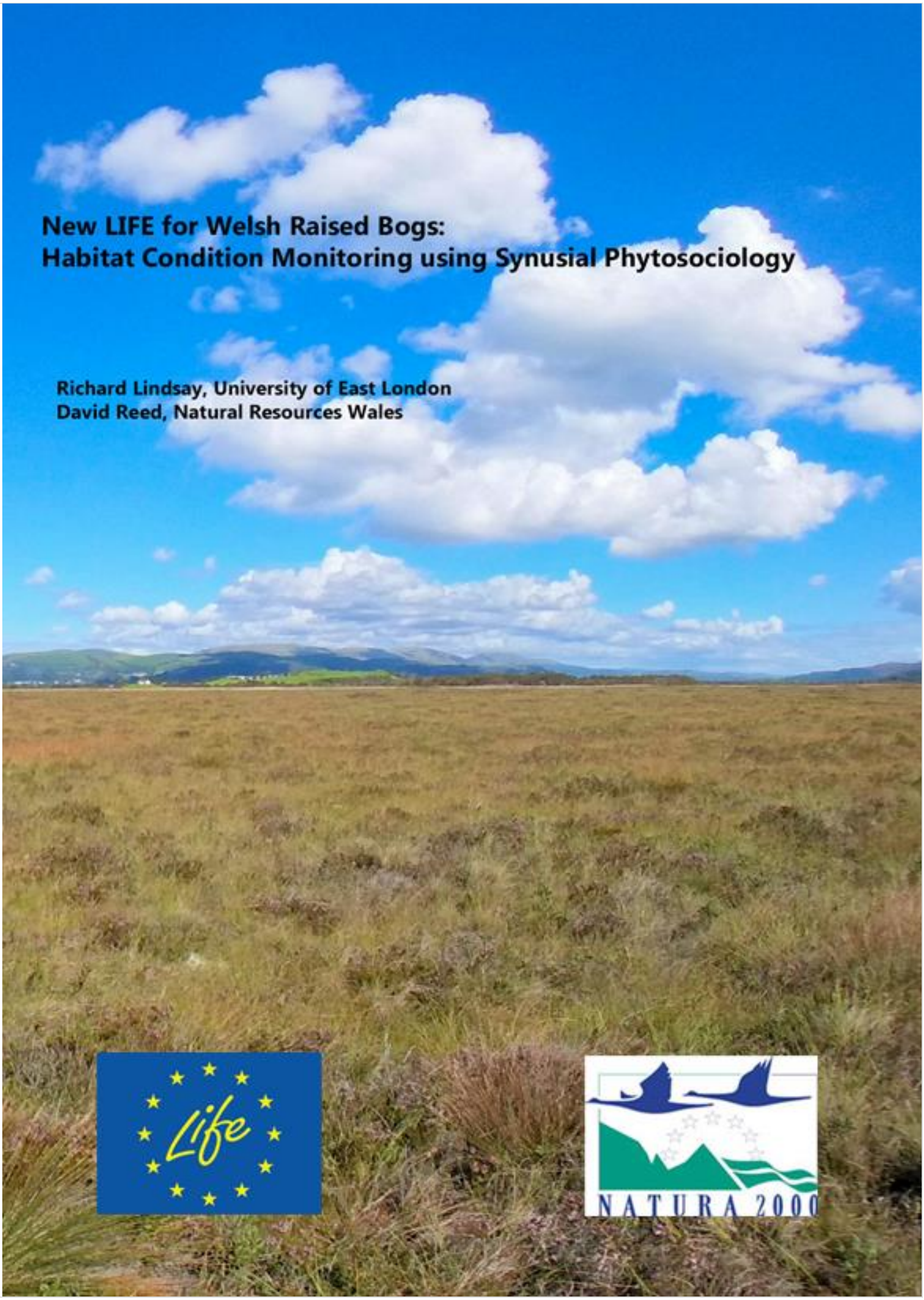
# New LIFE for Welsh Raised Bogs: Habitat Condition Monitoring using Synusial Phytosociology

**Richard Lindsay, University of East London**
**David Reed, Natural Resources Wales**



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## Contents

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## Executive Summary

1. The habitat condition of nine individual raised bog units is assessed in this report as part of the EU-funded New LIFE for Welsh Raised Bogs Project. These sites are distributed across Wales, ranging from the Pembrokeshire peninsula in the west to the Welsh-English border in the east, and from Eryri National Park (Snowdonia) in the north to the fringes of Bannau Brycheiniog National Park (Brecon Beacons) in the south.

2. The sites range in size from only some 250 m in diameter to the largest single raised bog dome in Wales with a surviving diameter of 3 km, as well as one of the largest raised mire complexes to survive in the UK. All of these sites have experienced significant impact, with some now very substantially reduced from their original natural extent while others have been subject to a variety of uses which have altered their character. The habitat condition of each of these sites thus inevitably displays the effects of these various historical impacts, and the objectives of the New LIFE for Welsh Raised Bogs Project are to halt existing degradation, support areas of resilience and provide pathways to recovery across all nine sites.

3. To this end, it was important that a suitable baseline of habitat condition is established against which these objectives can be measured and which could help to guide decision-making going forward in terms of what sort of interventions might be required and where they might most appropriately be applied.

4. Current UK approaches to the assessment of peat bog habitat condition, namely the National Vegetation Classification (NVC) and the Common Standards Monitoring System (CSM) are acknowledged as operating at too broad a scale of description to be capable of providing the necessary levels of detail required for the purposes of this project. In particular, neither approach utilises long-recognised key components of peat bog ecosystem diversity, in particular the distinctive small-scale 'hummock-hollow- microtopography of peat bog systems, meaning that these approaches were unable to identify features to target for restoration intervention and signals to look for as signs of success.

5. These key components of peat bog ecosystem diversity occur at differing spatial scales which together form a hierarchy of landscape features interlinked through their morphology, hydrology and biodiversity. This hierarchical approach to landscape ecology is the foundation of what is termed 'integrated synusial phytosociology' amongst continental European ecologists and was selected to form the basis of condition assessment for the current project.

6. In the case of the current project, integrated synusial phytosociology addressed peat bog condition at several distinct but interlinked scales:

    - the **macrotope** scale: the bog as an ecosystem complex consisting of the raised bog dome together with its contact zone (the lagg-fen) with the surrounding mineral ground and mineral ground-water table;
    - the **mesotope** scale: the morphology of the raised bog dome itself;
    - the **microtope** scale: a consistent area of surface texture, or patterning;

- the **nanotope** scale: the individual small-scale features, such as hummocks, or hollows, that create areas of consistent surface texture;
- the **synusial vegetation communities** that create the small-scale nanotope features.

7. The nine bogs were assessed using current and historical aerial photography to determine:

   - the likely condition of the macrotope complex as a whole (i.e. presence of natural lagg fen contact zone);
   - the condition of the mesotope (e.g. areas impacted by peat cutting, or by drainage);
   - polygon boundaries around areas of consistent texture/patterning.

8. For each bog, a minimum of five GPS waypoints was located within the collective polygon boundaries for each identified texture type and these were used as sampling points for ground-truth survey.

9. Ground-truth survey was based on the use of a 'condition matrix' at each survey point. The matrix recorded the presence and frequency of nanotope structures, or vertical 'zones', as well as the presence of pre-defined vegetation assemblages occurring within these structures. The matrix uses a 'traffic-light' colour coding system to assign each combination of vertical zone and vegetation assemblage to a condition-state. In addition, a synusial quadrat was also taken at each survey point. This involved recording abundance of each species within each nanotope zone.

10. Subsequent analysis of the field data was carried out using a combination of principal components analysis and reciprocal averaging to identify extreme outliers, then TWINSPAN to generate groupings, or 'end groups' from the two sources of data – namely the condition matrix sheets and the synusial quadrat sheets.

11. Analysis resulted in 42 combinations of nanotope zones or 'zone end-groups' (ZEGs), 26 combinations of matrix-defined vegetation assemblages or 'vegetation end-groups' (VEGs), and 20 synusial species communities (SYNs).

12. The 42 ZEGs were then grouped into six broad condition-states ranging from relatively natural to highly degraded. Each VEG was assigned to one of 12 condition-states, coded according to the 'traffic-light' colour-coding of the condition matrix, again ranging from relatively natural to highly degraded. The 20 synusial groups were classified into five broad classes of species community, identified as enriched bog margin, damaged bog resembling wet heath, degraded dry bog, relatively natural bog, and highly degraded bog. These were further sub-divided into 11 sub-groups of condition.

13. The ZEGs, VEGs and SYNs were then plotted onto the mesotope polygon maps for each site in order to map the distribution of the various condition-states present within each site. This mapping highlighted the fact that the disturbed nature of all nine sites resulted in complex mosaics of condition where, within any given texture/microtope polygon, indicators of better-quality bog might occur as small patches within otherwise poorer-quality habitat and vice-versa.

14. Cernydd Carmel emerged as the most disturbed of the nine sites, Waun Ddu was revealed to be the most relatively intact macrotope complex, while the best remaining areas of good-condition bog vegetation and microtopography were to be found on three of the smallest surviving raised bog remnants (Cors Caron NE and SE Bogs, and Cors Goch Trawsfynydd) as well as across parts of the largest site, most notably in areas of restored peat cuttings (Cors Fochno).

15. Cernydd Carmel was shown to possess only small patches of original primary bog surface distributed within a general expanse of highly disturbed bog dominated by large tussocks of *Molinia caerulea*. In places the degradation is so severe that true erosion gullies have formed – a rare feature on lowland raised bogs. These disturbed areas may represent revegetation of very old secondary peat cuttings or be the result of repeated intense fires. Given the absence of archival records, analysis of peat cores would be the only way of determining the true nature of this ground.

16. The large raised bog complex of Cors Caron was found, overall, to be in relatively poor condition. The complex as a whole had lost its lagg fen system, while the NE Bog and SE Bog had both been very substantially reduced in size by domestic peat cutting. Despite this, both still possessed areas of relatively good-condition bog habitat, albeit mixed with indicators of poor condition. The large West Bog, in contrast, was still largely intact as a primary raised bog dome but was found to be in generally poorer condition than either of the two smaller bogs in the complex. Its northern end was shown to be still recovering from the effects of a severe fire in the 1980s – severe enough to create erosion gullies – while the remainder of the bog was revealed as rather dry and tussock-dominated with only limited occurrence of the 'hummock-hollow' microtopography characteristic of good-quality bog habitat.

17. Cors Fochno, as the largest single raised bog in Wales and one of the largest surviving raised bogs in the UK, might have been expected to possess extensive areas of good-quality habitat. While this was the case in the eastern portion of the site, the condition of western parts was significantly reduced by the effects of large-scale drainage works. In addition, Cors Fochno as a functioning macrotope complex no longer exists because virtually the whole of the lagg-fen system has been lost, while the original raised bog primary mesotope has been substantially reduced as a result of domestic peat cutting. Perhaps the most significant feature in terms of habitat condition is the fact that the crown of the primary dome no longer supports *Sphagnum* hollows, while some of the best-condition habitat is now to be found in peat cuttings which have benefitted from at least two rounds of restoration intervention.

18. Although a small site, and one further reduced in extent by the encroachment of domestic peat cutting and agricultural land-claim, Cors Goch/Trawsfynydd retains areas of relatively good-condition bog habitat. It has lost its lagg fen and thus no longer represents a functioning raised bog macrotope complex, but remnant areas of 'hummock-hollow' microtopography persist on the surviving primary mesotope dome.

19. Esgyrn Bottom is one of the most damaged of the nine sites, second only to Cernydd Carmel in terms of its habitat condition. The majority of the primary raised bog

mesotope has been lost to domestic peat cutting resulting in extensive areas of ground dominated by large tussocks of *Molinia caerulea*. A few small patches of primary dome remain, and in places these possess small patches of relatively good-condition bog habitat but these are set within broader expanses of poor-quality dry bog habitat. A central watercourse may be a canalised natural system or may be an entirely artificial drainage channel, but in either case it does not act as a lagg fen system but rather as a drainage feature.

20. Rhos Goch retains one of the best lagg-fen systems seen in across the nine raised bog systems, but its primary raised bog mesotope has been very substantially impacted by its historic use for (probably) flax-retting. This has resulted in the primary dome being converted into a dense series of artificial hollows with very dry baulks between. The hollows now often possess areas of good-condition secondary bog habitat while the baulks are dominated by a mixture of *Molinia caerulea* tussocks and bog vegetation resembling dry heath.

21 Waun Ddu is the smallest of the nine raised bog systems and is the only one to retain a lagg fen in its entirety. The mesotope dome, while appearing to be intact, has in fact been subject to domestic peat cutting in the distant past and these areas of cutting have now regenerated to the point where they are almost indistinguishable from areas of original primary dome. In terms of its microtope and nanotope character, Waun Ddu displays a low-relief microtopography typical of high-quality raised bog, but the somewhat artificial nature of this is indicated by the vegetation communities occupying this microtopography. Waun Ddu has until very recently been used as a gathering ground for very large numbers of sheep. This has resulted in a vegetation which is more typical of an enriched bog margin than of more typical bog vegetation, and the trampling by large numbers of sheep also explains the low-relief nature of the microtopography.

22. Through the use of integrated synusial phytosociology these nine raised bogs have been shown to be largely dominated by poor-condition raised bog habitat, although remnant areas of relatively good-condition habitat remain. The condition-matrix sheets provide a readily-understood system of 'traffic light' indications of condition-state and highlights the fact that every one of the nine raised bogs displays evidence of damage and degradation though some also retain features indicative of good habitat condition.

23. The primary factors resulting in poor condition are:

- surface drainage resulting from loss of primary mesotope to domestic peat cutting and agricultural land-claim;
- fire damage;
- loss of lagg fen resulting in systemic hydrological instability of the raised bog macrotope complex.

24. Of the nine sites, Waun Ddu is probably the site most capable of rapid recovery to good condition because it is the one site which still retains a relatively intact macrotope complex. Cessation of its use as a gathering ground and establishment of a very low-level grazing regime would do much to allow this site achieve good habitat condition. In contrast, while the proposed (and now largely completed) bunding of

the remaining sites will do much to address loss of surface water from the remaining primary mesotope domes, the more fundamental issue affecting the hydrology of the macrotope complex – namely loss of the lagg fen component of the macrotope – undoubtedly represents a more complex challenge in terms of restoration intervention because of the potential impact on adjacent land. It is, nevertheless, a challenge that must be addressed if the sites are to be restored to fully functioning and self-sustaining raised bog macrotope complexes.

# 1. Introduction

1.1 The New LIFE for Welsh Raised Bogs Project, funded by the EU LIFE financial instrument and supported by the Welsh Government and Snowdonia National Park, sought to bring back into good ecological health nine of the 50 peatlands sites in Wales categorised as raised bog peatland. All nine of these raised bogs have experienced significant human impact (Lindsay & Immirzi, 1996) ranging from domestic peat cutting, agricultural land claim and deep drainage, to pits dug for flax retting, frequent burning, atmospheric pollution and overstocking with livestock. Consequently all nine sites display various degrees of degradation, resilience and, in some cases, recovery. The purpose of the New LIFE for Welsh Raised Bogs Project was to halt existing degradation, support areas of resilience and provide pathways to recovery across all nine sites.

1.2 In order to provide evidence that the range of conservation interventions employed during the course of the project do indeed achieve the intended aims, an important part of this programme involves establishing a baseline of habitat condition against which subsequent improvement (or otherwise) can be measured. In order to detect such change, an ecologically appropriate method of habitat description is required, and for various reasons discussed in the next section of the present report, the 'standard' methods of assessing peatland habitat condition in the UK were not considered sufficient for this task. Consequently a rather different approach was devised and adopted for the present project. It is an approach based on principles established more than 100 years ago and widely used, in various forms, across the European Continent.

1.3 The approach used in the present report is based on what is known (in the UK) as 'continental phytosociology' (Braun-Blanquet, 1928, 1932), though with an added refinement based on a concept set out by Gams (1918) which seeks to identify the smallest functional ecological unit, or 'synusia', as the building block of all ecological assemblages. In recent years the approach of 'synusial phytosociology' has been gaining ground across continental Europe (e.g. Gillet & Gallandat, 1996) as well as elsewhere around the world. Its underlying principles have also been used to good effect in certain key conservation cases in the UK (e.g. Lindsay *et al.*, 1988) and it forms the basis of official guidance for the selection of peat bogs protected by statute (SSSIs) in the UK, although the term 'synusial phytosociology' does not feature in the guidance (JNCC, 1994).

## 2. Peatlands as a 'two-phase' system

2.1 It has been noted since earliest times that the surfaces of bog peatlands and many types of fen peatland ecosystems are not smooth but instead display an uneven surface consisting of what has long been termed 'hummock-hollow microtopography' created by the particular growth-forms of moss species, predominantly species of the Genus *Sphagnum* (Weber, 1902; Osvald, 1923: Tansley, 1939; Godwin & Conway, 1939). This two-phase architecture, in which hummocks represent a terrestrial environment while hollows generally represent a more aquatic environment, is an almost universal feature of peat bogs as well as certain fen peatlands. It is seen in peatlands from the tropics to arctic (and Antarctic) regions and from sea-level to arctic-alpine zones.

2.2 Such a two-phase architecture was originally considered to represent a closed successional cycle where hummocks eventually grew beyond the influence of the bog water table and so dried out, subsequently degrading and collapsing to form hollows. Meanwhile hollows steadily accumulated peat to grow into hummocks, before again drying out and collapsing and thus completing the successional cycle. This presumed successional process was termed the 'hummock-hollow regeneration cycle' (Tansley, 1939) and can still be encountered today in certain accounts of peatland ecosystems.

2.3 It is now understood, however, that this is not generally how this two-phase architecture functions. Hummocks instead grow vigorously, accumulating fresh peat, drawing the bog water table up within this peat while adjacent hollows generate relatively little fresh peat and thus constrain the rate at which the overall bog water table can be drawn up by the hummocks. Belyea & Clymo (1998) liken the process to a puppy straining forward on its leash while the owner walks steadily behind constraining the rate of their combined onward motion.

2.4 Furthermore, Barber (1981) and Belyea & Clymo (2001) demonstrate how the hummock-hollow architecture provided the essential elements of a self-regulatory process that enabled peat bog systems to continue laying down peat despite substantial shifts in climate over millennial timescales. During dry phases in the climate when precipitation inputs to the bog were relatively low, hummock-forming species tended to become dominant because they could tolerate these drier conditions and also offered more resistance to lateral water losses than the aquatic hollows through which water could more more readily. Consequently hummocks tended to expand at the expense of hollows during such dry phases.

2.5 Conversely, when the climate became wetter and increased precipitation led to an excess of water on the bog surface, aquatic species of *Sphagnum* were favoured. This leads to an expansion of hollows and pools through which excess surface water could flow more readily and thus this excess would be shed from the site in a controlled way. Although the number of hummock features was reduced by expansion of hollows and pools, control of the increased rate of lateral water movement continued to be provided by the remaining hummock features.

2.6 This two-phase architecture did not, as was first thought, thus represent a localised dynamic feature with little consequence beyond the area of an individual hummock or hollow. This architecture instead represents a finely-tuned and responsive system fundamental to self-regulation of the bog system as a whole.

2.7 This responsive self-regulatory system is further enhanced by the regular arrangement of these individual small-scale features of 'hummock' and 'hollow' – technically termed 'microforms or nanotopes' - to create distinctive surface patterns, or 'microtopes' (Ivanov, 1981; Lindsay, 1995; Joosten *et al*., 2017). These microtope patterns provide meso-scale control of lateral surface-water movement and thus offer a further means of responding to changes in the overall water balance of a peatland.

2.8 The relationship between the two phases – terrestrial and aquatic – and the patterns created by their organised arrangement has formed the basis of much effort to model the development of peat bog systems and their millennial-scale process of peat accumulation (Couwenberg & Joosten, 2005; Belyea & Clymo, 2001; Okada, 2013). As such, this assemblage of architectures, which is such a characteristic feature of peatland systems, is recognised as representing a fundamental part of what a peatland ecosystem is, how it forms and is maintained over millennial timescales, as well as defining its ecological character.

2.9 The history of vegetation description during the last century has, however, meant that this essential dynamic component of peatland ecosystems has meant that, in the UK at least, the contribution of this aspect has not featured, or barely done so, within approaches to assessment of peatland habitat condition. To understand why this is the case, and how the current programme of monitoring for the New LIFE for Welsh Raised Bogs Project has sought to overcome this, it is necessary to understand the development of methods currently employed for condition-mapping in the UK.

## 3. Peatland condition mapping in the UK

3.1 Systematic description of vegetation assemblages began in Europe in the inter-war years with development by Braun-Blanquet (1928, 1932) of a formal approach to categorising and classifying plant assemblages, an approach which he termed 'phytosociology'. Although this then formed the basis of vegetation classification in the UK during the first half of the last century (e.g. Tansley, 1939; McVean & Ratcliffe, 1962), advances in computing in the post-war years led ecologists in the UK to focus more on the numerical analysis of complex datasets relating plant distribution to environmental gradients, thus giving rise to the term 'gradient analysis'. Associated statistical and graphical presentation of results using such computing power through various approaches which were referred to by the broad term of 'ordination' contrasted with the less obviously numerical approach of phytosociological 'classification' (Whittaker, 1973).

3.2 These two approaches increasingly went their separate ways, with numerical ordination being favoured by ecologists in the UK and the US, while phytosociological classification remained the predominant means of vegetation description on the continent. One consequence of this divergence was that continental botanists were able to generate national or regional maps of vegetation types because classification provided usable mapping classes. Inh contrast, such maps were not, and indeed could not, be generated for vegetation systems in the UK and the US because gradient analysis focuses on the way in which individual species are distributed along environmental gradients in a continuum, leading certain authorities to claim that 'there is no such thing as a plant community'.

3.3 Moreover, an increasing belief came to be held within the UK and US vegetation community that numerical gradient analysis using approaches such as ordination were in some way more 'objective' than the perceived 'subjective method of defining vegetation classes underpinning phytosociology, rendering numerical gradient analysis somehow superior to phytosociological approaches. This suspicion of phytosociology as a subjective approach wholly dependent upon the 'eye' of the expert was stimulated in the 1950s by a series of critical (though flawed) papers published by Poore (1955a,b,c). As such, botanical textbooks and published journal papers catering for the anglophone audience have tended to focus on numerical approaches and devoted little attention to phytosociological approaches because of the implied suggestion that phytosociology is subjective and therefore less robust than the favoured numerical approaches (e.g. Kent & Coker, 1992).

3.4 Such an impression of phytosociology is false and is based on a misunderstanding of the fundamental methods which underpin the system. While it may be true that final decisions about the resulting classes and hierarchies of phytosociology are to some extent subjective, this is also true of many steps within the numerical approach, from deciding on the area to be sampled, the size and number of samples, the parameters used to control the analysis, decisions made about interpreting species groupings which emerge from an ordination plot and the conclusions drawn from these subjectively-defined groupings.

3.5 The example exercise presented by Mueller-Dombois & Ellenberg ( 1974, pp. 177-195) uses meadow data to illustrate how the method of 'phytosociological sorting' of field data, which represents the first and most fundamental stage in phytosociology, objectively generates obvious and ecologically-meaningful vegetation groupings. Furthermore, and most significantly, even if the provided species names are hidden and the given abundance values are reduced to simple presence-absence, these same groupings emerge. As such, these groupings are as objectively defined as any outputs from the purportedly more objective approach of numerical analysis.

3.6 Furthermore, where very large datasets are involved, continental phytosociologists have employed numerical methods to begin the initial stages of sorting. In particular, they have used a numerical routine developed in the late 1970s by Hill (1979) called TWINSPAN (Two Way INdicator Species ANalysis). This programme is a numerical classification system which divides a dataset into successively smaller classes or 'end-groups' and is thus more compatible with the principles of phytosociological classification than would be the case for approaches generally employed in numerical gradient analysis.

3.6 However, while some in the UK have employed TWINSPAN to analyse their data, the main consequence for nature conservation arising from the UK's over-riding focus on numerical ordination analysis rather phytosociological classification was that UK vegetation science was not creating vegetation classes which could be mapped. This meant that when an an area considered to be of conservation value was under threat and decision-makers asked how extensive the particular vegetation assemblage of interest was within the wider regional or national context, it was not possible to give an answer. Whereas on the continent many nations had produced complete national vegetation maps which helped to put any particular vegetation assemblage into context, no such map existed for the UK – a position which is still the case today.

3.7 Given this absence of a vegetation classification with which to create maps of vegetation assemblages for conservation purposes, the statutory nature conservation for Britain (the Nature Conservancy Council - NCC) commissioned the University of Lancaster to produce a workable classification system for Britain. This could have been the point at which Britain returned to the use of phytosociology and employed a ready-made classification system. Unfortunately the decision was instead made to devise an entirely new system of vegetation classification based largely on existing UK field-datasets. This became the National Vegetation Classification (NVC), which is now the standard method of describing vegetation assemblages for nature conservation and planning purposes.

3.8 The NVC has been published as a series of volumes, with one of the first being that for mires and heaths (Rodwell, 1991). The introduction for the mires section of this volume begins with the following observation:

> *"In our survey of mires, the primary purpose has been to provide a classification of their vegetation according to its floristic composition, and not to categorise mires on the basis of their ecological development or hydrology, their situation in the landscape, or their gross morphology or fine surface patterning."*

The NVC for mires therefore excludes from specific consideration one of the core ecological features of a mire system, a feature which plays a central role in creating the ecosystem diversity and biodiversity of these systems, as will be described and demonstrated throughout the remainder of the present report.

3.9 Furthermore, because the NVC made extensive use of existing datasets in its development and many of these datasets used sampling strategies which made no distinction between different components of peatland patterning, the final classification specifically for peat bog vegetation types is limited to seven major vegetation communities together with a small number of sub-communities. In contrast, just small-herb fens are assigned to 31 vegetation communities while 22 forms of heath vegetation are recognised.

3.10 The NVC for mires is thus a broad-brush approach to the description of peat bog systems in the UK. It is a valuable tool for describing vegetation at regional or national scales, but it is increasingly recognised as not being suited to the task of assessing changes in peat bog habitat condition on any specific site. The likely, and observed, changes resulting from, for example, restoration intervention or from various forms of impact are often too subtle for the NVC to detect until such time as major change has occurred. Often the critical changes are rather subtle and would never become apparent if using the NVC as the assessment tool.

3.11 The limitations of the NVC as a tool for assessing changes in habitat condition was soon recognised by the statutory country conservation agencies which were the successors to the NCC. As a result, the UK coordinating body for the agencies, the Joint Nature Conservation Committee (JNCC) issued a guidance document to be used for monitoring the condition of protected sites. This guidance was termed Common Standards Monitoring (JNCC, 2004, 2009).

3.12 The Common Standards Monitoring (CSM) guidance for raised bogs within the lowland wetland habitats guidance and for blanket bogs in upland habitats both specify a range of features which should be evaluated when undertaking condition assessment. While the relevant NVC communities are mentioned, most attention is devoted to physical attributes of the habitat as well as to particular positive or negative indicator species. For lowland raised bogs there is a requirement to note any modification of surface patterning and record any reduction in the extent of microtopographic features, while for upland blanket bogs the focus is on positive and negative indicator species together with evidence of impact on 'sensitive areas', which are described as:

> *"Areas with notably uneven structure, at a spatial scale of 1m$^2$ or less. The unevenness should be the result of Sphagnum hummocks, lawns and hollows, or mixtures of well-developed cotton grass tussocks and spreading bushes of dwarf shrubs."*

3.13 Whilst this guidance highlights the fact that surface microtopography is a feature of interest, it provides little specific guidance about the character of this microtopography and what part it might play in assessing habitat condition – other than (unspecified) change or its absolute presence or absence. Indeed, as will be seen in subsequent sections of the present report, tussocks, which are specifically mentioned in the quote above as being a sensitive feature, are generally indicators of damage. The current guidance is thus presenting mixed messages about how the nature of any microtopography should be interpreted.

3.14 In addition, although adding 'lawns' and 'tussocks' into the catalogue of microtopographic features to note, the guidance remains largely focused on the rather simple two-phase concept of the hummock-hollow architecture. It also implies that microtopography only occurs in certain (better) parts of the peat bog system, whereas microtopography is present across all parts of a peat bog surface whether damaged or not, and provides valuable insight into the condition of any given portion of that system.

3.15 The next section of the present report explores the nature of the additional information about habitat character and condition which can be gleaned from a more holistic consideration of microtopography, vegetation and overall peatland hydromorphology. Achieving this more holistic perspective involves a return to the concepts of phytosociology and more specifically to a version of phytosociology referred to as synusial phytosociology.

## 4. The hierarchical architecture of peat bog systems

4.1 Although both the NVC and CSM acknowledge the existence of peatland microtopography and go so far as to reflect the broad hummock-hollow nature of this microtopography, neither system provides the tools required to go beyond the simple (and simplistic) view of peatland diversity and condition as an ecosystem described solely by the hummock-hollow model. While this simpler two-phase model of peatland microtopography has proved valuable in terms of modelling the overall meso-scale dynamics of peat bog systems and has persisted in the form of 'hummock-hollow topography' as a general term for the surface morphology of a peatland ecosystem, when examined more closely the surface architecture and ecological character of this microtopography has been shown to be more nuanced.

4.2 Based on detailed survey of large mire complexes in Sweden, Sjörs (1948, 1983) identified a number of distinct ecological zones within the hummock-hollow microtopography based on the height of each zone above or below the average bog water table. He termed these zones: hummock, lawn, carpet and mud-bottom hollow. Ratcliffe & Walker (1958) in their detailed study of the Silver Flowe, SW Scotland, also related the position of various species in relation to both the bog water table. In addition, they described a set of physical zonations associated with these species distributions, namely: tall hummock, medium hummock, dry flat, Sphagnum flat, shallow pools and deep pools. Goode & Lindsay (1979) and Lindsay, Riggall & Bignal (1983) also identified such zonation within peatlands located in both the Inner and Outer Hebrides.

4.3 A field workshop held in Finland in 1983 led to publication of several papers which together highlighted the fact that similar recognition of ecological zonations based on position above or below the peatland water table had become well established in Canada, Norway, Finland, Germany and the UK (Doyle Wells & Zoltai, 1985; Moen, 1985; Eurola & Holappa, 1985; Dierssen & Dierssen, 1985; Lindsay, Riggall and Burd, 1985). Lindsay, Riggall and Burd (1985) integrated a wide range of such zones into a single system and proposed a simple coding system which could be used alongside the differing (but equivalent) terms used by different authors and nations.

4.4 The hierarchical nature of functioning peatland landscapes and the importance of this approach when describing and assessing peatland systems has since been highlighted by Minayeva, Bragg & Sirin (2017) and Joosten *et al*. (2017). The complete hierarchy is shown in Figure 1.

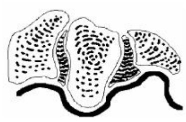
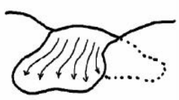
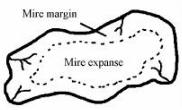
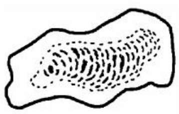
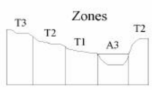
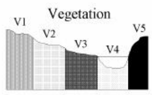
| Feature | Hierarchical level | Description | Hydrological relationship | Utility for classification and evaluation |
|---|---|---|---|---|
|  | Macrotope | Assemblage of hydrologically linked mire units | Individual bog units hydrologically linked via intervening fens and stream-courses | Identification of boundary for minimum, hydro-logically sound, conservation unit |
|  | Mesotope morphology | Distinct, recog-nisable hydro-topographic unit. | Inputs of rainfall, outputs of seepage, drainage and evapo-transpiration | Identification of individual, recognisable units for comparison |
|   | Mesotope sub-sectors | Distinction between mire-margin and mire expanse. | Broad patterns of water movement within the mesotope, from high ground to low ground | Recognition of 'core' and 'marginal' zones; in Europe, the margin often partly removed |
|  | Microtope | Repeated surface patterns - *e.g.* pool system. | Surface pattern reflects hydrology of acrotelm layer and overall mire gradient | Identification of naturalness; source of comparative diversity |
|   | Nanotope | Individual surface features (*e.g.* hummock, pool) | Small-scale water movements within the acrotelm | Source of niches for individual species; comparison of diver-sity and damage |
|   | Vegetation | Distribution of vegetation within surface structures. | Ultimate control of acrotelm and surface water movement | Source of comparative diversity; indicator of "naturalness" |

**Figure 1**. The hierarchical classification of peatland functional landscapes (Lindsay, 2010).

4.5 The finest-scale architecture of the peatland hierarchy corresponds to the concept of the 'synusia' as the smallest functional ecological element of an ecosystem assemblage. This term was first proposed at the beginning of the last century by Gams (1918), and is described by Gillet & Gallandat (1996) as:

> *"…an elementary one-layered floristically, physiognomically and ecologically homogeneous vegetation unit, directly linked to uniform environmental conditions (microclimate, microtopography, soil, biotic factors)…"*

4.6 Julve (1999) demonstrates that this concept can be applied across widely separated biogeographical boundaries, while Gillet & Gallandat (1996) and Julve and Vite

(2014) highlight the fact that, within their examples, synusiae are but the lowest level in a landscape hierarchy. Synusiae sit within a single habitat unit (e.g. wooded pasture) which itself sits within a complex of habitats that share common environmental drivers (e.g. soil, gradient, geology) and would thus, if left to natural processes, lead through succession to a single climax habitat. This complex is termed a tesela. A landscape unit consisting of several such tesela is referred to as a catena – a well-established term in landscape ecology.

4.7 This hierarchical approach is termed 'integrated synusial phytosociology' (Gillet & Gallandat, 1996), but this same hierarchical concept had already been applied to peat bog systems since the 1960s (Ivanov, 1981). In the case of peat bogs the synusial element was represented by the individual small-scale structures, or 'microforms' which then created surface pattern or 'microtope', while a whole bog unit, or 'mesotope', consisted of several microtope patterns. In Russia the predominant peat bog type is raised bog. Depending on the size of the raised bog, this may consist of a single mesotope or two or more fused mesotopes, all bounded by a lagg fen. The entire complex of bog and fen, equating to the catena of Gillet & Gallandat (1996) is the 'macrotope', which represents a landscape unit in which all parts are hydrologically-linked peat-forming components. As a system, this may be termed the '-tope' system, though it can be viewed more broadly as one example of integrated synusial phytosociology, or ISP.

4.8 The first formal use in the UK of the integrated synusial approach for the peatland habitat underpinned a major multi-year survey of the peatlands distributed across the two Scottish Districts of Caithness and Sutherland. The survey approach was based on the hierarchy set out by Ivanov (1981) but this time was applied to a blanket mire landscape,. The survey employed the simple coding system for the various synusial zones proposed by Lindsay, Riggall and Burd (1985) along with the nature of their microtope patterns, while higher levels of the hierarchy were used to define key landscape units.

4.9 The results of this survey demonstrated the value of using this integrated synusial approach in terms of describing significant ecological variation and condition across the two districts. Perhaps more significantly, the resulting report (Lindsay *et al*., 1988) provided sufficiently convincing evidence of ecological diversity within the Flow Country (the peatlands of Caithness and Sutherland) that the major threat of blanket afforestation across the area was halted by decision at Government Cabinet level. As an aside, in 2024 this area has been designated by UNESCO as the world's first peatland World Heritage Site on the basis of its ecological diversity and distinctive habitat type.

4.10 Notification of peat bog SSSIs by the statutory conservation agencies of the devolved national governments of the UK is guided by the Bogs chapter of Guidelines for Selection of Biological SSSIs (JNCC, 1994). Although the term 'synusia' is not used within the document, this guidance nevertheless employs the same integrated synusial approach as was used in the Flow Country survey (Lindsay *et al*., 1988) but provides a set of synusial categories (vertical zones combined with vegetation assemblages) which can instead be applied to peat bog systems across the whole of the UK rather than just for Caithness and Sutherland.

4.11 Lindsay *et al*. (1988) recognised ten synusial zones, as do the SSSI Guidelines, but Lindsay (2010) and this current project have added further nuance, in particular to the zones associated with damage, to create a total of 16 ecologically distinct synusial zones for use on peat bog systems (see Table 1).

**Table 1.** The total list of synusial zones identified for the UK, together with their relationship with the mean bog water-table and their field characteristics (Lindsay, 2010).

| Zone code | Zone name | Zone description |
|---|---|---|
| T5 | Peat mound | 1 m+ tall (to 3 or 4 m) – restricted to northern Scotland |
| T4 | Erosion hagg top | 40 cm+ above a bare peat face |
| T3 | Hummock | 30-50 cm above mean water table |
| T2 | High ridge | 15-30 cm above mean water table |
| T1 | Low ridge | 1-15 cm above mean water table |
| T1A1 | Terrestrial-aquatic transition | 0-5 cm above mean water table |
| A1 | Sphagnum hollow | Flat carpet of aquatic Sphagna at the mean water table |
| A2 | 'Mud-bottom' hollow | Bare peat or plant litter -5 cm to -15 cm below mean water table |
| A3 | Drought-sensitive pool | -10 cm to -40 cm below mean water table |
| A4 | Permanent pool | -40 cm to -6 m below mean water table |
| Em *Sphagnum* | Micro-erosion with Sphagnum | Interconnected micro-gully network, often between tussocks, with colonising *Sphagnum* |
| Em moss | Micro-erosion with other mosses | Interconnected micro-gully network, often between tussocks, with colonising non-*Sphagnum* moss |
| Em bare | Micro-erosion with bare peat | Interconnected bare-peat micro-gully network, often between tussocks |
| E1 | Re-vegetating erosion gully | Deep erosion gully, infilling with vegetation |
| E2 | Bare erosion gully | Deep, bare-peat erosion gully |

4.12 Furthermore, and as part of the present project, a collection of synusial vegetation assemblages has been identified (based largely on those already provided in the SSSI Guidelines) typically associated in the UK with these 16 vertical zones when in various condition-states. The zones and vegetation types have then been assembled into a matrix table of synusia (zone plus vegetation type), within which each synusia is assigned to a habitat condition-state (see Figure 2 and Annex 1).

| Mire pattern no: | Site: | | | Peat depth | Date | Time (to link photos) | Recorder | |
|---|---|---|---|---|---|---|---|---|
| **Zone** (relation to w/t) | DFR (321) Freq. | **Vegetation types : Terrestrial zones** | | | | **Primary** (original) **/ Secondary** (cut-over) **surfa** | | |
| | | **Relatively 'active', likely to be favourable condition ……………..>>** | | | | **<<.Degraded, some recovery…>>** | | **<< ….Degra** |
| T5 (peat mound) **found only in far north & west of Scotland** (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum |

**Figure 2**. Portion of the peat bog condition matrix. The complete matrix can be seen in Annex 1.

4.13 This 'condition matrix' was structured in such a way as to make field recording of the synusia present in any given part of a peat bog system as simple, rapid and straightforward as possible. In addition, it was also designed to provide an immediate visual picture of the habitat condition for that part of the site, enabling ready interpretation by a non-specialist audience, though the data can also be converted into more conventional 'quadrat data', thereby permitting various forms of numerical treatment.

4.14 Identification of the various synusial zones in the field was achieved using a simple moisture probe. Rather than indicate the current position of the water table within the peat, such probes detect the start of the exceptionally high-moisture zone which is a feature of the ability to retain moisture. In effect, this rather stable zone reflects the mean position of the water table through the year and is indicated on the moisture meter when the needle flicks up to the start of the blue zone on the scale (see Figure 3).


**Figure 3.** Use of a simple 30 cm soil moisture probe to determine the depth at which the zone of exceptionally high-moisture zone is located within the peat, thereby indicating the synusial zone. In this case (left) a T1 low ridge, and (right) a T3 hummock).

4.15 In summary, integrated synusial phytosociology was selected as the most appropriate method with which to gather habitat condition data for the New LIFE for Welsh Raised Bogs Project. The next section of the present report therefore describes how this approach was used to gather, assemble and analyse peatland condition data for the nine project sites.

# 5. Integrated synusial phytosociology (ISP) on Welsh raised bogs

## 5.1 Introduction

5.1.1 The fact that ISP is a hierarchical approach means that condition assessment of the nine raised bogs which are the focus of the New LIFE for Welsh Raised Bogs Project can be carried out at differing hierarchical levels equivalent to differing ecosystem scales. The highest level – namely at the macrotope scale – in this case refers to the raised bog unit as a whole, together with its lagg fen. The mesotope level is concerned with the meso-scale characteristics of each raised bog unit, so this describes the distinction between, for example, areas of peat cutting and remaining areas of primary bog surface. The microtope level is concerned with pattern, so focuses on the presence and distribution of particular synusial zones across the mire system, while the nanotope/vegetation level describes the nature of synusia (vegetation assemblages within synusial zones) which create these microtope patterns.

5.1.2 Each of these levels requires descriptive approaches which differ to greater or lesser extents. However, the intimate relationship between small-scale structures and the vegetation which creates these structures means that descriptive and assessment methods in effect merge for the lowest levels of the hierarchy. The nature of these lowest levels nevertheless has implications for, and sheds important light on, the condition of the peatland as expressed at higher levels in the hierarchy. It is therefore important to view the results from the ISP hierarchy as a whole in order to obtain a holistic view of a site's condition.

5.1.3 The approach adopted for the description and assessment of each level in the ISP hierarchy is set out below in the following sub-sections. The results obtained, together with an integrated assessment for each site, are provided in subsequent sections of the present report.

### 5.2 Macrotope – the whole mire complex

5.2.1 Raised bogs are rather simpler hydromorphological systems than is generally the case for blanket mire landscapes. As such, the key macrotope consideration is the extent to which the original mesotope dome(s) remain integrated with the surrounding mineral-ground landscape through the presence of a lagg-fen system.

5.2.2 The lagg fen in effect provides the hydrological foundation for the dome of stored precipitation-water that supports and shapes the mass of peat that forms the raised bog. Altering or removing the lagg fen has significant consequences for the bog as a whole and has the potential to be driving whole-system change which may in time over-ride or significantly alter the effects of localised conservation interventions.

5.2.3 Assessment at the macrotope scale therefore involves evaluating the extent to which the mire complex of raised bog and lagg fen remain intact as a combined system, or identifying areas where this is no longer the case because the lagg fen has been altered in some way.

### 5.3 Mesotope – condition of the raised bog unit

5.3.1 In a natural raised bog it is generally possible to distinguish two main regions, the outer zone representing the more markedly-sloping, and therefore somewhat drier, margin to the bog – termed the 'rand' – while the central expanse of the bog is characterised by its low gradient and high water table. Sjörs (1948) describes these two regions as the mire margin and the mire expanse respectively.

5.3.2 It is therefore reasonable to expect that even under natural conditions, integrated synusial phytosociological (ISP) changes would be observed towards the margins of a raised bog, but if there has been alteration of the lagg fen it is likely that this change would become more extreme and may extend further into what was once the mire expanse.

5.3.3 Significant interventions within the mesotope, such as the digging of drains, will be visible on aerial photography or other forms of remote sensing and can be used to identify areas which are likely to be under hydrological stress. More profound interventions such as domestic peat cutting, remove parts of the peat body and therefore have hydromorphological consequences for the remaining dome (Bragg, 1995; Lindsay, 1995).

5.3.4 Mesotope assessment therefore consists of identifying meso-scale features such as drains, plus identifying those parts of the bog dome that remain as original 'primary' dome and those areas that have been subject to peat removal whether through domestic peat cutting or agricultural land-claim. In the case of peat cutting or abandoned agricultural land, it may be that a secondary peat-forming vegetation has become established. This is an important feature to record because fresh growth and accumulation of secondary peat has the potential to infill such lost areas over time, thus reversing and ultimately halting the hydrological stresses caused by the original removal of peat.

5.3.5 Identification of features at this level is best achieved, at least initially, from aerial photographs because the spatial relationship of such features to the bog mesotope as a whole can readily be determined. In addition, peat cutting is generally quite distinctive because it creates rectilinear patterns that are never found on primary bog surfaces.

5.3.6 It can be difficult to identify portions of the dome lost to agricultural land claim or other interventions that remove any obvious evidence of the ground having once been part of the mesotope dome. Immediate post-war aerial photography can be used to identify those losses which have occurred since the middle of the last century but cannot be used to determine losses which occurred prior to 1946. 1st Edition British Geological Survey maps of 'superficial drift' may provide strong evidence that such areas were once part of the dome, though the map symbols cannot be taken as absolute proof of this. Equally, black soil exposed in such fields indicates that the area was once peat forming, but the peat may have been laid down within the lagg fen. Macrofossil analysis of peat cores taken from these fields may show the presence of typical bog species in the core, but it is just as likely that any bog peat has been stripped away during the land-claim process leaving only the underlying fen deposits. As such, estimates of how far the original dome(s) originally extended prior to any loss must remain, at best, speculative.

5.3.7 The condition matrix form was used to record areas of primary dome and secondary peat cuttings, in part from aerial photography as the initial provisional step, followed by ground-truth checking in the field. Very old secondary peat cuttings that have almost completely infilled can be difficult to detect from aerial photography unless the vegetation continues to display a marked rectilinear character. In the absence of such character it can sometimes be possible to detect subtle changes in the ground-surface profile while in the field, as was the case at Waun Ddu. Confirmation of infilled peat cuttings can then be checked using a peat corer, which will generally show a marked boundary between the fresh peat and the old peat-cutting surface – again, as was done at Waun Ddu. Conversely, old peat cuttings can sometimes be difficult to recognise in the field whereas the rectilinear pattern may be more obvious on aerial photographs as on the eastern edges of the southern dome of Cors Goch Trawsfynydd. Finally, LIDAR can provide useful indications of surface anomalies, in particular by picking out very subtle rectilinear features which may not be evident either on aerial photographs or during field survey. However, LIDAR was not used for this purpose during the project.

## 5.4 Microtope, nanotope and synusia

5.4.1 Recording of these three levels of the ISP is performed as an integrated multi-step process when using the condition matrix.

### *5.4.1 Defining microtopes*

5.4.1.1 Aerial photographs taken at various dates during the post-war years were obtained for the nine sites as was the current image obtainable from Google Maps at the start of the project. All images were contrast-stretched and, in the case of colour imagery, stretched for vibrance and saturation using Photoshop in order to enhance differences between the various parts of the images. Such enhancement in effect 'segmented' the images into reasonably evident blocks of tone. These adjusted images were then georeferenced to the OS National grid in ArcGIS.

5.4.1.2 These enhanced, segmented images were then compared and used to identify differing areas of consistent tone and texture by eye. In some cases the immediate post-war imagery enabled certain impacts to be more clearly recognised than later imagery when vegetation growth and peat accumulation had partially obscured such features. Given that microtope patterns are by definition areas of distinctive texture (and generally tone), the various identified areas of tone and texture were taken to represent microtope regions.

5.4.1.3 Using ArcGIS, polygon boundaries were drawn around these various microtope regions and at least five points were located within each of these regions, such that each microtope type had at least five such points. Each microtope polygon was labelled uniquely and the OS National Grid coordinates of all the points were noted. These points would act as GPS waypoints around which field survey would be carried out.

### 5.4.2 *Field survey of microtopes, nanotopes and synusia*

5.4.2.1 Prior to going into the field, each waypoint point was assigned a condition matrix sheet on which was recorded the polygon number and GPS point. Where possible, the primary or secondary nature of the polygon was determined from the aerial photography and recorded.

5.4.2.2 In the field the surveyor walked to the first waypoint planned for the day using both a GPS and a map of the microtope polygons. On reaching the waypoint the surveyor then walked around the vicinity of the waypoint to determine which synusial zones were present within the polygon. An estimate of frequency within that polygon was then made for each identified zone using a simple scale of Dominant, Frequent or Rare.

5.4.2.3 For each identified synusial zone, while walking around the polygon in the vicinity of the waypoint the field surveyor then circled, using a pen/marker, all examples seen of the synusial vegetation assemblages listed for each synusial zone within the matrix sheet. This generated a series of circles spread across the matrix sheet in a pattern that gives an immediate picture of composition and condition.

