Ireland Sites and Monuments Record lists 222 archaeological sites and monuments associated with peatlands.

While the SWAD does not provide definitive figures on the number of recorded archaeological sites in Scottish peatlands, its database lists 365 entries of interest in raised mires with a further 2,238 entries for 'peaty soils'. These figures provide some indication of the archaeological resource within Scottish peatlands. Similarly, the SPAD lists almost 800 entries relevant to palaeoenvironmental research in Scottish peatlands, most of which pertain to raised mires.

3.4 Summary
Whilst estimates have been produced on the basis of past survey and study, there are no definitive data on the actual number of archaeological sites in the peatlands of the UK. The available figures reflect land-use and the implications of this for archaeological visibility and hence the focus of subsequent investigation. The existing data are derived very much from 'hot-spots' of such research (i.e. The Somerset Levels), the wider applicability of which is unclear. There are very few figures from outside of the UK with which to compare and contrast. The most intensively investigated lowland peatlands are in the Republic of Ireland, where survey by the Irish Archaeological Wetland Unit identified 3,462 sites in 45,000ha of raised mire. This equates to 7.7 sites per km² (McDermott 2007), a considerably higher figure than the estimate by Van de Noort et al. (2002) of 1.2 sites per km² for English lowland peatlands. The concentration of sites in any given region is the product of 10 millennia of human activity, which would have resulted in areas with varying densities of archaeological sites. The following section considers case studies outlining in more detail the character of the historic environment record of peatlands in the UK.

4. The Nature of the Historic Environment Record of Peatlands: Overview

As highlighted in the previous section, knowledge and understanding of the historic environment record of the peatlands of the United Kingdom is highly variable. England is the only one of the nations to have benefitted from large scale, integrated investigation of the lowland peatland resource in the form of the EH Wetland Surveys (Section 3, Table 3.1, Figure 3.3). Additionally, some of the English peatlands have a long history of study, specifically the Somerset Levels and the Humberhead Levels. Archaeological interest in the lowland mire complex of Hatfield Moors, for example, began in the seventeenth century with the work of Abraham De la Pryme (1671-1704) who postulated a number of interpretations regarding the landscape as well as recording bog-oaks, Roman coins, and a bog body (Turner 1995).

In addition to these inconsistencies, the nature of study has varied considerably. For example, some areas have received greater proportions of palaeoenvironmental study than others, such as the uplands of the North York Moors and Dartmoor (e.g. Simmon 2003), and the lowlands of the Humberhead levels (e.g. Whitehouse et al. 2001). In contrast, peatlands within areas such as Cumbria and Staffordshire have received considerably less palaeoenvironmental study. Compared with the other nations of the UK, less work of this kind has been carried out in Northern Ireland.
4.1 Categories of peatland archaeology and palaeoenvironments

There are four distinct categories of the historic environment resource of peatlands:

1. Sub-peat archaeology;
2. Archaeological remains contained within the peat matrix itself;
3. Archaeological remains located on the surface of the peat;
4. The palaeoenvironmental record preserved within the peat.

It is possible for all four of these categories to be represented at a single site and hence they are not mutually exclusive. The following section expands on these categories and presents case studies to illustrate each in turn.

4.1.1 Sub-peat archaeology

Peat deposits can conceal remains associated with earlier human activity that took place within the pre-peat landscape. Such remains include megalithic structures, burial monuments and ancient field systems. An example of such pre-peat archaeology is the Copney Stone Circle Complex, County Tyrone, N. Ireland (Foley & MacDonagh 1998). The site is a Scheduled Ancient Monument (see Section 7) in State Care Guardianship. Known locally since the 1970s, the complex was scheduled in 1983 and taken into State care in 1990. The stone circles are part of the Mid-Ulster Stone Circle Complex constructed during the Bronze Age (c. 4,300-2,650 years before present) on land that was later subsumed by peat growth. Partial clearance of a thin layer of blanket peat revealed an impressive complex of stone circles typically comprising a central cairn surrounded by in excess of 100 packed uprights stones, forming monuments measuring between 16m and 20m in diameter. Other prehistoric monuments sealed beneath peat include the Creggandevesky court tomb in County Tyrone, Northern Ireland (http://www.peatlandsni.gov.uk/archaeology/tombs.htm), which was discovered during peat cutting.

In addition to large monuments, peat growth can mask other types of sites of archaeological importance. For example, extensive flint scatters have been exposed in peat scars at Waun Fignen Felen, Brecon Beacons, in South Wales (Berridge 1981). Here, the earliest stone artefacts were found on the land surface sealed below the peat and include a range of flint knives and arrowheads which probably indicate that the site was a focus for Mesolithic (c. 12,000-6,500 years before present) hunting trips. Prehistoric activity tends to be well-represented in upland areas but examples of early historic, medieval and later sites are also known, such as the medieval royal deer park at Kincardine in Aberdeenshire where the remains of a park pale (boundary) that may have been created by William the Lion (1165-1214) are recorded (Gilbert 1979).

4.1.2 Archaeological remains contained within the peat matrix itself: sites and artefacts preserved in and associated with the peat forming environment.

This second category reflects sites that were constructed or artefacts that were deposited within areas of peatland and are therefore distinct from the first category where peat growth had not commenced at the time of construction. In both cases, the remains are subsequently buried by successive peat growth.

Probably the best known and certainly the most comprehensively investigated sites of this second category are from the Somerset Levels. This area is the most important in terms of the recorded peatland archaeological record in England: one quarter of the surviving wet-preserved sites in England are found in this area and there are more scheduled examples of such sites here than in the whole of the rest of the country combined (Jones et al. 2003). The Sweet Track (Figure 2.1) is only one of a complex of prehistoric sites in this area including the Honeygore, Abbots Way, Bells, Bakers, Westhay and Nidons trackways. Generally, these wooden trackways reflect the status of the peatland as an obstacle to be crossed or accessed. The Sweet Track is around 2km long and joins the ‘island’ of Westhay to the
higher ground of Shapwick. Dendrochronological (tree-ring) dating has provided a very precise date for the construction of the site in 3,807 or 3,809 BC (5757-5759 years before present). Sites such as these which are built of wood are particularly vulnerable to a range of threats (see Section 6). Whilst archaeological remains found within peat itself tend to be made of wood, there are examples of stone structures preserved in this context, such as the recently discovered Neolithic stone row on Cut Hill, Dartmoor (Fyfe & Greeves 2010, Figure 4.1). This structure is over 200m in length and was exposed by peat cutting and erosion, although the stones themselves were originally constructed on top of the contemporaneous peat surface. On White Horse Hill, also on Dartmoor, a Bronze Age cist was recently discovered within the peat matrix (Figure 4.2).

The rich archaeological record of the Somerset Levels sits in contrast with that of the lowland peatlands of Fenns and Whixall Mosses on the Shropshire-Clwyd border, which have produced only one Bronze Age axe, a coin and a bog body of unknown date (Coles 1994). However, the archaeological potential of peatlands elsewhere than the Somerset Levels continues to be demonstrated such as by the discovery of a Neolithic timber trackway and platform (Figure 4.3) on Hatfield Moors (Humberhead Levels National Nature Reserve) in 2006. Being a linear monument, part of this site is preserved below the peat (on the pre-peat land surface) whilst the majority of the site is contained within the peat matrix (Chapman & Gearey in press). Plunkett & Foley (2006) identified 41 trackways in both lowland and upland contexts in their desk-based study of peatland archaeology in Northern Ireland. Of these, only 5 are known to survive including an upland example at Slaghtfreedan, Co. Tyrone dated to the Bronze Age.

