Cyfoeth Naturiol Cymru
Natural Resources Wales

A Survey and Assessment of H11 *Calluna vulgaris-Carex arenaria* Dune Heath 2014-15

Author: Jan Sherry

Surveyors: Jan Sherry, Emma Brown, Dan Guest, Sally Ellis, Julie Creer and Eurig Jones
Natural Resources Wales

NRW Evidence Report No. 138

Summary

Dune heath corresponding to the Annex 1 habitat **H2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)** is very rare in Wales. The largest known site was destroyed approximately 20 years ago, the remaining sites probably cover less than 20 hectares combined.

Four dune heath sites, believed to be the largest remaining areas of habitat in Wales were surveyed on the Gower in 2014 and Anglesey in 2015.

1. Pennard Burrows Golf Course, Gower supports areas of dune heath within the roughs. On the very nutrient-poor areas of bare sand the dune is short and lichen-rich and in good condition. Where deeper soils overlay the sand there is rank heathland and dune grassland vegetation. Appropriate management by cutting and grazing could improve the condition of this taller dune heath vegetation. **Area 3.76 ha.**

2. Penmaen Burrows, Gower is an unmanaged headland. The dune heath is largely very rank and there is considerable scrub invasion. Some areas of shorter lichen-rich vegetation survive and it is believed that the reintroduction of management could restore some of the more rank areas of dune heath. **Area 2.94 ha**.

3. Tywyn-gwyn, Beddmanarch Cymyran SSSI is an area of *Calluna* dominated dune heath with patches of lichen-rich vegetation. The site is grazed by cattle and rabbits although the rabbit population is currently low and hence there is little open sand. The site appears to be in good condition with favourable management, although the recovery of the rabbit population needs to be monitored. **Area 4.32 ha.**

4. Cymyran, Beddmanarch Cymyran SSSI is an area of unmanaged *Calluna* dominated dune heath with considerable scrub and bramble invasion. However the site still supports relatively extensive areas of *Cladonia*-rich habitat and whilst these are currently in satisfactory condition there are signs that even these areas are threatened by scrub encroachment. The introduction of some form of management is critical. **Area 2.72 ha**

A number of other areas or potential areas of H11 dune heath require investigation, these are likely to support very small areas of the dune heath habitat.

- Tywyn Aberfraw SSSI
- Llanddwyn Island, Newborough Warren and Ynys Llanddwyn SSSI
- Tiroedd a Glannau Rhwng Cricieth ac Afon Glaslyn SSSI
- Morfa Abererch SSSI
- Kenfig SSSI
- Earlswood Golf Course Crymlyn (original large site which may support a remnant of the dune heath vegetation

Contents

1. Introduction

The purpose of the survey is to identify, quantify and where possible ascertain the condition of dune heath vegetation which can be assigned to the Habitats Directive[1] Annex 1 habitat **H2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*).**
Although it is known that this habitat occurs in Wales there are currently no SACs supporting this habitat as a feature.

This current survey will focus on **H11a *Calluna vulgaris – Carex arenaria* Heath** and will allow Natural Resources Wales to report more comprehensively on **H2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)** at the next Article 17 reporting round.

The habitat is highly restricted in Wales and the largest known historic site, at Crymlyn in south Wales site was destroyed about 20 years ago. The remaining sites are relatively small, the four included in this survey are believed to be the largest extant areas of habitat.

[1] Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora

2. Description of H2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)

Dune heath occurs on mature stable dune. Ericoid dominated habitats are typically found on nutrient poor acidic soils. Therefore, on dunes heathland communities occur where the sand has been decalcified by the leaching of Calcium carbonate. In Wales dune heath is characterised by the abundance often dominance of *Calluna vulgaris*, along with *Erica cinerea* which can be abundant. The dune heath in Wales is typically found associated with dune grassland species such as *Festuca ovina, Agrostis capillaris, Carex arenaria* and *Ammophila arenaria*. Dune heath in Wales is also characterised by a dense mat of bryophytes including species such as *Hylocomium splendens, Hypnum cupressiforme* and *Pleurozium schreberi.* Where the sand is very nutrient-poor and subject to drought, the ericoid canopy is replaced by lichens most noticeably the *Cladonia* lichens which can form a dense grey mat over the sand.

In the Wales this Annex I type corresponds to the following NVC types:

- H11a *Calluna vulgaris – Carex arenaria* heath, *Erica cinerea* sub-community
- H11c *Calluna vulgaris – Carex arenaria* heath, species-poor sub-community

There may be other heaths on sand, which fall into the Annex 1 category which do not correspond to an NVC community.

3. Methodology

The survey was focused on the identification and description of the **H11a *Calluna vulgaris* – *Carex arenaria*** dune heath community. At each site, homogeneous stands of heathland were identified, sampled and mapped. The relevant draft chapter of the published NVC Volume (Rodwell, 1991), provided the framework for community definition. NVC determination relied heavily on the frequency and cover of characteristic species. Sub-communities were identified as far as possible but there was limited time to undertake sufficient sampling.

Vegetation was sampled selectively using 2 × 2 m quadrats, within which the abundance of each species of vascular plant, bryophyte and macro-lichen was estimated using the Domin scale. Where required, a quadrat sample was recorded in each main stand type. All vascular plants within each stand were assigned cover/frequency values using a standardized DAFOR scale.

Macro-lichens are a distinctive feature of this habitat. An attempt was made to identify all lichens on site, however, samples were sent to Tracey Lovering and Steve Chambers for verification.

Due to limited staff resources mapping time was limited. For Penmaen Burrows the H11 polygons were selected from an earlier Dune Survey. Individual areas of H11 were mapped on Pennard Burrows Golf Course by Dan Guest using aerial images. On Tywyn-gwyn and Cymyran very limited time meant it was not possible to plot individual stands of H11 instead it was agreed to map the outer boundary of the area of dune where H11 was the principal vegetation, even if this area included mosaics. These sites were mapped using GPS and/or aerial images.

4. Pennard Golf Course (Pennard Burrows): Site Description

4.1 Introduction

Pennard Golf Course is situated on the south-eastern corner of the Gower Peninsula, 12 km west of Swansea City Centre, between the villages of Pennard and Southgate. The Golf Course occupies approximately 70 hectares and is situated just inland from Three Cliffs Bay. The core area of play around the club house is situated at an altitude of 60 metres but the land drops towards the beach and Pennard Pill River to the west and north respectively. The course is described as being routed over "classically undulating and tumbling linksland". This landscape of hummocks and hollows has been created largely by the natural form of the underlying dune system with more recent changes arising from the creation and subsequent management of the golf course. Pennard has a long golfing history with the game being first played in 1896 and much of the early development of the golf course taking place after the reconstitution of the club in 1908. Today the course is well established with managed fairways, greens and revetted sand bunkers interspersed with areas of gorse scrub, dune grassland and dune heath forming the roughs.

Pennard Burrows on which the golf course is sited is a system of perched dunes formed by wind blown sand, the dune system is underlain by Carboniferous limestone as is much of the South Gower coast. The burrows cover approximately 85 hectares. The area has a history of considerable sand movement and it is believed that sand inundated both the castle and the former village of Pennard in medieval times leading to the abandonment of the castle by 1400. The River Pennard Pill, has sanded up considerably in the last few centuries, as it is known that in the 18th century ships could moor below Pennard Castle (Packham and Willis 1997).

Due to time constraints the present survey aimed to cover only the dune heath within the golf course. Survey effort was concentrated on mapping areas of dune heath and the assessment of the floristic quality of stands representing structural and floristical variation in the dune heath community. Quadrat recording was relatively limited due both to time constraints and to safety issues as the golf course was exceedingly busy and some stands of vegetation were impossible to sample due to their close proximity to greens and fairways. Some quardats had to be completed in more haste than was desirable and it is felt that more time spent on the open dune heath would likely to have yielded more lichen species.