5.4.2.4 In addition, having identified the range of synusial zones present in the polygon, the surveyor used a synusial quadrat sheet (see Annex 2) to record individual species present within each synusial zone. As with the matrix sheet, the synusial quadrat record was assembled by walking round the vicinity of the waypoint and recording everything that was seen within a 2-3 m radius of the waypoint. The 'quadrat' was thus a localised area of search from which estimates were made of percentage cover, rather than the conventional approach of using a single geometric shape and size.

5.4.2.5 In addition, for a number of points recorded in the manner described above, a 360° VR image was taken at the location using either a Ricoh Theta or a Vuze 360° camera.

### 5.4.3 *Analysis of microtope, nanotope and synusial data*

5.4.3.1 Condition matrix and synusial data were converted into quadrat format in Excel to permit analysis using a variety of approaches. This conversion entailed setting a single column for each record sheet in an Excel spreadsheet. For each synusial zone, each synusial vegetation group was assigned its own row and its presence or absence noted. Thus there might be a row for T3 Hypnum/dwarf shrubs, but also a row for T1 Hypnum/dwarf shrubs, and both may record presence if this synusial vegetation group was noted in both T3 and T1 on the matrix sheet. Every such individual data point is technically referred to as a 'pseudospecies' because it is a species record linked to a particular synusial zone. The same process was applied to the synusial quadrat sheets.

5.4.3.2 The Excel spreadsheet was then formatted for input to various analytical packages, the main one of which was TWINSPAN with the aim of generating a set of synusial categories which could then be mapped back onto the mesotope polygons to assess the character and condition of each mesotope.

5.4.3.3 The data were first processed using principal components analysis and reciprocal averaging to generate PCA and RA plots in order to identify extreme outliers in the data. The character of the data for these points was noted, then they were removed prior to running the data through TWINSPAN. This was done because extreme outliers can bias the early stages of the TWINSPAN division process.

5.4.3.4 The data were taken to 5 levels of division in TWINSPAN. The resulting 'end-groups' were then examined using phytosociological sorting methods (Mueller-Dombois & Ellenberg, 1974) to address misclassified groups and thereby improve the distinctiveness of the end-groups obtained from TWINSPAN. It is important to note here that Mark Hill, author of TWINSPAN, has always described it as a method for initial sorting of data (Mark Hill pers. comm.), which is indeed the manner in which continental phytosociologists employ it.

## 6. Additional (conventional) vegetation recording

6.1 For the Cors Caron raised bog complex, additional vegetation recording was undertaken to supplement the ISP approach or to obtain vegetation data associated with specific monitoring interventions. Two recording methods were used: fixed-point transects, and conventional 2 m x 2 m quadrats.

6.2 Neither of these approaches is directly translatable into the results of the ISP outputs because both extend across a range of synusial components. These additional vegetation data form a set of baseline data which can subsequently be compared with the results of re-survey at a later date. As such, analysis of these data to create a set of vegetation types is not the priority. Rather, the value of these monitoring locations arises from the specific changes observed over time within these specific localities.

6.3 *Fixed-point transects*

The fixed-point transects are 2 m x 0.5 m, divided into 25 cm squares, resulting in 16 sample squares within each transect. Within each square, the percentage cover was recorded for every plant species present in that square. The transect as a whole inevitably spans multiple synusial elements and thus cannot be directly related to the ISP data, but the specific benefit of the transect format is that it can highlight spatial (and potentially directional) change within the bounds of the transect over time.

6.4 *2 m x 2 m quadrats*

These are conventional quadrats located either alongside the fixed-point transects or associated with water-table or greenhouse-gas instrumentation. They use the standard 2 m x 2 m dimensions recommended by the NVC and thus have the same issues as the NVC in terms of embracing multiple synusial elements. As with the fixed-point transects, their benefit lies not in creating vegetation assemblages from the current data, but rather in future comparison through repeated recording within each quadrat to identify change within the specific bounds of the quadrat.

# 7. Results: Integrated synusial phytosociology (ISP) on Welsh raised bogs

7.1 The condition matrix and synusial quadrat data were used to generate four levels of insight and analysis:

- an immediate visual picture of condition for each microtope texture type, based on the pattern of synusial vegetation assemblages circled on the condition-matrix sheets, the collective picture of these sheets for the range of microtope textures occurring on a site providing an overall picture of site condition as well as highlighting those synusial features which should be set as targets for restoration action;
- zone end-groups (**ZEGs**) in which various combinations of synusial zones across the nine sites were identified and classified broadly into ZEG condition categories based on the presence or absence of zones that are either considered characteristic of healthy peat bog environments, or zones that indicate damage or degradation;
- synusial vegetation-assemblage end-groups (**VEGs**) based on combinations of the various vegetation assemblages set out in the condition matrix form, which itself defines a set of condition classes;
- synusial vegetation types (**SYNs**) arising from analysis of the synusial quadrat sheets and thus defining these SYNs in terms of complete species composition, with each SYN also being assigned to a broad SYN condition class.

7.2 As indicated earlier, the fixed-point transect data and the 2 m x 2 m quadrat data for Cors Caron have not been subject to analysis because they will be used in future monitoring rounds for direct localised comparison of change. The ZEGs, VEGs and SYNs, in contrast, have been used to assess baseline conditions across all nine sites.

7.3 The visual synusial pattern obtained from the condition-matrix sheets for each site will be explored in the sections of the present report where individual sites are described. The remainder of the current section considers the overall synusial features to emerge from the collective data gathered from all nine sites, namely the ZEGs, VEGs and SYNs derived from these data.

## 7.4 ZEG analysis

7.4.1 The condition matrix survey, when combined across all nine sites, identified the presence of 12 synusial zones. These are shown in Table 2, along with the sites in which they were recorded.

7.4.2 No single raised bog displayed all 12 zones, though the Cors Caron complex almost did so collectively. What is evident, however, is that there is considerable variation between sites, with only T2 high ridge occurring on all sites. Cernydd Carmel is notable for being the only site displaying deep erosion gullies – although this is a feature normally restricted to blanket bogs. Also notable is the absence on Waun Ddu of synusial zones associated with degradation – *i.e.* tussocks and various forms of erosion.

7.4.3 However, as will be seen later, this result for Waun Ddu cannot be taken to mean that the site is free from any form of damage. This is because areas which have been damaged and then undergone some form of recovery can resemble certain synusial zones but are in fact *secondary* features, which is why it is important to distinguish primary bog surfaces and their synusial zones from secondary bog surfaces and their zones.

7.4.4 Furthermore, some forms of damage merely shift the balance of zones within those zones which are normally considered to be indicators of ecosystem health. Thus a formerly wet site may become dominated by T3 hummocks if it is drying out, while conversely the effects of livestock trampling may remove all trace of such T3 hummocks even if a site is free of drainage impacts.

**Table 2.** Occurrence of synusial zones within the nine raised bog mesotopes.

| Site / Zone | Cernydd Carmel | Cors Caron NE Bog | Cors Caron SE Bog | Cors Caron West Bog | Cors Fochno | Cors Goch South | Rhos Goch | Esgyrn Bottom | Waun Ddu |
|---|---|---|---|---|---|---|---|---|---|
| T3 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| T2 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| T1 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ |
| T1A1 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ |
| A1 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| A2 | | | ■ | | ■ | ■ | | | ■ |
| A3 | | ■ | ■ | | | | | | |
| Tk | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| Em Sphagnum | ■ | ■ | | ■ | ■ | ■ | | ■ | |
| Em moss | ■ | ■ | | ■ | ■ | ■ | | ■ | |
| Em bare | ■ | ■ | | ■ | ■ | ■ | | ■ | |
| E2 | ■ | | | | | | | | |

7.4.5 It is informative next to consider the combinations of synusial zones found within individual polygon 'textures', or microtopes, across all the sites. Given that the permutations possible from a combination of 12 elements amounts to several million, the analysis of ZEG data across all sites for the collective polygon microtopes resulted in the identification of a modest 44 classes of synusial zone microtope (or 'texture') combinations. These microtopes range from areas wholly dominated by T3 hummocks to areas consisting only of Tk tussocks and E2 eroding gullies.

7.4.6 The composition of these 44 microtope classes can be seen in Figure 4, which also categorises the synusial zone nanotopes into those which are characteristic of peat bogs in good condition (pale blue shading) and those which are generally indicators of damage (pale pink/rose shading).

7.4.7 Numeric values displayed in Figure 4 are derived from conversion to % abundance of the 'DFR' code assigned to each synusial zone on the condition-matrix sheets. However, derivation of the 44 ZEGs was based only on presence-absence data, the abundance values merely providing an indication of the visual appearance of each ZEG.

7.4.8 The individual ZEG microtope textures are also sorted into categories and assigned colour coding for use in the site maps displayed in later sections of the present report:

- those which consist only of the 'good condition' synusial zone nanotopes (blue);
- those which are characterised only by the additional presence of Tk tussocks, indicative of damage (green);
- those with various additional indicators of degradation (turquoise, rose pink and orange);
- finally a set of microtopes that contain no indicators of good condition and possess only indicators of damage (red).

The data can be viewed in more detail in spreadsheet form in Annex 2.

7.4.9 The distribution of these ZEGs across the nine raised bogs, together with the resulting implications, will be explored within the individual site accounts which are provided in later sections of the present report.

## 7.5 VEGs analysis

7.5.1 Although the condition matrix form only records the presence or absence of any given synusial vegetation assemblage, it is nevertheless possible to quantify the percentage presence of each assemblage and thereby assign a % constancy to that assemblage within each VEG. This reliance on constance rather than cover/abundance values is the basis of phytosociological sorting.

7.5.2 In this way it was possible not only to subject the data to TWINSPAN analysis but also then to identify the key constants for each of the 26 VEG groups derived from such analysis. Quantitative values also meant that the data could be subject to analysis by Principal Components Analysis (PCA) or Reciprocal Averaging (RA), which were used to remove extreme outliers (mostly samples that lay outside the main mesotope bodies) prior to analysing the data using TWINSPAN, then phytosociological sorting, to identify the range of vegetation assemblages.

7.5.3 The detailed composition of each of the 26 VEG types can be seen in Annex 3 and is provided as a spreadsheet with multiple worksheets in Annex 4, while Figure 5 displays the VEG groups in the manner of Figure 4. However, in this case the colour coding given to any VEG reflects the combination of colour-codes assigned to each vegetation assemblage in the original condition matrix. The resulting combination of colours reflects the overall balance of condition-matrix colours that occur within the given VEG type. The base colours used in this case are thus just green turquoise, rose pink, orange and red because there is no blue shading on the condition matrix.

7.5.4 In the detailed tables of Annex 3 the key community constants were taken to be any vegetation assemblage which occurred in more than 50% of the records for that VEG. These are indicated by shading and a black border. The next level of community constant, namely those with % presence between 50 and 30, are also grey shaded but with no black border.

7.5.5 Within the key community constants, synusial vegetation assemblages were firstly ordered according to vertical arrangements of natural synusial zones (*i.e.* T3, T2, T1, T1A1, A1) followed by the damage synusial zones (*i.e.* Tk, Em Sphagnum, Em moss, Em bare), then *within* each synusial zone they were ordered by percentage presence. This same ordering procedure was then used for the assemblages occurring at constancies of 50% or less.

7.5.6 It will be noted that only nine synusial zones feature in the VEG analysis. This is because A2 hollows, A3 pools and deep erosion gullies occurred so rarely that they represented extreme outliers in PCA and were thus removed from the TWINSPAN analysis. Their presence within the few localities in which they did occur was nonetheless recorded.

## 7.6 SYN analysis

7.6.1 The synusial quadrat analysis generated 20 synusial vegetation communities which are characterised by various combinations of species assemblages distributed between particular synusial zones.

7.6.2 It may seem counter-intuitive that there should be significantly fewer SYN communities than ZEG synusial zone combinations given that there are more possible species combinations than is the case for the 12 synusial zones, but therein lies the reason why it is important to consider both vegetation and structure when describing and evaluating peat bog systems. In Tierra del Fuego, for example, bog surfaces are created by just two species of *Sphagnum* – true *S. magellanicum* forming the ridges and *S. falcalulatum* in the hollows – yet these two species create as much structural ecosystem diversity as anything in the northern hemisphere. The same is true for these Welsh sites, where many of these communities contain similar lists of species but these species are arranged in different combinations and occupy differing synusial zones.

| | Features associated with relatively good condition | | | | | | | Indicators of damage/degradation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Synusial zone<br>Zone End Group (ZEG) | T3 hummock | T2 high ridge | T1 low ridge | T1/A1 terrestrial /aquatic transition | A1 Sphagnum hollow | A2 'mud-bottom' hollows | A3 drought-sensitive pools | Tk tussock | ME (Sphagnum) micro-erosion with Sphagnum | ME (moss) micro-erosion with non-Sphagnum moss | ME (bare) micro-erosion | E2 eroding gully | |
| ZEG 1 | 90 | | | | | | | | | | | | |
| ZEG 2 | 59 | 79 | | | | | | | | | | | |
| ZEG 3 | | 90 | | | | | | | | | | | |
| ZEG 4 | 43 | 70 | 63 | | | | | | | | | | |
| ZEG 5 | 50 | 90 | | 50 | | | | | | | | | |
| ZEG 6 | 40 | 62 | 58 | 50 | | | | | | | | | |
| ZEG 7 | 47 | 70 | 60 | 20 | 33 | | | | | | | | blue |
| ZEG 8 | 70 | 90 | | | 30 | | | | | | | | |
| ZEG 9 | | 83 | 63 | | | | | | | | | | |
| ZEG 10 | | 58 | 58 | 63 | 5 | | | | | | | | |
| ZEG 11 | | 60 | 70 | | 30 | | | | | | | | |
| ZEG 12 | 32 | 44 | 56 | 42 | 2 | 18 | | | | | | | |
| ZEG 17 | | | | 50 | 70 | | 70 | | | | | | |
| ZEG 18 | 32 | 58 | 59 | 33 | | | | 52 | | | | | |
| ZEG 13 | | 64 | 53 | 36 | 38 | | | 48 | | | | | |
| ZEG 14 | | 69 | 56 | | 40 | | | 59 | | | | | |
| ZEG 15 | | 70 | 35 | 15 | 15 | 25 | | 40 | | | | | |
| ZEG 16 | | 63 | 50 | 17 | 23 | | 43 | 50 | | | | | |
| ZEG 19 | 39 | 66 | 54 | 38 | 33 | | | 54 | | | | | green |
| ZEG 20 | 73 | 54 | 37 | 29 | 44 | 4 | | 47 | | | | | |
| ZEG 21 | 53 | 60 | | 63 | | | | 50 | | | | | |
| ZEG 29 | | | 90 | 10 | | | | 50 | | | | | |
| ZEG 28 | | 60 | 70 | | | | | 50 | | | | | |
| ZEG 23 | 62 | 42 | | | | | | 50 | | | | | |
| ZEG 26 | 60 | 70 | 45 | | 10 | | | 45 | | | | | |
| ZEG 22 | 60 | 70 | | | | | | 50 | 40 | | | | |
| ZEG 36 | | 90 | 50 | | | | | 50 | 50 | 50 | | | turquoise |
| ZEG 35 | | 80 | | | | | | 70 | 60 | 60 | | | |
| ZEG 24 | 50 | 61 | 41 | | | | | 50 | | 6 | | | |
| ZEG 25 | 50 | 65 | | | 15 | 8 | | 60 | | 13 | | | |
| ZEG 30 | 70 | | | | | | | 50 | | 70 | | | rose pink |
| ZEG 31 | | 74 | | | | | | 66 | | 58 | | | |
| ZEG 32 | | | | | 30 | | | 70 | | 70 | | | |
| ZEG 37 | 17 | 33 | 3 | | | | | 77 | 30 | 50 | 50 | | |
| ZEG 43 | 48 | 36 | | | | | | 71 | 4 | | 70 | | |
| ZEG 38 | 50 | | 30 | | 10 | | | 70 | | 50 | 50 | | orange |
| ZEG 40 | 50 | 70 | | | | | | 70 | | 50 | 50 | | |
| ZEG 27 | 30 | 47 | 37 | | 17 | | | 70 | | | 63 | | |
| ZEG 42 | | 57 | 4 | | | | | 70 | | | 48 | | |
| ZEG 41 | | | | | | | | 71 | 1 | | 72 | | |
| ZEG 39 | | | | | | | | 70 | 3 | 57 | 40 | | |
| ZEG 34 | | | | | | | | 77 | | 70 | | | red |
| ZEG 45 | | | | | | | | 70 | | | | | |
| ZEG 33 | | | | | | | | | | 90 | | | |
| ZEG 44 | | | | | | | | 90 | | | | 90 | |

**Figure 4.** The 44 ZEGs derived from analysis of the condition matrix sheets, indicating their component synusial zones (nanotopes). Values are derived from converting the Dafor scale to a numeric scale. In colour shading of the main body, blue indicates nanotopes associated with relatively good condition, pale salmon indicates nanotopes associated with degradation. Colour shading in the right column also indicates condition for the purposes of site mapping, with ZEGs ranging from more natural (blue) to highly degraded (red). This table is also provided as an Excel spreadsheet (see Annex 2).

7.6.3 Furthermore, when the differing levels of the peatland hierarchy are combined to create a whole-ecosystem picture, as will be achieved when describing the individual sites, the importance of the interplay between these different hierarchical levels will become evident.

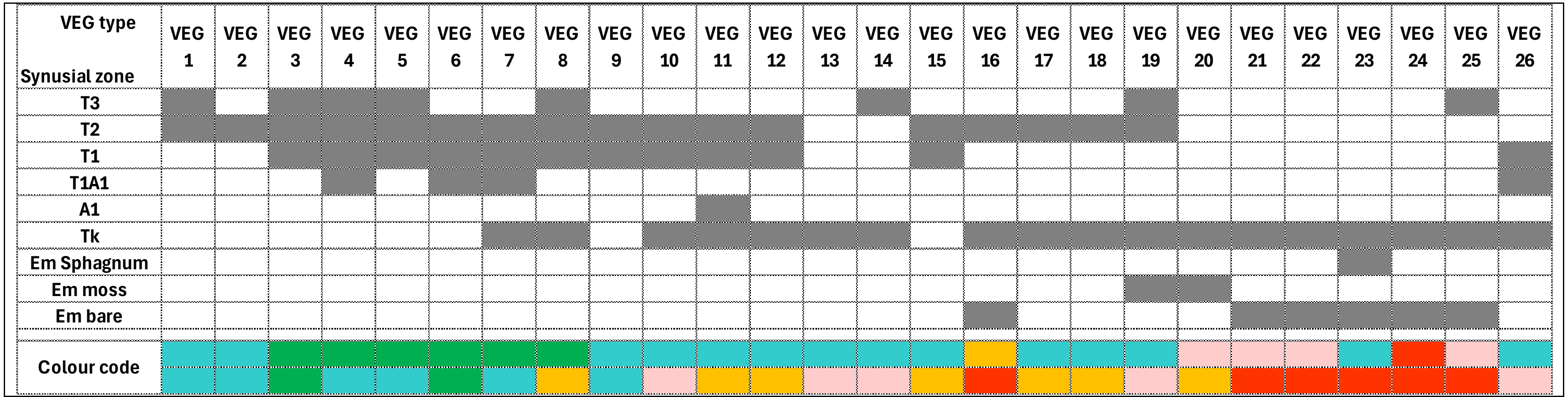



**Figure 5.** The 26 VEGs derived from analysis of the condition matrix sheets, indicating their dominant (i.e. most constant) component synusial zones (nanotopes) as grey-shaded cells. VEG types with similar synusial zone components nevertheless have differing synusial vegetation assemblages. For the full details of the vegetation assemblages, see Annexes 4 and 5. Colour shading along the base of the table indicates the overall combination of condition-matrix colour-coding assigned to each VEG type for the purposes of site mapping.

(Note: As this shading reflects the shading on the condition-matrix sheet and the condition matrix does not use blue shading, green is the best condition-category displayed here, as is the case on the condition matrix sheet.)

7.6.4 In the same manner as already shown for the ZEGs and VEGs, Figure 6 displays the distribution of SYNs within the range of synusial zones. Also shown are the colour-codes assigned to the 20 SYNs for site-mapping purposes. These colours highlight the five main vegetation types identified, namely:

- enriched bog margin communities (turquoise);
- enriched damaged bog resembling wet heath (orange);
- various degrees of drier bog with tussocks (shades of purple – darkest is driest);
- various degrees of relatively wet natural bog (shades of blue – darkest is wettest);
- severely degraded bog (shades of red – darkest is most disturbed).

7.6.5 The detailed composition of each of the 20 SYN types can be seen in Annex 5 and is provided as a spreadsheet with multiple worksheets in Annex 6.

7.5.6 In the detailed tables of Annexes 5 and 6 the key community constants were taken to be any species (strictly, 'pseudospecies') which occurred in more than 50% of the records for that SYN. These are indicated by shading and a black border. The next level of community constant, namely those with % presence between 50 and 30, are also grey shaded but with no black border.

7.6.7 Pseudospecies shaded pink in Annex 5 are species which are either completely faithful to that SYN (*i.e.* they only occur in that SYN), or are mostly faithful, occurring in no more than one or two other SYNs. As such, they act as indicator pseudospecies for particular SYNs.

7.6.8 Within the key community constants, synusial vegetation assemblages were firstly ordered according to vertical arrangements of natural synusial zones (*i.e.* T3, T2, T1, T1A1, A1) followed by the damage synusial zones (*i.e.* Tk, Em Sphagnum, Em moss, Em bare), then *within* each synusial zone they were ordered by percentage presence. This same ordering procedure was then used for the assemblages occurring at constancies of 50% or less.

## 7.7 Summary of ZEG, VEG and SYN analysis

7.7.1 One evident general observation arising from all three analyses is that features of damage predominate over features typical of good-condition peat bog habitat. Of the 44 ZEGs identified, only 30% are free from evident signs of degradation. For the VEG classes, only two of the 26 types are indicative of good condition, while only one of the 20 types of SYN is categorised as representing good condition peat bog habitat, with four others categorised as good but in somewhat poorer condition.

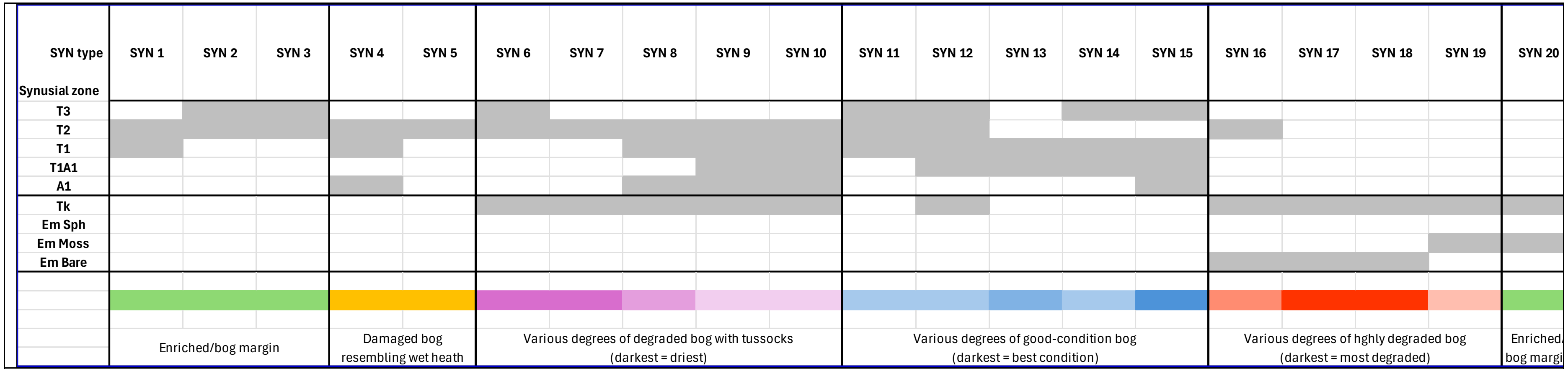



**Figure 6.** The 20 SYNs derived from analysis of the synusial quadrat sheets, indicating their dominant (i.e. most constant) component synusial zones (nanotopes) shown as grey-shaded cells. SYN types with similar synusial zone components nevertheless have differing synusial vegetation communities. For the full details of the vegetation communities, see Annexes 6 and 7. Colour shading along the base of the table indicates the colour-coding assigned to each SYN type for the purpose of site mapping.

7.7.2 The relative frequency of occurrence for the various synusial zones within the three forms of synusial classification can be seen in Figure 7, from which three things are evident. Firstly, synusial zones associated with natural bog surfaces occur more frequently than those associated with damage. This appears to contradict the observation above that damaged classes outnumber natural classes. The explanation is that in many of the identified ZEG, VEG and SYN classes, these natural features are accompanied by features of damage. Relatively few classes are entirely free from features indicative of damage.

7.7.3 Secondly, the commonest synusial zone in all three analyses is the T2 high-ridge zone, but the Tk tussock zone – a zone indicative of damage - is almost as frequently represented. Tussocks are therefore a common feature within the majority of the identified classes and therefore represent a key target indicator for restoration strategy. In the case of large *Molinia caerulea* tussocks it may be possible to mow these out, but for smaller *Molinia* tussocks and certainly for tussocks of *Eriophorum vaginatum* and *Trichophorum cespitosum* the most effective strategy is to encourage *Sphagnum* growth. Over time, this overwhelms the tussocks and leads all three tussock-forming species to adopt a looser growth form more characteristic of natural bog vegetation (Weber, 1902; Lindsay, 2010).

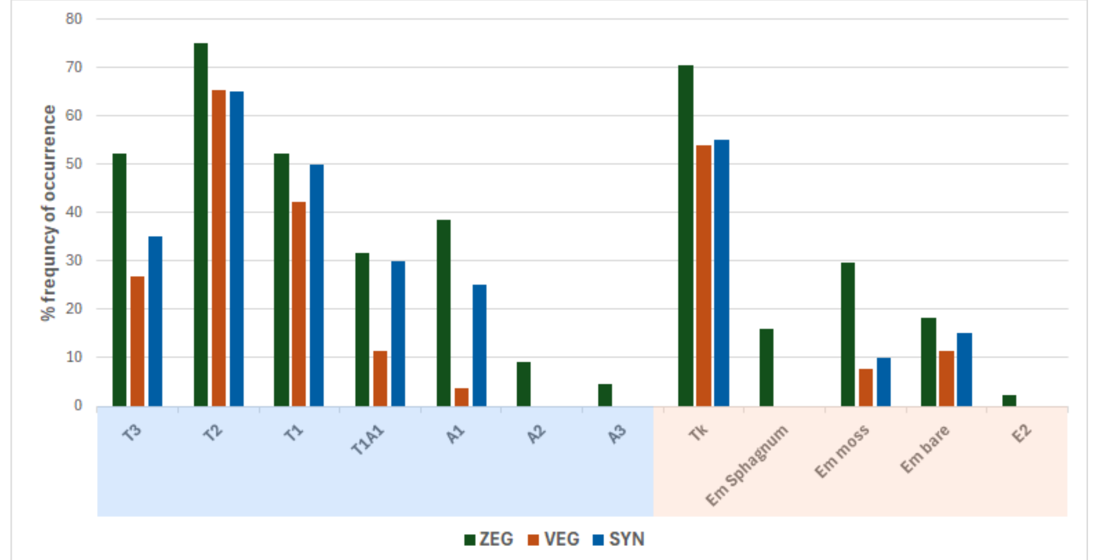



**Figure 7.** Relative frequency (% occurrence) of synusial zones within the three synusial classifications. Synusial zone labels associated with natural conditions are shaded pale blue, those associated with damage are shaded pale pink.

7.7.4 Thirdly, a good-condition natural bog surface would have roughly equal amounts of T2 and T1 with only scattered T3 hummocks, as well as (typically for this part of the UK) numerous A1 hollows with associated T1A1 transition zones. In this case, however, the majority of A1 hollows recorded are secondary features resulting from flooding of old peat cuttings or active restoration interventions (Lindsay *et al*, 1988).

The preponderance of the T2 high-ridge synusial zone, together with a relatively high frequency of T3 hummocks, occurring at the same frequency as T1 low ridge, indicates a bias towards drier conditions even in areas free from damage. However, in the majority of cases there is also evidence of damage, degradation or poor condition, which undoubtedly contributes to the drier conditions. Aerial pollution-loading by nitrogen oxides may also have played a part.

## 8. Individual site accounts

8.1 The combined analysis of synusial features across all sites is of value because it enables any given site to be placed in a broader context while also providing an overview of condition which can help to shape the scale of resources required for effective restoration of this suite of sites. At a practical level, however, each site is an individual hydromorphological unit, namely the mesotope and its lagg fen which together form the system macrotope. Even the bogs of Cors Caron consist of individual mesotopes although they share, to some extent, a lagg fen and thus represent a macrotope complex.

8.2 Determination of restoration needs and appropriate restoration actions must necessarily therefore be undertaken on a site-by-site basis. Consequently this section of the present report will focus on the nine individual sites and their current condition through the lens of integrated synusial phytosociology and the peatland ecosystem hierarchy.

### 8.3 Cernydd Carmel

8.3.1 <u>*Cernydd Carmel - macrotope and mesotope*</u> *(see Figure 8)*

8.3.1.1 Cernydd Carmel is a valleyside mire lying on a terrace situated between the high ridge of Banc y Llyn to the north and a spring-fed watercourse to the south. There is no discernible **lagg fen** zone (either in the form of a flushed contact zone with the mineral groundwater table or as a steam) along the northern edge of Cernydd Carmel but equally no evident sign of drainage to remove such a feature. As such, it has a largely natural transition zone from the steeper slopes of the northern ridge into the mire itself, albeit now transitioning into disturbed ground, as discussed below. This is also the case along its western boundary.

8.3.1.2 In contrast, although the southern-boundary watercourse of Cernydd Carmel is the outflow from a natural spring, the channel of this watercourse has been artificially canalised along significant sections of its length. It is now impossible to judge with certainty the extent to which this watercourse was artificially deepened in the past and therefore what impact this may have had on the hydrology of the site.

8.3.1.3 However, at the **mesotope** scale, historical aerial photography reveals that the whole mesotope has experienced widespread development of erosion channels – a highly unusual feature in lowland raised bogs in the UK. It cannot now be determined whether this is a result of headward erosion following deepening of the southern lagg fen. Alternatively it may have been caused by some other agency such as severe fire(s), or perhaps a combination of such agencies, but the extent of erosion channels is such that areas of apparent primary surface now occur only as multiple small islands adrift in a sea of *Molinia caerulea* tussocks.

8.3.1.4 As such, there is no discrete mappable area which can be defined as the remnant core of the primary bog surface, while whatever may have existed as a true lagg fen is now either lost within the *Molinia*-rich tussocky ground along the northern and western boundary, or as the canalised watercourse along the southern margin of the site.

8.3.1.5 In effect, the site consists of what is, for all intents and purposes, extensive secondary vegetation (*Molinia* tussocks) infilling the erosion gullies, together with a small-scale mosaic of primary bog remnants dissected by small erosion channels, with the bounding lagg fen either lost within the secondary vegetation or transformed into a major watercourse acting as a drainage feature (see Figure 8).

8.3.2 *<u>Cernydd Carmel – Condition matrix summary</u> (see Figure 9)*

8.3.2.1 Condition-matrix data for all Cernydd Carmel microtope polygons have been collated into Figure 9, which represents a summary condition matrix sheet for the site as a whole. It is not necessary to read the individual vegetation assemblages in order to understand the general condition of the site. It is instead the overall pattern of blue circles (actually ovals) that reveals this overall condition.

8.3.2.2 Furthermore, it is important to understand that in terms of condition assessment the critical aspect of the summary sheet is not the number of circles in the green zone (as long as there is one or more) but rather the presence and number of circles in the degraded sectors. *<u>Any</u>* circles in these sectors indicate some form of degradation.

8.3.2.2 The pattern of circles also acts as a guide for setting restoration targets because the objective should be to move any circles lying within the degraded colour tones into the green 'favourable' colour tone.

8.3.2.3 In the case of Cernydd Carmel, it is evident that although a few examples of typical bog vegetation persist, there are a great many other features indicative of damage – in some cases of extreme damage, such as the presence of E2 erosion gullies (a rare feature on lowland raised bogs in the UK).

8.3.2.4 The actual extent of these various condition features is revealed by mapping the ZEGs, VEGs and SYNs which together characterise each microtope polygon.

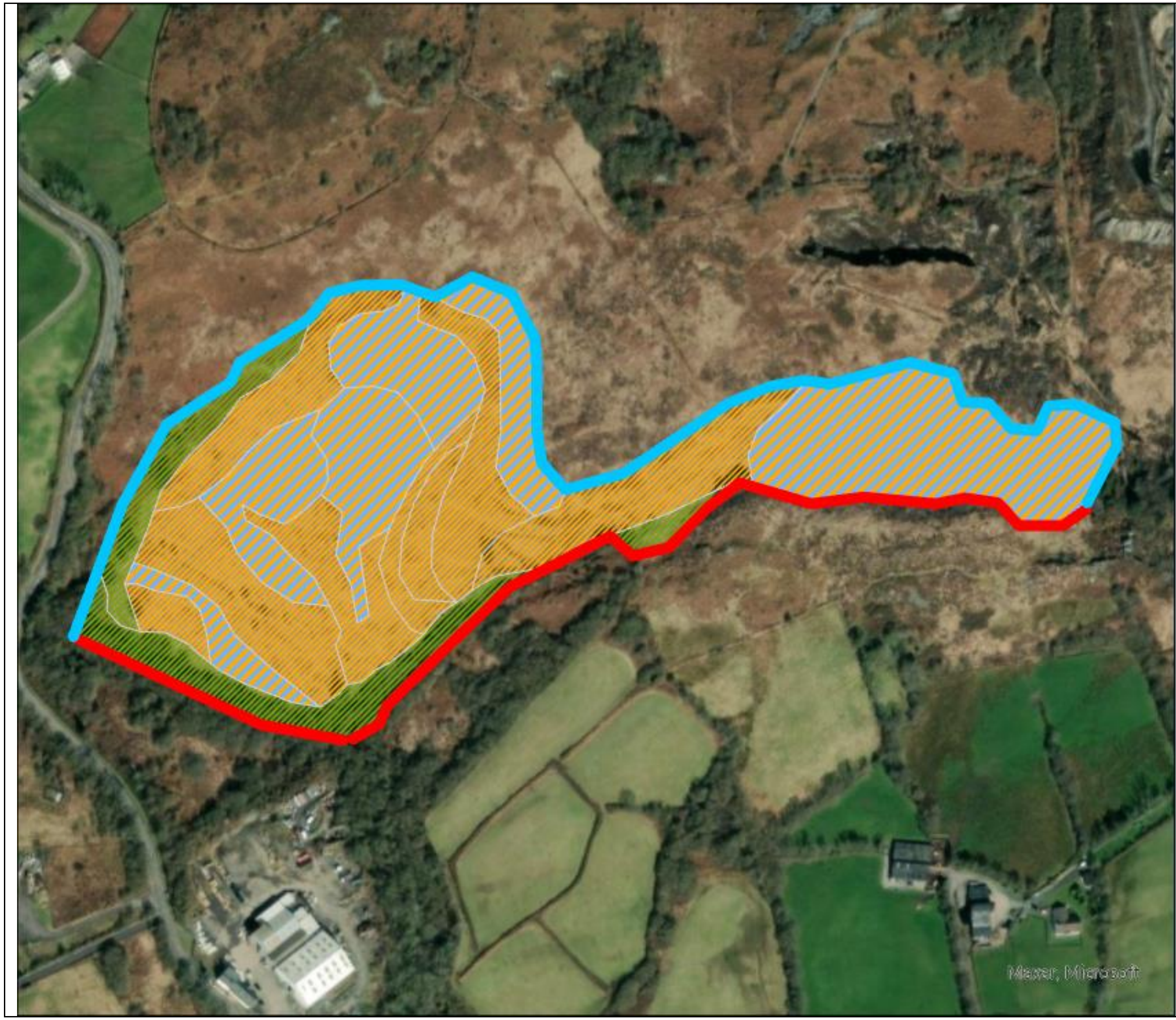



**Figure 8.**
Cernydd Carmel: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently drained ground but would likely become lagg fen if re-wetted.

Mire pattern no: | Site: Cernydd Carmel | Peat depth | Date 2019 | Time (to link photos) | Recorder | Grid ref:

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Polytrichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Polytrichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 9a.** Consolidated condition matrix for the Cernydd Carmel mesotope, incorporating condition matrix data from all combined primary and secondary microtope polygons recorded within the site.

| Mire pattern no: | Site: Cernydd Carmel | Peat depth | Date 2019 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 9b.** Consolidated condition matrix for the Cernydd Carmel mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site.

8.3.3 *Cernydd Carmel – ZEGs (see Figure 10 and Figure 4)*

8.3.3.1 Figure 10 shows the distribution of ZEG synusial zone types together with the primary or secondary (or a combination) status of each polygon as shown in Figure 8.

8.3.3.2 The most striking feature about Figure 10, which shows the distribution of ZEGs across Cernydd Carmel, is the preponderance of red shading particularly on its southern and eastern sides. This is where the erosion was particularly marked on early aerial photographs and where a large central erosion gully was still present at the start of the present project.

8.3.3.3 The best area of the site in terms of synusial zones is in the two central and northern polygons where there are multiple small remnants of primary bog surface but these are separated by extensive micro-erosion filled with *Molinia caerulea*.

8.3.3.4 The remnant primary surfaces are rather dry and flat, displaying little microtopography other than small tussocks of *Trichophorum cespitosum*. The best of the ZEGs, namely ZEG 31, is characterised only by T2 high ridge from the normal range of natural synusial zones and is accompanied by Tk tussocks and micro-erosion with non-*Sphagnum* mosses.

8.3.4 *Cernydd Carmel – VEGs (see Figure 11 and Figure 5)*

8.3.4.1 The predominant VEG colours in Figure 11 are turquoise, pink, orange and red, which all characterise the degraded sectors of the condition matrix. Microtopes of dominant red represent areas of VEG 22 and VEG 24 which are almost pure *Molinia* tussocks with scattered patches of either T2 high ridge with *Sphagnum* and dwarf shrubs or areas of micro-erosion with either bare peat or hypnoid mosses between.

8.3.4.2 Areas with turquoise are characterised by VEG 17 or VEG 18 which both consist of T2 high ridge assemblages of hypnoid mosses with dwarf shrubs and *Eriophorum vaginatum* or *Molinia caerulea*, with VEG 17 having little *Sphagnum* while VEG 18 has *Sphagnum* in both T2 high ridge and occurring as a mixed moss carpet in micro-erosion channels.

8.3.4.3 Where VEG 17 combines with other VEG assemblages, *Sphagnum* occurs in T3, T2 or T1 synusial zones depending on the accompanying VEG assemblage. T1 and T1A1 *Sphagnum fallax* even occurs when VEG 17 occurs with VEG 26.

8.3.4.4 Tk tussocks feature as a constant feature across all recorded VEG assemblages, however, and consist of either tall *Molinia caerulea* tussocks in the secondary areas or as smaller scattered tussocks of *Eriophorum vaginatum* or *Trichophorum cespitosum* particularly on patches of primary bog surface. *Eriophorum vaginatum* also occurs as moderately-sized tussocks in some of the secondary areas of ground.

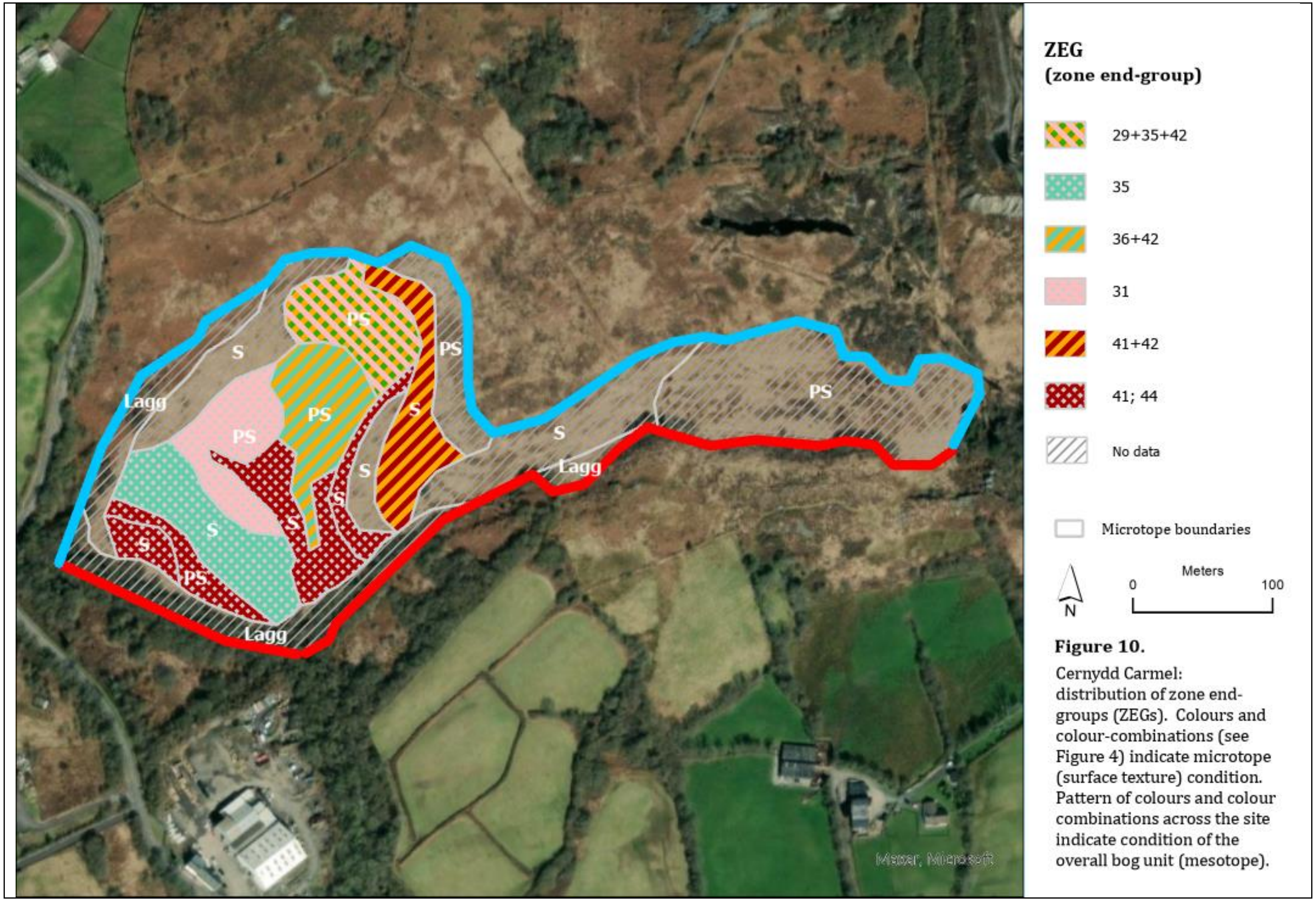



**Figure 10.**

Cernydd Carmel: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

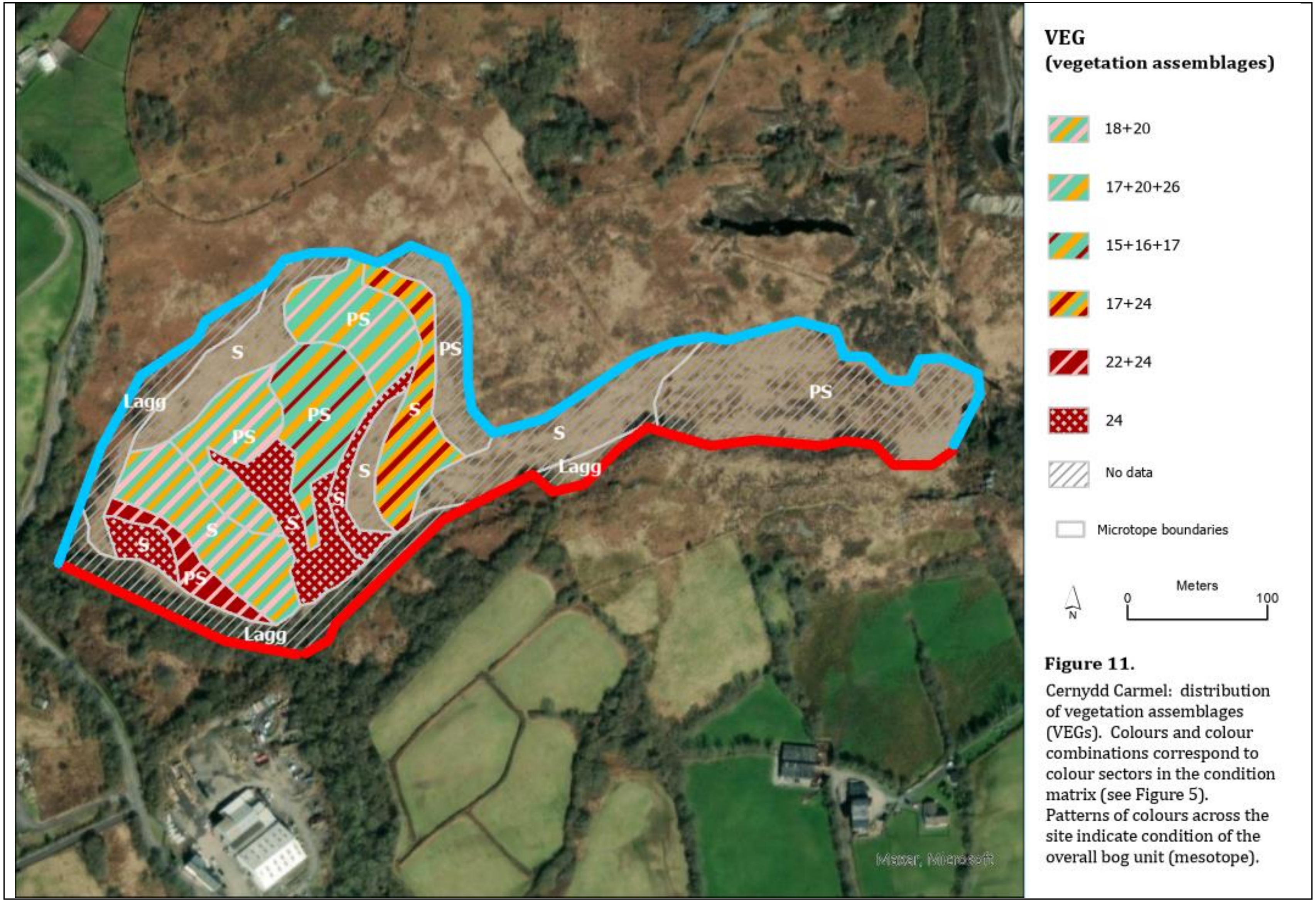



**Figure 11.**

Cernydd Carmel: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

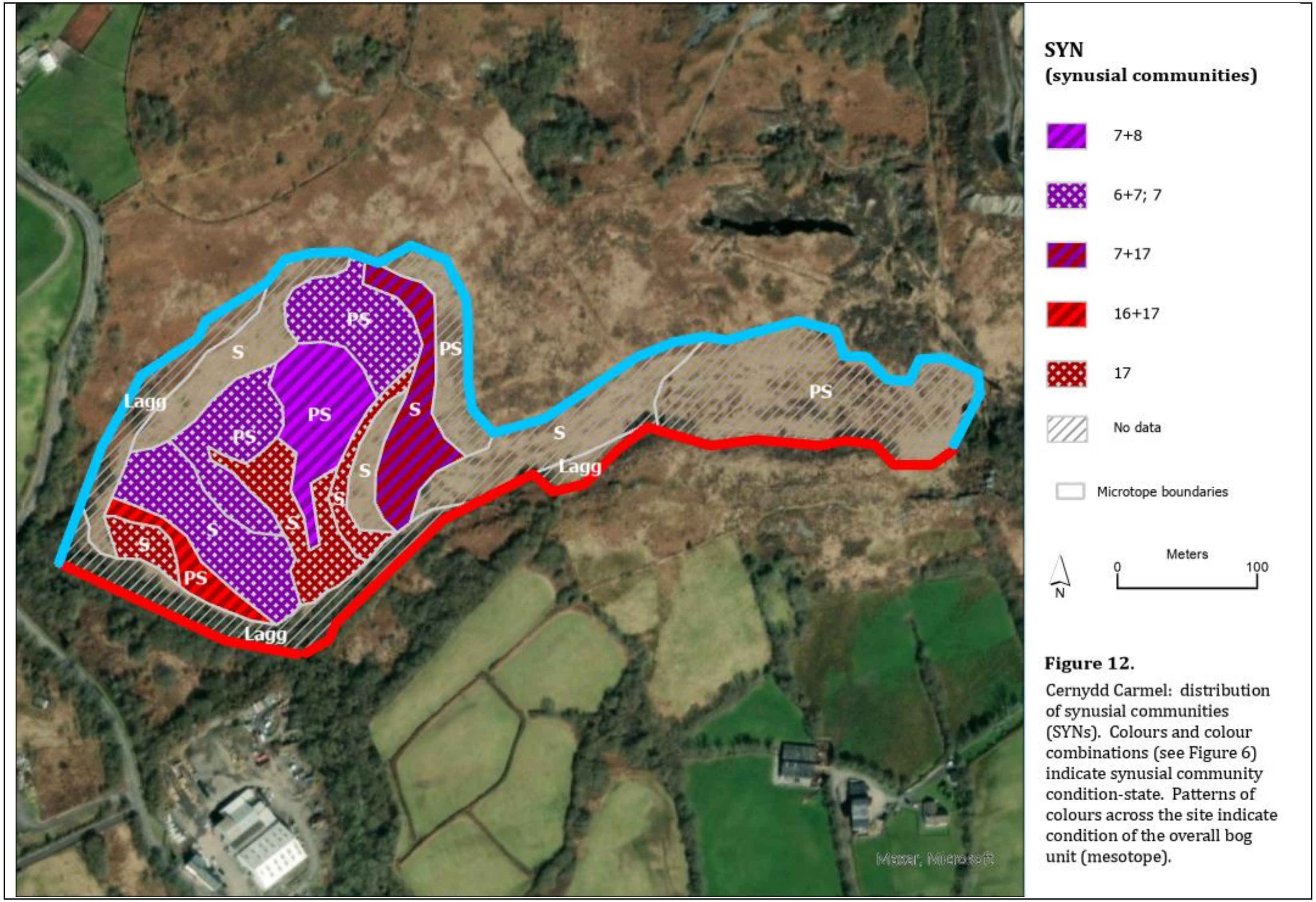



**Figure 12.**

Cernydd Carmel: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

8.3.5 *Cernydd Carmel – SYNs* *(see Figure 12 and Figure 6)*

8.3.5.1 The synusial species communities on Cernydd Carmel are dominated by two broad community types. There are dry bog communities characterised by the purple shading of SYN 6 and SYN 7, with dwarf shrubs and *Hypnum jutlandicum*. Other areas are characterised by the tall *Molinia caerulea* tussocks of SYNs 16 and 17. Between these tussocks, in the case of SYN 16 there are pockets of T2 with *Hypnum jutlandicum* and dwarf shrubs whereas SYN 17 is micro-eroded bare peat or even in places eroding gullies.