**Figure 4.1.** Cuthill Stone Row, Dartmoor, dating to the Neolithic period (Fyfe & Greeves 2010)

**Figure 4.2.** Bronze Age cist within the blanket peat on White Horse Hill, Dartmoor, located at over 600m above sea level. The site is situated above Neolithic peat and below middle Bronze Age peat deposits (Photo: R. Fyfe)
Figure 4.3. Late Neolithic trackway and platform on Hatfield Moors, South Yorkshire. The southern end of the site (background) rests on the pre-peat sands, whereas the rest of the site (foreground) lies on earlier peat deposits. The site was preserved by continued growth of the peatland following its construction. NB. The drainage ditch in the centre of the picture demonstrates the impact of peat cutting on the site whilst the wood in the bottom right hand corner of the picture has suffered from desiccation (see Section 6) (Photo: H. Chapman)

This demonstrates the potential for the preservation of similar structures within these peatlands, although significantly less excavation and fewer analyses have been carried out. Few recorded examples of this form of site are recorded in Scotland. The discovery of a near life-sized figure carved out of alder wood, known as the ‘Ballachulish Goddess’ and possibly dating to the Iron Age, was found in the lowland peat of Ballachulish Moss, near Fort William in North West Scotland (Coles 1994-5).

Investigations in the uplands at Loch Farlary, Sutherland, provided rare evidence of prehistoric activity in the form of the cut marks of Bronze Age tools on pine roots preserved within the peat itself. This probably reflects removal of the roots of dead trees uncovered during prehistoric peat cutting, rather than actual clearance of the woodland itself (Tipping 2008). Single artefacts representing chance loss or deliberate deposition are also recorded from a number of peatlands, such as the large quantity of archaeological material recovered from the Upper Forth valley in Scotland during peat clearance in the 18th and 19th centuries (Ellis 2001).

Perhaps the most compelling evidence preserved in peatlands is in the form of human remains, commonly referred to as ‘bog bodies’. Lindow Man (Section 2, Figure 2.2) is probably the most famous example, but many other peatlands have produced such evidence. For example, six bog bodies are known from Welsh peatlands, including three from the lowland sites of Gifron, Dolfawr Fair and Llyn Mawr (Turner 1995). Most of the known bog bodies were discovered during the late 19th and early 20th centuries, although they continue to be found today and attest the potential for peatlands to preserve vivid and direct evidence of past people.

4.1.3 Archaeological remains located on the surface of the peat
This includes evidence of human activity which is not concealed by peat growth, often of comparatively recent date. For the purposes of this discussion, this category is restricted to peatlands that have not been stripped down by peat cutting to expose deeper areas of peat.
in plan. In these instances, the cut-over surface may of course reveal sites which were originally part of the peat matrix. A common form of surface evidence relates to the exploitation of the peat resource itself. Both upland and lowland peatlands have been exploited for fuel, with some evidence such as that from Loch Farlary (4.1.2) suggesting that evidence for peat cutting may be of great antiquity in some areas (Tipping et al. 2008). Additionally, more recent features such as the evidence of railway tracks for the transportation of cut peat are preserved extensively on some lowland peatlands.

4.1.4 The palaeoenvironmental record and ‘long-term ecology’

This refers to the potential of the peat matrix to preserve a range of plant and animal remains (Figure 4.4) that provide information about the environment around archaeological sites and to help reconstruct long-term processes within the peatland itself, which often reflect external drivers such as climate change (e.g. Charman 1994a, b). Palaeoenvironmental analyses at the site of Waun Fignen Felen (Smith & Cloutman 1988) were crucial in establishing the relationship between the archaeological evidence and associated environmental changes. The focus of the Mesolithic human activity was a small lake which had formed in limestone bedrock. Pollen analyses and radiocarbon dating of the organic sediments which infilled the lake indicated the local presence of open woodland with areas of open ground that may have been maintained by grazing animals. There is evidence from the 8th millennium before present that the local heathland vegetation was burnt, possibly deliberately by human communities to encourage large game to gather. The use of fire to open up the vegetation may have played a role in the subsequent inception and spread of peat.

Figure 4.4. Examples of common types of sub-fossils preserved in peat: a) pollen grain; b) testate amoeba; c) plant macrofossil remains; d) a variety of beetle remains; e) cross-section of wood; e) tephra shard (Photo: G. Plunkett, E. Reilly & I. Stuijts)

The palaeoenvironmental record has played a critical role in understanding the patterns and processes of peat growth in uplands and lowlands, with a particular area of research being the role of human activity in the initiation of blanket peat spread. Some authors (e.g. Simmons 2003; Moore 1993; Tallis 1998) have argued that the evidence from a number of upland sites in the UK indicates clearance of the woodland and related agricultural activities by human communities during the mid-Holocene in particular (c. 5,000 years before present) resulted in waterlogging, leaching of nutrients from the soil and the subsequent accumulation of peat. However, recent palaeoenvironmental study of sites in the Scottish uplands has challenged the view that peat formation is necessarily related to the impact of early human activity on the environment, with evidence for blanket peat spread from as early as 8,500 years before present at certain locations in northern Scotland (Tipping 2008; see also Lawson et al. 2007). The identification of climatic changes using the palaeoenvironmental record of peatlands is another area of research that has grown significantly in recent years. Analyses of testate amoebae and peat humification from May Moss, North York Moors for
example, suggest a series of fluctuations between wetter/colder and drier/warmer conditions between c. 1,500 and 300 years before present (Chiverell 2001). Similar research on upland peats in the Templemoss Hills, south-east Scotland has identified a series of ‘major wet shifts’ during the Holocene that are replicated in analyses from the lowland site of Walton Moss, Cumbria, suggesting that peatland palaeoenvironmental records can be sensitive records of regional climatic fluctuation (Langdon et al. 2003).

The palaeoenvironmental record can also contribute significantly to discussions regarding the current status and management of the peatland resource. Chambers et al. (2007) used palaeoenvironmental data including plant macrofossil analyses from two sites in upland Wales to investigate long-term fluctuations in peat forming vegetation. These data suggest that changes in atmospheric inputs and grazing pressures in the post-industrial revolution period led to a decline in Sphagnum and the current dominance of heather and grass, although both study sites show improvement in floristic diversity in the 20th century. Other studies have used pollen and macrofossil analyses to investigate similar changes in peat building vegetation in lowland raised mires, demonstrating the vulnerability of certain peat forming species to environmental changes associated with human activity (e.g. Hughes et al. 2007). Sub-fossil insect remains have also been used to investigate long term changes in peatland ecosystems with subsequent implications for biodiversity, conservation and management (e.g. Whitehouse et al. 2008).

4.2 Summary
This section has provided a brief overview of the diverse character of the historic environment record of peatlands in the UK. The extant evidence ranges from impressive monuments such as the Copney stone circle and the discrete scatters of flint tools at Waun Fignen Felen reflecting the traces of human activity in the pre-peat landscape, to the timber trackways and platforms of the Somerset Levels that demonstrate the potential for evidence to be preserved within the peat itself. The traces of peat cutting and other activities on the surface of the peatlands reflect the long history of human exploitation of the natural environment. Palaeoenvironmental research provides a critical link between past and present processes in peatlands and for investigating the recursive relationship between humans and their environment. Such data can also make a valuable contribution to the climate change debate and to the long-term management of peatlands. Many lowland peatlands in particular have been substantially cut-over and often the ‘significant’ archaeological finds in peatlands have tended to be the result of chance discoveries during or following peat extraction; such as Lindow Man, many of the sites on the Somerset Levels and in Northern Ireland, the Hatfield trackway and platform. Other remains such as the flint scatters in the Welsh uplands at Waun Fignen Felen and the Cut Hill stone row, Dartmoor, have been revealed through the erosion of peat. Many of these archaeological sites, especially organic remains such as ‘bog bodies’ are unique to peatlands and are rarely, if ever, encountered in ‘dryland’ contexts. However, it is also this unique character of the record that presents a number of challenges to the understanding of the historic environment record of peatlands. These ‘gaps in knowledge’ will be considered in the next section.

