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Peatlands:

Condition mapping – a ‘new’ approach.

Richard Lindsay, Sustainability Research Institute


"It's not what we look at that's important, it's what we see." Henry David Thoreau


Photo: Iain Diack

C.A. Weber and the Raised Bog of Augstumal

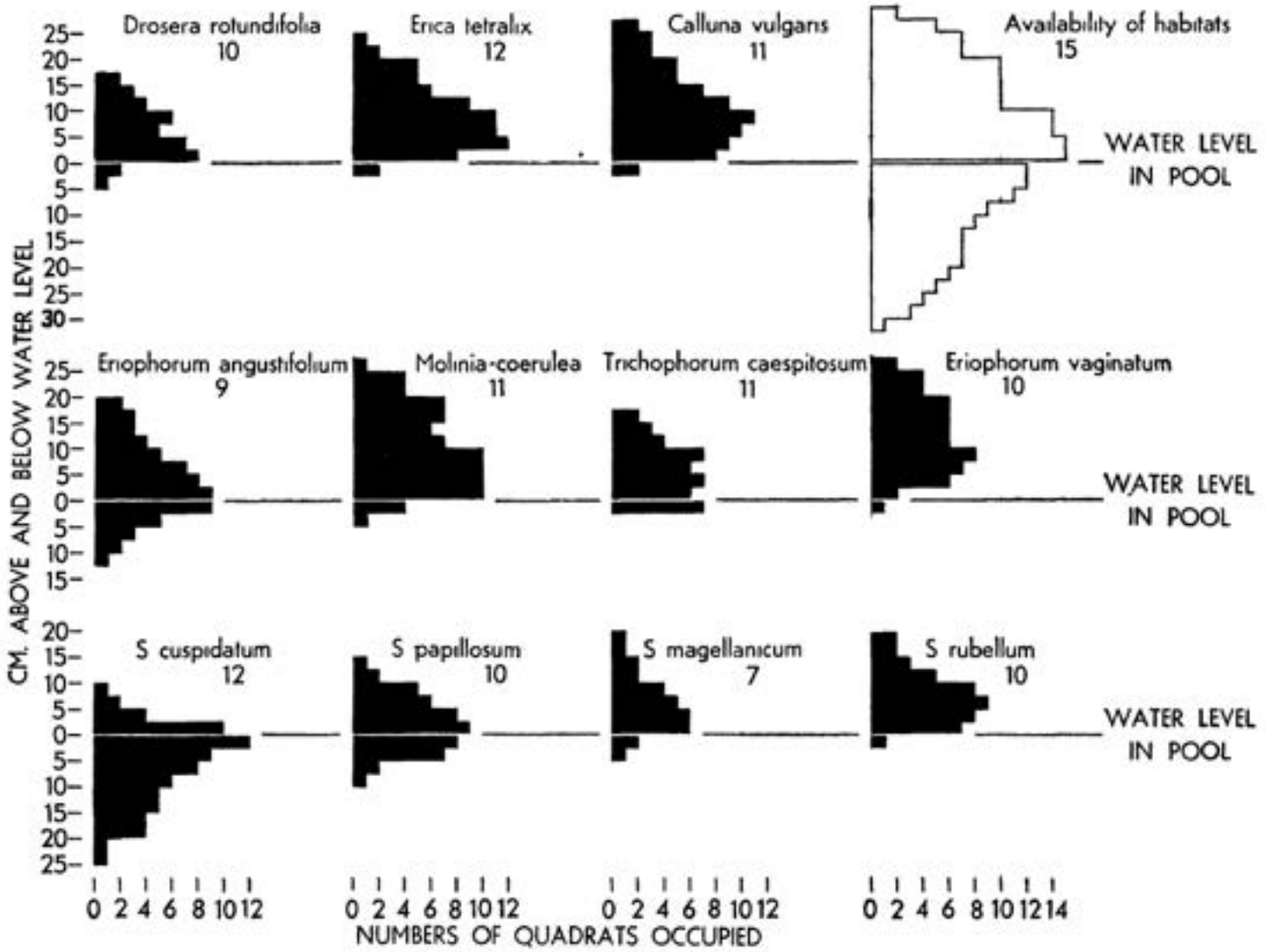
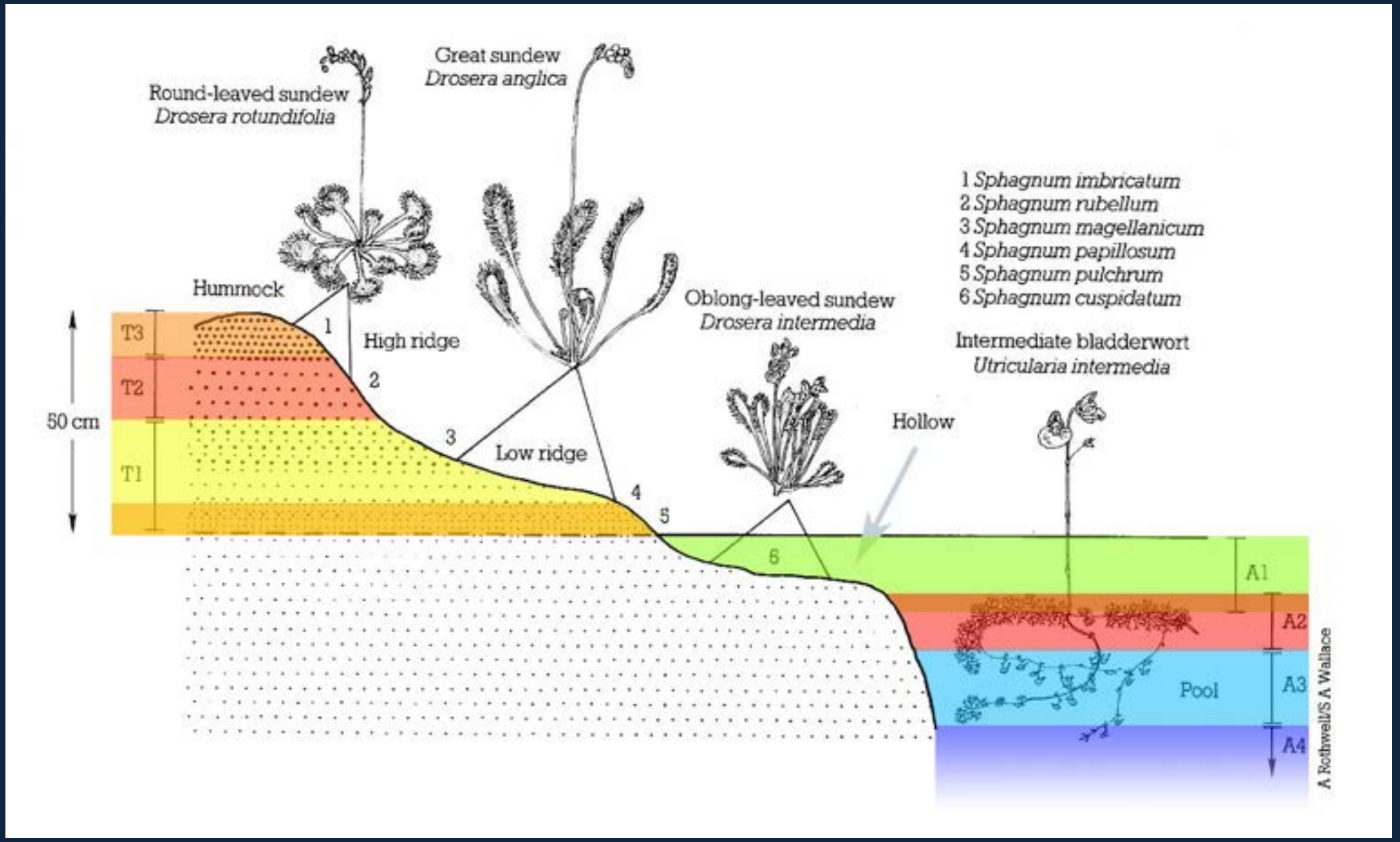
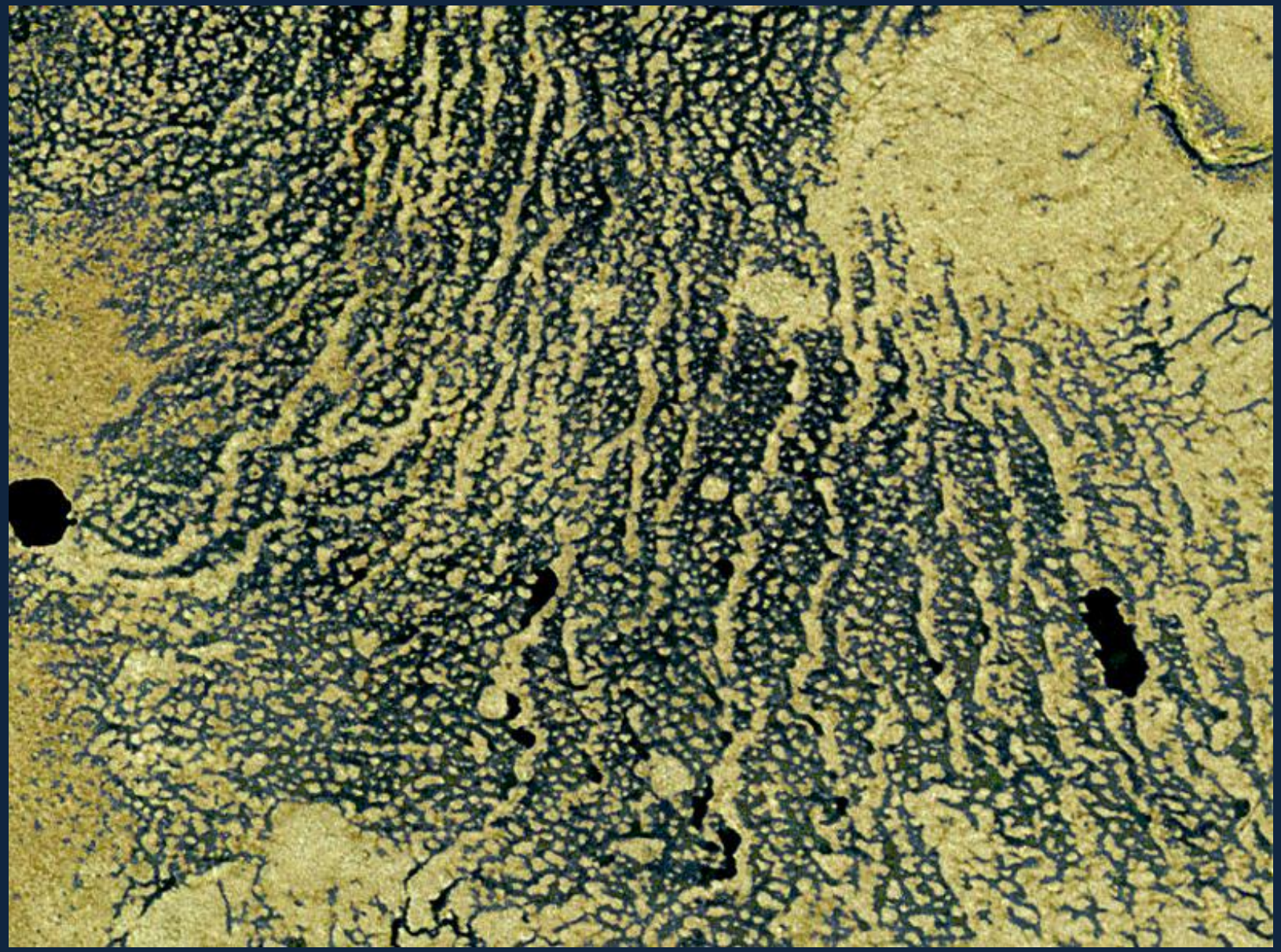
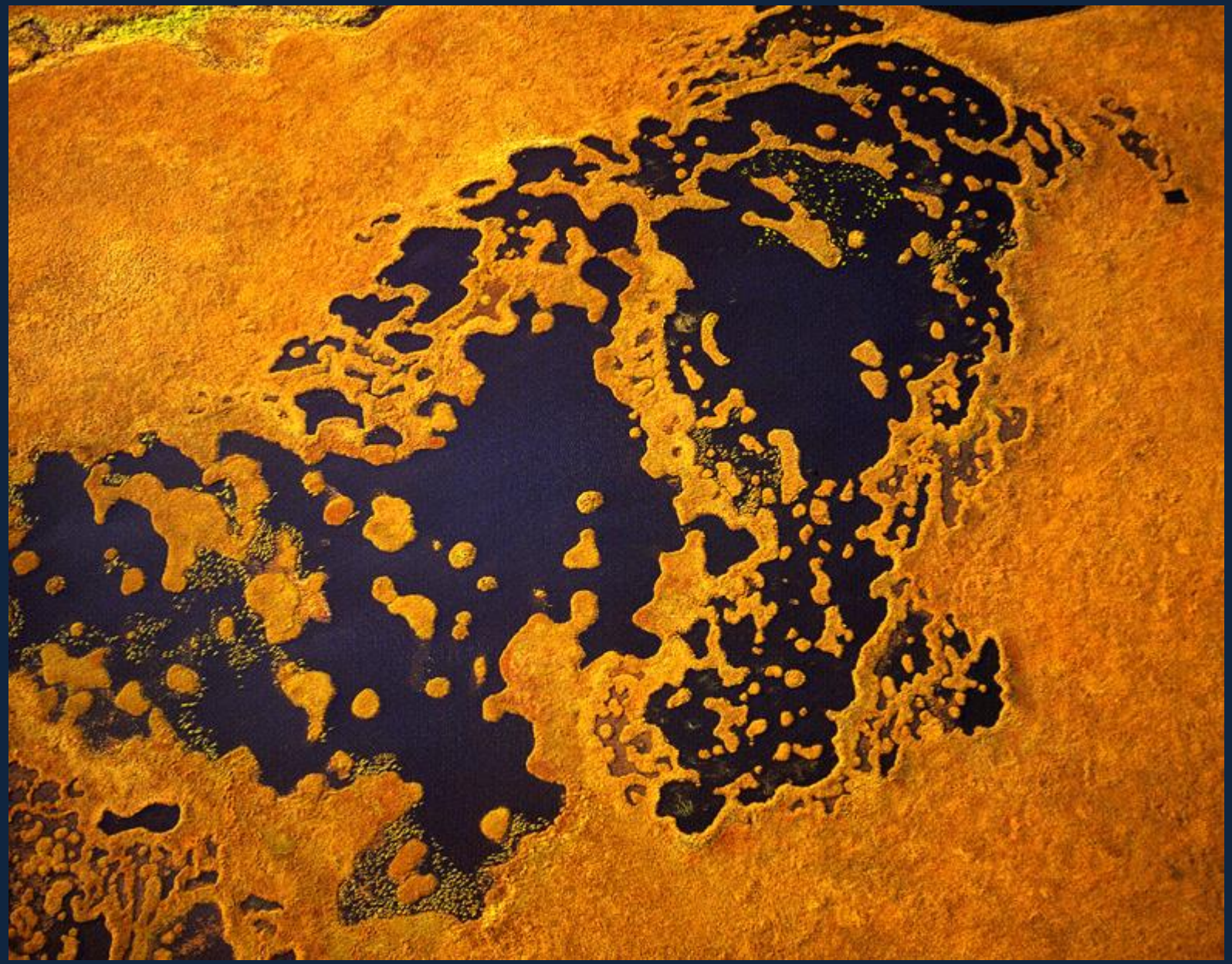


Fig. 3. Vertical distribution with respect to water table of selected species. The black area depicts the frequency of occurrence (horizontal) against vertical range for each species. The number below the name of each species is the total number of quadrats from which the observations are drawn.