8.3.5.2 Vegetation on the small primary remnants is dominated by three main communities. There are dry T3 hummocks of *Hypnum jutlandicum* and *Erica tetralix* in the case of SYN 6. In contrast there is T2 high ridge with *Hypnum jutlandicum* and dwarf shrubs in the case of SYN 7, while SYN 8 supports a richer community of T2 *Hypnum jutlandicum* with dwarf shrubs, T1 with *Sphagnum* including *S. fallax*, indicating recovering hollows, as well as A1 *Sphagnum* hollows with *Rhynchospora alba*. *Molinia caerulea* tussocks are present throughout.

8.3.6 *Cernydd Carmel – Summary*

8.3.6.1 Although not subject to the extensive marginal encroachment which typifies several of the sites under consideration, Cernydd Carmel is one of the worst of the nine in terms of peat bog ecosystem condition. It does, however, possess a large section of undrained lagg fen and is thus a more intact macrotope system than many of the other sites.

8.3.6.2 Quite why Cernydd Carmel should be in such poor condition is not entirely clear. It is highly unusual in being riven with erosion ranging from extensive micro-erosion through to full-scale erosion gullies, but whether this is because its southern lagg fen was canalised and deepened cannot now be determined because the canalisation of the lagg fen (and the extent of this action) as well as the appearance of erosion both pre-date the earliest aerial photography.

8.3.6.3 Intense erosion of bog systems is often associated with burning and the site is reported to have been burnt regularly in order to provide supplemental grazing for cattle. The scale of this might be determined by macrofossil analysis of short peat cores, looking in particular for concentrations, or even bands, of charcoal.

8.3.6.4 Recovery after domestic peat cutting is the other usual explanation for such a tussock-dominated system, but this is usually evident as rectilinear features visible on aerial photography. No such evidence is visible on even the earliest available aerial imagery, though LIDaR has revealed the presence of small localised cuttings but are not sufficiently extensive to explain the general nature of the site. Furthermore, erosion channels feature prominently on early imagery and such features are not normally associated with old, even very old, peat cuttings. However, proximity to the South Wales rail network might have led to more industrial-scale stripping of the peat in times past. Local archival records might shed light on this question.

## 8.4 Cors Caron Macrotope Complex

8.4.1 *<u>Cors Caron mire complex - macrotope and mesotope</u> (see Figure 13)*

8.4.1.1 Cors Caron consists of three distinct mesotopes linked in part by a common **lagg fen** in the form of the River Teifi – the large West Bog lying to the west of the Teifi while both the smaller NE Bog and SE Bog lie to the east.

8.4.1.2 The valley floor of the River Teifi is relatively level so it is possible that in the undisturbed state all three bogs once sat within a single expanse of flood-plain fen through which the Teifi meandered. Flood plains bordered by rising ground often also receive water from spring fens and seepages supplied by artesian pressure or surface runoff from the surrounding slopes, so it is possible that the lagg fen along the eastern side of the complex was originally a mixture of flood-plain fen, spring fen and seepage fen.

8.4.1.3 The Teifi channel has, however, been deepened on a number of occasions during the last century or so, resulting in complete loss of lagg fen through the centre of the complex. Meanwhile peat cutting and agricultural land-claim and drainage have removed the majority of the lagg fen not immediately associated with the Teifi channel, leading to almost complete loss of the **lagg fen-raised bog macrotope** complex.

8.4.1.4 Furthermore, domestic peat cutting and agricultural land claim have substantially reduced the area of primary surface two of the mesotopes within the complex – the NE Bog and the SE bog – rendering the individual **mesotopes** now even more isolated from each other.

8.4.1.5 As the three bog mesotopes are now in effect hydrologically separated, and each bog has experienced different land-use impacts resulting in differing present-day condition-states, each bog will be considered separately before finally considering Cors Caron as a large macrotope complex.

## 8.5 Cors Caron NE Bog

8.5.1 *<u>Cors Caron NE Bog- macrotope and mesotope</u> (see Figure 14)*

8.5.1.1 The NE Bog lies to the east of the River Teifi and originally abutted the rising ground to the east. As such, it is possible that the **lagg fen** of the NE Bog was originally a mixture of flood-plain fen, spring fen and seepage fen while the western margin would have been provided by the lagg fen formed by the riparian zone of the River Teifi.

8.5.1.2 As noted above, however, the lagg fen of this riparian zone has been completely lost, so the western portion of the lagg fen no longer exists. Aerial imagery from the immediate post-war period also shows that the eastern margin of the bog had already by then been impacted by domestic peat extraction and agricultural land-claim, leading to loss of this peat margin and the lagg fen.

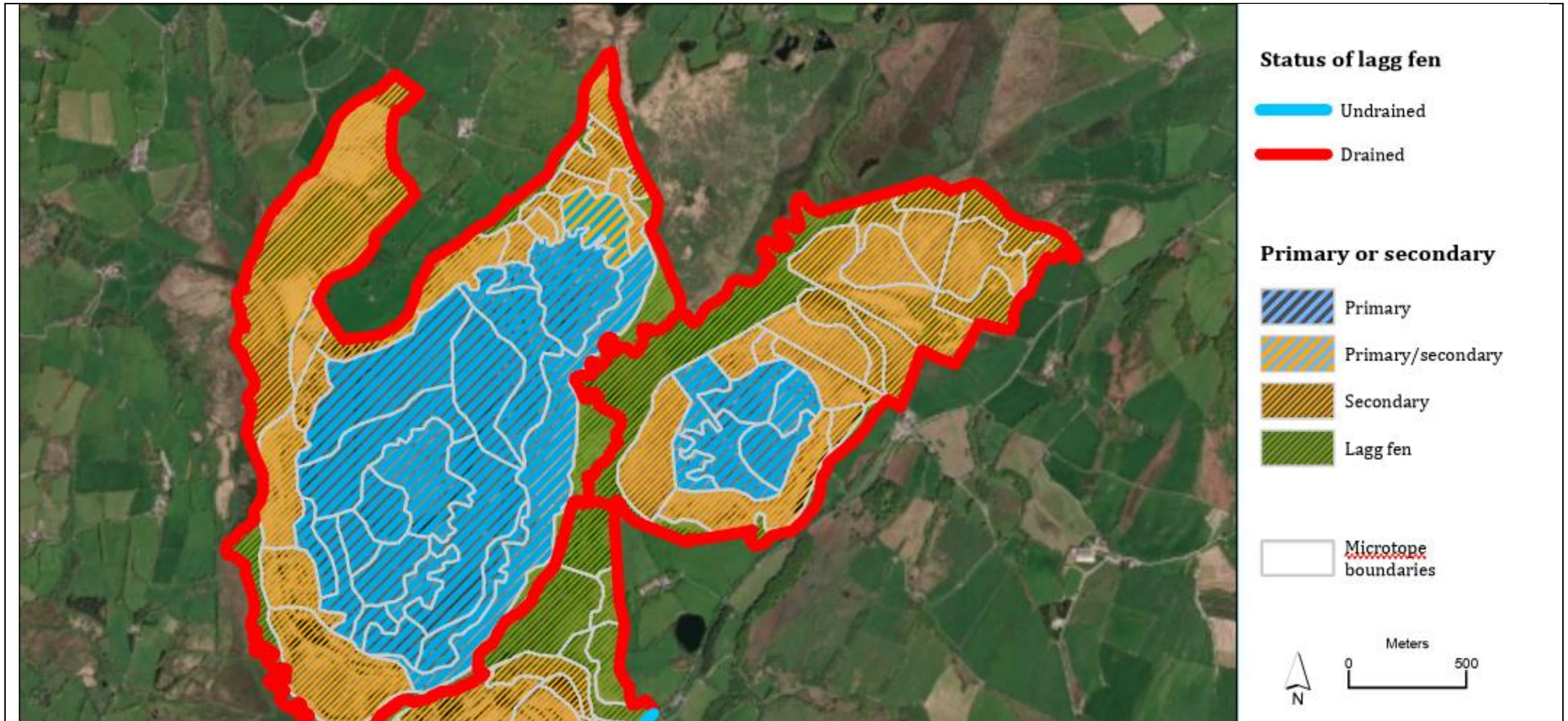



**Figure 13.**
Cors Caron macrotope complex: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently drained ground but would likely become lagg fen if re-wetted.

8.5.1.3 Consequently the macrotope complex of the NE raised bog dome and associated lagg fen has been lost as a functioning dome and lagg **macrotope**.

8.5.1.4 Indeed the entire margin, plus a significant part of the mire expanse, have both historically been the focus of domestic peat cutting with the result that a large proportion of the **mesotope** now consists of a secondary regeneration surface. The surviving primary dome, although now reduced to less than half of its original extent, is nevertheless relatively free from additional active attempts to drain this remaining primary mire expanse.

8.5.2 <u>*Cors Caron NE Bog – Condition matrix summary*</u> *(see Figures 15 and 16)*

8.5.2.1 Condition-matrix data for all Cors Caron NE Bog microtope polygons have been collated into Figures 15 and 16, which represent summary condition matrices sheet for the site as a whole. Two sets of condition matrices are presented because Figure 15 collates data gathered in 2019, separating primary surfaces (15a) from secondary surfaces (15b) while Figure 16 shows combined primary and secondary data from 2023 following a range of restoration interventions by the project team.

8.5.2.2 The overall picture for 2019, as shown in Figure 15a, reveals that although there are several features typical of good-condition peat bog habitat on the primary surface, these are more than balanced by the range of features indicating various degrees of poor condition. There are several records within the turquoise sector, potentially suggesting progress towards recovery although without subsequent repeat measurements there is the possibility that at least some of these records actually indicate a shift from good-condition to poorer condition. In addition, there are several records for the poorest-condition sectors.

8.5.2.3 For the secondary surfaces the balance is entirely towards features of damage with more features of serious damage than for signs of recovery. Conditions are essentially rather dry and little sign of re-wetted peat cuttings encouraging development of *Sphagnum*-rich secondary assemblages.

8.5.2.4 The position in 2019 therefore suggested that parts of the mire expanse were maintaining reasonably good condition but there were considerable grounds for concern because of the large number of features pointing to unfavourable conditions within the site.

8.5.2.5 The picture to emerge from 2023 (Figure 16) thus offers cause for optimism because although the number of unfavourable features increases slightly compared with the position in 2019, a great many more features associated with good condition were recorded. Restoration interventions on peat bog systems are rarely able to replace features of degradation over such short timescales, so it is hardly surprising that these remain for the moment.

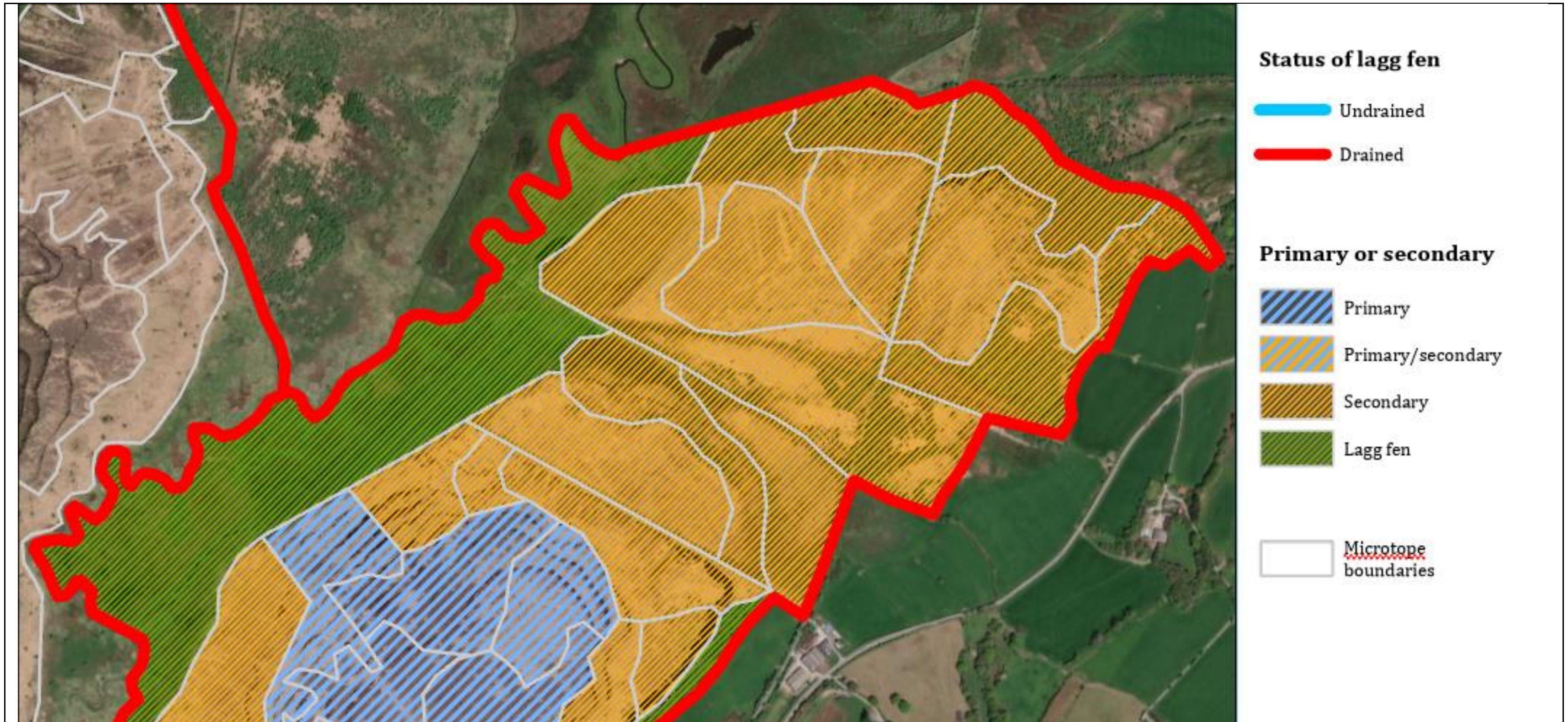



**Figure 14.**
Cors Caron NE Bog: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently drained ground but would likely become lagg fen if re-wetted.

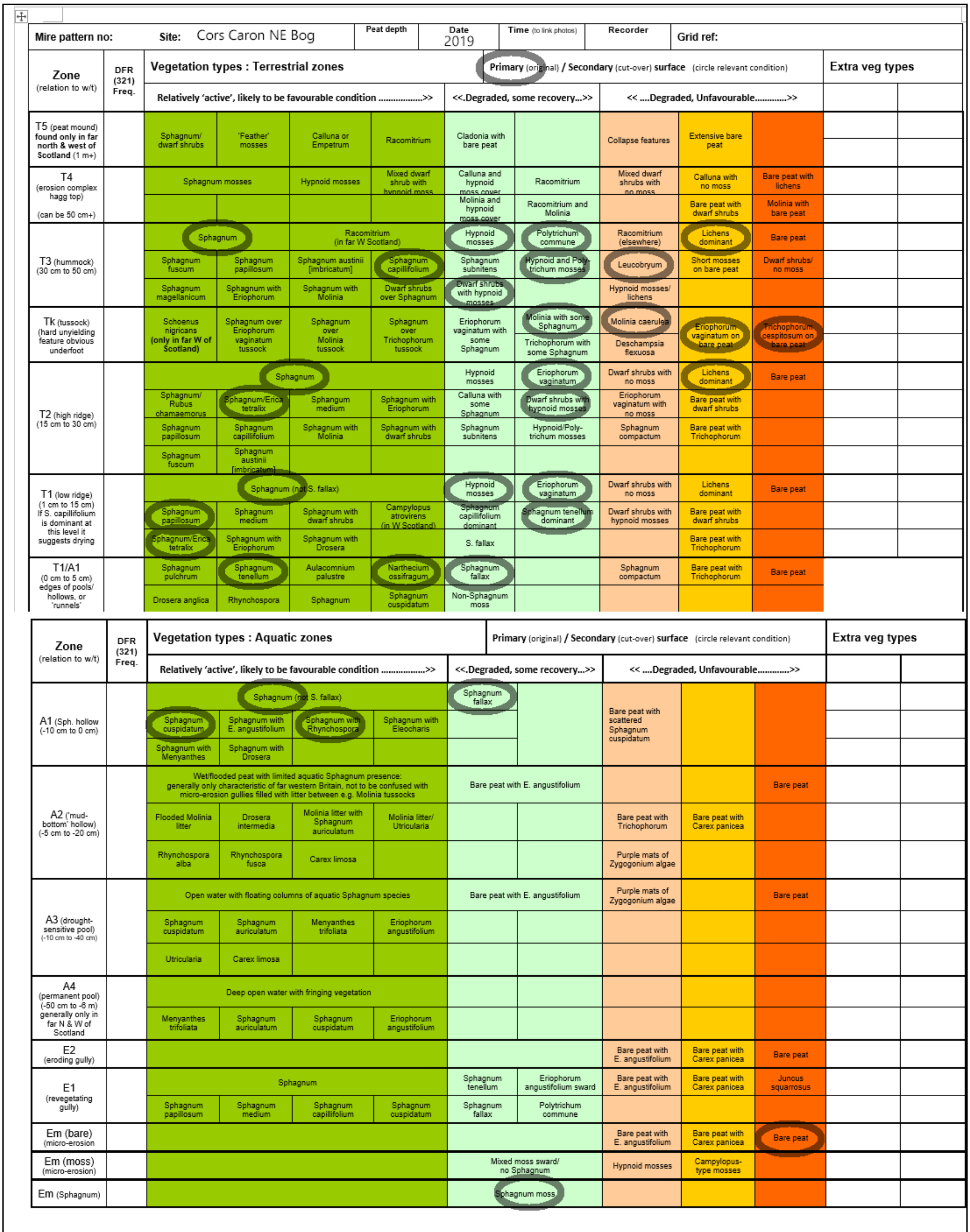



**Figure 15a.** Consolidated condition matrix for the Cors Caron NE Bog mesotope, incorporating condition matrix data from all primary microtope polygons recorded within the site. These data were collected in **2019**.

Mire pattern no: | Site: Cors Caron NE Bog | Peat depth | Date 2019 | Time (to link photos) | Recorder | Grid ref:

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | |

**Figure 15b.** Consolidated condition matrix for the Cors Caron NE Bog mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site. These data were collected in **2019**.

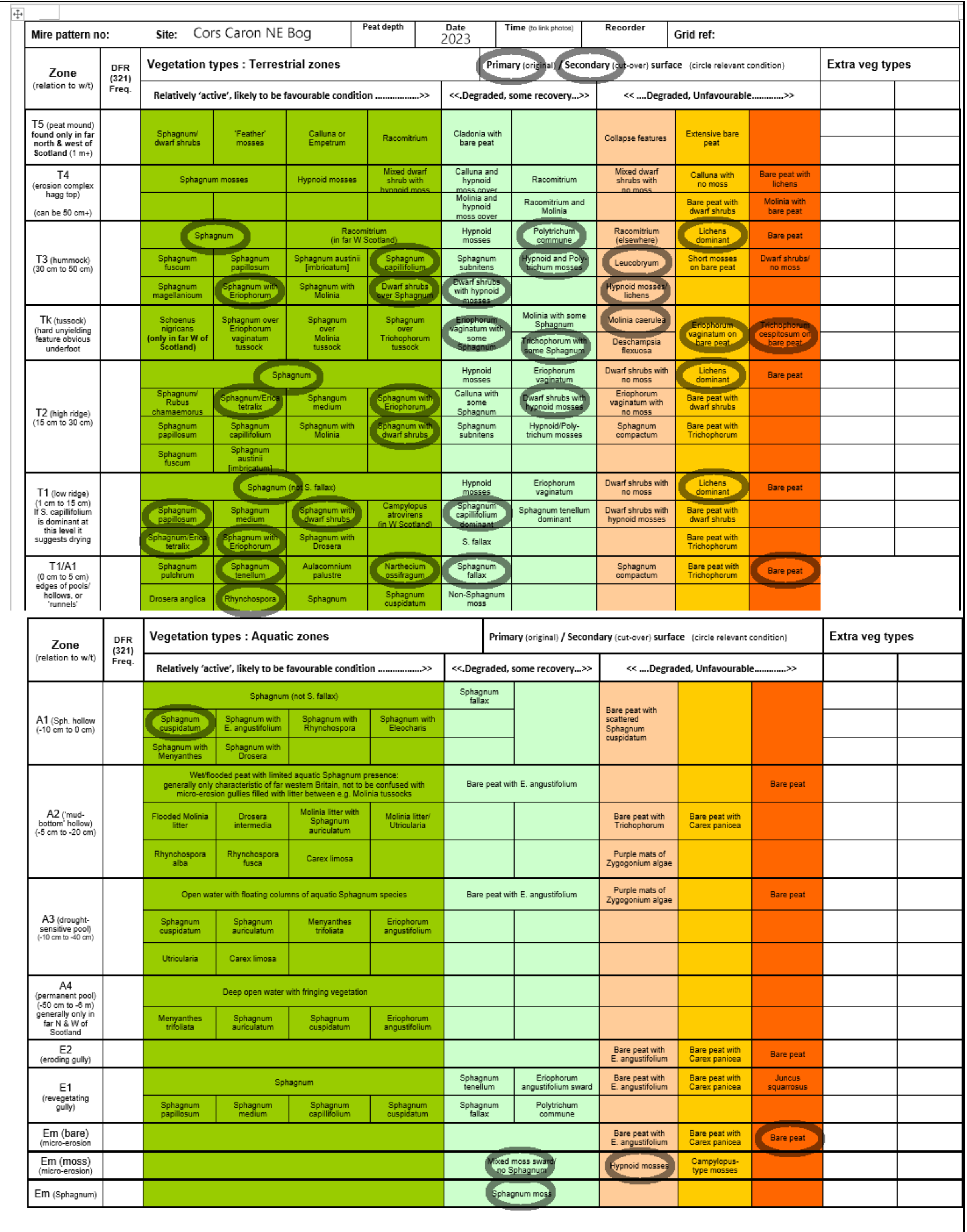



**Figure 16.** Consolidated condition matrix for the Cors Caron NE Bog mesotope, incorporating condition matrix data from all microtope polygons, both primary and secondary, recorded within the site. These data were collected in **2023** following a series of restoration interventions undertaken as part of the New LIFE for Welsh Raised Bogs Project.

8.5.2.6 Indeed the act of restoration intervention can temporarily result in localised degradation as poor-condition features degrade due to rising water tables. Concerns over the slight increase in degradation features observed in 2023 should therefore be outweighed by the increase in features indicative of good condition. Ultimately, of course, the restoration target should be removal of all these negative indicators.

8.5.3 *Cors Caron NE Bog – ZEGs (see Figure 17 and Figure 4)*

8.5.3.1 The orange of the peat cuttings stands out clearly as a ZEG 42 collar around the remnant primary dome and consists mostly of *Molinia* tussocks and micro-erosion albeit with some scattered examples of T2 high ridge and T1 low ridge.

8.5.3.2 Substantial parts of the remnant primary dome, particularly to the west, are characterised by ground featuring various tussock-dominated communities. These range from areas supporting the full range of synusial zones from T3 to A1 hollows but within which Tk tussocks are a prominent feature in ZEG 19, to the drier more damaged ground of ZEG 43 in which only T3 hummocks and T2 high ridge lie within areas dominated by micro-erosion in various states of re-vegetation.

8.5.3.3 The areas of best habitat condition based on zonal features are smaller in extent than the more degraded parts of the primary dome and are located on the eastern part of the remnant dome. They occur as VEGs 6, 10 and 18, which between them embrace the range of T3 to T1A1, while the more mixed-condition combination of ZEGs 17, 20 and 24 include A1 hollows and even A3 drought-sensitive pools (though these are probably secondary features) nonetheless with Tk tussocks as constant companions for ZEGs 20 and 24.

8.5.4 *Cors Caron NE Bog – VEGs (see Figure 18 and Figure 5)*

8.5.4.1 The vegetation assemblages reflect the pattern of ZEGs across the site. The very best area on the eastern part of the dome supports VEG 6 and 7 assemblages which both have constant presence of T2, T1 and T1A1 with VEG 6 being *Sphagnum*-rich throughout this range whereas the T2 zone in VEG 7 is rather drier and *Trichophorum cespitosum* tussocks are a constant feature.

8.5.4.2 The vegetation assemblages here are dominated by relatively low-relief *Sphagnum*-rich ridges extending down to a T1A1 transition zone with *Sphagnum tenellum*, *Rhynchospora* and some *S. pulchrum*. This is mixed with the somewhat drier low-relief assemblage for VEG 7 in which lichens, dwarf shrubs and *Hypnum jutlandicum* feature more prominently.

8.5.4.3 The adjacent, westerly, part of the primary dome, differs from the best parts by adding VEG 21 to the assemblage mix, with its emphasis on tussocks of *Molinia caerulea* and *Eriophorum vaginatum* together with T3 hummocks of *Polytrichum commune*.

8.5.4.4 More degraded parts of the primary dome are characterised by vegetation assemblages similar to those of the best parts of the dome but with increasing amounts of lichen, dwarf shrubs and *Hypnum jutlandicum* in the T2 and T1 zones, characteristic of VEGs 10, 11 and 21. Further signs of former fire damage are seen in the increased presence of Tk tussocks together with *Sphagnum tenellum* as a dominant in the T1 zone, this being a sign of recovery from post-fire conditions where wet bare peat is exposed and typically colonised by this pioneer species.

8.5.4.5 The secondary areas of peat cuttings are characterised by VEGs 16 and 22 with their Tk tussocks of *Molinia caerulea* and various states of micro-erosion - from bare peat to *Sphagnum* establishment – and varying from relatively dry *Hypnum* communities to flooded areas of cuttings where *Sphagnum cuspidatum* is becoming established.

8.5.5 <u>*Cors Caron NE Bog – SYNs*</u> *(see Figure 19 and Figure 6)*

8.5.5.1 The pattern of synusial communities is rearranged somewhat compared to the pattern of ZEGs and VEGs although the result is somewhat mixed. The area containing some examples of the best SYN 15 is the most northerly of the primary sectors, but this also contains examples of the driest SYN 6 community as well as the sub-optimal wet bog SYN 12. While this area has T3 hammocks with *Hypnum jutlandicum*, *Cladonia* and *Leucobryum glaucum*, it is comparatively rich in *Sphagnum capillifolium* and *S. papillosum* T2 and T1 ridge communities with *Andromeda polifolia* and *Narthecium ossifragum*.

8.5.5.2 The adjacent northerly sector of the primary surface consists entirely of the (albeit sub-optimal) wet bog community of SYNs 11 and 12 and thus represents the next-best sector in terms of condition. Both embrace the T3 to T1 range of synusial zones and though both have rather dry T3 hummocks, SYN 12 also extends down to a *Sphagnum tenellum* T1A1 zone while also introducing constant presence of *Trichophorum cespitosum* and *Eriophorum vaginatum* tussocks.

8.5.5.3 In contrast, the central and southern parts of the primary dome have a more mixed community of the somewhat drier SYN 10 mixed with SYN 12, giving T2 high ridge with less *Sphagnum*, a low-relief profile of T1 to A1 rich in *Sphagnum papillosum*, *S. tenellum* and *S. cuspidatum* with *Narthecium ossifragum* and *Rhynchospora alba*, as well as abundant Tk tussocks of *Molinia*, *Eriophorum vaginatum* and *Trichophorum cespitosum*.

8.5.5.4 Areas of peat cutting also display a range of conditions although all are decidedly indicative of the effects resulting from such cutting. Conditions range from relatively simple SYN 16 *Molinia caerulea* tussocks and micro-erosion to SYNs 6 and 7 areas of Tk tussock and various stages of re-colonisation by mosses, both *Hypnum jutlandicum* and *Sphagnum*, along with a limited range of other typical bog species.

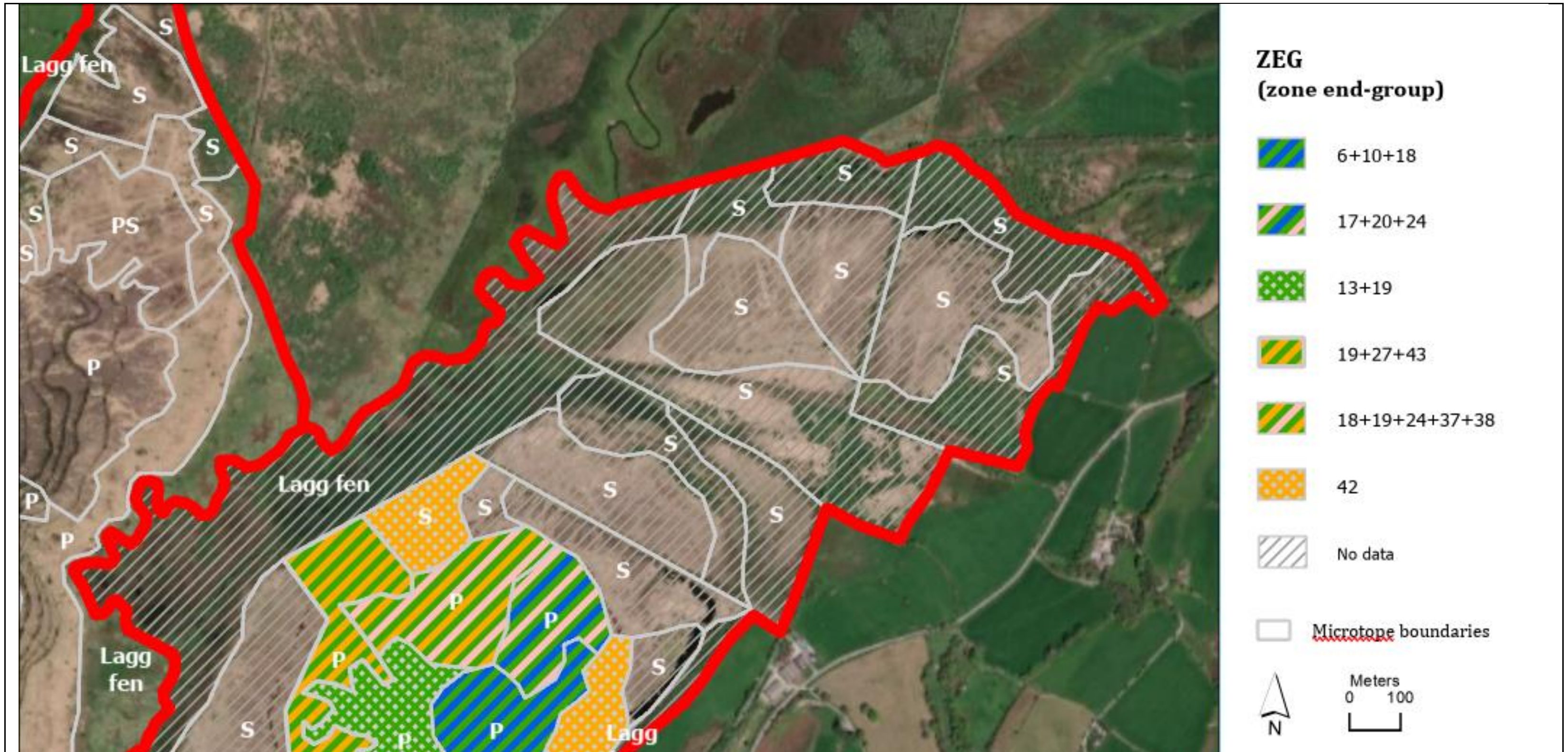



**Figure 17.**

Cors Caron NE Bog: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

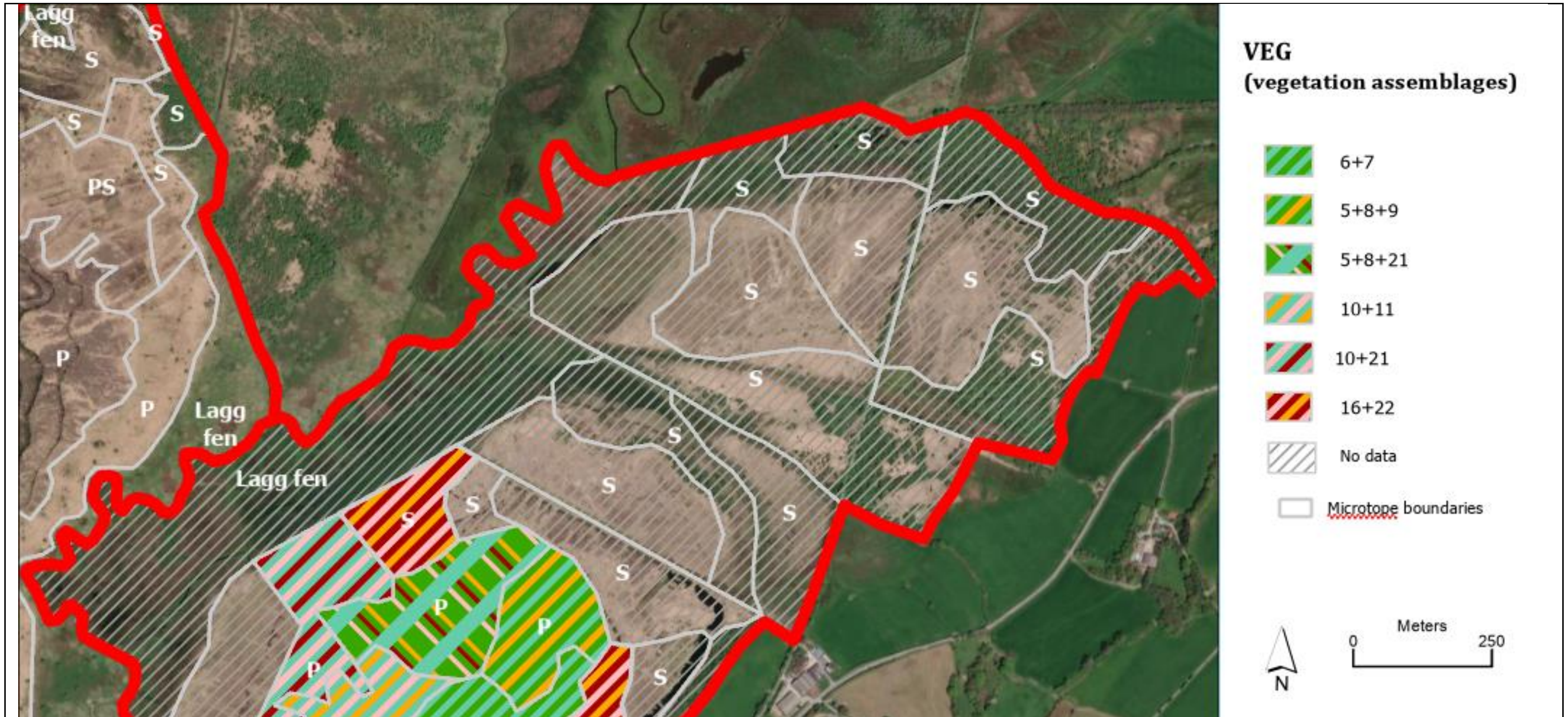



**Figure 18.**
Cors Caron NE Bog: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

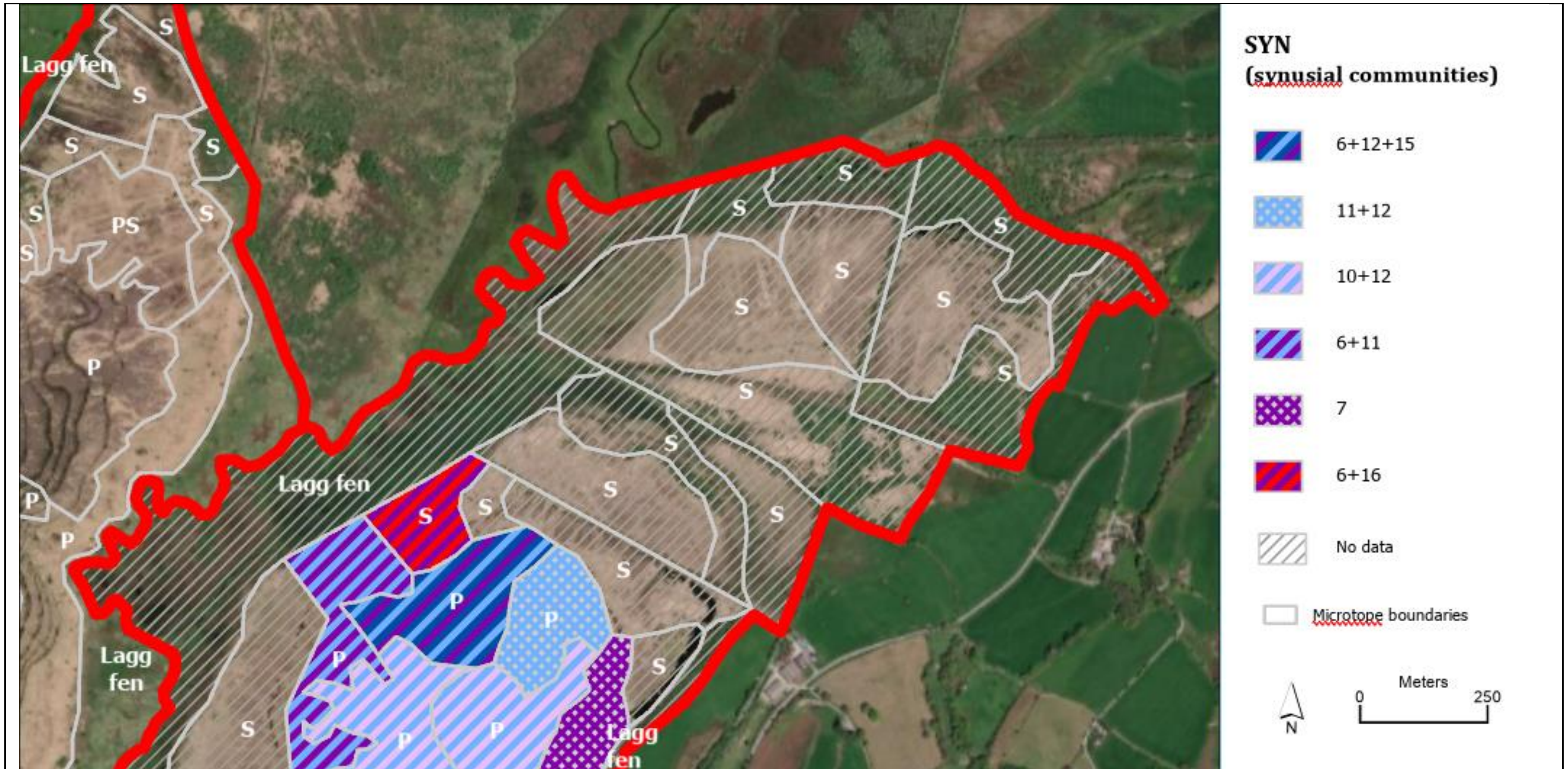



**Figure 19.**

Cors Caron NE Bog: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

8.5.6 *Cors Caron NE Bog – Summary*

8.5.6.1 The condition of the NE Bog is significantly affected by three key factors, namely total loss of the lagg fen, removal of substantial parts of the raised bog dome by domestic peat cutting, and the effect of unknown numbers of fires and their severity, likely common when the Carmarthen-Aberystwyth steam trains ran. Perhaps what is most remarkable about the site is the fact that despite these major impacts the remnant primary dome continues to support some examples of good-quality raised bog habitat – albeit in somewhat fragmentary form.

8.5.6.2 The other remarkable aspect of this site is that evidence from repeat use of the condition matrix appears to show, after less than four years, a marked move towards improved condition following restoration interventions by NRW.

8.5.6.3 Other than ensuring that fire is no longer a hazard for the site, the two greatest constraints to habitat improvement are, firstly, the hydrological disjunction at the face of the old peat cuttings caused by loss of peat, and secondly the complete absence of any functional lagg fen around the site.

8.5.6.4 The bunding undertaken across the site by NRW will help to mitigate, though not completely resolve, the hydrological effects of the peat cuttings. Indeed, the evidence from the 2023 round of condition-matrix monitoring suggests that this may be happening. Steady accumulation of fresh peat in the cuttings will also be important here in the longer-term, but this is to some extent constrained by the other major barrier to complete recovery – namely the absence of a functioning lagg fen.

8.5.6.5 A lagg fen would maintain suitable conditions for vigorous peat accumulation in the peat cuttings while also removing the key underlying hydrological issue that currently prevails, which is that the base on which the bog water-table rests has been artificially lowered as a result of lowering the river bed of the River Teifi. As well as its loss having a direct effect on the west side of the bog it also facilitated drainage of other parts of the lagg fen.

8.5.6.6 Finally, it is evident that a substantial body of peat once lay to the north-east of the current remnant dome. This northern portion peatland was lost before the earliest available aerial photography so it is not possible to be sure of this ground's nature. It appears to be a former area of raised bog, but although there is clear evidence of domestic peat cutting across the northern portion of this northern area it is difficult to determine whether this represented an extension of the current NE Bog or was instead a separate bog unit. Even on the earliest available aerial imagery there are three straight dividing lines separating the current bog from this northern area. Though now obviously artificial, could these be canalised versions of a pre-existing lagg-fen stream, or have these been dug opportunistically once peat cutting had removed part of the original bog dome? Either way, the opportunity exists to extend the macrotope complex of the remaining raised bog to incorporate this northern portion, whether as a separate bog linked by a lagg fen or as an integral part of the current NE Bog.

## 8.6 Cors Caron South East Bog

8.6.1 *Cors Caron SE Bog- macrotope and mesotope* *(see Figure 20)*

8.6.1.1 As already discussed, the Cors Caron macrotope complex consists of three mire systems originally linked by a common lagg fen system associated with the River Teifi. Like the NE Bog discussed above, the South East Bog lies to the west of the Teifi, and, like the NE Bog, has been subject historically to extensive domestic peat cutting around much of its margins.

8.6.1.2 Indeed what is immediately apparent is that a much larger proportion of the SE Bog primary dome has been lost to domestic peat cutting compared to that of the NE Bog (if, that is, one discounts the apparently separate area to the north of the NE Bog discussed above). Furthermore, the remnant primary dome of the SE Bog lies centrally within the area of peat cutting so has been impacted equally on all sides whereas peat cutting has encroached only a modest distance into the southern margin of the NE Bog.

8.6.1.3 The **mesotope** of the SE Bog has therefore suffered very substantial modification, with only a small proportion of the original primary dome surviving. This is surrounded by a halo of abandoned domestic peat cuttings as secondary bog surfaces that are in various stages of vegetation recovery.

8.6.1.4 On the other hand, the SE Bog has what is the closest thing to a surviving section of **lagg fen** running along its south-eastern boundary where the bog meets sharply rising ground. It is not a fully functioning lagg fen, particularly as it abuts directly into the secondary peat cuttings, but it retains a limited facsimile of what would once have existed here.

8.6.1.5 For the remainder of the SE Bog boundary the lagg fen has been completely lost, particularly with loss of the flood-plain fen of the River Teifi when the river bed was deepened.

8.6.1.6 Overall, therefore, with the combination of extensive domestic peat cutting and loss of a substantial part of the lagg fen, the **macrotope** of the SE Bog is now severely compromised.

8.6.2 *Cors Caron SE Bog – Condition matrix summary* *(see Figure 21)*

8.6.2.1 Condition-matrix data for all Cors Caron SE Bog microtope polygons have been collated into Figure 21, which represents a summary condition matrix sheet for the site as a whole.


**Figure 20.**
Cors Caron SE Bog: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Part of the West Bog, lying across the River Teifi to the west of the SE Bog, is also visible

8.6.2.2 From the consolidated condition matrix of Figure 21a it is possible to see that the SE Bog primary surface has many features indicative of good condition, indeed many more than the post-restoration matrix of the NE Bog, but more significantly in terms of overall condition, the SE Bog also has a considerable number of features associated with poor condition. This reflects the combination of areas that still retain good condition and areas significantly impacted by the surrounding peat cuttings.

8.6.2.3 Significant numbers of positive features are also associated with peat cutting areas where re-wetting has resulted in development of secondary features resembling natural zonations (particularly A2 and A3 pools), as shown in Figure 21b. Indeed these features outnumber the features indicative of damage.

8.6.2.4 Overall, though, while the site retains significant areas of reasonably good condition across the small remnant primary dome and some good features have regenerated in the cuttings, the large area of peat cuttings and its features of damage dominate the mesotope as a whole.

8.6.3 *Cors Caron SE Bog – ZEGs* *(see Figure 22 and Figure 4)*

8.6.3.1 The remnant primary dome displays a remarkably consistent texture-pattern of synusial zones across its area, albeit not in the best condition-state largely because of the consistent presence of tussocks throughout what is otherwise a surface texture consisting of all zones from T3 hummocks to A1 hollows.

8.6.3.2 Secondary surfaces in the peat cuttings consist mostly of (secondary) T2 high ridge, T1 low ridge and A1 hollows within a Tk tussock- and micro-erosion-dominated sward. The separate mapped area of secondary cuttings to the south consists of a somewhat drier community of secondary T3 hummocks and T2 high ridge within an even denser sward of Tk tussocks.