5. Current gaps in knowledge

Key stakeholder comment:
“We probably have more gaps than we have knowledge.”
Gaps in knowledge impede our full understanding of the nature of the historic environment resource of peatlands (Section 4). This in turn affects our ultimate ability to assess the implications of threats to the resource (Section 6) and thus impacts on how best to manage and protect sites (Section 7). The ‘gaps’ have been identified from a review of the published literature, existing research agendas and from consultation as part of this review (Section 1) and are for the sake of brevity grouped into five broad themes which as far as possible include issues which are common to both upland and lowland peatlands.

5.1 Spatial and temporal gaps
This refers to our knowledge of the geographical location of archaeological sites and also to the physical intactness of peatland deposits and hence the implications for the age of any associated archaeology. As outlined above, the known distribution of sites within peatlands in the UK is the result of both chance finds and the locations of specific survey and research projects. The latter are often determined by land-use (peat cutting, Figure 5.1) and subsequent threat, two closely related factors which often drives the focus of research from a management perspective. Good examples of this are the heavily extracted lowland peats of the Somerset Levels and the Humberhead Levels National Nature Reserve (Section 5) where sites have been identified as the peatlands have been stripped down. Subsequently, archaeological fieldwork has concentrated upon these areas of present damage and threat. Hence, the irony of wetland archaeology is that the agent of the destruction of the resource is also the process by which the greater proportions of archaeological sites are discovered. Gaps in spatial knowledge are often related as much to a lack of concerted survey or investigation rather than an established lack of, or low potential for the preservation of, archaeological sites. There is de facto very little or no knowledge of archaeological site distributions from the more intact areas of peatland. As discussed in the previous section, estimates of the likely numbers of sites in the latter contexts can only to be extrapolated from areas affected by extraction or by other processes which affect the physical integrity of the peat, such as erosion. The lack of a robust estimate of the distribution of archaeological sites in UK peatlands provides a clear challenge for the effective future management of the historic environment record of peatlands.

Figure 5.1. Peat cutting on Gidleigh Common, Dartmoor in 1983 (Photo: Chris Chapman)

A related aspect is the temporal gaps in the record for many areas. Activities including peat cutting and agriculture which actively remove deposits, or drainage which leads to the desiccation and thus eventual loss of shallower layers of peat, will result in the loss of the
more recent layers of deposit first (see Section 6, below). The majority of raised mires in Britain, for example, have lost peat deposits post-dating the Romano-British period (c. last 1,500 years) at least. Knowledge of the historic environment resource of cut-over peatlands in the lowlands in particular is therefore significantly biased towards earlier periods. The post-Roman peat resource is rare, with the cut-over surface of many peatlands exposing layers of peat which accumulated in the prehistoric period. The age of the surviving peat can however vary significantly between and also within affected sites and knowledge of the precise age of such deposits depends on the availability of palaeoenvironmental data (see Figure 5.2).

![GIS generated model of the age of the surviving peat surface of the lowland raised mire of Hatfield Moors, South Yorkshire. Very limited areas of later (post Iron Age) deposits survive due to peat cutting. Any archaeological sites dating to these missing periods have of course also been lost.](image)

High quality palaeoenvironmental studies of upland and lowland peatland in the UK have produced detailed information regarding vegetation, climate change and the impact of human activity (as highlighted in Section 5). However, certain questions such as drivers and large scale patterns of peatland spread are poorly understood (e.g. Tipping 2008). Such data may have implications for human activity and the possible locations and character of archaeological sites. Palaeoenvironmental research can generate useful data on the depth, character and age of peat, which in archaeological terms may permit an assessment of the potential for the preservation of remains at a given location. Grids or transects of cores can be employed to identify sub-peat stone structures (e.g. Fyfe & Greeves 2010), but cannot generally be employed to locate archaeology within the peat itself.

### 5.2 Filling in the gaps: finding sites

Ultimately, enhancing our knowledge of the historic environment record of peatland relies on filling the spatial and temporal gaps in the distribution of sites described above. The most efficient and effective means of discovering archaeological sites is by fieldwalking and the examination of peat scars, drain faces and other exposed areas of peat. However, this relies upon the existence of such ‘transects’ through the peat deposits to have any chance of locating sites within or beneath the peat. High watertables in ditches and drains can also
prohibit effective survey. Visibility may be less of a problem for sites on the surface of the peat, but this too is dependent upon the nature of the vegetation cover or land-use. This is illustrated by the North West Wetlands Survey which failed to locate any new sites, a result which was attributed largely to the fact that many of the fieldwalked areas were under pasture.

Remote sensing approaches that are used for finding and characterising sites on drylands include aerial photography and geophysical techniques such as Ground Penetrating Radar, Magnetometry and Earth Resistance which permit the non-intrusive identification of subsurface archaeological remains. One of the greatest challenges for archaeologists working within peatlands is that this geophysical ‘toolkit’ has very limited application in peatlands (Coles and Coles 1996). Aerial photography might assist in the identification of archaeology on the surface of the peat (Section 4), the specific hydrological conditions of peatlands mean that geophysical methods can rarely be used to locate or map archaeological sites within or sealed beneath peat. There have been a number of studies aimed at developing such techniques, but these are in development and currently no tested scientific method is available that can be used to remotely identify archaeology within or beneath peatlands. Some studies have demonstrated that ground penetrating radar (GPR) can be used to map pre-peat landscapes and may be useful in the identification of certain archaeological features (e.g. Utsi 2007; Clarke & Stoneman 2001; Clarke et al. 1999) and to generate data which may be useful in a ‘predictive’ capacity (e.g. Chapman & Gearey 2003). The airborne remote sensing technology of LIDAR (light detection and ranging) also has potential for understanding aspects of the historic environment record associated with the surface of peatlands but cannot locate sites within or beneath the peat.

5.3 Understanding preservation of the archaeological and palaeoenvironmental resource
Understanding the microenvironment of peat growth, both in terms of its current hydrological status and character of its past formation processes, can be a critical factor in establishing prospects of the future preservation of archaeological sites and deposits of palaeoenvironmental value. There has been significant research in recent years into the hydrological, chemical and biological processes of organic preservation within peatlands. This has demonstrated the potential for the remote monitoring of the burial environment (watertable depth, water quality etc.) of wet-preserved archaeological sites with minimal disturbance to the remains (e.g. Brunning 2007a & b; Lillie & Smith 2007; Lillie 2007). However, variability in burial environments, data collection and monitoring protocols means that further research is required in order to fully determine the potential and practical application of such approaches (e.g. Holden et al. 2006). Factors which control the state of preservation are relatively well understood in principle, but synergies between past and present hydrological regimes in terms of the continuing preservation in situ of different materials, for example, are under-researched.

5.4 Collating and analysing available datasets
Whilst a number of projects and initiatives have sought to collate information on the historic environment on local and regional scales, there is still a need to assess and analyse the information which has been collected to date, including that from archaeological and palaeoenvironmental sources and associated information from other stakeholder groups.

5.5 Public perception and understanding
Peatlands are an integral part of our cultural landscape, appearing in various forms in poetry, art and literature. They can play a significant part in regional and local identities through myths and legends. The history and of the Fenlands and Norfolk Broads for example is in part one of the interaction between people and peat. The historic environment record forms an integral part of this history and identity, but is perhaps something that is not always best...
appreciated or promoted. A key issue may be physical access to sites and the manner in which evidence is accessed and presented. The lack of a consistent approach across the wider sector to interpretation of sites and landscapes is perhaps also part of the problem. A general comment by stakeholders in that we need to explore current perceptions and knowledge and consider ways to present information from the historic environment record that will help to raise consciousness of the value of peatlands in the broadest sense.

