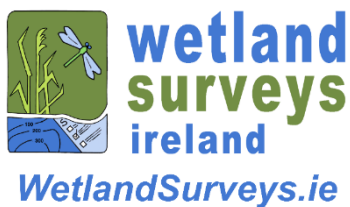


Ecotope Mapping within a sub-set of designated raised bogs

WETLAND SURVEYS IRELAND
A Report to the National Parks and Wildlife Service

July 2024



NPWS

An tSeirbhís Páirceanna
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Ecotope Mapping within a sub-set of designated raised bogs 2024

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Cover photograph: Pool system in central ecotope at Firville Bog, Co. Tipperary by Adam Vanmechelen.

Key words: Habitats Directive, Active Raised Bog, Ireland, Annex I, monitoring, conservation.

Site list: SAC 000216, River Little Shannon Callows (Cloniff Bog); NHA 000564, River Little Brosna Callows (Annagh Bog); SAC 000641, Ballyduff-Clonfinane Bog; SAC 000647, Kilcarren-Firville Bog; NHA001812, Lough Garr; SAC 002348, Clooneen Bog; 002349, Corbo Bog.

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EXECUTIVE SUMMARY

The main objective of the study was to undertake a survey of nine raised bogs and collect data which would feed into the report on the conservation status of the following Habitats Directive Annex I habitats within these bogs: Active raised bogs (ARB) (7110); Bog woodland (91D0); Degraded raised bogs still capable of natural regeneration (DRB) (7120) and Depressions on peat substrates of the Rhynchosporion (7150). The surveys of the nine bogs, which occur within five Specials Areas of Conservation (SACs) and two Natural Heritage Areas (NHAs) were conducted from March to May 2024. Only high bog habitats were surveyed. The data collected will feed into the National Parks and Wildlife Service's *Multi-Annual Raised Bog Monitoring Programme (2021-24)* under which a comparison with previous surveys of these sites will be carried out and a Conservation Condition Assessment of ARB at each site undertaken. The data will also be used to inform Article 17 reporting for raised bog habitats for the 2025 reporting cycle.

Across the nine sites, 71.2ha of ARB was recorded with ARB present on all sites except for one (Annagh Bog). 9.1ha of central ecotope was recorded across five sites (Ballyduff Bog, Clonfinane Bog, Corbo Bog, Firville Bog and Kilcarren Bog) with a total of 5.6ha of active flush recorded across seven sites (Ballyduff Bog, Clonfinane Bog, Cloniff Bog, Clooneen Bog, Corbo Bog, Kilcarren Bog and Lough Garr Bog) and 53.2ha of sub-central ecotope also recorded across seven sites (Ballyduff Bog, Clonfinane Bog, Cloniff Bog, Clooneen Bog, Corbo Bog, Firville Bog and Kilcarren Bog). 3.3ha of Bog Woodland corresponding to the Priority Annex habitat 91D0 was recorded across three sites (Clonfinane Bog, Clooneen Bog and Lough Garr Bog). The occurrence of 91D0 along the lagg zone of Lough Garr Bog is a new record for the habitat.

Notes on impacts on the ARB at each site were also collected and these included positive impacts from restoration efforts (Ballyduff Bog and Clonfinane Bog) as well as negative impacts from drainage, fire (Kilcarren Bog), ongoing turf cutting (Clooneen Bog and Corbo Bog) and potential impacts from ammonia deposition (Ballyduff Bog, Clonfinane Bog and Firville Bog).

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1. Introduction

The National Parks and Wildlife Service (NPWS), of the Department of Housing, Local Government and Heritage provides the legislative and policy framework for the conservation of nature and biodiversity in Ireland. It also oversees its implementation, with particular emphasis on the protection of habitats and species.

In terms of environment and biological diversity, Ireland's raised bogs are of importance not only nationally, but they are of European and indeed global significance. The current designated raised bog network consists of 62 raised bog SACs and 75 raised bog NHAs totalling an area of 17,995 ha. The legal basis on which SACs are selected and designated is the Habitats Directive while the Natural Heritage Areas are designated using national legislation (the Wildlife Acts).

In order to assess the conservation status of Annex I raised bog habitats, in fulfilment of commitments to Articles 11 & 17 of the Habitats Directive the NPWS has commissioned three previous bog monitoring surveys (Fernandez *et al.*, 2005, Fernandez *et al.*, 2012 and Fernandez *et al.*, 2014); the resulting reports and individual sites reports are available in the publications section of the NPWS website. These reports provide full details on survey methodologies with another monitoring survey, *Multi-Annual Raised Bog Monitoring Programme 2021-24* being led by *Wetland Surveys Ireland* currently underway.

The following are the four Annex I raised bog habitats within the Habitats Directive, the first two of which are priority habitats:

- **7110** Active raised bogs (ARB)
- **91D0** Bog woodland
- **7120** Degraded raised bogs still capable of natural regeneration (DRB)
- **7150** Depressions on peat substrates of the Rhynchosporion

The NPWS requested that high bog ecotope vegetation surveys following Fernandez *et al.*, 2014 methodologies be undertaken within a sub-set of six designated raised bogs (see table 1 below). Cutover bog habitats surveys are not required as part of this project. Data from these surveys is to be incorporated into the current NPWS *Multi-Annual Raised Bog Monitoring Programme 2021-24* and the 2025 Article 17 of the Habitats Directive (92/43/EEC) national raised bog Annex I habitats conservation status assessment. Any changes in habitat extent, quality or intensity of pressures from previous surveys is to be assessed.

Table 1 List of sites which were to be surveyed as part of this project. Note that access to Cloonmoylan was not feasible and Clooneen Bog and Corbo Bog were surveyed instead.

SITECODE	Site Name	High Bog Area (ha)
248	Cloonmoylan Bog SAC	412
564	Annagh Bog (River Little Brosna Callows NHA)	24
641	Ballyduff/Clonfinane Bog SAC	198
647	Kilcarren-Firville Bog SAC	362
1812	Lough Garr NHA	48
216	Cloniff Bog (River Shannon Callows SAC)	43

Note that the original list of six sites to be surveyed given in Table 1 as part of this project was updated during the course of the project as access issues to Cloonmoylan Bog SAC resulted in it being replaced by two smaller sites, namely Corbo Bog SAC 002349 and Clooneen Bog SAC 002348.

2. Methods

Full ecotope surveys were carried out on all sites following the methods outlined by Fernandez *et al.* (2012), which are outlined here:

2.1 Field Preparation (Survey Equipment, Software and GIS development)

Data during the survey was collected on GPS enabled tablets that were connected via Bluetooth to an EOS Arrow 100 GNSS receiver to enable sub-metre accuracy. ESRI software was used to collect data with data dictionaries set up prior to surveys commencing.

Prior to surveys commencing, digital spatial data from previous raised bog surveys was collated and uploaded onto field maps using ESRI software, to ensure this data was accessible during surveys. Table 2 lists the most recent data sources available for each of the sites surveyed.

Table 2 showing the most recent data sources available for each of the sites surveyed.

SITECODE	Site Name	Most recent data source
564	Annagh Bog (River Little Brosna Callows NHA)	Fernandez <i>et al.</i> (2006)
641	Ballyduff/Clonfinane Bog SAC	Fernandez <i>et al.</i> (2014)
647	Kilcarren-Firville Bog SAC	Fernandez <i>et al.</i> (2014)
1812	Lough Garr NHA	Fernandez <i>et al.</i> (2006)
216	Cloniff Bog (River Shannon Callows SAC)	None
2348	Clooneen Bog SAC	Crushell & Crowley (2017)
2349	Corbo Bog SAC	Fernandez <i>et al.</i> (2014)

Other relevant GIS layers such as modelled Degraded Raised Bog (DRB) were also added to the field maps prior to survey.

2.2 Field Surveys

The entire high bog was re-surveyed. Sections mapped as sub-marginal, sub-central and central ecotope in previous surveys were surveyed in more detail as well as areas that were modelled as Degraded Raised Bog (DRB). All data was collected using ESRI software (using tablets connected to EOS Arrow 100 GNSS receivers, which enabled sub-metre accuracy). The following were the main features collected during surveys:

- Ecotopes points: Ecotope points were recorded by assigning a Community Complex to a particular area of high bog from the field key in Appendix 1. Each of the Community Complexes listed in Appendix 1 (and described in Appendix 2) were added to a data dictionary to be used during the survey when taking ecotope points. Active and Degraded Raised Bog are divided into community complexes which are characterised by vegetation communities and these complexes are then amalgamated into ecotopes with different physical characteristics using the approach outlined by Kelly and Schouten (2002).
- Ecotope boundary points: recorded between the boundary of two ecotopes.

- **Quadrats:** Quadrats recorded in the Fernandez et al. (2012) survey were re-surveyed and additional quadrats recorded when considered necessary (e.g. in newly recorded active peat forming areas or when it was deemed that an insufficient number of quadrats were recorded in 2012). The size of quadrats was 4m x 4m for Active and Degraded Raised Bog and 10m x 10m for Bog Woodland. Quadrats were recorded using Survey123 software with two photos taken of each quadrat. One from the south-western corner showing the quadrat in the landscape and one close-up of the vegetation within the quadrat. The quadrats were also marked with two bamboo sticks; one marking the south-western corner and the other marking the north-eastern corner.
- **Impacts:** Impacting activities such as peat cutting, high bog and cutaway drainage, burning, forestry on high bog and cutover and invasive species were recorded. Regional NPWS staff were consulted to obtain further information on impacting activities, but also on conservation measures such as restoration works. Notes on whether individual areas of ARB appeared to be increasing, stable or decreasing were also taken.

2.3 Post-survey

A digital vector format ecotope vegetation map was produced based on the spatial data collected during the survey using ArcMap 10.5 and the most recent aerial photography (including BlueSky imagery largely from 2019). ITM was used as the co-ordinate reference system.