Journal of Ecology, Vol. 46, No. 2 (Jul., 1958), pp. 407-445

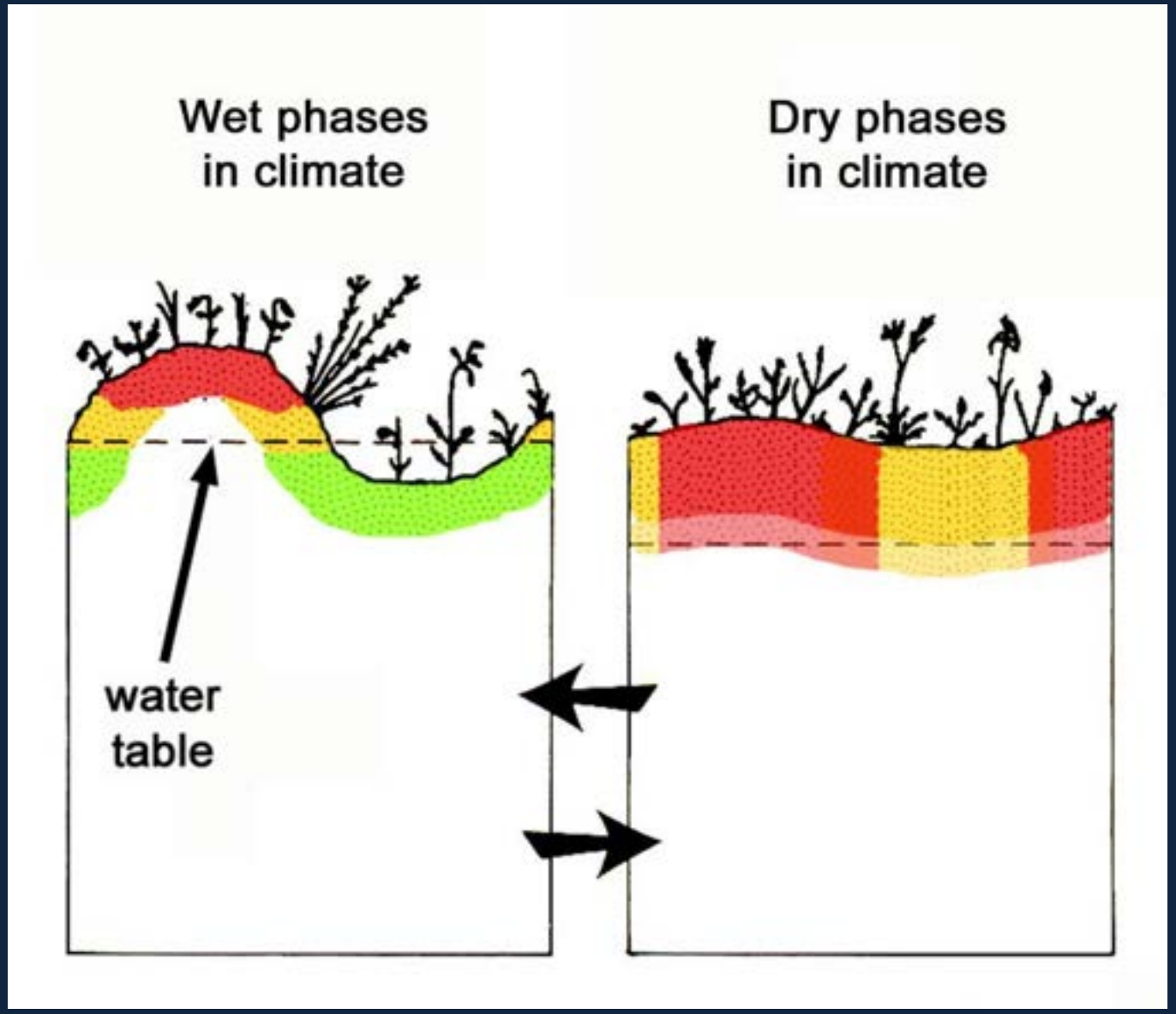

Round-leaved sundew
Drosera rotundifolia
Great sundew
Drosera anglica
1 Sphagnum imbricatum
2 Sphagnum rubellum
3 Sphagnum magellanicum
4 Sphagnum papillosum
5 Sphagnum pulchrum
6 Sphagnum cuspidatum
Hummock
High ridge
Oblong-leaved sundew
Drosera intermedia
Intermediate bladderwort
Utricularia intermedia
Hollow
Low ridge
50 cm
T3
T2
T1
1
2
3
4
5
6
A1
A2
A3
A4
Pool
A. Rothwell/S A Wallace

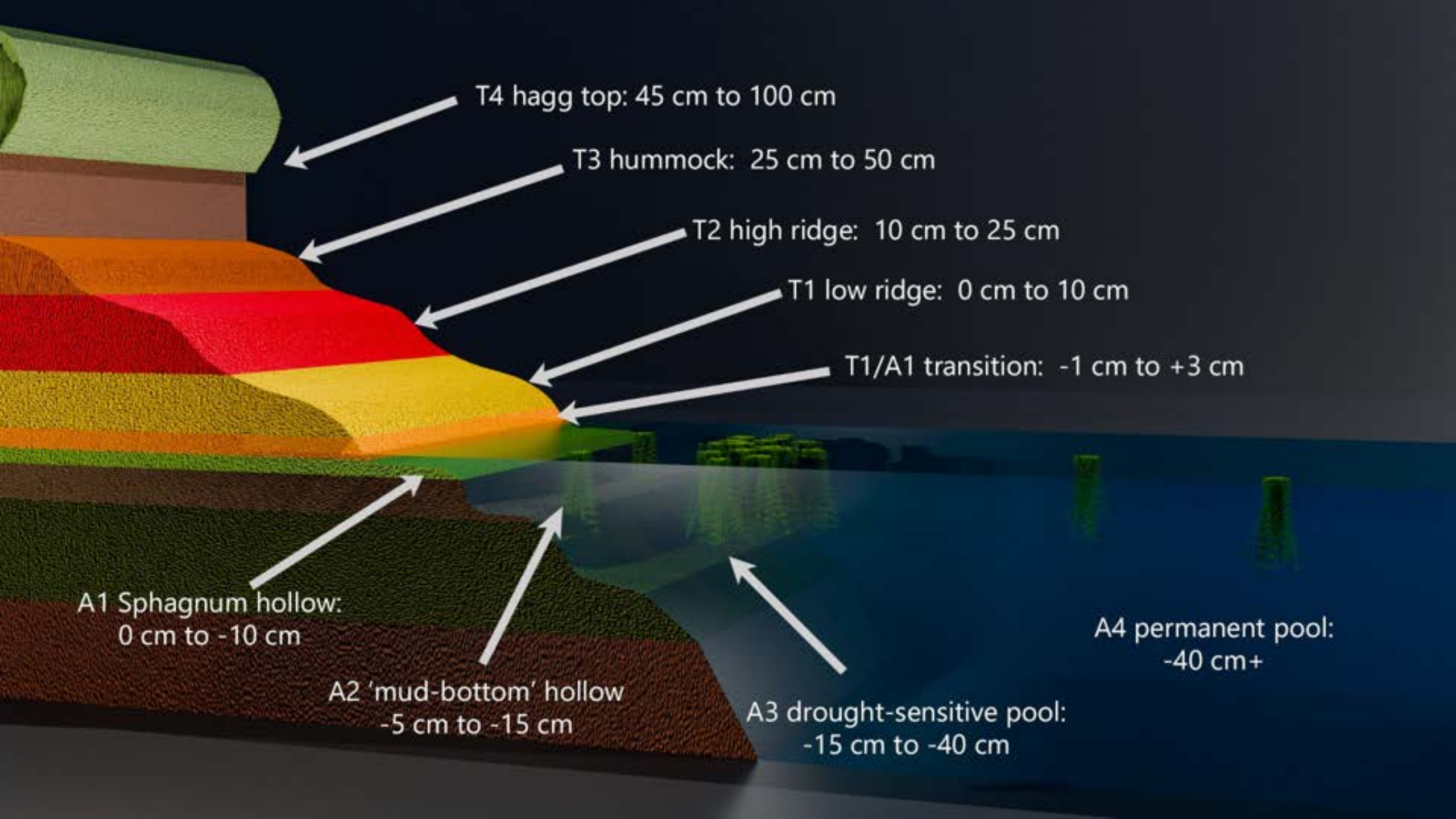





Google


0.5 km
Image © 2015 CNES / Astrium
Google earth


Wet phases
in climate
Dry phases
in climate
water
table


T4 hagg top: 45 cm to 100 cm
T3 hummock: 25 cm to 50 cm
T2 high ridge: 10 cm to 25 cm
T1 low ridge: 0 cm to 10 cm
T1/A1 transition: -1 cm to +3 cm
A1 Sphagnum hollow:
0 cm to -10 cm
A2 'mud-bottom' hollow
-5 cm to -15 cm
A3 drought-sensitive pool:
-15 cm to -40 cm
A4 permanent pool:
-40 cm+

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Ombrogenous mires in Islay and Mull

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Synopsis

The vegetation and surface structure of two ombrogenous mires from the Inner Hebrides are described. Two-way indicator species analysis and hand sorting of these data are used to identify vegetation communities. The surface patterning of both sites is examined using levelling data which are related to the water table. From this, four significant surface features are recognised: *hummock*, *ridge*, *hollow* and *pool*. The relationship between the vegetation communities and these features is examined, and the two study sites subsequently compared in terms of these small-scale features. The ombrogenous mires of the Inner Hebrides are then related in the same way to other mire systems described by previous authors.

Introduction

Most of the larger islands of the Inner Hebrides have extensive areas covered by blanket mire which has developed as a result of the strongly oceanic, cool, wet climate. Extensive deep peat deposits occur even at sea level on islands where the geology is conducive to peat development, and shallow blanket peat is widespread on the montane areas of Jura, Skye and Rhum.

In this account, two areas have been chosen to illustrate the range of ecological variation (Fig. 1): (a) Coladoir Bog, Mull, a natural patterned bog and an example of a widespread habitat type mostly severely modified by land use; (b) Glac na Criche, Islay, oceanic blanket mire vegetation having affinities with Western Ireland but not previously described from Scotland.

Plant species of ombrogenous mires are sensitive to the local patterns of waterlogging in the surface peat. Individual species occur at specific heights above or below the water table (Ratcliffe and Walker 1958). The hummock-hollow mosaic of the mire surface provides a wide range of conditions within the small-scale pattern and such patterns become increasingly complex towards the north and west of Britain. Species able to tolerate the oceanic climate along the Atlantic coast of Scotland find there a greater variety of surface features in which they may obtain a suitable niche. These ecological differences between north and south, east and west, must affect the overall distribution of species associations across the country, yet the

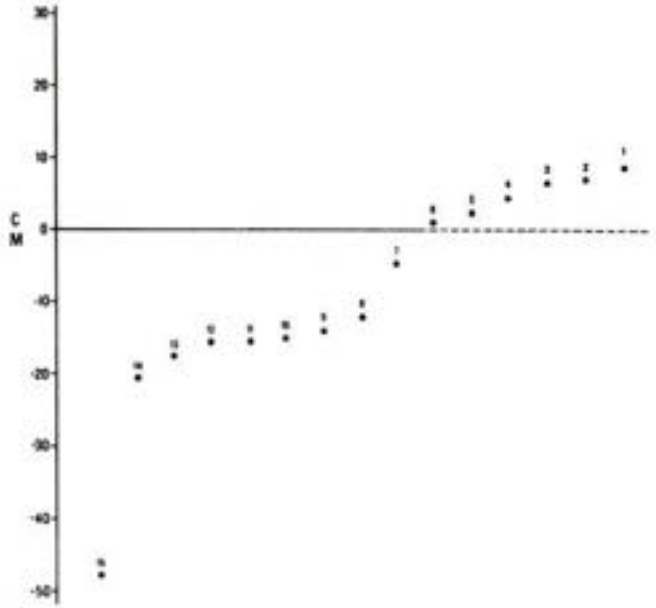

Figure 4. Mean height of noda numbered 1 to 15, above or below water table on Coladoir Bog.

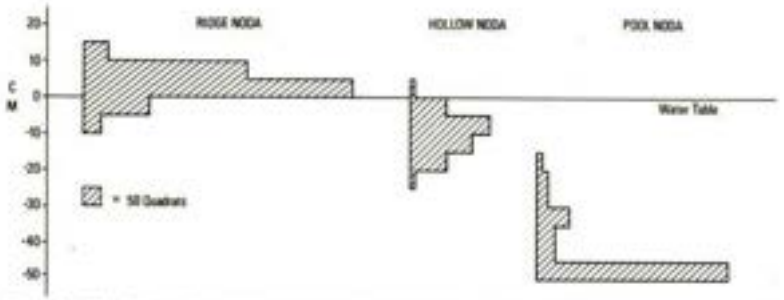

Figure 5. Distribution of noda with respect to the water table, combined for the three major elements of the microtopography from Coladoir Bog.

Ridge level. This refers to anything above the water table, although the vegetation may also occasionally extend a little way below the water table. The majority of heights associated with *ridge* level at Coladoir lie within 10 cm of the water table, although a few rise as high as 15 cm, and occasional hummocks rise much higher. Within areas of surface patterning the ridges are ribbon-like, as described above, and

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Integrated synusial phytosociology: some notes on a new, multiscalar approach to vegetation analysis

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Abstract. The integrated synusial approach of the vegetation is based on the differentiation of several spatio-temporal organization levels. A phytocoenosis (community of the second level) is considered as a complex of synusiae (communities of the first level) and is characterised by a strong tendency to self-organization. At each level, a typology of the communities can be performed. Ecological indicator values as well as different diversity indices are calculated for each vegetation unit. They are useful for understanding the spatial and temporal organization of the phytocoenoses. As an example, this approach is applied to wooded meadows.

Keywords: Catena; Cluster Analysis; Community structure; Correspondence Analysis; Diversity; Ecological indication; Organization level; Phytocoenosis; Synusia; Tessela.

Nomenclature: Tutin et al. (1964-1980).

Introduction

Recent progress in hierarchy theory (Allen & Starr 1982; Auger et al. 1992), system theory and landscape ecology (Zonneveld & Forman 1990) make it possible to develop new tools for phytosociology. These tools should allow a better insight and a more precise description of the structural diversity of the plant community and its dynamics according to both spatial and temporal scales. For this 'multiscalar' approach the 'integrated synusial method' was developed (Gillet et al. 1991). This method tries to fulfil the objectives through emphasizing a precise analysis of the basic organization levels in vegetation. It integrates two complementary aspects: (1) community structure and diversity; (2) system organization and dynamics.

According to this approach four spatio-temporal organization levels are considered (Fig. 1):

(1) *Synusia* (Cain 1936; Barkman 1978), an elementary one-layered floristically, physiognomically and ecologically homogeneous vegetation unit, directly linked to uniform environmental conditions (microclimate, microtopography, soil, biotic factors), which is used in the sense of a concrete community (patch) and not as an abstract classification unit (Du Rietz 1936; Lippmaa 1939; Gillet 1986);

(2) *Phytocoenosis* (Guinochet 1973; Barkman 1978; Westhoff & van der Maarel 1978), a complex of synusiae which are functionally strongly linked both in space (mosaics, stratification) and time (seasonal aspects, regeneration cycles);

(3) *Tessela* (de Bolòs 1963; Theurillat 1992), a complex of phytocoenoses which are under the influence of the same abiotic site conditions (geology, topography, climate) and which would lead to the same climax;

(4) *Catena* (de Bolòs 1963; Theurillat 1992), a zonation of phytocoenoses or tesselas integrated into the same geomorphological landscape unit (note that this is a phytocoenological variant of the original catena concept from soil science).

We apply a three-step analysis to these different integration levels:

(1) sampling and field description: botanical composition, vegetation structure, environmental conditions;

(2) typology and classification: statistical comparison, floristic-sociological classification, statistical correlation with environmental variables;

(3) modelling and simulation: qualitative and quantitative models of predictive dynamic systems.

The integrated synusial method was first applied to deciduous forests of the French Jura (Gillet 1986, 1988), and has also been applied to other natural and semi-natural communities, including other forests (Julve & Gillet 1994), wooded pastures (Gillet & Gallandat 1994), subalpine vegetation (Gillet et al. 1994), flood plains and peat bogs. It has been developed particularly in the framework of the project PATUBOIS, a multidisciplinary research program dealing with wooded pastures in the Swiss Jura (Gallandat et al. 1995a, b).

The present paper presents a brief survey of this approach, with emphasis on aspects of structure and diversity at the first two integration levels, with some examples from wooded pastures (Gallandat et al. 1995a, b). Fig. 1 shows how a wooded pasture phytocoenosis is built up of different synusiae, and at the same time forms part of a higher unit, the tesela, which is embedded in a catena.

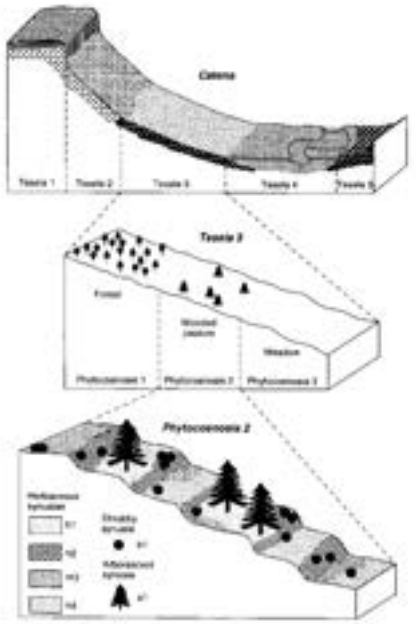


Fig. 1. The main vegetation organization levels considered in the integrated synusial phytosociology (after Gillet et al. 1991).

Integrated synusial approach

Characterization of synusiae

Synusiae are organized in space and time within phytocoenoses, as elements of a mosaic or a zonation, stratal and epiphytic communities or seasonal aspects. First a stand of vegetation is divided into synusia. The vegetation of a wooded meadow system may be composed of woody and shrub-rich patches, meadows and local cryptogam communities which are described separately as synusiae. Fig. 2 and Table 1 show the synusial organization of a concrete wooded pasture phytocoenosis.

A *synusial relevé* is a quantitative description of the species occurring in the sample plot of any concrete synusia distinguished in the system. For each synusia the following parameters are derived from a relational data base:

1. *Pastoral value*, i.e. the quantitative and qualitative value of the available biomass for grazing (Daget & Poissonet 1971; Gallandat et al. 1995a, b).