5.6 Summary
This section has briefly considered the existing gaps in knowledge in terms of the historic environment record of peatlands. This is by no means an exhaustive list, but it has attempted to include the range of issues identified by stakeholders. Whilst we have outstanding examples of the range of archaeology that peatlands can contain, we are still often unable to remotely identify sites in areas that have not already been disturbed. Understanding the distribution of sites we know about means attempting to fill in the geographical blanks. Peat cutting and other processes often affect peat from the surface down and hence impacts effectively move backwards through time in terms of the archaeological and palaeoenvironmental record. In many areas this represents the loss of at least the last millennia and half or so of peat accumulation, or recent times back to the Romano-British period, but this is highly variable between and within sites. Once discovered the often fragile nature of peatland archaeology means assessing the prospects for a site to remain stable in the long term and hence determining the physical state of the peat matrix in which it is buried. Progress has been made in understanding and monitoring the nature of burial environments, but more work is needed to explore the wider applicability of such approaches. Finally, there is a need for further interrogation of the information we already possess. The next section of this document will consider the nature of the threats to the historic environment resource of peatlands.

6. Risk & threat

Key stakeholder comment:

“Land reclamation was particularly damaging in the 1970s and 1980s. Now mechanical peat cutting for horticulture and some fuel is the worst. Development and dumping are factors. Undesignated areas not subject to government grants where owners can do anything they wish (at their expense).”

6.1 Introduction
The waterlogged and anaerobic nature of peatland environments results in the exceptional preservation of organic archaeological and palaeoenvironmental remains: the survival of this resource is therefore inextricably linked with the fate of the peatlands themselves (Coles & Coles 1986; Coles 1995; Pryor 2001). Destruction of peat will of course lead to the loss of any archaeology or palaeoenvironmental information preserved within or on the peat matrix and the exposure of archaeological remains sealed beneath the peat (Section 4.1). However, other threats may, initially at least, have a less direct but ultimately no less damaging impact on the resource. Any process which leads to a reduction in the levels of saturation or to the quality of the water itself within a peatland, can impact negatively on the long-term survival of the archaeological and palaeoenvironmental record. Organic material such as wood is especially vulnerable, but inorganic archaeological remains including stone may be at risk from any process which leads to exposure and hence weathering, biological and chemical decay. Once this archaeological and palaeoenvironmental information is lost or damaged it cannot be retrieved.
The threats to the archaeological and palaeoenvironmental resource outlined in this section (Table 6.1) are applicable to upland and lowland peats throughout the UK and Northern Ireland and indeed have been identified elsewhere in the world (e.g. Coles 1995; Van de Noort et al. 2002). These threats occur against a background of a diminishing peatland resource, although it is recognised that in recent decades the establishment of SSIS and National Parks and other conservation initiatives have played a significant role in countering the loss and deterioration of peatlands within the UK and Northern Ireland. Nonetheless, few intact peatlands survive in the UK, with almost all deposits having been altered or impacted upon in some way by human activity. We recognise two broad categories of threat:

- **Direct**: any process which results in the actual physical removal or damage to the archaeological and palaeoenvironmental resource;
- **Indirect**: any process which may lead to conditions inimical to the long term stability and preservation of the archaeological and palaeoenvironmental resource.

**Table 6.1. Threats to UK peatlands and the historic environment record.**

<table>
<thead>
<tr>
<th>What is the threat?</th>
<th>Nature of threat</th>
<th>Why is it a threat?</th>
<th>Implications for the historic environment record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion</td>
<td>Direct</td>
<td>Peat extraction – industrial (horticultural use) &amp; domestic (fuel) Erosion</td>
<td>Exposure and destruction of archaeological sites &amp; loss of peat as palaeoenvironmental resource</td>
</tr>
<tr>
<td>De-watering</td>
<td>Indirect</td>
<td>Water abstraction Drainage Reclamation – for agricultural purposes</td>
<td>Desiccation and degradation of peat matrix which results in destruction of archaeological &amp; palaeoenvironmental resource</td>
</tr>
<tr>
<td>Afforestation</td>
<td>Direct/Indirect</td>
<td>Change in land use Alters soil chemistry Drainage Root damage</td>
<td>Tree planting disrupts peat stratigraphy and alters conditions for preservation of archaeological sites via increased drainage &amp; root penetration</td>
</tr>
<tr>
<td>Peat cutting</td>
<td>Direct/Indirect</td>
<td>Removal of resource Drainage</td>
<td>Destruction of archaeological and palaeoenvironmental resource. Dessication associated with drainage to permit extraction.</td>
</tr>
<tr>
<td>Burning</td>
<td>Direct/Indirect</td>
<td>Wild fires Controlled fires</td>
<td>Loss of peat resulting in exposure and destruction of archaeological and palaeoenvironmental resource</td>
</tr>
<tr>
<td>Climate change</td>
<td>Direct/Indirect</td>
<td>Changes in level &amp; distribution of rainfall affecting peat growth &amp; system development</td>
<td>Effect ability of peatlands to remain anaerobic &amp; waterlogged and protect archaeological &amp; palaeoenvironmental resource</td>
</tr>
<tr>
<td>Development</td>
<td>Direct/Indirect</td>
<td>Wind farms and infrastructural developments</td>
<td>Loss of peat related to construction and consequent exposure &amp; destruction of archaeological and palaeoenvironmental resource</td>
</tr>
</tbody>
</table>
6.2 Erosion

Work in the Peak District of England mapping the extent of peatland erosion (Phillips et al. 1981) has suggested that some 8% of the total peat-covered landscape is now bare and that peat is being eroded locally at up to 30 mm per year. More recent attempts at quantifying upland erosion in England and Wales considered 399 upland sites (McHugh et al. 2002) and suggested that 24,566 ha were affected by erosion (0.284 km$^3$ erosion volume), the vast majority of which (73%) was thought to result from water erosion (e.g. see Figure 3.2). Short-term erosion measurements between 1997 and 1999 indicated an expansion in the affected area by 518 ha. The erosion of peat can result in the direct loss of the archaeological and palaeoenvironmental resource. Recent fieldwork in upland peats covering most of the area of the medieval deer park at Kincardine, Scotland (Section 4) has led to the identification of two significant risks to this major peatland historic landscape (Prof. Richard Oram, University of Stirling, pers. comm.). Increased rainfall at certain times of year has accelerated erosion affecting parts of the scheduled monuments. Blockage of old water-courses and the failure of maintenance of estate drainage systems has increased motility on hillsides, leading to the erosion of large sections of the park's enclosing boundaries, and in some cases their complete destruction. The extent of this loss can be measured against gaps visible in aerial photographs from the 1940s.

6.3 De-watering

Undrained peat can be up to 90% water. Drainage can therefore result in a significant reduction in the peat mass, whilst the related shift from anaerobic to aerobic conditions can lead to oxidation and the loss of organic matter through processes of microbial decay. Such processes are highly damaging to fragile organic archaeological remains and the associated palaeoenvironmental resource. Considerable areas of lowland peats have been lost over the last three centuries through systematic drainage and reclamation. It is estimated that 72% of lowland peatlands in England have been converted to arable land (Van de Noort et al. 2002). This has resulted in a loss of peat through drainage, ploughing and erosion, sometimes referred to as ‘peat wastage’. It is estimated that over the last half century the volume of peat lost through wastage lies between 755 and 1035 million m$^3$ (Van de Noort et al. 2002.). Whilst the contribution from peatlands has not been quantified, 30% of the overall supply of public freshwater for England and Wales is from groundwater abstraction (Van de Noort et al. 2002). Water abstraction in Dumfriesshire Scotland has also lowered the water table and caused water shortages (Crone & Clarke 2007).