8.6.4 *Cors Caron SE Bog – VEGs* *(see Figure 23 and Figure 5)*

8.6.4.1 In terms of the VEG vegetation assemblages, the primary dome and the secondary vegetation in the peat cuttings are not so distinguishable from each other. The turquoise 'degraded recovering' sector of the condition matrix, symbolised by VEGs 10, 11, 12 and 14 along with their accompanying hues of either pink or orange, occurs throughout and is mostly the best condition-state achieved. VEG 10 is distinguished by dry T2 but *Sphagnum*-rich T1, T1A1 and A1, albeit with these latter elements with significant amounts of S. fallax. VEG 11 has the same synusial zones but is *Sphagnum*-rich in all zones, this time with *S. tenellum* together with *S. fallax*. VEG 12 has less A1 hollows but contains scattered T1A1 with *S. tenellum* and *S. pulchrum* rather than *S. fallax*. VEG 14 consists of mostly dry T3 and *Sphagnum*-rich T2 and T1 with little T1A1. All have constant presence of Tk tussocks consisting variously of *Molinia caerulea*, *Eriophorum vaginatum* or *Trichophorum cespitosum*.

| Mire pattern no: | Site: Cors Caron SE Bog | Peat depth | Date 2019 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | **Primary (original)** / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | **Sphagnum** | | Racomitrium (in far W Scotland) | | **Hypnoid mosses** | **Polytrichum commune** | Racomitrium (elsewhere) | **Lichens dominant** | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | **Sphagnum capillifolium** | Sphagnum subnitens | **Hypnoid and Poly-trichum mosses** | **Leucobryum** | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | **Dwarf shrubs with hypnoid mosses** | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | **Eriophorum vaginatum with some Sphagnum** | Molinia with some Sphagnum | **Molinia caerulea** | **Eriophorum vaginatum on bare peat** | **Trichophorum cespitosum on bare peat** | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | **Sphagnum** | | | | Hypnoid mosses | **Eriophorum vaginatum** | **Dwarf shrubs with no moss** | **Lichens dominant** | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | **Sphagnum/Erica tetralix** | Sphangum medium | **Sphagnum with Eriophorum** | **Calluna with some Sphagnum** | **Dwarf shrubs with hypnoid mosses** | **Eriophorum vaginatum with no moss** | Bare peat with dwarf shrubs | | | |
| | | **Sphagnum papillosum** | Sphagnum capillifolium | Sphagnum with Molinia | **Sphagnum with dwarf shrubs** | **Sphagnum subnitens** | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | **Sphagnum (not S. fallax)** | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | **Lichens dominant** | Bare peat | | |
| | | **Sphagnum papillosum** | Sphagnum medium | **Sphagnum with dwarf shrubs** | **Campylopus atrovirens (in W Scotland)** | Sphagnum capillifolium dominant | **Sphagnum tenellum dominant** | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | **Sphagnum/Erica tetralix** | **Sphagnum with Eriophorum** | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | **Sphagnum tenellum** | Aulacomnium palustre | **Narthecium ossifragum** | **Sphagnum fallax** | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | **Rhynchospora** | **Sphagnum** | **Sphagnum cuspidatum** | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | **Sphagnum (not S. fallax)** | | | | **Sphagnum fallax** | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | **Sphagnum cuspidatum** | **Sphagnum with E. angustifolium** | **Sphagnum with Rhynchospora** | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | **Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks** | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | **Flooded Molinia litter** | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | **Sphagnum cuspidatum** | Sphagnum auriculatum | Menyanthes trifoliata | **Eriophorum angustifolium** | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 21a.** Consolidated condition matrix for the Cors Caron SE Bog mesotope, incorporating condition matrix data from all primary microtope polygons recorded within the site.

| Mire pattern no: | Site: Cors Caron SE Bog | Peat depth | Date 2019 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 21b.** Consolidated condition matrix for the Cors Caron SE Bog mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site.


**Figure 22.**

Cors Caron SE Bog: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

8.6.4.2 The exception to this constrained condition occurs in a small portion of the north-western margin of the remnant primary dome where the green of 'good condition' associated with VEGs 8 and 13 is mixed with all condition colour sectors apart from the very worst condition-state. *Sphagnum* is common throughout the T3 to A1 spectrum here, but although in general the texture is low-relief characterised by T2 high ridge and T1 low ridge there are numerous signs of drying, including lichens and non-*Sphagnum* mosses.

8.6.4.3 The 'thumb' of primary bog that extends out to the east is in markedly poorer condition than the bulk of the primary dome although the VEGs 11 and 12 here still maintain the underpinning turquoise condition-state. That such a small outcropping of the dome should be drier than the remainder is no surprise given the extreme hydrological pressures acting on three sides, but post-war aerial imagery also reveals that attempts were made to drain this ground although for some reason the drains were not taken right across this thumb of ground.

8.6.4.4 The fact that the secondary peat cuttings are not so different from those on the primary dome in terms of their vegetation assemblages suggests that these areas of peat cutting are in a rather advanced state of vegetation re-colonisation, albeit within a *Molinia*-tussock sward, though the areas to the south are drier. Two, or perhaps three, previous rounds of restoration intervention would thus appear to be having a positive effect.

8.6.5 *Cors Caron SE Bog – SYNs (see Figure 24 and Figure 6)*

8.6.5.1 The synusial species communities of the SE Bog display more variation than has been noted for the ZEGs and VEGs. The primary dome essentially divides into a northern and a southern sector, with the the northern sector supporting synusial communities markedly wetter than those in the southern sector.

8.6.5.2 Rather surprisingly, it is the eastern 'thumb' of primary bog that supports examples of SYN 15, the synusia most characteristic of wet natural conditions with T3 *Sphagnum capillifolium* hummocks, T1 *S. papillosum* low ridge and patches of *S. pulchrum* T1A1 transitioning into *S. cuspidatum* hollows. However, these examples are interspersed with some of the driest synusial communities, characterised by Syns 7, 8 and 9 with a preponderance of hypnoid moss T2 high ridge particularly in SYNs 7 and 8, with the latter also introducing *Sphagnum* T1 low ridge and A1 hollows. SYN 9 is the wettest of the drier synusia and brings in *Sphagnum*-rich T2 to A1 synusial zones. Nevertheless, *Calluna vulgaris*, *Hypnum jutlandicum* and lichens are constant features of all three synusia, together with constant presence of *Molinia caerulea* tussocks. This mixed combination of synusial communities highlights the hydrological pressures bearing down on this outcrop of primary dome.

8.6.5.3 The main northern part of the primary dome is characterised by somewhat greater-relief but otherwise largely similar synusial communities to the eastern ‘thumb’ but lacking the wettest SYN 15 and limiting the driest SYN 7 to a single area.

8.6.5.4 The southern part of the primary dome is dominated wholly by synusia associated with varying degrees of drier conditions. These SYN 8, 9 and 10 synusial communities are all low-relief with T2 high ridge or Tk tussocks providing the highest zonal elements and although *Sphagnum papillosum* is a common feature of T1 low ridge it is accompanied by *S. tenellum*, which is generally a sign of recovery from fire. In general the T2 zone synusia are characterised by dwarf shrubs, *Hypnum jutlandicum* and lichens. The lower, wetter, end of the zonal range is nevertheless present in the form of T1A1 zones of *Sphagnum tenellum* and A1 hollows with *S. cuspidatum* and *Rhynchospora alba*, so perhaps past fire damage was largely restricted to the hummocks and high ridges.

8.6.5.5 The southernmost peat cutting areas are even drier, dominated by SYNs 6 and 9 with T3, T2 and Tk tussock zones within which the synusia are characterised by dwarf shrubs, *Hypnum jutlandicum* and lichens. Areas of secondary re-wetting do occur, and have swards of A1 *Sphagnum fallax* and, in places, *S. cuspidatum* with *Rhynchospora alba*.

8.6.6 <u>*Cors Caron SE Bog – Summary*</u>

8.6.6.1 Despite massive loss of the primary bog mesotope to domestic peat cutting, this remarkable little bog remnant still manages to support a vegetation which, in small pockets, represents synusia characteristic of peat bog habitat in good condition.

8.6.6.2 The impact of the surrounding peat cuttings, together with the effect of past fires and the loss of lagg fen, nevertheless combine to have a malign influence over all parts of this surviving remnant. This is evident from the extensive occurrence of *Hynum jutlandicum* beneath a canopy of dwarf shrubs, particularly *Calluna vulgaris*, together with the almost ubiquitous presence of tussock growth-forms.

8.6.6.3 As with the NE Bog, maintenance and expansion of the present bog synusia will depend on the extent to which surface water can be retained on the surface (thus inhibiting growth of *Molinia*), as well as the extent to which fresh accumulation of peat can be encouraged in the secondary cuttings.

8.6.6.4 Ultimately, the other critical factor is the question of whether the lagg fen can be restored. Doing so would provide a better hydrological foundation for the primary remnant while also assisting in the sustained rewetting of the secondary peat cuttings, thereby encouraging peat formation in these marginal areas.


**Figure 23.**
Cors Caron SE Bog: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

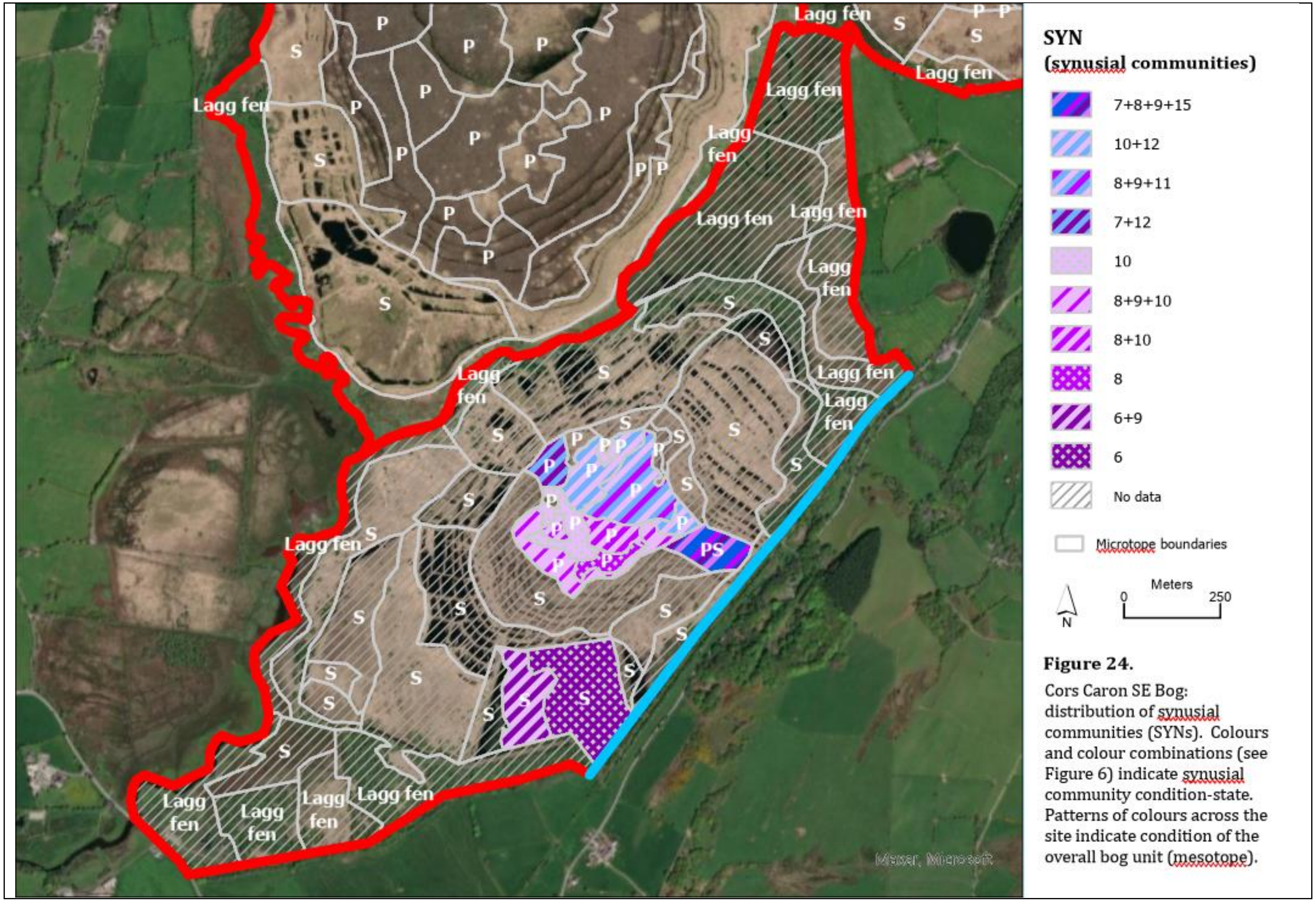



**Figure 24.**
Cors Caron SE Bog: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

## 8.7 Cors Caron West Bog

8.7.1 *Cors Caron West Bog - macrotope and mesotope* *(see Figure 25)*

8.7.1.1 As is evident from Figure 25, the West Bog of the Cors Caron **macrotope** complex is not merely the largest **mesotope** unit within the complex but has also retained a far greater proportion of its primary mire dome. Domestic peat cutting has taken a comparatively limited area from the southern end of the bog and a smaller area still from the northern tip. As such, it would be reasonable to expect this very large primary dome to be in good ecological condition.

8.7.1.2 Balanced against this, however, is the fact that the entire **lagg fen** of the West Bog has been drained, either in the form of agricultural field drains or by the deepening of the River Teifi which forms the eastern margin of the bog.

8.7.1.3 It is also the case that the bog originally possessed a long arm of mire habitat running off to the west then north, while to the south it is evident from post-war aerial imagery that mire habitat extended as far south as the original southern limit of the SE Bog macrotope. Whether these extensions were ever raised bog or are traces of an extensive lagg fen cannot now be determined, but at the very least they highlight how extensive the original lagg fen may have been.

8.7.1.4 Looking at the Cors Caron **macrotope complex** as a whole, the loss of lagg fen from the macrotope complex represents a substantial and wholly negative impact on the hydrological and biodiversity character of the complex, as is the very extensive loss of primary dome from the bogs on the east side of the River Teifi. What should be a remarkable assemblage of extensive mire habitats, unique in Wales and shared in potential character within the UK by only the Duddon Mosses in Cumbria and the Lochar Mosses in Dumfries & Galloway, is currently in severely diminished form (as are, indeed, these two other UK examples).

8.7.2 *Cors Caron West Bog – Condition matrix summary* *(see Figure 26)*

8.7.2.1 Condition-matrix data for all Cors Caron West Bog microtope polygons have been collated into Figure 26a, which represents a summary condition matrix sheet for the primary surfaces of the West Bog, and Figure 26b for secondary surfaces.

8.7.2.2 Perhaps unsurprisingly given its much greater size and relatively limited loss of primary dome, the consolidated matrix data for the primary area of the West Bog (Figure 26a) display a far greater number of features characteristic of good habitat condition than is recorded for either the NE Bog or the SE Bog. The full range of features typical of a raised bog in good condition, spanning T3 hummocks to A1 hollows, is present and associated with vegetation classes that are also mostly indicators of active bog.

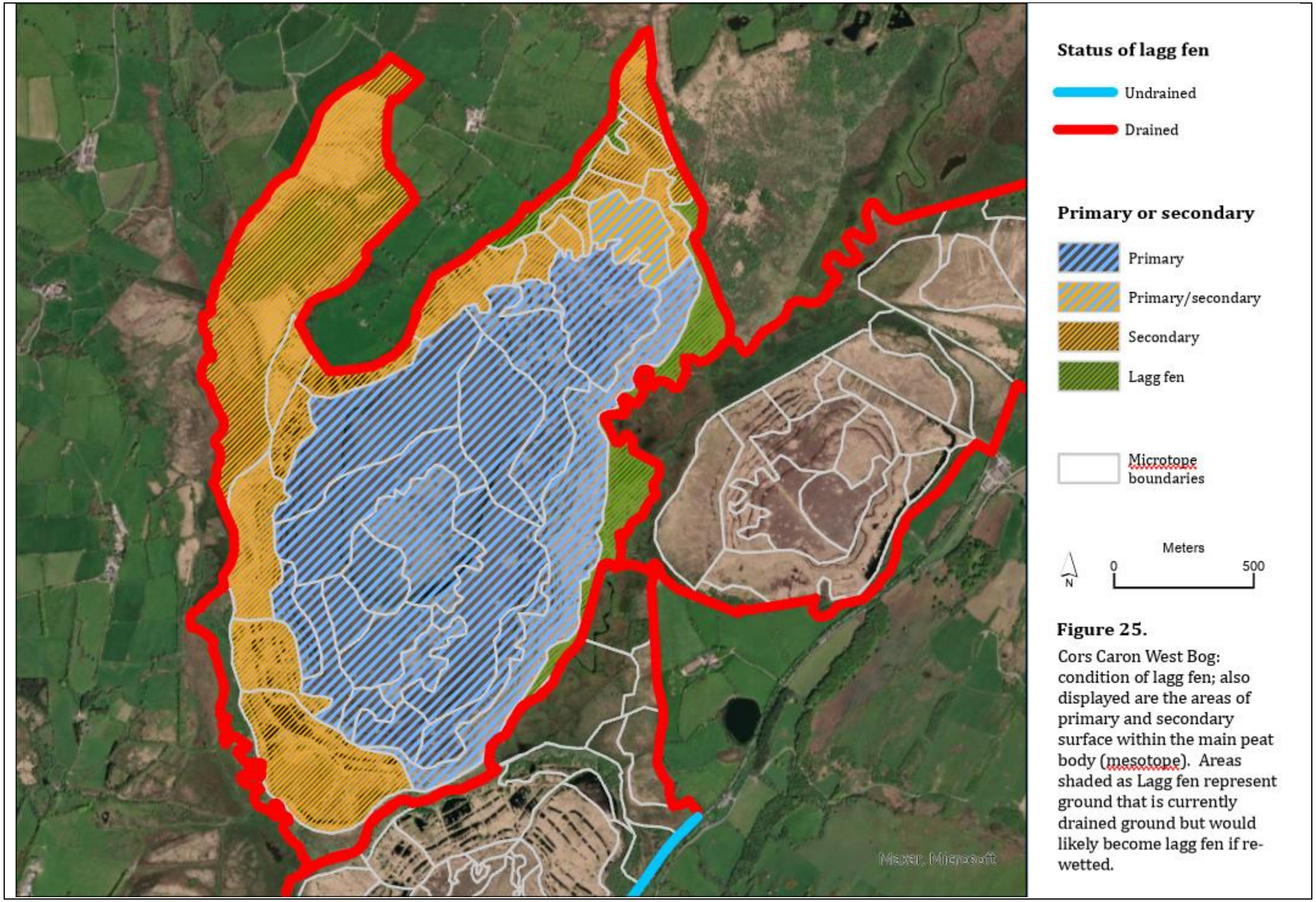



**Figure 25.**

Cors Caron West Bog: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently drained ground but would likely become lagg fen if re-wetted.

| Mire pattern no: | Site: Cors Caron West Bog | Peat depth | Date 2020/21 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 26a.** Consolidated condition matrix for the Cors Caron West Bog mesotope, incorporating condition matrix data from all primary microtope polygons recorded within the site.

| Mire pattern no: | | Site: Cors Caron West Bog | | | Peat depth | Date 2020/21 | Time (to link photos) | Recorder | | Grid ref: | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zone** (relation to w/t) | **DFR (321) Freq.** | **Vegetation types : Terrestrial zones** | | | | **Primary** (original) / **Secondary** (cut-over) **surface** (circle relevant condition) | | | | | **Extra veg types** | |
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphagnum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| **Zone** (relation to w/t) | **DFR (321) Freq.** | **Vegetation types : Aquatic zones** | | | | **Primary** (original) / **Secondary** (cut-over) **surface** (circle relevant condition) | | | | | **Extra veg types** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 26b.** Consolidated condition matrix for the Cors Caron West Bog mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site.

8.7.2.3 Less satisfactory, however, are the numerous indicators of poor condition, ranging from lichen dominance on hummocks and ridges to the presence of micro-erosion in various condition-states. Tussocks are also a common feature and do not occur in moss-rich natural or near-natural form but rather, at best, as tussocks undergoing a degree of moss colonisation.

8.7.2.4 The majority of poor-condition features do at least lie within the 'Degraded, some recovery' sector of the matrix which suggests either that degradation has not been serious or if it originally was serious then conditions are now much improved. Nonetheless, the primary area is far from being in full favourable condition, which is disappointing given that the West Bog represents one of the largest surviving primary raised bog domes in the UK and is almost entirely free from intrusive drainage ditches – which is itself an unusual feature amongst these large surviving sites, most of which have at least some major drainage features.

8.7.2.5 The secondary ground contains equal numbers of features indicative of good condition and poor condition, though the features of good condition are entirely restricted to the T3 hummock and T1 low ridge zone. Poor-condition examples of Tk tussock and T2 high ridge are, however, recorded. While there are no records for T1A1, recolonising peat-cutting hollows provide the good-condition indicators of *Sphagnum cuspidatum* and *Rhynchospora alba*.

8.7.3 *Cors Caron West Bog – ZEGs* *(see Figure 27 and Figure 4)*

8.7.3.1 In terms of surface structure the West Bog displays two broad characters. Across the main body of the primary dome there is an complex of zones ranging from ZEG 13 to ZEG 26, all of which provide a consistent surface structure of T2 high ridge and T1 low ridge with frequent T1A1 transition zone and less frequent T3 hummocks and A1 hollows, but always with a significant presence of Tk tussocks.

8.7.3.2 The eastern border of the bog, where it meets the deepened River Teifi, is characterised by ZEG 33 with dense Tk tussocks and micro-erosion which is mostly carpeted with non-*Sphagnum* mosses.

8.7.3.2 The crown of the bog supports a distinct and complex assemblage of its own, featuring ZEGs 13, 18, 23, 24, 26 and 28. being somewhat drier than the majority of the mesotope surface, as indicated by the more limited presence of T1A1 and A1 zones and dominance of T3 hummocks and T2 high ridge. Tussocks are also a significant presence here but in this case there is some evidence of micro-erosion, albeit now colonised by non-*Sphagnum* moss.


**Figure 27.**

Cors Caron West Bog: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

8.7.3.3 There is a distinct area towards the northern end of the bog with ZEG 41 where Tk tussocks and micro-erosion become the sole structural features - in effect being an extension of the surface texture seen along the eastern margin of the bog. This northern area is distinctive in displaying markedly linear erosion features similar in character to those seen on Cernydd Carmel – features which, as mentioned in the account of Cernydd Carmel, are unusual on UK lowland raised bogs. As with that latter site, the features are associated with an area possessing a distinct gradient where the primary dome slopes down towards the bog margin. These erosion features end where the ground again levels out at the foot of this slope.

8.7.3.4 The western margin of the bog is characterised by secondary surface structures associated with peat cutting and are thus a combination of ZEGs 24 and 25 with drier baulks and peat-cutting hollows. Some of these cutting hollows have been re-wetted and hold much water, thus resembling A3 drought-sensitive pools although they are entirely secondary in character.

8.7.4 *Cors Caron West Bog – VEGs* *(see Figure 28 and Figure 5)*

8.7.4.1 In contrast to the pattern of ZEG surface structures, the VEG vegetation assemblages form three distinct regions – a central region running from NE to SW along the length of the bog, a 'halo' around the crown of the bog, and an eastern region bordering the River Teifi.

8.7.4.2 The halo of vegetation around the central dome supports the best condition vegetation assemblages, although even these are a mixture of VEGs 5, 6, 7 and 8. There is good-condition vegetation consisting of *Sphagnum*-rich T3 hummocks to T1A1 transition but this is mixed with somewhat drier T3 hummocks to T1 low ridge communities characterised by hypnoid moss and *Sphagnum* while *Eriophorum vaginatum* or *Molinia caerulea* tussocks are a constant feature. Scattered A1 *Sphagnum cuspidatum* hollows also occur here within VEG 5 and VEG 8.

8.7.4.3 The central region of Cors Caron West Bog, including the central dome, is characterised by much the same good-condition vegetation but this time mixed with a markedly drier combination of VEGs 5, 7, 8, 10 and 14, resulting in relatively low-relief vegetation assemblages dominated mostly by T2 high ridge and T1 low ridge in which *Sphagnum* is common but lichens and *Hypnum jutlandicum* are often dominant. T3 hummocks of *Sphagnum capillifolium* or lichens occur occasionally while *Molinia caerulea* or *Eriophorum vaginatum* tussocks are a consistent presence.

8.7.4.4 The eastern region of the bog does not support any of the best-condition vegetation assemblages, consisting instead of those assemblages typical of degraded but recovering bog habitat. These are characterised mostly by VEGs 19, 22 and 25 featuring T3 hummocks or T2 high ridge dominated by lichens and *Hypnum jutlandicum* together with often dominant Tk tussocks of *Molinia caerulea* and moss-rich micro-erosion. Presence of T2 high ridge with *Sphagnum* *papillosum* together with scattered examples of *S. fallax* in T1A1 and A1 zones, particularly in VEG 22, point to some degree of recovery.

8.7.4.5 As before, the area of erosion on the northern slope of the bog is distinctive, consisting of VEG 23 with *Molinia caerulea* tussocks and micro-erosion which ranges from bare peat to areas of *Sphagnum* colonisation, together with T2 high ridge supporting dwarf shrubs and *Hypnum jutlandicum*. To the north of this, the vegetation returns to VEG 8 - an assemblage of T3 to T1 zones in which lichens are often dominant in the T3 and T2 zones whereas *Sphagnum*-dominated communities characterise the T1 zone. Tussocks of *Molinia caerulea* and *Eriophorum vaginatum* are also common here.

8.7.5 <u>*Cors Caron West Bog – SYNs*</u> *(see Figure 29 and Figure 6)*

8.7.5.1 The distribution of synusial communities largely follows the same pattern as described above for the VEG assemblages although there is a larger gap in the data for the SYN communities.

8.7.5.2 Broadly, the western side of the Cors Caron West Bog supports the best-condition communities to occur on the site in the form of SYNs 11 and 12, though these are not the best possible communities. T3 hummocks are dominated by dwarf shrubs, lichens and *Hypnum jutlandicum*, whereas there is more *Sphagnum* in the T2 and T1 ridge zones although much of this is either *S. capillifolium*, indicating possible drying, and *S. tenellum*, indicating possible recovery from fire damage. Transition and hollow communities are, however, largely absent.

8.7.5.3 Central parts of the bog feature various combinations of SYNs 6, 8, 9, 10 and 12. Of these SYNs 8, 9 and 10 support scattered A1 hollows characterised by *Sphagnum cuspidatum*, *S. tenellum* and *Rhynchospora alba*. Terrestrial zones of SYNs 6, 8 and 12 are drier than in western parts of the bog, being more dominated by dwarf shrubs and lichens at both the T3 and T2 level while *Sphagnum* is restricted to the T2 and T1 ridge zones and hollows.

8.7.5.4 The northern area of sloping bog margin with erosion is again distinctive, featuring SYN 17 with dwarf shrubs, *Molinia caerulea* and *Hypnum jutlandicum* dominating areas of T2 high-ridge level, Tk tussocks of *Molinia* dominant in places – particularly the erosion channels – and much micro-erosion with just bare peat.

8.7.5.5 The SYN 17 area was subject to a severe fire in the mid-1980s which burnt for weeks and reportedly “could be seen glowing at night”. Such fires can smoulder deep into the peat over extended periods, creating channels of peat ash, which perhaps explains the presence of E2 erosion gullies running through this area.

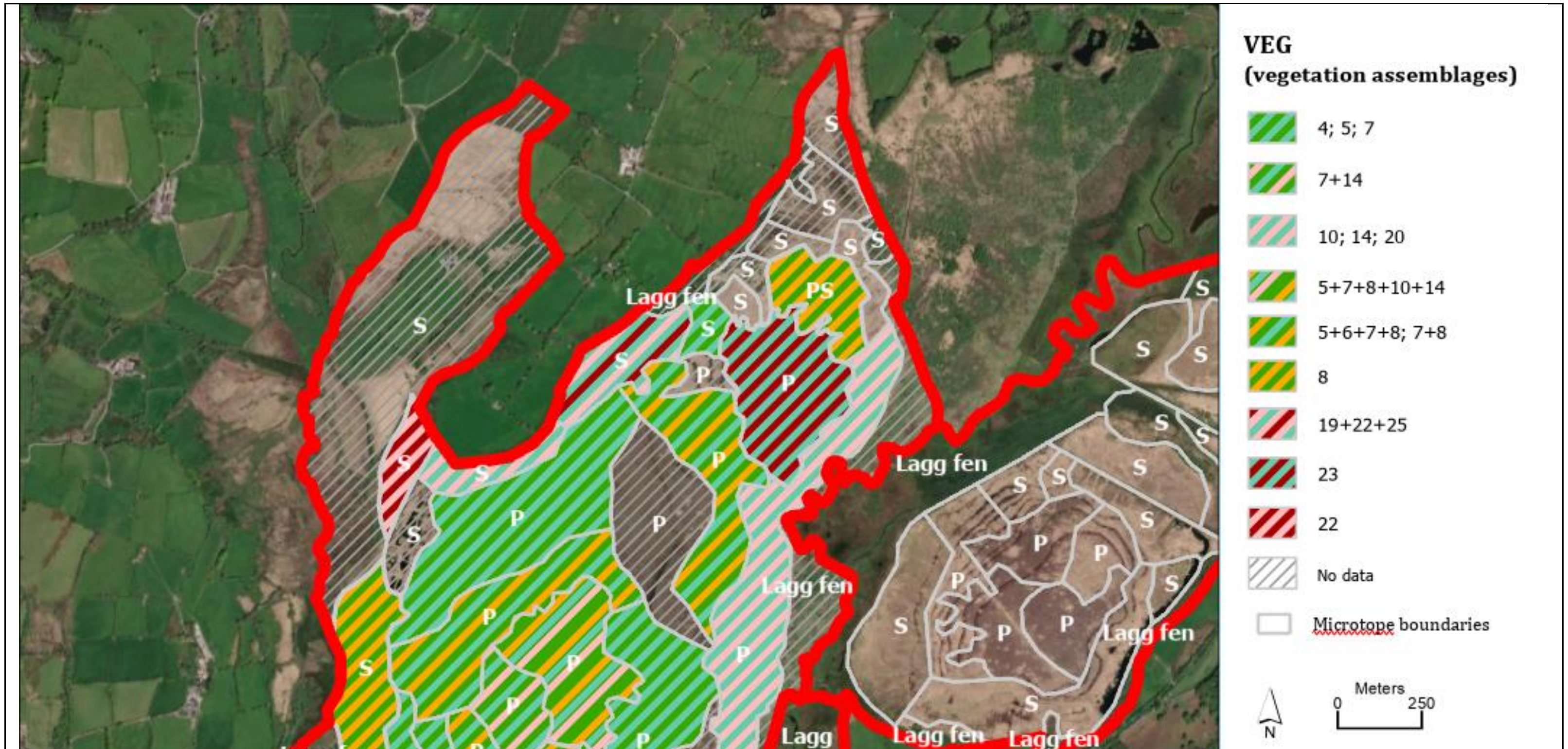



**Figure 28.**

Cors Caron West Bog: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

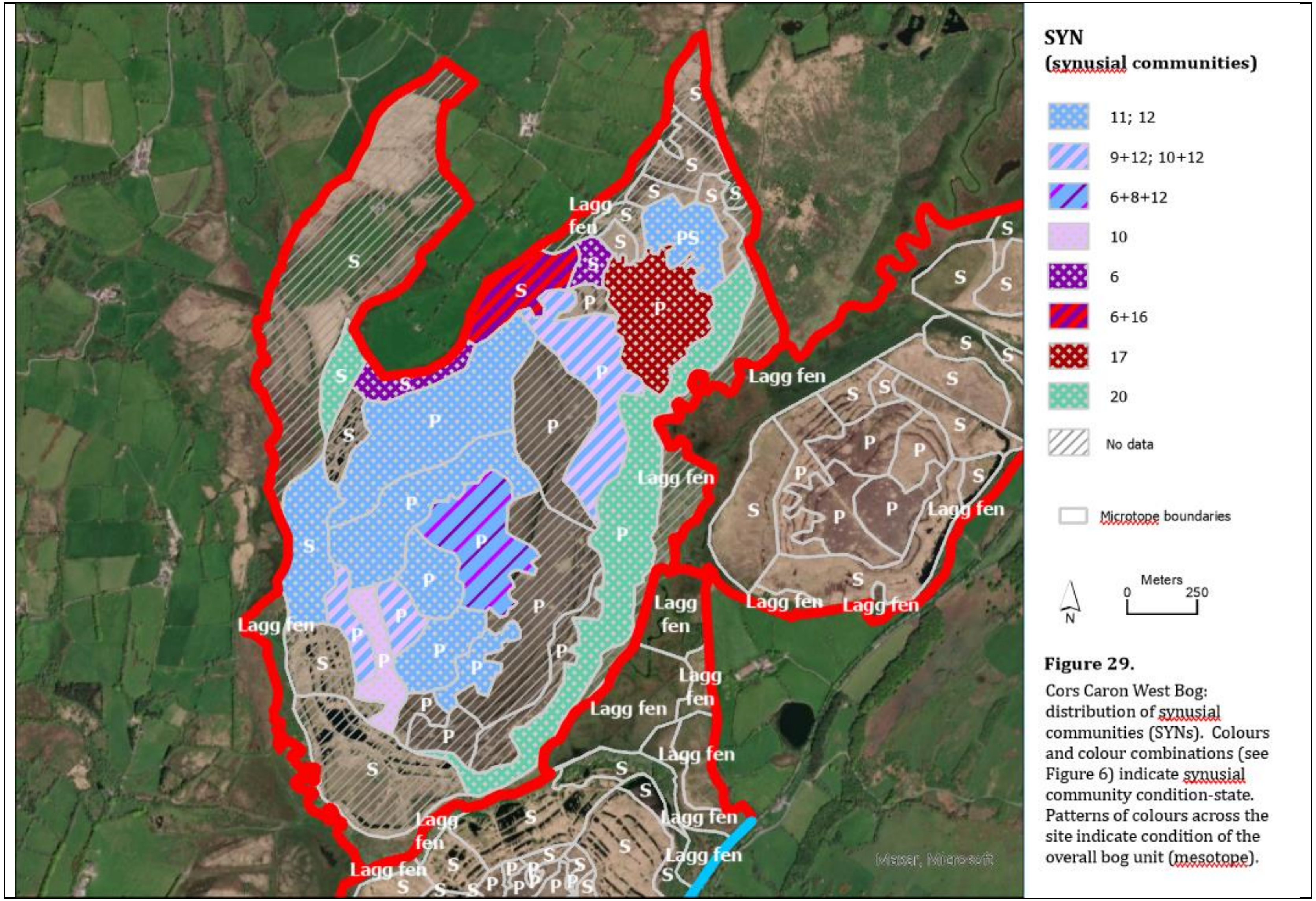



**Figure 29.**
Cors Caron West Bog: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

8.7.6 *Cors Caron West Bog – summary*

8.7.6.1 As highlighted by the earlier description of the condition matrix, it is disappointing that a site so large and so relatively free from major disruption to the mesotope dome should be in such relatively modest condition. Godwin (1981) gives a pre-war account of carrying out survey on this bog and observes:

> *"Over the highest and wettest part of the bog we found a pool and hummock complex closely resembling that of the Irish bogs with the difference that here the chief hummock-building Sphagna were brown S. pulchrum and the prevalently green S. papillosum, with the red species S. rubellum, S. plumulosum [S. subnitens] and S. medium in a subsidiary role."*

8.7.6.2 This description does not reflect the current position. Nor would it be possible to find examples of the extensive open-water pools and hollows illustrated by Godwin (1981). The location of his 'regeneration complex' (*i.e*. the area of pool and hummocks) and 'Sphagnetum' correspond to some of the current best areas shown in Figures 26 to 28 but the quality of this ground today does not appear to match either his description or his illustrations of the pre-war condition.

8.7.6.3 The difference between the pre-war condition and the present day is largely that of degree, because Godwin (1981) recognized at the time that marginal impacts such as peat cutting as well as possible fire events may have given rise to the *Molinia*- and *Trichophorum*-dominated ground which, even then, occupied the central part of the bog. He also noted the area to the northern end of the bog as being *Calluna*-dominated and characterized by erosion.

8.7.6.4 Godwin (1981) does not refer to the absence of a lagg fen as a possible source of change. However, with greater understanding today of peat bog hydrology and the way in which hydromorphology and vegetation generate an inter-dependent set of responsive features, it is more evident now than it was in Godwin's time that loss of the lagg fen is also a likely driver of change.

8.8 **Cors Caron macrotope complex – summary** *(see Figure 30)*

8.8.1 An account of the Cors Caron macrotope complex and its current condition-state is a tale of many parts, some of which are currently missing. The most critical missing element is the lagg fen which is difficult to restore as long as the River Teifi continues in its currently deepened state. Two of the bog mesotopes are also missing large amounts of peat, lost to domestic peat cutting. The much larger bog, which has largely escaped extensive loss to such cutting, should therefore, given its size, display a largely natural bog surface rich in species and surface structures characteristic of a habitat in good condition.

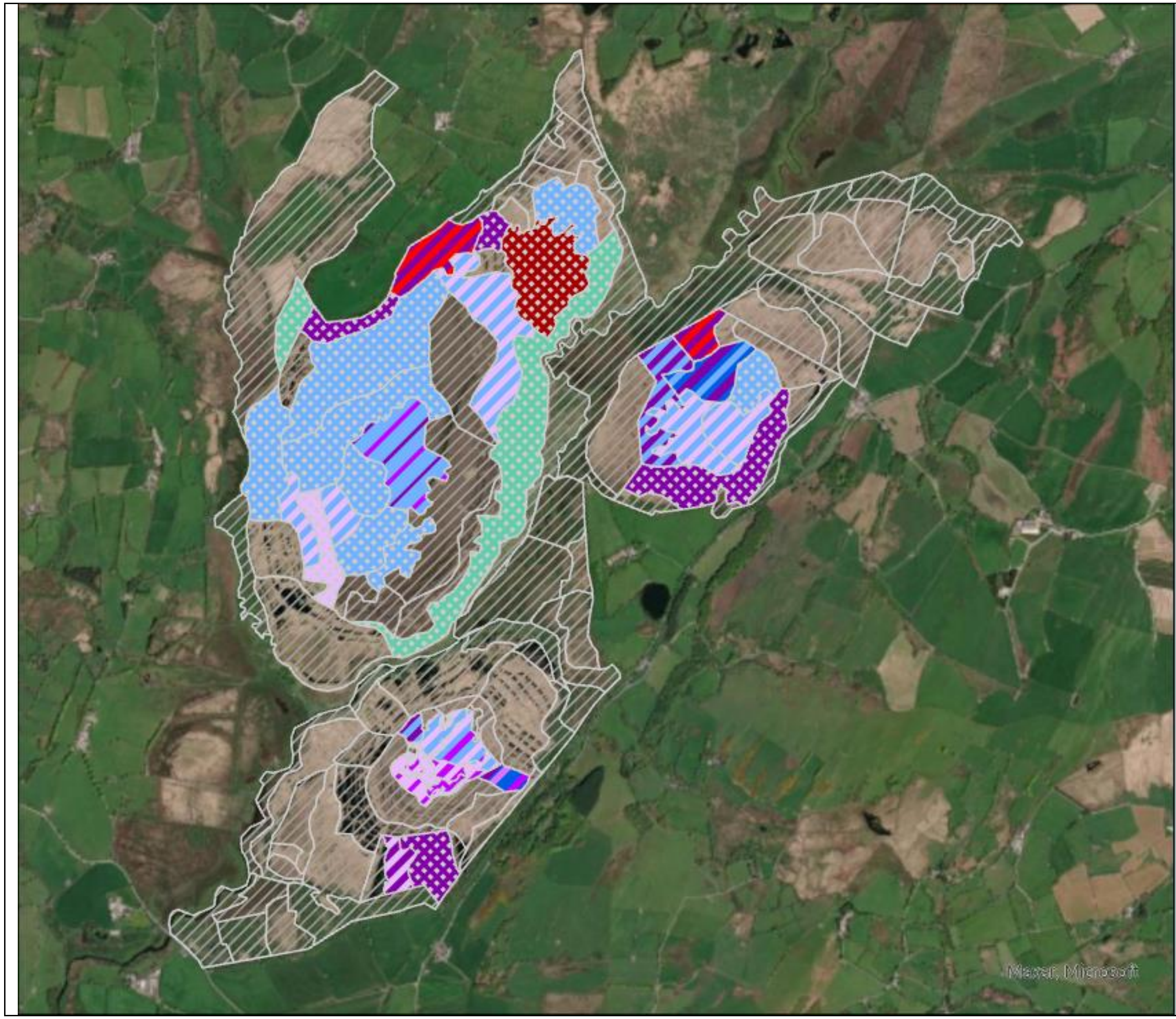



**Figure 30.**
Cors Caron macrotope complex: All synusial communities displayed. The key above shows the most extreme ends of the various condition-states, with lesser states being paler shades of these colours.

8.8.2 However, Figure 30 reveals a rather different and somewhat unexpected picture. The large West Bog does not possess any of the best synusial community, although it does support extensive areas which are of good but lesser quality. Equally, though, extensive areas of rather dry synusia mingle with the good synusia, while towards the northern end of this large bog there is evidence of quite substantial degradation.

8.8.3 Whether the somewhat constrained state of relatively good-condition ground can be attributed to the long-term effects of losing the lagg fen, or whether fire has been a significant factor in shaping the current surface, might be determined by macrofossil analysis of short peat cores for charcoal and changes in the macrofossil record. However, it seems that there is something more systemic at work here.

8.8.4 Historical drainage records might provide some form of time-line from which a historical hydrological context might be assembled, as has been done at, for example, Chat Moss in Manchester, but this relies on there being written records and/or maps containing relevant information.

8.8.5 Perhaps the most surprising thing about the synusial mapping of this complex is the revelation that it is the two smaller, much more damaged, bogs which still retain pockets of good-condition habitat, albeit intermingled with much more degraded parts. As such, it may be that restoration of the lagg fen around these two mesotopes could help both to maintain this interest but also enable these synusia to expand more rapidly across these smaller domes than might be possible across the larger bog.

8.8.6 That said, this should not be taken as a reason to delay restoring the lagg fen for the complex as a whole. Such an action can only benefit all parts of the system.

## 8.9 Cors Fochno

8.9.1 *Cors Fochno - macrotope and mesotope* *(see Figure 31)*

8.9.1.1 Cors Fochno is the largest raised bog in Wales and one of the largest surviving raised bogs in the UK. Unlike the largest bog of the Cors Caron Complex, however, Cors Fochno has been subject to extensive domestic peat cutting and large-scale drainage attempts.

8.9.1.2 In addition to being cut off from its natural ecotone margin to the west by the canalised Afon Leri, domestic peat cuttings have cut into the primary raised dome **mesotope** from all sides, substantially so from the south but also encroaching significantly into the site from the north too. As a result, the extend of secondary peatland exceeds the remaining area of primary bog surface.

8.9.1.3 Partly as a consequence of the peat cutting but also as a result of agricultural land-claim and drainage, the Cors Fochno **lagg fen** has all-but disappeared. A small remnant may persist at the junction between the bog and the rising ground at Coed Gwynfryn, while the bog woodland extending from there to the northern boundary may represent a secondary form of lagg fen but overall the **macrotope** system of lagg fen and raised bog dome no longer exists.

8.9.1.4 In addition, a very substantial drainage system was dug into the north-west sector of the mesotope dome after World War 2. Maintenance of these very large drains over a period of several decades has resulted in changes to the surface morphology of the bog, particularly in this area. Such changes are the result of primary consolidation, secondary compression and oxidative wastage (Hobbs, 1986) and can only be physically and sustainably reversed through fresh accumulation of peat.

8.9.2 *<u>Cors Fochno – consolidated condition matrix</u> (see Figure 32)*

8.9.2.1 Despite its very much larger size, the Cors Fochno condition matrix (Figure 32a) for the primary bog does not display significantly more features of good condition than the small SE Bog at Cors Caron. Nor does it show fewer negative features than that bog. The combination of extensive domestic peat cutting and major attempts at drainage have evidently had a substantial impact on the condition-state of this mire system.

8.9.2.2 Meanwhile the condition matrix for the secondary peat-cutting areas (Figure 32b) displays almost as many features of good condition as the primary bog, but has more features indicative of damage. The numerous features of good condition suggest that vegetation recovery is well advanced in many parts of the secondary peat cuttings.

8.9.2.3 However, the condition matrix does not provide a direct indication of extent occupied by each of these features. For this, mapping of the various ZEGs, VEGs and SYNs is required.

8.9.3 *<u>Cors Fochno – ZEGs</u> (see Figure 33 and Figure 4)*

8.9.3.1 The core area of high-quality mire features indicated by ZEGs 6, 7, 9 and 10 has an obviously skewed distribution towards the eastern side of the bog and away from the area of large-scale intense drainage in the north-west sector of the system. This area of high-quality mire features consists of T3 hummocks to A1 hollows though biased towards the terrestrial zones, and even extends into areas of very old domestic peat cuttings to the south-east, suggesting that habitat recovery here is well advanced.

8.9.3.2 While the majority of the primary site displays mire features which are indicative of moderately good condition, the area associated with the large-scale drainage works in the north-west is marked by a combination of ZEG 6 and the lower-quality ZEGs 18 and 23.

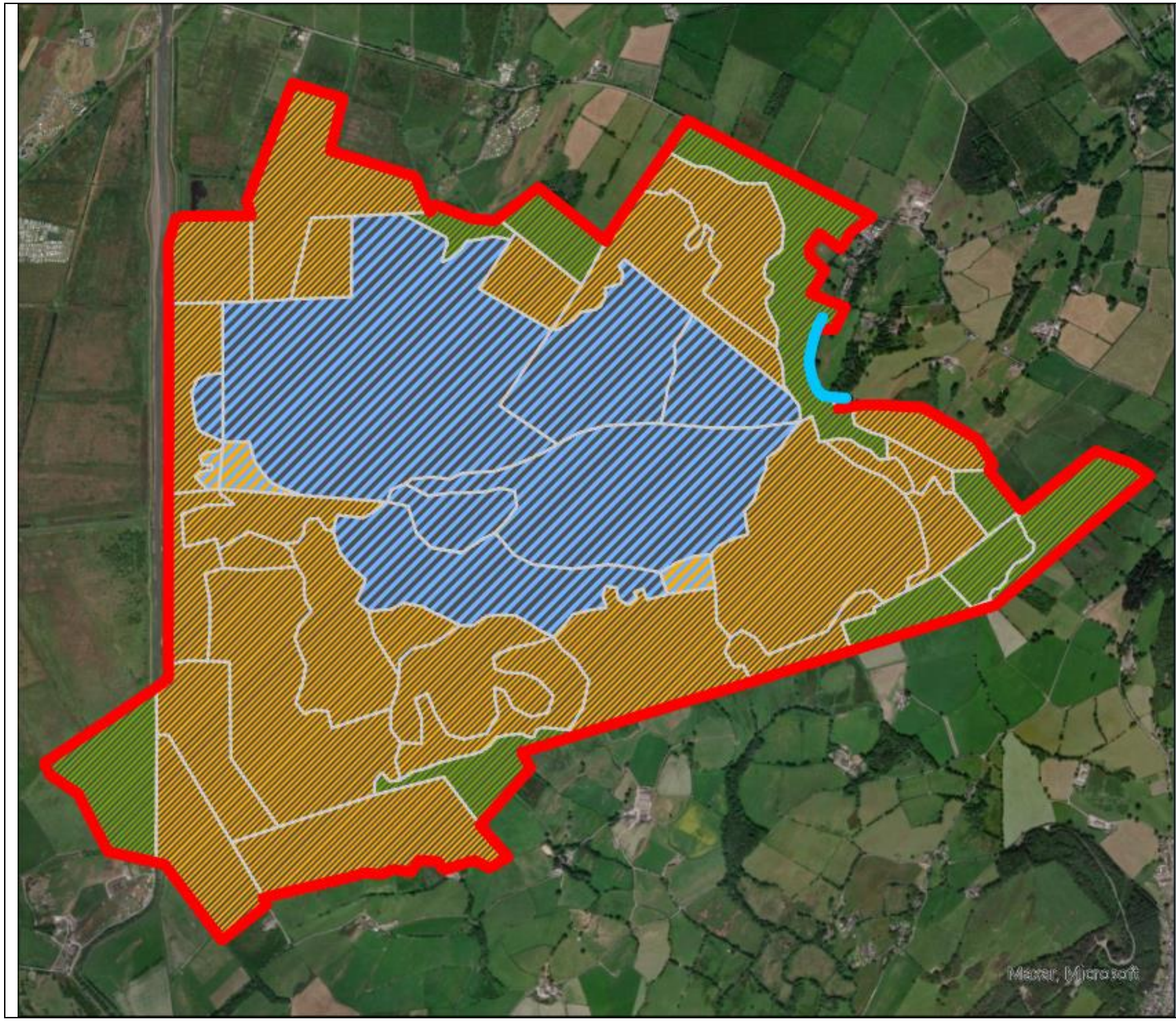



**Figure 31.**
Cors Fochno: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently drained ground but would likely become lagg fen if re-wetted.

| Mire pattern no: | Site: Cors Fochno | Peat depth | Date 2020/21 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 32a.** Consolidated condition matrix for the Cors Fochno mesotope, incorporating condition matrix data from all primary microtope polygons recorded within the site.

