Crynodeb Gweithredol

Gwnaethpwyd arolwg o'r cymunedau glaswelltir, rhos, twyni tywod ac arforol ar ryw 150ha o Warchodfa Natur Genedlaethol Ystangbwll yn Sir Benfro yn ystod mis Gorffennaf a mis Awst 2012. Y Dosbarthiad Cenedlaethol Llystyfiant ddarparodd y fframwaith ar gyfer mapio a disgrifio'r llystyfiant. Ar gyfer y gwaith mapio defnyddiwyd ffotograffau awyr o ansawdd da ar raddfa o 1:5000 neu 1:2500, a dynnwyd ym mis Mai 2012. Cymerwyd 105 o samplau cwadrat i gynorthwyo â'r gwaith o leoli is-gymunedau'r Dosbarthiad Cenedlaethol Llystyfiant ac i ddarparu disgrifiad manwl o'r mathau allweddol o lystyfiant.

Mae cymunedau twyni tywod yn helaeth ac yn amrywiol yma, gyda gwahanol fathau o lystyfiant y draethlin, twyn symudol, twyn lled-sefydlog a glaswelltir twyn sefydlog. Mae yna faint nodedig o'r gymuned olaf yma, gyda darn helaeth o laswelltir twyn sefydlog *Festuca rubra - Galium verum* (SD8)**.** Ymddengys nad yw dwy gymuned benodol o ddiddordeb wedi cael eu disgrifio gan y Dosbarthiad Cenedlaethol Llystyfiant na chan arolygon blaenorol - sef y glaswelltir twyn sefydlog calchgar sy'n cael ei fapio yma fel SD8 'CG', a chymuned doreithiog o gennau sy'n cael ei henwi yma'n 'dwyn llwyd calchaidd'.

Ceir glaswelltir calchgar o gwmpas cefnennau a brigiadau calchfaen, gyda darnau o ansawdd da o laswelltir *Festuca ovina - Carlina vulgaris* (CG1) a glaswelltir *Festuca ovina – Avenula pratensis* (CG2). Mae'r darn bach o laswelltir *Festuca ovina – Hieracium pilosella – Thymus praecox* (CG7) hefyd o ddiddordeb, gan fod y gymuned hon wedi cael ei nodi ar dri safle arall yn unig yng Nghymru. Mae 'llystyfiant *Fulgensia*', sy'n ymddangos yn unigryw, yn cael ei ddisgrifio.

Mae'r llystyfiant rhos, er nad yw'n helaeth, o ddiddordeb cadwraethol mawr gan fod llawer ohono'n doreithiog o rywogaethau ac yn fath 'rhos laswellt calchaidd' nodedig. Mae'r rhos arforol yn darparu diddordeb tebyg, gyda darn bach ond arwyddocaol o ros *Calluna vulgaris - Scilla verna*, is-gymuned *Viola riviniana* (H7b), sy'n brin yng Nghymru.

Mae nifer fawr o gymunedau arforol yn cael eu disgrifio. At ei gilydd ychydig iawn mae'r rhain wedi cael eu newid, er bod rhyngbarthau tua'r môr i laswelltiroedd rhos, twyn neu galchgar wedi'u cuddio i raddau helaeth gan welliannau yn y gorffennol.

Executive Summary

The grasslands, heaths, sand dunes and maritime communities comprising some 150ha of Stackpole NNR in Pembrokeshire were surveyed during July and August 2012. The National Vegetation Classification provided the framework for mapping and describing the vegetation. Mapping utilised high quality aerial photographs at a scale of 1:5000 or 1:2500, taken in May 2012. 105 quadrat samples were taken to assist with NVC sub-community placement, and to provide a detailed description of the key vegetation types.

Sand dune communities are extensive and varied here, with various types of strandline vegetation, mobile dune, semi-fixed dune and fixed dune grassland. The latter is particularly well represented, with an extensive area of *Festuca rubra – Galium verum* fixed dune grassland (SD8)**.** Two particular communities of interest appear not to have been described by the NVC or previous surveys – the calcicolous fixed dune grassland mapped here as SD8 'CG', and a lichen-rich community here termed 'calcareous grey dune'.

Calcicolous grassland occurs around limestone ridges and outcrops, with high quality areas of *Festuca ovina - Carlina vulgaris* grassland (CG1) and *Festuca ovina – Avenula pratensis* grassland (CG2). The small area of *Festuca ovina – Hieracium pilosella – Thymus praecox* grassland (CG7) is also of interest, as this community has only been noted at three other sites in Wales. An apparently unique '*Fulgensia* vegetation' is described.