4.2 Habitat Description

All the dune heath within the golf course is classed as **H11 *Calluna vulgaris – Carex arenaria* heath,** two sub-communities were recorded **H11a *Erica cinerea* sub-community** and **H11c species-poor sub-community**. The areas of dune heath is approximately 2.77 hectares.

The **H11a *Erica cinerea* sub-community** occurs on small stable dune hummocks where a very thin humic layer overlays the sand. The sub-community is characterised by only low to moderate ericoid cover with both *Calluna vulgaris* and *Erica cinerea* present. The sub-shrubs rarely grow to more than 10cm in height and frequent seedlings of both species were present. However, cryptogams form the distinctive element of the vegetation and occupy much of the ground between the sub-shrubs. The low-growing mats of intermixed bryophytes and lichen are dominated by a few species, typically *Hypnum cupressiforme, Dicranum scoparium, Pseudoscleropodium purum* and *Cladonia portentosa*. *Cladonia furcata subsp. subrangiformis* is probably more abundant than it appears, as it is found growing interlaced with *Cladonia portentosa*. Other bryophytes include *Polytrichum pilferum, Rhytiadelphus squarrosus* and the liverwort *Ptilidium ciliare*. A number of other lichen species are present, the most frequent being *Cetraria aculeata* and *Peltigera canina*, whilst *Cladonia unicialis* and *Cladonia gracilis* are less frequent. Of the graminoids *Festuca ovina* occurred at low cover whilst *Carex arenaria, Aira praecox* and *Anthoxanthum odoratum* are typically sparsely distributed through the vegetation. Forbs such as *Jasione montana* and *Plantago lanceolata* are typically sparse with *Hypochoeris radicata* present at low cover in some stands. *Logfia minima* is recorded from one stand where it is locally abundant, this species may have been present in other stands which were not sampled. *Quercus* seedlings are present.

In the **H11c species-poor sub-community** the ericoid cover is tall (up to 50cm), dense and dominated by *Calluna vulgaris*. *Erica cinerea* is present at low cover and associated with more open and low growing patches of vegetation. Bryophytes typically *Hylocomium splendens*, *Pseudoscleropodim purum*, *Hypnum cupressiforme* and *Dicranum scoparium* occur beneath the ericoid canopy in places forming a relatively thick hummocky mat. Tall Graminoids are characterised by *Deschampsia flexuosa*, *Festuca ovina* and *Anthoxanthum odoratum. Carex arenaria* is generally sparse but can be locally abundant. Of the lichens only *Cladonia portentosa* is present growing on the bryophyte mat. Typical heathland forbs such as *Galium saxatile, Potentilla erecta* and *Veronica officinalis* are found in shorter patches of vegetation. *Quercus* saplings are present.

In addition to the two subcommunities there are stands of tall *Carex-Festuca-Agrostis* grassland (NVC community not sampled) with ericoids which are locally abundant. These stands are typically richer in forbs and graminoids than the **H11c species-poor sub-community** but have fewer bryophytes and lichens than the **H11a *Erica cinerea* sub-community**. The vegetation could be considered a grassy variant of the H11c or *Carex-Festuca-Agrostis* grassland which has been colonised by ericoids at some point due to sudden grazing changes. Rodwell (1991) notes " *occasional bushes (sub-shrubs) are sometimes to be seen among more extensive tracts of grassland but there is rarely that gentle gradation of size and age among bushes that denotes a continuous process of invasion. More usually, it looks as if the patterns reflect past colonisation events, with grass/heath transitions often subsequently sharpened up by renewed grazing*."

4.3 Management

The course is managed by the golf club which primarily entails maintenance of the playing areas (the greens and fairways) rather than the roughs. However, the golf club are keen to protect the semi-natural vegetation, for example they have taken measures to safeguard the pyramidal orchids from grazing cattle. From conversations with the club and members there is

no doubt that the flora of the dunes is appreciated and valued. The site has high scenic appeal to the golfers and the profusion of flowers and native vegetation is part of the appeal.

Pennard Burrows is registered common land and it is grazed with the adjoining Pennard Valley. Cattle are grazed from June to November, although the exact number of cattle is not known. There is no sign of damage by cattle to the dune heath community, although there is anecdotal evidence reports that the amount of heather has declined and that the fairways have changed species composition. It is difficult to say whether this is the result of grazing. Some grazing particularly by cattle is important for the dune heath, as it prevents the vegetation becoming rank and halts the spread of gorse and other scrub.

Some mechanical management of the taller **H11c species-poor heath** would be desirable as this may encourage cattle to graze these areas. Rodwell suggests that renewed grazing can reverse the decline of the species-poor heath. The heath should be cut back hard to ground level in the winter and the arisings removed. The sand could then be disturbed by light scarification to encourage recolonisation, excessive disturbance should be avoided as this may remove the leached upper sand horizon and the thin skin of humic material. It would be preferable to trial this approach in one or two areas first to see how well dune heath recovers after perturbation. Areas of tall grassland with an ericoid component could be managed to increase the dune heath vegetation by taking a grass cut, removing the arising and scarifying the sand beneath.

The areas of short **H11a *Erica cinerea* heath** need no additional management. Although tree seedlings were present, it seems unlikely they will establish on the thin soils and with the grazing pressure, however, it may be necessary to remove tree seedlings at intervals. Care should be taken not to allow fertiliser, lime or herbicide use in these areas as these will all damage the vegetation. Where gorse starts to shade areas of dune heath it would be beneficial to cut it to push back the front edge of the gorse patch. There is also a need to ensure no new paths are created through the heath as this will lead to further habitat loss and fragmentation.

4.4 Conclusion and Conservation Assessment

H11 *Calluna vulgaris – Carex arenaria* heath is very rare in Wales with less than 50 hectares recorded. The vegetation falls within the European Annex 1 habitat-type 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*). Currently there are no Special Areas of Conservation (SAC) in Wales which include the habitat as a qualifying SAC feature.

The largest area of dune heath in South Wales was destroyed some years ago near Crymlyn Burrows. The dune heath on Gower therefore represents the largest remaining area of the habitat in the south and the majority of this land lies outside the designated site series and therefore receives no statutory protection.

As the best example in the south, Pennard Golf Course is a site of high conservation value which needs to be maintained and protected by working with the Golf Club and commoners.

The current survey mapped the entire area of dune heath but did not separate the higher quality **H11a Erica *cinerea* sub-community** from the **H11c species-poor sub-community**, it would therefore be useful to separately map the two communities to calculate the area of lichen-rich habitat.

Much of the dune heath on the site is in good condition showing no signs of over-grazing or enrichment. Careful management of the ranker vegetation may improve the areas of species-poor heath.

4.5 Quadrat Descriptions and Photographs

Quadrat 1
Open heath in sand soil with thin humic layer. Low growing mat of bryophytes and the lichens, *Cladonia portentosa*, *C. furcata subrangiformis*, *C. unicialis*, *Cetraria aculeata* with patches of dwarf-shrub. Graminoids and forbs sparsely distributed throughout. Heather seedlings (*Calluna* and *Erica cinerea* frequent). Little old or degenerate heather.

Quadrat 2
Calluna dominated heath with high canopy cover. Deep moss layer beneath. Species-poor no lichens. *Carex arenaria* present but less widely distributed than in the open heath. Vegetation tall.

Quadrat 3
Area of short bryophyte/lichen rich heath with scattered patches of dwarf-shrub. High cover of *Cladonia portentosa*. Frequent *Calluna* and *Erica cinerea* seedlings. Graminoids and Forbs sparse and distributed throughout sward.

Quadrat 4
Low mat of bryophytes and lichens few mature ericoid plants but abundant *Calluna* and *Erica cinerea* seedlings. Graminoids scattered through heath. *Carex arenaria* absent from quadrat but present in stand

Quadrat 5
Short dune heath with mat of lichen and bryophytes and scattered ericoids. One plant of *Logfia minima* in quadrat but locally abundant nearby.

Quadrat 6
Tall (30cm) rank *Calluna* dominated heath. Very species poor but *Carex arenaria* still present. Locally scrub invasion.