2. *Environmental conditions*, expressed as weighted mean values for ecological indicator values for important factors such as moisture, nutrient status and pH, as compiled by Landolt (1977). The system of Landolt valid for Switzerland is similar to the well-known system of Ellenberg (1974, 1991), one difference being that the factors are estimated along a usually 9-point scale in the Ellenberg system, whereas Landolt used 5-point scales. Weighted means for plant communities can be used to refine indicator values for lesser known species (van der Maarel 1993) and the process of averaging links up directly to the basic idea of reciprocal averaging as used in Correspondence Analysis (ter Braak & Barendrecht 1986; ter Braak & Wiertz 1994).

3. *Synusial species diversity*. This is expressed as D_1, adapted from Shannon's diversity index:

$$D_1 = -\sum (p_i \log_2 p_i) \qquad (1)$$

where $p_i = C_i / \Sigma C_i$ and C_i the cover value of species i as calculated from the cover/abundance values estimated in the field according to the transformation suggested by van der Maarel (1979), and ΣC_i the sum of all cover values of species included in the relevé.

Synusial relevés are compared and classified in elementary synusial syntaxa (de Foucault 1984) using floristic-statistical methods, notably Correspondence Analysis and Agglomerative Clustering. These elementary typological units are grouped into synusial associations, *assivas* in the sense of Lippmaa (1939), which are integrated in a general classification system (Julve 1993).

Characterization of phytocoenoses

Each wooded pasture phytocoenosis is determined by a set of ecological site conditions referring to geomorphology, geology, mesoclimate, tree cover, intensity of grazing and fertilization, etc. Each phytocoenosis is described in the field by a so-called *phytocoenotic relevé*, which comprises a list of quantitative analyses of all the elementary synusial syntaxa observed in a concrete phytocoenosis.

On the level of the phytocoenosis several parameters can be determined, in a similar way as on the synusial level. Different biodiversity indices are computed from each relevé.

1. *Synusial diversity* D_2 is calculated in the same way as the synusial species diversity D_1:

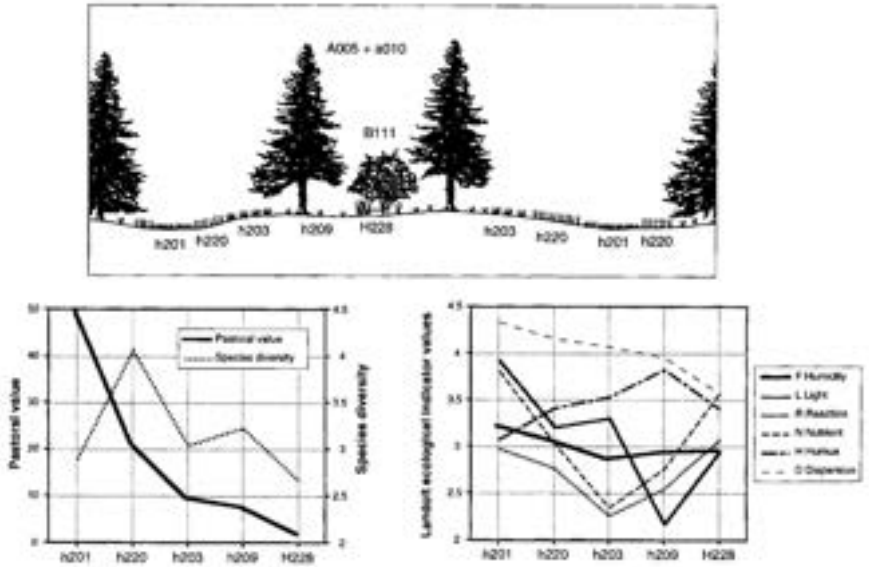


Fig. 2. Synusial communities along a transect through an extensively used wooded pasture (see Table 1 for the characterization of the synusiae). Pastoral, species diversity and ecological indicator values are given for each type of herbaceous synusiae (typology after Gallandat et al. 1995a).

$$D_2 = -\sum (p_i \log_2 p_i) \qquad (2)$$

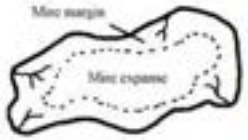
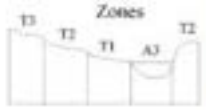
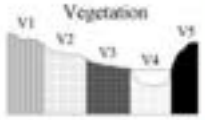
with again $p_i = C_i / \sum C_i$, but now with C_i being the cover value of synusia i as calculated from the cover/abundance values estimated in the field according to the transformation suggested by van der Maarel (1979), and $\sum C_i$, the sum of all cover values of the synusiae included in the relevé.

2. *Potential floristic richness FR* is defined as the species assemblage derived from the species occurrences in all the different elementary synusial syntaxa, except accidental species (i.e. species which are present in less than 10% of the relevés of each elementary synusial syntaxon).

3. *Phytosociological diversity PD* is defined as the product of the potential floristic richness *FR* and the equitability (relative diversity) in the phytocoenotic relevé (*n* is the number of synusial elementary syntaxa):

Table 1. Main types of synusiae occurring in an extensively used wooded pasture (see Fig. 2). h and H: low and high herbaceous synusiae; b and B: low and high shrub synusiae; a and A: low and high arborescent synusiae (typology after Gallandat et al. 1995).

Elementary syntaxon	Ecological type	Main species
h201	Trophic eutrophic grazed meadow	*Poa supina* *Ranunculus repens*
h220	Mesotrophic grazed meadow	*Agrostis capillaris* *Festuca nigrescens*
h203	Oligotrophic lawn	*Nardus stricta* *Vaccinium myrtillus*
h209	Underwood lawn	*Oxalis acetosella* *Galium rotundifolium*
H228	Clear-cut fallow	*Arctium hella-donna* *Rubus idaeus*
B111	Clear-cut shrubland	*Sambucus racemosa*
a010	Low arborescent layer	*Picea abies* *Sorbus aucuparia*
A005	Tall arborescent layer	*Picea abies*

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"

10 Analysis of vegetation communities

Although the survey was essentially concerned with ombrotrophic vegetation, a number of fen systems were sampled in the course of the work. In addition, the transitional types, such as ladder fens, were recorded in some detail. Thus a certain proportion of the overall data-set describes minerotrophic vegetation.

This report does not discuss the minerotrophic vegetation in any detail, because a more comprehensive review of Scottish fens is required before their status can be assessed. The provisional communities are presented here in tabular form for completeness, but, other than ladder fens, will not be further commented on.

The vegetation analysis derived a total of 33

Ericetum tetralicis (see Dierssen 1982); M15/15d-*Sphagnum compactum* wet heath, *Juncus squarrosus-Dicranum scoparium* sub-community (Proctor & Rodwell 1986)

This community becomes more common towards the west of the Flow Country, where even slopes receive sufficient rainfall and run-off to form wet heath over thin peat. The community is also characteristic of peat-cuttings where the subsoil has almost been exposed, leaving just a thin peat covering. In time, under such conditions, the wet heath component could be expected to succumb to *Sphagnum* colonisation and redevelopment of peat.

Juncus squarrosus is a major component, but not entirely constant, and the community is sometimes

Structural type	1	2					3							
Vegetation group number	1	2		3			4				5			
Surface pattern zone		T		T4/T3/T1			T3/T2				T2/T1			
Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	
Species name														
Juncus squarrosus	IV													
Carex nigra	III													
Luzula spp.	I													
Juncus effusus	I													
Polytrichum juniperinum	I													
Sphagnum recurvum	I													
Hylocomium splendens		III												
Rhytidiadelphus squarrosus	I	II												
Rhytidiadelphus loreus		IV	I											
Pleurozium schreberi	II	V	IV				III							
Hypnum cupressiforme		IV	III						II	I				
Empetrum nigrum		IV	IV	I										
Hypogymnia physodes		II	I						I					
Rubus chamaemorus			II											
Calluna vulgaris	III	V	V	IV	V	V	V	V	V	V	IV	IV	IV	
Erica cinerea	I			I	II									
Cladonia arbuscula		II	II	II	I									
Cladonia impexa	II	IV	IV	III	V	V	V	III	IV	V	I	III	IV	
Racomitrium lanuginosum	II		I	V	V	IV	IV		II	II		I		
Trichophorum cespitosum	I	II	I	III	IV	IV	IV	III	IV	IV	III	III	V	
Potentilla erecta					IV	III					II			
Molinia caerulea					V	III	III				IV	I		
Lycopodium selago				II		II								
Sphagnum fuscum			I				V							
Rodiolaria sulvatica					II									

loreus, and both *Hypnum cupressiforme* and *Sphagnum rubellum* are somewhat reduced. This is the only community in which cloudberry *Rubus chamaemorus* is recorded, although it is common on the high peat plateaux of the Highlands. The community represents, along with Community 2, the typical peat-dominated vegetation of relatively undamaged catchment slopes.

Vegetation group 3 - *Racomitrium* hummocks/hags

Community 4 - *Racomitrium lanuginosum-Cladonia*

Erico-Sphagnetum magellanici, subass. *Cladonia uncialis, Racomitrium lanuginosum* phase; M17b - *Scirpus cespitosus-Eriophorum vaginatum* blanket mire, *Cladonia* subass.

This is typical of the highest erosion hags throughout the two Districts, with a mat of *Racomitrium* capped by a sward of *Cladonia* species, although the absence of *Molinia caerulea* tends to mean that the type is commoner in the east. Bare peat is a common component of the surface.

Community 5 - *Racomitrium-Molinia* hummocks

3 *Sphagnum-rich*, hummocks and ridges

The majority of communities within this category are characteristic of undamaged mires. The term "hummocks and ridges" is taken to mean all those parts of the mire surface which lie above the water table, other than erosion hags and peat-mounds. The structural type can be subdivided into five main vegetation types based largely on the dominant species of *Sphagnum*. Each of these can then be divided on the basis of characteristic species complements, to give a total of 14 community types, making this the richest of the major structural divisions. Such variety is not surprising in view of the fact that the bulk of niche partition for the blanket mire vegetation must occur within this structural span.

Vegetation group 4 –*Sphagnum* hummocks

Community 7 -*Sphagnum fuscum* hummocks

Erico-Sphagnetum magellanici, subass. typical, phase *Sphagnum fuscum;* M18b -*Erica tetralix-Sphagnum papillosum,* subcomm. *Empetrum nigrum-Cladonia*

12 Analysis of site types

As a final stage in the analysis of peatland features, to provide a further basis for nature conservation evaluation, the variation between mire systems throughout the two Districts was examined on the basis of two major attributes. These were the vegetation groups derived from the earlier vegetation analysis and the information relating to microtopography obtained from survey. In the field, the surface structure is often the more striking and readily identifiable attribute because the vegetation almost invariably occurs as a complex mosaic within the structural patterns (see Chapters 1 and 2). By combining these, the overall character of the mire unit can be revealed, as illustrated by Lindsay *et al.* (1983) and Lindsay *et al.* (1985).

We assigned vegetation types derived from the floristic descriptions to individual sites. On the basis of information recorded on the original field sheet, these vegetation types were then allocated to

vegetation types had been allocated to each site, the information was transferred from the Revelation data-base into TWINSPAN, where each site was treated as a single sample, with attributes of vegetation type rather than species. The resulting data matrix thus consisted of 399 such samples, each with a record of one or more vegetation types. This second-order analysis of TWINSPAN output is a technique successfully employed by Ratcliffe & Hattey (1982) in the analysis of lowland wetland communities in Wales. The approach allows the broad spectrum of vegetation to be classified from all samples irrespective of sites and then the sites from which samples were taken to be classified in turn on the basis of the combination of vegetation classes each site contains.

The TWINSPAN analysis, at the first level of division, isolated eroding mire from *Sphagnum-rich* types.

Comm. no.	Microtope and community type	Site type: Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10	Type 11	Type 12	Type 13	Type 14	Type 15
	Peat mounds (T5)					I	I				I					I
	Erosion haggs (T4)		I	I	I	II	I	I	I		II	III		V*	IV	V*
	Hummocks (T3)	I	V	IV	V	V	V	V	V	V	V	V		V*	IV	IV*
	High ridge (T2)	IV	V	V*	V*	V*	V*	V*	V*	IV*	V*	V*	III	V*	V*	V*
	Low ridge (T1)	V*	V	V*	V*	V	V	V*	V*	II	V	V	V*	IV	V	IV
	Sphagnum hollow (A1)	I	IV	V	V*	V	V	V	V	V	V	III	III	III	III	IV
	Mud-bottom hollow (A2)	V*	V*	V	V	IV*	V	V*	V	III	IV	V*		V*	V	V*
	Erosion channel (TA2)		II			I	I		I		II	V*		V*	IV	IV*
	Drought-sensitive pools (A3)		III	III	III	III	IV	III	V*	V*	V*	III		III	II	II
	Permanent pools (A4)		I	I	I	I	II		V	V*	V*	II				I
1	*Juncus squarrosus* thin peat		I		I	I	II			I		I		II	I	I
2	*Empetrum–Hylocomium splendens* mounds/hummocks		I		I	I	I	I	II	III	I				I	I
3	*Empetrum*–hypnoid moss slopes and hummocks	I	I	I	I	I	I	I	II		I	I		I	I	I
4	*Racomitrium–Cladonia* hummocks and hags		I	I	I	II	I	I	I	I	II		III	III	III	III
5	*Racomitrium–Molinia* hummocks and hags	I	II	II	I	I	II	III			I	I		I	I	II
6	*Racomitrium–Pleurozia* wet low ridge	I	III	IV	I	I	II	III	I	I	I	I		I	I	II
7	*Sphagnum fuscum* hummocks		II	I	II	I	II	II	III	III	I	II	I	I	II	
8	*Sphagnum imbricatum* hummocks	II	III	I	IV	IV	III	III	IV	III	IV	III	III	II	II	
9	*Sphagnum rubellum–Odontoschisma* dry ridges	I	I	I	II	III	I	I	I	I	I	I	I	I	I	
10	Mixed *Sphagna* (*S. rubellum* hummocks)	I	I	III	II	I	III	III	II	II	III	III	I	I	I	II
11	*Sphagnum papillosum–Molinia* ridge	I	II	I	I	IV	III	I	I	I	I	I	I			
12	*Sphagnum–Eriophorum vaginatum* ridge	I	II	II	I	IV	II	II	III	III	II	IV	II	II	I	
13	*Sphagnum compactum* ridge		I	II	I	I	I	II	I	I	II	III	II	I		
14	*Sphagnum magellanicum–S. subnitens*	III	I		I							I				
15	*Sphagnum magellanicum–S. rubellum* ridge	I	II	I	III	I	III	IV	III	I	IV	I	II	II	II	
16	*Sphagnum–Arctostaphylos–Betula nana* mire		I		II	I	I		III	II	I	V	I	I	I	
17	*Sphagnum papillosum–Carex pauciflora*		I	II	I	I	I	I	I		I			II	I	
18	*Rhynchospora alba–Sphagnum* low ridge		I	III	I		I	I						I		
19	*Campylopus atrovirens* low ridge		II	II	I	I	I	I	I			I		I	I	II
20	*Schoenus–Molinia* mire	I	II	II		I										
21	*Carex panicea* damaged mire		I		I	I	I	I	I		I	I		I	III	II
22	*Narthecium ossifragum* "runnel"	I	I		I	I	I	I			I	I			I	I
23	Microbroken mire					I	I				I		V	I	I	III
24	*Sphagnum cuspidatum–Eleocharis multicaulis*						II				II					
25	Pure *Sphagnum cuspidatum* carpets		I		II	III	I		I	III	I	I		I	I	II

Rhynchospora alba-Drosera intermedia mud-bottom hollows of western areas are also restricted to this type, and *Campylopus atrovirens* carpets, often associated with a mixed *Sphagnum* sward which includes *S. tenellum,* are characteristic. This is a type very similar to that described for parts of Coladoir Bog on Mull (Lindsay *et al.* 1983) and in mires on the Outer Hebrides (Goode & Lindsay 1979; Hulme 1985).

Distribution

Entirely restricted to the west coast, this type characterises the Sutherland peatlands west of the Moine Thrust. It is a type which could have been expected much more widely through central Sutherland if that geological boundary were not there.

Site type 4: Low-relief northern boreal **blanket bog** (see Figure 54)

General appearance

Found typically on spurs or saddles, this type appears initially similar to low-relief 'western' bog, but on closer inspection it is generally found to have a more 'corrugated' appearance than the western type. This appearance is derived from the more clearly defined orientation of the surface microtopography. It also has more obvious *Sphagnum* and dwarf shrub layers than the western type. It frequently contains extremely soft quaking mire.

Surface microtopes

The dominant elements are T2 and Tl ridge, with Al hollows. These combine to form a surface topography which is not as smooth as the more western type, being distinctly raised into a series of corrugations which generally reach T2 level. Higher T3 hummocks are scattered through this, and in places the corrugations give way to pools of A2 or A3 free water.