3. Results

3.1 Ecotope surveys

The extent of each ecotope recorded at the surveyed sites is shown in Table 3.

Table 3 showing the extent of each ecotope recorded on the surveyed sites during the 2024 surveys.

		7110			91D0 (and 7110)	Non ARB ecotopes				
Site Code	Site Name	Central	Sub-central	Active Flush	Bog Woodland	Sub-marginal	Marginal	Facebank	Inactive Flush	Other High Bog habitat
216	Cloniff Bog (River Shannon Callows SAC)	0	0.16	0.66	0	19.57	2.59	0.37	16.00	1.74
564	Annagh Bog (River Little Brosna Callows NHA)	0	0	0	0	16.83	2.93	3.10	0	0.19
641	Ballyduff Bog	1.34	16.54	0.12	0	47.20	15.67	3.68	1.87	0.04
641	Clonfinane Bog	0.02	2.80	0.68	0.30	60.78	11.21	8.53	1.12	0.42
647	Firville Bog	3.51	11.04	0	0	105.67	59.03	3.83	0.57	0
647	Kilcarren Bog	1.68	8.40	0.58	0	119.79	35.45	8.09	3.90	0
1812	Lough Garr NHA	0	0	1.68	1.62	27.56	12.23	5.08	3.46	0.12
2348	Clooneen Bog SAC	0	0.21	0.77	1.38	54.69	22.22	1.92	12.79	0
2349	Corbo Bog SAC	2.51	14.04	1.13	0	32.11	33.76	4.71	7.50	0

3.2 Additional findings

As noted in Table 2, three sites had not been surveyed for at least c. 20 years with one of the bogs (Cloniff Bog) never surveyed in detail ((i.e. no ecotope survey of the site had ever been undertaken). A number of interesting notes of conservation/biodiversity significance were made on these three sites:

- Annagh Bog: Small section with an undisturbed rand margin leading down into the callows.
- Lough Garr Bog: Good quality *Sphagnum*-rich bog woodland, which corresponds to the priority Annex habitat 91D0 was recorded over 1.6ha in the north-east of the site. It occurred in the lagg zone in what seemed like a smooth transition (no sign of a facebank) from the high bog. This bog woodland grades into active flush to the west on the high bog and into wet woodland on fen peat and mineral soil to the east. A brief description of the bog woodland was recorded as follows: "*Sphagnum*-rich woodland that corresponds to 91D0. Canopy is dominated by c 12. m tall *Betula pubescens* (20-30cm dbh). Mature *Salix* rare but becoming locally frequent at edges. Sapling *Betula* is abundant especially at woodland edges. *Salix* saplings abundant where bog woodland grades into wet woodland in the east. *Sphagnum* cover is high and there is abundant *Sphagnum fallax* as well as frequent *S. palustre* and occasional *S. rubellum*. *Molinia caerulea* is abundant in parts and there is frequent *Carex rostrata* as well as occasional *Rubus fruticosus*, *Carex paniculata* and *Polytrichum commune*."
- Cloniff Bog: A lagg zone with fen characteristics such as frequent *Schoenus nigricans* (no brown mosses recorded) was recorded to the east of the high bog. This area is likely to have been very slightly cut a long time ago (at least decades). An apparently undisturbed, steep rand slope to the west of the high bog down to the river was also recorded.

These areas were not surveyed in detail since the focus of the survey was on high bog habitats. The occurrence of 91D0 habitat and the accompanying data was submitted to the 91D0 monitoring programme within the NPWS. Further survey work is recommended on some of these areas, particularly in the lagg zone on Cloniff Bog. This is a potentially interesting area with *Schoenus nigricans*, *Myrica gale* and *Sphagnum* spp. No brown mosses recorded but again the area was not comprehensively surveyed.

3.3 Potential impacts

Both positive and negative impacts were recorded. Positive impacts were restricted to two sites (Ballyduff Bog and Clonfinane Bog) where restoration works have been undertaken in the past (2003) and ongoing re-wetting was recorded.

The main negative impacts across the sites were drainage, turf cutting and potential impacts from ammonia deposition. These impacts are recorded in the GIS dataset. Recent turf cutting was recorded at only two sites (Corbo and Clooneen), fire damage at one site (Kilcarren) while potential impacts from ammonia deposition were recorded on three sites (Ballyduff, Clonfinane and Firville).

Kelleghan *et al.* (2022) recently reported on the identification and assessment of potential impacts of agricultural atmospheric ammonia deposition. The following were given as indications of impacts of ammonia and nitrogen deposition:

- Algae: a proliferation of green algal slimes on trees, other plants (e.g. Heather), moss and lichens
- Indicator lichens: the presence of lichen species such as *Xanthoria parietina* are indicative of ammonia pollution
- *Cladonia portentosa*: this lichen can turn pink as a result of ammonia and light exposure in combination, followed by breakdown and loss of structure.
- Decay of *Sphagnum*: patches of decaying *Sphagnum* species (brown/dark green and slimy)

- Vascular plants: bleaching, stunted growth, exacerbated fungal and frost damage to heather species most notably *Calluna vulgaris*, increase in tall vegetation.

During the surveys of Ballyduff, Clonfinane and Firville bogs, some of these indicators were observed across the three sites and are illustrated in Figure 1. Indicators were most abundant in the drier sections of the sites and included:

- *Sphagnum* hummocks degrading and going to mush
- An abundance of *Odontoschisma sphagnii* (this has also been reported as being a possible indication of ammonia pollution)
- High amounts of algal growth on *Calluna* stems
- *Xanthoria* lichen species on birch
- High cover values of *Sphagnum tenellum* (this has also been reported as being a possible indication of ammonia pollution)





Figure 1 a -f Indicators of potential impacts from ammonia deposition on Ballyduff and Clonfinane bogs recorded during ecotope surveys in March 2024.

The Site-Specific Conservation objectives for Ballyduff/Clonfinane Bog and all raised bog sites is that the level of N deposition should not exceed the low end of the range 5kg N/ha/yr. This recommendation is based on a precautionary approach, as the evidential basis for setting a higher level is not particularly strong as alluded to by Payne (2014). Total N deposition in the vicinity of Ballyduff/Clonfinane Bog was reported by Henry & Aherne (2014) is 12.7kg N/ha/yr.

Kelleghan *et al.* (2022) note that the application of critical loads is more complex compared to critical levels, because it is inclusive of wet/dry deposited ammonia and ammonium, and wet/dry deposited oxides of nitrogen (Aherne *et al.*, 2017). The Critical Level for ammonia is a pan-European threshold recommended by the United Nations (UNECE, 2007). The level is $1 \mu\text{g}/\text{m}^3$ for raised bogs as these are ecosystems where lichens and bryophytes are a significant component. Where the annual average ambient ammonia concentration is above this level, visible impacts on habitats and species can be expected. Kelleghan *et al.* (2019) modelled atmospheric ammonia levels at Ballyduff/Clonfinane SAC and estimated that 100% of the site was above $1.0 \mu\text{g}/\text{m}^3$ and that 77.9% of the site was above $2.0 \mu\text{g}/\text{m}^3$. At Kilcarren/Firville SAC Kelleghan *et al.* also estimated that 100% of the site was above $1.0 \mu\text{g}/\text{m}^3$ and that 22.7% was above $1.0 \mu\text{g}/\text{m}^3$.

Air Pollution Information System (APIS) (<https://www.apis.ac.uk/app>) estimates the background ammonia and nitrogen levels at a 1km square level and for these three sites the background ammonia levels are 2.5-2.6 $\mu\text{g}/\text{m}^3$ (accessed 19th April 2024), so the Critical Level for ammonia concentrations are well exceeded at these sites.

4. Discussion

The data recorded during these surveys (e.g. community complex descriptions and locations, ecotope boundaries point data, quadrats, photographic records, impacting activities) will be assessed in the current NPWS *Multi-Annual Raised Bog Monitoring Programme 2021-24* and the 2025 Article 17 of the Habitats Directive (92/43/EEC) national raised bog Annex I habitats conservation status assessment. Any changes in habitat extent, quality or intensity of pressures from previous surveys will be evaluated as part of those projects.

The results of these surveys will also need to be used in reviewing the restoration plans of the surveyed sites. For example, the presence of Annex bog woodland on Lough Garr was unknown when the restoration plans were originally drawn up and neither had the presence of a semi-natural lagg zone on Cloniff Bog been recorded. Further, more detailed ecological surveys of these areas are recommended. The apparent impacts of ammonia deposition as observed on Ballyduff, Clonfinane and Firville Bogs warrants further investigation, and it is recommended that this is done in conjunction with the *Environmental Protection Agency* who have developed a National Ecosystem Monitoring Network (NEMN) across a number of habitats (including raised bogs) and sites in order to monitor Air Pollution Impacts across Sensitive Ecosystems (Kelleghan *et al.*, 2021).

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Appendix 1 Ecotope and Community Complex Key

The following is an approximate guide (adapted from Fernandez *et al.*, 2005) designed to aid the keying out of high bog ecotopes and in turn community complexes on Irish raised bogs. It should be realised that no dichotomous key is perfect and where the key does not seem to work, the community complex descriptions in Appendix 2 should be reviewed to see what complex is the best fit.

Note that this key was designed for the purpose of mapping *relatively* homogenous areas of >400 m². The following attributes are considered to define a community complex: vegetation composition and cover: *Sphagnum* cover, robustness of *Calluna vulgaris*, presence of *Cladonia* species; ground firmness (firm, soft, very soft, quaking); acrotelm depth and micro-topography (e.g. flats, lawns, hollows, pools, hummocks). The communities are given numeric names according to the dominant or characteristic species. A more comprehensive description of the community complexes is given in Appendix 2. This raised bog vegetation classification is based on the work of Kelly *et al.* (1995).