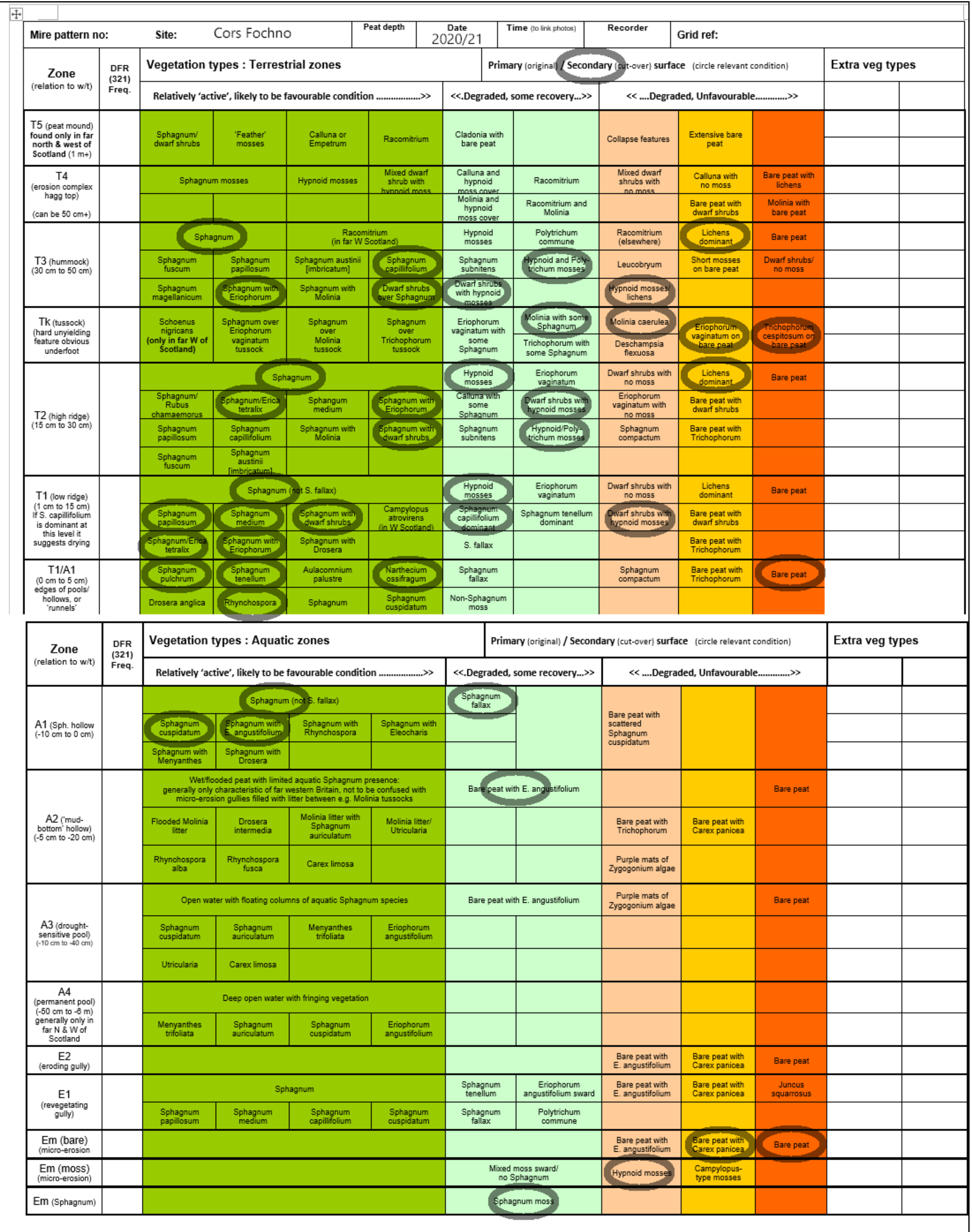



**Figure 32b.** Consolidated condition matrix for the Cors Fochno mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site.

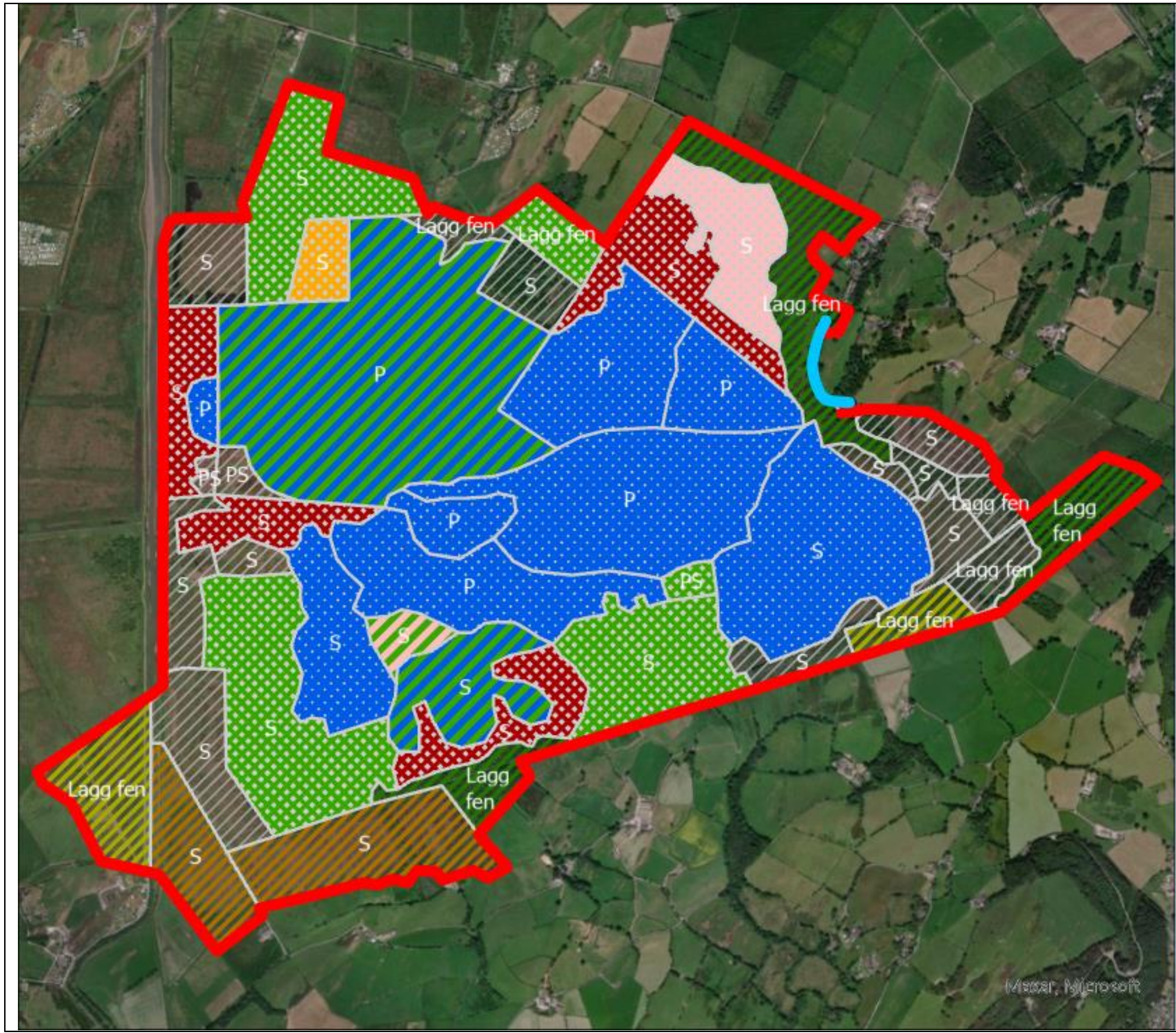



**Figure 33.**

Cors Fochno: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

8.9.3.3 These latter ZEGs are characterised by a mixture of good-quality T3 to T1A1 features combined with more Tk tussock-rich ground in which T3 hummocks and T2 high ridge become the commoner zonations.

8.9.3.4 Secondary areas range from good-condition ZEGs 6 and 7 to areas of somewhat lesser condition with ZEG 18 having only terrestrial zones including Tk tussocks, to areas of ZEG 34, 39 or 41 lacking features of good bog condition and dominated by Tk tussocks with micro-erosion in various states of moss colonisation.

8.9.3.5 Overall, however, the predominant synusial zones in both primary and secondary areas indicate a reasonable level of condition with only relatively limited areas characterised by features of extremely poor condition.

8.9.3.6 The large area characterised as ZEG 32 and as being of rather poor bog condition in the north of the site is an area of old domestic peat cuttings which now represents a form of secondary lagg fen containing much of ecological interest. The same cannot be said for the poor-quality VEG 34 area on the western margin of the bog where it abuts the canalised Afon Leri. Here the ground is entirely dominated by *Molinia caerulea* tussocks and micro-erosion with only limited colonisation by non-*Sphagnum* mosses.

8.9.4 <u>Cors Fochno – VEGs</u> *(see Figure 34 and Figure 5)*

8.9.4.1 The VEG assemblages separate out the area characterised as best-quality (VEG 6) from both the area of major drainage in the north-west of the site but also now the areas of domestic peat cutting. This best-quality area is characterised by *Sphagnum*-rich T2 high ridge, T1 low ridge and T1A1 transition zones with *Rhynchospora alba*, *Sphagnum tenellum* and some *S. pulchrum* together with more scattered T3 hummocks of either *Sphagnum* or somewhat drier assemblages.

8.9.4.2 The area of major drainage is also assigned to VEG 6 but in addition now includes VEGs 5 and 7, which are characterised by more frequent presence of dry T3 hummock and T2 high ridge communities dominated by lichens, dwarf shrubs and hypnoid mosses. Tk tussocks of *Eriophorum vaginatum* are also a frequent presence, as are scattered *Molinia caerulea* tussocks.

8.9.4.3 Areas of primary bog surrounding the core area of VEG 6 are assigned to VEGs 4 and 5, as are the best-quality areas of secondary peat cuttings forming the south-eastern corner of the bog. These areas differ from the best core area in having markedly drier and more constant presence of T3 hummock zones dominated by lichens, dwarf shrubs and hypnoid mosses.

8.9.4.4 Overall, the areas of peat cuttings forming the southern region of the site are structurally complex. They contain, for example, VEGs 14, 20 and 22, incorporating areas of recolonised peat-cutting hollows now forming secondary A1 *Sphagnum cuspidatum* hollows as well as drier areas of peat-cutting baulk supporting dry features such as T3 hummocks of *Leucobryum glaucum* and dwarf shrubs over hypnoid mosses mixed with more *Sphagnum*-rich ridge and hummock features.

8.9.5 <u>*Cors Fochno – SYNs*</u> *(see Figure 35 and Figure 6)*

8.9.5.1 Somewhat unexpectedly, mapping of the synusial communities results in the best areas of bog synusia, SYN 15, being found in the secondary areas of peat cutting in the south-eastern regions of the site rather than the left-of-centre core area. These peat cuttings consist of T3 hummocks in which former *Molinia caerulea* and *Eriophorum vaginatum* tussocks are now largely overwhelmed by *Sphagnum* growth and have become part of the hummock synusia. Meanwhile the peat-cutting hollows now resemble T1A1 and A1 *Sphagnum*-rich communities with *S. papillosum* and *S. cuspidatum*.

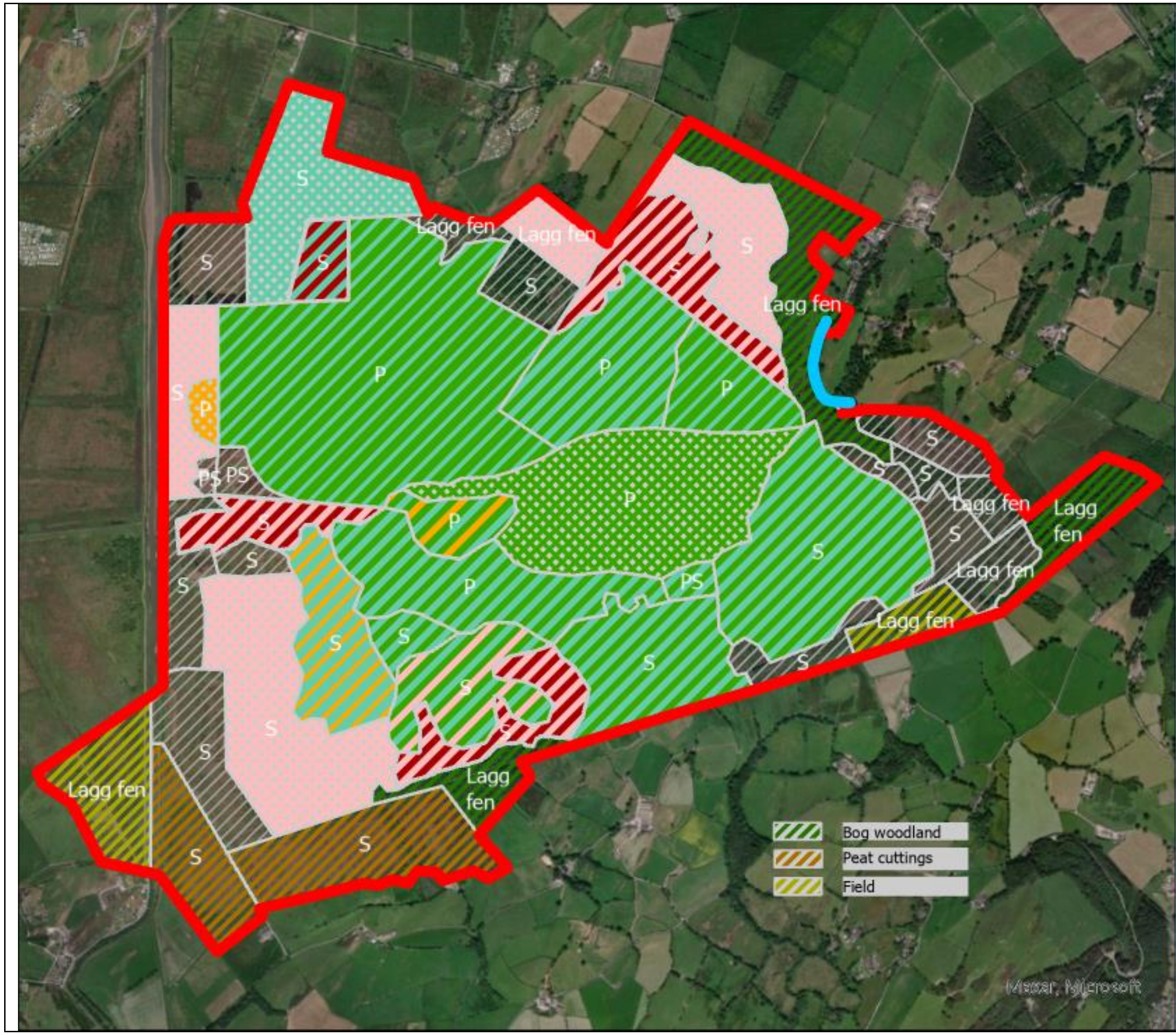
8.9.5.2 Tellingly, the left-of-centre core area, characterised by SYN 13, is a community of good condition but it consists almost exclusively of only T1 and T1A1 synusia dominated by *Sphagnum tenellum* and *S. pulchrum* with no A1 hollows at all. Furthermore, the T1 zone now contains significant presence of *Hypnum jutlandicum*, *Calluna vulgaris* and *Cladonia portentosa* along with *S. capillifolium*, all of which would normally be associated with T2 or T2 synusial zones.

8.9.5.3 This is significant because this core area was originally known for its A1 *Sphagnum cuspidatum* hollows with a T1A1 fringe of *S. pulchrum* and *S. tenellum*. Loss of this A1 zone, combined with an apparent increase within the T1 zone of what are typically T3 and T2 communities, together suggest that there may be systemic drying of the surviving primary dome.

8.9.5.4 The north-west portion of the site, with its major drainage works, is characterised by the SYN 14 community, which is one of the lowest-grade communities within the good condition-state categories. It is characterised by T3 hummocks dominated by *Calluna vulgaris* and *Cladonia portentosa*, rather dry T1 low ridge with dwarf shrubs, lichens and *Sphagnum papillosum*, and T1A1 transition zone with *Rhynchospora alba*.

8.9.5.5 This synusial community is also found in the south-west portion of the site within rather drier areas of peat cuttings than is found in the cuttings further to the east. This sector of the site also contains some of the most degraded habitat consisting of *Molinia caerulea* tussocks and bare micro-erosion, albeit in places mixed with areas showing good recovery of bog synusia.

8.9.5.6 Highlighting the oceanic nature of this bog, some areas of damaged secondary ground around the margins of the bog display the synusial community SYN 19 with *Molinia caerulea* tussocks and *Myrica gale* over a bryophyte layer of *Hypnum jutlandicum* or a dense layer of *Molinia* litter.




**VEG (vegetation assemblages)**

- 6
- 5+6; 6+7
- 4; 5
- 4+14
- 6+12
- 2
- 9+11
- 14; 20
- 15
- 23
- 22
- No data
- Microtope boundaries

N

Meters 0 500

**Figure 34.**

Cors Fochno: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

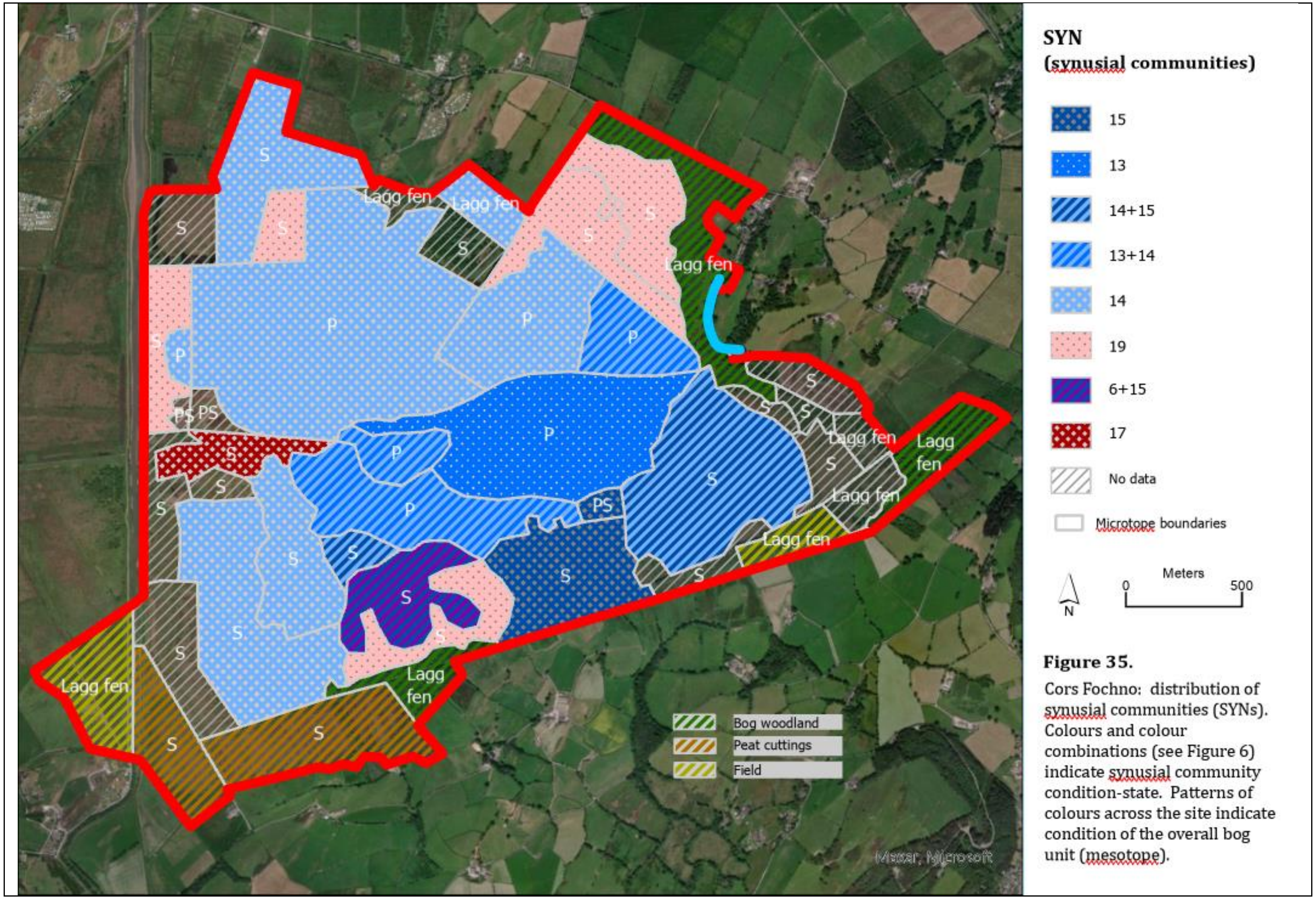



**Figure 35.**

Cors Fochno: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

8.9.6 *Cors Fochno – Summary*

8.9.6.1 Cors Fochno has long been regarded as one of the 'type' sites for the raised bog habitat, particularly in the UK, characterised as having an extremely wet hummock-hollow central area (Taylor, 1983; Slater 1984). While it may be the largest single raised bog in Wales, it has also experienced large historical impacts, although it is remarkable how frequently this site is described in scientific literature as 'undisturbed'.

8.9.6.2 These impacts may increasingly be altering the make-up of the bog surface. That this might be the case should perhaps not be so surprising, given the major drainage works in the north-west part of the site, loss of the lagg fen, truncation of the site by the Afon Leri and some loss of the site to agricultural drainage and land-claim.

8.9.6.3 In particular, the large drainage system in the north-west portion of the site appears to have resulted in a distorted distribution of the wettest and most natural parts of the site towards the east compared with surveys undertaken in the 1960s (Taylor, 1983).

8.9.6.4 There is, however, some cause for optimism in the fact that areas of peat cutting to the south and west of the remaining primary dome appear to be re-developing a secondary form of typical bog habitat with, one may assume, associated fresh accumulation of peat, thereby reducing the hydrological stresses on this eastern side of the bog.

8.9.6.5 Significant progress toward recovery nevertheless would require effective intervention to reverse the impacts of the north-west drainage works and truncation by the Afon Leri to address current pressures on the mesotope, combined with re-establishment of a lagg fen to create a functioning macrotope system once again.

## 8.10 Cors Goch/Trawsfynydd South

8.10.1 *Cors Goch - macrotope and mesotope* *(see Figure 36)*

8.10.1.1 As with all other sites so far described, the Cors Goch **macrotope** has lost its natural **lagg fen** to agricultural drainage and domestic peat cutting. Meanwhile the **mesotope** has been substantially transformed into a combination of secondary mire surface and surviving primary bog dome by a historical pattern of domestic peat cutting and agricultural land-claim.

8.10.1.2 The remnant primary dome is somewhat smaller than the remaining dome of the Cors Caron SE Bog although the proportional loss is less, so the hydrological stresses on the Cors Goch dome may not be as severe as those affecting the Cors Caron site.

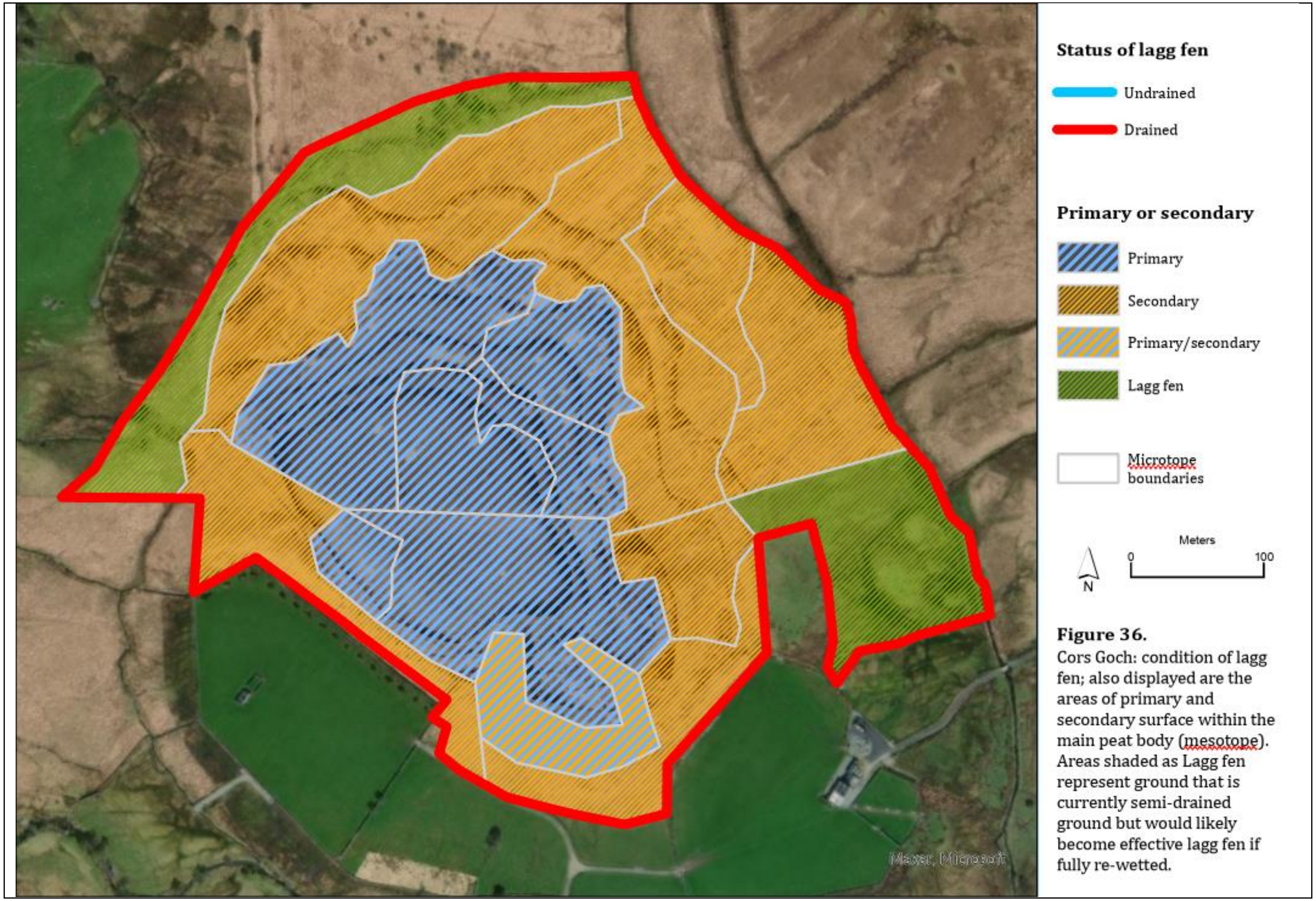



**Figure 36.**
Cors Goch: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently semi-drained ground but would likely become effective lagg fen if fully re-wetted.

8.10.1.3 The current primary dome and its crown appear to be markedly offset to the south-west compared with the original extent of the bog. While the offset of the dome as a whole is evidently a result of peat cutting from the north-east, the offset crown may be a result of altered hydromorphology following this loss (Bragg, 1995).

8.10.1.4 The current pattern of primary dome and secondary surface shown in Figure 36 is based on early post-war aerial imagery in which areas of peat cutting are more evident than in imagery from more recent times.

8.10.2 <u>*Cors Goch – condition matrix summary*</u> *(see Figure 37)*

8.10.2.1 For such a small site, and particularly after the degree of disturbance it has experienced, the summary of condition obtained from the condition matrix is to a degree remarkable. It has more features of good condition than of poor condition, and the total number of good-condition features on the primary surface matches that of the very much larger Cors Fochno and Cors Caron West Bog (Figure 37a).

8.10.2.2 The areas of secondary bog also contain substantial indicators of good condition (Figure 37b) suggesting that secondary vegetation recovery is well advanced within these areas of peat cutting.

8.10.2.3 In terms of overall condition, however, it is not the number of good-condition features that matter so much as the number of features indicative of poor condition, and Cors Goch still has a significant number of these.

8.10.2.4 The condition matrix features indicative of damage are evenly divided between 'Damaged, some recovery' and the more seriously damaged sectors of the condition matrix. There are, however, few indicators of the most serious damage.

8.10.3 <u>*Cors Goch – ZEGs*</u> *(see Figure 38 and Figure 4)*

8.10.3.1 The best-condition range of synusial zones (ZEGs 4, 6, 11 and 12) displayed in Figure 38 largely corresponds to the crown of the remaining primary dome, although it also includes a small horseshoe-shaped area which may be an extremely old set of domestic peat cuttings. This ground possesses all synusial zones from T3 hummocks to A2 mud-bottom hollows and is free from Tk tussocks.

8.10.3.2 The northern part of the primary dome is of somewhat lesser quality in terms of its synusial zones, with ZEG 18 restricted to terrestrial zones and also having a significant presence of Tk tussocks. As this side of the dome has experienced the majority of losses to peat extraction and agricultural land-claim, it is no surprise that this has had an impact on the quality of this ground.

| Mire pattern no: | Site: Cors Goch | Peat depth | Date 2021 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 37a.** Consolidated condition matrix for the Cors Goch mesotope, incorporating condition matrix data from all primary microtope polygons recorded within the site.

| Mire pattern no: | Site: Cors Goch | Peat depth | Date 2021 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones — Relatively 'active', likely to be favourable condition .................>> | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) — <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones — Relatively 'active', likely to be favourable condition .................>> | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) — <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 37b.** Consolidated condition matrix for the Cors Goch mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site.

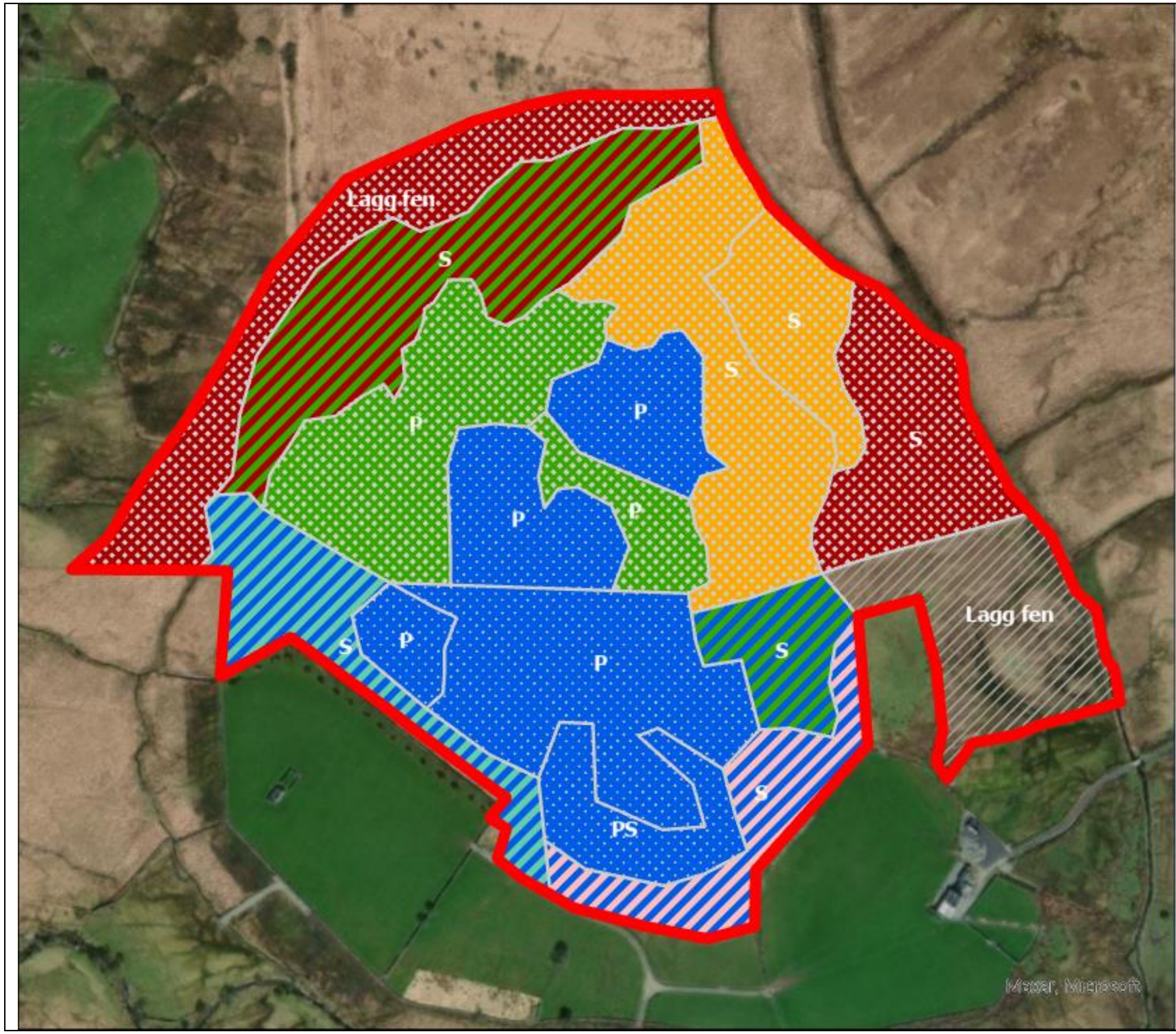



**Figure 38.**

Cors Goch: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

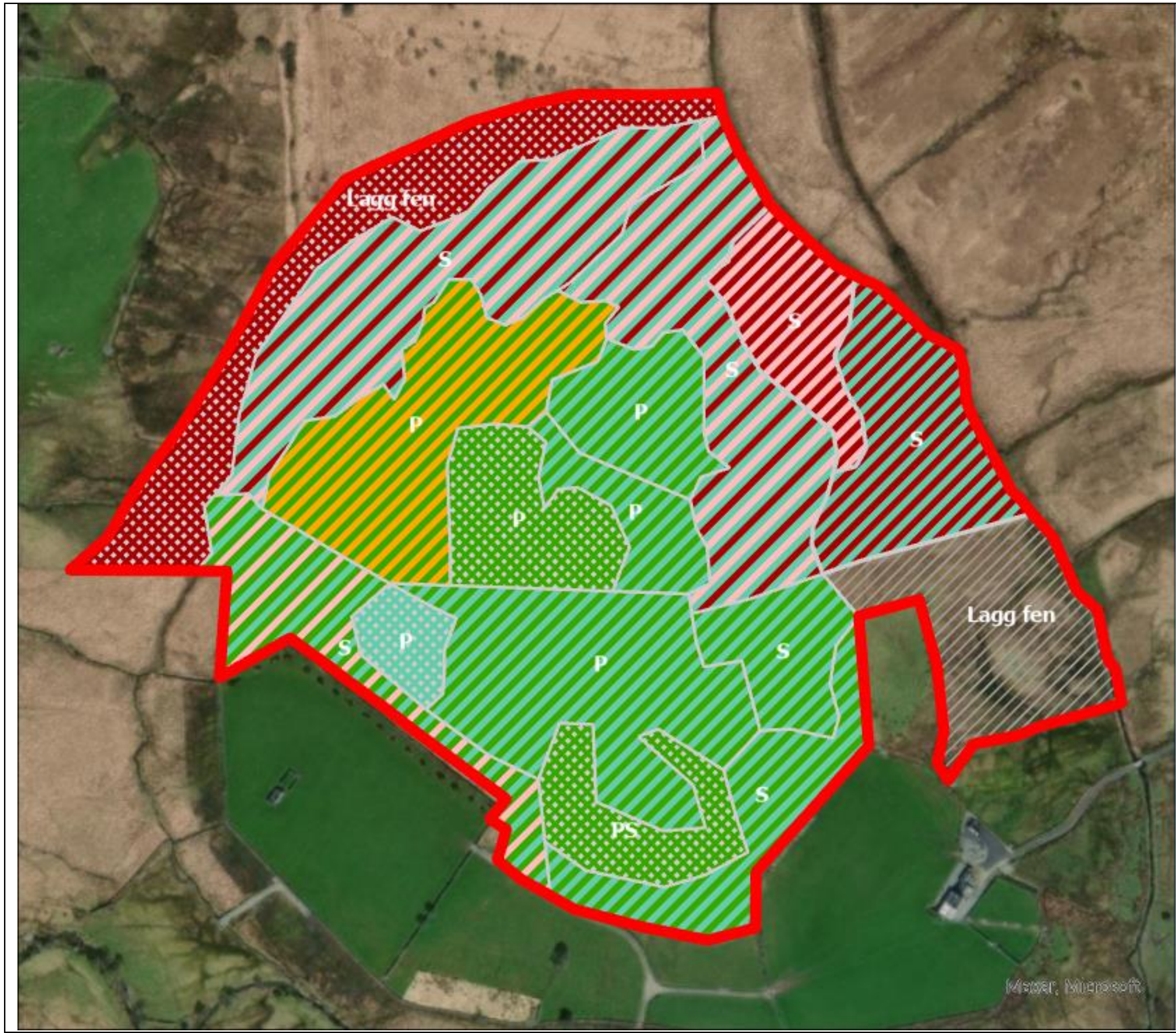



**Figure 39.**

Cors Goch: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

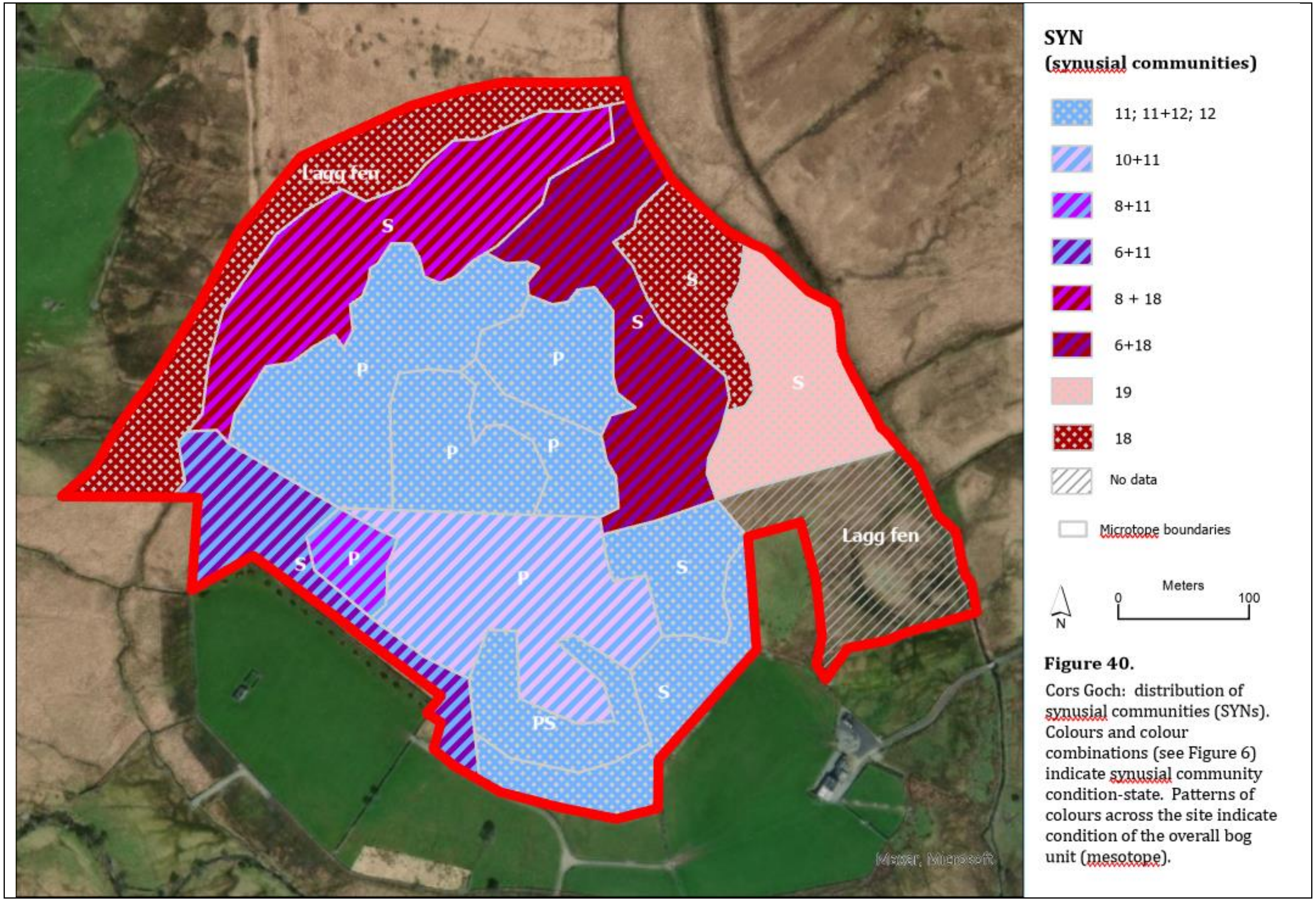



**Figure 40.**

Cors Goch: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

8.10.3.3 Areas of secondary peat cuttings vary considerably in quality, from ground that supports a mix of ZEG 7 with 22, 24 and 26 containing areas of T3, T2 and T1 synusia and little micro-erosion, to areas of ZEG 28, 34 and 41 that are exclusively dominated by TK tussock and micro-erosion.

8.10.4 *Cors Goch – VEGs (see Figure 39 and Figure 5)*

8.10.4.1 The best areas of vegetation synusia, VEGs 3 and 6, are more restricted than the area occupied by good-condition synusial zones, being restricted to part of the crown of the bog as well as the horseshoe-shaped area of (possibly) very old peat cuttings.

8.10.4.2 The remainder of the primary dome is characterized by mixtures of ZEGs 3, 5, 7 and 9, giving a largely *Sphagnum*-rich community of T3 hummocks with *S. capillifolium*, lichens or *Hypnum jutlandicum*, T2 and T1 ridge synusia with *Sphagnum* and dwarf shrubs, patches of T1A1 *Rhynchospora alba* and *S. tenellum* and scattered Tk tussocks of *Trichophorum cespitosum* and *Eriophorum vaginatum*.

8.10.4.3 The community just described also occurs in some of the oldest areas of peat cutting, while the closely-related VEG 8 assemblage occupies the most north-west part of the primary dome. Forming a northern 'collar' around the primary dome is an area of secondary ground characterized by VEGs 10, 14, 24 and 25, supporting a mix of rather T3 hummocks, T2 and T1 assemblages richer in *Sphagnum*, some areas of T1A1 and A1 assemblages, and dense areas of *Molinia caerulea* tussocks with bare-peat or mixed moss micro-erosion.

8.10.4.4 The outer northern 'rim' of the bog now consists exclusively of VEG 24 with dense *Molinia caerulea* tussocks and largely bare micro-erosion.

8.10.5 *Cors Goch – SYNs (see Figure 40 and Figure 6)*

8.10.5.1 Synusial communities of good bog habitat, albeit of the lowest grade within that category (SYNs 11 and 12), dominate the primary dome – the same synusia that characterise the best part of the Cors Caron West Bog and the drainage-affected north-west portion of Cors Fochno. Much of the offset crown of Cors Goch instead supports a mixture of SYN 10 and 11, giving rise to a mixed character in which drier T2 synusia and *Sphagnum*-rich T1 zones mix with *Sphagnum*-rich zones ranging from T2 to A1, though with fairly constant tussocks of *Eriophorum vaginatum* and *Molinia caerulea*.

8.10.5.2 Peat cuttings on the north-eastern side of the bog are generally dominated by rather dry-bog SYN 6, 8 and 18 synusial communities dominated by *Molinia caerulea* tussocks with micro-erosion between. Cuttings to the west and south-west are wetter and support synusial mixes of SYNs 6, 8 and 11 with drier T3 hummocks and T2 high ridge but T1 zones dominated by *Sphagnum tenellum,* *Narthecium ossifragum* together with secondary A1 hollows of *Sphagnum* and *Rhynchospora alba*.

8.10.5.3 The outer fringes of the site are dominated by SYN 18, which is not the worst-state of the poor-condition states. The north-western and north-eastern margins, although dominated by *Molinia caerulea* tussocks with micro-erosion, also have scattered T3 hummocks with *Hypnum jutlandicum* and *Erica tetralix* together with *Myrica gale*. As such, these fringes are in places perhaps slowly reverting to the wetter conditions of a lagg fen.

8.10.6 <u>*Cors Goch – Summary*</u>

8.10.6.1 For such a small site, particularly one that has experienced such disruption to the macrotope and mesotope, Cors Goch retains a significant range of bog synusia in comparatively good condition. T3 hummocks of the scarce *Sphagnum austinii* are absent from most of the other sites described here and are becoming increasingly rare on Cors Fochno. To find it persisting here on the remnant primary dome points to both the likely quality of this site prior to peat cutting and loss of lagg fen, as well as highlighting the extent to which that former bog community has survived to the present day.

8.10.6 2 Being such a small site, the impact on the surrounding landscape of re-establishing the lagg fen would be much less than would be the case for a site such as Cors Caron. Much of the ground to the north and east is already poorly-drained and supports a form of mire community that could form the basis of a renewed lagg fen.

## 8.11 Esgyrn Bottom

8.11.1 <u>*Esgyrn Bottom - macrotope and mesotope*</u> *(see Figure 41)*

8.11.1.1 Esgyrn Bottom is one of only two bogs of the nine to have retained an apparently undrained **lagg fen**. The true nature of this feature is, however, hidden partly by the woodland cover that now dominates much of the site but also because so much of the site has historically been subject to domestic peat extraction that the original character of the lagg fen is difficult to discern.

8.11.1.2 Lying in such a narrow steep-sided valley, the main **macrotope** system may originally have been bisected into two or more **mesotopes** by a somewhat meandering central watercourse, while the fen margins of the macrotope were presumably always a challenge to drain. It is not possible to know, however, whether this central watercourse is a canalised natural channel or a wholly artificial channel – in either case presumably to aid in draining the peat cuttings.

8.11.1.3 Much of the ground is now secondary peat cuttings, tussock-dense like Cernydd Carmel and with small scattered patches of primary bog but, unlike that site, some larger distinct patches of primary dome also remain.