Vegetation

Far more strikingly dominated by *Sphagnum* than the western type, the general communities comprise various dwarf shrub *Sphagnum* communities, including frequent *S. imbricatum* types. The characteristic vegetation, however, is *Sphagnum-Betula nana-Arctostaphylos uva-ursi,* which is common on both T1 and T2 ridges growing through the soft *Sphagnum* sward. This and the abundance of *S. papillosum* make it unique to Caithness and Sutherland as a blanket bog community. Also within the vegetation mosaic is the typical *S. cuspidatum*

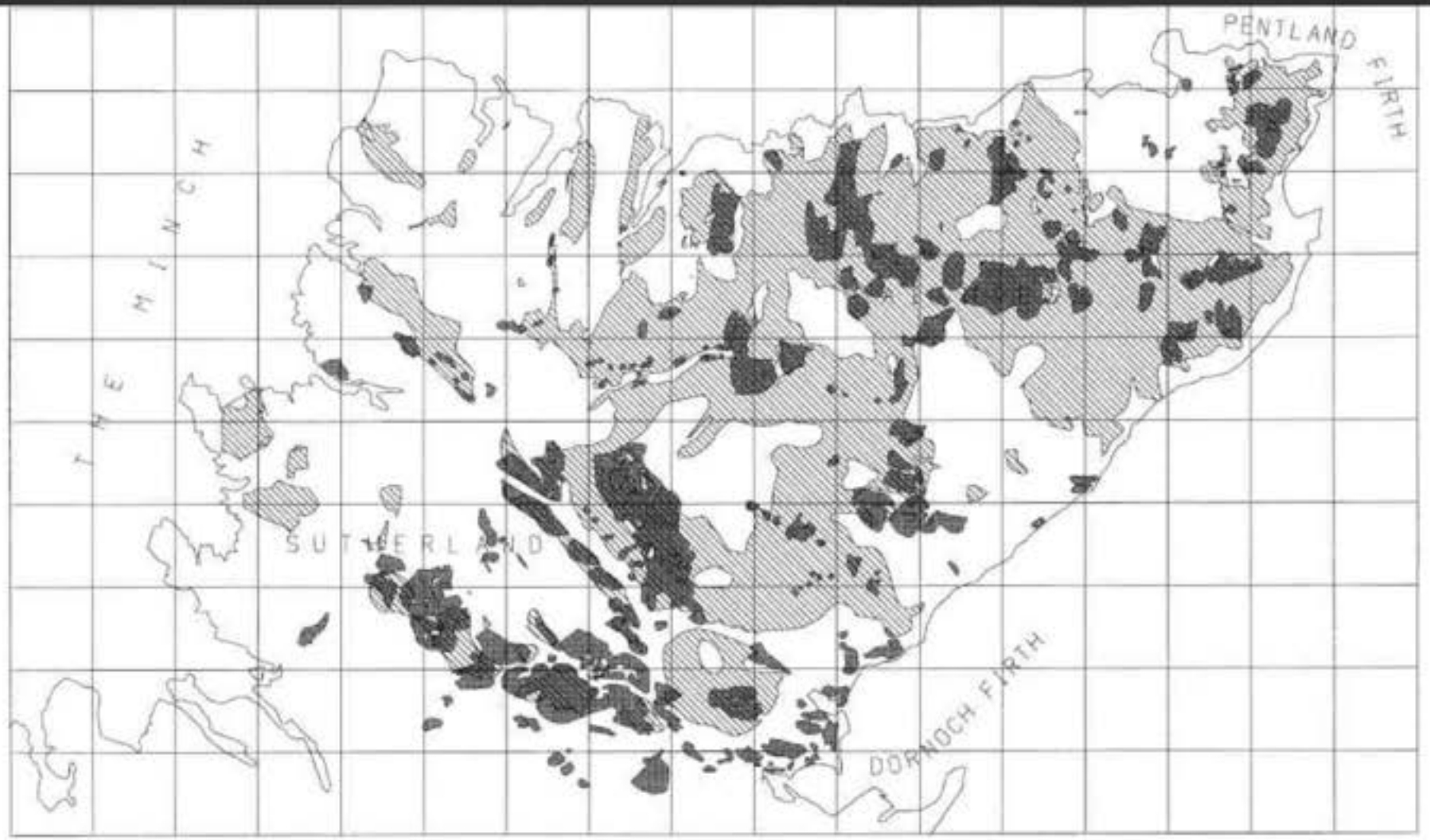


Figure 86 Total recommended area for nature conservation, on the basis of "key" peatland systems and ornithological and freshwater interests, within the "plantable" zone. Land classed as "unplantable" by the Forestry Commission has been excluded. Land already afforested or programmed for planting is shown by dark shading. Freshwater catchments lying entirely off the peat are not shown.

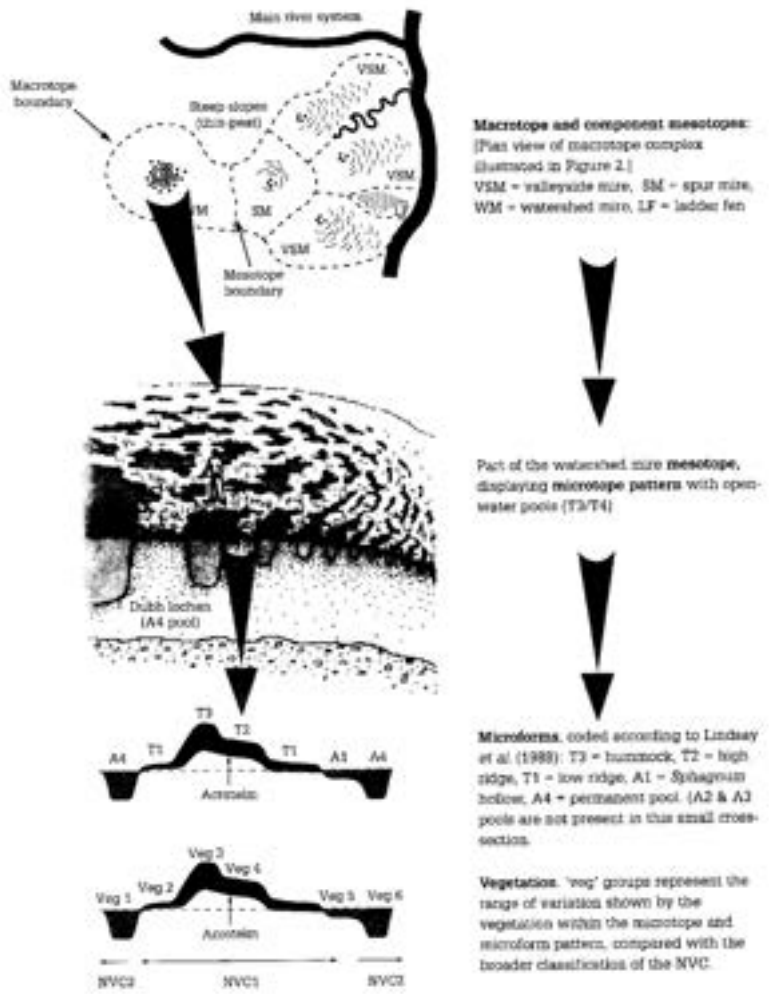


Figure 4 The hierarchy of features used to classify bog systems. Terms are derived from Ivanov (1981) but are described in the accompanying text.

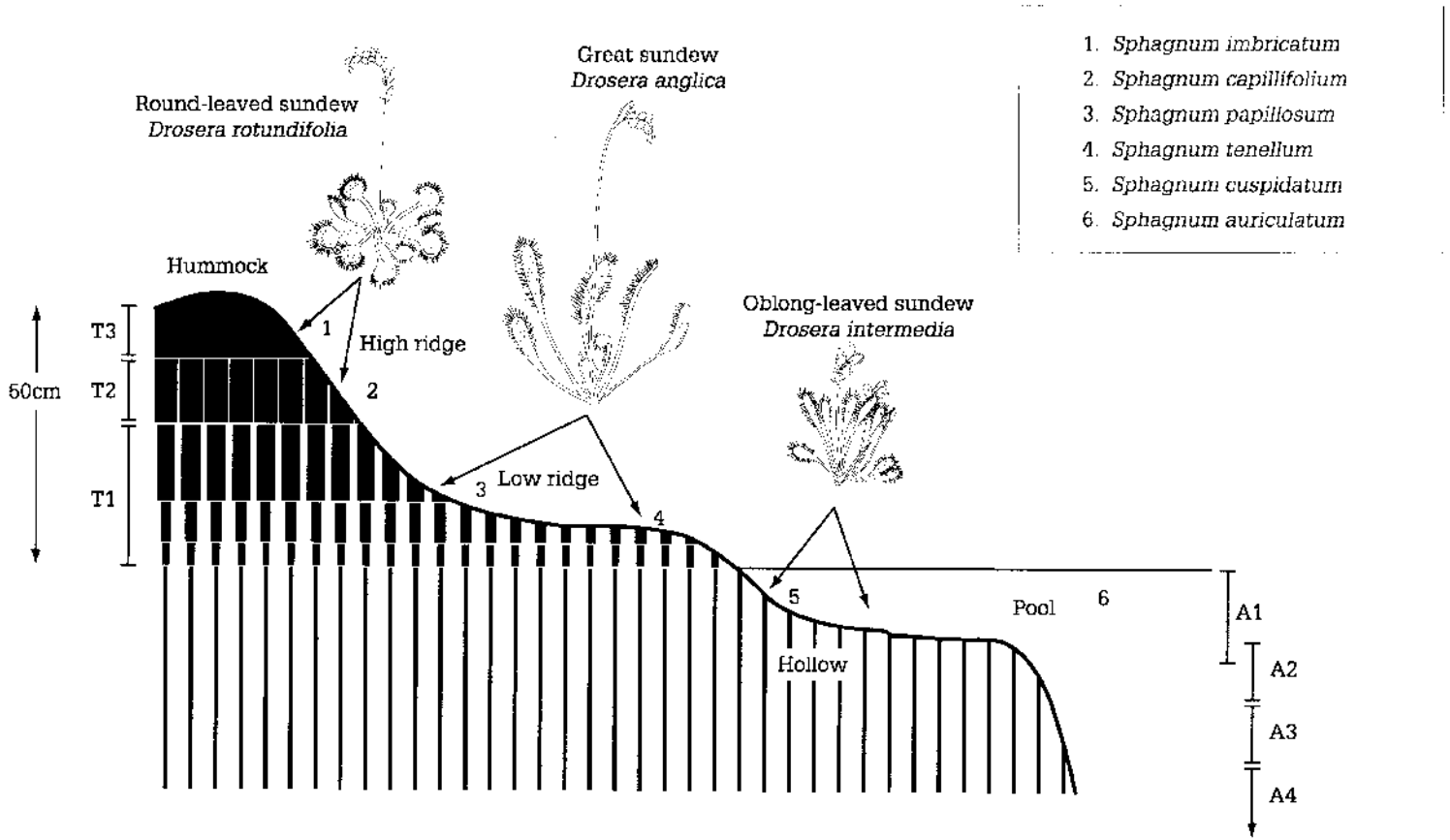


Figure 5 Generalised distribution of structural features (microforms) and the typical distribution of species within the pattern. All natural bogs have some form of pattern, at least across their mire expanse, although in some sites the pattern may consist only of T3 hummocks alternating with T2 high-ridge. Many sites towards the southern and eastern limits of the present bog distribution in Britain have no aquatic (A) zones and consist only of terrestrial (T) zones. (Taken from Lindsay *et al.* 1988)

Table 3 Mire microforms

Terrestrial (T) zones

(T1) Low ridge ("lawn": Sjörs 1948) - common on mire areas which are free from damage; 1-10 cm above the mean water table; generally the richest zone for characteristic mire species.

(T2) High ridge - the general level of many mire surfaces, particularly outside pool systems; 10-20 cm above the mean water table.

(T3) Hummock - normally the highest element in the pattern and always bryophytic-formed; 20 cm to 1 m above the mean water table.

(T4) Peat hag - associated with erosion; 1-2 m above the mean water table.

(T5) Peat mound - occurs only in Shetland, Caithness, Sutherland and the Outer Hebrides; 1-3 m above the water table and possibly linked to incipient 'palsa' form, though the origins are as yet obscure.

Aquatic (A) zones

(A1) *Sphagnum* hollow ("carpet": Sjörs 1948) - a true hollow (i.e. aquatic phase) of dense *Sphagnum cuspidatum*; 0-10 cm below the mean water table.

(A2) Mud-bottom hollow (Sjörs 1948) - a hollow dominated by a relatively solid bare peat base, but with some aquatic *Sphagnum*; 5-20 cm below the mean water table; not recorded from eastern Britain (including Caithness).

(A3) Drought-sensitive pool (Lindsay *et al.* 1988) - an area of open water with an unconsolidated peat base which remains flooded for much of the time but in drought conditions will dry up; 20-50 cm below the mean water table.

(A4) Permanent pool (Lindsay *et al.* 1988) ("summer pool": Tuhkriy 1984) - an area of open water which is sufficiently deep to remain flooded even during extreme drought; 1-4 m deep; restricted to north-west Strathclyde, Tayside and regions north of them.

(TA2) Erosion gullies, resembling mud-bottom hollows but with flowing water.

These surface features are arranged into patterned areas in various combinations (see Figure 5). The range of surface patterns contributes significantly to variability within and between sites. **This range should therefore be represented in the selection process**. The distribution and abundance of particular levels or zones in areas of patterning provide one level of selection, but in addition the form and orientation taken up by the patterns are an important factor. Lindsay *et al.* (1985) indicated in general terms the geographical variation displayed by these patterns across Britain. A site may, for example, consist purely of low ridge (T1) and high ridge (T2) without any true aquatic phase. Increasing wetness of climate gives rise to patterned areas of increasing complexity. In the driest areas of bog formation in Britain the aquatic phase, if it exists at all, tends to form small unaligned hollows (A1/A2), but with increasing wetness these hollows become markedly linear. Open water hollows (A3) demonstrate extreme linear patterning towards the north and west of Scotland, whilst open-water pools (A4) are characteristically rounded, formed on the top of watersheds and restricted to the most northerly oceanic areas of Britain.

Erosion patterns and features can also be important characters in comparisons of mire mesotopes and macrotopes. The most obvious features are the deep erosion gullies and hags typical of many plateau and watershed sites. Further north, erosion features include empty pools, leaving exposed beds of peat or even bedrock. Deep gully erosion is a well-known feature of peat in the Pennines, with gullies attaining depths of 2-3 m. However, if an erosion complex forms only in the surface skin of peat comprising the top few centimetres, both the gullies and the hags tend to be extremely small, with hags no more than 20-25 cm high and with diameters of 10-30 cm, surrounded by a network of interconnecting shallow channels. This is not intense erosion, as many channels support a wet matrix of *Sphagnum* and peat; nor, however, is it completely intact mire. The term 'microbroken' has been coined to classify this particularly abundant mire feature. On aerial photographs the mire surface appears to be dimpled or covered with a dense mass of rounded papillae, rather than with the dramatic linear patterns or heavy reticulate networks associated with hag and gully erosion. This stage may later develop into more serious gullying or sheet erosion.

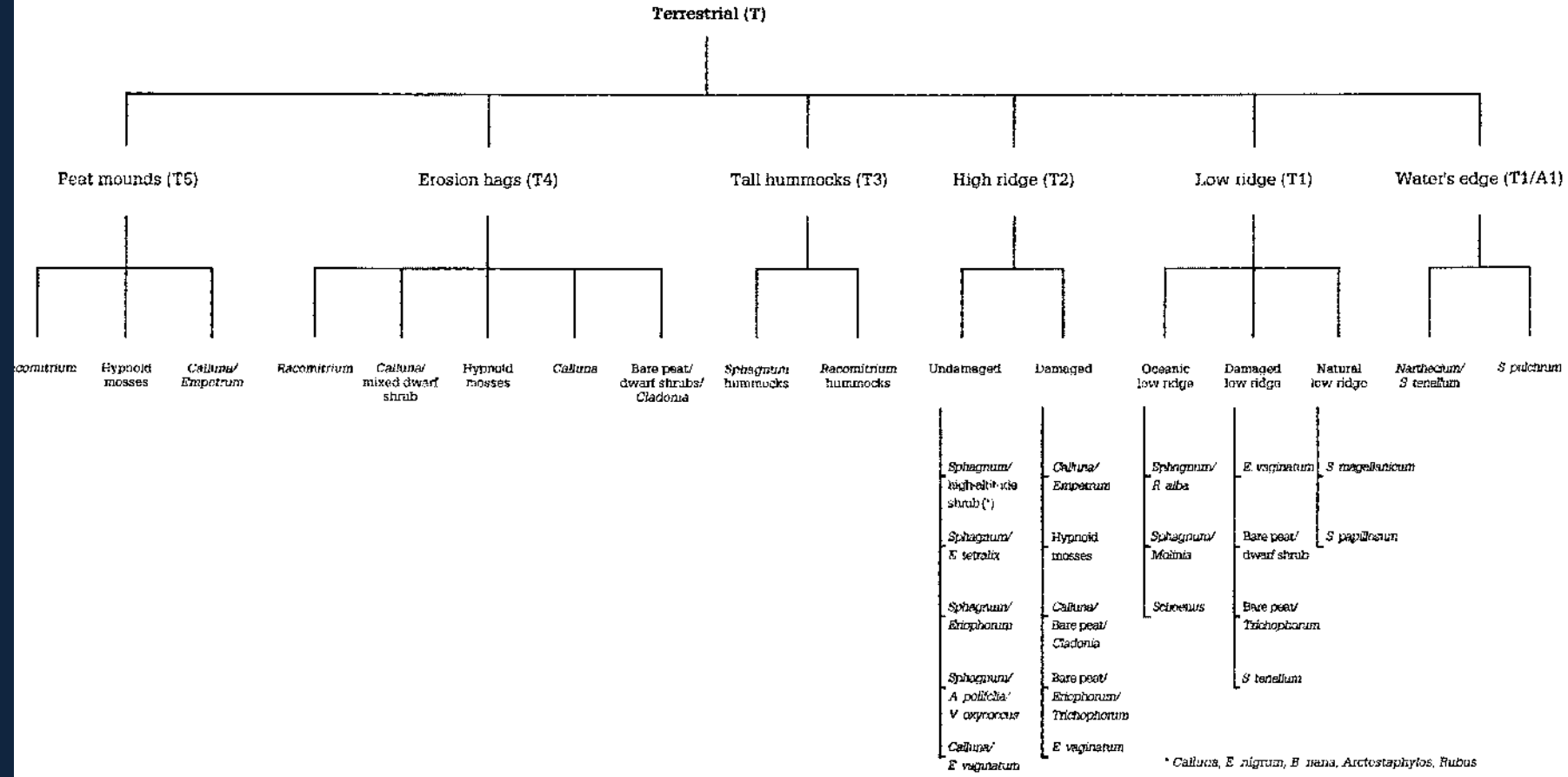


Figure 3(a) Hierarchy of microtope and vegetation stands - Terrestrial. Vegetation stands refer to species constants, though often they are also dominants. In general, these are visually distinct, sometimes striking, stands although obvious cases of co-dominant mixtures also occur (see also Lindsay *et al.* 1985, Lindsay *et al.* 1988). The broad abundance of each stand within each distinct area of pattern type (microtope) should be recorded for comparative evaluation. The list is not comprehensive and other types may be encountered. Work to harmonise the vegetation stands with those used widely in Europe is currently on-going.