Key

1. Western indicators *Racomitrium lanuginosum*, *Campylopus atrovirens*, *Pleurozia purpurea* and large pools with frequent open water all **present (at least two of the three indicators present)** Use Western Ecotopes Key
- Western indicators *Racomitrium lanuginosum*, *Campylopus atrovirens*, *Pleurozia purpurea* and large pools with frequent open water **absent (or only one of the three indicators present)** Use Midland Ecotopes Key

Midland Ecotopes Key

1. *Sphagnum* cover >40% 2
- Sphagnum* cover ≤40% Use Non-ARB Ecotopes Key
2. Pools cover ≥20% 3
- Pools cover <20% 4
3. *Sphagnum* cover ≥75% (CENTRAL) COMPLEX 14
- Sphagnum* cover 41-75% 6
4. Pools cover 11-20% 5
- Pools cover <10% 11
5. *Sphagnum* cover ≥75% (CENTRAL) COMPLEX 15
- Sphagnum* cover 41-75% 6
6. *Narthecium* cover ≥10% 9
- Narthecium* cover <10% 7
7. *Eriophorum* spp cover ≥15% (SC) COMPLEX 9/7+P
- Eriophorum* spp cover <15% and *Rhynchospora alba* cover ≥10% (SC) COMPLEX 4+P
8. *Rhynchospora alba* cover <10% (SC) COMPLEX 9/7+P

	<i>Rhynchospora alba</i> cover >10%.....	(SC) COMPLEX 9/7/4+P
9.	<i>Eriophorum</i> spp cover ≥10%	(SC) COMPLEX 6/9+P
	<i>Eriophorum</i> spp cover <10%	10
10.	<i>Rhynchospora alba</i> cover ≥10%.....	(SC) COMPLEX 6/4+P
	<i>Narthecium</i> cover >20% (interpool conditions relatively dry, <i>Sphagnum</i> cover <50% and dominated by <i>S. rubellum</i>)	Consider SM options (Use Non-ARB Ecotopes Key)
11.	<i>Sphagnum</i> cover ≥75%	12
	<i>Sphagnum</i> cover 41-75%	17
12.	Pools present (though often more like <i>Sphagnum cuspidatum</i> filled hollows) AND at least some microtopographical variation	(CENTRAL) COMPLEX 10/15
	Pools absent.....	13
13.	‘Wetter’-loving <i>Sphagna</i> (e.g. <i>Sphagnum papillosum</i> , <i>S. medium</i> and/or <i>S. cuspidatum</i> dominate the <i>Sphagnum</i> layer	14
	Conditions are relatively dry and <i>Sphagnum rubellum</i> dominates <i>Sphagnum</i> layer (though ‘wetter’ loving <i>Sphagna</i> are present)	(SC) COMPLEX 9/7/10
14.	<i>Eriophorum</i> spp cover ≥15%	(SC) COMPLEX 10/9
	<i>Eriophorum</i> spp cover <15%	15
15.	<i>Rhynchospora alba</i> cover ≥15%.....	(SC) COMPLEX 10/4
	<i>Rhynchospora alba</i> cover <15%.....	16
16.	<i>Narthecium</i> cover ≥15%.....	(SC) COMPLEX 10/6
	<i>Narthecium</i> cover <15%.....	Consider most suitable option between 10/9, 10/6 and 10/4
17.	Pools present	6
	Pools rare or absent	18
18.	‘Wetter’-loving <i>Sphagna</i> (e.g. <i>Sphagnum papillosum</i> , <i>S. medium</i> and/or <i>S. cuspidatum</i> dominate the <i>Sphagnum</i> layer	19
	Conditions are relatively dry, <i>Sphagnum rubellum</i> dominates <i>Sphagnum</i> layer and <i>Calluna vulgaris</i> cover usually >33%.....	23
19.	<i>Eriophorum</i> spp cover ≥15%	(SC) COMPLEX 9/10
	<i>Eriophorum</i> spp cover <15%	20
20.	<i>Rhynchospora alba</i> cover ≥15%.....	(SC) COMPLEX 4/10
	<i>Rhynchospora alba</i> cover <15%.....	21
21.	<i>Narthecium</i> cover ≥15%.....	(SC) COMPLEX 6/10
	<i>Narthecium</i> cover <15%.....	22

22. *Carex panicea* cover $\geq 15\%$ (SC) COMPLEX 3/10
Carex panicea cover $< 15\%$ **Consider most suitable option between 9/10, 6/10 and 4/10**
23. *Sphagnum* $> 50\%$ cover and species other than *S. rubellum* and *S. tenellum* are present at some cover value (i.e. $> 5\%$) (SC) COMPLEX 9/7/10
Sphagnum $< 50\%$ cover **Consider SM Complex 9/7**

Western Ecotopes Key

1. Pools $> 20\%$ cover 6
Pools $< 20\%$ cover 2
2. Pools 11-20% cover 3
Pools $\leq 10\%$ cover **Use Midland ARB Ecotopes key**
3. *Sphagnum* cover $\geq 30\%$ cover 4
Sphagnum cover $< 30\%$ cover **Use Non-ARB Ecotopes Key**
4. *Narthecium ossifragum* $> 10\%$ cover 5
Narthecium ossifragum $\leq 10\%$ cover (*Eriophorum* spp $> 10\%$ cover and *Carex panicea* $> 10\%$ cover) (SC) COMPLEX 3/9+P
5. *Eriophorum* spp $> 10\%$ cover (SC) COMPLEX 6/9+P
Rhynchospora alba $> 10\%$ cover (SC) COMPLEX 6/4+P
6. *Sphagnum* cover $> 40\%$ cover (CENTRAL) COMPLEX 35
Sphagnum cover $\leq 40\%$ cover 7
7. *Sphagnum* cover 21-40% cover 8
Sphagnum cover $\leq 20\%$ cover **Use Non-ARB Ecotopes Key**
8. *Narthecium ossifragum* cover $> 15\%$ cover (SC) COMPLEX 6/35
Carex panicea cover $> 15\%$ cover (SC) COMPLEX 3/35
Rhynchospora alba cover $> 15\%$ cover (SC) COMPLEX 4/35

Non-ARB Ecotopes Key (Generally areas with a *Sphagnum* cover $\leq 40\%$)

1. Pools cover $\geq 10\%$ 2
Pools cover $< 10\%$ or absent 6
2. *Eriophorum* spp $> 10\%$ cover 3
Eriophorum spp $\leq 10\%$ cover 5
3. *Carex panicea* cover $>$ *Narthecium* cover (SM) 9/7/3+P
Carex panicea cover $<$ *Narthecium* cover 4

4.	<i>Narthecium</i> >10% cover.....	(SM) 9/7/6+P
	<i>Trichophorum</i> ≥10% cover.....	(SM) 9/7/2+P
5.	<i>Carex panicea</i> cover > 10% cover.....	(SM) 6/3+P
	<i>Narthecium</i> > 15% cover.....	(SM) 6+P
6.	<i>Eriophorum</i> spp ≥15% cover (and <i>Sphagnum</i> usually ≥30% cover)	7
	<i>Eriophorum</i> spp <15% cover (and <i>Sphagnum</i> usually <30% cover)	11
7.	<i>Narthecium</i> <5% cover (Hummock dominated and hollows/flats/lawns/pools largely absent, <i>Sphagnum</i> cover c. 40% sometimes higher)	(SM) Complex 9/7
	At least some hollows or flats present	8
8.	Hollows or depressions frequent	9
	Flats frequent	10
9.	<i>Rhynchospora alba</i> >10% cover.....	(SM) Complex 9/7/4
	<i>Narthecium</i> >10% cover.....	(SM) Complex 9/7/6
10.	<i>Carex panicea</i> >10% cover	(SM) Complex 9/7/3
	<i>Trichophorum</i> ≥10% cover.....	(SM) Complex 9/7/2
11.	<i>Sphagnum</i> >10% cover	12
	<i>Sphagnum</i> ≤10% cover	15
12.	<i>Narthecium</i> >15% cover.....	13
	<i>Narthecium</i> ≤15% cover.....	14
13.	<i>Rhynchospora alba</i> >10% cover.....	(SM) Complex 6/4
	<i>Carex panicea</i> >10% cover	(SM) Complex 6/3
	None of the above and <i>Calluna vulgaris</i> 30-50% cover.....	(SM) Complex 7/6
14.	<i>Rhynchospora alba</i> >15% cover.....	(SM) Complex 4/7
	<i>Calluna vulgaris</i> >75% cover (<i>Eriophorum</i> spp. the next most frequent vascular plant and the <i>Sphagnum</i> cover >20%).....	(SM) Complex 7/9
15.	Moderate to steep slope with frequent to abundant <i>Trichophorum</i> (>10% cover)	17
	Gentle to moderate (or no) slope and <i>Trichophorum</i> not a major component of vegetation (<5% cover)	16
16.	Aside from <i>Calluna</i> , <i>Narthecium</i> is the most abundant plant.....	(M) Complex 6/7
	Aside from <i>Calluna</i> , <i>Carex panicea</i> is the most abundant plant.....	(M) Complex 3/6
17.	<i>Calluna vulgaris</i> cover >40%.....	(M) Complex 2/7
	<i>Carex panicea</i> cover >15%	(M) Complex 2/3
	<i>Rhynchospora alba</i> prominent in erosion/run-off channels	(M) Complex 2/4

Appendix 2 Community Complex descriptions

The following is a brief description of the main features that distinguish each community complex from each other. Community complexes often merge or grade into each other and can be difficult to identify and map in the field. The following descriptions give the typical characteristics of each community complex and the actual characteristics on the ground may vary slightly. A summary list of the ARB and non-ARB complexes described is given in Tables 1 & 2 respectively and a key to help identify each complex is given in Appendix 1. Table 3 summarises some of the general features of each ecotope.