Quadrat 7
Low mat of lichens and bryophytes - varied lichen flora, *Cladonia portentosa* particularly abundant. Vegetation very dry

5. Penmaen Burrows: Site Description

5.1 Introduction

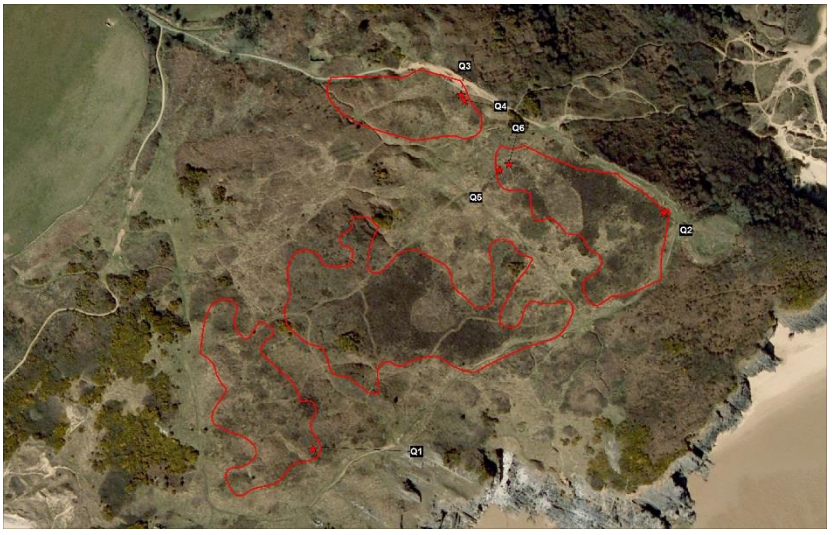
Penmaen Burrows is situated in the south-eastern corner of the Gower Peninsula approximately 14 km west of Swansea City Centre. The site occupies 30 hectares and is situated on the coastal cliff which marks the western edge of Three Cliffs Bay and the eastern edge of Oxwich Bay. The cliffs here reach a maximum height of around 60 metres. A small portion of the cliff on the seaward edge falls within the Great Tor Three Cliffs Bay geological SSSI and the Oxwich Bay SSSI lies to the west and is contiguous with Penmaen Burrows. Oxwich Bay SSSI supports a range of notified habitat and species features including dunes.

The National Trust owns the site and the adjacent Nicholaston Burrows. The site is an important recreational resource and the busy all-Wales coastal path runs along the cliff top. Penmaen Burrows is an important archaeological site and is known for the remains of a Neolithic burial chamber, the Norman Ringwork and its medieval church.

The burrows were formed by windblown sand and are underlain by Carboniferous limestone. Like the nearby Pennard Burrows the area has been subject to much sand movement in past centuries. It is believed that the old church of Penmaen was abandoned following the Black Death in the 14th Century and subsequently became covered by sand. Legend has it that the village of Stedwarlango also lies buried beneath the burrows.

The site supports a mixture of scrub woodland, coastal grassland and heath. Much of the central area has been invaded by dense bramble and bracken. On the coastal cliff itself the vegetation is rank but is kept more open by salt-spray and wind.

The current survey focused on areas of heath and did not sample or map other vegetation types.



5.2 Habitat Descriptions

At first glance the heath at Penmaen does not resemble typical dune heath: the vegetation is tall and rank dominated by *Calluna vulgaris* or *Vaccinium myrtillus* with high canopy cover. In places it is invaded by both bracken and bramble and tree saplings and trees are encroaching on to the heath. However, a closer inspection demonstrates that *Carex arenaria* is constant throughout the heath although it is very sparse and only locally frequent. The area of the dune heath is approximately 2.65 hectares.

Therefore all the heath has been classed as **H11 *Calluna vulgaris – Carex arenaria* heath,** two sub-communities were recorded, the **H11c species-poor sub-community** and very small amounts of the **H11a *Erica cinerea* sub-community**.

The bulk of the vegetation falls into the **H11c species-poor sub-community**. Over much of this area the heath is dominated by tall *Calluna* (Q1 Target note 1) which in places reaches waist height, however in the eastern corner near the Norman Ringwork (Q2) *Vaccinium myrtillus* is dominant with *Calluna* sub-dominant.

The vegetation is species poor with little lichen interest. *Carex arenaria* is present but sparse. In some places there is a thick layer of bryophytes beneath the canopy, typically *Pseudoscleropodium purum, Hylocomium splendens* and *Rhytidiadelphus squarrosus.* Most of these stands are invaded by bracken and other species more indicative of the transition to scrub such as *Lonicera periclymenum* and *Teucrium scorodonia.* Typical heathland forbs such as *Veronica officinalis, Galium saxatile, Hypochoeris radicata* and *Potentilla erecta* are sparsely distributed. At the stand level (Q1), there are areas of shorter vegetation with hummocks of bryophytes, typically *Pseudoscleropodium purum* and *Hypnum cupressiforme* on which *Erica cinerea* can be found, including a significant number of seedlings. *Festuca ovina* and *Agrostis capillaris* are also found in this shorter growing vegetation.

Small patches of H11a *Erica cinerea* sub-community occurs adjacent to the path north of the Norman Ringwork (Q3 and 4) and amongst dense bracken and bramble in the hard to access central zone (Q5 and 6). The vegetation is shorter than the species poor sub-community, but there are no open areas of sand. There is a thick mat of bryophytes, typically *Hypnum cupressiforme, Pseudoscleropodium purum,* and *Dicranum scoparium.* The ericoid component is varied with stands of low to moderate *Erica cinerea* cover (Q 4 and 5), patches of *Vaccinium myrtillus* (Q3) and areas of taller *Calluna vulgaris.* Dead woody shoots of *Erica cinerea* are prominent in some areas (Q3, 4 and 5). The only lichens recorded are *Cladonia portentosa* and *Peltigera canina*. *Cladonia portentosa* reaches moderate cover in Quadrat 4 and 6. Graminoids, *Agrostis capillaris, Anthoxanthum odoratum, Carex arenaria, Festuca ovina* and *Luzula campestris* are more prominent than in the species poor sub-community. Quadrat 4 is also notable for the high cover of *Hypochoeris radicata* and the frequency of *Vicia hirsuta*. Both bracken and *Teucrium* are present, indicating the unmanaged state of the vegetation and the transition to scrub.

5.3 Management

The site is currently unmanaged, with the exception of vegetation along the coastal path which is strimmed. The site has not been grazed for many years as is demonstrated by the succession to scrub woodland along the northern edge and the invasion of bramble and bracken.

Penmaen Burrows is registered common land, but no commoners currently exercise their rights on the land.

5.4 Conclusion and Conservation Assessment

H11 *Calluna vulgaris – Carex arenaria* heath is very rare in Wales with less than 50 hectares recorded. The vegetation falls within the European Annex 1 habitat-type 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*). Currently there are no Special Areas of Conservation (SAC) in Wales which include the habitat as a qualifying SAC feature.

The dune heath at Penmaen Burrows is currently in poor condition, but the persistence of more open areas and some lichen interest suggests that the heath may have held more interest in the past when it was managed by grazing.

Rodwell suggests that renewed grazing can reverse the decline of the species-poor heath. It is not known whether it is at all feasible to restore grazing at Penmaen, however, every effort should be made to encourage the re-establishment of grazing preferably by heavy livestock. There are other habitats such as the limestone and coastal grasslands which would also benefit from grazing. In the absence of grazing the remaining dune heath could be preserved and possibly enhanced by mechanical management. The heath should be cut back hard to ground level in the winter and the arisings removed. The sand could then be disturbed by light scarification to encourage recolonisation, excessive disturbance should be avoided as this may remove the leached upper sand horizon and the thin skin of humic material. Because the interest is being lost from the site, there is no reason not to try some relatively drastic intervention.