Towards ecosystem-based restoration of peatland biodiversity

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SUMMARY

Natural peatlands support rich biological diversity at the genetic, species, ecosystem and landscape levels. However, because the character of this diversity differs from that of other ecosystem types, the value of peatlands for biodiversity has often been overlooked. Fundamentally, this arises because peatland ecosystems direct part of the energy captured by primary production into long-term storage within a peat layer, and thus establish a structural and functional basis for biodiversity maintenance that is not found elsewhere. This article examines the far-reaching implications for the assessment of peatland biodiversity as well as for the drivers, methods and targets of peatland conservation and restoration initiatives. It becomes clear that a robust framework for the management and restoration of peatland biodiversity must be founded in structural-functional ecosystem analysis, and such a framework is developed. The authors draw on a broad base of

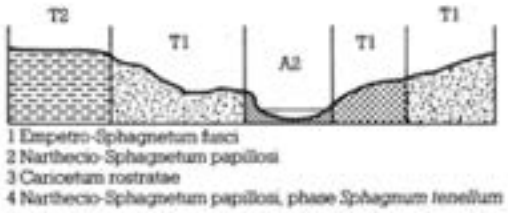
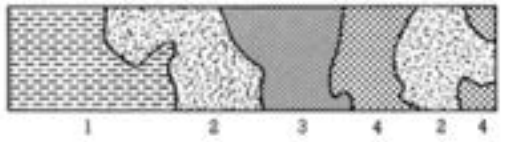
The landscape		Description	Vegetation unit	Scale (m^2)
	Macrotope	The mire complex (or system; several merged mire massifs)	Biogeographic zone	10^5–10^9
	Mesotope	The mire massif (separate raised bog, fen, *etc.*)	Mire massif type	10^2–10^7
	Microtope	Homogeneous element of landscape heterogeneity within the mire massif (hummock-hollow complex, margin, sedge mat, *Sphagnum* carpet)	Complex of phytocoenoses	10^2–10^6
	Microform (nanotope)	Hummock, hollow, pool, ridge	Phytocoenosis	10^{-1}–10^1
	Vegetation mosaic	Microcoenosis, tussock, *etc.*	Microcoenosis	10^{-2}–10^{-1}

Figure 3. The elements of hierarchical mire classification (after Masing 1974 and Lindsay *et al.* 1988).

Common Standards Monitoring Guidance

for

Upland habitats

Version July 2009

Updated from (June 2008)

JOINT NATURE CONSERVATION COMMITTEE

ISSN 1743-8160 (online)

14.6 Interest feature: Blanket bog and valley bog (upland)

Includes the following NVC types: M1 *Sphagnum auriculatum* bog pool community, M2 *Sphagnum cuspidatum / recurvum* bog pool community, M3 *Eriophorum angustifolium* bog pool community, M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire, M18 *Erica tetralix – Sphagnum papillosum* raised and blanket mire, M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire, M20 *Eriophorum vaginatum* blanket and raised mire, M21 *Narthecium ossifragum – Sphagnum papillosum* valley mire. Some of these types may also occur on lowland raised bogs and valley mires, which are covered by the Lowland wetland guidance.

The above communities can be heavily influenced by management, notably burning and grazing, leading to degradation and replacement by the following communities: H9 *Calluna vulgaris – Deschampsia flexuosa* heath, H12 *Calluna vulgaris – Vaccinium myrtilus* heath, M15 *Scirpus cespitosus – Erica tetralix* wet heath, M16 *Erica tetralix – Sphagnum compactum* wet heath, M25 *Molinia caerulea – Potentilla erecta* mire, U6 *Juncus squarrosus – Festuca ovina* grassland. See below on how to assess the condition of these communities.

Includes the Annex I types: Blanket bogs (H7130), Depressions on peat substrates of the Rhynchosporion (H7150).

Reporting category: Bogs

General notes and qualifications:

- **Where blanket bog communities are being replaced by either degraded mire communities (M15, M16, M25), drier heath communities (H8, H12) or grassland type U6, and where restoration back to blanket bog is considered to be feasible, then the degraded communities should be assessed using the attributes and targets ascribed to blanket bog.**
- Rhynchosporion: given the intimate relationship between blanket bog and the Rhynchosporion, with the latter typically occurring as a minor component of the former, no specific guidance has been developed for Rhynchosporion in a blanket bog setting. It should be assumed to reflect the condition of the surrounding blanket bog. Guidance for the assessment of Rhynchosporion in a lowland setting is given in the Lowland Wetland Guidance.
- When assessing frequency or cover within the vegetation, exclude all bare rock and recently burned ground from the assessment. Recently burned areas can be recognised by the presence of loose charcoal on partially burnt stems that easily produces black marks on fingers and clothes (it takes two to three years for charcoal to be weathered from stems).

Mandatory attributes	Targets	Method of assessment / Comments
Feature extent (see Section 7 for further guidance).	(1) There should be no measurable decline in the area of the feature.	Field comparison with baseline map of feature, or occurrence of feature at points on a systematic sample grid, or recording of location and number of individual patches if the feature is fragmented into very small patches (the last may be all that is practical for Rhynchosporion hollows).
Vegetation composition — frequency of indicator species.	(1) At least 6 indicator species should be present (Table 1). **Qualifiers:** In blanket bog, *Sphagnum fallax (S. recurvum*	Target (1) assessed against visual estimate at 4 m^2 scale. Score each *Sphagnum* sp separately.

Mandatory attributes	Targets	Method of assessment / Comments
		* Disturbed bare ground is where a substrate of bare humus, bare peat, bare mineral soil, bare gravel, or soil covered only by an algal mat, has its surface broken and imprinted by hoof marks, wallows, human foot prints, or vehicle and machinery tracks. The emphasis is on 'disturbed' rather than 'bare'. † Drainage should be considered active if it has altered, or is likely to alter, or remove, the original vegetation, and facilitate the removal of of water from the site. It is typically evident in blanket bog as a band of enhanced heather growth either side of a moorgrip. Target (2) assessed against visual estimate at 4 m^2 scale.

Table 1. Indicator Species

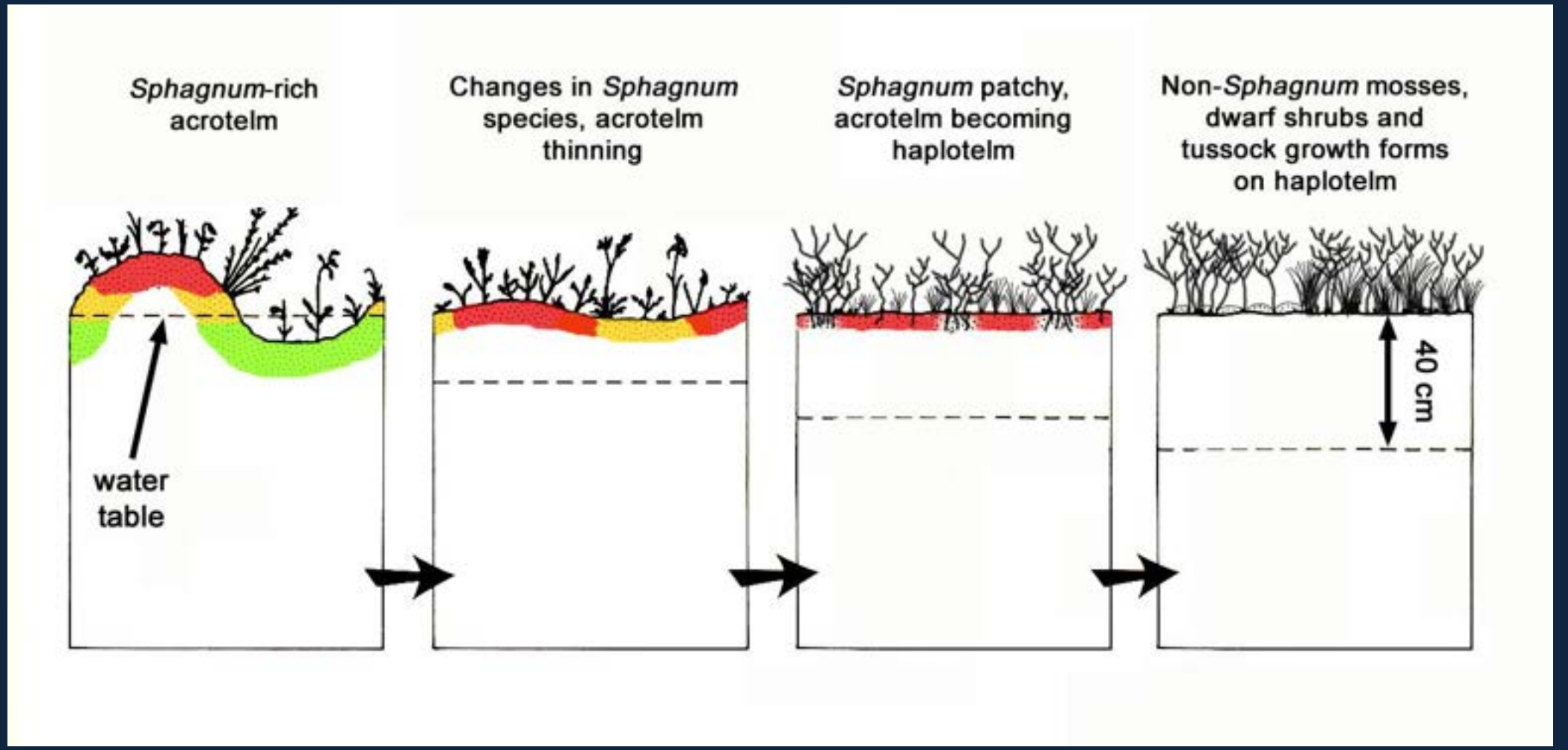
Andromeda polifolia	*Cornus suecica*	*Eriophorum vaginatum*	Non-crustose lichens	*Sphagnum* spp.
Arctostaphylos spp	*Drosera* spp.	*Menyanthes trifoliata*	*Pleurocarpous* mosses	*Trichophorum cespitosum*
Betula nana	*Erica* spp.	*Myrica gale*	*Racomitrium lanuginosum*	*Vaccinium* spp.
Carex bigelowii	*Empetrum nigrum*	*Narthecium ossifragum*	*Rubus chamaemorus*	
Calluna vulgaris	*Eriophorum angustifolium*		*Rhynchospora alba*	

Table 2. Areas very sensitive to disturbance

(a) Slopes greater than 1 in 3 (18°), and all the sides of gullies.
(b) Ground with abundant and/or an almost continuous carpet of *Sphagnum*, other mosses, liverworts and/or lichens.
(c) Areas with noticeably uneven structure, at a spatial scale of around 1 m^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. The surface of the vegetation canopy, including moss dominated areas will not be uniform and some parts should be at least 20 cm higher than other parts.
(d) Pools, wet hollows, haggs and erosion gullies, and within 5 – 10 metres of the edge of watercourses.

Favourable Conservation Status

…all the structure and function necessary for the long-term maintenance of the interest is in place and likely to remain in place for the foreseeable future.


Sphagnum-rich acrotelm
Changes in *Sphagnum* species, acrotelm thinning
Sphagnum patchy, acrotelm becoming haplotelm
Non-*Sphagnum* mosses, dwarf shrubs and tussock growth forms on haplotelm
water table
40 cm

IUCN UK Committee Peatland Programme Briefing Note No. 1

IUCN UK Committee Peatland Programme
Briefing Note N°1

Peat Bog Ecosystems: Key Def

Bogs are particular types of
This contrasts

IUCN UK Committee Peatland Programme
Briefing Note N° 2

Peat Bog Ecosystems: Structure, Form, State and Condition

Actively-growing bogs are wetlands which consist of two laye
layer of peat-forming vegetation (the *acrotelm*), generally between 1
the relatively inert, permanently-waterlogged peat store (the *catot*
metres deep. A peat bog can thus be thought of as a tree, muc
dimension. The acrotelm represents the thin canopy consist
catotelm represents the branches and trunk of the tree. The an
a tree the water travels upwards through the trunk to the leaves
from the living canopy downwards into the trunk of the catote
material which then forms peat in the catotelm, much as
photosynthesis to create the trunk and branches of a tree.
accumulate peat, or control water loss from the catotelm, ju
canopy of leaves. In a fully functioning natural bog only
catotelm peat beneath is normally shielded from view by
forest canopy is visible when forests are viewed from abo

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IUCN UK Committee Peatland Programme Briefing Note No. 3

IUCN UK Committee Peatland Programme
Briefing Note N° 3

Impacts of Artificial Drainage on Peatlands

Two common misconceptions are associated with artificial drainage of p
that drainage impacts are largely confined to drain margins. In fact they
much wider area – in some cases, across the whole bog. The second
the bog water table should be the main focus of attention when studying th
Although it is important to measure the water table, the value of such data
surface subsidence is not also measured. In the long term, surface subside
water table is likely to show the greater drainage effect.