Heath vegetation, although not extensive, is of high conservation interest as much of it is species-rich and of a distinctive 'calcareous grass heath' type. The maritime heath provides similar interest, with a small but significant area of *Calluna vulgaris - Scilla verna* heath, *Viola riviniana* sub-community (H7b), rarely encountered in a Welsh context.

Numerous maritime communities are described. These are generally little modified, although seaward transitions to heath, dune or calcicolous grasslands are largely obscured by past improvements.

Stackpole NNR – Mere Pool Valley, Stackpole Warren and Coast NVC site description

Introduction

Stackpole NNR is situated on the south-western Pembrokeshire coast, 6 km south-west of Pembroke. The overall area of the NNR is 233ha. This survey covered the grassland, heath, dune and maritime communities which occupy some 150ha from Barafundle Bay to Broadhaven.

Carboniferous Limestone underlies the whole site. This generally has a relatively high clay content. Exposures of limestone occur on the coastal cliffs, and fragments of damaged limestone pavement are found above the cliffs in two places. Further exposures are found in the Mere Pool valley, and behind Barafundle. Accumulations of frost-shattered limestone scree, dating from the Ice Age, mantle some slopes here. Blown sand covers the limestone to varying depths across the majority of the site, and it is the influence of this which explains a large part of the floristic variation. However, rocks and soils in this area have not been mapped or described in sufficient detail to understand the detail of this influence. The different soil types can show a patchy distribution from broad to local scale (over a distance of a few metres). The pH of these soils is also highly variable, but within the range 4.5 – 8. Parent materials for soil development include residues of weathering of muddy limestones, generally iron-rich clays. Towards the back of the Warren, there are accumulations of wind-blown silt (loess) derived from fluvioglacial outwash deposits formerly exposed on what is now the sea bed. Once this material was removed, the underlying sand (also mainly of fluvioglacial origin) was blown inland as well. Significant additions of wind-blown sand occurred during climatic downturns of the Iron Age and post-Norman arrival, in the latter case exacerbated by the introduction of rabbits. The sand is mainly composed of quartz or other siliceous grains with varying amounts of calcareous shell debris. These contribute to alkalinity which can persist even in the previously cultivated areas or ancient dune sands.

Previous Survey Work

Surveys covering the NNR in the past have focussed on the sand dunes (Ashall, Duckworth, Holder & Smart, 1991), woodlands (Castle & Mileto, 2002) and maritime vegetation (Cooper, Doody & Malloch, 1987). Community assignation in the former work often seems erroneous, as the survey tries to frame most vegetation in a sand dune context – maritime communities

are under-mapped, and calcicolous grassland was not recognised. The latter work used drafts of the NVC to produce maps, but with a bias towards recording maritime communities at the expense of calcicolous grassland. Samples sometimes appear incorrectly assigned as a result. Direct comparisons between the former surveys and this one are not possible.

Outline of Current Survey Methodology

This survey aimed to map all of the grassland, dune, heath and maritime vegetation to NVC sub-community level. No attempt was made to allocate stands of dense scrub, woodland and bracken to NVC communities, however, stands within the survey area were accurately mapped and the main dominant recorded. We were unable to record the cliff communities in detail, as their sheer nature made both access and mapping too difficult. We aimed to record at least five quadrats in each sub-community identified. In practice, this would have entailed well over 300 quadrats, and time was not available for this. We chose therefore to focus our sampling effort on the vegetation of key conservation interest, and that which could not be satisfactorily placed within the NVC framework.

The survey was carried out with reference to aerial photographs taken by Exegesis in May 2012. Initial mapping was carried out at relatively large scale (1:5000), slightly limiting the accuracy of stand sizes and shapes, but mapping was carried out on high resolution small scale (1:2500) photos when these became available. The mid-late summer survey meant that many plants were flowering, but identification of winter annuals and spring-flowering bulbs was dependent on seeding material remaining visible. The presence of *Scilla verna* – key to placement of some communities – was generally discernible from seed heads, but its frequency and extent may have been underestimated in places. *Hyacinthoides non-scripta* may have been missed in rank coastal grassland. Common winter annuals such as *Erophila verna* and rarer species such as *Hornungia petraea* were missed, but this will not have affected community placement.