Table 2 List of ARB community complex types in key and summarised below. Those give in brackets are considered variants of the complex they follow.

	Central	Sub-central
Midland & Western sites	14	9/7+P (9/7/4+P) 10/9 (10/9a) (9/10)
	15	4+P 10/4 (4/10)
	10/15	6/4+P 10/6 (6/10)
		6/9+P 3/10 (10/3)
		3/9+P 9/7/10
Western sites only	35	6/35 (4/35) (3/35)

Table 3 List of non-ARB community complex types in key and summarised below. Those give in brackets are considered variants of the complex they follow.

	Sub-marginal	Marginal
Midland & Western	9/7/6+P (9/7/3+P & 9/7/2+P)	3/6+P
	6+P (6/3+P)	6/7 (6/7/3 & 6/7/2)
	9/7 (7/9)	3/6 (3/6/2, 3/6/4 & 3/6/7)
	9/7/6 (9/7/4, 9/7/3 & 9/7/2)	2/7 (2/4 & 2/3)
	6/4	1
	6/3 (6/3/9)	
	4/7	
	7/6 (7/6/4 & 7/6/3)	

Table 4 Summary characteristics of general ecotopes on high bog. Note that these are indicative values only and the key and general descriptions should be referred to for further detail.

Ecotope	<i>Sphagnum</i> cover (%)	Micro-topography	Pool Cover (%)	Firmness	Characteristic species
Central	>75 (>40% on western sites)	Hummocks, hollows, lawns and pools	>10%	Quaking	<i>Sphagnum</i> species abundant. Pools support <i>Drosera anglica</i> (or sometimes

					<i>D. intermedia</i> in western sites)
Sub-central	>40 (>30% on western sites)	Hummocks, hollows, lawns and (usually) pools	Absent or <20%	Very soft	<i>Sphagnum</i> species abundant. An abundance of <i>S. medium</i> sometimes characterises this ecotope. Pools often support <i>Drosera anglica</i>
Sub-marginal	11-40	Hummocks and hollows (occasionally pools)	Absent or <10%	Soft	<i>Narthecium ossifragum</i> may be abundant
Marginal	≤10	Poorly differentiated. Often dominated by flats. Occasionally wet hollows or tear pools	Largely absent	Firm	<i>Calluna vulgaris</i> , <i>Carex panicea</i> and/or <i>Trichophorum germanicum</i> may be abundant.
Facebank	≤10	None	Absent	Firm	Vigorous <i>Calluna vulgaris</i> growth

CENTRAL ECOTOPE COMPLEXES

Complex 14

Microtopography: Hummocks, hollows and pools (>20% cover) and sometimes lawns.

***Sphagnum* cover:** >75%

Firmness: Quaking

Characteristic species: *Sphagnum cuspidatum* (>20% cover)

Description: Apart from some soak areas, this central ecotope complex indicates the wettest conditions on the high bog. Quaking mats of *Sphagnum* characterise this complex with *S. cuspidatum*-filled pools covering >20% of the complexes surface area. The pools support *Eriophorum angustifolium*, *Drosera anglica* and *Menyanthes trifoliata* with *Rhynchospora alba* around the pool edges and in patches within the pools. Algae is largely absent from the pools. The inter-pool areas usually support frequent hummocks of *Sphagnum rubellum* as well as hummocks of *S. beothuk* and *S. austinii*. *S. papillosum* and *S. medium* are also frequent usually occurring in lawns and replacing *S. cuspidatum* as the dominant *Sphagnum* towards the edges of the complex. *Calluna vulgaris* (11-20%) and *Eriophorum vaginatum* (5-10%) are found at relatively low cover values on the hummocks with *Narthecium ossifragum* and *Erica tetralix* also present, but at a lower cover value (ca. 5%). The overall *Sphagnum* cover is 75-100% (usually >90%).

Similar Complexes: This complex differs from Complex 15 in that pools are more frequent. Where pools are less distinct, the complex may grade into Complex 10/15. Where the *Sphagnum* cover is poorer, the complex grades into the sub-central ecotope.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex usually supports the Annex habitat “Depressions on peat substrates of the Rhynchosporion” (7150).

Complex 15

Microtopography: Hummocks, hollows and pools (11-20% cover) and sometimes lawns.

***Sphagnum* cover:** >75%

Firmness: Very soft or quaking

Characteristic species: *Sphagnum cuspidatum* (>10% cover)

Description: This is a wet central ecotope complex that is characterised by scattered *Sphagnum cuspidatum*-filled pools usually covering 11-20% of the complex's surface area. The bog surface is very soft and sometimes quaking. The pools support *Eriophorum angustifolium*, *Drosera anglica* and *Menyanthes trifoliata* with *Rhynchospora alba* around the pool edges and in patches within the pools. There can be very occasional patches of algae and/or open water in the pools. The inter-pool areas usually support frequent hummocks of *Sphagnum rubellum* (usually 10-20% cover) as well as hummocks of *S. beothuk* and *S. austinii*. *S. papillosum* and *S. medium* are also frequent (20-40% cover or higher) and usually dominate around the pool edges, and also occur in lawns as well as low hummocks. *S. cuspidatum* cover is usually high (>10% cover and usually >20% over). *Calluna vulgaris* (11-20%) and *Eriophorum vaginatum* (5-10%) are found at relatively low cover values on the hummocks with *Narthecium ossifragum* and *Erica tetralix* also present, but at a lower cover value (ca. 5%).

Similar Complexes: This complex differs from Complex 14 in that pools are less frequent. Where pools are less distinct, the complex may grade into Complex 10/15. Where the *Sphagnum* cover is poorer, the complex grades into the sub-central ecotope.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex usually supports the Annex habitat “Depressions on peat substrates of the Rhynchosporion” (7150).

Complex 10/15

Microtopography: Hummocks, hollows and lawns with pools (<10% cover)

***Sphagnum* cover:** >75%

Firmness: Very soft (at times quaking)

Characteristic species: *Sphagnum medium* and *S. cuspidatum* co-dominate the lawns/pools

Description: This is a central ecotope complex and the bog surface is usually very soft underfoot and at times quaking. The micro-topography is less well developed than in other central ecotope complexes and characterised by low hummocks, lawns and pools. However, the pools can be more like *Sphagnum* filled hollows/lawns than pools with *S. cuspidatum* and *S. medium* usually dominating in them. *S. medium* is usually a larger component of this complex than it is in Complex 14 or 15. *Rhynchospora alba* is also more frequent than in Complex 14 or 15 occurring at c. 10% cover, mostly across the *Sphagnum* lawns and/or pools. *Sphagnum papillosum* can also be prominent in this complex and occurs in lawns and low hummocks particularly at pool margins (where the pools are more distinct). *Eriophorum vaginatum* often grows abundantly across the *Sphagnum* lawns, usually occurring at >10% cover. *Calluna vulgaris* (11-20%) grows on hummocks, which are usually composed of *S. papillosum* and *S. rubellum* with occasional *S. austinii* and *S. beothuk*. *Narthecium ossifragum* is usually present at a low cover value (ca.5%) but can increase towards the margins of the complex.

Similar Complexes: This central Complex 10/15 can be difficult to differentiate from the sub-central Complex 10/9. In 10/15, there is at least some variation in microtopography with hummocks being somewhat distinct from lawns and pools etc. whereas this distinction is not always clear in Complex 10/9. *Drosera anglica* and *Menyanthes trifoliata* can be relatively frequent in 10/15 but are usually rare or

absent in 10/9. Some taller hummocks of *Sphagnum austinii* and *S. beothuk* may also be present in 10/15 and hummocks in general usually account for >25% of cover while in 10/9 cover of hummocks is usually less. Complex 10/15 also tends to have at least some quaking element while 10/9 does not. *Eriophorum* spp. usually occur at >10% cover in both complexes but tend to be more abundant in 10/9 (usually being by the far the most dominant vascular plant), sometimes reaching cover values of >30%.

Complex 10/15 can also be difficult to differentiate from the sub-central Complex 10/4. Again in 10/15, there is greater variation in microtopography with hummocks being distinct from lawns and pools etc. Some taller hummocks of *Sphagnum austinii* and *S. beothuk* may also be present in 10/15 and 10/15 tends to have at least some quaking element while 10/4 does not. *Rhynchospora alba* tends to have a higher cover value in 10/4 (often >20%) than in 10/15 (usually 5-10%).

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex usually supports the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 35

Microtopography: Pools (>20%), flats and hummocks

***Sphagnum* cover:** >40%

Firmness: Very soft or quaking

Characteristic species: *Racomitrium lanuginosum* and *Campylopus atrovirens*

Description: This is the wet central ecotope complex of western raised bogs. Pools are frequent, covering >20% of the complexes surface area, but tend to differ from the pools of the midland raised bogs in a number of ways. Firstly, they tend to be deeper and more elongate and inter-connecting. Secondly, open water is much more visible and predominates in many pools. Thirdly, although *S. cuspidatum* is still present, *S. auriculatum* is much more frequent than in the midland bogs and is sometimes the most common of the aquatic *Sphagna*. Where the pools are shallower there is a higher cover of *Sphagnum cuspidatum* and pools sometimes contain scattered *Rhynchospora alba*, *Eriophorum angustifolium*, *Drosera anglica* and *Menyanthes trifoliata* and some algal patches are present, but not dominant. *Campylopus atrovirens* is usually present at the pool margins along with *Sphagnum papillosum*. Island hummocks of *Racomitrium lanuginosum* are also common. The inter-pool vegetation has a much poorer *Sphagnum* cover than in the midland raised bogs with *Narthecium ossifragum* flats often dominating. Hummocks are present, however, with *S. austinii*, *S. beothuk* and *S. rubellum* occurring. The overall *Sphagnum* cover is often much lower than in the midland raised bog central complexes and can be as low as 40%. *S. papillosum* is usually the most abundant *Sphagnum*. *Carex panicea* is also much more common on this central complex (10%) than in the midland central complexes where it is usually absent or present in very low amounts (<5%). *Eriophorum vaginatum* and *Calluna vulgaris* are usually present on hummocks.