A peat bog is a wetland in which the peat soil is likely to have a **moisture co**
than 95% in the undisturbed state – "there are more solids in milk than in pea
also often have areas of standing surface water. This water-logging is what cre
and allows it to function. Consequently drainage is generally regarded as th
stage of activity to convert the peatland for exploitation and is thus one of the
forms of human impact on peat bog ecosystems. Often the
however, disappointing because the anticipated drain
limited in their extent. Peat just a metre or
moisture content by weight. The

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Research article

Surface structure on abandoned upland blanket peatland tracks

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ABSTRACT

Temporary permissions are often granted for track use on peatlands. However, even when peatland track designs attempt to minimise environmental impacts via use of mesh systems, such linear disturbances may have

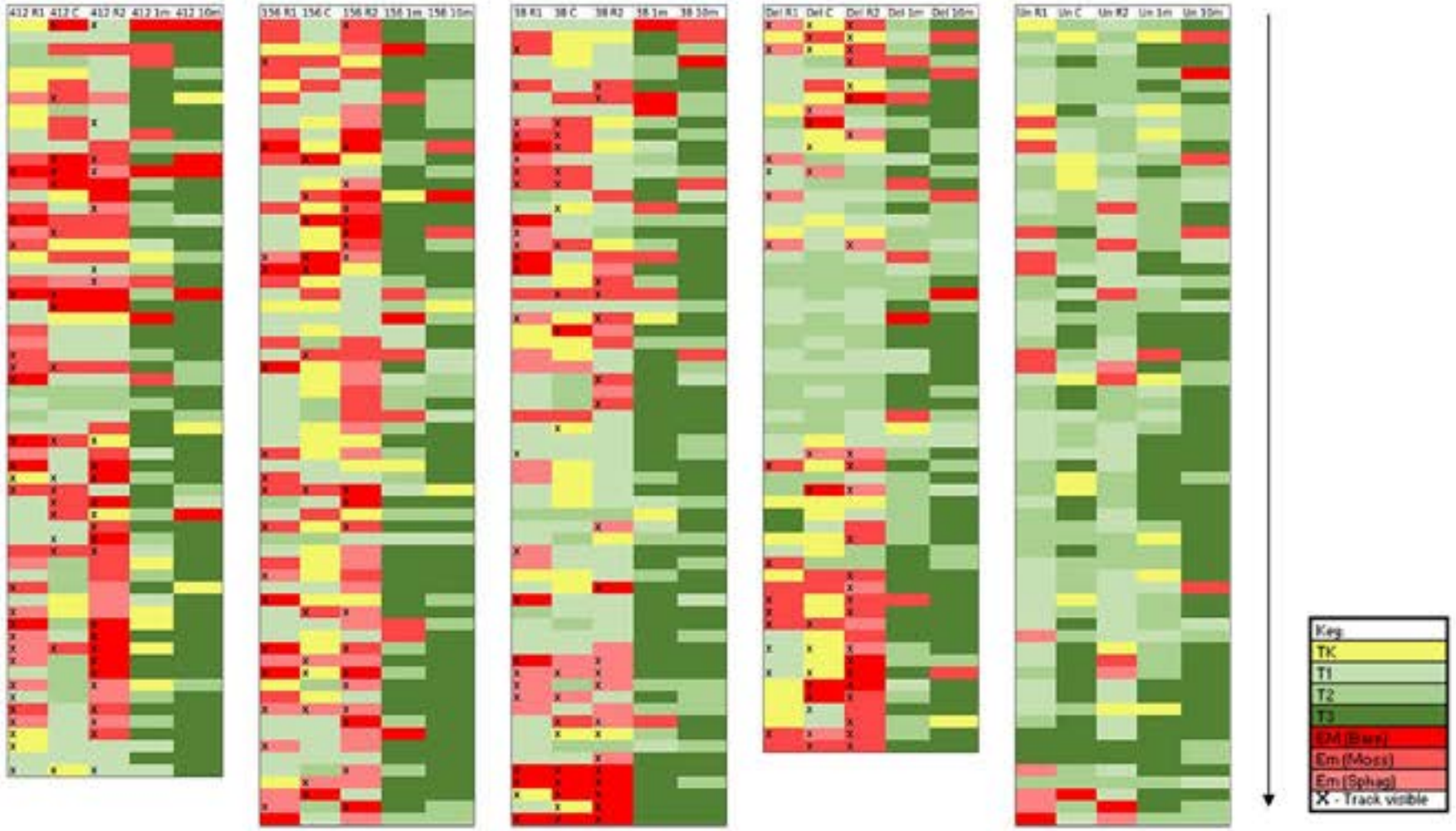

Fig. 3. Schematic maps showing nanotope types identified at each survey point; Rut 1 (R1), Centre (C), Rut 2 (R2) along abandoned track sections and 1 m and 10 m transects. From L–R: 412 passes (PWEEK_AH), 156 passes (PWEEK), 38 passes (PMONTH), 76 passes with delayed driving start (PDELAYED) and 24 passes with no surface mesh (UNSURFACED), from top to bottom of slope (arrow). Key code descriptions are provided in Table 2.

Mire pattern no: Site:			Peat depth	Date	Time (to link photos)	Recorder	Notes:					
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/Empetrum	Racomitrium	Cladonia/bare peat		Collapse features	Extensive bare peat			
T4 (erosion complex hagg top) (50 cm+)		Sphagnum mosses		Hypnoid mosses	Mixed dwarf shrub/ hypnoid moss	Calluna/hypnoid moss cover	Racomitrium	Mixed dwarf shrubs/ no moss	Calluna/ no moss	Bare peat/ lichens		
						Molinia/hypnoid moss cover	Racomitrium/Molinia		Bare peat/dwarf shrubs	Molinia/ bare peat		
T3 (hummock) (30 cm-50 cm)		Sphagnum		Racomitrium (in far W Scotland)		Hypnoid mosses	Polytrichum commune	Racomitrium (elsewhere)	Lichens dominant	Bare peat		
		Sphagnum fuscum	Sphagnum papillosum	Sphagnum austini [imbricatum]	Sphagnum capillifolium	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Leucobryum	Short mosses/bare peat	Dwarf shrubs/ no moss		
		Sphagnum magellanicum	Sphagnum/ Eriophorum	Sphagnum/ Molinia	Dwarf shrubs over Sphagnum	Dwarf shrubs/ 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	Trichophorum cespitosum		
							Trichophorum with some Sphagnum	Deschampsia flexuosa				
T2 (high ridge) (15 cm-30 cm)		Sphagnum				Hypnoid mosses	Eriophorum vaginatum	Dwarf shrubs/ no moss	Lichens dominant	Bare peat		
		Sphagnum/ Rubus chamaemorus	Sphagnum/Erica tetralix	Sphagnum magellanicum	Sphagnum/ Eriophorum	Calluna with some Sphagnum	Dwarf shrubs/ hypnoid mosses	Eriophorum vaginatum/ no moss	Bare peat/ dwarf shrubs			
		Sphagnum papillosum	Sphagnum capillifolium	Sphagnum/ Molinia	Sphagnum/ dwarf shrubs	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Sphagnum compactum	Bare peat/ Trichophorum			
		Sphagnum fuscum	Sphagnum austini [imbricatum]									
		Sphagnum (not S. fallax)				Hypnoid	Eriophorum	Dwarf shrubs/	Lichens			

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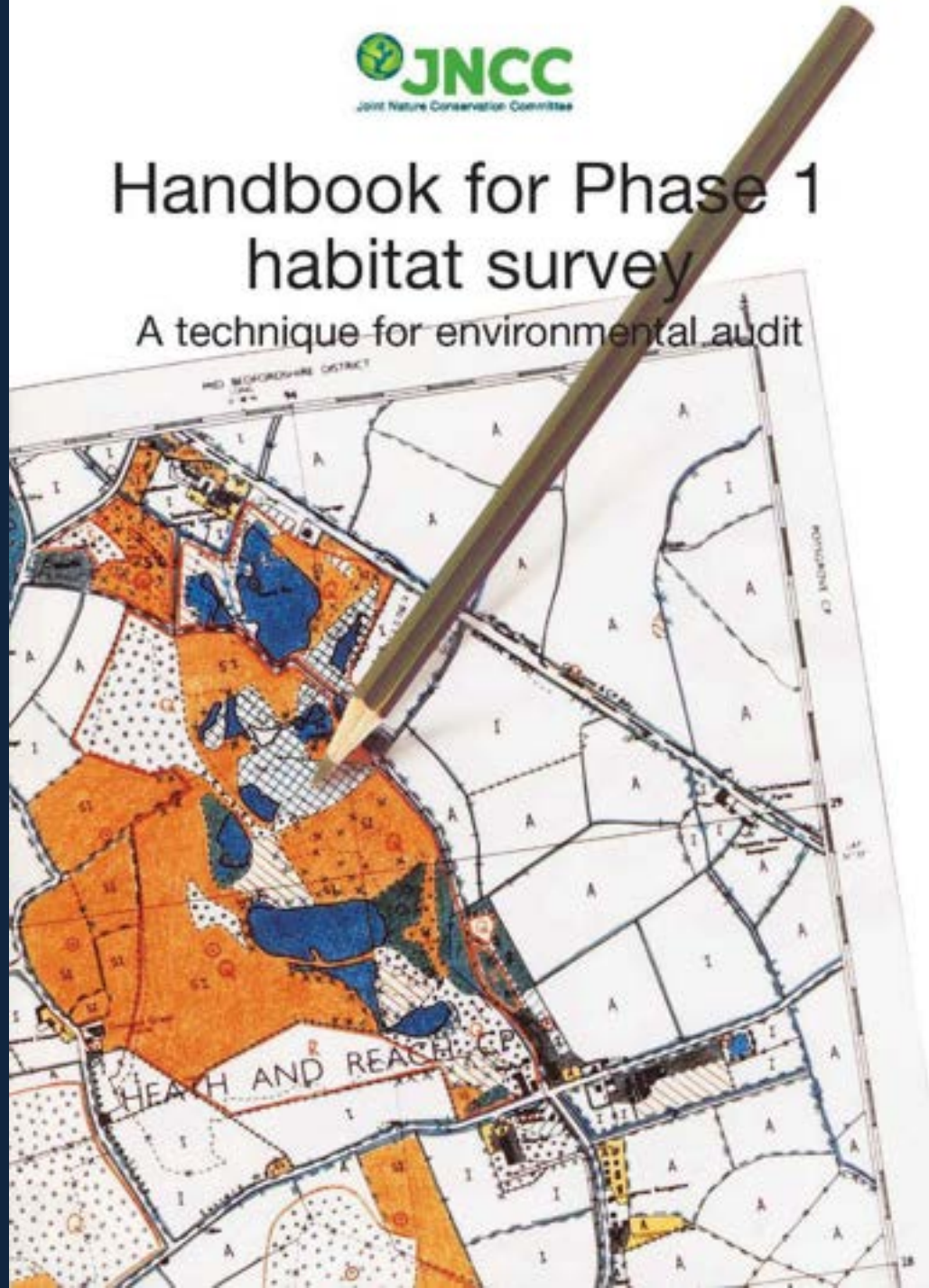
Handbook for Phase 1 habitat survey

A technique for environmental audit



MLURI

THE LAND COVER OF SCOTLAND 1988

FINAL REPORT

THE MACAULAY LAND USE RESEARCH INSTITUTE
CRAIGIEBUCKLER ABERDEEN AB9 2QJ

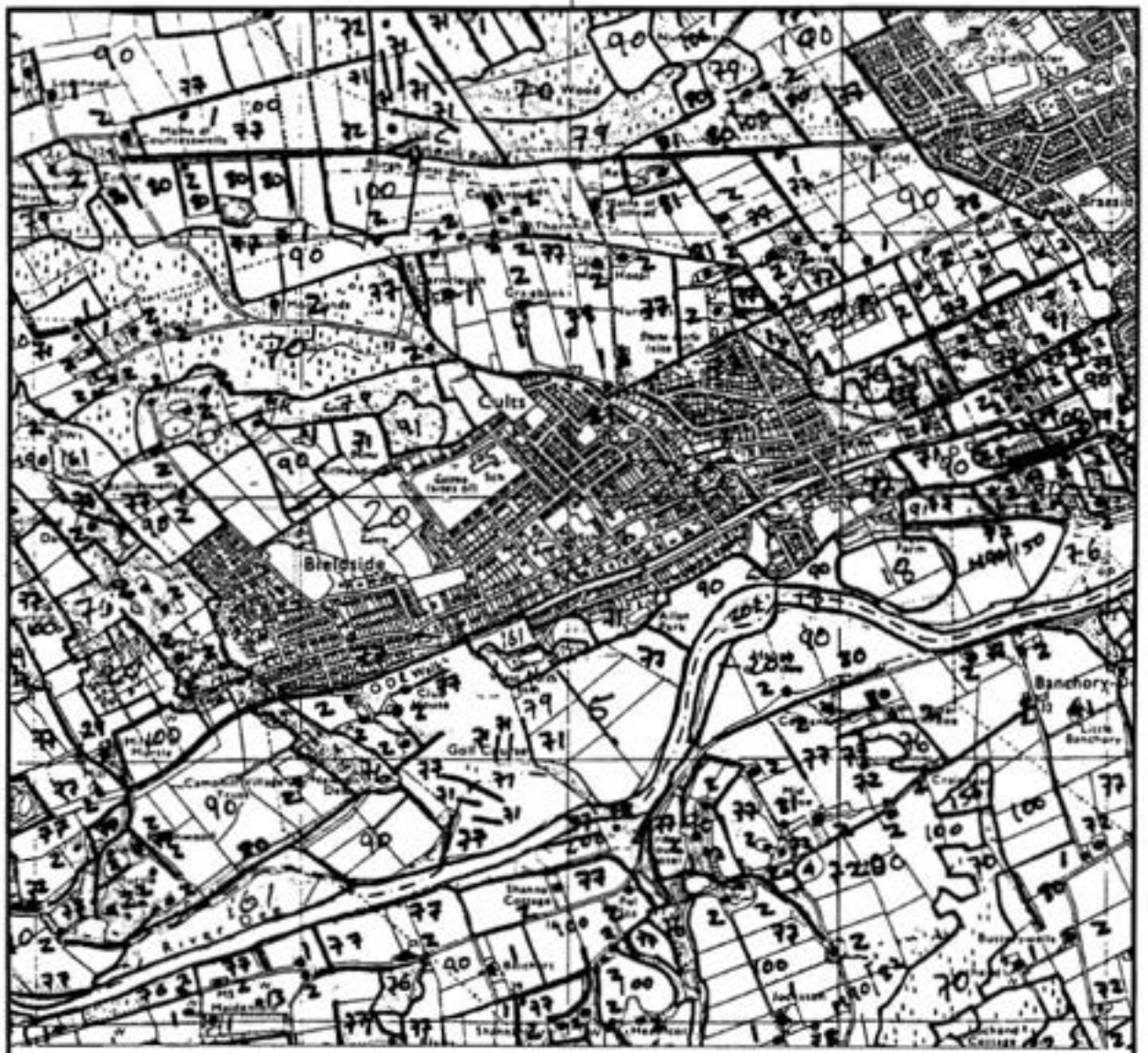


Figure 4.3 Example of base map with superimposed land cover information; area shown is to the west of Aberdeen

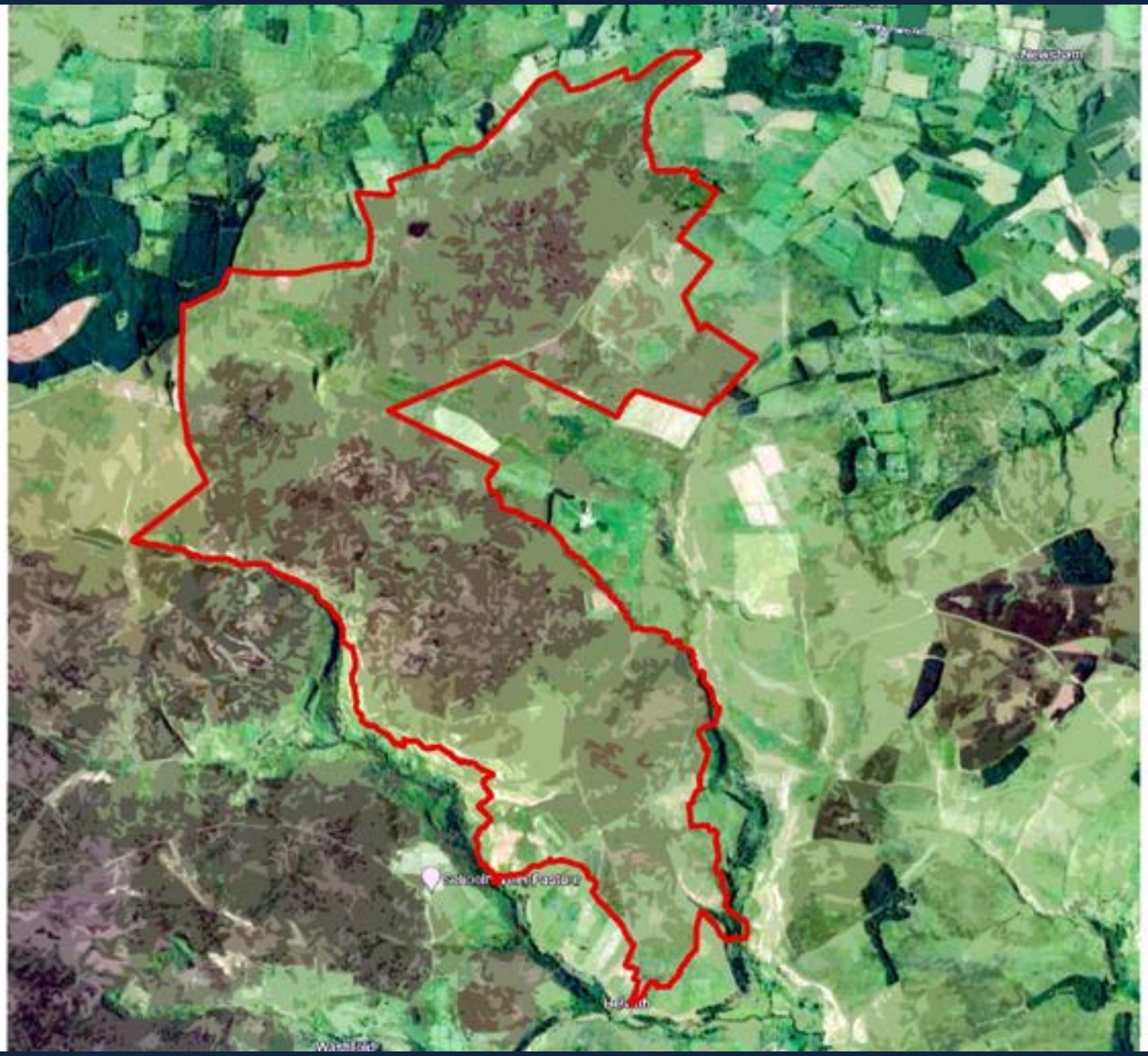
Open-source free software for image segmentation and labeling