Mosaics of communities have been mapped where different communities or sub-communities occur in intimate association, or with complex, ill-defined boundaries. Extended transitions between vegetation types have not been mapped – in common with CCW's Phase II survey approach, intermediate vegetation was assigned to the closest fitting community. It should be noted that many parts of the NNR display complex, gradual transitions between communities in response to subtle variations in salt exposure, sand depth, pH, grazing pressure and other environmental influences. The map represents a simplification of this complexity, and boundaries on the ground are not always as clear cut as the map representation.

Summary of Vegetation Communities

The most abundant community on the site is ***Festuca rubra* – *Galium verum* fixed dune grassland (SD8)**. Various sub-communities are represented, including a form with a strong calcicolous element which does not fit within the existing NVC framework. Across the plateau of Stackpole Head and parts of the Warren, the fixed dune has suffered from past agricultural improvement and has become more akin to a neutral grassland community. This often resembles ***Cynosurus cristatus* - *Centaurea nigra* grassland** (**MG5**), but is an anomalous form perhaps best referred to as '**other neutral grassland**'. Over more strongly leached sand or loess, the grassland becomes more calcifugous and has been termed '**other acid grassland**'. Elsewhere, reduction or removal of grazing pressure has led to the fixed dune grassland becoming rank and impoverished, or invaded by bracken, *Rubus caesius* or *Clematis vitalba* scrub. Some of the fixed dune, notably across Broadhaven dunes, has become ***Ammophila arenaria* – *Arrhenatherum elatius* dune grassland (SD9)** through this process of neglect. Strandline vegetation is limited to small strips of ***Honkenya peploides* – *Cakile maritima* strandline community (SD2)** and ***Leymus arenarius* mobile-dune community (SD5)** on the two beaches of the survey area, and ***Elymus pycnanthus* salt-marsh community (SM24)** around the lake outlet. Mobile and semi-fixed dune communities are fairly well represented across the fore-dunes, blowouts, and former sand extraction areas. These include reasonably typical ***Ammophila arenaria* mobile dune community (SD6)**, ***Ammophila arenaria* – *Festuca rubra* semi-fixed dune community (SD7)**, ***Carex arenaria* dune-community (SD10)** and ***Phleum arenarium* – *Arenaria serpyllifolia* dune annual community (SD19)**, as well as other semi-fixed dune vegetation which cannot be satisfactorily accommodated by the NVC framework. The most distinctive form of this has been termed **'calcareous grey dune'**, which is well represented on dune-ridges on the western part of the Warren and in the Mere Pool Valley.

As most of the sand-dunes are perched high up on a limestone plateau, slack vegetation is not well represented on the site. A few seasonally damp areas occur in the central hollows of old dunes on the western part of the Warren, but wet dune slack vegetation is only developed in association with small areas of former sand-extraction in the Mere Pool Valley. Some of this has been assigned to the ***Potentilla anserina* – *Carex nigra* dune-slack (SD17)**. Most of these secondary slacks have been further modified into small ponds, with fringing areas of ***Phragmites australis* swamp (S4)**, ***Eleocharis palustris* swamp (S19)** and ***Scirpus lacustris* ssp. *tabernaemontani* swamp (S20)**.

Where the sand thins towards outcropping limestone, dune grassland gradually gives way to calcareous grassland communities. An unusual community of this transition zone has been recognised, and provisionally assigned to **'*Fulgensia* vegetation'** with no clear NVC equivalent. The more widespread ***Festuca ovina - Avenula pratensis* grassland** (**CG2**) is scattered along the coastal strip away from the main salt spray zone, and in areas alongside some of the limestone outcrops. The steeper rocky slopes hold ***Festuca ovina - Carlina vulgaris* grassland** (**CG1**). Small areas of ***Festuca ovina – Hieracium pilosella – Thymus praecox* grassland (CG7)** occupy thin soils in the Devil's Quoit field. Small areas of three further calcareous grassland communities were recognised – ***Brachypodium pinnatum* grassland (CG4)**, ***Avenula pubescens* grassland** (**CG6**) and '**calcareous scrub margin vegetation'**.

***Calluna vulgaris – Scilla verna* (H7)** occurs on the coastal strip, often in association with CG2 and sharing some of that communities suite of calcicoles. Further inland, similarly calcicolous heath but lacking in maritime species has been referred to the **Calcareous Grass Heath** community recognised elsewhere in Wales by CCW surveyors. Less calcicolous heath has been termed '**Other Heath**'.