Similar Complexes: Where *Narthecium ossifragum* flats reach cover values of >20%, the *Sphagnum* cover is usually slightly lower (21-40%) and the complex grades into the sub-central Complex 6/35.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can support the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

SUB-CENTRAL ECOTOPE COMPLEXES

Complex 9/7+P (and 9/7/4+P)

Microtopography: Hummocks, hollows and pools (>10% cover) and sometimes lawns.

***Sphagnum* cover:** >40% (usually 60-70%)

Firmness: Soft to very soft

Characteristic species: *Eriophorum* spp. (>15%) and *Sphagnum cuspidatum* (>10% cover)

Description: This is a sub-central complex in which the bog surface is generally soft with occasional quaking areas. The pools within this complex are small in size (usually not interconnecting) and the pool cover averages at c. 10%. These pools usually have a good cover (>75% of each pool) of *Sphagnum cuspidatum* with *Eriophorum angustifolium*, *Rhynchospora alba* and *Drosera anglica* also present. Occasionally the pools are not distinctive and appear more like *Sphagnum* filled lawns with *Narthecium ossifragum* often found scattered throughout the *Sphagnum* pool/lawn patches. *S. papillosum* and *S. medium* are frequent at the pool margins and/or in lawns, and on some sites *S. pulchrum* is found. *Calluna vulgaris* (20-30%) and *Eriophorum vaginatum* (10-15%) are abundant and there are occasional large wide hummocks of *Sphagnum rubellum* and *S. austinii* with lower hummocks of *S. rubellum* frequent as well. *S. beothuk* can also occur as occasionally. The general *Sphagnum* cover is usually 60-70%.

Variants: Where *Rhynchospora alba* is prominent and has a cover of >10%, the complex is distinguished as Complex 9/7/4+P.

Similar Complexes: Where *Narthecium ossifragum* increases to >10% cover and the *Sphagnum* cover decreases, the complex grades in to the sub-marginal Complex 9/7/6+P. Where the *Sphagnum* cover increases, the complex grades in to the central Complex 15. In addition to having a lower *Sphagnum* cover, Complex 9/7+P can be differentiated from Complex 15 in that the pools are usually smaller and are not interconnecting.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can support the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 4+P

Microtopography: Low hummocks, lawns and interconnecting pools (>10% cover).

***Sphagnum* cover:** >40% (usually 60-70%)

Firmness: Soft to very soft

Characteristic species: *Rhynchospora alba* (>10%) and *Sphagnum cuspidatum* (>10% cover)

Description: This is a sub-central complex in which the bog surface is generally soft to very soft. The pools within this complex are large and sometimes interconnecting. Where western indicators are present consider the sub-central Complex 4/35. *Rhynchospora alba* (>10%) is the most prominent species in the vegetation, sometimes having a cover of up to 25%. Pools are mostly filled with *Sphagnum cuspidatum*, but cover can vary in places. *Menyanthes trifoliata* and *Drosera anglica* are usually present. The *Sphagnum* layer is dominated by *S. papillosum*, *S. medium* and/or *S. cuspidatum*, though *S. rubellum* and *S. austinii* are usually also present. The cover of *Narthecium ossifragum* is usually very low (<5%) and it is sometimes absent. *Eriophorum vaginatum* (usually >10%) is also prominent.

Similar Complexes: Where the cover of *Narthecium ossifragum* is higher, consider Complex 6/4+P. Where the cover of *Eriophorum vaginatum* is higher (>15%) and pools are relatively small in size (and not interconnecting), consider the Complex 9/7/4+P. Where the *Sphagnum* cover decreases and the cover of *Narthecium ossifragum* or *Eriophorum* spp. increases, consider the sub-marginal Complexes 6+P and 4/9+P.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex supports the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 6/4+P

Microtopography: Hummocks, flats, hollows/depressions, lawns and pools (>10% cover).

***Sphagnum* cover:** >40% (usually higher, but can be lower on western sites)

Firmness: Soft to very soft (rarely quaking)

Characteristic species: *Narthecium ossifragum* (>15%) and *Rhynchospora alba* (>15%)

Description: This sub-central complex is usually found on western raised bog sites. The bog surface is very soft underfoot and there may be some quaking areas close to the pools. The pool cover is variable, ranging from between 10-30% cover. *Sphagnum cuspidatum* is found in scattered patches of the pools

(averaging at ca. 30-50% of each pool) with *S. papillosum* at the pool margins along with *Campylopus atrovirens*. Large patches of open water are also present with *Sphagnum auriculatum*, *Drosera anglica* and algae usually present. The overall *Sphagnum* cover is also variable, but averages at >40% with hummocks of *Sphagnum rubellum*, *S. papillosum*, *S. austinii* and occasionally *S. beothuk* found in the inter-pool areas. *Narthecium ossifragum* dominates flats and hollows occurring at 15-30% cover with *Rhynchospora alba* also characterising the complex, being found at 15-20% cover in depressions, lawns and at the edges of pools. *Carex panicea* is also usually present at 5-10% cover as well as *Eriophorum* spp. (averaging at 10% cover). On midland sites there is usually a higher *Sphagnum* cover (>50%) with *S. cuspidatum* generally >50% cover of each pool, and *Campylopus atrovirens* is absent.

Similar Complexes: Where pool and *Sphagnum* cover is lower, consider the sub-marginal Complex 6/4. Where *Narthecium ossifragum* cover is higher and *Rhynchospora alba* and *Sphagnum* cover is lower, consider the sub-marginal Complex 6+P.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex supports the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 6/9+P

Microtopography: Low hummocks, flats, hollows/depressions, lawns and pools (>10% cover).

***Sphagnum* cover:** >40% (usually higher, but can be lower on western sites)

Firmness: Soft to very soft

Characteristic species: *Narthecium ossifragum* (>15%) and *Eriophorum* spp. (>15%)

Description: This is a sub-central complex in which the bog surface is soft. Pools cover 10-20% of the surface area, and many have an algal covering with a patchy cover of *Sphagnum cuspidatum* (30-50% of each pool), though most have a high cover of *S. papillosum* and/or *S. medium* around their margins. *Drosera anglica*, *Rhynchospora alba* and *Eriophorum angustifolium* are also present in the pools. The overall *Sphagnum* cover is usually >40% composed mostly of hummocks of *S. papillosum* and *S. rubellum* with *S. austinii* also usually present. *Narthecium ossifragum* (averaging 20%) and *Eriophorum vaginatum* (15-20%) dominate the inter-pool vegetation, and the relative abundance and height of *Calluna vulgaris* can often be low (10-20% cover). Where the cover of pools increases and they are long and interconnecting and some western indicators are present, consider Complex 6/35.

On midland sites there is usually a higher *Sphagnum* cover (>50%) with *S. cuspidatum* typically >50% cover of each pool; *Campylopus atrovirens* is normally absent. Sometimes this complex can indicate relatively recent burning.

Similar Complexes: Where pool and *Sphagnum* cover is lower, consider the sub-marginal Complex 6/9. Where *Narthecium ossifragum* cover is higher and *Eriophorum* spp. and the *Sphagnum* cover is lower, consider the sub-marginal Complex 6+P or 6/3+P where there is an increased cover of *Carex panicea*.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can support the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 3/9+P

Microtopography: Dominated by hummocks, flats and pools (>10%)

***Sphagnum* cover:** >40% (usually higher, but can be lower on western sites)

Firmness: Soft to very soft

Characteristic species: *Carex panicea* (>15%), *Eriophorum* spp. (>15%) and *Pleurozia purpurea* or *Campylopus atrovirens* usually present

Description: This is a sub-central complex that tends to occur on sites that have some western indicators present such as *Campylopus atrovirens* and *Pleurozia purpurea*. *Carex panicea* reaches high cover values (>15%) within the complex due to the western influence. The *Sphagnum* cover is >40% (and usually >50%), tending to be higher on the less western sites. *Eriophorum* spp. are also prominent, particularly *E. vaginatum*. *Menyanthes trifoliata* is usually present in the pools. The *Sphagnum* layer is dominated by

S. rubellum and *S. papillosum* though *S. cuspidatum* and *S. medium* are also frequent, and *S. austinii* and *S. beothuk* are often present. The cover of *Narthecium ossifragum* and *Rhynchospora alba* is low (usually 5-10%). *Eriophorum angustifolium* is usually the more abundant *Eriophorum* spp. and the cover of *Cladonia portentosa* is usually high (>25%) with *C. uncialis* often present also.

Similar Complexes: Where the cover of *Narthecium ossifragum* increases and the *Sphagnum* cover decreases, consider the sub-marginal Complex 6/3+P. Where western indicators are frequent and the pool cover is >20%, consider the sub-central Complex 3/35.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can sometimes support the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 6/35 (and 3/35, 4/35)

Microtopography: Hummocks, flats and large interconnecting pools (>20% cover).