Agricultural improvement, be that via intensification or extensification, remains a significant factor. Wholesale drainage of upland peatlands, particularly in the latter half of the twentieth century, has been undertaken to facilitate expansion in pasture and upland grazing. England/UK drainage schemes implemented in the 1960s and 1970s resulted in the drainage of 1.5 million hectares of blanket peat, the residual effect of which is ongoing in the form of the slow desiccation and degradation of upland peats. Archaeological sites such as round barrows occur in upland situations throughout the UK and Northern Ireland and the partial exposure of such sites within peatland pasture is relatively commonplace. The long chambered cairn at the Cave of Kilhern in Dumfries & Galloway, Scotland and the complex of funerary and ritual structures at Beaghmore, Co. Tyrone, Northern Ireland are examples of sites exposed as a result of land 'improvement' projects in peatlands over the last century (Pilcher 1969).
The impact of reclamation and ongoing drainage of lowland peatlands for agricultural use is illustrated by the Mesolithic site of Star Carr, North Yorkshire (Mellars & Dark 1998) (Figures 6.1 & 6.2). The organic remains at this site included a brushwood 'platform', bone and red deer antler objects. Recent work has indicated significant deterioration in the levels of preservation at the site with the archaeological and palaeoenvironmental resources highly vulnerable to the effects of drainage and agriculture (ref: www.starcarr.com accessed 03/08/10; Hall et al. 2007). Data from the Somerset Levels indicates rates of peat wastage in pasture fields at rates of 0.44 m to 0.79 m over the past century (Brunning 2002). No comparable measurements were available for peat wastage in arable fields in Somerset, but in the fenland of East Anglia assessments of wastage rates suggest a loss of 3.83 m per 100 years (Hutchinson 1980) and 2 m to 3 m per 100 years (French & Pryor 1993). Archaeological sites have often been discovered when revealed by peat wastage, such as the Bronze Age pile alignments of Harters Hill and Ivythorne (Brunning 1998) and the dug out canoe known as "Squire Phippen's big ship" which appeared during dry periods in the Brue valley until it was dismantled and used by the cottagers for fuel (Stradling 1849, 52).

These case studies illustrate the direct impact of peat wastage on the peatland archaeological and palaeoenvironmental resources. Other research illustrates the effect that deep water tables can have on the in situ preservation of the archaeological and palaeoenvironmental resource: study at the late Bronze Age site of Flag Fen, Peterborough, England has demonstrated the difficulty in preserving archaeological sites where water abstraction and other forms of development and drainage impact on the hinterland of a site and compromise the preservation of the archaeology in situ (Lillie 2007). The Neolithic Abbot's Way trackway (Cox et al. 1992) and the Iron Age settlement at Meare in the Somerset Levels (Coles et al. 1986) have both been affected by desiccation resulting from water abstraction. It has been stated that the only site that appears secure from the threat of desiccation in the Somerset Levels is the section of the Sweet Track that benefits from a pumping system which keeps water levels high in the Shapwick Heath National Nature Reserve (Brunning et al. 2000).

6.4 Afforestation
Forestry is an important land use on peatland in the UK, with any peat deposit more than 0.45 m deep being classified by foresters as ‘deep peat’ (Anderson 1997). Much afforestation has occurred on blanket bog as it was considered relatively unproductive in agricultural terms.
and therefore was cheap to purchase (Thompson et al. 1988). Peatlands are generally drained to facilitate tree growth with the subsequent indirect threat of dewatering to any archaeological sites. In addition, roots can directly impact archaeological deposits compromising their value for accurate palaeoenvironmental study. ‘Proposals for Increased woodland to take up carbon’ is a recent government report by the National Assessment of UK Forestry and Climate Change Steering Group 2009 and ‘Combating Climate Change - a role for UK forests’ is becoming a policy document for future planting. The report suggests that appropriate planting of 23,000 hectares a year – over 40 years would involve changing the use of only 4% of the UK’s land, and is equivalent to planting the area of Lancashire every 15 years. This would mean a 200% increase on current levels of planting with subsequent implications for the historic environment resource of peatlands.

6.5 Peat Extraction
It is estimated that in 1997, 0.95 million m³ of peat were extracted from peatlands in England (Van de Noort et al. 2002). The associated destruction of the archaeological and palaeoenvironmental resource cannot be reliably quantified. An assessment of the impact of peat cutting in the Somerset Levels concluded that of 175 sites identified in this area, 59 had been partially or totally destroyed over the last 150 years. Peat extraction was found to be responsible for damage to or destruction of 48 of these (Brunning 2001). The scale of commercial peat harvesting varies but mechanised large-scale peat extraction is ongoing at several sites throughout the UK & Northern Ireland. In 1999 the Peatland Working Group identified nine lowland sites in England where large-scale peat harvesting was occurring, including from areas designated as SSSI or identified for their nature conservation value. In Scotland, commercial peat extraction takes place mainly, though not exclusively, in the southwest and the Central Lowlands, and on a smaller scale than in England. Crone & Clarke (2007, 22) suggest that this may be detrimental to the recognition of peat extraction in Scotland as a threat to heritage resources as: “…[in] some ways the situation [vis-a-vis peat extraction] in Scotland can be characterised as the absence of a sufficiently recognisable threat to the resource.” A similar issue may apply to Northern Ireland and Wales where peat cutting also occurs on a smaller scale to England.

Commercial peat extraction can be contrasted with domestic peat cutting in terms of the pace of destruction and scale of impact. Nonetheless, the latter poses a challenge to the discovery, preservation and protection of the archaeological and palaeoenvironmental resource. In Northern Ireland, wooden trackways have been identified through peat cutting within five peatlands in Co. Tyrone (http://www.peatlandsni.gov.uk/archaeology/timber.htm accessed 03/08/10). These finds demonstrate that the lowland peats of Northern Ireland may have the archaeological potential of equivalent peatlands in the Irish republic, where in excess of 3,000 wooden structures have been identified to date.

6.6 Burning
Controlled or prescribed burning is a traditional technique in the management of the vegetation of upland peatlands in particular. For example, it has been estimated that 42 km² of the southern Pennine moorlands has been burnt since 1970 (Tallis 1997). Burning at the appropriate time of year can cause minimal damage to the peat matrix itself, although its use in the future management of upland peats is currently under revision (Reed et al. 2009). Extended dry periods or hot summers can lead to wild fires which, particularly during drought conditions, may become uncontrollable and cause significant damage to extensive areas. In some circumstances the peat can burn to a considerable depth and may smoulder for months. This can have significant implications for the historic environment as demonstrated on Fylingdales Moor, North Yorkshire, in the late summer of 2003 (Figure 6.3), when an area of 2.4 km² of moorland was devastated by a wild fire.
The Fylingdales blaze uncovered an archaeological landscape that included prehistoric field systems, rock art (Figure 6.4), funerary monuments, in addition to a network of ditches associated with the eighteenth century Stoupe Brow alum quarry, and many earthworks left over from military training during the World War II (Vyner 2007). The fire resulted in the rapid exposure of the archaeology through the loss of peat and covering mats of vegetation and roots. This left the sites vulnerable to weathering with many ephemeral features lost due to wind and water damage. It is again ironic that processes which are inimical to peatlands can help to fill in geographical gaps in our knowledge (see Section 5).

6.7 Climate change
Climate change is considered to be a significant driver in this context and has been recognised as a potential threat to the peatland historic environment since at least the 1990s (Coles 1995; Van de Noort et al. 2002). A recent study provides estimates of the vulnerability of wetlands, including peatlands, to future changes in hydrology based on predicted changes in climate (Acreman et al. 2009). Current models suggest that changes in rainfall and temperature will result in reduced summer rainfall and increased summer evaporation with implications for peatlands depending on their geographical location. In this scenario North West Scotland might experience a small increase in water availability in the summer, whilst southern England would experience a decrease and associated lowering of wetland water tables (Acreman et al. 2009). Such changes are likely to place wetland plant communities, including peat-forming vegetation, under increasing stress. As a result, England may become too dry for the growth of some types of lowland mire leaving existing peatlands vulnerable to desiccation and to further degradation of the historic environment resource. Climate change may alter sea levels, weather patterns, the hydrological cycle of the peatlands and patterns of water temperatures. The effects are complex and outside the scope of this document to consider in detail; in practice, they may have both benign and adverse impacts upon peatlands.