5.6 Quadrat Photographs and Descriptions

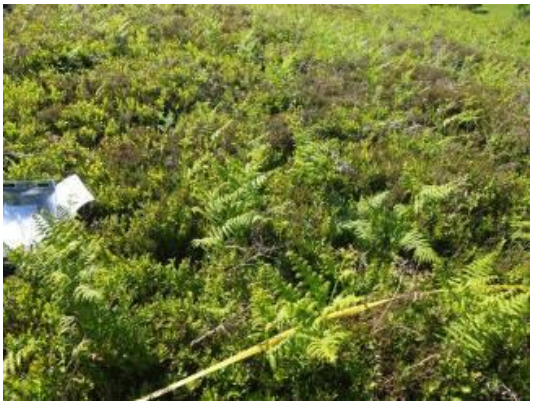
Quadrat 1
Tall closed canopy *Calluna*, with *Pteridium* growing through the canopy. *Carex arenaria* is very sparse under the canopy. *Lonicera periclymenum* and *Teucrium scorodonia* are present.

Stand 1: Shorter vegetation found near to Quadrat 1 with *Erica cinerea* growing through a thick bryophyte layer. *Carex arenaria* locally frequent. *Lonicera periclymenum* and *Teucrium scorodonia* are present.

Quadrat 1 tall *Calluna*

Stand 1 Short bryophyte vegetation

Quadrat 2
Closed canopy of *Calluna* and *Vaccinium myrtillus* with *Pteridium, Lonicera* and *Teucrium.* Sparse *Carex arenaria.*




Quadrat 2 *Calluna, Vaccinium* and *Pteridium*

Quadrat 3

Short vegetation consisting of a thick mat of bryophytes, principally *Pseudoscleropodium purum and Hypnum cupressiforme* with patches of *Erica cinerea and Vaccinium myrtillus. Carex arenaria* present at low cover*. Cladonia portentosa* sparsely distributed.

Quadrat 3

Bryophyte mat on hummock

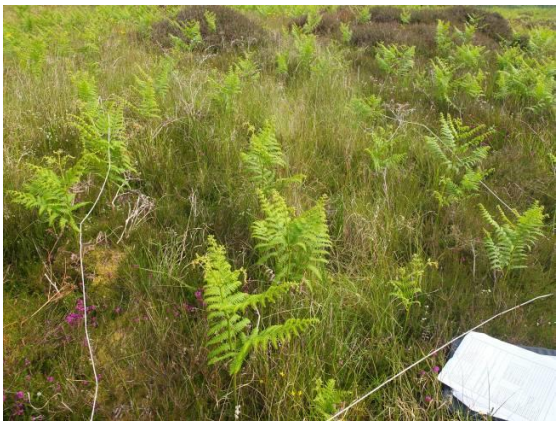
Quadrat 4

Short vegetation with a low cover of *Erica cinerea* growing through hummocks of bryophytes. *Cladonia portentosa* reaches moderate cover. *Carex arenaria* frequent*.* Notably high cover of *Hypochoeris radiacata.*


Quadrat 4 *Cladonia portentosa* and abundant *Hypocheris radiacata*

Quadrat 5
Grassy heath with a high cover of *Agrostis capillaris. Carex arenaria* sparse. *Erica cinerea* growing in hummocks of *Pseudoscleropodium purum* and *Hypnum cupressiforme*

Quadrat 5 Bracken invaded grassy heath



Quadrat 6
Mosaic of tall Calluna and low growing bryophytes mats the latter with patches of *Erica cinerea* and *Cladonia portentosa.* Low cover *of Carex arenaria, Galium saxatile* and *Festuca ovina.*

Quadrat 6 low growing moss mat with *Galium saxatile, Erica* and *Cladonia*

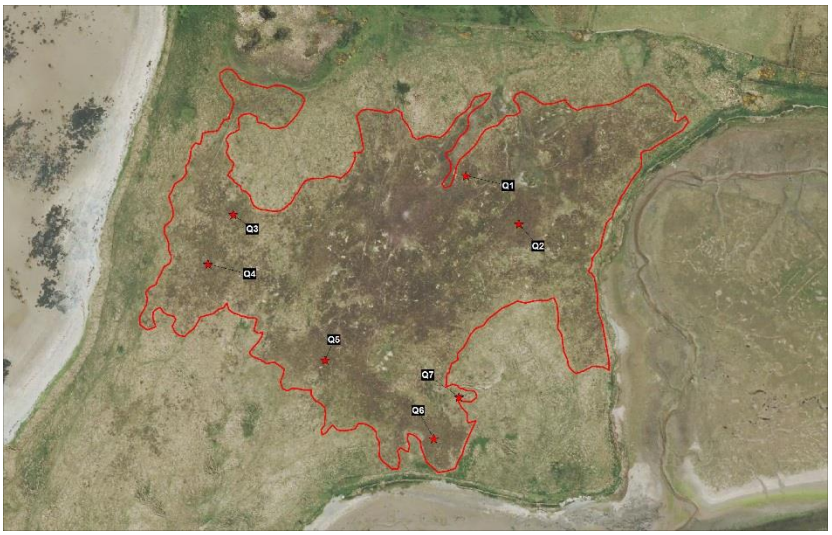
6. Tywyn-gwyn (Beddmanarch Cymyran Site 1): Site Description

6.1 Introduction

Tywyn-gwyn is part of the much larger Beddmanarch Cymyran SSSI which encompasses the shallow waters of the strait which separates Holy Island from mainland Anglesey. The SSSI includes mudflats, sandbanks and saltmarsh habitats in addition to the two areas of sand dune surveyed in this study. Tywyn-gwyn lies at the northern end of the SSSI on the Anglesey mainland forming a small peninsula between the strait and the mouth of the Afon Alaw. The dunes are relatively low the tallest being no more than 3 or 4 metres high. There are several areas of moist dune slack within the heath and one excavated temporary pond where cattle are watered.

The heath dominated vegetation is located in the northern part of the dunes and grades into grassier marram dominated vegetation on the southern and western edges.

The Anglesey Coastal Path traverses the northern edge of the dunes.



6.2 Habitat Description

The dune heath within the site is classed as **H11 *Calluna vulgaris – Carex arenaria* heath.** The vegetation is characterised by high ericoid cover particularly *Calluna vulgaris* although *Erica cinerea* is abundant in some stands. The dwarf-shrubs are typically low growing with woody stunted *Calluna*, rarely taller than 20-25 cm. There are frequent seedlings of both *Calluna* and *Erica* in areas of bare sand and open short vegetation. On the western edge of the heath, an area of well-vegetated dune supports abundant *Rosa pimpinellifolia* growing amongst and over the dwarf-shrub canopy. *Erica cinerea* and *Salix repens* are found in the moist dune slacks although *Calluna* remains the most abundant sub-shrub.

Festuca ovina is the most significant of the graminoids in terms of cover, although *Ammophil*a is abundant in some stands. *Carex arenaria* is sparsely scattered. Forbs are sparse, although *Thymus polytrichus, Hypochoeris radicata, Galium saxatile, Lotus corniculatus* and *Lotus pedunculatus* are locally abundant, the last of these found in moist slacks.

The cryptogam element of the vegetation is much less distinctive on this site than on the Cymyran (Beddmanarch Cymyran Site 2) section of the SSSI. Although three *Cladonia* species

were recorded (*Cladonia chlorophaea, C. portentosa, C. pyxidata*) only *Cladonia portentosa* makes any significant contribution to cover.

Brypophytes particularly the mosses *Hylocomium splendens*, *Hypnum cupressiforme, Dicranum scoparium* and *Pleurozium schreberi* are abundant, in places forming a luxuriant mat below the dwarf-shrub canopy.

Determination of the sub-community on this site is not easy; the **H11a *Erica cinerea* sub-community** is identified here by the presence of both *Calluna* and *Erica cinerea*, moderate to high cover of *Festuca ovina,* the presence of cryptogams particularly *Cladonia* lichens and the presence of a number of preferentials such as *Hypochoeris radicata*, *Ononis repens* and *Rosa pimpinellifolia.* The **H11c species-poor sub-community** is *Calluna* dominated, lacks or has a low frequency of *Erica cinerea,* cryptogams and other preferentials. However, in reality there is no clear division between the two sub-communities and it would be difficult to map them separately.