Sphagnum cover: >30% (but usually higher)

Firmness: Soft to very soft and rarely quaking

Characteristic species: *Narthecium ossifragum* (>20%), *Racomitrium lanuginosum* and *Campylopus atrovirens*

Description: This is a sub-central complex that is found on western raised bogs. The bog surface is usually soft though it can be very soft occasionally. It is similar to the central Complex 35, but *Sphagnum* cover is lower and *Narthecium ossifragum* flats are more common with *N. ossifragum* covering >20% of the surface area. Pools cover >20% of the surface area and have a patchy cover of *Sphagnum* (ca. 25% of each pool) including both *S. cuspidatum* and *S. auriculatum*. The pools are mostly filled with open water, though *Eriophorum angustifolium*, *Drosera anglica* and *Menyanthes trifoliata* are usually present as well as algae. *Sphagnum papillosum* is usually abundant at the pool margins with the western indicator *Campylopus atrovirens* also present. Island hummocks of *Racomitrium lanuginosum* are occasional. *Narthecium ossifragum* dominates the inter-pool areas along with *Rhynchospora alba* (10-20%), which occurs mostly at the pool margins. The overall *Sphagnum* cover within this complex is usually c. 40% with *S. papillosum*, the most abundant of the *Sphagna*. Hummocks of *S. rubellum* are frequent in the inter-pool areas and there is usually occasional *S. austinii* and *S. beothuk*. In the inter-pool areas, there are no dominant higher plants other than *Narthecium ossifragum*, although patches of *Carex panicea* can be common.

Variants: Where the cover of *Carex panicea* increases to >20% the complex is termed 3/35. Where the cover of *Rhynchospora alba* increases to >20% the complex is termed 4/35.

Similar Complexes: Where *Narthecium ossifragum* cover is higher and *Sphagnum* cover is lower, consider the sub-marginal Complex 6+P. Where the pool and *Sphagnum* cover is higher, consider the central Complex 35.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex, particularly the 4/35 variant usually supports the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 10/9 (and 10/9a, 9/10)

Microtopography: In-filled hollows/lawns and hummocks with pools <10% or absent

Sphagnum cover: >75% (9/10 variant has a lower cover)

Firmness: Soft to very soft and sometimes quaking

Characteristic species: *Eriophorum* spp. (>15%) and *Sphagnum cuspidatum* (>10% cover and usually much higher)

Description: This is a wet sub-central complex, which shares many characteristics of a central complex ecotope. The surface, in general, is soft to very soft underfoot with occasional quaking areas. There is a very good *Sphagnum* cover (>75%) and the vegetation is dominated by lawns of *S. papillosum*, *S. medium* and *S. cuspidatum* along with frequent tufts of *Eriophorum vaginatum* (>15%) and *E. angustifolium*. These

lawns are sometimes more like infilled depressions or pools. In general, the microtopography is poorly developed with the lawn or pool-like areas often forming large homogenous patches. Hummocks are usually occasional and low-growing and composed of *S. rubellum*, *S. medium* and *S. papillosum* (which grades into lawns) and very occasionally of *S. beothuk* and *S. austinii*. *Calluna vulgaris* (10%) is less frequent than in other complex types but is frequent on hummocks. *Rhynchospora alba* (10%) is scattered across the *Sphagnum* lawns, which are composed mostly of *S. cuspidatum* and *S. medium* and sometimes *S. papillosum*.

Variants: A variant of this complex occurs where *Eriophorum angustifolium* is more dominant and this is termed **10/9a**. The dominant *Sphagna* in **10/9a** is usually *S. medium*. Where conditions are slightly drier and the *Sphagnum* cover is lower (41-75%), another variant, the sub-central Complex **9/10** occurs. Hummocks are usually more common in this variant and *S. papillosum* is more abundant. Complex 10/9 and all its variants are often associated with areas re-wetting after restoration works.

Similar Complexes: The sub-central Complex 10/9 can be difficult to differentiate from the central Complex **10/15**. In 10/15, there is at least some variation in microtopography with hummocks being somewhat distinct from lawns and pools etc. whereas this distinction is not as clear in Complex 10/9. *Drosera anglica* and particularly *Menyanthes trifoliata* can be relatively frequent in 10/15 but are usually rare or absent in 10/9. Some taller hummocks of *Sphagnum austinii* and *S. beothuk* may also be present in 10/15 and hummocks in general usually account for >25% of cover while in 10/9 cover of hummocks is usually <25%. Complex 10/15 also tends to have at least some quaking element while 10/9 does not. *Eriophorum* spp. usually occur at >10% cover in both complexes but tend to be more abundant in 10/9 (usually being by the far the most dominant vascular plant), sometimes reaching cover values of >30%. Complex 9/10, on the other hand, is differentiated from Complex **9/7/10** in having a lower cover of hummocks (usually <50%) compared to 9/7/10 (usually >50%). *Sphagnum* lawns are also usually a prominent feature of 9/10 and rare in 9/7/10. *S. cuspidatum* cover is also higher in 9/10 (usually >10%) than in 9/7/10 (usually <5%).

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can support the Annex habitat "Depressions on peat substrates of the Rhynchosporion" (7150).

Complex 10/4 (and 4/10)

Microtopography: In-filled hollows/lawns and hummocks with pools <10% or absent

***Sphagnum* cover:** >75% (4/10 variant has a lower cover)

Firmness: Soft to very soft and sometimes quaking

Characteristic species: *Rhynchospora alba* (>15%) and *Sphagnum cuspidatum* (>10% cover)

Description: This is a sub-central complex, in which the surface is usually very soft underfoot. Low hummocks and hollows are present and sometimes there are occasional pools (<10% cover). *Sphagnum* (>75%) dominates the vegetation occurring in low hummocks, lawns, in-filled hollows and pools along with *Rhynchospora alba* (>15%), which is found growing in pools, hollows and lawns. *Eriophorum angustifolium*, *Drosera anglica* and *Menyanthes trifoliata* are found occasionally. Hummocks of *S. rubellum* are frequent and hummocks of *S. austinii*, *S. subnitens* and *S. beothuk* are also usually present. *Calluna vulgaris* (10-20%) dominates in hummocks with *Eriophorum vaginatum* (5-20%) frequent in places. *Narthecium ossifragum* is present at low cover values in hollows (<10%).

Variants: Where conditions are slightly drier and the *Sphagnum* cover is lower (41-75%), variant Complex **4/10** occurs. Pools present in **4/10** often show signs of desiccation with algae frequent and the dominant 'pool' *Sphagna* often being *Sphagnum papillosum* and *S. medium* instead of *S. cuspidatum*.

Similar Complexes: Complex 10/4 can be difficult to differentiate from the central Complex **10/15**. In 10/15, there is greater variation in microtopography with hummocks being distinct from lawns and pools etc. Some taller hummocks of *Sphagnum austinii* and *S. beothuk* may also be present in 10/15 and 10/15 tends to have at least some quaking element while 10/4 does not. *Rhynchospora alba* tends to have a higher cover value in 10/4 (often >20%) than in 10/15 (usually 5-10%).

Where pools occur at a cover of >10%, consider the sub-central Complex **4+P** (where pools are interconnecting and there are open water areas) or Complex **9/7/4+P** (where pools are smaller and not interconnecting but have an excellent *Sphagnum* cover).

Complex 4/10, on the other hand, is differentiated from sub-marginal Complex **9/7/4** in having a higher *Sphagnum* cover. Algae and other indications of desiccation are also more common in Complex 9/7/4.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex supports the Annex habitat “Depressions on peat substrates of the Rhynchosporion” (7150).

Complex 10/6 (and 6/10)

Microtopography: In-filled hollows/lawns and hummocks with pools <10% or absent

***Sphagnum* cover:** >75% (**6/10** variant has a lower cover)

Firmness: Soft to very soft

Characteristic species: *Narthecium ossifragum* (>15%) and *Sphagnum cuspidatum* (>10% cover)

Description: This is a sub-central complex, in which the surface is usually very soft underfoot. Low hummocks and hollows are present and sometimes there are occasional pools (<10% cover). *Sphagnum* (>75%) dominates the vegetation occurring in low hummocks, lawns, in-filled hollows and pools along with *Narthecium ossifragum* (>15%, usually >20%), which is found growing in pools, hollows and lawns. *Eriophorum angustifolium*, *Drosera anglica* and *Menyanthes trifoliata* are found occasionally. Hummocks of *S. rubellum* are frequent and hummocks of *S. austinii*, *S. subnitens* and *S. beothuk* are also usually present. *Calluna vulgaris* (10-20%) dominates in hummocks with *Eriophorum vaginatum* (5-20%) frequent in places. *Rhynchospora alba* is present at low cover values in hollows (<5%).

Variants: Where conditions are slightly drier and the *Sphagnum* cover is lower (41-75%), variant Complex **6/10** occurs. Any pools present in 6/10 usually show signs of desiccation with algae often frequent and the dominant ‘pool’ *Sphagnum* being *Sphagnum papillosum* and/or *S. medium* instead of *S. cuspidatum*.

Similar Complexes: Where pools occur at a cover of >10%, the cover of *Narthecium* is >25%, the *Narthecium* hollows are largely devoid of *Sphagnum* and the overall cover of *Sphagnum* is c 40% or lower, consider the sub-marginal Complex **6+P**.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can support the Annex habitat “Depressions on peat substrates of the Rhynchosporion” (7150).

Complex 3/10 (and 10/3)

Microtopography: In-filled hollows/lawns, flat and hummocks with pools <10% or absent

***Sphagnum* cover:** >40% (**10/3** variant has a higher cover)

Firmness: Soft to very soft

Characteristic species: *Carex panicea* (>15%), *Cladonia portentosa* (>25%) and *Pleurozia purpurea* usually present

Description: This is a transitional sub-central/sub-marginal complex that has characteristics of each ecotope. It tends to occur on sites that have some western indicators present such as *Pleurozia purpurea*. *Carex panicea* reaches high cover values (>15%) within the complex due to the western influence, reaching cover values of 30% in the more western sites. The bog surface is soft underfoot and very soft in places. The *Sphagnum* cover is >40% (and usually >50%), tending to be higher on the less western sites. This is dominated by hummocks of *Sphagnum rubellum* with frequent lawns and low hummocks of *S. medium* and *S. papillosum* as well as occasional hummocks of *S. austinii* and *S. beothuk*. There are also usually patches of *S. cuspidatum* in in-filled hollows. *Calluna vulgaris* and *Eriophorum* spp. are the only other prominent vascular plants with *E. angustifolium* sometimes being particularly abundant. The cover of *Cladonia portentosa* is usually high (>25%) while the cover of *Rhynchospora alba* tends to be low (<5%).