The coastal fringe has a range of communities in classic zonations. The cliffs themselves have the ***Crithmum maritimum – Spergularia rupicola* maritime rock-crevice community (MC1)** and the ***Atriplex prostrata – Beta vulgaris* ssp. *maritima* sea-bird cliff community (MC6)**. Slopes or cliff edges have the ***Armeria maritima – Cerastium diffusum* ssp. *diffusum* maritime therophyte community (MC5)**, or ***Festuca rubra – Armeria maritima* maritime grassland (MC8)**. Back from the cliff edge, the ***Festuca rubra – Plantago* spp. maritime grassland (MC10)** gives way to ***Festuca rubra – Holcus lanatus* maritime grassland (MC9)** or ***Festuca rubra – Daucus carota* ssp. *gummifer* maritime grassland (MC11)** in the landward transitions.

Sizable patches of dense scrub occur in association with the dune and calcareous grassland. These have not been mapped to NVC level, but are mostly dominated by *Clematis vitalba*, and *Ulex europaeus*. Bracken occurs in association with the scrub, and has invaded significant areas of the dune grassland. *Rubus caesius* has also taken hold in under-grazed areas.

Community Descriptions

Salt-marsh

A narrow zone, corresponding to ***Elymus pycnanthus* salt-marsh community (SM24)**, is found near the lake outlet at the top of Broadhaven beach (unsampled). It is dominated by sea couch, *Elymus atherica* (*pycnanthus*).

Strandline Vegetation, Mobile and Semi-fixed Dune Communities

Strandline vegetation was very poorly developed at Barafundle, and of only limited occurrence at Broadhaven, although it is possible that recent sand deposition coupled to the activities of holiday-makers had temporarily buried plants. The only well developed area comprises a stand of the ***Leymus arenarius* mobile-dune community (SD5)** along the less exposed north-east facing edge of the Broadhaven dunes (unsampled). Here, a continuous but sparse cover of *Leymus arenarius* is interspersed with some *Honkenya peploides* in an example of the **Species-Poor sub-community, SD5a**. A tiny patch of *Leymus arenarius* was also noted at the south end of Barafundle. The strandline along the beach here comprises a discontinuous line – too narrow to map - of scattered *Atriplex prostrata, Carex arenaria, Beta vulgaris* ssp. *maritima* and *Cakile maritima* plants. This vegetation is broadly referable to ***Honkenya peploides – Cakile maritima* strandline community (SD2)**.

Behind the strandline vegetation, Barafundle has a belt of the ***Ammophila arenaria* mobile dune community (SD6).** This comprises relatively small, scattered tussocks of *Ammophila* with few other associates on the fresh, bare sand. Most of this belongs to the ***Ammophila arenaria* sub-community, SD6d**, but a small area of the ***Festuca rubra* sub-community**, **SD6e**, was also mapped. The fescue here appears to be *Festuca arenaria* rather than *F. rubra*. A more extensive area of SD6 covers the fore-dune at Broadhaven, mapped as SD6e but often somewhat transitional between the two sub-communities. *Festuca* cf. *arenaria* is generally frequent, and other associates include *Tussilago farfara, Hypochaeris radicata, Senecio jacobaea* and *Eupatorium cannabinum. Ononis repens* is rare here.

More stable marram areas occur behind the mobile dune at Barafundle and in one place on the seaward edge of the Warren. These correspond to the ***Ammophila arenaria – Festuca rubra* semi-fixed dune community (SD7)**. *Ammophila* still dominates here, but with various perennial grasses and dicotyledons accompanying it in a generally closed sward. On the Warren (Q18), the rather rank, species-poor stand belongs to the **Typical sub-community**,

SD7a. *Holcus lanatus*, *Agrostis capillaris* and *Agrostis stolonifera* are frequent among the accompanying grasses, and occasional *Lolium perenne* provides evidence of past modification of the Warren. *Carex arenaria*, *Senecio jacobaea* and *Glechoma hederacea* are among the few other associates. Stands on the Barafundle dunes are richer, have abundant *Ononis repens* and belong to the ***Ononis repens*** **sub-community**, **SD7c** (unsampled).