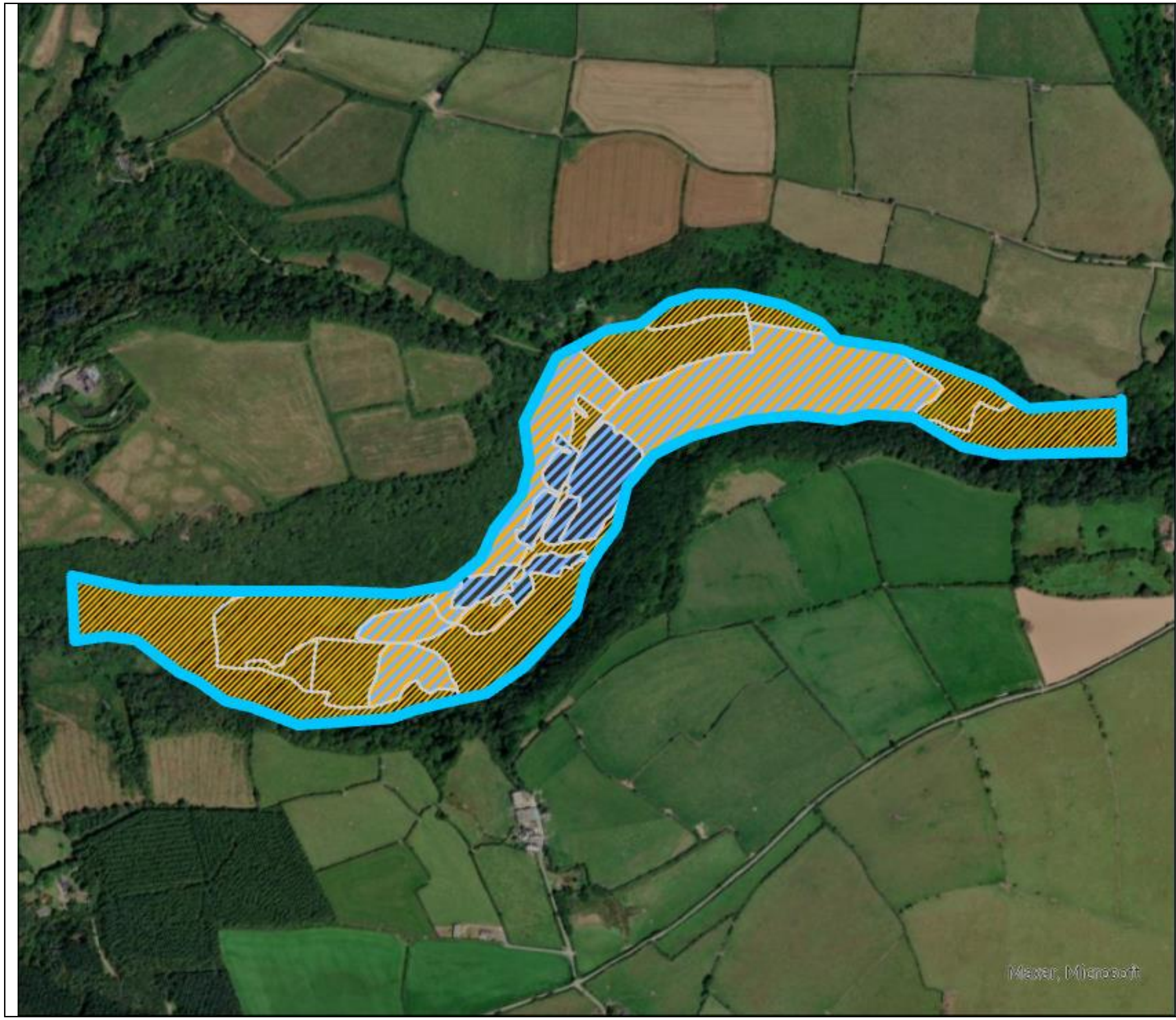



**Figure 41.**
Esgyrn Bottom: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope).

8.11.1.4 Even in high summer the ground between the tussocks of the peat cuttings is wet or even flooded because the surrounding, confining, slopes keep the current surface supplied with water.

8.11.2 *<u>Esgyrn Bottom – condition matrix summary</u> (see Figure 42)*

8.11.2.1 The Primary Condition Matrix of Esgyrn Bottom (Figure 42a) resembles that of Cernydd Carmel in having relatively few features of good condition, though more than Cernydd Carmel. Features of poor condition outnumber those of good condition though in this case with fewer features than those of Cernydd Carmel.

8.11.2.2 What is most marked about features of both good and poor condition at Esgyrn Bottom is that there are none from the T1 low ridge zone, highlighting the dry nature of the remaining primary mire surfaces. This primary surface is also characterised in many places by micro erosion between tussocks of *Molinia caerulea* or T3 hummocks of *Leucobryum glaucum* caped with lichens.

8.11.2.3 In contrast, the Secondary Condition Matrix (Figure 42b) shows a marked bias towards features of good condition although, again, there are no features from the T1 low ridge zone. These features of good condition consist of T2 and T3 examples of *Sphagnum* beneath a dwarf-shrub layer, along with secondary A1 hollows in which *Sphagnum cuspidatum* has become established.

8.11.2.4 Otherwise the ground is an expanse of wet micro-erosion and Tk tussock consisting of *Molinia caerulea* tussocks and a micro-erosion network characterised by bare peat or patches of moss cover.

8.11.3 *<u>Esgyrn Bottom – ZEGs</u> (see Figure 43 and Figure 4)*

8.11.3.1 The pattern of ground recorded by the condition matrices is reflected in the zone map of ZEGs, where extensive areas of the secondary surfaces are dominated by some of the worst-condition ZEGs, (ZEGs 34, 39, 41 and 45) characterised by Tk tussocks and micro-erosion in various stages of colonisation by moss species.

8.11.3.2 Some secondary surfaces and a number of remnant primary areas in the centre of the site, are characterised by ZEGs 37, 40 and 42 so while they are still characterised by tussocks and micro-erosion, they also have T3 hummocks and T2 high ridge communities with very occasional examples of T1 low ridge.

8.11.3.3 The largest single block of primary surface is similar in being characterised by a mix of ZEG 30 and 41 with T3 hummocks and T2 high ridge together with Tk tussocks within a micro-erosion network, but in this case much of the micro-erosion has become colonised by non-*Sphagnum* mosses.

8.11.3.4 One small block of rather better-condition primary surface survives within this central area of primary remnants as ZEG 23, which is entirely dominated by T3 hummocks and T2 high ridge along with small but frequent Tk tussocks.

| Mire pattern no: | Site: Esgyrn Bottom | Peat depth | Date 2021 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | |

**Figure 42a.** Consolidated condition matrix for the Esgyrn Bottom mesotope, incorporating condition matrix data from all primary microtope polygons recorded within the site.

| Mire pattern no: | Site: Esgyrn Bottom | Peat depth | Date 2021 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 42b.** Consolidated condition matrix for the Esgyrn Bottom mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site.

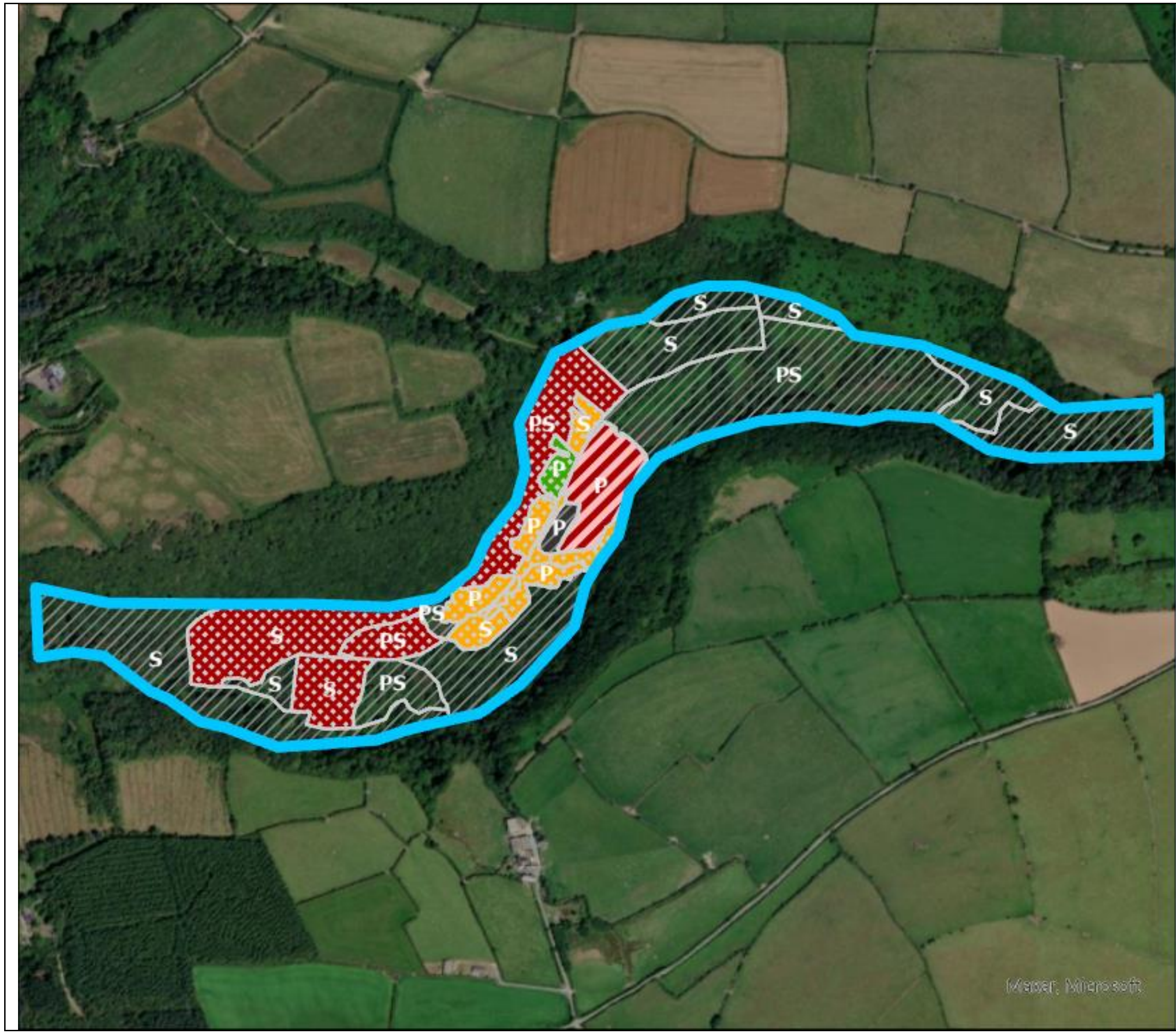



**Figure 43.**

Esgyrn Bottom: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

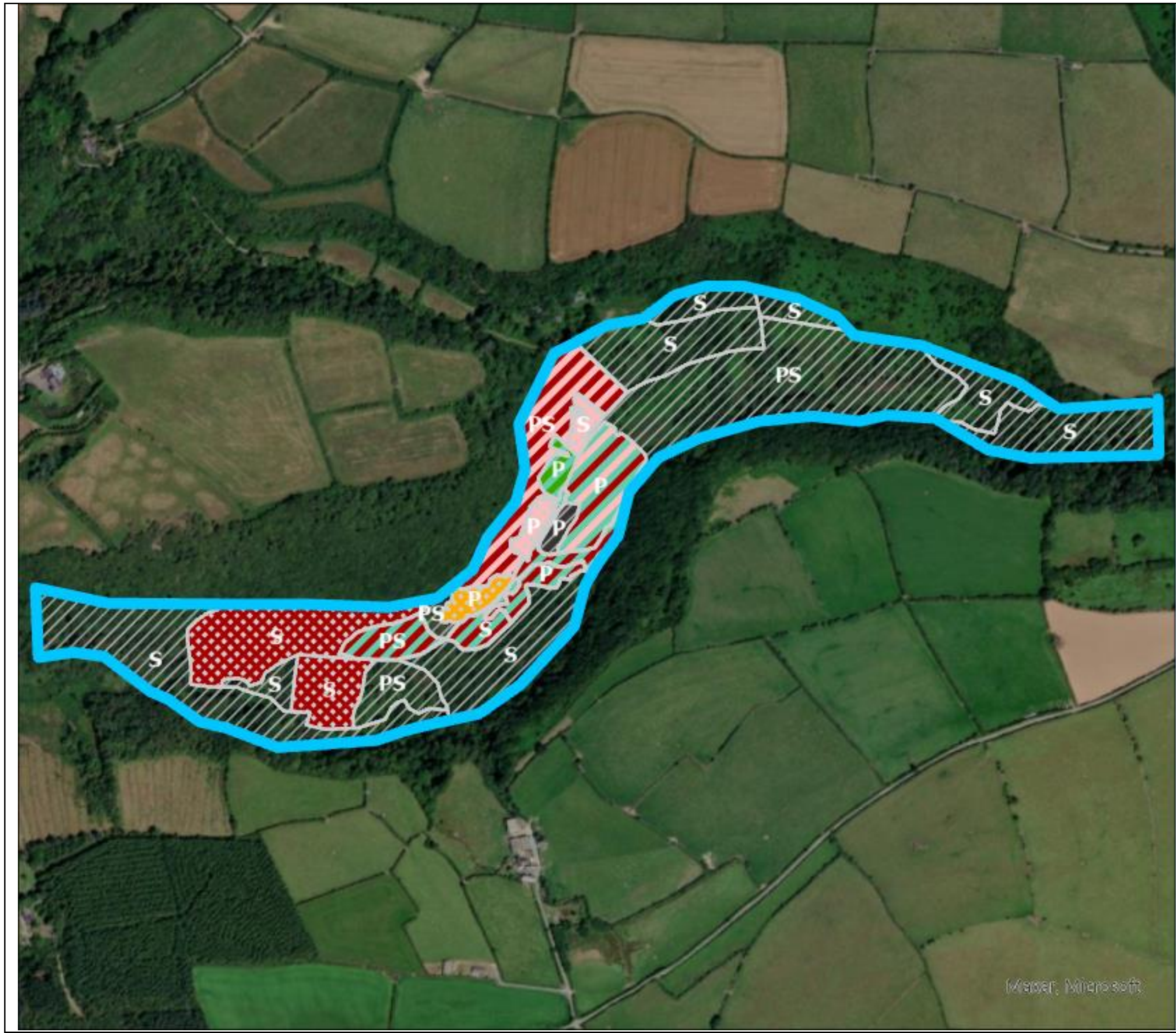



**Figure 44.**

Esgyrn Bottom: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

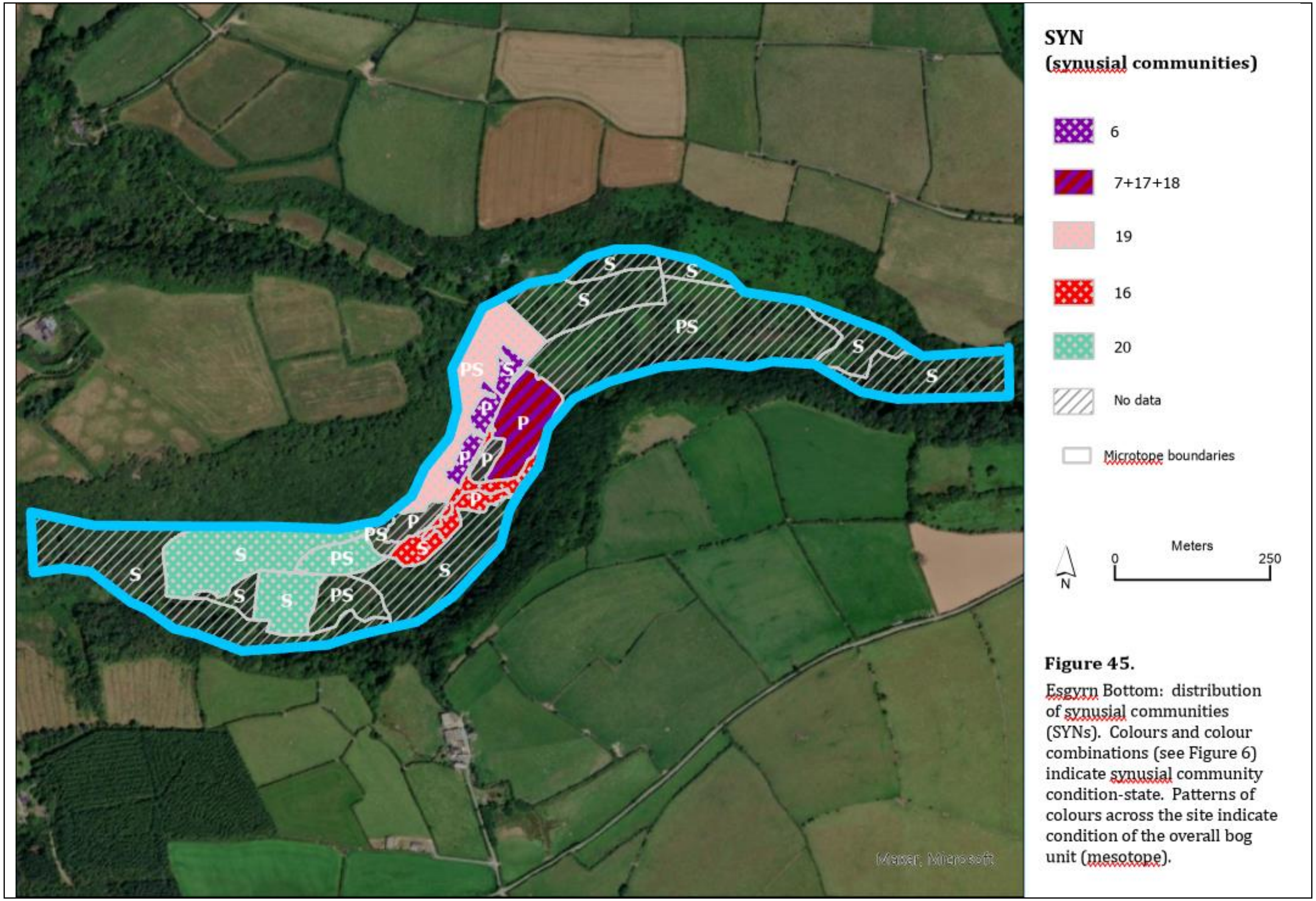



**Figure 45.**

Esgyrn Bottom: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

8.11.4 *Esgyrn Bottom – VEGs* *(see Figure 44 and Figure 4)*

8.11.4.1 The VEG assemblages reveal the small area of best primary surface to be VEG 5 with a mixture of *Sphagnum*-rich T2 high ridge with a canopy of dwarf shrubs while T3 hummocks are a mixture of *Sphagnum*, *Leucobryum glaucum* or *Hypnum jutlandicum* beneath the same dwarf-shrub canopy.

8.11.4.2 The VEG assemblage of the largest block of primary surface (VEGs 19 and 23) indicates that the predominant vegetation is one in which T3 hummocks and T2 high ridge are consistently characterised by a dwarf-shrub canopy over a hypnoid moss layer. *Molinia caerulea* and *Eriophorum vaginatum* tussocks meanwhile sit within a micro-erosion complex largely colonised by hypnoid moss.

8.11.4.3 One small section of primary surface with VEG 13 has a constant presence of *Molinia caerulea* tussocks and rather dry T3 hummocks but, in addition, not only has *Sphagnum*-rich T2 high ridge but also scattered examples of A1 *Sphagnum cuspidatum* hollows.

8.11.4.4 The next-best of the other areas of primary surface (VEG 18) is rather similar to the largest remaining block of primary ground, but lacks T3 hummocks. Other areas of primary surface have only scattered examples of T2 high ridge with dwarf shrubs and hypnoid moss, the major part of the vegetation being dominated by *Molinia caerulea* tussocks within a micro-erosion network variously colonised by *Sphagnum* or non-*Sphagnum* mosses.

8.11.4.5 Apart from some areas of secondary surface which are similar to the lowest quality of the primary remnants, the bulk of the secondary ground is dominated by VEG 24 with large *Molinia caerulea* tussocks between which is a wet network of micro-erosion with either bare peat or scattered T2 patches of T2 with *Sphagnum*, dwarf shrubs or lichens.

8.11.5 *Esgyrn Bottom – SYNs* *(see Figure 45 and Figure 4)*

8.11.5.1 The synusial communities of this site range from the driest of typical bog communities to areas that are best described as bog-edge or even lagg fen communities.

8.11.5.2 The best communities, of SYN 6, are found on small portions of the remnant primary surface as well as in one small area of recovering secondary bog. This community has no T1 elements. While dominated by T3 hummocks and T2 high ridge with *Hypnum jutlandicum*, *Molinia caerulea* and *Erica tetralix*, this ground also has *Sphagnum capillifolium* as T3 hummocks while also extending down to T2 high ridge where *S. papillosum* also occurs. Both *Eriophorum* species are also frequent features of the vegetation.

8.11.5.3 The largest area of primary surface with SYNs 7, 17 and 18, at best supports *Sphagnum tenellum* at the T2 level, pointing to former areas of wet bare peat possibly resulting from fire damage. The bulk of the synusial communities consist of *Molinia caerulea* tussocks and micro-erosion with T2 high ridge and, more commonly, T3 hummocks with *Hypnum jutlandicum* dominating both these and extensive areas of micro-erosion.

8.11.5.4 Other areas of primary and secondary surface are characterised by SYNs 16 and 19 with varying densities of *Molinia caerulea* tussocks and micro-erosion with T2 high ridge swards of *Hypnum jutlandicum* in which dwarf shrubs and *Narthecium ossifragum* occur.

8.11.5.5 The most extensive areas of secondary surface at the western end of the site support a synusial community assemblage of SYN 20, consisting of species in some ways more characteristic of wet woodland and lagg fen than of bog habitat, with the moss species *Eurynchium praelongum* and *Mnium hornum*, the herbaceous *Rumex acetosa* and the scrambler *Rubus fruticosus*.

8.11.6 *Esgyrn Bottom – Summary*

8.11.6.1 The major part of Esgyrn Bottom reflects the history of extensive peat cutting on the site. Small remnants of the primary surface have been left high and dry as uncut baulks or tracts of ground. Meanwhile the abandoned peat cuttings have filled with very large tussocks of *Molinia caerulea* which is encouraged by the steady movement of water down the valley now that the cuttings have become waterlogged.

8.11.6.2 Some small parts of the secondary surfaces have developed a vegetation which is no worse than, and in some cases better than, most areas of remnant bog surface, highlighting the potential for recovery given the right conditions. The best means of converting the *Molinia*-dominated ground to something closer to good condition lies in stagnating as far as possible the water flowing through the valley. Mowing the current standing of crop of tussocks would also then assist in reducing the present huge difference in microtopographic range from micro-erosion channels to tussock-top.

## 8.12 Rhos Goch

8.12.1 *Rhos Goch - macrotope and mesotope* *(see Figure 46)*

8.12.1.1 The Core Management Plan for Rhos Goch (NRW, 2017) states that a **lagg fen** community exists around much of the site, though OS mapping suggests that a small part of this on the northern side of the site has been turned into a drain. Despite this intervention the site possesses fine examples of lagg-fen communities around much of its margin. The status of the **macrotope** margin on its south-western border is unclear, though is bordered by 'downstream' agricultural land that would normally have drained field boundaries.


**Figure 46.**
Rhos Goch: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently semi-drained ground but would likely become effective lagg fen if fully re-wetted.

8.12.1.2 The status of the **mesotope** as a whole is uncertain, in part because Hughes (2005) states that there is a significant gap in the peat chronological archive indicating, according to Hughes (2005) that peat cutting had removed this peat, thus suggesting that the mesotope has a whole is secondary.

8.12.1.3 However, the nature of the current microtopography, particularly visible in aerial photography from the early post-war period, is more suggestive of randomly-dug retting pits across the site. Such practices are known from other sites (e.g. Austwick Moss in Yorkshire) where flax in particular was soaked in the acidic water prior to further processing. The extreme and abrupt height differences between the upstanding baulks and the adjacent depressions is more typical of such activity than any general lowering of the mesotope water table would normally induce.

8.12.1.4 If the explanation of the current microtopography is indeed to be found in historical use of Rhos Goch as a flax-ring site, the question then remains as to whether the existing upstanding baulks represent areas of the original primary dome or are in fact part of a secondary surface following the peat cutting losses identified by Hughes (2005). Given that Hughes (2005) based his conclusions on a relatively small number of peat cores, it is impossible to say what proportion of the original bog surface survives, if any. For the present, part of the area free from evidence of these suggested retting pits has been classified in Figure xx as (potential) primary bog while the bulk of the pitted area has been classified as a mixture of primary and secondary surface.

8.12.1.5 Furthermore, the status of the extended area to the south-west indicated as lagg fen in Figure 46 is also unclear. Did the original bog mesotope extend across this part of the site and thus this whole section should be classed as secondary bog? Its character now is more characteristic of lagg fen and so it has been classified as such, but there is now no way of knowing whether the original bog mesotope extended across this area. If this part of the site was always somewhat flushed by waters collecting from the surrounding catchment it is possible that much, if not all, of this portion of the site was always a form of extended lagg fen, but this must remain as only a speculative possibility.

8.12.2 *<u>Rhos Goch – condition matrix summary</u> (see Figure 47)*

8.12.2.1 The uncertain nature of the current surface microtopography means that a condition matrix combining both elements – possible primary and secondary surfaces – is the only reasonable approach.

8.12.2.2 Although the upstanding baulks are dry and dominated by tussocks of *Molinia caerulea* and *Eriophorum vaginatum* together with dry dwarf shrub canopies over hypnoid mosses or occasional patches of *Sphagnum*, the hollows, whether they be natural or secondary retting pits, support a vegetation assemblage of reasonable quality.

| Mire pattern no: | Site: Rhos Goch | Peat depth | Date 2019 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 47.** Consolidated condition matrix for the Rhos Goch mesotope, incorporating condition matrix data from all microtope polygons, primary and secondary, recorded within the site.

8.12.2.3 While *Sphagnum fallax* is the dominant moss species of both the T1A1 and A1 zones of the hollows, pointing to the secondary nature of these features, the margins of such hollows support assemblages of *Sphagnum*, *Erica tetralix*, non-tussock *Eriophorum vaginatum* and *Drosera rotundifolia* that certainly mirror features of good condition.

8.12.2.4 A further striking aspect of the condition matrix is that there is no record of micro-erosion on the condition-matrix form, an absence shared with only one other site under consideration in the present report. In the case of Rhos Goch, however, this absence may simply be due to the fact that the hollows are wet, self-contained and extremely numerous, with the result that there is insufficient area of the upstanding, potentially primary, surface in any one location for micro-erosion to become an evident feature when recording the form. This may therefore be a failure of monitoring rather than true evidence for the absence of micro-erosion in this case.

8.12.3 <u>*Rhos Goch – ZEGs*</u> *(see Figure 48 and Figure 4)*

8.12.3.1 Analysis of all condition data across all nine sites to generate the ZEG assemblages does indeed suggest that micro-erosion is likely to be present on the baulks of Rhos Goch, with VEG 38 characterised by both moss-rich and bare-peat micro-erosion, along with frequent Tk tussocks. This accords with the general impression gained when walking along the baulks on this site.

8.12.3.2 The main body of the bog, with its possible retting pits, thus consists partly of the VEG 38 assemblage, referred to above, dominating the raised baulks while in the hollows there are synusial zones spanning the range from T3 hummock to T1A1 hollow and even occasional A2 mud-bottom hollow, along with frequent presence of Tk tussocks but no micro-erosion.

8.12.3.3 One area to the west of this main body is tentatively identified as primary bog in Figure 46, while in Figure 48 this is assigned to an assemblage consisting of T3 hummocks and T2 high ridge, Tk tussocks and T1A1 transition zone but without any actual hollow features. It thus has a somewhat mixed character of being somewhat dry (with the dominance of T3, T2 and Tk while lacking T1) together with wetter T1A1 parts. This is certainly more typically a feature of regenerating secondary peat cuttings, so perhaps categorising this part as primary bog in Figure 46 is not really justified.

8.12.4 <u>*Rhos Goch – VEGs*</u> *(see Figure 49 and Figure 5)*

8.12.4.1 Both VEG 13 and VEG 26, which are shown in Figure 49 to cover the whole of the remaining bog mesotope, are characterised by the presence of *Sphagnum fallax*, which lends further weight to the argument that in fact the whole current mesotope is secondary in nature.

8.12.4.2 VEG 13 embraces the whole of the bog mesotope area, with its constant presence of *Molinia caerulea* tussocks but also constant presence of some

*Sphagnum*, whether this be terrestrial or aquatic species. Meanwhile the *Sphagnum fallax* and *Drosera* assemblages of VEG 26 would be specifically associated with the retting hollows.

8.12.5 <u>*Rhos Goch – SYNs*</u> *(see Figure 50 and Figure 6)*

8.12.5.1 The synusial species communities also reflect this dichotomy, with the baulks characterised by the driest of the bog SYNs with *Molinia caerulea*, *Hypnum jutlandicum* and *Erica tetralix*, while the hollows are characterised by SYN 14 in which *Sphagnum*-rich T1 low ridge, drier T3 hummocks and *Rhynchospora alba* T1A1 transition zones are the dominant community components.

8.12.5.2 The area potentially indicated as primary bog in Figure XX is also mapped as the driest of the bog communities, SYN 6, but without any of the wetter SYN 4 community.

8.12.6 <u>*Rhos Goch – Summary*</u>

8.12.6.1 Rhos Goch is a difficult site to classify in terms of condition because it has several features of good condition but the status of these features is not at all clear. Are they mostly original primary features that have for some reason developed an extreme display of microtopography or is the site a wholly secondary system with the microtopography artificially created by historical actions?

8.12.6.2 The evidence provided by Hughes (2005) certainly indicates that at least parts of the site have been significantly impacted by part human activity and should now be regarded as secondary in nature, but whether or not the hollows are primary or secondary features they undoubtedly today contain much of the current interest.

8.12.6.3 The condition and status of parts lacking the pattern of hollows and baulks are in some ways even more uncertain because it is not clear whether or not they once formed part of a larger mesotope bog dome but are now secondary recovering features or areas which have in effect become part of a wider, albeit secondary, lagg fen.

8.12.6.4 Nonetheless, the site macrotope has the benefit of having a largely intact lagg fen while the mesotope retains, or has regained, substantial small but numerous areas supporting synusial bog communities indicative of good condition. Further improvement or recovery of the site would thus be aided by supporting and encouraging the best of these communities to be maintained and ultimately expand.

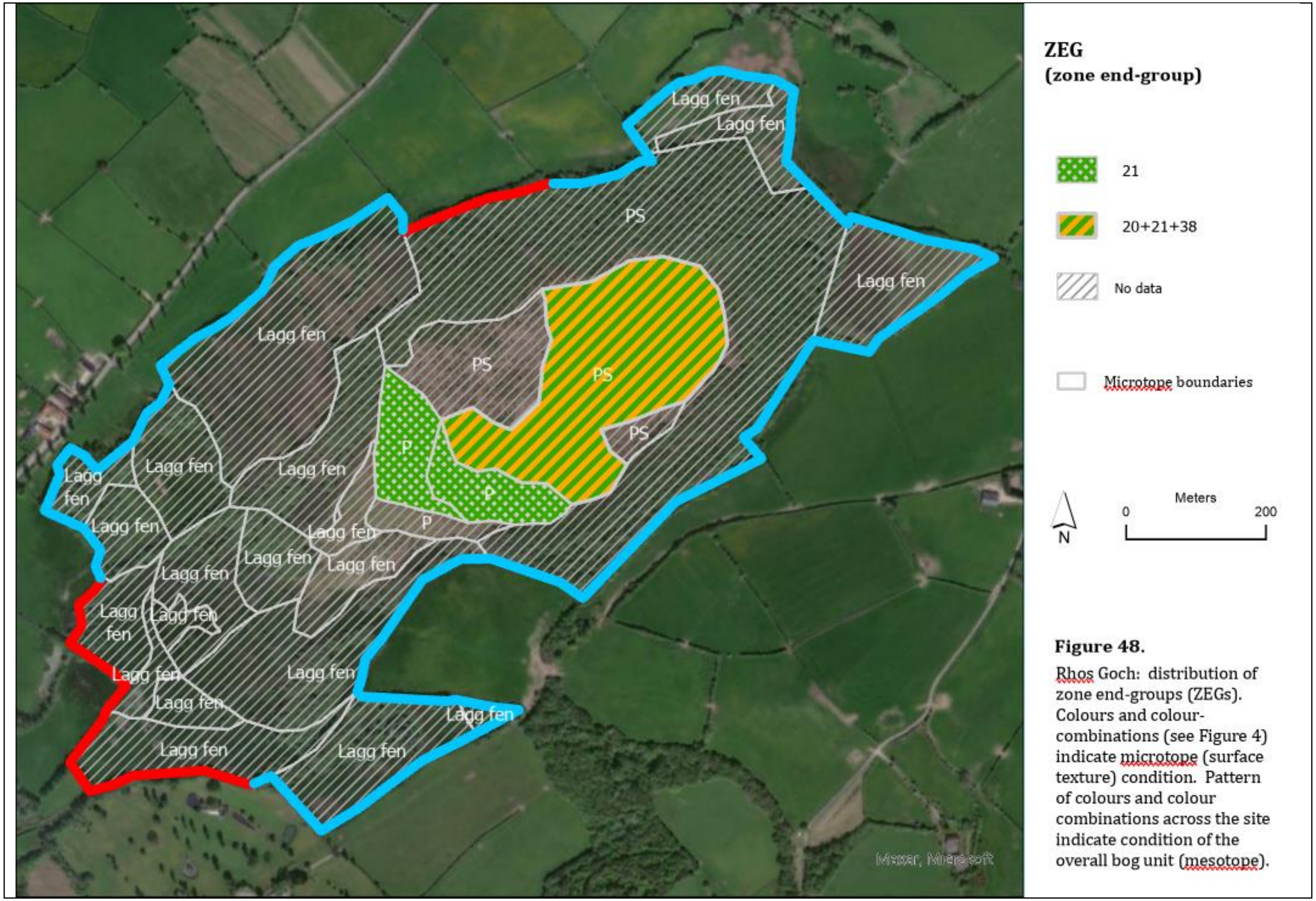



**Figure 48.**

Rhos Goch: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).


**Figure 49.**
Rhos Goch: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

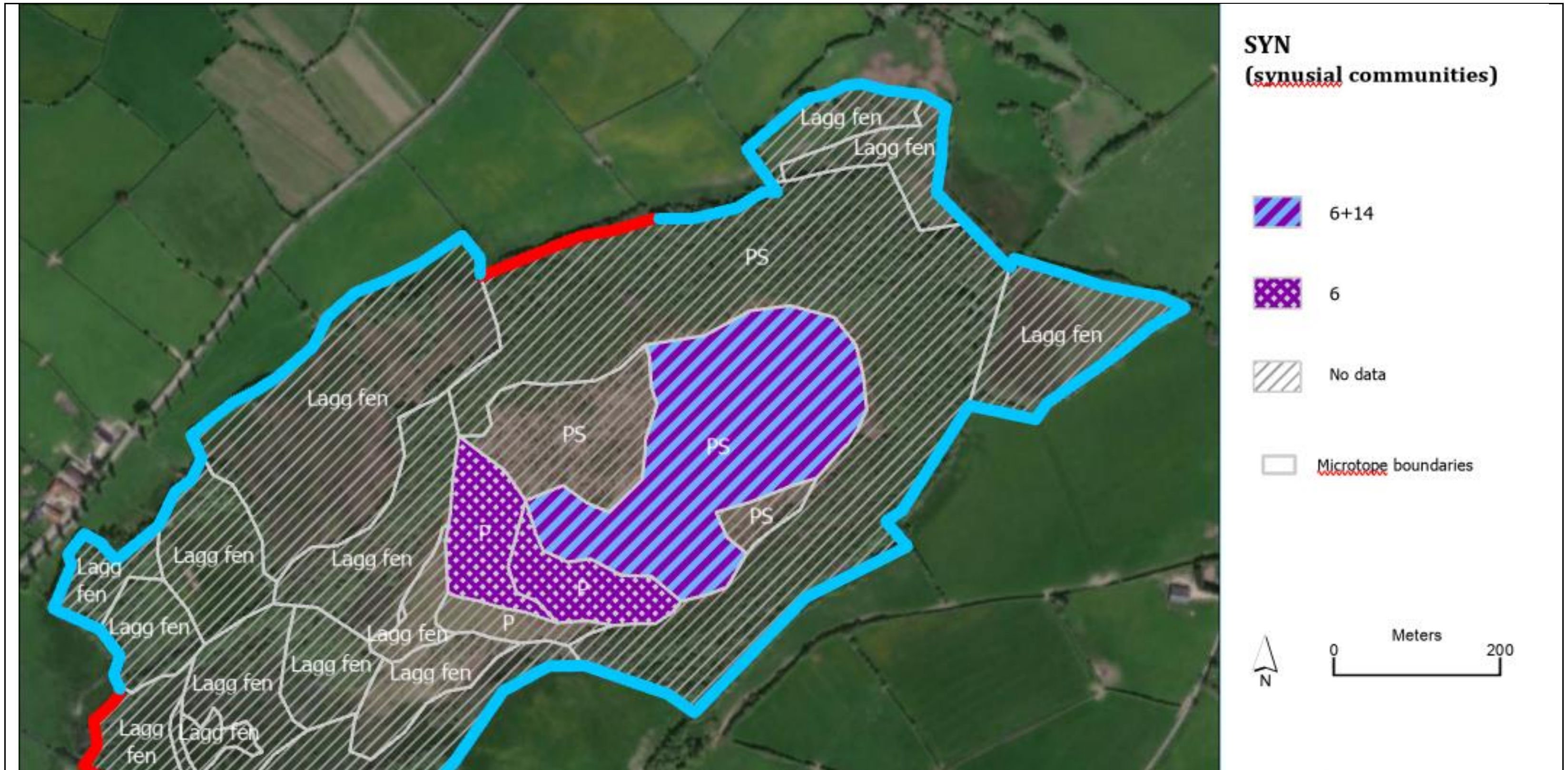



**Figure 50.**
Rhos Goch: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

## 8.13 Waun Ddu

8.13.1 *Waun Ddu - macrotope and mesotope* *(see Figure 51)*

8.13.1.1 Waun Ddu is the smallest of the sites considered in the present report, and indeed counts as one of the smallest lowland raised bogs in the UK. It sits in a hollow at the foot of a high escarpment and is now bordered on both sides of the raised bog dome by streams which may once have been a single watercourse that became divided by growth of this small bog dome.

8.13.1.2 Of the nine sites considered in the present report, the very small Waun Ddu site is the only **macrotope** to have retained a **lagg fen** in its entirety. In addition, its general appearance suggests that the mesotope is entire and free from any significant human impact.

8.13.1.3 Appearances are, however, deceptive. Close inspection reveals that the morphology of the **mesotope** dome betrays evidence of large very shallow depressions and very slightly elevated areas. These are not features that would form as a natural consequence of bog growth. The depressed areas instead point to locations of extremely old peat cuttings which have infilled with fresh peat to the point where they are almost (but not quite) indistinguishable from the areas of surviving primary dome.

8.13.1.4 The fact that these areas are indeed infilled peat cuttings was confirmed by taking peat cores which showed a substantial thickness of relatively fresh peat sitting above a black dense peat with an abrupt boundary separating the two. Had these areas not also been slight anomalous depressions, this boundary might have been assigned to the '*Grenzhorizon*' which is found in many continental raised bogs but is a less frequent or obvious feature in UK raised bogs (Godwin, 1981).

8.13.1.5 Early post-war aerial imagery does indeed suggest a pattern of paler and darker regions that appear to reflect the areas of depressed ground and slightly elevated surfaces visible today. Such distinctions are much less clear in recent imagery, but the depressed areas probably still have sufficient difference in elevation for LIDAR to be able to distinguish these from the surviving primary bog surface.

8.13.2 *Waun Ddu – condition matrix summary* *(see Figure 52)*

8.13.2.1 Given the visual appearance of a largely intact raised bog or at least one that has shown almost complete recovery from previous impacts, the condition matrix sheets provide an unexpected picture of condition.

8.13.2.2 Sheets for the primary (Figure 52a) and secondary (Figure 52b) surfaces are broadly similar, which is not surprising given the fact that the old cuttings now almost indistinguishable from the primary dome. However, both sheets are heavily biased towards the 'degraded, some recovery' condition-state with some features of worse condition. There are relatively few features indicative of good-condition raised bog habitat.


**Figure 51.**
Waun Ddu: condition of lagg fen; also displayed are the areas of primary and secondary surface within the main peat body (mesotope). Areas shaded as Lagg fen represent ground that is currently drained ground but would likely become lagg fen if re-wetted.

| Mire pattern no: | Site: Waun Ddu | Peat depth | Date 2021 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Polytrichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Polytrichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition .................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 52a.** Consolidated condition matrix for the Waun Ddu mesotope, incorporating condition matrix data from all primary microtope polygons recorded within the site.

| Mire pattern no: | Site: Waun Ddu | Peat depth | Date 2021 | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Polytrichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans (only in far W of Scotland) | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Polytrichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Aquatic zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

**Figure 52b.** Consolidated condition matrix for the Waun Ddu mesotope, incorporating condition matrix data from all secondary microtope polygons recorded within the site.

8.13.2.3 The majority of condition-features point to a non-*Sphagnum* moss cover and occasional patches of bare peat. The likely explanation of this is discussed under the sections describing the ZEGs, VEGs and SYNs of the site.

8.13.3 *Waun Ddu – ZEGs (see Figure 53 and Figure 4)*

8.13.3.1 The collection of ZEGs recorded for Waun Ddu display not merely the best condition-state in terms of synusial zones compared with all other sites considered in the present report, but the entire set of condition-states are classed as indicative of good condition.

8.13.3.2 The synusial zones range from T3 hummocks to A1 hollows. Tussocks are absent, as is any evidence of micro-erosion. As such, the synusial zones would suggest that this is a bog surface in excellent condition.

8.13.3.3 However, synusial zones themselves are only part of the condition-assessment process, and when the synusial vegetation assemblages and synusial communities are brought into consideration the picture changes significantly.

8.13.4 *Waun Ddu – VEGs (see Figure 54 and Figure 4)*

8.13.4.1 Almost the entire Waun Ddu site is characterised by VEG 2 accompanied by other VEGs. The character of VEG 2 inclines towards the sort of community more typical of the lagg fen, particularly when paired with VEG 1, with both assemblages being characterised by constant presence of *Polytrichum commune*, which is a typical feature of the lagg fen margin where the plant benefits from increased nutrient levels.

8.13.4.2 VEG 2 also has areas of wet bare peat with hypnoid mosses and *Carex panicea*, which is again a feature of the lagg fen edge, although it can also arise as a result of trampling on a bog surface. This is perhaps an important clue to explaining the present condition of the Waun Ddu mire system.

8.13.4.3 Limited areas within the northern half of the site are characterised by a somewhat drier assemblage in which dwarf shrubs and hypnoid mosses are the constant feature, albeit with occasional presence of *Sphagnum*. These are perhaps the highest elevation parts of the remnant primary dome although on Waun Ddu all heights are relative.

8.13.5 *Waun Ddu – SYNs (see Figure 55 and Figure 4)*

8.13.5.1 The Waun Ddu SYN communities consist entirely of either the enriched bog margin SYNs 1, 2 and 3, or the damaged bog resembling wet heathland communities of SYNs 4 and 5. The southern half of the site is dominated by the bog margin communities while the northern half supports a mix of bog margin and damaged bog resembling wet heath communities.


**Figure 53.**

Waun Ddu: distribution of zone end-groups (ZEGs). Colours and colour-combinations (see Figure 4) indicate microtope (surface texture) condition. Pattern of colours and colour combinations across the site indicate condition of the overall bog unit (mesotope).

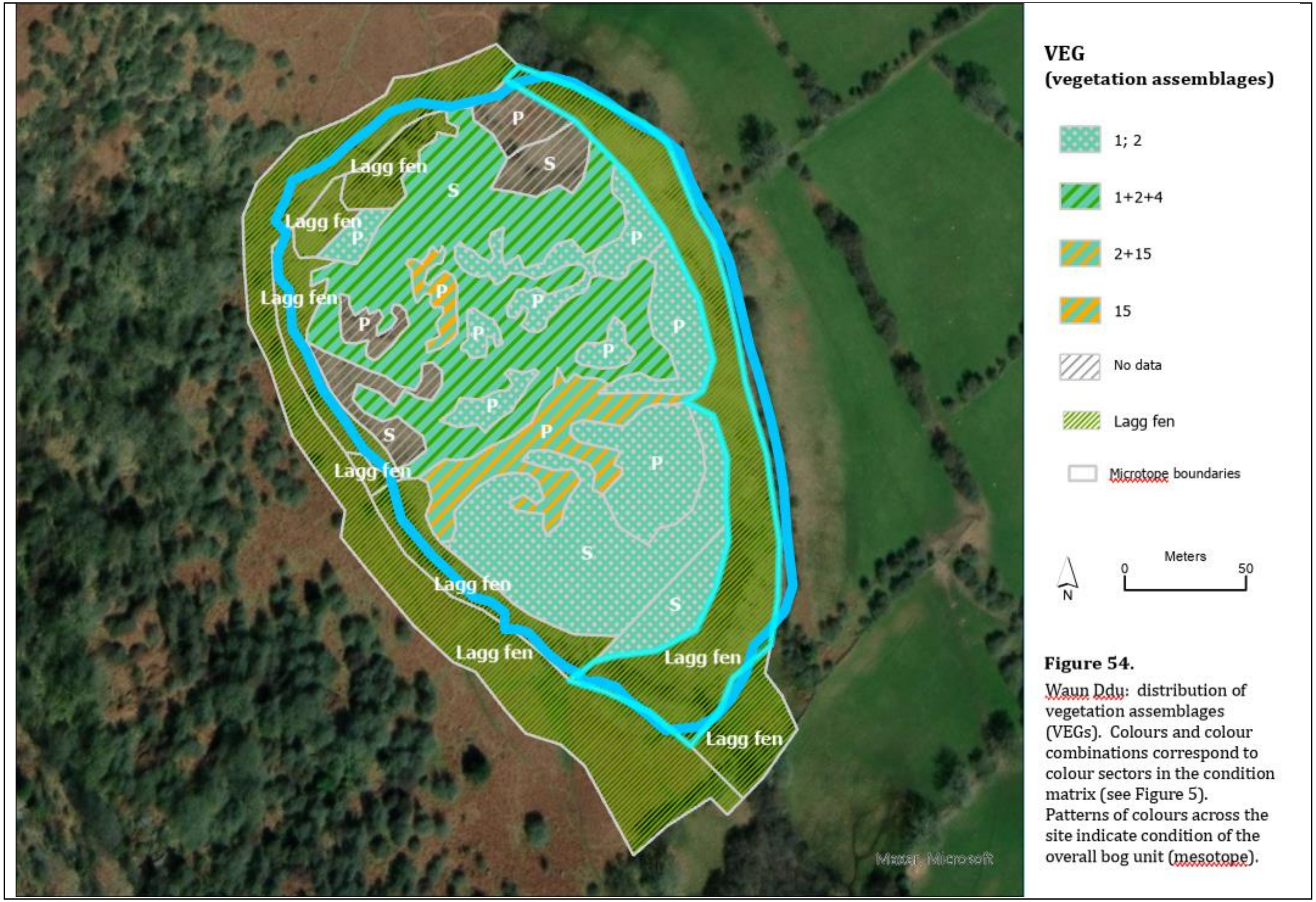



**Figure 54.**
Waun Ddu: distribution of vegetation assemblages (VEGs). Colours and colour combinations correspond to colour sectors in the condition matrix (see Figure 5). Patterns of colours across the site indicate condition of the overall bog unit (mesotope).


**Figure 55.**

Waun Ddu: distribution of synusial communities (SYNs). Colours and colour combinations (see Figure 6) indicate synusial community condition-state. Patterns of colours across the site indicate condition of the overall bog unit (mesotope).

8.13.5.2 The species compositions rich in grasses such as *Anthoxanthum odoratum*, *Nardus stricta* and *Festuca ovina*, together with mosses such as *Rhytidiadelphus squarrosus*, and *Dicranum scoparium*, and herbs such as *Galium saxatile* and *Potentilla erecta* all point to marked enrichment of the bog surface.

8.13.5.3 This sign of enrichment, combined with the relative firmness of the general surface and the extremely short height of all vegetation, together point to a likely explanation for the condition-state of the present surface.

8.13.5.4 The site is known as having been a gathering-place for sheep at certain times of the farming year. Numbers of more than 1,000 head of sheep have been mentioned, which would provide ample opportunity for enrichment of the bog surface and thus encouragement of species normally restricted to the lagg fen margins. It would also explain the very short stature of the vegetation, as well as patches of wet bare peat where trampling has been particularly severe.

8.13.6 <u>*Waun Ddu – Summary*</u>

8.13.6.1 Despite the evidence of ancient peat cutting, Waun Ddu currently represents the best example of an entire raised bog macrotope with a mesotope that is now largely recovered from the past peat cutting, and now supports a synusial vegetation community which, though currently somewhat distorted by current land-use practice, has the potential to re-establish a near-natural system within a relatively short time-interval.