Variants: Where the *Sphagnum* cover is >75%, the complex is distinguished as Complex **10/3**.

Similar Complexes: Where conditions are slightly drier and the *Sphagnum* cover is lower, consider the sub-marginal complex 9/7/3. This is differentiated from 3/10 in having less *Sphagnum* in hollows or lawns and a thinner *Sphagnum* layer in hummocks. Where the cover of pools is higher (>10%), consider the sub-central complex 3/9+P.

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can sometimes support the Annex habitat “Depressions on peat substrates of the Rhynchosporion” (7150).

Complex 9/7/10

Microtopography: Dominated by hummocks with occasional hollows. Pools very rare or absent.

***Sphagnum* cover:** >50% (usually higher)

Firmness: Soft to very soft (usually very soft)

Characteristic species: *Calluna vulgaris* (20-40%), *Eriophorum vaginatum* (>15%; generally >20%) and *Sphagnum rubellum* is the dominant *Sphagnum*.

Description: This is a transitional sub-central/sub-marginal complex that has characteristics of each ecotope. The complex usually grades into the sub-marginal Complex 9/7 and the differences between the two complexes are very subtle. The surface is usually soft to very soft underfoot. Hummocks dominate with occasional hollows and lawns, and pools are largely absent. Generally, however, the *Sphagnum* layer in the sub-central complex is thicker and has a slightly higher cover (>50%). *S. rubellum* is usually the dominant *Sphagnum* within this complex, but there is always at least some cover (>5% and usually >10%) of ‘wetter’ *Sphagna*, typically *S. medium*. There are also often very occasional hummocks of *S. austinii*. *Eriophorum vaginatum* (usually >20%) is also more abundant in the sub-central complex than in 9/7 and characterises the vegetation along with *Calluna vulgaris* (c. 30%) and little or no cover (<5%) of *Narthecium ossifragum*.

Similar Complexes: Where the cover of *Calluna vulgaris* increases (>50%) and that of *Eriophorum vaginatum* decreases (<15%), the cover of *Sphagnum* also usually decreases and the complex grades into the sub-marginal Complex 9/7. Complex 9/7/10 is differentiated from the better quality Complex 9/10 in having a higher cover of hummocks (usually >50%) compared to 9/10 (usually <50%). *Sphagnum* lawns are also usually a prominent feature of 9/10 and rare in 9/7/10. *S. cuspidatum* cover is also higher in 9/10 (usually >10%) than in 9/7/10 (usually <5%).

Annex habitats: As well as supporting the Priority Annex habitat Active Raised Bog (7110), this complex can sometimes support the Annex habitat “Depressions on peat substrates of the Rhynchosporion” (7150).

SUB-MARGINAL ECOTOPE COMPLEXES

Complex 9/7/6+P (and 9/7/3+P, 9/7/2+P)

Microtopography: Hummocks, hollows, flats and pools (>10% cover).

***Sphagnum* cover:** 11-40% (usually c. 30-40%)

Firmness: Soft

Characteristic species: *Eriophorum* spp. (>10%); *Narthecium* dominated hollows (>10%; usually >20%).

Description: This is a sub-marginal complex that may have some characteristics of the sub-central Complex 9/7+P. However, generally there is a lower cover of *Sphagnum* within 9/7/6+P and a higher cover of *Narthecium* dominated hollows. These *Narthecium* hollows can occur in 9/7+P but will be accompanied by a relatively high *Sphagnum* cover while in 9/7/6+P, the hollows are largely devoid of *Sphagnum*. Pools in 9/7/6+P also differ from those in 9/7+P in that the cover of *Sphagnum* is patchier (usually <50% cover of pool) and algae is more common. Otherwise, species composition can be similar to the sub-central Complex 9/7+P.

Variants: Two variants of this complex also occur. These tend to occur where hollows are less distinctive, and flats become more prominent. In these cases, *Narthecium ossifragum* usually becomes

less abundant and is replaced by either *Carex panicea* (Complex 9/7/3+P) and/or *Trichophorum germanicum* (Complex 9/7/2+P).

Similar Complexes: Differentiated from the sub-central **Complex 9/7+P** in having a lower *Sphagnum* cover and a higher cover of *Narthecium ossifragum* and algae.

Annex habitats: None.

Complex 6+P (and 6/3+P)

Microtopography: Low hummocks, flats, hollows/depressions and pools (>10% cover).

Sphagnum cover: 11-40% (usually c. 20-30%)

Firmness: Soft

Characteristic species: *Narthecium ossifragum* (>15%)

Description: This is a sub-marginal complex that may have some characteristics of the sub-central Complexes 6/9+P and/or 6/35. However, generally there is a lower cover of *Sphagnum* within 6+P. In Complex 6+P, *Narthecium* dominated areas can cover a large amount of the complex (usually >25%) and these areas are largely devoid of *Sphagnum*. Pools are usually less extensive than in 6/35 and support less *Sphagnum* than in 6/9+P. The cover of *Eriophorum vaginatum* is also usually low (<10%) in 6+P.

Variants: Where there is an increased cover of *Carex panicea*, the variant 6/3+P occurs.

Similar Complexes: Differentiated from the sub-central **Complex 6/9+P** in having a lower *Sphagnum* cover and a higher cover of *Narthecium ossifragum*, *Carex panicea* and algae. Differentiated from the marginal **Complex 3/6+P** in having a higher *Sphagnum* cover, a higher cover of *Narthecium ossifragum* and a lower cover of *Carex panicea*. The ground also tends to be soft in 6/3+P while firm in 3/6+P.

Annex habitats: None.

Complex 9/7 (and 7/9)

Microtopography: Dominated by hummocks with occasional hollows. Pools absent.

Sphagnum cover: 11-50% (usually c. 40%, but can be much lower in Complex 7/9)

Firmness: Soft to very soft (usually soft)

Characteristic species: *Calluna vulgaris* (>30% and usually >50%), *Eriophorum vaginatum* (>10%) and *Sphagnum rubellum* is the dominant *Sphagnum*.

Description: This is a sub-marginal complex that has many characteristics of and often grades into the sub-central Complex 9/7/10. The differences between the two complexes are subtle and not easy to identify. However, in general the *Sphagnum* layer in the sub-marginal complex is thinner and reaches a slightly lower abundance cover averaging at ca. 40% but is sometimes higher. Although *Eriophorum vaginatum* (10-15%) characterises the vegetation along with *Calluna vulgaris* (>30%), it is not as abundant as it is in the sub-central complex. Furthermore, the *Sphagnum* layer is dominated almost entirely by *S. rubellum* with occasional *S. tenellum* and *S. papillosum*.

Variants: Where the cover of *Calluna vulgaris* increases to >75%, conditions are generally drier and the complex is distinguished as Complex 7/9. The growth of *Calluna* is usually more robust in these areas, often growing up to 0.7m and the cover of *Eriophorum vaginatum* is lower (5%). There is also an increased cover of *Hypnum jutlandicum* underneath the *Calluna*.

Similar Complexes: Complex 9/7 differs from 9/7/10 in that generally there is a lack of cover of any 'wetter' *Sphagna* with *S. medium* being particularly useful as a diagnostic species of 9/7/10. The quality of the complex generally degrades with an increase in cover of *Calluna vulgaris* and a decrease in cover of *Eriophorum vaginatum*. *Narthecium ossifragum* is absent or occurs at <5% cover. Where there is an increase in cover of *Narthecium ossifragum* (>5%), the complex grades in to the sub-marginal Complex 9/7/6.

Annex habitats: None.

Complex 9/7/6 (and 9/7/4, 9/7/3, 9/7/2)

Microtopography: Dominated by hummocks and hollows. Pools largely absent.

Sphagnum cover: 11-40% (usually c. 25-30%)

Firmness: Soft to very soft (usually soft)

Characteristic species: *Calluna vulgaris* (>25%), *Eriophorum vaginatum* (>10%) and *Narthecium ossifragum* (>10%).

Description: This is one of the most common complexes found on the high bog and is indicative of a slightly lowered water table. It is similar to Complex 9/7, but with the addition of frequent *Narthecium* dominated hollows that cover at least 10% of the complex. These hollows can often cover up to 50% of the complex and generally have little or no *Sphagnum* cover.

Variants: Where the hollows are more like depressions and have a higher cover of *Rhynchospora alba* instead of *Narthecium ossifragum*, the variant 9/7/4 occurs. Note that in 9/7/4, the depressions still have little or a patchy cover of *Sphagnum*, and where the cover becomes moderate, consider the sub-central complexes 9/7/10 or 4/10. Where the hollows are more like flats and have a higher cover of *Carex panicea* instead of *Narthecium ossifragum*, the variant 9/7/3 occurs, or where the flats support a high cover of *Trichophorum germanicum*, the variant 9/7/2 occurs.

Similar Complexes: Differentiated from Complex 9/7 in having a lower *Sphagnum* cover and a higher cover of hollows dominated by *Narthecium ossifragum*. Differentiated from the sub-central Complex 9/7/10 in that the hollows have little, or no *Sphagnum* cover and the overall *Sphagnum* cover is <40%, consider.

Annex habitats: None.

Complex 6/4

Microtopography: Dominated by low hummocks, hollows, flats and depressions that often appear to have been a former pool system. Pools and lawns largely absent.

Sphagnum cover: 11-40% (usually c. 25-30%)

Firmness: Soft to Very soft

Characteristic species: *Rhynchospora alba* (≥15%) and *Narthecium ossifragum* (≥20%)

Description: This is a typical sub-marginal complex with *Sphagnum* cover usually c. 25-30%. *Rhynchospora alba* dominates in depressions, which appear to be dried out pool systems. These depressions have a patchy *Sphagnum* cover with occasional *S. medium* and *S. cuspidatum* (both usually <5%). *S. papillosum* and *S. rubellum* are the most abundant *Sphagnum*. *Eriophorum* spp. can also be prominent, and *Narthecium* can have a large cover value (up to 40%). The relative abundance and height of *Calluna vulgaris* can often be low in this complex.