Ammophila arenaria quickly becomes very sparse in the landward transition on the Barafundle dunes. Some of the more open dune vegetation here cannot be easily accommodated within the NVC framework, and has been mapped as '**Other Semi-fixed Dune Vegetation**'. Q71 represents the more open extreme of this vegetation, which typically contains an abundance of *Ononis repens*, frequent *Carex arenaria*, rosettes of *Pilosella officinarum*, *Leontodon saxatilis* and *L. autumnalis*, a scattering of annuals and, towards the CG2 on the northern slope, some *Echium vulgare*, *Geranium robertianum*, *Teucrium scorodonia* together with a few calcicoles such as *Blackstonia perfoliata* and *Carlina vulgaris*. Bracken generally forms a sparse, salt-scorched canopy.

Carex arenaria is the dominant in the small patches of ***Carex arenaria*** **dune-community (SD10)** mapped on the Barafundle dunes, and the larger patches within blowouts on the Warren, Compartment 47a. On the south side of the former, the open, sandy stand also has *Anagallis arvensis*, *Erodium cicutarium*, *Echium vulgare*, *Senecio jacobaea* and *Crepis capillaris*, whilst the stand to the north has a more closed sward and can be referred to the ***Festuca rubra*** **sub-community, SD10a**. *Carex arenaria* remains abundant in the rather scrubby adjoining 'other semi-fixed dune vegetation', suggesting some affinities between the two communities. The stands on the Warren are more typical of the community, with strings of the sedge encroaching on to open sand. Neither *Festuca ovina* or *Festuca rubra* were noted here, and stands have not been assigned at the sub-community level as a result. Small areas were mapped as '**bare sand**' where this pioneer sedge has not yet been able to establish, generally as a result of human trampling.

More species-rich vegetation of open but stabilised sand generally corresponds to the ***Phleum arenarium – Arenaria serpyllifolia*** **dune annual community (SD19)**. Good examples occur along the old boundary wall on the west side of the Warren (Q53), and around blowouts within Compartment 47a (Q40). The assemblage of annuals is distinctive here, with *Phleum arenarium*, *Arenaria serpyllifolia*, *Catapodium marinum*, *Vulpia fasciculata*, *V. bromoides* and *Erodium cicutarium* all typical associates. The bulk of the cover is generally provided by patches of *Ononis repens* and *Thymus polytrichus*. *Ammophila* and *Carex arenaria* are reduced to a few sparse shoots here, and there is plenty of open sand. Reasonably well

characterised examples occur patchily on the Broadhaven dunes (Q90,91), with a more developed bryophyte turf of *Syntrichia ruralis* ssp. *ruraliformis*, *Homalothecium lutescens* and *Hypnum lacunosum*. *Erigeron acer* and *Sedum acre* are additionally frequent. One small stand occurs just above the strandline here, with *Honkenya peploides* joining the associates. Less well characterised stands occur locally on the dune ridges. They were sampled near the mouth of the Mere Pool valley, Compartment 4b (Q89) and on the Warren, Compartment 47a (Q21). These have a canopy of bracken, generally burnt off by salt exposure, and a rather impoverished suite of annuals which often lacks *Phleum arenarium*. They are perhaps closer to SD7c in their general floristics, but lack the *Ammophila arenaria* of that community.

One further community was mapped on areas of dune which appeared almost fully stabilised. This was termed '**Calcareous Grey Dune**'. It has affinities to the SD19 but is strikingly lichen-rich and also has a few calcareous fixed dune species. *Cladonia rangiformis* is usually the dominant lichen, but *Cladonia furcata* is frequent and can be more abundant. *Leptogium gelatinosum* is also frequent, and the distinctive blue-grey patches of *Toninia sedifolia* are locally prominent. A few other species occur more sporadically, including *Peltigera membranacea*, *P. Rufesens*, *Cladonia poccillum* and *Collema auriforme*. The main vascular plant dominants are *Pilosella officinarum*, *Thymus polytrichus* and *Ononis repens*, and *Leontodon saxatilis* is a constant at lower cover. Fixed dune species such as *Lotus corniculatus*, *Prunella vulgaris* and *Galium verum* are locally frequent. As in the SD19, dune annuals are generally well represented, with *Arenaria serpyllifolia* and *Catapodium marinum* most frequent amongst these. A calcicolous feel is imparted by a scattering of species such as *Carlina vulgaris*, *Asperula cynanchica* and *Sanguisorba minor*. *Homalothecium lutescens* and *Hypnum lacunosum* dominate the bryophytes, but *Pleurochaete squarrosa* and *Trichostomum crispulum* are also generally frequent and there are often a few other acrocarps, including *Didymodon acutus* in one sample. Good examples of the community were mapped towards the back of the Barafundle dunes (Q26), in the Mere Pool Valley (Q82,92) and on the west side of the Warren, Compartment 41b (Q54,55,93). All stands are of high quality, and lacking any signs of agricultural modification. Bracken appears naturally weakened in these stands, and scrub species such as *Clematis vitalba* not yet a problem.