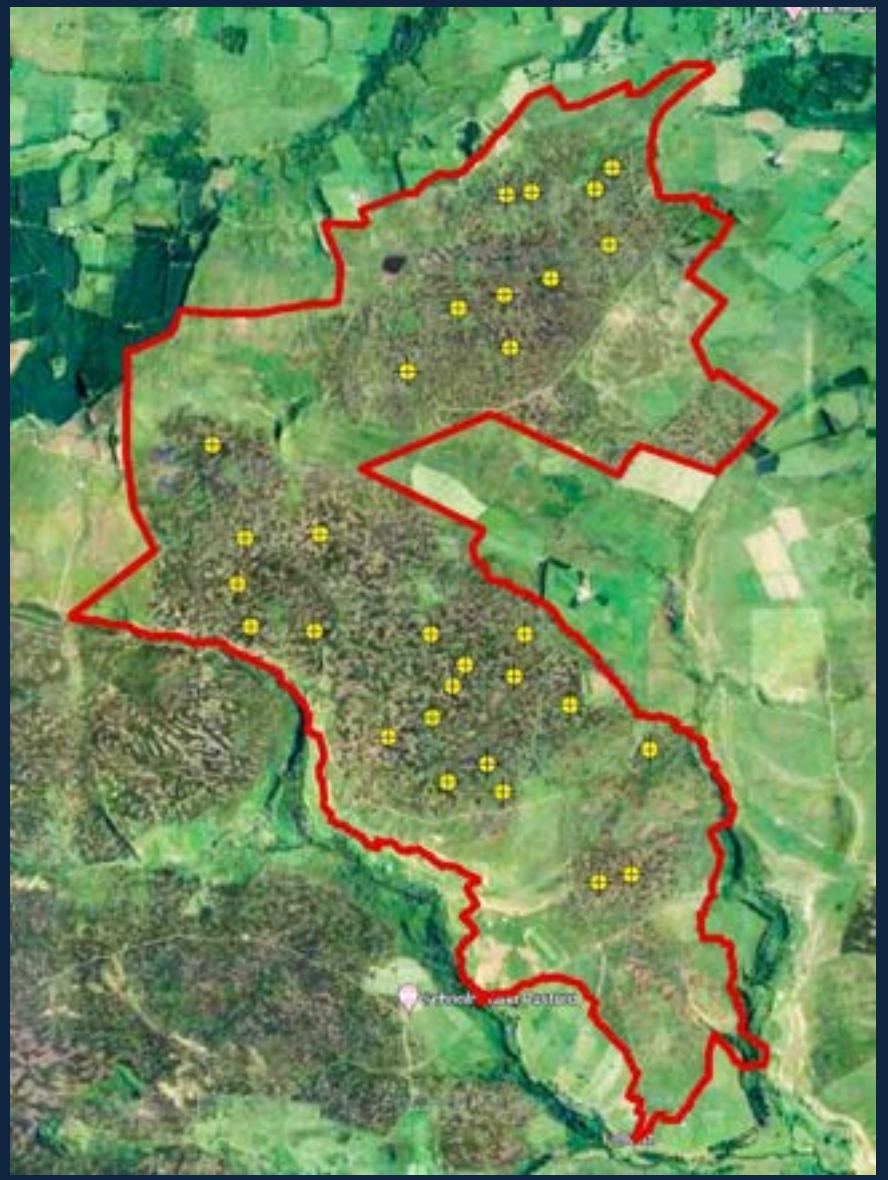
foo bar · Follow
4 min read · Feb 11, 2021

You can make your own segmentation and/or labeling tool. I have my own


Snake Pass Summit
A57
Snake Rd
Snake Rd
Snake Rd
A57
Featherbed Top
Snake Path
River Ashop
River Ashop
River Ashop


Google





Mire pattern no: Site:			Peat depth	Date	Time (to link photos)	Recorder	Notes:					
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/Empetrum	Racomitrium	Cladonia/bare peat		Collapse features	Extensive bare peat			
T4 (erosion complex hagg top) (50 cm+)		Sphagnum mosses		Hypnoid mosses	Mixed dwarf shrub/ hypnoid moss	Calluna/hypnoid moss cover	Racomitrium	Mixed dwarf shrubs/ no moss	Calluna/ no moss	Bare peat/ lichens		
						Molinia/hypnoid moss cover	Racomitrium/Molinia		Bare peat/dwarf shrubs	Molinia/ bare peat		
T3 (hummock) (30 cm-50 cm)		Sphagnum		Racomitrium (in far W Scotland)		Hypnoid mosses	Polytrichum commune	Racomitrium (elsewhere)	Lichens dominant	Bare peat		
		Sphagnum fuscum	Sphagnum papillosum	Sphagnum austini [imbricatum]	Sphagnum capillifolium	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Leucobryum	Short mosses/bare peat	Dwarf shrubs/ no moss		
		Sphagnum magellanicum	Sphagnum/ Eriophorum	Sphagnum/ Molinia	Dwarf shrubs over Sphagnum	Dwarf shrubs/ 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	Trichophorum cespitosum		
							Trichophorum with some Sphagnum	Deschampsia flexuosa				
T2 (high ridge) (15 cm-30 cm)		Sphagnum				Hypnoid mosses	Eriophorum vaginatum	Dwarf shrubs/ no moss	Lichens dominant	Bare peat		
		Sphagnum/ Rubus chamaemorus	Sphagnum/Erica tetralix	Sphagnum magellanicum	Sphagnum/ Eriophorum	Calluna with some Sphagnum	Dwarf shrubs/ hypnoid mosses	Eriophorum vaginatum/ no moss	Bare peat/ dwarf shrubs			
		Sphagnum papillosum	Sphagnum capillifolium	Sphagnum/ Molinia	Sphagnum/ dwarf shrubs	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Sphagnum compactum	Bare peat/ Trichophorum			
		Sphagnum fuscum	Sphagnum austini [imbricatum]									
						Hypnoid	Eriophorum	Dwarf shrubs/	Lichens			

Mire pattern no: Site:		Peat depth	Date	Time (to link photos)	Recorder	Notes:					

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/Empetrum	Racomitrium	Cladonia/bare peat		Collapse features	Extensive bare peat			
T4 (erosion complex hagg top) (50 cm+)		Sphagnum mosses		Hypnoid mosses	Mixed dwarf shrub/ hypnoid moss	Calluna/hypnoid moss cover	Racomitrium	Mixed dwarf shrubs/ no moss	Calluna/ no moss	Bare peat/ lichens		
						Molinia/hypnoid moss cover	Racomitrium/Molinia		Bare peat/dwarf shrubs	Molinia/ bare peat		
T3 (hummock) (30 cm-50 cm)		Sphagnum		Racomitrium (in far W Scotland)		Hypnoid mosses	Polytrichum commune	Racomitrium (elsewhere)	Lichens dominant	Bare peat		
		Sphagnum fuscum	Sphagnum papillosum	Sphagnum austini [imbricatum]	Sphagnum capillifolium	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Leucobryum	Short mosses/bare peat	Dwarf shrubs/ no moss		
		Sphagnum magellanicum	Sphagnum/ Eriophorum	Sphagnum/ Molinia	Dwarf shrubs over Sphagnum	Dwarf shrubs/ 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	Trichophorum cespitosum		
							Trichophorum with some Sphagnum	Deschampsia flexuosa				
T2 (high ridge) (15 cm-30 cm)		Sphagnum				Hypnoid mosses	Eriophorum vaginatum	Dwarf shrubs/ no moss	Lichens dominant	Bare peat		
		Sphagnum/ Rubus chamaemorus	Sphagnum/Erica tetralix	Sphagnum magellanicum	Sphagnum/ Eriophorum	Calluna with some Sphagnum	Dwarf shrubs/ hypnoid mosses	Eriophorum vaginatum/ no moss	Bare peat/ dwarf shrubs			
		Sphagnum papillosum	Sphagnum capillifolium	Sphagnum/ Molinia	Sphagnum/ dwarf shrubs	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Sphagnum compactum	Bare peat/ Trichophorum			
		Sphagnum fuscum	Sphagnum austini [imbricatum]									
		Sphagnum (not S. fallax)				Hypnoid	Eriophorum	Dwarf shrubs/	Lichens			


MOISTURE
METER


1 2 3 4 5 6 7 8 9 10
DRY
MOIST
WET
MOISTURE
METER

Mire pattern no: 16 Site: CORS FOCHNO | Peat depth: 530cm | Date: 05/03/2021 | Recorder: D KREED | Notes:

Zone (relation to w/t)	DFR (321) Freq.	Vegetation types : Terrestrial zones — Relatively 'active', likely to be favourable condition ..... >>				<< Degraded, some recovery... >>		<< ... Degraded, Unfavourable ..... >>			Extra veg types	
T5 (peat mound) found only in far north & west of Scotland (2 m+)		Sphagnum/ dwarf shrubs	Feather mosses	Calluna/Empetrum	Racomitrium	Cladonia/bare peat		Collapse features	Extensive bare peat			
T4 (erosion complex hagg top) (1 m+)		Sphagnum mosses		Hypnoid mosses	Mixed dwarf shrub/ hypnoid moss	Calluna/hypnoid moss cover	Racomitrium	Mixed dwarf shrubs/ no moss	Calluna/ no moss	Bare peat/Cladonia		
						Molinia/hypnoid moss cover	Racomitrium/Molinia		Bare peat/dwarf shrubs	Molinia/bare peat		
T3 (hummock) (30 cm-1 m)	O 10%	Sphagnum		Racomitrium (in far W Scotland)		Hypnoid mosses	Polytrichum commune	Racomitrium (elsewhere)	Lichens dominant 40%	Bare peat		
		Sphagnum fuscum	Sphagnum papillosum	Sphagnum austini [imbricatum]	Sphagnum capillifolium	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Leucobryum	Short mosses/bare peat	Dwarf shrubs/ no moss		
		Sphagnum magellanicum	Sphagnum/ Eriophorum	Sphagnum/ Molinia	Dwarf shrubs over Sphagnum	Dwarf shrubs/ hypnoid mosses 60%		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	Trichophorum cespitosum		
							Trichophorum with some Sphagnum	Deschampsia flexuosa				
T2 (high ridge) (15 cm/30 cm)	A 45%	Sphagnum				Hypnoid mosses	Eriophorum vaginatum	Dwarf shrubs/ no moss	Lichens dominant 30%	Bare peat		
		Sphagnum/ Rubus chamaemorus	Sphagnum/Erica tetralix 5%	Sphagnum magellanicum	Sphagnum/ Eriophorum	Calluna with some Sphagnum	Dwarf shrubs/ hypnoid mosses	Eriophorum vaginatum/ no moss	Bare peat/ dwarf shrubs			
		Sphagnum papillosum	Sphagnum/ Eriophorum	Sphagnum/ Molinia	Sphagnum/ dwarf shrubs 25%	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Sphagnum compactum	Bare peat/ Trichophorum			
		Sphagnum fuscum	Sphagnum austini [imbricatum]	Sphagnum capillifolium								
T1 (low ridge) (1 cm-15 cm) If S. capillifolium is dominant at this level it suggests drying	A 25%					Hypnoid mosses	Eriophorum vaginatum	Dwarf shrubs/ no moss	Lichens dominant	Bare peat		
			Sphagnum magellanicum	Sphagnum/ dwarf shrubs 25%	Campylopus atrovirens (in W Scotland)	Sphagnum capillifolium dominant	Sphagnum tenellum dominant	Dwarf shrubs/ hypnoid mosses	Bare peat/ dwarf shrubs			
		Sphagnum/Erica tetralix 5%	Sphagnum/ Eriophorum 25%	Sphagnum/ Drosera		S. fallax			Bare peat/ Trichophorum			
T1/A1 (0 cm-5 cm) edges of pools/ hollows, or 'runnels'	F 20%	Sphagnum pulchrum	Sphagnum cuspidatum 30%	Aulacomnium palustre	Narthecium ossifragum 25%	Sphagnum fallax		Sphagnum compactum	Bare peat/ Trichophorum	Bare peat		
		Drosera anglica	Rhynchospora 50%									


18
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12
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11
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9
14
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14
4
0
22
0

	Features associated with good condition					Indicators of damage/degradation
	T3 hummock	T2 high ridge	T1 low ridge	T1/A1 terrestrial /aquatic transition	A1 Sphagnum hollow	Tk tussock
ZEG 6	40	62	58	50		
ZEG 10		58	58	63	5	
ZEG 18	32	58	59	33		52