6.8 Development
Upland sites are highly desirable locations for wind farms because of their greater exposure to high winds, and peatlands predominate on the flatter summits, which are often preferred for engineering reasons. The extensive access tracks and turbine footprints required for such
developments have the potential to lead to direct and indirect damage to the resource. Wind farms are likely to become more prevalent with the increasing appetite for generation of electricity from renewable sources.

6.9 Other threats: access and military impact
Localised damage can be inflicted on peatlands by vehicles and foot traffic. This can lead to erosion and the damage and loss of peat by other agencies. Although this is a localised threat there is a direct risk to the peatlands within training grounds and ranges as a result of ordnance impact and erosion by military vehicles. For example, recent fieldwork on Blackbrook Hill, Dartmoor, identified 862 bomb craters in an area of c. 25ha. Although no sites are currently known from this area, the base of the damaged peat has been dated to the Neolithic/early Bronze, indicating the potential for damage or destruction of any sub-peat archaeological remains (Fyfe 2008).

6.10 Summary
The continued survival of the historic environment record of peatlands is faced by a range of threats. In general, any threat to the physical extent or integrity of peatlands as functioning ecosystems is also one to the archaeological and palaeoenvironmental resource. The quantification of the scale of past loss of archaeological sites is highly problematic due to the lack of reliable figures on the loss and damage to peatlands themselves, as well as a shortage of robust knowledge of the geographical distribution of the archaeological resource as discussed in Section 5. In addition, synergies between the threats listed in this section further complicate this picture. The available evidence indicates that both direct and indirect threats including peat cutting, agriculture and drainage have impacted upon the known resource and will continue to compromise the finite and fragile archaeological and palaeoenvironmental resource of the peatlands of the UK and Northern Ireland. The following section will consider the current legislation, policies and guidance which protect the historic environment resource.

7. Protection of the peatland historic environment

Key stakeholder comment:
“At present in Scotland there is no formal policy. An objective should be to inform and educate those working in peat of what to look out for in terms of cultural heritage remains and what to do if they are encountered.”

7.1 Introduction
The underlying principle for the protection and preservation of the historic environment of peatlands is in line with that for all other such heritage assets (defined as those elements of the historic environment that have significance): that the best sites should be preserved for future generations. The loss of sites removes direct evidence of our past and the chance to study it; hence the historic environment resource is regarded as finite and non-renewable. Archaeological sites and deposits preserved in-situ are considered to have the most integrity. The challenge is in determining the significance of the record and understanding how to place value on historic places, landscapes, sites or objects (Drury & McPherson 2008).

7.2 Legislation and guidance
Statutory protection for archaeological sites across the United Kingdom is through designation, and a number of Scheduled Monuments exist in peatlands. Further protection is afforded to archaeological sites through planning law. There are approximately 20,000 Scheduled Ancient Monuments (SM) in England, accounting for a total land area of 497 km²,
of which 3.7 km² lies within peatlands (less than 1%). Statutorily protected archaeology sites in peatlands are therefore significantly under represented in the schedule. Designated sites include Glastonbury lake village and part of the Neolithic Sweet Track in the Somerset Levels, but do not currently include two of the most famous archaeological sites in England’s peatlands, Flag Fen and Star Carr.

Currently, no areas of peatland are scheduled for the significance of their palaeoenvironmental record in isolation. Some such sites are protected as geological Sites of Special Scientific Interest (SSSI). Others are designated as RIGS (Regionally Important Geological/Geomorphological Sites) and whilst not benefiting from national statutory protection, are regarded as regionally or locally representative sites where ‘... consideration of their importance becomes integral to the planning process’ in the words of the Earth Science Conservation Strategy (ESCS). Conservation of geological and geomorphological sites which may include areas of peatlands of palaeoenvironmental significance is part of the responsibilities of the statutory nature conservation agencies: the Countryside Council for Wales, Natural England and Scottish Natural Heritage. A major initiative to identify and describe the most important geological sites in Britain began in 1977 in the form of The Geological Conservation Review (GCR). Fifteen peatland sites in uplands and lowlands have been listed to date, most of which are located within England (Huddart & Glasser 2002). The results of the GCR programme are being published in a series of 45 volumes, the Geological Conservation Review Series (http://www.jncc.gov.uk/page-2731).

Table 7.1 shows the European Conventions which have been ratified by the United Kingdom and presents the variations in primary and planning legislation which exists across the UK and Northern Ireland. The Ramsar convention is an international treaty which allows for the designation of sites to safeguard the natural environment. Although the original wording of this convention does not specifically mention archaeology, when designating a ‘Ramsar site’, a country must include information regarding the ‘Social and Cultural Value’ of wetlands, including peatlands. This recognises that the historic environment is a significant component in understanding and managing surviving wetlands, which must be included in any restoration or management planning. In England, Planning Policy Statement 5: Planning for the Historic Environment (PPS5) sets out the Government’s planning policies on conservation of the historic environment. It was published in 2010 and replaced Planning Policy Guidance 15: Planning and the Historic Environment (PPG15) and Planning Policy Guidance 16: Archaeology and Planning (PPG16). PPS5 and its predecessors enable protection, recording and enjoyment of historic environment assets through the application and monitoring of conditions set within the planning process. Comparable policies and guidance exist for Wales, Scotland and Northern Ireland (Table 7.1).
### Table 7.1: Active legislation, policy and guidance in the UK

<table>
<thead>
<tr>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
<th>N. Ireland</th>
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<tbody>
<tr>
<td><strong>European Conventions (Ratified)</strong></td>
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<tr>
<td>Valletta - The European Convention on the protection of Archaeological Heritage 1992</td>
<td></td>
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<tr>
<td>Ramsar - The Convention on Wetlands 1971 (established cultural importance of wetlands)</td>
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<td></td>
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<tr>
<td><strong>Primary Legislation</strong></td>
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<tr>
<td>Ancient Monuments and Archaeological Areas Act (1979) - Established statutory protection for historic sites (Scheduled Monuments) and Listed buildings</td>
<td></td>
<td>Historic Monuments and Archaeological Objects Act (1995) - Established Scheduled of Monuments and Listed buildings</td>
<td></td>
</tr>
<tr>
<td>The National Heritage Act (1983) - Established 'Commissions' i.e. English Heritage, CADW (Wales) and Historic Scotland</td>
<td>In 2007 powers transferred from Department of Environment to the Northern Ireland Environment Agency (NIEA)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Planning Policy and Guidance</strong></td>
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<td></td>
<td></td>
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<tr>
<td><strong>Peat deposits with geological designation protection</strong></td>
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<td></td>
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<tr>
<td>Geological Conservation Review (GCR) of geological and geomorphological sites undepins designation as Sites of Special Scientific Interest (SSSI’s) Regionally Important Geological Sites (RIGS)</td>
<td></td>
<td>Areas of Special Scientific Interest (ASSI)</td>
<td></td>
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</tbody>
</table>

### 7.3 Resources and practice

The challenge in protecting and managing the historic environment record of peatlands, as for all other heritage assets, relies on sites having been identified, recorded and characterised. The lack of consistent survey data and a firm knowledge base for many peatlands is therefore a key factor in terms of policy, which primarily affects the reliability, consistency and quality of information that can be provided to stakeholders by the relevant bodies. Attempts to understand and quantify the scale of the issues facing the historic environment record of peatlands in England led to the wetland survey projects and subsequent reviews described above (see Section 3). This has in turn provided the impetus for the development of research frameworks and agendas in some areas. Nowhere in the UK or Northern Ireland has developed a full research framework for the resource, although English Heritage produced *The Strategy for Wetlands* (Olivier & Van de Noort 2002), and the historic environment of wetlands was a theme developed within English Heritage’s National Heritage Protection Plan (*forthcoming*). National Research Frameworks have also been produced for Wales and Scotland. Table 7.2 shows the strategies, both national and sub-regional that exist across the UK and Northern Ireland.
**Table 7.2: Relevant Research Frameworks & Strategies in the UK**

<table>
<thead>
<tr>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
<th>N. Ireland</th>
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</thead>
<tbody>
<tr>
<td><strong>Strategies (wetlands)</strong></td>
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<tr>
<td><strong>Sub-regional</strong></td>
<td></td>
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<tr>
<td>Regional Research Frameworks MARISP HMEW 2002 Upland peat survey Yorkshire peat partnership</td>
<td>None known</td>
<td>None known</td>
<td></td>
</tr>
<tr>
<td><strong>‘Toolkits’</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetland Vision</td>
<td>None Known</td>
<td>None Known</td>
<td>None Known</td>
</tr>
</tbody>
</table>

*Wetland Vision* ([www.wetlandvision.org.uk](http://www.wetlandvision.org.uk)) represents a major collaborative initiative in England, involving English Heritage, The Environment Agency, Natural England, the RSPB and The Wildlife Trusts. It provides a philosophical and technical framework that highlights the potential for wetland creation, restoration and rehabilitation and has provided resources (information and grants) to support local delivery.