8.13.6.2 While nutrient loads can take some time for the living vegetation to grow above the influence of the nutrient-rich layers of peat, the important first step is to prevent further enrichment. Having arranged this key step, a degree of very light grazing would prevent drier parts of the bog from becoming dominated by drier-heath-like communities until such time as a *Sphagnum*-dominated synusial community can be re-established. This *Sphagnum*-rich community would then keep typical heath species such as *Calluna vulgaris* and *Hypnum jutlandicum* permanently in check.

## 9. Discussion

9.1 Recording and analysis of site data using synusial phytosociology has provided four ways to evaluate the habitat condition of these nine peat bog sites using presence-absence data:

- visual condition-matrix assessment;
- synusial zone composition;
- synusial vegetation assemblages;
- synusial community types.

9.2 The condition-matrix condition assessment gives an immediate visual picture of habitat health based on a 'traffic light' system of colour coding, and has revealed that every one of the nine sites under consideration shows significant signs of degradation as a result of past land-use activities.

9.3 Being based on a simple check-list of presence-absence the matrix does not, however, give an indication of how extensively each of the identified condition-indicators is distributed across the site. For this, the individual matrix sample points were assigned to polygons each defining particular texture types (microtopes) visible from aerial imagery. Analysis of the matrix data to generate the three synusial categories listed above and subsequent assigning of these to microtope polygons revealed the extent of these derived synusial categories within each site.

9.4 The resulting maps have revealed that synusial communities indicative of the best, most natural, habitat condition are extremely limited in extent on even the best of the sites and even then are generally mixed with communities of lesser condition, while several of the sites under consideration have no good-quality communities at all.

9.5 The largest raised bog, Cors Fochno, now displays a good though constrained version of synusial zones, assemblages and communities over the crown of the bog and only possesses the best of the synusial communities in secondary regenerating peat cuttings. The other very large bog, Cors Caron West Bog, does not possess any examples of the very best synusial communities.

9.6 Surprisingly, the best examples of synusial zones, assemblages and communities are to be found on some of the much smaller bogs, namely Cors Caron NE Bog and Cors Caron SE Bog, the primary domes of which have been substantially reduced in size by past domestic peat cutting. In both cases, however, this best-condition community is mixed with lower-quality vegetation, sometimes some of the lowest quality. This gives rise to concern that the high-quality communities are in danger of being replaced by those of lower quality because of long-term drainage effects arising from the loss of primary dome to peat cutting.

9.7 Equally unexpected is the discovery that the other synusial zones, assemblages and communities of good, if lesser quality, are found on one of the smallest sites, namely Cors Goch, despite its substantial losses of primary dome to domestic peat cutting and the fact that it is a fraction of the size of the large Cors Caron West Bog yet still supports synusial communities that are as good as the best found on the larger site.

9.8 Waun Ddu is the smallest of all the bogs yet is in many respects the most intact macrotope system of all the nine sites because it has retained the entirety of its lagg fen and while the site has experienced losses to peat cutting long ago, these cuttings have now almost completely regenerated to re-create a complete mesotope dome. If it were not for the use of this site as holding ground for large numbers of sheep, this tiny site has the potential to be the very best of all the nine raised bogs.

9.9 While fire damage, and in at least some cases repeated fire damage, has undoubtedly resulted in significant damage to the synusial structure of the surface vegetation across most of these other sites, the underlying causes of relatively poor –

in some cases extremely poor – condition across the remaining eight sites can be attributed to three factors. These are:

- loss of the lagg fen and thus disruption of the macrotope system;
- partial loss of primary dome to domestic peat cutting resulting in disruption to the hydromorphological mesotope and macrotope system.

Only by addressing these fundamental issues, as well as preventing further fires, will it be possible to achieve sustained and sustainable recovery of these sites into the foreseeable future.

9.10 The combined analysis of synusial features across all sites has proved to be of value because it has enabled any given site to be placed in the broader context of the sites as a whole. Further collection of synusial data from other parts of the UK as part of several other ongoing projects, it will eventually be possible to place these nine sites and their condition-states within a broader picture of the raised bog habitat across the UK.

9.11 In providing an overview of condition across all nine sites, the combined analysis can also help to shape the restoration actions, priorities and the scale of resources required by Natural Resources Wales for effective restoration of this suite of sites.

9.12 Perhaps even more importantly, the synusial approach has provided Natural Resources Wales with a sensitive yet robust tool with which it can subsequently judge the success or otherwise of its restoration interventions. From the limited data currently available, it would appear that the synusial approach has already proved itself capable of providing such information in a cost-effective yet robust manner.

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## Annex 1: Peat bog condition matrix

| Mire pattern no: | Site: | Peat depth | Date | Time (to link photos) | Recorder | Grid ref: |
|---|---|---|---|---|---|---|
| | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | Vegetation types : Terrestrial zones | | | | Primary (original) / Secondary (cut-over) surface (circle relevant condition) | | | | | Extra veg types | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Relatively 'active', likely to be favourable condition ..................>> | | | | <<.Degraded, some recovery...>> | | << ....Degraded, Unfavourable.............>> | | | | |
| T5 (peat mound) found only in far north & west of Scotland (1 m+) | | Sphagnum/ dwarf shrubs | 'Feather' mosses | Calluna or Empetrum | Racomitrium | Cladonia with bare peat | | Collapse features | Extensive bare peat | | | |
| T4 (erosion complex hagg top) (can be 50 cm+) | | Sphagnum mosses | | Hypnoid mosses | Mixed dwarf shrub with hypnoid moss | Calluna and hypnoid moss cover | Racomitrium | Mixed dwarf shrubs with no moss | Calluna with no moss | Bare peat with lichens | | |
| | | | | | | Molinia and hypnoid moss cover | Racomitrium and Molinia | | Bare peat with dwarf shrubs | Molinia with bare peat | | |
| T3 (hummock) (30 cm to 50 cm) | | Sphagnum | | Racomitrium (in far W Scotland) | | Hypnoid mosses | Polytrichum commune | Racomitrium (elsewhere) | Lichens dominant | Bare peat | | |
| | | Sphagnum fuscum | Sphagnum papillosum | Sphagnum austinii [imbricatum] | Sphagnum capillifolium | Sphagnum subnitens | Hypnoid and Poly-trichum mosses | Leucobryum | Short mosses on bare peat | Dwarf shrubs/ no moss | | |
| | | Sphagnum magellanicum | Sphagnum with Eriophorum | Sphagnum with Molinia | Dwarf shrubs over Sphagnum | Dwarf shrubs with hypnoid mosses | | Hypnoid mosses/ lichens | | | | |
| Tk (tussock) (hard unyielding feature obvious underfoot | | Schoenus nigricans **(only in far W of Scotland)** | Sphagnum over Eriophorum vaginatum tussock | Sphagnum over Molinia tussock | Sphagnum over Trichophorum tussock | Eriophorum vaginatum with some Sphagnum | Molinia with some Sphagnum | Molinia caerulea | Eriophorum vaginatum on bare peat | Trichophorum cespitosum on bare peat | | |
| | | | | | | | Trichophorum with some Sphagnum | Deschampsia flexuosa | | | | |
| T2 (high ridge) (15 cm to 30 cm) | | Sphagnum | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum/ Rubus chamaemorus | Sphagnum/Erica tetralix | Sphangum medium | Sphagnum with Eriophorum | Calluna with some Sphagnum | Dwarf shrubs with hypnoid mosses | Eriophorum vaginatum with no moss | Bare peat with dwarf shrubs | | | |
| | | Sphagnum papillosum | Sphagnum capillifolium | Sphagnum with Molinia | Sphagnum with dwarf shrubs | Sphagnum subnitens | Hypnoid/Poly-trichum mosses | Sphagnum compactum | Bare peat with Trichophorum | | | |
| | | Sphagnum fuscum | Sphagnum austinii [imbricatum] | | | | | | | | | |
| T1 (low ridge) (1 cm to 15 cm) If S. capillifolium is dominant at this level it suggests drying | | Sphagnum (not S. fallax) | | | | Hypnoid mosses | Eriophorum vaginatum | Dwarf shrubs with no moss | Lichens dominant | Bare peat | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum with dwarf shrubs | Campylopus atrovirens (in W Scotland) | Sphagnum capillifolium dominant | Sphagnum tenellum dominant | Dwarf shrubs with hypnoid mosses | Bare peat with dwarf shrubs | | | |
| | | Sphagnum/Erica tetralix | Sphagnum with Eriophorum | Sphagnum with Drosera | | S. fallax | | | Bare peat with Trichophorum | | | |
| T1/A1 (0 cm to 5 cm) edges of pools/ hollows, or 'runnels' | | Sphagnum pulchrum | Sphagnum tenellum | Aulacomnium palustre | Narthecium ossifragum | Sphagnum fallax | | Sphagnum compactum | Bare peat with Trichophorum | Bare peat | | |
| | | Drosera anglica | Rhynchospora | Sphagnum | Sphagnum cuspidatum | Non-Sphagnum moss | | | | | | |

| Zone (relation to w/t) | DFR (321) Freq. | **Vegetation types : Aquatic zones** | | | | | **Primary** (original) **/ Secondary** (cut-over) **surface** (circle relevant condition) | | | | **Extra veg types** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Relatively 'active', likely to be favourable condition ..................>>** | | | | **<<.Degraded, some recovery...>>** | | **<< ....Degraded, Unfavourable.............>>** | | | | |
| A1 (Sph. hollow (-10 cm to 0 cm) | | Sphagnum (not S. fallax) | | | | Sphagnum fallax | | Bare peat with scattered Sphagnum cuspidatum | | | | |
| | | Sphagnum cuspidatum | Sphagnum with E. angustifolium | Sphagnum with Rhynchospora | Sphagnum with Eleocharis | | | | | | | |
| | | Sphagnum with Menyanthes | Sphagnum with Drosera | | | | | | | | | |
| A2 ('mud-bottom' hollow) (-5 cm to -20 cm) | | Wet/flooded peat with limited aquatic Sphagnum presence: generally only characteristic of far western Britain, not to be confused with micro-erosion gullies filled with litter between e.g. Molinia tussocks | | | | Bare peat with E. angustifolium | | | | Bare peat | | |
| | | Flooded Molinia litter | Drosera intermedia | Molinia litter with Sphagnum auriculatum | Molinia litter/ Utricularia | | | Bare peat with Trichophorum | Bare peat with Carex panicea | | | |
| | | Rhynchospora alba | Rhynchospora fusca | Carex limosa | | | | Purple mats of Zygogonium algae | | | | |
| A3 (drought-sensitive pool) (-10 cm to -40 cm) | | Open water with floating columns of aquatic Sphagnum species | | | | Bare peat with E. angustifolium | | Purple mats of Zygogonium algae | | Bare peat | | |
| | | Sphagnum cuspidatum | Sphagnum auriculatum | Menyanthes trifoliata | Eriophorum angustifolium | | | | | | | |
| | | Utricularia | Carex limosa | | | | | | | | | |
| A4 (permanent pool) (-50 cm to -6 m) generally only in far N & W of Scotland | | Deep open water with fringing vegetation | | | | | | | | | | |
| | | Menyanthes trifoliata | Sphagnum auriculatum | Sphagnum cuspidatum | Eriophorum angustifolium | | | | | | | |
| E2 (eroding gully) | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| E1 (revegetating gully) | | Sphagnum | | | | Sphagnum tenellum | Eriophorum angustifolium sward | Bare peat with E. angustifolium | Bare peat with Carex panicea | Juncus squarrosus | | |
| | | Sphagnum papillosum | Sphagnum medium | Sphagnum capillifolium | Sphagnum cuspidatum | Sphagnum fallax | Polytrichum commune | | | | | |
| Em (bare) (micro-erosion | | | | | | | | Bare peat with E. angustifolium | Bare peat with Carex panicea | Bare peat | | |
| Em (moss) (micro-erosion) | | | | | | Mixed moss sward/ no Sphagnum | | Hypnoid mosses | Campylopus-type mosses | | | |
| Em (Sphagnum) | | | | | | Sphagnum moss | | | | | | |

## Annex 2: Example Synusial Quadrat Sheet

Site: WEST BOG CORS CARON | Date: 20/05/2020 | Microtope no: 35 | Location: (1)

| Zone | DFR | Microtope synusial species composition | | | | | |
|---|---|---|---|---|---|---|---|
| T3 HUMMOCK | (D) 80% | PLEUROZIUM SCHREBERI | (A) | SPHAGNUM CAPILLIFOLIUM | (O.A) | CALLUNA VULGARIS | (F.A) |
| | | MOLINIA CAERULEA | (F) | ERIOPHORUM VAGINATUM | (F) | POLYTRICHUM STRICTUM | (F) |
| | | CLADONIA PORTENTOSA | (F.O) | VACCINIUM MYRTILLUS | (F) | ERICA TETRALIX | (O) |
| | | DICRANUM SCOPARIUM | (O) | HYPNUM JUTLANDICUM | (F) | VACCINIUM OXYCOCCUS | (O.F) |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| TK TUSSOCK. | (F) 15% | MOLINIA CAERULEA | (A) | ERIOPHORUM VAGINATUM. | (F) | HYPNUM JUTLANDICUM | (F) |
| | | | | | | | |
| | | | | | | | |
| T2 HIGH RIDGE. | (O) 5% | ERIOPHORUM VAGINATUM | (F) | ANDROMEDA POLIFOLIA | (O.F) | PLEUROZIUM SCHREBERI | (F.A) |
| | | CALLUNA VULGARIS | (F.A) | MOLINIA CAERULEA | (F.A) | ERICA TETRALIX | (F) |
| | | VACCINIUM MYRTILLUS | (F.A) | EMPETRUM NIGRUM. | (O.F) | SPHAGNUM FALLAX | (O) |
| | | DICRANUM SCOPARIUM. | (O) | VACCINIUM OXYCOCCUS | (O) | SPHAGNUM SUBNITENS | (O) |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Annex 3: Composition of the 26 VEG groups**

Synusial vegetation assemblages which have greater than 50% constancy are listed first, shaded grey and surrounded by a thick black box. Within this group, items are ordered firstly according to the vertical zonation of nanotopes, then according to % constancy. Synusial vegetation assemblages that have between 30% and 50% are shaded grey with no black outline. Boxes with thin lines indicate possible sub-assemblages.

| VEG 1 | |
|---|---|
| | % const. |
| | |
| **T3 Polytrichum commune** | **83** |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **83** |
| | |
| **T3 Dwarf shrubs/hypnoid mosses** | **33** |
| T3 Hypnoid/Polytrichum mosses | 25 |
| | |
| T2 Hypnoid mosses | 25 |
| T2 Hypnoid/Polytrichum mosses | 17 |
| | |
| T1 Hypnoid mosses | 8 |
| T1 Dwarf shrubs/hypnoid mosses | 8 |
| | |
| T3 Hypnoid mosses | 8 |
| | |
| T2 Sphagnum/dwarf shrubs | 17 |
| T2 Molinia/hypnoid moss | 8 |
| T2 Eriophorum vaginatum | 8 |
| | |
| T1 Sphagnum/Eriophorum | 8 |
| T1 Sphagnum/dwarf shrubs | 8 |
| | |
| A1 Sphagnum cuspidatum | 17 |
| | |

| VEG 2 | |
|---|---|
| | **% const.** |
| | |
| **T2 Hypnoid/Polytrichum mosses** | **100** |
| **T2 Dwarf shrubs/hypnoid mosses** | **75** |
| | |
| **T3 Polytrichum commune** | **50** |
| | |
| **T1/A1 Bare peat** | **50** |
| | |
| T2 Hypnoid mosses | 25 |
| T2 Hypnoid moss/Carex panicea | 25 |
| | |
| T1 Hypnoid mosses | 25 |
| | |
| Tk Molinia with some Sphagnum | 25 |
| Tk Molinia caerulea | 25 |
| | |
| T3 Sphagnum capillifolium | 25 |
| T3 Hypnoid mosses | 25 |
| | |
| A2 Bare peat | 25 |
| | |
| T2 Eriophorum vaginatum | 25 |
| | |
| T1/A1 Sphagnum/Molinia | 25 |

| VEG 3 | |
| --- | --- |
| | % const. |
| | |
| **T3 Sphagnum capillifolium** | **100** |
| **T3 Racomitrium** | **75** |
| **T3 Lichens dominant** | **75** |
| | |
| **T2 Sphagnum/Erica tetralix** | **75** |
| | |
| **T1 Sphagnum/Erica tetralix** | **75** |
| **T1 Sphagnum tenellum dominant** | **75** |
| | |
| **T3 Sphagnum/Molinia** | **50** |
| | |
| T2 Sphagnum magellanicum | 25 |
| | |
| A1 Sphagnum/E. angustifolium | 25 |
| A1 Sphagnum cuspidatum | 25 |
| | |
| T2 Sphagnum/dwarf shrubs | 25 |
| T2 Dwarf shrubs/hypnoid mosses | 25 |
| | |
| T1 Dwarf shrubs/hypnoid mosses | 25 |
| | |
| T3 Polytrichum alpestre | 25 |
| | |
| T2 Sphagnum/Eriophorum | 25 |
| T2 Sphagnum/Eriophorum | 25 |
| T2 Racomitrium | 25 |
| T2 Lichens dominant | 25 |
| | |
| T1 Narthecium dominant | 25 |

| VEG 4 | |
|---|---|
| | **% const.** |
| | |
| **T3 Dwarf shrubs/hypnoid mosses** | **78** |
| **T3 Lichens dominant** | **78** |
| **T3 Dwarf shrubs over Sphagnum** | **67** |
| | |
| **T2 Sphagnum/Erica tetralix** | **100** |
| **T2 Sphagnum/dwarf shrubs** | **89** |
| | |
| **T1 Sphagnum/Erica tetralix** | **100** |
| **T1 Sphagnum/Eriophorum** | **78** |
| | |
| **T1/A1 Rhynchospora** | **89** |
| **T1/A1 Sphagnum pulchrum** | **78** |
| | |
| T3 Sphagnum/Eriophorum | 33 |
| T3 Sphagnum capillifolium | 11 |
| T3 Leucobryum | 11 |
| | |
| **T2 Sphagnum/Eriophorum** | **56** |
| **T2 Dwarf shrubs/hypnoid mosses** | **44** |
| T2 Sphagnum papillosum | 22 |
| T2 Lichens dominant | 22 |
| | |
| **T1 Sphagnum/dwarf shrubs** | **44** |
| T1 Sphagnum tenellum dominant | 11 |
| T1 Lichens dominant | 11 |
| | |
| A1 Sphagnum/E. angustifolium | 22 |
| A1 Sphagnum cuspidatum | 22 |
| A1 Sphagnum/Rhynchospora | 11 |
| | |
| Tk Eriophorum vaginatum with some Sphagnum | 22 |
| Tk Eriophorum vaginatum | 22 |
| Tk Trichophorum with some Sphagnum | 11 |

| VEG 5 | |
|---|---|
| | % const. |
| | |
| **T3 Lichens dominant** | **76** |
| **T3 Dwarf shrubs/hypnoid mosses** | **53** |
| | |
| **T2 Sphagnum/Erica tetralix** | **71** |
| | |
| **T1 Sphagnum/Erica tetralix** | **65** |
| **T1 Sphagnum/Eriophorum** | **53** |
| | |
| **T3 Dwarf shrubs over Sphagnum** | **47** |
| **T3 Sphagnum capillifolium** | **41** |
| **T3 Leucobryum** | **24** |
| T3 Sphagnum/Eriophorum | 12 |
| T3 Sphagnum papillosum | 6 |
| T3 Racomitrium (elsewhere) | 6 |
| T3 Hypnoid/Polytrichum mosses | 0 |
| T3 Hypnoid mosses/lichens | 6 |
| | |
| **T2 Sphagnum/Eriophorum** | **41** |
| **T2 Sphagnum/dwarf shrubs** | **35** |
| T2 Lichens dominant | 12 |
| T2 Dwarf shrubs/hypnoid mosses | 24 |
| T2 Sphagnum papillosum | 6 |
| T2 Hypnoid/Polytrichum mosses | 6 |
| | |
| **T1 Sphagnum/dwarf shrubs** | **53** |
| T1 Sphagnum magellanicum | 18 |
| T1 Dwarf shrubs/hypnoid mosses | 6 |
| | |
| T1/A1 Sphagnum tenellum | 24 |
| T1/A1 Narthecium ossifragum | 18 |
| T1/A1 Sphagnum fallax | 12 |
| T1/A1 Rhynchospora | 12 |
| T1/A1 Bare peat | 6 |
| | |
| **A1 Sphagnum cuspidatum** | **47** |
| A1 Sphagnum/E. angustifolium | 24 |
| A1 Terrestrial species invading | 6 |
| A1 Sphagnum fallax | 6 |
| | |
| A2 Bare peat/Eriophorum angustifolium | 6 |
| | |
| **Tk Eriophorum vaginatum with some Sphagnum** | **53** |
| **Tk Molinia caerulea** | **24** |
| **Tk Eriophorum vaginatum** | **24** |
| Tk Trichophorum with some Sphagnum | 24 |
| Tk Molinia with some Sphagnum | 18 |
| Tk Trichophorum cespitosum | 12 |
| | |
| Em Sphagnum-Sphagnum moss | 6 |
| | |
| Em moss-Hynoid mosses | 6 |
| | |
| Em bare-Bare peat | 6 |
| | |

| VEG 6 | |
|---|---|
| | **% const.** |
| | |
| **T2 Sphagnum/Erica tetralix** | 78 |
| **T2 Sphagnum/dwarf shrubs** | 78 |
| | |
| **T1 Sphagnum/Erica tetralix** | 89 |
| | |
| **T1/A1 Rhynchospora** | 100 |
| **T1/A1 Sphagnum tenellum** | 78 |
| | |
| **T3 Sphagnum capillifolium** | 44 |
| **T3 Lichens dominant** | **33** |
| **T3 Dwarf shrubs/hypnoid mosses** | **33** |
| **T3 Dwarf shrubs over Sphagnum** | **33** |
| T3 Racomitrium (elsewhere) | 11 |
| T3 Polytrichum alpestre | 11 |
| T3 Leucobryum | 11 |
| | |
| **T2 Lichens dominant** | **56** |
| T2 Sphagnum papillosum | 22 |
| T2 Sphagnum/Eriophorum | 11 |
| T2 Sphagnum capillifolium | 11 |
| | |
| **T1 Sphagnum/Eriophorum** | **56** |
| **T1 Sphagnum/dwarf shrubs** | **44** |
| T1 Lichens dominant | 22 |
| T1 Sphagnum/Drosera | 11 |
| T1 Sphagnum magellanicum | 11 |
| | |
| **T1/A1 Sphagnum pulchrum** | **44** |
| **T1/A1 Narthecium ossifragum** | **44** |
| | |
| A2 Rhynchospora alba | 11 |
| | |
| Tk Eriophorum vaginatum with some Sphagnum | 11 |

| VEG 7 | |
|---|---|
| | % const. |
| | |
| **T2 Lichens dominant** | 88 |
| **T2 Dwarf shrubs/hypnoid mosses** | 69 |
| | |
| **T1 Sphagnum/Erica tetralix** | 88 |
| **T1 Sphagnum/Eriophorum** | 81 |
| **T1 Sphagnum/dwarf shrubs** | 63 |
| | |
| **T1/A1 Rhynchospora** | 81 |
| **T1/A1 Sphagnum tenellum** | 63 |
| | |
| **Tk Trichophorum cespitosum** | 63 |
| | |
| T3 Leucobryum | 19 |
| T3 Racomitrium (elsewhere) | 13 |
| T3 Lichens dominant | 13 |
| T3 Sphagnum capillifolium | 6 |
| T3 Sphagnum austinii (imbricatum) | 6 |
| T3 Polytrichum commune | 6 |
| T3 Polytrichum alpestre | 6 |
| T3 Hypnoid/Polytrichum mosses | 6 |
| T3 Hypnoid mosses/lichens | 6 |
| | |
| **T2 Sphagnum/Erica tetralix** | 44 |
| **T2 Sphagnum/dwarf shrubs** | 44 |
| T2 Sphagnum papillosum | 13 |
| T2 Sphagnum austinii (imbricatum) | 6 |
| T2 Racomitrium | 6 |
| | |
| T1 Lichens dominant | 56 |
| T1 Sphagnum papillosum | 13 |
| | |
| **T1/A1 Narthecium ossifragum** | 50 |
| T1/A1 Sphagnum pulchrum | 19 |
| T1/A1 Sphagnum fallax | 13 |
| | |
| A1 Sphagnum cuspidatum | 25 |
| A1 Sphagnum/E. angustifolium | 13 |
| A1 Sphagnum/Rhynchospora | 6 |
| | |
| **Tk Eriophorum vaginatum** | 31 |
| Tk Molinia with some Sphagnum | 6 |
| Tk Molinia caerulea | 6 |
| Tk Eriophorum vaginatum with some Sphagnum | 6 |

| VEG 8 | |
|---|---|
| | % const. |
| | |
| **T3 Lichens dominant** | **70** |
| **T3 Sphagnum capillifolium** | **70** |
| | |
| **T2 Lichens dominant** | **80** |
| | |
| **T1 Sphagnum/Erica tetralix** | **90** |
| **T1 Sphagnum/Eriophorum** | **70** |
| | |
| **Tk Eriophorum vaginatum** | **100** |
| **Tk Trichophorum cespitosum** | **90** |
| | |
| **T3 Dwarf shrubs/hypnoid mosses** | **60** |
| **T3 Leucobryum** | **50** |
| **T3 Dwarf shrubs over Sphagnum** | **40** |
| T3 Sphagnum/Eriophorum | 20 |
| T3 Polytrichum alpestre | 20 |
| T3 Racomitrium (elsewhere) | 10 |
| T3 Hypnoid mosses/lichens | 10 |
| | |
| **T2 Sphagnum/Erica tetralix** | **60** |
| **T2 Dwarf shrubs/hypnoid mosses** | **60** |
| T2 Sphagnum/Eriophorum | 10 |
| T2 Sphagnum/dwarf shrubs | 10 |
| T2 Sphagnum papillosum | 10 |
| T2 Sphagnum magellanicum | 10 |
| T2 Racomitrium | 10 |
| | |
| **T1 Lichens dominant** | **40** |
| **T1 Sphagnum/dwarf shrubs** | **30** |
| T1 Sphagnum papillosum | 20 |
| T1 Sphagnum magellanicum | 20 |
| T1 Dwarf shrubs/hypnoid mosses | 20 |
| T1 Racomitrium | 10 |
| | |
| **T1/A1 Sphagnum tenellum** | **50** |
| **T1/A1 Narthecium ossifragum** | **50** |
| **T1/A1 Rhynchospora** | **40** |
| T1/A1 Sphagnum fallax | 10 |
| | |
| **A1 Sphagnum cuspidatum** | **40** |
| A1 Sphagnum fallax | 20 |
| A1 Sphagnum/Rhynchospora | 10 |
| | |
| **Tk Molinia caerulea** | **40** |
| Tk Trichophorum with some Sphagnum | 10 |
| Tk Eriophorum vaginatum with some Sphagnum | 10 |
| | |
| Em moss-Hynoid mosses | 10 |
| | |

| VEG 9 | |
|---|---|
| | % const. |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **75** |
| | |
| **T1 Sphagnum/Erica tetralix** | **100** |
| | |
| **T2 Hypnoid mosses** | **50** |
| T2 Lichens dominant | 25 |
| T2 Juncus maritimus | 25 |
| T2 Eriophorum vaginatum | 25 |
| | |
| **T1 Sphagnum tenellum dominant** | **75** |
| T1 Sphagnum/dwarf shrubs | 25 |
| T1 Sphagnum papillosum | 25 |
| T1 Sphagnum magellanicum | 25 |
| T1 Dwarf shrubs/hypnoid mosses | 25 |
| | |
| **T1/A1 Narthecium ossifragum** | **75** |
| **T1/A1 Rhynchospora** | **50** |
| **T1/A1 Sphagnum tenellum** | **50** |
| T1/A1 Sphagnum pulchrum | 25 |
| | |
| **A1 Sphagnum/E. angustifolium** | **75** |
| **A1 Sphagnum cuspidatum** | **50** |
| **A2 Flooded Molinia litter** | **50** |
| A1 Sphagnum/Rhynchospora | 25 |
| | |

| VEG 10 | |
|---|---|
| | % const. |
| | |
| **T2 Lichens dominant** | **65** |
| **T2 Dwarf shrubs/hypnoid mosses** | **47** |
| | |
| **T1 Sphagnum papillosum** | **59** |
| | |
| **Tk Molinia caerulea** | **76** |
| **Tk Eriophorum vaginatum** | **53** |
| | |
| T3 Leucobryum | 12 |
| T3 Molinia | 6 |
| T3 Lichens dominant | 12 |
| T3 Hypnoid mosses | 12 |
| T3 Sphagnum capillifolium | 12 |
| T3 Polytrichum commune | 12 |
| T3 Dwarf shrubs/hypnoid mosses | 12 |
| | |
| T2 Sphagnum/dwarf shrubs | 18 |
| T2 Sphagnum papillosum | 24 |
| T2 Eriophorum vaginatum | 12 |
| T2 Sphagnum/Erica tetralix | 12 |
| T2 Sphagnum/Eriophorum | 6 |
| T2 Molinia/Erica | 6 |
| T2 Calluna with some Sphagnum | 6 |
| | |
| **T1 Sphagnum/Erica tetralix** | **59** |
| T1 Sphagnum/Eriophorum | 47 |
| T1 Sphagnum tenellum dominant | 6 |
| T1 Lichens dominant | 12 |
| T1 Sphagnum/dwarf shrubs | 6 |
| T1 Sphagnum magellanicum | 6 |
| T1 Dwarf shrubs/hypnoid mosses | 6 |
| | |
| **T1/A1 Sphagnum tenellum** | **53** |
| **T1/A1 Rhynchospora** | **47** |
| **T1/A1 Narthecium ossifragum** | **41** |
| **T1/A1 Sphagnum fallax** | **29** |
| | |
| **A1 Sphagnum/Rhynchospora** | **47** |
| **A1 Sphagnum fallax** | **47** |
| **A1 Sphagnum cuspidatum** | **41** |
| A1 Sphagnum/E. angustifolium | 6 |
| | |
| **Tk Trichophorum cespitosum** | **59** |
| Tk Eriophorum vaginatum with some Sphagnum | 12 |
| | |
| Em bare-Bare peat | 0 |

| VEG 11 | |
|---|---|
| | % const. |
| | |
| **T2 Sphagnum/Erica tetralix** | **76** |
| | |
| **T1 Sphagnum papillosum** | **90** |
| | |
| **A1 Sphagnum cuspidatum** | **90** |
| **A1 Sphagnum fallax** | **71** |
| | |
| **Tk Molinia caerulea** | **86** |
| **Tk Eriophorum vaginatum** | **71** |
| | |
| T3 Dwarf shrubs/hypnoid mosses | 5 |
| | |
| **T2 Calluna with some Sphagnum** | **43** |
| T2 Dwarf shrubs/hypnoid mosses | 29 |
| T2 Sphagnum/dwarf shrubs | 24 |
| T2 Lichens dominant | 5 |
| T2 Dwarf shrubs/no moss | 5 |
| | |
| **T1 Sphagnum tenellum dominant** | **38** |
| T1 Campylopus atrovirens (in W Scotland) | 5 |
| | |
| **T1/A1 Sphagnum tenellum** | **48** |
| T1/A1 Narthecium ossifragum | 19 |
| T1/A1 Sphagnum papillosum | 5 |
| T1/A1 Sphagnum fallax | 5 |
| T1/A1 Rhynchospora | 5 |
| | |
| **A1 Sphagnum/E. angustifolium** | **33** |
| A1 Sphagnum/Rhynchospora | 5 |
| A1 Sphagnum (not Sphagnum fallax) | 5 |
| | |
| A2 wet/flooded bare peat | 5 |
| | |
| A3 Sphagnum cuspidatum | 5 |
| A3 Eriophorum angustifolium | 5 |
| | |
| **Tk Trichophorum cespitosum** | **48** |
| | |

| VEG 12 | |
|---|---|
| | % const. |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **75** |
| **T2 Calluna with some Sphagnum** | **75** |
| | |
| **T1 Sphagnum papillosum** | **75** |
| | |
| **Tk Trichophorum cespitosum** | **75** |
| **Tk Molinia caerulea** | **75** |
| | |
| **T2 Sphagnum/Erica tetralix** | **50** |
| T2 Sphagnum subnitens | 25 |
| T2 Eriophorum vaginatum/no moss | 25 |
| T2 Eriophorum vaginatum | 25 |
| | |
| T1 Sphagnum tenellum dominant | 25 |
| T1 Sphagnum tenellum | 25 |
| | |
| **T1/A1 Sphagnum tenellum** | **50** |
| T1/A1 Sphagnum pulchrum | 25 |
| T1/A1 Rhynchospora | 25 |
| | |
| A1 Sphagnum/Rhynchospora | 25 |
| | |
| A2 Flooded Molinia litter | 25 |
| A2 wet/flooded bare peat | 25 |
| | |
| **A3 Sphagnum cuspidatum** | **50** |
| A3 flooded bare peat | 25 |
| | |
| Tk Eriophorum vaginatum with some Sphagnum | 25 |
| | |

| VEG 13 | |
|---|---|
| | **% const.** |
| | 100 |
| | |
| **Tk Molinia caerulea** | **100** |
| | |
| **T3 Dwarf shrubs/hypnoid mosses** | **60** |
| T3 Sphagnum papillosum | 20 |
| T3 Hypnoid/Polytrichum mosses | 20 |
| T3 Dwarf shrubs over Sphagnum | 10 |
| | |
| **T2 Sphagnum/Erica tetralix** | **60** |
| **T2 Dwarf shrubs/hypnoid mosses** | **40** |
| **T2 Calluna with some Sphagnum** | **40** |
| **T2 Sphagnum/dwarf shrubs** | **30** |
| T2 Sphagnum/Eriophorum | 10 |
| T2 Sphagnum subnitens | 10 |
| T2 Sphagnum papillosum | 10 |
| | |
| T1 Sphagnum tenellum dominant | 20 |
| T1 Sphagnum papillosum | 20 |
| | |
| **T1/A1 Sphagnum fallax** | **60** |
| T1/A1 Narthecium ossifragum | 20 |
| T1/A1 Sphagnum cuspidatum | 10 |
| | |
| **A1 Sphagnum/E. angustifolium** | **60** |
| **A1 Sphagnum cuspidatum** | **30** |
| A1 Sphagnum/Rhynchospora | 10 |
| A1 Sphagnum fallax | 10 |
| | |
| **Tk Eriophorum vaginatum** | **40** |
| | |
| Em moss-Hynoid mosses | 10 |
| | |

| VEG 14 | |
|---|---|
| | **% const.** |
| | |
| **T3 Dwarf shrubs/hypnoid mosses** | **100** |
| | |
| **Tk Molinia caerulea** | **89** |
| **Tk Eriophorum vaginatum** | **67** |
| | |
| **T3 Sphagnum capillifolium** | **44** |
| **T3 Lichens dominant** | **33** |
| **T3 Hypnoid/Polytrichum mosses** | **33** |
| T3 Dwarf shrubs over Sphagnum | 22 |
| T3 Sphagnum/Eriophorum | 11 |
| T3 Polytrichum alpestre | 11 |
| T3 Molinia | 11 |
| T3 Leucobryum | 11 |
| T3 Hypnoid mosses/lichens | 11 |
| | |
| **T2 Sphagnum/Erica tetralix** | **56** |
| **T2 Dwarf shrubs/hypnoid mosses** | **56** |
| **T2 Sphagnum/dwarf shrubs** | **33** |
| T2 Lichens dominant | 22 |
| T2 Calluna with some Sphagnum | 11 |
| | |
| **T1 Sphagnum/dwarf shrubs** | **33** |
| T1 Sphagnum/Erica tetralix | 22 |
| T1 Sphagnum tenellum dominant | 11 |
| T1 Sphagnum papillosum | 11 |
| T1 Sphagnum capillifolium dominant | 11 |
| T1 Hypnoid mosses/Carex panicea | 11 |
| T1 Hypnoid mosses | 11 |
| T1 Eriophorum vaginatum | 11 |
| | |
| T1/A1 Carex panicea | 11 |
| | |
| A1 Sphagnum fallax | 22 |
| A1 Sphagnum cuspidatum | 22 |
| | |
| A2 Limited aquatic Sphagnum presence | 11 |
| | |
| **Tk Molinia with some Sphagnum** | **33** |
| Tk Trichophorum cespitosum | 22 |
| | |
| Em bare-Bare peat | 22 |
| | |

| VEG 15 | |
| --- | --- |
| | **% const.** |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **86** |
| | |
| **T1 Dwarf shrubs/hypnoid mosses** | **86** |
| | |
| T3 Hypnoid mosses | 14 |
| | |
| **T2 Sphagnum/Erica tetralix** | **43** |
| **T2 Lichens dominant** | **29** |
| **T2 Calluna with some Sphagnum** | **29** |
| T2 Sphagnum/dwarf shrubs | 14 |
| T2 Festuca/Campylopus type | 14 |
| | |
| **T1 Sphagnum/dwarf shrubs** | **43** |
| **T1 Sphagnum tenellum dominant** | **43** |
| T1 Festuca/Polytrichum | 14 |
| | |
| A1 Terrestrial species invading | 14 |
| A1 Sphagnum cuspidatum | 14 |
| | |
| **Tk Trichophorum cespitosum** | **43** |
| **Tk Molinia caerulea** | **43** |
| Tk Eriophorum vaginatum | 14 |
| | |
| **Em Sphagnum-Sphagnum moss** | **29** |
| | |
| Em moss-Mixed moss with some Sphagnum | 14 |
| Em moss-Hynoid mosses | 14 |
| | |

| VEG 16 | |
|---|---|
| | % const. |
| | |
| T2 Molinia/hypnoid moss | 67 |
| T2 Lichens dominant | 67 |
| T2 Hypnoid mosses | 67 |
| | |
| Tk Molinia caerulea | 100 |
| | |
| Em bare-Bare peat | 67 |
| | |
| T2 Dwarf shrubs/hypnoid mosses | 33 |
| T2 Calluna with some Sphagnum | 33 |
| T2 Bare peat/Trichophorum | 33 |
| | |
| T1 Bare peat/dwarf shrubs | 33 |
| | |
| Tk Trichophorum with some Sphagnum | 33 |
| Tk Eriophorum vaginatum with some Sphagnum | 33 |
| Tk Eriophorum vaginatum | 33 |
| | |
| Em bare-Trichophorum | 33 |
| | |
| E2 Molinia litter | 33 |
| E2 Bare peat | 33 |
| | |

| VEG 17 | |
|---|---|
| | **% const.** |
| | |
| **T2 Hypnoid mosses** | **75** |
| | |
| **Tk Trichophorum cespitosum** | **100** |
| **Tk Molinia caerulea** | **100** |
| **Tk Eriophorum vaginatum** | **100** |
| | |
| **T2 Eriophorum vaginatum/no moss** | **50** |
| **T2 Dwarf shrubs/hypnoid mosses** | **50** |
| T2 Sphagnum/Erica tetralix | 25 |
| T2 Dwarf shrubs/no moss | 25 |
| T2 Bare peat/Trichophorum | 25 |
| | |
| **Em bare-Bare peat** | **50** |
| Em bare Molinia litter | 25 |
| | |

| VEG 18 | |
|---|---|
| | **% const.** |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **100** |
| **T2 Calluna with some Sphagnum** | **67** |
| | |
| **Tk Molinia caerulea** | **100** |
| **Tk Eriophorum vaginatum** | **67** |
| | |
| **Em moss-Mixed moss with some Sphagnum** | **33** |
| | |

| VEG 19 | |
|---|---|
| | **% const.** |
| | |
| **T3 Dwarf shrubs/hypnoid mosses** | **100** |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **67** |
| | |
| **Tk Molinia caerulea** | **100** |
| **Tk Eriophorum vaginatum** | **67** |
| | |
| **Em moss-Hynoid mosses** | **67** |
| | |

| VEG 20 | |
|---|---|
| | % const. |
| | |
| **Tk Molinia caerulea** | **90** |
| | |
| **Em moss-Hynoid mosses** | **90** |
| | |
| T3 Sphagnum capillifolium | 20 |
| T3 Sphagnum/Molinia | 10 |
| T3 Sphagnum papillosum | 10 |
| T3 Dwarf shrubs over Sphagnum | 10 |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **50** |
| **T2 Calluna with some Sphagnum** | **50** |
| T2 Sphagnum/Erica tetralix | 20 |
| T2 Molinia/Sphagnum | 10 |
| T2 Dwarf shrubs/no moss | 10 |
| | |
| A1 Sphagnum/Phragmites | 10 |
| | |
| **Tk Trichophorum cespitosum** | **40** |
| Tk Molinia with some Sphagnum | 10 |
| Tk Eriophorum vaginatum | 10 |
| | |
| Em Sphagnum-Sphagnum moss | 30 |
| | |
| Em bare-Bare peat | 10 |
| | |

| VEG 21 | |
|---|---|
| | % const. |
| | |
| **Tk Molinia caerulea** | **100** |
| **Tk Eriophorum vaginatum** | **100** |
| | |
| **Em bare-Bare peat** | **100** |
| | |
| **T3 Polytrichum commune** | **50** |
| **T3 Lichens dominant** | **50** |
| T3 Sphagnum capillifolium | 25 |
| T3 Leucobryum | 25 |
| | |
| T1 Sphagnum papillosum | 25 |
| T1 Sphagnum capillifolium dominant | 25 |
| | |
| **A1 Sphagnum cuspidatum** | **50** |
| | |
| Tk Eriophorum vaginatum with some Sphagnum | 25 |
| | |
| Em Sphagnum-Sphagnum moss | 25 |
| | |
| Em moss-Mixed moss sward/no Sphagnum | 25 |
| | |

| VEG 22 | |
|---|---|
| | **% const.** |
| | |
| **Tk Molinia caerulea** | **100** |
| | |
| **Em bare-Bare peat** | **100** |
| | |
| T2 Sphagnum/Erica tetralix | 22 |
| T2 Bare peat/dwarf shrubs | 22 |
| T2 Lichens dominant | 11 |
| | |
| Tk Molinia with some Sphagnum | 11 |
| | |
| Em moss-Hynoid mosses | 22 |
| | |

| VEG 23 | |
|---|---|
| | % const. |
| | |
| **Tk Molinia caerulea** | **100** |
| | |
| **Em Sphagnum-Sphagnum moss** | **67** |
| | |
| **Em bare-Bare peat** | **67** |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **33** |
| | |
| **Em moss-Mixed moss sward/no Sphagnum** | **50** |
| Em moss-Hynoid mosses | 17 |
| | |

| VEG 24 | |
|---|---|
| | % const. |
| | |
| **Tk Molinia caerulea** | **100** |
| | |
| **Em bare Molinia litter** | **100** |
| | |
| Em moss-Mixed moss sward/no Sphagnum | 25 |
| | |
| **Em bare-Bare peat** | **50** |
| | |

| VEG 25 | |
|---|---|
| | % const. |
| | |
| **T3 Leucobryum** | **67** |
| **T3 Dwarf shrubs/hypnoid mosses** | **67** |
| | |
| **Tk Molinia caerulea** | **100** |
| | |
| **Em bare Molinia litter** | **100** |
| | |
| **T3 Hypnoid mosses/dwarf shrubs/Molinia** | **33** |
| | |
| **T2 Dwarf shrubs/hypnoid mosses** | **33** |
| | |
| **Em bare-Bare peat** | **33** |
| | |

| VEG 26 | |
|---|---|
| | % const. |
| | |
| T1 Sphagnum fallax | 67 |
| | |
| T1/A1 Sphagnum fallax | 100 |
| | |
| Tk Molinia caerulea | 100 |
| | |
| T1 Sphagnum/Eriophorum | 33 |
| T1 Sphagnum/Drosera | 33 |
| T1 Eriophorum vaginatum | 33 |
| T1 Dwarf shrubs/no moss | 33 |
| | |
| Tk Eriophorum vaginatum | 33 |
| | |

**Annex 4: Excel spreadsheet of all VEG groups.**

This spreadsheet is held by Natural Resources Wales

**Annex 5: Composition of the 20 synusial species communities**

Species (actually 'pseudospecies') which have greater than 50% constancy within the synusial species community are listed first, shaded grey and surrounded by a thick black box. Within this group, items are ordered firstly according to the vertical zonation of nanotopes, then according to % constancy.

Pseudospecies that have between 30% and 50% are shaded grey with no black outline.