Veg 4

T3 Lichens dominant
T3 Dwarf shrubs/hypnoid mosses
T3 Dwarf shrubs over Sphagnum

T2 Sphagnum/Erica tetralix
T2 Sphagnum/dwarf shrubs

T1 Sphagnum/Erica tetralix
T1 Sphagnum/Eriophorum

T1/A1 Rhynchospora
T1/A1 Sphagnum pulchrum

Veg 6

T2 Sphagnum/Erica tetralix
T2 Sphagnum/dwarf shrubs

T1 Sphagnum/Erica tetralix

T1/A1 Rhynchospora
T1/A1 Sphagnum tenellum

Veg 7

T2 Lichens dominant
T2 Dwarf shrubs/hypnoid mosses

T1 Sphagnum/Erica tetralix
T1 Sphagnum/Eriophorum
T1 Sphagnum/dwarf shrubs

T1/A1 Rhynchospora
T1/A1 Sphagnum tenellum

Tk Trichophorum cespitosum

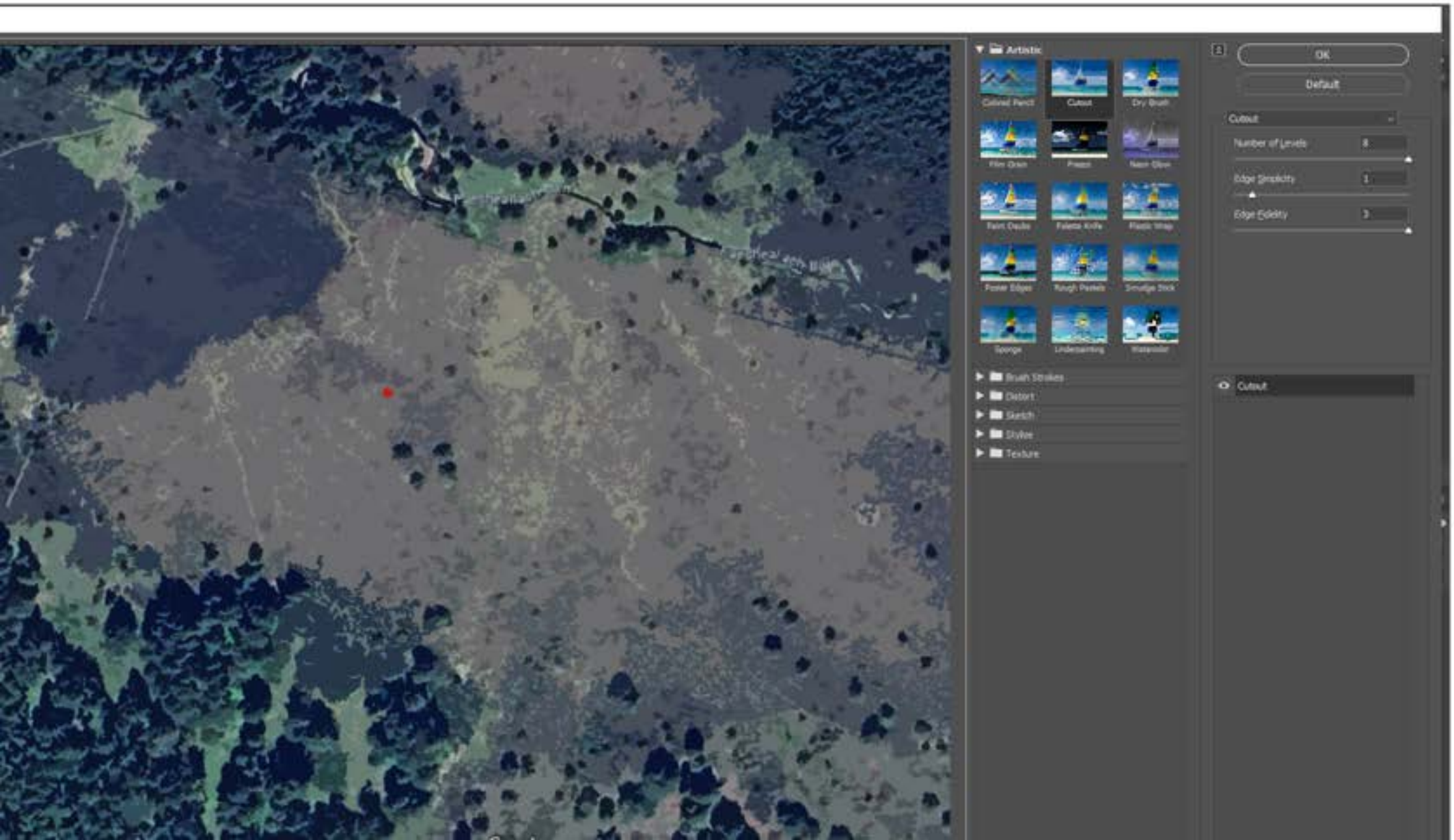
Veg 12

T2 Dwarf shrubs/hypnoid mosses
T2 Calluna with some Sphagnum

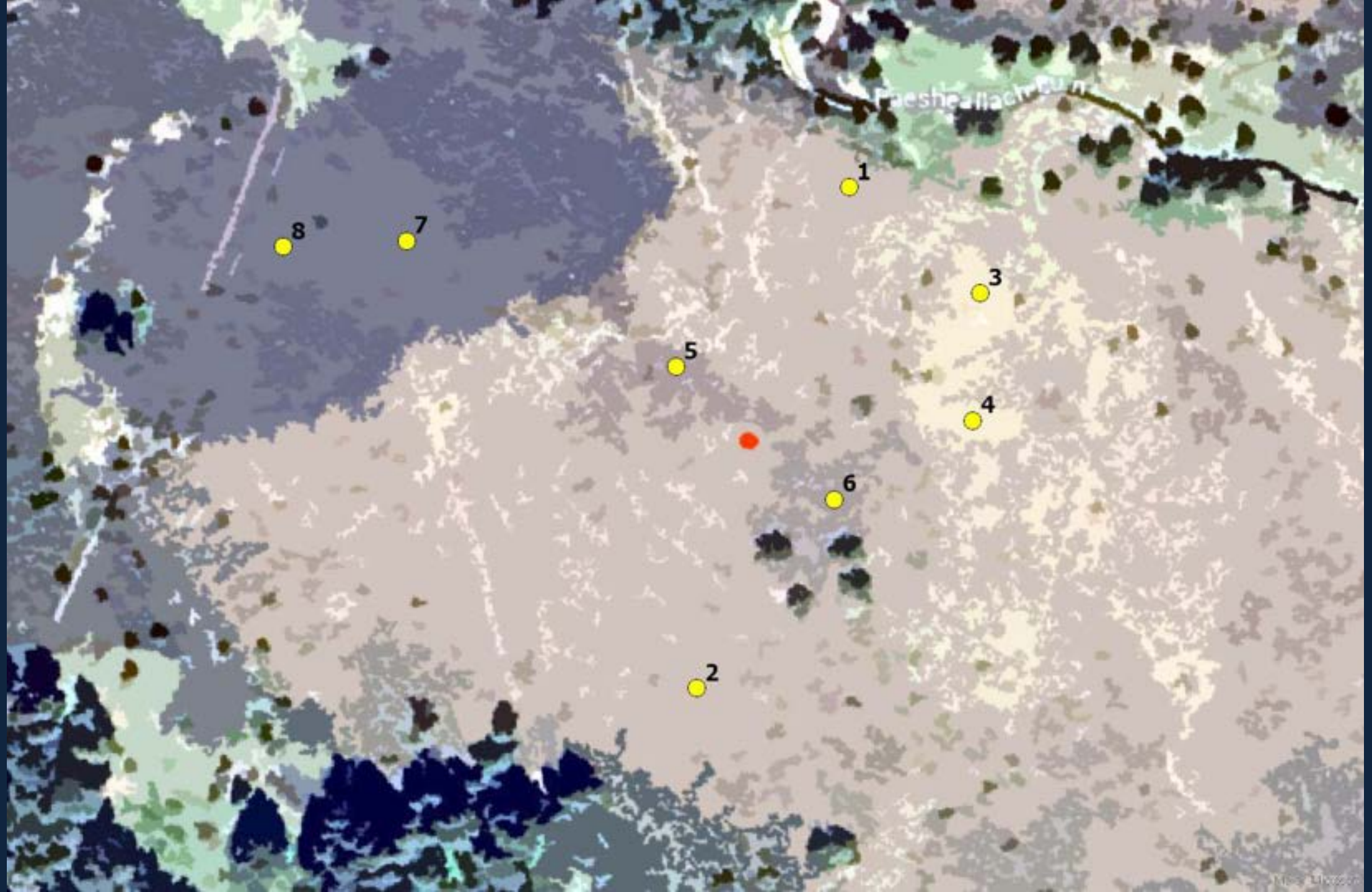
T1 Sphagnum papillosum

Tk Trichophorum cespitosum
Tk Molinia caerulea


Faeshealiach Burn
Faeshealiach Burn
Faeshealiach Burn
Google


Artistic
Colored Pencil
Cutout
Dry Brush
Film Grain
Fresco
Neon Glow
Paint Daubs
Palette Knife
Plastic Wrap
Poster Edges
Rough Pastels
Smudge Stick
Sponge
Underpainting
Watercolor
Brush Strokes
Distort
Sketch
Stylize
Texture
OK
Default
Cutout
Number of Levels
8
Edge Simplicity
1
Edge Fidelity
3
Cutout


Google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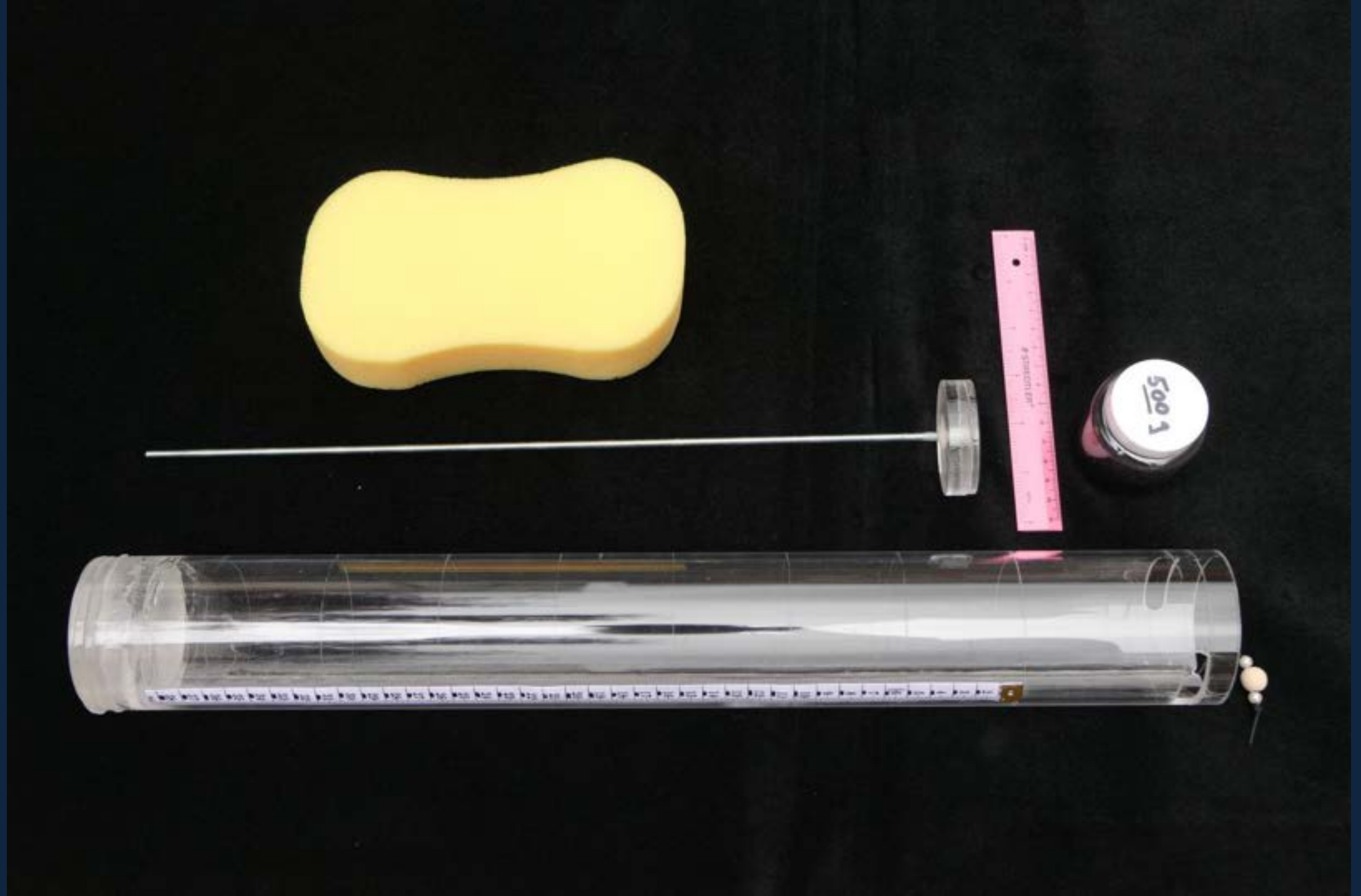
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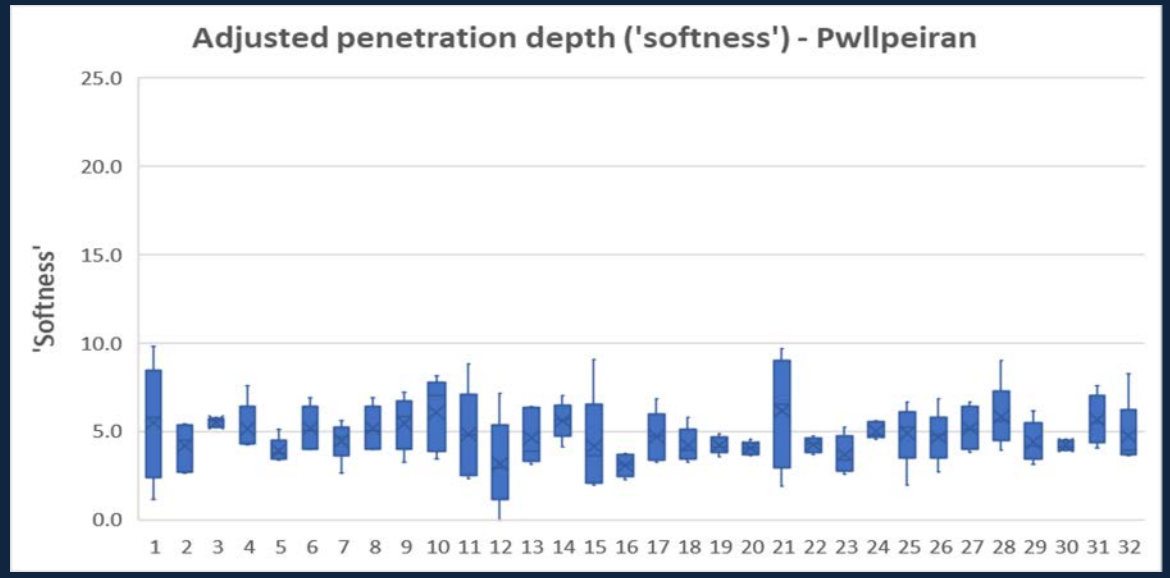
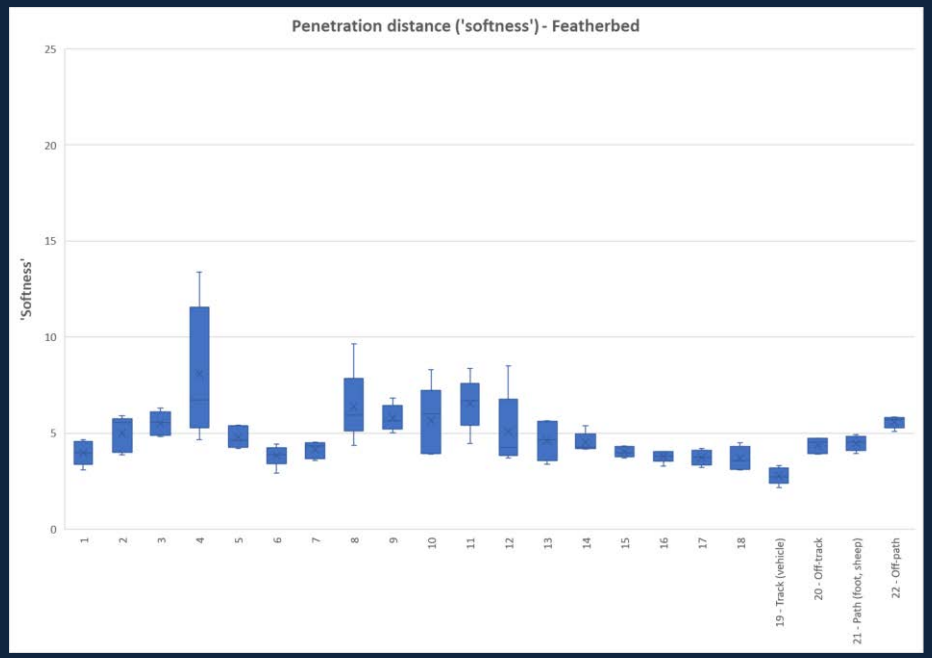
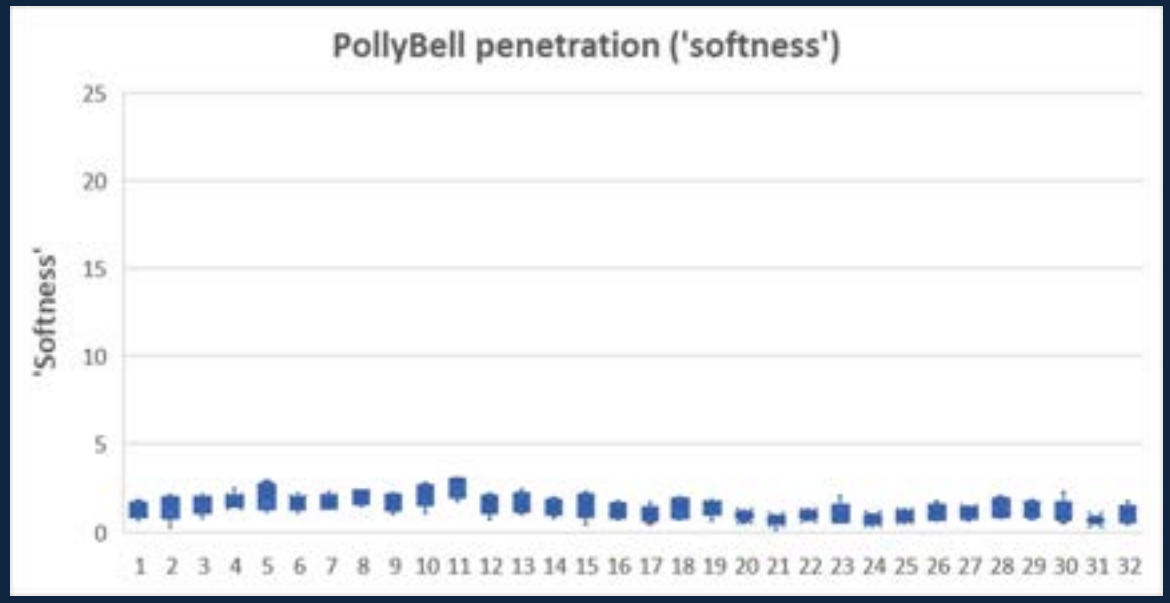

Adjusted penetration depth ('softness') - Pwllpeiran
'Softness'
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32


Penetration distance ('softness') - Featherbed
'Softness'
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
19 - Track (vehicle)
20 - Off-track
21 - Path (foot, sheep)
22 - Off-path


PollyBell penetration ('softness')
'Softness'
25
20
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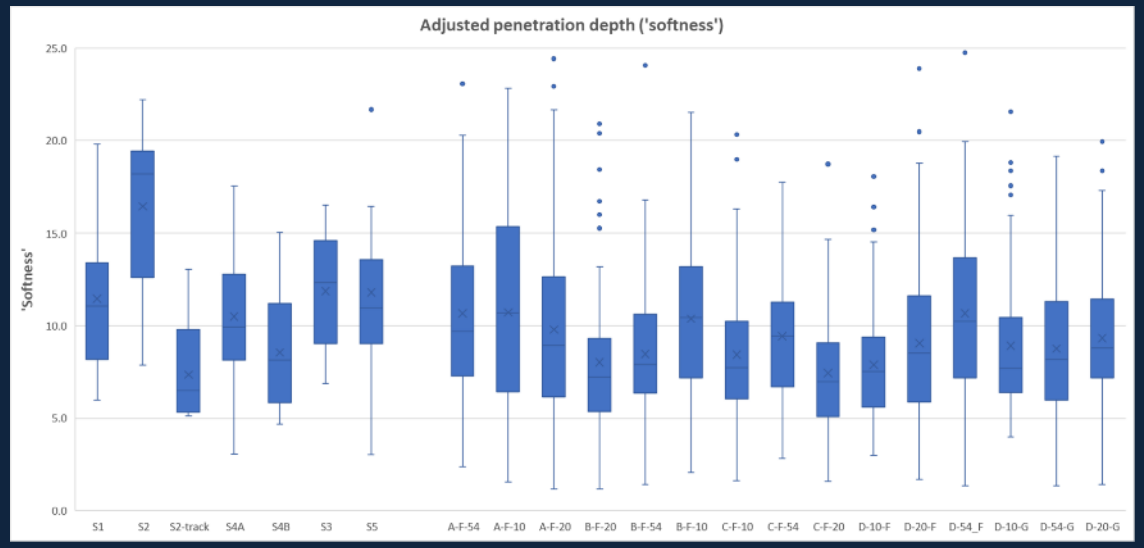
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32


Adjusted penetration depth ('softness')
'Softness'
25.0
20.0
15.0
10.0
5.0
0.0
S1 S2 S2-track S4A S4B S3 S5 A-F-54 A-F-10 A-F-20 B-F-20 B-F-54 B-F-10 C-F-10 C-F-54 C-F-20 D-10-F D-20-F D-54_F D-10-G D-54-G D-20-G