**7.4 Enhancing protection**

A number of key issues, underpinned by stakeholder responses, can be identified with regards to improving the protection that could be afforded to heritage assets in future:

- Variations exist in how legislation for the historic environment is interpreted and applied to peatlands;
- A lack of consistency in the collection of information has led to variability in how the resource has been assessed and recorded;
- There is a lack of consistency in the coverage and validity of policies and strategies for wetlands and peatlands;
- Consideration of palaeoenvironmental work in peatlands should be more systematically developed in research frameworks;
- Significant variations exist in terms of funding for the historic environment between regions;
- Specific policies and guidance on the historic environment are not being consistently developed and delivered in policies developed by other stakeholder groups.

**7.5 Summary**

Whilst historic environment legislation is available to enable the protection of the best and most valued peatland sites, it is only as effective as the knowledge which underpins selection. The principle of preservation *in situ* means that wherever possible, sites should be preserved in the ground rather than be excavated. As observed in Section 5, sites can only be protected in this way if they can be located, characterised and demonstrated to be stable within their associated burial environment; issues which can be problematic. Successful management of the archaeological and palaeoenvironmental resource of peatlands is therefore dependent upon the development of consistent policies and guidance, supported by a better understanding of the resource, alongside co-operation from a wide range of stakeholders and partners. In order to develop these policies, good communication,
advocacy and a consistency of approaches are needed across the sector as a whole. This is a challenge given the gaps in spatial and temporal knowledge regarding the distribution of sites and the difficulties associated with ‘filling’ these gaps (Section 5). The next section outlines the areas of possible conflict and also of consensus between different stakeholder groups.

8. Conflicts and consensus: management priorities for the historic environment of peatlands

The management priorities for the historic environment of peatlands are substantially those of other key stakeholders, although areas of possible conflict exist (Table 8.1). Generally, all groups prioritise management practices that:

- Stabilise peat and reduce erosion;
- Halt the physical removal of peat;
- Maintain high water tables;
- Promote active peat formation.

These actions provide significant positive gains for the protection and preservation of the four different elements (as defined in Section 4) of the historic environment record of peatlands.

In the context of peatland management, the palaeoenvironmental archive has much to offer other stakeholder groups through providing a long-term record of the extent, distribution and character of peatlands in the past. The palaeoenvironmental record can assist in understanding a range of issues which concern peatlands, including hydrological and vegetation changes, management practices (including burning) and carbon deposition and storage. These data also provide an evidence basis for the possible consequences of future climatic change. Recent initiatives such as the ‘Bridging the Gap’ network should ensure continued and profitable dialogue between palaeoenvironmental researchers and other stakeholders (http://www2.hull.ac.uk/science/geography/research/environmental_change/mjb3.aspx), but this area requires further consideration in terms of potential mutually beneficial knowledge transfer.

Examples of ‘best practice’ do exist. The Exmoor Mire Restoration Project (http://www.exmoor-nationalpark.gov.uk/mire) has been working to restore damaged peatlands on this upland for the last 4 years (David Smith, Exmoor NPA, pers. comm.). Seventeen archaeological sites have been re-wetted and a mitigation agreement devised by the mire project office and the Exmoor NPA Archaeologists which seeks to avoid any known areas of historic interest within the peat. Plans pertaining to restoration work are submitted in advance of the work to the park’s archaeologists to allow time for potential impact of such work on archaeologically sensitive areas, including those significant for their palaeoenvironmental record. The appropriate archaeological and/or palaeoenvironmental response can be devised including any amendments to the proposed scheme or required archaeological fieldwork. This strategy is now standard practice for any contractors or individuals undertaking hydrological restoration work on mires on Exmoor. It is hoped that the strategy may form the basis for future mire restoration work across the whole of the southwest of England.

Where conflicts arise (Table 8.1), they tend to surround the methods by which different goals are achieved. The processes of peatland restoration undertaken in collaboration with historic environment specialists provide a means and mechanism for assessing and recording archaeological and palaeoenvironmental remains, resulting in subsequent advances in the state of knowledge. Without input from the historic environment sector, management actions
that might impact directly or indirectly (Section 6) on the peat matrix pose a risk to the in situ integrity of the historic environment peatland record (Section 4). Conflicts may arise when certain conservation measures which do not require planning consent are carried out, which may preclude input from the historic environment sector and possibly lead to the discovery of and/or unintentional damage to the archaeological and palaeoenvironmental resource.

*Table 8.1: Harmonies and possible areas of conflict between IUCN UK Peatland Programme review areas*

<table>
<thead>
<tr>
<th>Review area</th>
<th>Harmonies</th>
<th>Conflicts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. State of peatlands</strong></td>
<td>Knowledge of the extent and condition of peat, Understanding peat depth and properties in 3D</td>
<td>Terminologies and mapping of peat, Methodologies for defining condition of peatlands</td>
</tr>
<tr>
<td><strong>2. Climate change</strong></td>
<td>Provision of an evidence basis for past change</td>
<td>Disturbance of in-situ peat during restoration</td>
</tr>
<tr>
<td><strong>3. Biodiversity</strong></td>
<td>Promotion of functioning, peat building systems, Maintenance of high water tables, Provision of an evidence basis for past change, Removal of scrub and higher vegetation (plantations)</td>
<td>Focus on vegetation and peat surface, not on peat matrix, Seasonal lowering of the water table for management, Disturbance of peat matrix for habitat creation, Disturbance of in-situ peat during peat rehabilitation</td>
</tr>
<tr>
<td><strong>4. Restoration</strong></td>
<td>Promotion of functioning, peat building systems, Maintenance of high water tables, Opportunities for generating understanding of historic environment</td>
<td>Loss of visible, surface, evidence of peatland exploitation, Disturbance of in-situ peat during restoration works, Disturbance of in-situ peat during rehabilitation</td>
</tr>
<tr>
<td><strong>5. Burning</strong></td>
<td>Provision of an evidence basis for past change, Increased visibility of heritage assets on surface</td>
<td>Degradation of peat surface</td>
</tr>
<tr>
<td><strong>6. Hydrology</strong></td>
<td>Provision of an evidence basis for past change, Maintenance of high water tables</td>
<td>Seasonal lowering of the water table for management, Disturbance of in-situ peat during restoration works</td>
</tr>
</tbody>
</table>

Historic environment practitioners and managers, in common with carbon management groups, seek to understand peatlands on a range of scales, ranging from the ‘macroscale’, such as mapping the three dimensional extent of peat deposits, through to investigating the nature and behaviour of the microenvironment of the peat matrix itself. There are clear areas of overlap in terms of future research priorities. However, methods of measuring and determining peat condition in particular can vary between stakeholders. Some groups (e.g. hydrology, biodiversity) place the emphasis on the surface, rather than the sub-surface, condition of peatlands. High water tables are a key to the preservation of the archaeological and palaeoenvironmental resource, but seasonal lowering of water tables may be desirable for nature conservation and biodiversity. Fluctuating watertables can be damaging to archaeological and palaeoenvironmental deposits, especially if they are situated within the zone of fluctuation. Overall, most practices are of considerable net benefit to the historic environment, provided that adequate dialogue exists with other stakeholder groups.