6.3 Management

The site is managed by grazing with cattle. This is believed to occur during the winter months when there is water on the site. No cattle were present during the survey but recent poaching by cattle was evident around the dried up margins of the temporary pond.

There is also evidence of rabbit grazing on the site and the adjacent field is noted as an historic rabbit warren on the OS maps. The level of rabbit grazing is currently low, probably as a result of a cyclical crash in the rabbit population. Consequently, the area of bare sand within the dune heath appears to be far smaller than on previous visits. It is clear that the cattle are not creating bare sand on the dunes, therefore the rabbits are particularly important to generate patches of sand for colonisation by cryptogams and young ericoids. It is assumed that the rabbit population will recover and future excavation of burrows will provide sufficient bare sand. It would be worthwhile visiting the site in a few years to determine whether this has occurred, or if the decline in the rabbit population is a more long-term problem.

There is limited invasion of the heath by hawthorn and common gorse, therefore it would appear that the combined impact of cattle and rabbit grazing is currently sufficient to maintain the open heath vegetation. Future visits will determine if any change to management is required.

6.4 Conclusion and conservation assessment

H11 *Calluna vulgaris – Carex arenaria* heath is very rare in Wales with less than 50 hectares recorded. The vegetation falls within the European Annex 1 habitat-type 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*). Currently there are no Special Areas of Conservation (SAC) in Wales which include the habitat as a qualifying SAC feature.

Tywyn-gwyn is one of the largest remaining sites and is of high conservation value. Continued liaison with the land owner will ensure the site is protected and managed appropriately.

The dune heath on the site appears to be in good condition. The lack of bare sand, as discussed previously, is likely to be the result of cyclical changes in rabbit numbers and so long as the population recovers, this is not currently of concern. Regular monitoring of the SSSI would provide a better picture of how the site changes over time and would help determine future management needs.

6.5 Quadrat Photographs and Descriptions

Quadrat 1
Calluna dominated heath with frequent *Carex arenaria* and scattered *Ammophila arenaria*. *Cladonia* lichens; *C. portentosa, C. chlorophaea and C. pyxidata* present at low cover

Quadrat and Stand 2
Calluna dominant, bushes woody and stunted. Open, low growing bryophyte-rich layer within the heath and some small patches of bare sand with *Cladonia portentosa*. *Festuca ovina* scattered throughout, but *Carex arenaria* absent and *Ammophila* only found locally at the stand level. *Cladonia chlorophaea* and *Peltigera canina* found on a larger patches of rabbit excavated sand in the wider stand.

Quadrat 2

Stand 2 Bare ground with *Cladonia* and *Peltige*ra. Signs of rabbit

Quadrat 3
Calluna co-dominant with *Festuca ovina* creating an open more grassy heath. Low hummocky *Calluna* found growing on old ant hills with a mat of bryophytes beneath, notably *Hypnum cupressiforme* and *Hylocomium splendens*. No lichen species recorded

Quadrat and Stand 4
Low growing rabbit-grazed *Calluna*. Pioneer *Calluna* found growing on relict sandy anthills. Small patches of bare sand on anthills and rabbit scrapes with *Cladonia chlorophaea, C. portentosa* and *Polytrichum juniperium.* High cover of *Festuca ovina* in the quadrat and the wider stand supports patches of *Festuca* dominated grassland with locally abundant *Galium saxatile* and *Lotus corniculatus*. *Ammophila* at low cover in the quadrat and occasional in the stand, *Carex arenaria* rare in the wider stand.

Quadrat 4

Quadrat 4 showing bare sand and *C. portentosa*

Stand 4

Stand 4 – Grass dominated patch with *Galium saxatile* and *Lotus corniculatus*

Quadrat 5

Very short *Calluna* heath with small patches of grass dominated vegetation principally *Festuca ovina.* Small patches of bare sand and low growing bryophyte mats notably *Hylocomium splendens* and *Pleurozium schreberi.* Lichens not recorded in the quadrat, but *Cladonia chlorophaea* and *Peltigera canina* found in the wider stand.

Quadrat 5

Quadrat 5 Small patches of bryophyte-rich Vegetation amongst *Calluna*

Quadrat and Stand 6

Heath in wet dune slack on thin humic layer over sand. Very short *Calluna* with a luxuriant bryophyte mat below, notably *Hylocomium splendens* and *Hypnum cupressiforme. Erica cinerea* absent but scattered *Erica tetralix* and sparse *Salix repens*. *Cladonia portent*osa growing within and over the *Calluna* canopy.

Quadrat 6

Quadrat 6 *Cladonia portentosa* on *Calluna*

Stand 6 *Salix repens* scattered within *Calluna*

Quadrat 7

Dune face with co-dominant *Rosa pimpinellifolia* and *Calluna* and abundant *Erica cinerea*. *Calluna* and *Erica* growing beneath and through the *Rosa*. Areas of grassy vegetation dominated by *Festuca ovina* with *Ammophila* at low cover. *Carex arenaria* scattered through the stand. No lichens in the quadrat or stand.

7. Cymyran (Beddmanarch Cymyran Site 2): Site Description

7.1 Introduction

Cymyran is part of the much larger Beddmanarch Cymyran SSSI, which encompasses the shallow waters of the strait which separates Holy Island from mainland Anglesey.

The SSSI includes mudflats, sandbanks and saltmarsh habitats in addition to the two areas of sand dune surveyed in this study. Cymyran lies at the southern end of the SSSI on the Anglesey mainland, adjacent to the RAF Valley airfield. Running along the shore of the strait this is a narrow low-lying site. The terrain is relatively flat with a series of low dunes. It forms part of the Tywyn Trewan Common, which was broken up by the establishment of RAF Valley in 1940.

The small area of dune heath is located in the northern part Cymyran and straddles the track to Plas Cymyran.

The Anglesey Coastal Path passes through the site along the track to Plas Cymyran. In addition a number of small paths crisscross the dunes giving access to the shore.

7.2 Habitat Description

The first impression of the site is that the vegetation is quite rank and that large areas of the heath have been invaded by bramble and scrub including gorse, hazel, willow and pine. Parts of the heath are now quite difficult to access because they are so overgrown particularly with bramble. Unusually, *Chamerion angustifolium*, is locally abundant within the *Calluna* dominated vegetation.

Amongst the ranker vegetation there are, however, more typical areas of **H11 *Calluna vulgaris* – *Carex arenaria* heath.** The vegetation is characterised by high ericoid cover, with *Calluna* forming a hummocky canopy with a thick mat of bryophytes, notably *Hypnum cupressiforme,* beneath*. Erica cinerea* is a frequent but minor component of the canopy. *Erica tetralix* is co-dominant with *Calluna* in damp slacks where *Salix repens* is also found growing on dense bryophyte mats. Graminoids and forbs are generally sparse and scattered, except along the edges of the paths where grassier and more forb-rich open heath is found.

Patches of lichen-dominated vegetation are found within the heath, some of these are relatively extensive and species-rich with 10 species of *Cladonia* recorded and the likelihood of other species being overlooked. *Cladonia portentosa* is the most abundant species growing both on bare sand and within the *Calluna* canopy in places becoming dominant. *Cladonia rangiferina* is the only other species contributing significantly to cover and is locally abundant. Forbs such as *Hypochoeris radiacata* and *Ononis repens* are more frequent in the *Cladonia*-rich areas than within the ericoid canopy. *Genista anglica* was found in some abundance in one location close to Quadrat 3 at SH29977593.

The lichen-rich areas would appear to be attributable to the **H11a *Erica cinerea* sub-community,** although *Erica cinerea* is only present at very low cover and *Festuca ovina* very patchy in its distribution and where present, is at low cover. However, the distinctive cryptogam element is characteristic of this sub-community. Other areas are species-poor and dominated by *Calluna* and therefore more easily placed in the **H11c species-poor sub-community**. However, the initimate mix of *Cladonia*-rich and species-poor vegetation makes it impossible to assign sub-community type at a stand level and therefore the sub-communities are not separately mapped.