In phytosociological sorting, species with constancies less than 10% are regarded as 'incidentals' and are not used in the sorting process. As the composition of some SYNs includes a long 'tail of pseudospecies with scores of less than 10% , only those at 10% constancy or above are shown in the following table. Full SYN composition can be seen in the Excel spreadsheets provided in Annex 6.

| SYN 1 | |
|---|---|
| | % const. |
| **T2-Juncus squarrosus** | **100** |
| **T2-Aulacomnium palustre** | **100** |
| **T2-Festuca ovina** | **100** |
| **T2-Hypnum jutlandicum** | **100** |
| **T2-Polytrichum commune** | **100** |
| **T2-Nardus stricta** | **100** |
| **T2-Molinia caerulea** | **100** |
| | |
| **T1-Festuca ovina** | **100** |
| **T1-Nardus stricta** | **100** |
| **T1-Pleurozium schreberi** | **100** |
| **T1-Anthoxanthum odoratum** | **100** |
| **T1-Potentilla erecta** | **100** |
| | |
| T2-Juncus effusus | 50 |
| T2-Sphagnum capillifolium | 50 |
| T2-Rhynchospora alba | 50 |
| T2-Pleurozium schreberi | 50 |
| T2-Dicranum scoparium | 50 |
| T2-Vaccinium myrtillus | 50 |
| T2-Hylocomium splendens | 50 |
| T2-Rhytidiadelphus squarrosus | 50 |
| T2-Galium saxatile | 50 |
| T2-Calluna vulgaris | 50 |
| | |
| T1-Rhytidiadelphus squarrosus | 50 |
| T1-Agrostis canina | 50 |
| T1-Hypnum jutlandicum | 50 |
| T1-Galium saxatile | 50 |
| T1-Agrostis capillaris | 50 |
| T1-Sphagnum subnitens | 50 |
| T1-Molinia caerulea | 50 |
| T1-Luzula campestris | 50 |
| T1-Juncus effusus | 50 |
| T1-Calliergon stramineum | 50 |
| T1-Calliergon cuspidata | 50 |
| T1-Hylocomium splendens | 50 |
| T1-Carex panicea | 50 |
| T1-Anagallis tenella | 50 |
| | |
| T1/A1-Calliergon cuspidata | 50 |
| T1/A1-Nardus stricta | 50 |
| T1/A1-Carex panicea | 50 |
| T1/A1-Carex demissa | 50 |
| T1/A1-Juncus effusus | 50 |
| T1/A1-Festuca ovina | 50 |

| SYN 2 | |
| --- | --- |
| | % const. |
| **T3-Pleurozium schreberi** | **100** |
| **T3-Festuca ovina** | **100** |
| **T3-Galium saxatile** | **100** |
| **T3-Polytrichum commune** | **80** |
| **T3-Vaccinium myrtillus** | **80** |
| **T3-Hypnum jutlandicum** | **80** |
| | |
| **T2-Festuca ovina** | **100** |
| **T2-Pleurozium schreberi** | **100** |
| **T2-Juncus squarrosus** | **100** |
| **T2-Potentilla erecta** | **100** |
| **T2-Vaccinium myrtillus** | **80** |
| **T2-Rhytidiadelphus squarrosus** | **80** |
| **T2-Galium saxatile** | **80** |
| **T2-Anthoxanthum odoratum** | **80** |
| **T2-Agrostis capillaris** | **80** |
| **T2-Dicranum scoparium** | **80** |
| | |
| **T3-Juncus squarrosus** | **60** |
| **T3-Rhytidiadelphus squarrosus** | **60** |
| **T3-Luzula campestris** | **60** |
| **T3-Dicranum scoparium** | **60** |
| T3-Molinia caerulea | 40 |
| T3-Aulacomnium palustre | 40 |
| T3-Polytrichum alpestre | 40 |
| T3-Calluna vulgaris | 40 |
| T3-Rumex acetosella | 20 |
| T3-Hylocomium splendens | 40 |
| T3-Campylopus flexuosus | 20 |
| T3-Agrostis capillaris | 20 |
| T3-Potentilla erecta | 20 |
| T3-Erica tetralix | 20 |
| T3-Cladonia furcata | 20 |
| T3-Thuidium tamariscinum | 20 |
| T3-Cladonia portentosa | 20 |
| | |
| **T2-Aulacomnium palustre** | **60** |
| **T2-Molinia caerulea** | **60** |
| **T2-Carex caryophyllea** | **60** |
| **T2-Luzula campestris** | **60** |
| T2-Hypnum jutlandicum | 40 |
| T2-Polytrichum commune | 40 |
| T2-Polytrichum alpestre | 40 |
| T2-Calluna vulgaris | 40 |
| T2-Nardus stricta | 20 |
| T2-Juncus effusus | 20 |
| T2-Trichophorum cespitosum | 20 |
| T2-Sphagnum capillifolium | 20 |
| T2-Erica tetralix | 20 |
| T2-Campylopus flexuosus | 20 |
| T2-Cladonia portentosa | 20 |
| T2-Cerastium fontanum | 20 |
| | |
| T1-Rhytidiadelphus squarrosus | 20 |
| T1-Galium saxatile | 20 |
| T1-Festuca ovina | 20 |
| T1-Dicranum scoparium | 20 |
| T1-Aulacomnium palustre | 20 |
| T1-Anthoxanthum odoratum | 20 |
| T1-Agrostis capillaris | 20 |
| T1-Vaccinium myrtillus | 20 |
| T1-Poa annua | 20 |
| T1-Nardus stricta | 20 |
| T1-Trichophorum cespitosum | 20 |
| T1-Cerastium fontanum | 20 |

| SYN 3 | |
|---|---|
| | **% const.** |
| **T3-Molinia caerulea** | **100** |
| **T3-Polytrichum commune** | **86** |
| **T3-Vaccinium myrtillus** | **86** |
| **T3-Pleurozium schreberi** | **71** |
| | |
| **T2-Aulacomnium palustre** | **100** |
| **T2-Vaccinium myrtillus** | **100** |
| **T2-Molinia caerulea** | **100** |
| **T2-Festuca ovina** | **100** |
| **T2-Pleurozium schreberi** | **71** |
| **T2-Eriophorum vaginatum** | **71** |
| **T2-Dicranum scoparium** | **71** |
| **T2-Cladonia portentosa** | **71** |
| | |
| **T3-Polytrichum alpestre** | **57** |
| **T3-Juncus squarrosus** | **57** |
| **T3-Rhytidiadelphus squarrosus** | **57** |
| T3-Aulacomnium palustre | 43 |
| T3-Hypnum jutlandicum | 43 |
| T3-Festuca ovina | 43 |
| T3-Cladonia portentosa | 43 |
| T3-Dicranum scoparium | 43 |
| T3-Galium saxatile | 29 |
| T3-Luzula campestris | 14 |
| T3-Eriophorum vaginatum | 14 |
| T3-Potentilla erecta | 14 |
| T3-Erica tetralix | 14 |
| T3-Campylopus flexuosus | 14 |
| T3-Calluna vulgaris | 14 |
| | |
| **T2-Polytrichum alpestre** | **57** |
| **T2-Rhytidiadelphus squarrosus** | **57** |
| **T2-Sphagnum capillifolium** | **57** |
| **T2-Juncus squarrosus** | **57** |
| T2-Erica tetralix | 43 |
| T2-Calluna vulgaris | 43 |
| T2-Cladonia furcata | 43 |
| T2-Polytrichum commune | 29 |
| T2-Hypnum jutlandicum | 29 |
| T2-Galium saxatile | 29 |
| T2-Trichophorum cespitosum | 29 |
| T2-Sphagnum cuspidatum | 29 |
| T2-Campylopus introflexus | 29 |
| T2-Luzula campestris | 14 |
| T2-Hylocomium splendens | 14 |
| T2-Sphagnum subnitens | 14 |
| T2-Carex caryophyllea | 14 |
| T2-Nardus stricta | 14 |
| | |
| T1-Polytrichum commune | 14 |
| T1-Sphagnum cuspidatum | 14 |
| T1-Molinia caerulea | 14 |
| T1-Sphagnum capillifolium | 14 |
| | |
| T1/A1-Sphagnum cuspidatum | 29 |
| T1/A1-Molinia caerulea | 29 |
| T1/A1-Polytrichum commune | 14 |
| T1/A1-Eriophorum vaginatum | 14 |
| T1/A1-Trichophorum cespitosum | 14 |
| | |
| A1-Sphagnum cuspidatum | 14 |
| A1-Trichophorum cespitosum | 14 |
| A1-Juncus effusus | 14 |
| A1-Eriophorum vaginatum | 14 |

| SYN 4 | |
|---|---|
| | % const. |
| **T3-Polytrichum commune** | **67** |
| **T3-Molinia caerulea** | **67** |
| **T3-Vaccinium myrtillus** | **67** |
| **T3-Festuca ovina** | **67** |
| | |
| **T2-Aulacomnium palustre** | **100** |
| **T2-Vaccinium myrtillus** | **100** |
| **T2-Trichophorum cespitosum** | **100** |
| **T2-Sphagnum capillifolium** | **100** |
| **T2-Pleurozium schreberi** | **100** |
| **T2-Dicranum scoparium** | **100** |
| **T2-Polytrichum alpestre** | **100** |
| **T2-Molinia caerulea** | **100** |
| **T2-Calluna vulgaris** | **100** |
| **T2-Festuca ovina** | **100** |
| **T2-Cladonia portentosa** | **100** |
| **T2-Juncus squarrosus** | **100** |
| **T2-Campylopus flexuosus** | **67** |
| **T2-Polytrichum commune** | **67** |
| **T2-Hypnum jutlandicum** | **67** |
| **T2-Eriophorum vaginatum** | **67** |
| **T2-Potentilla erecta** | **67** |
| **T2-Luzula multiflora** | **67** |
| **T2-Carex caryophyllea** | **67** |
| **T2-Rhytidiadelphus squarrosus** | **67** |
| | |
| **T1-Sphagnum cuspidatum** | **100** |
| **T1-Molinia caerulea** | **100** |
| **T1-Aulacomnium palustre** | **100** |
| **T1-Trichophorum cespitosum** | **67** |
| **T1-Campylopus flexuosus** | **67** |
| **T1-Polytrichum commune** | **67** |
| **T1-Eriophorum vaginatum** | **67** |
| **T1-Vaccinium myrtillus** | **67** |
| | |
| **A1-Sphagnum cuspidatum** | **67** |
| | |
| T3-Aulacomnium palustre | 33 |
| T3-Sphagnum capillifolium | 33 |
| T3-Eriophorum vaginatum | 33 |
| T3-Pleurozium schreberi | 33 |
| T3-Hypnum jutlandicum | 33 |
| T3-Galium saxatile | 33 |
| | |
| T2-Festuca rubra | 33 |
| T2-Cladonia coccifera | 33 |
| T2-Sphagnum cuspidatum | 33 |
| T2-Cladonia furcata | 33 |
| T2-Erica tetralix | 33 |
| | |
| T1-Polytrichum alpestre | 33 |
| T1-Cladonia uncialis | 33 |
| | |
| A1-Molinia caerulea | 33 |

| SYN 5 | |
|---|---|
| | % const. |
| **T2-Dicranum scoparium** | **100** |
| **T2-Festuca ovina** | **100** |
| **T2-Pleurozium schreberi** | **100** |
| **T2-Vaccinium myrtillus** | **100** |
| **T2-Hypnum jutlandicum** | **100** |
| **T2-Cladonia portentosa** | **100** |
| **T2-Carex caryophyllea** | **100** |
| **T2-Galium saxatile** | **100** |
| **T2-Juncus squarrosus** | **100** |
| **T2-Polytrichum commune** | **100** |
| **T2-Trichophorum cespitosum** | **100** |
| **T2-Calluna vulgaris** | **67** |
| **T2-Rhytidiadelphus squarrosus** | **67** |
| **T2-Campylopus flexuosus** | **67** |
| **T2-Molinia caerulea** | **67** |
| **T2-Nardus stricta** | **67** |
| **T2-Potentilla erecta** | **67** |
| | |
| T2-Luzula campestris | 33 |
| T2-Sphagnum capillifolium | 33 |
| T2-Agrostis capillaris | 33 |
| T2-Aulacomnium palustre | 33 |
| T2-Campylopus introflexus | 33 |
| T2-Luzula multiflora | 33 |
| T2-Polytrichum alpestre | 33 |
| T2-Erica tetralix | 33 |
| T2-Cladonia unicialis | 33 |
| T2-Rumex acetosella | 33 |
| | |
| T1-Calluna vulgaris | 33 |
| T1-Carex caryophyllea | 33 |
| T1-Dicranum scoparium | 33 |
| T1-Festuca ovina | 33 |
| T1-Pleurozium schreberi | 33 |
| T1-Rhytidiadelphus squarrosus | 33 |
| T1-Vaccinium myrtillus | 33 |
| T1-Hypnum jutlandicum | 33 |
| T1-Aulacomnium palustre | 33 |
| T1-Campylopus introflexus | 33 |
| T1-Trichophorum cespitosum | 33 |

| SYN 6 | |
|---|---|
| | % const. |
| **T3-Molinia caerulea** | **89** |
| **T3-Erica tetralix** | **74** |
| **T3-Hypnum jutlandicum** | **70** |
| | |
| **T2-Erica tetralix** | **74** |
| **T2-Molinia caerulea** | **67** |
| | |
| **Tk-Molinia caerulea** | **93** |
| | |
| **T3-Cladonia portentosa** | **59** |
| **T3-Calluna vulgaris** | **48** |
| **T3-Eriophorum vaginatum** | **37** |
| **T3-Sphagnum capillifolium** | **30** |
| **T3-Eriophorum angustifolium** | **30** |
| T3-Vaccinium myrtillus | 22 |
| T3-Pleurozium schreberi | 22 |
| T3-Vaccinium oxycoccos | 15 |
| T3-Polytrichum strictum | 15 |
| T3-Leucobryum glaucum | 11 |
| T3-Trichophorum cespitosum | 11 |
| T3-Sphagnum papillosum | 11 |
| T3-Andromeda polifolia | 11 |
| T3-Polytrichum alpestre | 11 |
| | |
| **T2-Calluna vulgaris** | **56** |
| **T2-Hypnum jutlandicum** | **52** |
| **T2-Cladonia portentosa** | **52** |
| **T2-Eriophorum vaginatum** | **48** |
| **T2-Sphagnum papillosum** | **44** |
| **T2-Eriophorum angustifolium** | **41** |
| **T2-Sphagnum capillifolium** | **37** |
| **T2-Narthecium ossifragum** | **30** |
| T2-Sphagnum tenellum | 22 |
| T2-Sphagnum fallax | 22 |
| T2-Sphagnum subnitens | 19 |
| T2-Aulacomnium palustre | 15 |
| T2-Vaccinium oxycoccos | 15 |
| T2-Trichophorum cespitosum | 15 |
| T2-Pleurozium schreberi | 15 |
| T2-Andromeda polifolia | 15 |
| T2-Vaccinium myrtillus | 11 |
| T2-Betula pubescens | 11 |
| | |
| T1-Sphagnum fallax | 19 |
| T1-Erica tetralix | 19 |
| T1-Eriophorum angustifolium | 15 |
| T1-Molinia caerulea | 15 |
| | |
| T1/A1-Sphagnum fallax | 22 |
| T1/A1-Erica tetralix | 15 |
| T1/A1-Eriophorum angustifolium | 15 |
| T1/A1-Drosera rotundifolia | 11 |
| | |
| A1-Sphagnum cuspidatum | 15 |
| | |
| **Tk-Eriophorum vaginatum** | **56** |
| **Tk-Trichophorum cespitosum** | **26** |
| Tk-Erica tetralix | 11 |
| Tk-Sphagnum tenellum | 11 |
| Tk-Sphagnum fallax | 11 |
| Tk-Eriophorum angustifolium | 11 |
| | |
| Em-Sphagnum-Sphagnum papillosum | 11 |
| | |
| Em-moss-Hypnum jutlandicum | 22 |
| Em-moss-Molinia caerulea | 11 |
| | |
| **Em-bare-Molinia litter** | **26** |
| Em-bare-Bare peat only | 19 |

| SYN 7 | |
|---|---|
| | **% const.** |
| **T2-Erica tetralix** | **100** |
| **T2-Hypnum jutlandicum** | **100** |
| **T2-Molinia caerulea** | **81** |
| **T2-Calluna vulgaris** | **81** |
| **T2-Eriophorum vaginatum** | **75** |
| | |
| **Tk-Molinia caerulea** | **100** |
| | |
| | |
| **T2-Cladonia portentosa** | **56** |
| **T2-Trichophorum cespitosum** | **50** |
| **T2-Eriophorum angustifolium** | **50** |
| **T2-Sphagnum tenellum** | **38** |
| **T2-Vaccinium myrtillus** | **38** |
| T2-Sphagnum fallax | 25 |
| T2-Sphagnum capillifolium | 19 |
| T2-Potentilla erecta | 19 |
| T2-Aulacomnium palustre | 13 |
| T2-Sphagnum subnitens | 13 |
| T2-Dicranum scoparium | 13 |
| T2-Andromeda polifolia | 13 |
| T2-Osmunda regalis | 19 |
| T2-Dryopteris dilatata | 19 |
| | |
| T1-Erica tetralix | 19 |
| T1-Cladonia portentosa | 13 |
| T1-Eriophorum angustifolium | 13 |
| T1-Eriophorum vaginatum | 13 |
| | |
| **Tk-Eriophorum vaginatum** | **56** |
| **Tk-Trichophorum cespitosum** | **50** |
| Tk-Tricophorum germinacum | 13 |
| Tk-Erica tetralix | 19 |
| Tk-Calluna vulgaris | 19 |
| Tk-Hypnum jutlandicum | 19 |
| Tk-Vaccinium myrtillus | 19 |
| | |
| Em-moss-Hypnum jutlandicum | 19 |
| | |
| **Em-bare-Bare peat only** | **44** |
| **Em-bare-Molinia litter** | **31** |
| Em-bare-Trichophorum cespitosum | 19 |
| Em-bare-Molinia caerulea | 13 |
| Em-bare-Hypnum jutlandicum | 13 |

| SYN 8 | % const. |
|---|---|
| **T2-Erica tetralix** | **94** |
| **T2-Cladonia portentosa** | **89** |
| **T2-Eriophorum vaginatum** | **83** |
| **T2-Molinia caerulea** | **78** |
| **T2-Hypnum jutlandicum** | **78** |
| **T2-Andromeda polifolia** | **78** |
| **T2-Calluna vulgaris** | **72** |
| **T1-Sphagnum papillosum** | **83** |
| **T1-Eriophorum vaginatum** | **83** |
| **T1-Erica tetralix** | **78** |
| **T1-Andromeda polifolia** | **78** |
| **T1-Sphagnum tenellum** | **78** |
| **T1-Molinia caerulea** | **67** |
| **T1-Eriophorum angustifolium** | **67** |
| **T1-Narthecium ossifragum** | **61** |
| **A1-Sphagnum cuspidatum** | **72** |
| **A1-Rhynchospora alba** | **72** |
| **A1-Sphagnum fallax** | **61** |
| **Tk-Molinia caerulea** | **94** |
| **T2-Trichophorum cespitosum** | **50** |
| **T2-Eriophorum angustifolium** | **39** |
| **T2-Sphagnum papillosum** | **33** |
| **T2-Cladonia unicialis** | **33** |
| T2-Sphagnum capillifolium | 22 |
| T2-Sphagnum tenellum | 17 |
| T2-Vaccinium myrtillus | 17 |
| T2-Leucobryum glaucum | 17 |
| T2-Sphagnum subnitens | 17 |
| **T1-Cladonia portentosa** | **50** |
| **T1-Rhynchospora alba** | **44** |
| **T1-Hypnum jutlandicum** | **28** |
| **T1-Drosera rotundifolia** | **28** |
| **T1-Calluna vulgaris** | **28** |
| T1-Trichophorum cespitosum | 22 |
| T1-Sphagnum capillifolium | 22 |
| T1-Vaccinium oxycoccos | 17 |
| T1-Sphagnum subnitens | 22 |
| T1-Sphagnum medium | 11 |
| T1-Sphagnum fallax | 11 |
| T1/A1-Sphagnum fallax | 11 |
| **A1-Erica tetralix** | **39** |
| **A1-Eriophorum angustifolium** | **33** |
| A1-Andromeda polifolia | 22 |
| A1-Drosera rotundifolia | 17 |
| A1-Molinia caerulea | 17 |
| A1-Eriophorum vaginatum | 11 |
| A1-Sphagnum tenellum | 11 |
| **Tk-Eriophorum vaginatum** | **56** |
| **Tk-Trichophorum cespitosum** | **39** |
| Em-Sphagnum-Sphagnum tenellum | 11 |
| Em-moss-Hypnum jutlandicum | 11 |

| SYN 9 | |
|---|---|
| | % const |
| **T2-Erica tetralix** | **100** |
| **T2-Cladonia portentosa** | **100** |
| **T2-Hypnum jutlandicum** | **80** |
| **T2-Eriophorum vaginatum** | **80** |
| **T2-Calluna vulgaris** | **80** |
| **T2-Trichophorum cespitosum** | **80** |
| **T2-Sphagnum papillosum** | **80** |
| **T2-Eriophorum angustifolium** | **80** |
| | |
| **T1-Sphagnum papillosum** | **80** |
| **T1-Molinia caerulea** | **80** |
| | |
| **T1/A1-Sphagnum tenellum** | **80** |
| **T1/A1-Erica tetralix** | **80** |
| **T1/A1-Eriophorum angustifolium** | **80** |
| | |
| **A1-Sphagnum cuspidatum** | **100** |
| **A1-Rhynchospora alba** | **80** |
| **A1-Sphagnum fallax** | **80** |
| | |
| **Tk-Molinia caerulea** | **100** |
| **Tk-Eriophorum vaginatum** | **80** |

| | |
|---|---|
| **T2-Molinia caerulea** | **60** |
| **T2-Andromeda polifolia** | **60** |
| **T2-Vaccinium oxycoccos** | **60** |
| T2-Leucobryum glaucum | 40 |
| T2-Polygala serpyllifolia | 20 |
| T2-Pleurozium schreberi | 20 |
| T2-Cladonia unicialis | 20 |
| T2-Sphagnum subnitens | 20 |
| T2-Sphagnum fallax | 20 |
| T2-Aulacomnium palustre | 20 |
| | |
| **T1-Vaccinium oxycoccos** | **60** |
| **T1-Erica tetralix** | **60** |
| **T1-Cladonia portentosa** | **60** |
| **T1-Andromeda polifolia** | **60** |
| T1-Hypnum jutlandicum | 40 |
| T1-Eriophorum vaginatum | 40 |
| T1-Drosera rotundifolia | 40 |
| T1-Sphagnum capillifolium | 40 |
| T1-Trichophorum cespitosum | 20 |
| T1-Narthecium ossifragum | 20 |
| T1-Eriophorum angustifolium | 20 |
| T1-Calluna vulgaris | 20 |
| T1-Sphagnum fallax | 20 |
| T1-Sphagnum subnitens | 20 |
| T1-Empetrum nigrum | 20 |
| T1-Dicranum scoparium | 20 |
| | |
| **T1/A1-Eriophorum vaginatum** | **60** |
| **T1/A1-Molinia caerulea** | **60** |
| **T1/A1-Rhynchospora alba** | **60** |
| T1/A1-Sphagnum papillosum | 40 |
| T1/A1-Sphagnum fallax | 40 |
| T1/A1-Narthecium ossifragum | 40 |
| T1/A1-Drosera rotundifolia | 40 |
| T1/A1-Vaccinium oxycoccos | 20 |
| T1/A1-Sphagnum cuspidatum | 20 |
| T1/A1-Hypnum jutlandicum | 20 |
| T1/A1-Andromeda polifolia | 20 |
| T1/A1-Sphagnum pulchrum | 20 |
| | |
| A1-Erica tetralix | 40 |
| A1-Eriophorum angustifolium | 40 |
| A1-Andromeda polifolia | 20 |
| A1-Sphagnum tenellum | 20 |
| A1-Eriophorum vaginatum | 20 |
| A1-Drosera rotundifolia | 20 |
| A1-Sphagnum recurvum | 20 |
| | |
| A2-Eriohporum angustifolium | 20 |
| A2-Rhynchospora alba | 20 |
| A2-Drosera intermedia | 20 |
| | |
| **Tk-Trichophorum cespitosum** | **60** |
| | |
| Em-Sphagnum-Molinia caerulea | 20 |
| Em-Sphagnum-Eriophorum vaginatum | 20 |
| Em-Sphagnum-Erica tetralix | 20 |
| Em-Sphagnum-Calluna vulgaris | 20 |
| Em-Sphagnum-Andromeda polifolia | 20 |
| Em-Sphagnum-Sphagnum papillosum | 20 |

| SYN 10 | |
|---|---|
| | % cons |
| **T2-Cladonia portentosa** | **100** |
| **T2-Eriophorum vaginatum** | **100** |
| **T2-Erica tetralix** | **100** |
| **T2-Andromeda polifolia** | **100** |
| **T2-Calluna vulgaris** | **88** |
| **T2-Hypnum jutlandicum** | **88** |
| **T2-Trichophorum cespitosum** | **71** |
| **T2-Eriophorum angustifolium** | **71** |
| | |
| **T1-Erica tetralix** | **100** |
| **T1-Andromeda polifolia** | **100** |
| **T1-Sphagnum papillosum** | **88** |
| **T1-Eriophorum vaginatum** | **88** |
| **T1-Cladonia portentosa** | **88** |
| **T1-Eriophorum angustifolium** | **76** |
| **T1-Trichophorum cespitosum** | **65** |
| **T1-Rhynchospora alba** | **65** |
| | |
| **T1/A1-Sphagnum tenellum** | **100** |
| **T1/A1-Rhynchospora alba** | **100** |
| **T1/A1-Andromeda polifolia** | **82** |
| **T1/A1-Erica tetralix** | **76** |
| **T1/A1-Narthecium ossifragum** | **65** |
| | |
| **A1-Sphagnum cuspidatum** | **82** |
| **A1-Rhynchospora alba** | **65** |
| | |
| **Tk-Trichophorum cespitosum** | **71** |
| **Tk-Molinia caerulea** | **65** |
| **Tk-Eriophorum vaginatum** | **65** |

| | |
|---|---|
| **T2-Molinia caerulea** | **59** |
| **T2-Sphagnum papillosum** | **29** |
| T2-Sphagnum capillifolium | 24 |
| T2-Sphagnum subnitens | 24 |
| T2-Vaccinium myrtillus | 18 |
| T2-Pleurozium schreberi | 12 |
| T2-Narthecium ossifragum | 18 |
| T2-Leucobryum glaucum | 18 |
| T2-Cladonia unicialis | 12 |
| | |
| **T1-Calluna vulgaris** | **47** |
| **T1-Molinia caerulea** | **29** |
| **T1-Sphagnum tenellum** | **29** |
| **T1-Hypnum jutlandicum** | **29** |
| **T1-Narthecium ossifragum** | **29** |
| T1-Sphagnum capillifolium | 18 |
| T1-Sphagnum medium | 18 |
| T1-Cladonia ciliata | 18 |
| T1-Sphagnum subnitens | 12 |
| T1-Racomitrium lanuginosum | 12 |
| T1-Cladonia uncialis | 12 |
| | |
| **T1/A1-Eriophorum angustifolium** | **59** |
| **T1/A1-Eriophorum vaginatum** | **53** |
| **T1/A1-Sphagnum papillosum** | **47** |
| **T1/A1-Sphagnum fallax** | **35** |
| **T1/A1-Cladonia uncialis** | **35** |
| T1/A1-Cladonia portentosa | 24 |
| T1/A1-Trichophorum cespitosum | 18 |
| T1/A1-Sphagnum cuspidatum | 12 |
| T1/A1-Vaccinium oxycoccos | 18 |
| T1/A1-Calluna vulgaris | 12 |
| T1/A1-Drosera rotundifolia | 12 |
| T1/A1-Hypnum jutlandicum | 12 |
| | |
| **A1-Eriophorum angustifolium** | **41** |
| **A1-Sphagnum fallax** | **35** |
| **A1-Andromeda polifolia** | **35** |
| **A1-Eriophorum vaginatum** | **29** |
| **A1-Erica tetralix** | **29** |
| A1-Drosera rotundifolia | 12 |

| SYN 11 | % const. |
|---|---|
| **T3-Molinia caerulea** | **83** |
| **T3-Eriophorum vaginatum** | **78** |
| **T3-Cladonia portentosa** | **72** |
| **T3-Hypnum jutlandicum** | **67** |
| **T3-Erica tetralix** | **61** |
| | |
| **T2-Erica tetralix** | **83** |
| **T2-Eriophorum vaginatum** | **78** |
| **T2-Cladonia portentosa** | **78** |
| **T2-Molinia caerulea** | **72** |
| **T2-Sphagnum capillifolium** | **72** |
| **T2-Hypnum jutlandicum** | **61** |
| **T2-Trichophorum cespitosum** | **61** |
| **T2-Sphagnum papillosum** | **61** |
| | |
| **T1-Sphagnum papillosum** | **100** |
| **T1-Erica tetralix** | **100** |
| **T1-Eriophorum vaginatum** | **94** |
| **T1-Eriophorum angustifolium** | **83** |
| **T1-Molinia caerulea** | **78** |
| **T1-Sphagnum tenellum** | **67** |
| **T1-Narthecium ossifragum** | **67** |

| | |
|---|---|
| **T3-Sphagnum capillifolium** | **56** |
| **T3-Trichophorum cespitosum** | **56** |
| **T3-Leucobryum glaucum** | **50** |
| **T3-Calluna vulgaris** | **39** |
| **T3-Racomitrium lanuginosum** | **28** |
| **T3-Eriophorum angustifolium** | **28** |
| **T3-Andromeda polifolia** | **28** |
| **T3-Narthecium ossifragum** | **28** |
| T3-Sphagnum papillosum | 11 |
| T3-Polytrichum alpestre | 11 |
| T3-Vaccinium myrtillus | 11 |
| T3-Dicranum scoparium | 11 |
| | |
| **T2-Narthecium ossifragum** | **56** |
| **T2-Eriophorum angustifolium** | **44** |
| **T2-Calluna vulgaris** | **39** |
| **T2-Andromeda polifolia** | **28** |
| T2-Racomitrium lanuginosum | 22 |
| T2-Polygala serpyllifolia | 17 |
| T2-Sphagnum tenellum | 11 |
| T2-Sphagnum subnitens | 11 |
| T2-Myrica gale | 11 |
| T2-Leucobryum glaucum | 11 |
| T2-Cladonia unicialis | 11 |
| | |
| **T1-Trichophorum cespitosum** | **44** |
| **T1-Sphagnum capillifolium** | **39** |
| **T1-Andromeda polifolia** | **33** |
| **T1-Hypnum jutlandicum** | **33** |
| **T1-Sphagnum medium** | **33** |
| **T1-Cladonia portentosa** | **33** |
| **T1-Rhynchospora alba** | **28** |
| T1-Calluna vulgaris | 22 |
| T1-Racomitrium lanuginosum | 11 |
| T1-Myrica gale | 11 |
| T1-Sphagnum fallax | 11 |
| T1-Campylopus flexuosus | 11 |
| | |
| T1/A1-Narthecium ossifragum | 11 |
| T1/A1-Rhynchospora alba | 11 |
| T1/A1-Eriophorum vaginatum | 11 |
| | |
| **A1-Sphagnum cuspidatum** | **39** |
| A1-Erica tetralix | 22 |
| A1-Eriophorum angustifolium | 17 |
| A1-Sphagnum fallax | 17 |
| A1-Rhynchospora alba | 11 |
| A1-Sphagnum tenellum | 11 |
| | |
| **Tk-Molinia caerulea** | **50** |
| **Tk-Eriophorum vaginatum** | **44** |
| Tk-Trichophorum cespitosum | 22 |
| | |
| Em-bare-Bare peat only | 11 |

| SYN 12 | % const |
|---|---|
| **T3-Cladonia portentosa** | **88** |
| **T3-Eriophorum vaginatum** | **88** |
| **T3-Erica tetralix** | **82** |
| **T3-Calluna vulgaris** | **79** |
| **T3-Andromeda polifolia** | **74** |
| **T3-Hypnum jutlandicum** | **62** |
| | |
| **T2-Eriophorum vaginatum** | **100** |
| **T2-Cladonia portentosa** | **97** |
| **T2-Erica tetralix** | **88** |
| **T2-Andromeda polifolia** | **82** |
| **T2-Calluna vulgaris** | **76** |
| **T2-Hypnum jutlandicum** | **74** |
| **T2-Trichophorum cespitosum** | **71** |
| **T2-Sphagnum capillifolium** | **68** |
| **T2-Sphagnum papillosum** | **68** |
| | |
| **T1-Erica tetralix** | **97** |
| **T1-Sphagnum papillosum** | **94** |
| **T1-Eriophorum vaginatum** | **94** |
| **T1-Andromeda polifolia** | **88** |
| **T1-Cladonia portentosa** | **79** |
| **T1-Eriophorum angustifolium** | **62** |
| **T1-Sphagnum capillifolium** | **62** |
| | |
| **T1/A1-Sphagnum tenellum** | **79** |
| **T1/A1-Erica tetralix** | **76** |
| **T1/A1-Rhynchospora alba** | **62** |
| **T1/A1-Andromeda polifolia** | **62** |
| | |
| **Tk-Trichophorum cespitosum** | **68** |
| **Tk-Eriophorum vaginatum** | **68** |

| | |
|---|---|
| **T3-Sphagnum capillifolium** | **56** |
| **T3-Pleurozium schreberi** | **44** |
| **T3-Vaccinium oxycoccos** | **41** |
| **T3-Leucobryum glaucum** | **38** |
| **T3-Empetrum nigrum** | **38** |
| **T3-Trichophorum cespitosum** | **35** |
| **T3-Vaccinium myrtillus** | **35** |
| **T3-Polytrichum alpestre** | **32** |
| **T3-Eriophorum angustifolium** | **29** |
| T3-Molinia caerulea | 21 |
| T3-Dicranum scoparium | 12 |
| | |
| **T2-Eriophorum angustifolium** | **56** |
| **T2-Empetrum nigrum** | **47** |
| **T2-Pleurozium schreberi** | **38** |
| **T2-Molinia caerulea** | **35** |
| **T2-Vaccinium oxycoccos** | **32** |
| **T2-Vaccinium myrtillus** | **26** |
| T2-Racomitrium lanuginosum | 15 |
| T2-Sphagnum subnitens | 18 |
| T2-Narthecium ossifragum | 21 |
| T2-Odontoschisma sphagni | 12 |
| T2-Dicranum scoparium | 15 |
| T2-Leucobryum glaucum | 12 |
| T2-Cladonia ciliata | 12 |
| | |
| **T1-Calluna vulgaris** | **56** |
| **T1-Trichophorum cespitosum** | **56** |
| **T1-Vaccinium oxycoccos** | **59** |
| **T1-Hypnum jutlandicum** | **35** |
| **T1-Sphagnum tenellum** | **35** |
| **T1-Rhynchospora alba** | **32** |
| **T1-Narthecium ossifragum** | **32** |
| **T1-Sphagnum subnitens** | **32** |
| **T1-Molinia caerulea** | **26** |
| T1-Cladonia uncialis | 21 |
| T1-Sphagnum medium | 18 |
| T1-Racomitrium lanuginosum | 15 |
| T1-Sphagnum fallax | 18 |
| T1-Drosera rotundifolia | 12 |
| T1-Aulacomnium palustre | 12 |
| | |
| **T1/A1-Narthecium ossifragum** | **56** |
| **T1/A1-Eriophorum vaginatum** | **56** |
| **T1/A1-Eriophorum angustifolium** | **50** |
| **T1/A1-Sphagnum papillosum** | **26** |
| **T1/A1-Vaccinium oxycoccos** | **35** |
| **T1/A1-Sphagnum fallax** | **29** |
| **T1/A1-Cladonia portentosa** | **26** |
| **T1/A1-Cladonia uncialis** | **26** |
| T1/A1-Sphagnum pulchrum | 18 |
| T1/A1-Trichophorum cespitosum | 15 |
| T1/A1-Sphagnum cuspidatum | 15 |
| T1/A1-Calluna vulgaris | 15 |
| | |
| **A1-Sphagnum cuspidatum** | **29** |
| A1-Sphagnum fallax | 18 |
| A1-Rhynchospora alba | 15 |
| | |
| **Tk-Molinia caerulea** | **26** |
| Tk-Hypnum jutlandicum | 12 |

| SYN 13 | |
|---|---|
| | % const. |
| **T1-Eriophorum vaginatum** | **100** |
| **T1-Calluna vulgaris** | **100** |
| **T1-Sphagnum tenellum** | **100** |
| **T1-Myrica gale** | **100** |
| **T1-Rhynchospora alba** | **80** |
| **T1-Sphagnum capillifolium** | **80** |
| **T1-Eriophorum angustifolium** | **80** |
| **T1-Cladonia portentosa** | **80** |
| **T1-Hypnum jutlandicum** | **80** |
| **T1-Sphagnum pulchrum** | **80** |
| | |
| **T1/A1-Rhynchospora alba** | **100** |
| **T1/A1-Sphagnum pulchrum** | **100** |
| **T1/A1-Erica tetralix** | **80** |
| **T1/A1-Eriophorum angustifolium** | **80** |
| **T1/A1-Sphagnum tenellum** | **80** |
| **T1/A1-Narthecium ossifragum** | **80** |
| **T1/A1-Sphagnum cuspidatum** | **80** |
| | |
| T3-Leucobryum glaucum | 20 |
| | |
| T2-Calluna vulgaris | 20 |
| T2-Hypnum jutlandicum | 20 |
| T2-Cladonia portentosa | 20 |
| T2-Myrica gale | 20 |
| T2-Eriophorum vaginatum | 20 |
| T2-Eriophorum angustifolium | 20 |
| T2-Andromeda polifolia | 20 |
| T2-Narthecium ossifragum | 20 |
| | |
| **T1-Erica tetralix** | **60** |
| **T1-Sphagnum papillosum** | **60** |
| **T1-Andromeda polifolia** | **60** |
| **T1-Narthecium ossifragum** | **60** |
| T1-Algal growth | 20 |
| T1-Cladonia uncialis | 20 |
| | |
| **T1/A1-Cladonia uncialis** | **60** |
| T1/A1-Trichophorum cespitosum | 20 |
| T1/A1-Andromeda polifolia | 20 |
| T1/A1-Eriophorum vaginatum | 20 |
| T1/A1-Sphagnum capillifolium | 20 |
| T1/A1-Myrica gale | 20 |
| T1/A1-Cladonia portentosa | 20 |

| SYN 14 | % const |
|---|---|
| **T3-Calluna vulgaris** | **67** |
| **T3-Cladonia portentosa** | **67** |
| | |
| **T1-Erica tetralix** | **93** |
| **T1-Eriophorum angustifolium** | **93** |
| **T1-Calluna vulgaris** | **80** |
| **T1-Sphagnum papillosum** | **73** |
| **T1-Eriophorum vaginatum** | **73** |
| **T1-Cladonia portentosa** | **73** |
| **T1-Andromeda polifolia** | **67** |
| **T1-Myrica gale** | **67** |
| | |
| **T1/A1-Rhynchospora alba** | **67** |

| | |
|---|---|
| **T3-Hypnum jutlandicum** | **60** |
| **T3-Eriophorum vaginatum** | **60** |
| **T3-Erica tetralix** | **47** |
| **T3-Myrica gale** | **40** |
| **T3-Molinia caerulea** | **40** |
| **T3-Sphagnum capillifolium** | **40** |
| **T3-Eriophorum angustifolium** | **27** |
| T3-Sphagnum papillosum | 13 |
| T3-Leucobryum glaucum | 13 |
| T3-Trichophorum cespitosum | 13 |
| | |
| **T1-Sphagnum capillifolium** | **60** |
| **T1-Sphagnum tenellum** | **53** |
| **T1-Hypnum jutlandicum** | **47** |
| **T1-Molinia caerulea** | **40** |
| **T1-Rhynchospora alba** | **33** |
| **T1-Sphagnum subnitens** | **33** |
| **T1-Narthecium ossifragum** | **27** |
| **T1-Cladonia uncialis** | **27** |
| T1-Sphagnum pulchrum | 20 |
| T1-Carex panicea | 20 |
| T1-Sphagnum medium | 13 |
| T1-Sphagnum fallax | 13 |
| | |
| **T1/A1-Eriophorum angustifolium** | 60 |
| **T1/A1-Erica tetralix** | 47 |
| **T1/A1-Sphagnum cuspidatum** | 47 |
| **T1/A1-Sphagnum tenellum** | 33 |
| **T1/A1-Sphagnum pulchrum** | 33 |
| **T1/A1-Andromeda polifolia** | 33 |
| **T1/A1-Sphagnum papillosum** | 33 |
| **T1/A1-Narthecium ossifragum** | 33 |
| **T1/A1-Eriophorum vaginatum** | 27 |
| **T1/A1-Cladonia portentosa** | 27 |
| **T1/A1-Cladonia uncialis** | 27 |
| T1/A1-Molinia caerulea | 20 |
| T1/A1-Myrica gale | 20 |
| T1/A1-Drosera rotundifolia | 13 |
| T1/A1-Calluna vulgaris | 20 |
| T1/A1-Sphagnum capillifolium | 13 |
| T1/A1-Sphagnum medium | 13 |
| | |
| A1-Sphagnum cuspidatum | 13 |
| A1-Eriophorum angustifolium | 13 |
| | |
| **Tk-Molinia caerulea** | 27 |
| Tk-Eriophorum vaginatum | 13 |
| Tk-Hypnum jutlandicum | 13 |

| SYN 15 | % cons |
|---|---|
| **T3-Calluna vulgaris** | **100** |
| **T3-Molinia caerulea** | **100** |
| **T3-Erica tetralix** | **100** |
| **T3-Sphagnum capillifolium** | **100** |
| **T3-Cladonia portentosa** | **86** |
| **T3-Eriophorum vaginatum** | **71** |
| | |
| **T1-Eriophorum vaginatum** | **86** |
| **T1-Erica tetralix** | **86** |
| **T1-Sphagnum papillosum** | **71** |
| **T1-Rhynchospora alba** | **71** |
| | |
| **T1/A1-Rhynchospora alba** | **86** |
| **T1/A1-Eriophorum angustifolium** | **86** |
| **T1/A1-Erica tetralix** | **71** |
| **T1/A1-Sphagnum papillosum** | **71** |
| **T1/A1-Eriophorum vaginatum** | **71** |
| | |
| **A1-Sphagnum cuspidatum** | **100** |
| **A1-Eriophorum angustifolium** | **86** |

| | |
|---|---|
| **T3-Hypnum jutlandicum** | **57** |
| **T3-Eriophorum angustifolium** | **57** |
| **T3-Myrica gale** | **57** |
| T3-Sphagnum papillosum | 43 |
| T3-Andromeda polifolia | 43 |
| T3-Trichophorum cespitosum | 29 |
| T3-Sphagnum subnitens | 29 |
| T3-Polytrichum alpestre | 14 |
| T3-Narthecium ossifragum | 14 |
| T3-Vaccinium oxycoccos | 14 |
| T3-Leucobryum glaucum | 14 |
| | |
| **T1-Andromeda polifolia** | **57** |
| **T1-Sphagnum capillifolium** | **57** |
| **T1-Molinia caerulea** | **57** |
| T1-Eriophorum angustifolium | 43 |
| T1-Sphagnum tenellum | 29 |
| T1-Myrica gale | 29 |
| T1-Calluna vulgaris | 29 |
| T1-Narthecium ossifragum | 29 |
| T1-Sphagnum subnitens | 14 |
| T1-Sphagnum pulchrum | 14 |
| T1-Sphagnum medium | 14 |
| T1-Hypnum jutlandicum | 14 |
| T1-Cladonia portentosa | 14 |
| | |
| **T1/A1-Sphagnum pulchrum** | **57** |
| **T1/A1-Andromeda polifolia** | **57** |
| **T1/A1-Myrica gale** | **57** |
| T1/A1-Sphagnum tenellum | 43 |
| T1/A1-Sphagnum cuspidatum | 43 |
| T1/A1-Narthecium ossifragum | 29 |
| T1/A1-Molinia caerulea | 29 |
| T1/A1-Calluna vulgaris | 29 |
| T1/A1-Sphagnum capillifolium | 14 |
| T1/A1-Hypnum jutlandicum | 14 |
| T1/A1-Cladonia portentosa | 14 |
| | |
| **A1-Rhynchospora alba** | **57** |
| A1-Erica tetralix | 29 |
| A1-Molinia litter | 14 |
| A1-Sphagnum fallax | 14 |
| A1-Drosera rotundifolia | 14 |
| A1-Andromeda polifolia | 14 |
| A1-Myrica gale | 14 |
| A1-Drosera intermedia | 14 |
| | |
| A2-Rhynchospora alba | 29 |
| A2-Campylopus flexuosus | 29 |
| A2-Eriohporum angustifolium | 14 |
| A2-Drosera intermedia | 14 |
| | |
| **Tk-Eriophorum vaginatum** | **57** |
| Tk-Hypnum jutlandicum | 29 |
| Tk-Molinia caerulea | 14 |
| Tk-Trichophorum cespitosum | 14 |
| | |
| Em-moss-Molinia litter | 14 |
| | |
| Em-bare-Molinia litter | 14 |

| SYN 16 | % const. |
|---|---|
| **T2-Molinia caerulea** | **100** |
| **T2-Erica tetralix** | **100** |
| **T2-Hypnum jutlandicum** | **75** |
| | |
| **Tk-Molinia caerulea** | **100** |
| | |
| **Em-bare-Molinia litter** | **100** |
| | |
| T3-Leucobryum glaucum | 25 |
| T3-Molinia caerulea | 25 |
| | |
| **T2-Calluna vulgaris** | **50** |
| **T2-Narthecium ossifragum** | **50** |
| T2-Ulex europeus | 25 |
| T2-Isopterygium elegans | 25 |
| | |
| **Tk-Hypnum jutlandicum** | **50** |
| Tk-Vaccinium myrtillus | 25 |
| Tk-Eriophorum angustifolium | 25 |
| Tk-Erica tetralix | 25 |
| Tk-Calluna vulgaris | 25 |
| Tk-Trichophorum cespitosum | 25 |
| | |
| Em-Sphagnum-Isopterygium elegans | 25 |
| Em-Sphagnum-Sphagnum capillifolium | 25 |
| | |
| Em-moss-Molinia litter | 25 |
| Em-moss-Isopterygium elegans | 25 |
| | |
| **Em-bare-Bare peat only** | **50** |
| Em-bare-Molinia caerulea | 25 |

| SYN 17 | % const. |
|---|---|
| | 100 |
| **Tk-Molinia caerulea** | 100 |
| | |
| **Em-bare-Molinia litter** | 80 |
| **Em-bare-Bare peat only** | 80 |
| | |
| **Tk-Calluna vulgaris** | **60** |
| **Tk-Erica tetralix** | **60** |
| Tk-Dryopteris dilatata | 20 |
| Tk-Juncus maritimus | 20 |
| Tk-Salix caprea | 20 |
| | |
| Em-moss-Phragmites australis | 20 |
| | |
| Em-bare-Molinia caerulea | 20 |

| | |
|---|---|
| **SYN 18** | **% const.** |
| **Tk-Molinia caerulea** | **100** |
| | |
| **Em-bare-Molinia litter** | **80** |
| | |
| **T3-Molinia caerulea** | **60** |
| **T3-Hypnum jutlandicum** | **60** |
| **T3-Erica tetralix** | **60** |
| T3-Leucobryum glaucum | 20 |
| T3-Calluna vulgaris | 20 |
| T3-Myrica gale | 20 |
| T3-Eriophorum vaginatum | 20 |
| T3-Eriophorum angustifolium | 20 |
| T3-Sphagnum capillifolium | 20 |
| T3-Racomitrium lanuginosum | 20 |
| T3-Narthecium ossifragum | 20 |
| | |
| **Tk-Myrica gale** | **60** |
| **Tk-Hypnum jutlandicum** | **60** |
| **Tk-Erica tetralix** | **60** |
| Tk-Eriophorum angustifolium | 40 |
| Tk-Eriophorum vaginatum | 40 |
| Tk-Campylopus flexuosus | 20 |
| Tk-Narthecium ossifragum | 20 |
| | |
| Em-moss-Molinia litter | 20 |
| Em-moss-Hypnum jutlandicum | 20 |
| | |
| **Em-bare-Bare peat only** | **60** |
| Em-bare-Myrica gale | 20 |

| SYN 19 | |
|---|---|
| | **% const.** |
| **Tk-Molinia caerulea** | **100** |
| **Tk-Myrica gale** | **71** |
| | |
| **Em-moss-Hypnum jutlandicum** | **100** |
| **Em-moss-Molinia litter** | **71** |
| | |
| T1-Phragmites australis | 14 |
| | |
| A1-Sphagnum denticulatum | 14 |
| | |
| **Tk-Hypnum jutlandicum** | **57** |
| **Tk-Erica tetralix** | **57** |
| Tk-Rubus fruticosus | 29 |
| Tk-Phragmites australis | 29 |
| Tk-Calluna vulgaris | 43 |
| Tk-Pteridium aquilinum | 14 |
| Tk-Juncus maritimus | 14 |
| Tk-Dryopteris dilatata | 14 |
| Tk-Sphagnum palustre | 14 |
| Tk-Potentilla erecta | 14 |
| Tk-Osmuna regalis | 14 |
| Tk-Juncus effusus | 14 |
| Tk-Sphagnum papillosum | 14 |
| Tk-Polytrichum commune | 14 |
| | |
| Em-Sphagnum-Sphagnum cuspidatum | 14 |
| Em-Sphagnum-Molinia litter | 14 |
| Em-Sphagnum-Sphagnum fimbratum | 14 |
| Em-Sphagnum-Myrica gale | 14 |
| Em-Sphagnum-Bare peat only | 14 |
| | |
| Em-moss-Eurhynchium praelongum | 14 |
| Em-moss-Bare peat only | 14 |
| Em-moss-Andromeda polifolia | 14 |
| Em-moss-Thuidium tamariscinum | 14 |
| Em-moss-Salix caprea | 14 |
| Em-moss-Myrica gale | 14 |
| Em-moss-Lophocolea bidentata | 14 |
| Em-moss-Calluna vulgaris | 14 |
| Em-moss-Leucobryum glaucum | 14 |
| Em-moss-Eriophorum angustifolium | 14 |
| | |
| Em-bare-Molinia litter | 29 |
| Em-bare-Bare peat only | 14 |

| SYN 20 | % const. |
|---|---|
| **Tk-Molinia caerulea** | **100** |
| **Tk-Dryopteris dilatata** | **100** |
| **Tk-Rubus fruticosus** | **67** |
| | |
| **Em-moss-Molinia litter** | **100** |
| **Em-moss-Eurhynchium praelongum** | **100** |
| **Em-moss-Rubus fruticosus** | **67** |
| **Em-moss-Juncus effusus** | **67** |
| **Em-moss-Mnium hornum** | **67** |
| **Em-moss-Rumex acetosa** | **67** |
| | |
| Tk-Deschampsia cespitosus | 33 |
| | |
| Em-Sphagnum-Molinia litter | 33 |
| Em-Sphagnum-Sphagnum palustre | 33 |
| | |
| Em-moss-Isopterygium elegans | 33 |
| Em-moss-Thuidium tamariscinum | 33 |
| Em-moss-Angelica sylvestris | 33 |
| Em-moss-Betula pubescens | 33 |
| Em-moss-Brachythecium rivulare | 33 |
| Em-moss-Brachythecium rutabulum | 33 |
| Em-moss-Carex rostrata | 33 |
| Em-moss-Corylus avellana | 33 |
| Em-moss-Dryopteris dilitata | 33 |
| Em-moss-Filipendula ulmaria | 33 |
| Em-moss-Holcus lanatus | 33 |
| Em-moss-Iris pseudacorus | 33 |
| Em-moss-Valeriana officinalis | 33 |

## Annex 6: Excel spreadsheet of all SYN communities

This spreadsheet is held by Natural Resources Wales