**9. Conclusions**
This report has summarised the importance of peatlands for the historic environment, based principally on a review of the available literature alongside the gathering of current views from a range of stakeholders through a questionnaire survey. Existing literature was found to be relatively abundant for the English peatlands, with a series of large-scale wetland surveys that included the study of the largest peatlands in England undertaken since the 1970s and funded by English Heritage. Information from Northern Ireland, Scotland and Wales was less plentiful, but a number of archaeological projects that include peatlands are currently being undertaken. The main conclusions drawn in this report are summarized below.

The value of peatlands for the historic landscape comprises four, in practice partially overlapping, categories:

- Sub-peat archaeology, where peat deposits conceal the pre-peat landscape including any remains associated with human activity;
- Archaeology preserved within the peat matrix itself, where sites and artefacts are preserved in the peat forming environment and benefitting from waterlogged, acidic and anoxic soil conditions that play a critical role in the long-term preservation of a range of organic (and to a lesser extent: inorganic) archaeological materials;
- Archaeology located on the surface of the peat, including the industrial archaeology and historic record of peat cutting, and the surviving landscape of late medieval and early modern human activity, for example their use as Royal Forests for hunting;
- The palaeoenvironmental archive preserved within the peat, including pollen, plant and insect remains, and other ‘proxies’ that can be studied to reveal aspects of past changes in climate, environment and vegetation; this includes the origin and development of the peatlands.

On the basis of previous research on English wetlands, this project has extrapolated the density of archaeological sites within peatlands so that an outline of the potential resource can be presented. This indicates that the total number of archaeological sites beneath and within the peat, and on the peat surface is around 22,500. The highest number of sites (c. 11,000) would be in Scotland, followed by England (c. 7,000), Northern Island (c. 3,500) and Wales (just over 300 sites).

The literature review and stakeholder questionnaire identified a number of gaps in our knowledge of the importance of UK peatlands for the historic environment. These include:

- A poor understanding of the spatial distribution and density of archaeological sites in peatlands;
- Limits to the chronological span of sites, and a dearth of information on Roman and post-Roman peatlands where the upper layers have been removed by peat extraction or erosion;
- A poor understanding of the formation processes of peat;
- Limits in the understanding of the preservation of peat, and of archaeological remains within the peat matrix, in particular in relationship to hydrogeological processes;
- The absence of (geophysical) techniques that can identify archaeological remains buried beneath or within the peat;
- A lack of understanding of the impact of management practices on the peatland as a historic environment;
- A poorly developed understanding of the value of peatlands as historic landscapes amongst the public and other stakeholders and a poor understanding of how to remedy this.

One of the respondents to the questionnaire summed up this situation eloquently, by noting that: “We probably have more gaps than we have knowledge.”
The main threats to peatlands as historic landscapes are the same as the threats to the ecological functions of peatlands. These include:

- Destruction of peatlands through peat extraction, thereby destroying the archaeology and the palaeoenvironmental archive;
- Erosion of peatlands due to over-grazing, or foot and vehicle access, directly destroying the peatland archaeology and the palaeoenvironmental archive;
- De-watering of the peatland through drainage or water abstraction, thereby oxidising organic archaeology and the palaeoenvironmental archive leading to their deterioration and eventual destruction;
- Reclamation of peatlands for agricultural purposes, resulting in the desiccation and degradation of peat matrix and eventual destruction of archaeology and the palaeoenvironmental archive;
- Afforestation of peatlands changes the soil chemistry and hydrology of the peatlands and, together with root damage, leads to damage to, and eventual destruction of, peatland archaeology and the palaeoenvironmental archive;
- Burning (controlled and wild fires) of peatlands leads to peat loss, resulting in exposure and destruction of archaeology and the palaeoenvironmental archive.

The report noted that modern climate change will have far-reaching consequences for the UK peatlands. Probably the greatest impacts will be noticed in the south of the UK, where precipitation is expected to fall significantly during summer months, leading to the drying out of mires and oxidisation of the archaeology and palaeoenvironmental archive. For all UK peatlands, the prediction of more frequent extreme weather events will have largely unforeseen consequences. It also noted the impact of climate change through measures to mitigate against global warming, for example in the form of wind turbine developments on peatlands.

The report outlined the historic environment legislation in the UK. Historic environment legislation is, in principal, able to protect the most valuable peatlands. However, the successful management of peatland archaeology and palaeoenvironmental archives requires the development of consistent policies and guidance which are shared by all stakeholders. The report advocates good communication, advocacy and a consistency of approaches.

The report observed that, where conflicts exist between the historic environment and other ecosystem functions of peatlands, these tend to concern the methods by which certain goals are achieved and not the goals themselves. Indeed, a peatland that is a living, wet and flourishing ecosystem offers the best protection for the historic environment and the palaeoenvironmental archive, beneath and within the peat.

Nevertheless, areas of potential conflict include:

- The seasonal lowering of the water table for reasons of peatland management;
- Disturbance of the peat matrix for habitat creation and of *in-situ* peat removal during restoration management;
- The loss of visible, surface, evidence of peatland exploitation;
- The degradation of the peat surface.

The areas of common interest are far greater, and include:

- Shared knowledge of the extent and condition of peat, and understanding peat depth and properties in 3D, will assist peatland management for ecological and archaeological purposes;
• An evidence basis for past change from archaeological and palaeoenvironmental research can help in developing peatland management plans and practices;
• The promotion of functioning, peat building systems with high water tables serves the ecology and historic environment functions of peatlands equally well;
• Removal of scrub and higher vegetation (plantations) returns peatlands to their natural state and helps to protect the archaeology and palaeoenvironmental archive of peatlands;
• Sensible peatland management provides opportunities for generating a new understanding of the historic environment.

Finally, this conclusion advocates the increased dialogue between stakeholders involved in peatland protection, to improve the quality of integrated peatland management. Such dialogue should focus on three areas:

• The inclusion of appropriate archaeological and palaeoenvironmental assessments in advance of restoration/rehabilitation works. Examples of best practice exist, for example on Dartmoor, where peatland restoration works are preceded by meetings involving archaeologists and nature conservationists. It should be noted that palaeoenvironmental assessments have the potential for informing key review areas, notably climate change and carbon audits; hydrological functioning and trajectories of peat forming communities in the past which could be replicated in the future;
• The methodologies for defining the state and condition of peatlands need to be discussed, and appropriate ‘fit for purpose’ strategies developed that also seek to protect the archaeology and palaeoenvironmental archive; this could be achieved by means of monitoring additional peatland properties, such as redox potential and water quality;
• The management practices that involve physical disturbance to the peat matrix need to be reviewed; this can be achieved by maintaining adequate records and plans of where peat has been removed from and where it has been moved to.

Acknowledgements

We are grateful to individuals and organisations who responded to the stakeholders’ survey, particularly given the tight timescales involved. We are also grateful to Dr Jen Heathcote (English Heritage) for her invaluable advice and guidance. We are appreciative of Frank Bradford and Chris Chapman for permission to reproduce their excellent photographs. Finally, we are grateful to Dr Aletta Bonn and the other members of the IUCN UK Peatland Programme team for all of their input and support.

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Web links

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[www.archaeoleg.org.uk/intro](http://www.archaeoleg.org.uk/intro)

[www.somerset.gov.uk/somerset/cultureheritage/heritage/projects/marisp](http://www.somerset.gov.uk/somerset/cultureheritage/heritage/projects/marisp)