7.3 Management

The site is currently un-managed, some cutting of the heathland vegetation took place around 7 or 8 years ago (2006 / 2007), but no further mechanical management has taken place. The site is unfenced and therefore not grazed by stock, although there are active graziers on the remainder of the common, on the far side of RAF Valley. There were no signs of rabbit activity at the time of the survey and no indication of rabbit use in recent years such as old burrows. The site appears to have become significantly more scrub invaded in the last 10 years or so and there are plenty of young trees in the dunes. Some of the paths through the dunes appear to be less well used than in the past, and consequently there is less bare sand on path margins. There have been no recent complaints about off road vehicles which were frequent a few years ago and it appears that this activity has stopped at this site.

7.4 Conclusion and conservation assessment

H11 *Calluna vulgaris – Carex arenaria* heath is very rare in Wales with less than 50 hectares recorded. The vegetation falls within the European Annex 1 habitat-type 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*). Currently there are no Special Areas of Conservation (SAC) in Wales which include the habitat as a qualifying SAC feature.

Cymyran is one of the largest remaining sites for dune heath and despite the lack of management, still supports some areas of lichen-rich dune heath. The site is therefore of high conservation value. It also supports a population of *Juncus capitatus* at SH29957592 and SH29877580. The lack of management is of considerable concern as bramble and scrub are invading the entire dune system. Whilst the lichen – rich areas tend to be on areas of bare sand, which are less likely to become scrub encroached, these areas are becoming shaded by surrounding scrub and the total area of dune heath is threatened, as is the *J. capitatus*.

Grazing management would appear to be extremely difficult on this site due to the open boundaries along the shore and at the entrance to the track. The proximity to RAF valley and the Coastal Path may also present barriers to grazing livestock due to regular disturbance. Cutting and removing scrub and bramble needs to be undertaken as a priority to protect the remaining areas of heath. In addition, it might be possible to open up pathways to allow more access across the dunes to promote disturbance of sand. The cutting of the heathland vegetation 7 or 8 years ago had some success, but it may well be better to strip some areas

back to bare sand to allow re-colonisation. As this is a small site this could be done by hand. In the long-term it would be worth considering some form of shepherded grazing.

7.5 Quadrat and Stand Photographs and Descriptions

Quadrat and Stand 1
Dense *Calluna* on a gentle slope with a thick mat of *Hypnum cupressiforme* beneath. Few herbs or graminoids although *Ammophila* is scattered throughout the quadrat and stand. Large patches of *Cladonia* particularly *C. portentosa* and *C. rangiferina.* Bare eroding sand on the steeper slopes in the wider stand supporting a rich lichen flora.

Quadrat 1

Stand 1 eroding sand and abundant *Cladonia*

Quadrat 2
Tall *Calluna* with a thick mat of *Hypnum cupressiforme* beneath*. Cladonia portentosa* abundant growing over the *Calluna* canopy and on dead stems. Other *Cladonia* species in small bare patches of sand. Shorter vegetation with *Carex arenaria*, *Ammophila* and *Erica cinerea*.

Quadrat 2

Quadrat 2 Cladonia *portentosa*

Quadrat 3
Cladonia portentosa dominant forming a mat of low growing vegetation interspersed with *Calluna* bushes, many of which are dying or dead, although plenty of young *Calluna* and *Erica* present. Small patches of bare sand with other *Cladonia* species, *Cetraria muricata* and *Frullania tamarisci.*


Quadrat 3 Abundant *Cladonia portentosa, Chamerion* and *Ulex* noticeable

Quadrat and Stand 4

Dune slack with tall *Calluna* and *Erica tetralix*. Shorter areas with dense mat of bryophytes, *Salix repens* and *Carex arenaria*. *Cladonia ciliata, C. chlorophaea* and *C. rangiferina* on patches of bare ground under dead *Calluna*. *Cladonia portentosa* patches within shorter vegetation. Scattered *Chamerion*.

Quadrat 4 *Erica tetralix* and *Calluna*

Quadrat 4 scrub and *Chamerion*

Stand 4 View of dune slack

Stand 4 *Cladonia portentosa*

Quadrat 5
Quadrat adjacent to path running through *Festuca ovina* dominated *Calluna* heath. Other graminoids including *Anthoxanthum* and *Carex arenaria* and *Ammophila* abundant in the quadrat and/or the stand. Forb-rich *Pedicularis sylvestris* and *Inula conyza* locally abundant. No *Cladonia* lichens and bryophytes sparse.

Quadrat 5 Grassy open heath

8. References

Packham, J. R and A. J Willis. 1997. Ecology of Dunes, Saltmarsh and Shingle. Cambridge University Press.

Rodwell J. S. 1991(Ed). 1991a. British Plant Communities Volume 2. Cambridge University Press.

APPENDIX 1 QUADRAT AND STAND DATA

Pennard Golf Course (Pennard Burrows) Quadrat Data

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Frequency	Constancy	Domin Range
Calluna vulgaris	5	8	3	4	5	7	6	100	V	3-8
Carex arenaria	3	2			2	4	1	71	IV	1-4
Festuca ovina	4	4	4	1	2	4	4	100	V	1-4
Luzula campestris		3		3			1	43	III	1-3
Polytrichum piliferum			3	3	2		1	57	III	1-3
Cetraria aculeata	1		1	2	2		1	71	IV	1-2
Dicranum scoparium	4		5	4	3	3	4	86	V	3-5
Erica cinerea	4	5	4	3	2		4	86	V	2-5
Cladonia portentosa	4		5	3	8	1	6	86	V	1-8
Cladonia furcata subrangiformis	3		3	3	3		2	71	IV	2-3
Aira praecox	1		3	3	2		1	71	IV	1-3
Cladonia gracilis							2	14	I	2-2
Hypochoeris radicata	2		1	4	2		1	71	IV	1-4
Cladonia unicialis	1		1				1	43	III	1-1
Jasione montana	1		1		1			43	III	1-1
Agrostis capillaris	1		1	3	2	4		71	IV	1-4
Galium saxatile		1						14	I	1-1
Hylocomium splendens		4						14	I	4-4
Ptilidium ciliare	2		1					29	II	1-2
Anthoxanthum odoratum	3	4	3	4	1	3	4	100	V	1-4
Peltigera canina	1				2		4	43	III	1-2
Pseudoscleropodium purum	1	6	4	1		3	4	86	V	1-6
Deschampsia flexuosa						4		14	I	4-4
Cladonia coccifera				1				14	I	1-1
Pilosella officinarum				1				14	I	1-1
Rumex acetosella			1					14	I	1-1
Senecio jacobaea				1				14	I	1-1-
Plantago lanceolata							1	14	I	1-1
Quercus seedling							1	14	I	1-1
Veronica officinalis		1						14	I	1-1
Dactylis glomerata		2						14	I	2-2
Logfia minima					1			14	I	1-1
Barbula sp.				1				14	I	1-1
Trifolium dubium				2				14	I	2-2
Trifolium striatum				1				14	I	1-1
Viccia hirsuta				1				14	I	1-1
Cephaloziella sp.				1			1	29	II	1-1