Similar Complexes: Where *Calluna vulgaris* is more of a feature and the cover of *Narthecium* decreases, consider the sub-marginal Complex 4/7.

Annex habitats: None.

Complex 6/3 (and 6/3/9)

Microtopography: Dominated by low hummocks, hollows and flats. Lawns absent. Pools largely absent.

Sphagnum cover: 11-40% (usually c. 20-25%)

Firmness: Soft

Characteristic species: *Carex panicea* (≥15%) and *Narthecium ossifragum* (≥20%)

Description: *Narthecium ossifragum* dominates in hollows and there are little or no deeper depressions or pools. *Carex panicea* (≥15%) dominates in flats and is often mixed in with the *Narthecium* hollows. *Sphagnum* cover is usually c. 20-25% and is generally composed of low hummocks of *Sphagnum rubellum*, *S. papillosum* and *S. tenellum*.

Variants: Where *Eriophorum* spp. are present at >10% cover, the surface can be softer and the cover of *Sphagnum* higher. This is considered a variant of 6/3 and is termed 6/3/9.

Similar Complexes: Where this complex occurs with pools, consider the sub-marginal Complex 6/3+P. Where the cover of *Narthecium* decreases, that of *Carex panicea* can increase. In these areas the surface is often firmer, and the cover of *Sphagnum* lower. Consider the marginal Complex 3/6 where the *Sphagnum* cover is at or below 10% cover.

Annex habitats: None.

Complex 4/7

Microtopography: Dominated by hummocks and hollows. (Sometimes with features that appear to be degraded dried out former pools now dominated by *Rhynchospora* and/or algae)

Sphagnum cover: 11-40% (usually c. 25%)

Firmness: Soft

Characteristic species: *Rhynchospora alba* ($\geq 20\%$)

Description: This complex is characterised by a high cover of *Rhynchospora alba* (usually $>20\%$). Ericaceous shrubs (*Calluna vulgaris* and *Erica tetralix*) are the only other vascular plants that occur at high covers (usually 30-50% combined with both plants close to equal cover values). The cover of *Eriophorum* spp., *Narthecium ossifragum* and any other vascular plants is usually $<5\%$. There can be a diverse range of *Sphagnum* present with small patches ($<5\%$) of *S. medium* and *S. cuspidatum* persisting in the wetter parts where the occasional pool can sometimes be found. However, *S. rubellum*, *S. papillosum* and *S. tenellum* are more abundant.

Similar Complexes: Where the cover of *Narthecium* increases and ericaceous shrubs are less prominent, consider the sub-marginal Complex 6/4.

Annex habitats: None.

Complex 7/6 (and 7/6/4, 7/6/3)

Microtopography: Dominated by hummocks, flats and hollows.

Sphagnum cover: 11-40% (usually c. 20%)

Firmness: Soft

Characteristic species: *Narthecium ossifragum* ($\geq 20\%$) and *Calluna vulgaris* ($>25\%$)

Description: This is a poor-quality sub-marginal complex (many characteristics of marginal ecotope) characterised by having a high cover of *Narthecium ossifragum* (usually $>20\%$). Other than *Narthecium ossifragum* and *Calluna vulgaris*, no other vascular plants usually occur at a cover of $>10\%$ cover. *Sphagnum* cover is generally c. 20% and is dominated by *S. rubellum*.

Variants: A variant of this complex occurs where *Rhynchospora alba* is present at a cover of $>10\%$ (usually in depressions) and this is termed 7/6/4. Another variant of this complex occurs where *Carex panicea* is present at a cover of $>10\%$ and this is termed 7/6/3.

Similar Complexes: It can be difficult to distinguish Complex 7/6 from the marginal Complex 6/7. Apart from there being a higher *Sphagnum* cover, the surface is usually softer underfoot, hummocks are more common and *Eriophorum* spp are more frequent (although they still usually occur at $\leq 5\%$ cover). *Rhynchospora alba* is also usually present within Complex 7/6 (often $>5\%$ cover) while it can be largely absent (usually $<5\%$ cover) within 6/7.

Annex habitats: None.

MARGINAL ECOTOPE COMPLEXES

Complex 3/6+P

Microtopography: Low hummocks, flats, hollows and pools ($>10\%$ cover).

Sphagnum cover: c. 10%

Firmness: Firm

Characteristic species: *Carex panicea* ($>15\%$) and *Narthecium ossifragum* ($>15\%$)

Description: *Carex panicea* and *Narthecium ossifragum* are the most prominent vascular plants in this complex and there is usually a poorly developed microtopography with flats dominating. Pools are usually tear pools and while they may sometimes support a moderate *Sphagnum* cover, inter-pool areas are firm and almost devoid of *Sphagnum* ($<10\%$ cover). The cover of *Eriophorum vaginatum* is also usually low ($<5\%$).

Similar Complexes: Differentiated from the sub-marginal **Complex 6/3+P** in having a lower *Sphagnum* cover, a lower cover of *Narthecium ossifragum* and a higher cover of *Carex panicea*. The ground also tends to be firm in 3/6+P while it is soft in 6/3+P. Where pools are less distinctive and there is an increased cover of *Rhynchospora alba*, consider Complex 3/6/4.

Annex habitats: None.

Complex 6/7 (and 6/7/3, 6/7/2)

Microtopography: Hummocks, hollows and flats.

Sphagnum cover: ≤10%

Firmness: Firm

Characteristic species: *Narthecium ossifragum* (≥20%) and *Calluna vulgaris* (≥20%)

Description: This marginal complex is characterised by having a high cover of *Narthecium ossifragum* (usually >20%). Other than *Narthecium ossifragum* and *Calluna vulgaris*, no other vascular plants usually occur at a cover of > 10% cover. *Sphagnum* cover is generally c. 10% and is dominated by *S. rubellum*.

Variants: A variant of this complex occurs where *Carex panicea* is present at a cover of >10% and this is termed 6/7/3. Another variant of this complex occurs where *Trichophorum germanicum* present at a cover of >10% and this is termed 6/7/2. A third variant occurs where *Rhynchospora alba* is present at a cover of >10% (usually in depressions or erosion channels) and this is termed 6/7/4.

Similar Complexes: It can be difficult to distinguish Complex 6/7 from the sub-marginal Complex 7/6. Apart from there being a lower *Sphagnum* cover, the surface is usually firmer underfoot, flats are more dominant and *Eriophorum* spp are less frequent (largely absent or occurring at 1-3% cover). *Rhynchospora alba* is also usually present within Complex 7/6 (often >5% cover) while it can be largely absent (usually <5% cover) within 6/7 (except where there are scattered tear pools or erosion channels). The slope of the bog is also usually more pronounced in 6/7.

Annex habitats: None.

Complex 3/6 (and 3/6/2, 3/6/4, 3/6/7)

Microtopography: Hummocks, hollows and flats.

Sphagnum cover: ≤10%

Firmness: Firm

Characteristic species: *Carex panicea* (>15%) and *Narthecium ossifragum* (>10%)

Description: Flats dominate usually at >30% cover (often >50%) with *Carex panicea* (>15% and usually >25% cover) dominating. *Narthecium ossifragum* (>10% cover) is also prominent. The *Sphagnum* cover is very poor (≤10%) and is composed almost entirely of *S. rubellum* and *S. tenellum*.

Variants: A variant of this complex occurs where *Rhynchospora alba* is present at a cover of >10% (usually in depressions or erosion channels) and this is termed 3/6/4. This variant can sometimes support occasional tear pools and often occurs where there is at least a moderate slope. Another variant of this complex occurs where *Trichophorum germanicum* present at a cover of >10% and this is termed 3/6/2. A third variant occurs where flats are less dominant (but still occur at c. 25% cover), and *Calluna vulgaris* is prominent (>25% cover), and this is termed 3/6/7.

Similar Complexes: Where the cover of *Narthecium* increases, that of *Carex panicea* can decrease. In these areas the surface is often softer, and the cover of *Sphagnum* higher. Consider the sub-marginal Complex 6/3 where the *Sphagnum* cover is above 10% cover.

Annex habitats: None.

Complex 2/7 (and 2/3, 2/4)

Microtopography: Hummocks, tussocks and flats.

Sphagnum cover: ≤10%

Firmness: Firm

Characteristic species: *Trichophorum germanicum* (≥10%)

Description: This marginal complex is typically found close to the high bog margin where there is a moderate to steep slope. The *Sphagnum* cover is very poor ($\leq 10\%$) and is composed almost entirely of *S. rubellum* and *S. tenellum*. *Calluna vulgaris* can occur at high cover values (usually $>50\%$).

Variants: A variant of this complex occurs where *Calluna* is less dominant and *Rhynchospora alba* is present at a cover of $>10\%$ (usually in depressions or erosion channels) and this is termed Complex 2/4. Another variant of this complex occurs where *Calluna* is less dominant and *Carex panicea* occurs at a cover of $>10\%$ and this is termed 2/3.

Annex habitats: None.

FACEBANK ECOTOPE COMPLEXES

Complex 1

Microtopography:

Sphagnum cover: $\leq 10\%$

Firmness: Firm

Characteristic species: Robust *Calluna vulgaris* ($>90\%$)

Description: This complex usually occurs at the high bog margin and is characterised by the dominance of a robust growth of *Calluna vulgaris* ($>90\%$ cover and $>0.75\text{m}$ in height). *Sphagnum* cover is poor and usually no other vascular plants are prominent. Cracks in the bog surface are often frequent.

Annex habitats: None.