Pennard Golf Course Stand Data

	S1	S2	S3	S4	S5	S6	S7
Calluna vulgaris	A	D	O	A	F	D	A
Carex arenaria	F (A)	R		O	R	O	R
Festuca ovina	F (A)	O	O	O	R	O	R
Luzula campestris		O		O			R
Polytrichum piliferum			O	R	R		R
Cetraria aculeata	R		R	R (O)	R		R
Dicranum scoparium	O (F)		A	F	O	R	O
Erica cinerea	F	A	O	F	O		O
Cladonia portentosa	R (A)		A	R	D	R	A
Cladonia furcata subrangiformis	R (F)		O	R (F)	O		R
Aira praecox	R (F)		O	O (F)	R		R
Cladonia gracilis							R
Hypocheoris radicata	O		R	F	R		R
Cladonia unicialis	R		R				R
Jasione montana	R		R		R		
Agrostis capillaris	R		R	O	R	O	
Galium saxatile		R					
Hylocomium splendens		O					
Ptilidium ciliare	R		R	R			
Hypnum cupressiforme	O (F)		R	F	O	R	O
Pleurozium schreberi	O	O					
Anthoxanthum odoratum	F(A)	O	O	F(A)	R	O	O
Peltigera canina	R				R		R
Pseudoscleropodium purum	O (A)	A	O	O (A)		R	O
Deschampsia flexuosa						O	
Cladonia coccifera				R			
Pilosella officinarum				R			
Rumex acetosella			R			R	
Senecio jacobaea				R			
Plantago lanceolata	O						R
Quercus seedling	O					R	R
Ranunculus bulbosa	R						
Veronica officinalis	O	R					
Veronica chamaedrys	R						
Dactylis glomerata		R					
Logfia minima				R(F)	R		
Barbula sp.				R			
Trifolium dubium				R			
Trifolium striatum				R			
Viccia hirsuta				R			
Cephaloziella sp.				R			R
Rhytidiadelphus squarrosus				O			

Penmaen Burrows Quadrat Data

	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Frequency	Constancy	Domin Range
Calluna vulgaris	9	6	6	4	6	6	100	V	4-9
Carex arenaria	1	1	3	2	2	3	100	V	1-3
Festuca ovina		4	4	5	3	4	83	V	3-5
Luzula campestris		3		2			33	II	2-3
Dicranum scoparium				3		2	33	II	2-3
Erica cinerea	4	5				5	50	III	4-5
Cladonia portentosa			2	5		5	50	III	2-5
Hypochoeris radicata			4	5			33	II	4-5
Agrostis capillaris			4	4	7		50	III	4-7
Galium saxatile		1		1	1	5	67	IV	1-5
Hylocomium splendens	3	4					33	II	3-4
Vaccinium myrtillus		7	5				33	II	5-7
Potentilla erecta		1	2		1	2	67	IV	1-2
Hypnum cupressiforme			3	4	4	6	67	IV	3-6
Polytrichum juniperium			1	1			33	II	1-1
Anthoxanthum odoratum			4	3		1	50	III	1-4
Peltigera canina				1		2	33	II	1-2
Thymus polytrichus				1			17	I	1-1
Pseudoscleropodium purum		8	6	4	4		67	IV	4-8
Pilosella officinarum			2				17	I	2-2
Lonicera periclymenum	4	3					33	II	3-4
Pteridium aquilinum	5	4	2	1	3		83	V	1-5
Teucrium scorodonia		2	2	1			50	III	1-2
Veronica chamaedrys		1	1				33	II	1-1
Dactylis glomerata		2					17	I	2-2
Rhytidiadelphus squarrosus		5					17	I	5-5
Hieracium spp.			2				17	I	2-2
Viccia hirsuta			1	3			33	II	1-3
Quercus seedling				1			17	I	1-1

Penmaen Burrows Stand Data

	S 1
Calluna vulgaris	D
Carex arenaria	R (F)
Festuca ovina	O
Erica cinerea	O (F)
Hypochoeris radicata	R
Agrostis capillaris	O
Galium saxatile	R
Hylocomium splendens	O
Hypnum cupressiforme	O (A)
Pseudoscleropodium purum	O (A)
Deschampsia flexuosa	R
Lonicera periclymenum	O
Pteridium aquilinum	A
Teucrium scorodonia	R
Veronica chamaedrys	R
Veronica officinalis	O

Tywyn-gwyn Beddmanarch Cymyran 1 Quadrat Data

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Frequency	Constancy	Domin Range
Calluna vulgaris	8	8	8	8	8	9	7	100	V	7-9
Carex arenaria	4			3				29	II	3-4
Festuca ovina	5	4	8	7	5	2		86	V	2-8
Luzula campestris	1	1	1	2		2		71	IV	1-2
Dicranum scoparium	1		2	2	1	3		71	IV	1-3
Erica cinerea	4	2			3		6	57	III	2-6
Cladonia portentosa	3	3		2		4		57	III	2-4
Aira praecox				1	1			29	II	1-1
Rosa Pimpinellifolia							7	14	I	7-7
Hypochoeris radicata	1	1			1		2	57	III	1-2
Agrostis capillaris					1			57	III	1-1
Galium saxatile			2	2			3	0		2-3
Hylocomium splendens	7	1	3	2	4	5		86	V	1-7
Potentilla erecta			3		2	1		43	III	1-3
Erica tetralix						3		14	I	3-3
Hypnum cupressiforme	1	1	6	3		4	2	86	V	1-6
Ammophila arenaria	3	4	2		3			57	III	2-4
Pleurozium schreberi				2		3		29	II	2-3
Polytrichum juniperinum		1		3		1		43	III	1-3
Anthoxanthum odoratum	2	1	4	4	1	3		86	V	1-4
Lotus corniculatus	3			1			1	43	III	1-3
Galium verum							1	14	I	2
Rhytidiadelphus triquetrus	1	1		2		2	4	71	IV	1-4
Peltigera canina	1							14	I	1
Pseudoscleropodium purum						1	1	29	II	1-1
Pilosella officinarium				3				14	I	3-3
Rumex acetosella					1			14	I	1-1
Rhytidiadelphus squarrosus	1		1		1		4	14	I	1-4
Tortula ruralus ruraliformis							1	14	I	1-1
Ulex europeaus	4							14	I	4-4
Brachythecium albicans		1						14	I	1-1
Pedicularis sylvestris		2						43	III	2-2
Carex pilulifera		2		3	2			14	I	2-3
Holcus lanatus			1					14	I	1-1
Cladonia chlorophaea				2				14	I	2-2
Veronica officinalis					1			14	I	1-2
Carex nigra						4		14	I	4-4
Molinia caerulea						2		14	I	2-2
Juncus articulatus						1		14	I	1-1

Tywyn-gwyn Beddmanarch Cymyran 1 Stand Data

	S1	S2	S3	S4	S5	S6	S7
Calluna vulgaris	D	D	D	D	D	A	A
Carex arenaria	A		R				O
Festuca ovina	A		D		A	R	A
Luzula campestris			R		O	R	
Polytrichum piliferum					R		
Dicranum scoparium			R	O	R	R	A
Erica cinerea	F		O	O	O		
Cladonia portentosa	O	O		R		O	
Aira praecox			R				
Cladonia pyxidata	R						
Rosa Pimpinellifolia						R	D
Hypochoeris radicata		R	O	O	R		
Campylopus introflexus					R		
Ononis repens		O		O	R (O)		
Agrostis capillaris							O
Galium saxatile	O	O	F	O	R	R	O
Campanula rotundifolia							
Hylocomium splendens	D	R	O	O	O	O (A)	
Salix repens						R	
Potentilla erecta		O		R	R	R	
Erica tetralix						O (F)	
Hypnum cupressiforme			F	O		O (A)	F
Ammophila arenaria	A	R	O		O		A
Pleurozium schreberi			R	O	R	R	
Polytrichum juniperinum				R		R	
Anthoxanthum odoratum			O				A
Lotus corniculatus	O	O (F)		O (A)	O		F
Rhytidiadelphus triquetrus						R	
Peltigera canina	R	R		O	R		
Thymus polytrichus							A
Pseudoscleropodium purum						R	O
Trifolium repens					R (O)		
Pilosella officinarium			A				
Rumex acetosella	O		F	R			
Senecio jacobaea	R			R			O
Lathyrus pratensis	R						F
Rhytidiadelphus squarrosus			R		R		
Tortula ruralus ruraliformis	R			R			R
Ulex europeaus					R		
Brachythecium albicans							
Pedicularis sylvestris					O (F)		
Carex pilulifera							R
Holcus lanatus		R	R				F

	S1	S2	S3	S4	S5	S6	S7
Cladonia chlorophaea	R	R		R	R		
Veronica officinalis	R	O (F)	O	R			R
Stellaria pallida	R						
Veronica chameadrys	R			R	O		
Rubus fruticosus	O						
Polypodium spp.	R						
Ornithopus perpasillus		R					
Sedum anglica		R					
Carex panacea		R					
Lotus pedunculatus			O (A)		O (A)		
Veronica arvensis			R				
Cerastium fontanum				O			
Plantago lanceolata				R			
Rumex acetosa					R		O
Carex nigra						F	
Molinia caerulea						R	
Juncus articulatus						R	
Viola spp.				R	R		A
Cisium arvense							O
Crataegus monogyna							R

Cymyran – Beddmanarch Cymyran 2 Quadrat Data

	Q1	Q2	Q3	Q4	Q5	Frequency	Constancy	Domin
Calluna vulgaris	9	10	6	6	7	100	V	6-10
Carex arenaria		2	1	3	4	80	IV	1-4
Festuca ovina	1	3			7	60	III	1-7
Luzula campestris		1	1			60	III	1-1
Dicranum scoparium		2	2	3		60	III	2-3
Erica cinerea	2	3	1		3	80	IV	1-3
Cladonia portentosa	5	4	8	1		80	IV	1-8
Aira praecox			2		1	40	II	1-2
Cladonia gracilis			1			20	I	1-1
Hypochoeris radicata			1		3	40	II	1-3
Cladonia unicialis subps biuncinalis			1			20	I	1-1
Cladonia rangiferina	6			1		40	II	1-6
Cetraria muricata			1			20	I	1-1
Agrostis capillaris				3	1	40	II	1-3
Galium saxatile					2	20	I	2-2
Hylocomium splendens					3	20	I	3-3
Potentilla erecta			2	1	1	60	III	1-2
Erica tetralix				6		20	I	6-6
Hypogymnia physodes			1			20	I	1-1
Hypnum cupressiforme	7	5	3	4	3	100	V	3-7
Ammophila arenaria	2	4				40	II	2-4
Anthoxanthum odoratum	1	3	1		5	80	IV	1-5
Lotus corniculatus		1	1			40	II	1-1
Pseudoscleropodium purum				2		20	I	2-2
Trifolium repens					1	20	I	1-1
Pilosella officinarium		1	1			40	II	1-2
Rhytidiadelphus squarrosus	1					20	I	1-1
Carex pilulifera		1	2			40	II	1-2
Brachythecium albicans				4	1	40	II	1-4
Pedicularis sylvestris			3	3	6	60	III	3-6
Frullania tamarisci			4			20	I	4-4
Cladonia ciliata			1	1		40	II	1-1
Chamerion angustifolium				2		20	I	2-2
Cladonia chlorophaea				1		20	I	1-1
Holcus lanatus				3		20	I	3-3
Luzula multiflora				3		20	I	3-3
Inula conyza					4	20	I	4-4
Polygala vulgare					3	20	I	3-3
Rosa arvensis					2	20	I	2-2
Rubus fruticosus agg.					2	20	I	2-2
Trifolium dubium					2	20	I	2-2
Poa pratensis					3	20	I	3-3

Cymyran - Beddmanarch Cymyran 2 Stand Data

	S1	S2	S3	S4	S5
Calluna vulgaris	D	D	A	A (D)	A
Carex arenaria		R	R	F (A)	A
Festuca ovina		O	R		A
Luzula campestris	R	R	R	R	
Dicranum scoparium	R	R	R	F	
Erica cinerea	F	O	R	F	O
Cladonia portentosa	A	O (A)	A	O (A)	
Cladonia furcata subrangiformis	R				
Aira praecox	O		R		R
Cladonia gracilis			R		
Cladonia foliacea	R				
Hypochoeris radicata		R	R	R	A
Cladonia unicialis subps biuncinalis			R		
Jasione montana					R
Campylopus introflexus	R				
Cladonia rangiferina	A			R	
Cladonia crispata					
Cetraria muricata	R		R		
Agrostis capillaris		R		O	O
Hylocomium splendens					R
Pohlia nutans					
Poa pratensis					O
Salix repens				F	
Vaccinium myrtillus					
Potentilla erecta			R	R	F
Erica tetralix				A	
Hypogymnia physodes			R		
Hypnum cupressiforme	A	F	R	A	R
Ammophila arenaria	F	O		O	A
Pleurozium schreberi		O			
Anthoxanthum odoratum	F	O	R	O	A
Ceratodon purpureus					
Lotus corniculatus	A	R	R	R	F
Galium verum		R			
Rhytidiadelphus triquetrus				R	
Peltigera canina	R				R
Pseudoscleropodium purum				F	
Trifolium repens					R
Pilosella officinarium		R		R	
Rumex acetosella					R
Cetraria foliacea	R				
Rhytidiadelphus squarrosus	O				

	S1	S2	S3	S4	S5
Carex pilulifera			R		
Brachythecium albicans				R	R
Pedicularis sylvestris		R	R	R	O
Frullania tamarisci			O (A)		
Cladonia ciliata			R	R	
Cladonia ramulosa	R	R			
Cladonia squamosa var squamosa		R			
Chamerion angustifolium				R	A
Cladonia chlorophaea				R	
Holcus lanatus					R (O)
Luzula multiflora					O (A)
Inula conyza					O (A)
Polygala vulgare					R
Rosa arvensis					R
Rubus fruticosus agg.				R	R
Trifolium dubium					R
Lathyrus pratensis	R			R	
Ulex europeaus	O	R			F (A)
Torula ruralis ruraliformis	R			R	
Angelica sylvestris				R	
Teucrium scorodonia				R	
Carex panacea				R	
Nardus sricta				R	
Plantago lanceolata					R
Rosa arvensis					R
Ranunculus bulbosa					R

APPENDIX B QUADRAT LOCATIONS

Quadrat	Site	Date	X-Coord	Y-Coord
Q1	Penmaen Burrows	12/06/2014	253130.1	187886.99
Q2	Penmaen Burrows	12/06/2014	253379.1	188054.72
Q3	Penmaen Burrows	13/06/2014	253235	188138.39
Q4	Penmaen Burrows	13/06/2014	253237.7	188134.16
Q5	Penmaen Burrows	13/06/2014	253262.1	188084.97
Q6	Penmaen Burrows	13/06/2014	253269.1	188089.03
Q1	Pennard Burrows	11/06/2014	254834.7	188221.84
Q2	Pennard Burrows	11/06/2014	254758.9	188192.55
Q3	Pennard Burrows	12/06/2014	254730.6	188179.06
Q4	Pennard Burrows	12/06/2014	254528.8	187949.38
Q5	Pennard Burrows	12/06/2014	254519	187968.43
Q6	Pennard Burrows	12/06/2014	254471.6	188046.79
Q7	Pennard Burrows	12/06/2014	254497.9	188083.99
Q1	Tywyn-gwyn	16/06/2015	229498.3	381650.24
Q2	Tywyn-gwyn	16/06/2015	229531.8	381619.76
Q3	Tywyn-gwyn	16/06/2015	229351.5	381625.64
Q4	Tywyn-gwyn	16/06/2015	229335.7	381594.28
Q5	Tywyn-gwyn	16/06/2015	229409.5	381533.78
Q7	Tywyn-gwyn	17/06/2015	229493.8	381510.54
Q6	Tywyn-gwyn	17/06/2015	229478.1	381484.21
Q1	Cymyran	17/06/2015	229894.6	375804.8
Q2	Cymyran	17/06/2015	229874.2	375769.55
Stand 1	Cymyran	17/06/2015	229904.2	375794.92
Q3	Cymyran	17/06/2015	229937.7	375912.24
Q5	Cymyran	18/06/2015	229888.8	375869
Q4	Cymyran	18/06/2015	229871.2	375831.88

Published by:
Natural Resources Wales
Cambria House
29 Newport Road
Cardiff
CF24 0TP

0300 065 3000 (Mon-Fri, 8am - 6pm)

enquiries@naturalresourceswales.gov.uk
www.naturalresourceswales.gov.uk

Further copies of this report are available from:

Email: library@cyfoethnaturiolcymru.gov.uk