Dune Slack Vegetation

'Dry Slack' vegetation, developed within the dune hollows on Stackpole Warren, has been described under SD8 in the Fixed Dune Grassland chapter, below. More typical slack vegetation is restricted to the Mere Pool valley. A number of ponds occupy most of the

hollows which would presumably have contained wet slack vegetation, but there are examples of three different communities, which occupy different hydrological niches.

The most extensive of these has been termed '**damp slack vegetation**' as it appears to occupy damp or seasonally wet surfaces, transitional to the wet hollows. Q85 is typical of this vegetation, with a species-rich, short open sward dominated by *Carex flacca*. *Agrostis stolonifera* is abundant, and small plants and bryophytes are frequent, including *Sagina nodosa, Centaurium pulchellum, Erigeron acer, Juncus articulatus, Plantago coronopus* and *Fissidens dubius*. *Bryum pseudotriquetrum* is abundant in one or two slightly wetter patches, and here brings the vegetation close to the *Sagina nodosa – Bryum pseudotriquetrum* dune-slack community (SD13), particularly the *Holcus lanatus – Festuca rubra* sub-community, SD13b. The lack of *Salix repens* would make this a rather atypical example though. This plant was only noted by the large trackside pond.

Where the water table is higher (Q103), the slack vegetation is generally referable to ***Potentilla anserina – Carex nigra*** **dune-slack, *Carex flacca* sub-community (SD17b).** *Carex flacca* replaces *Carex nigra* here, reflecting the calcareous nature of the sand. Other prominent associates include *Potentilla anserina, Calliergon cuspidatum, Mentha aquatica* and *Hydrocotyle vulgaris*, and both *Equisetum variegetum* and the hybrid horsetail *Equisetum x littorale* are frequent in the sampled stand. Numerous tussocks of *Festuca arundinacea* are also found in this stand, and *Salix cinerea* bushes dominate the central 'sump'.

The ponds comprise some open water, and often more extensive areas of swamp vegetation, with areas corresponding to ***Eleocharis palustris*** **swamp (S19)**, ***Scirpus tabernaemontani*** **swamp (S20)** and one small stand of ***Phragmites australis*** **reedswamp (S4).**

Fixed Dune Grassland

Festuca rubra – Galium verum **fixed dune grassland (SD8)** is the dominant vegetation type of the survey area. *Festuca rubra*, together with other grasses such as *Poa humilis*, forbs such as *Galium verum, Lotus corniculatus* and *Plantago lanceolata*, and pleurocarpus mosses such as *Scleropdium purum*, make up a generally closed sward. This varies from a close-cropped fine-grained turf, to a rank sward invaded by bracken or *Rubus caesius*. *Carex arenaria* at low cover appears to be a good marker for the community. Four different sub-communities are represented.

The **Typical sub-community (SD8a)** is the least extensive of these, covering ?ha behind Barafundle and ?ha in Compartment 47a. The Barafundle stands are un-grazed and bracken-invaded, with the community constants rather poorly represented. Some areas (Q28) have a turf of pleurocarpous moss and an abundance of *Viola riviniana* and *Ononis repens* under a bracken canopy. The small areas on Stackpole Warren occur in association with other rank areas of fixed dune. The stand sampled in Q65 is dominated by tussocky *Festuca rubra* in a rather rank and fairly species-poor sward. It is presumably derived from SD8b through under-grazing, and retains a few of the associates of that sub-community at low frequency. *Rosa pimpinellifolia* and bracken are abundant.

The ***Luzula campestris*** **sub-community (SD8b)** is characterised by a good representation of the community constants together with frequent *Luzula campestris*, *Agrostis capillaris* or *Anthoxanthum odoratum*. *Holcus lanatus* is also generally abundant. There is typically some *Euphrasia officinalis* and a scattering of other forbs such as *Veronica chamaedrys*, *Ranunculus bulbosus* or *Odontites verna*, but the turf is not notably species-rich and calcicoles are all but absent. Areas of this sub-community vary in their degree of agricultural modification, with large parts of the Warren comprising semi-improved swards with frequent *Lolium perenne*, abundant *Holcus lanatus* and *Trifolium repens* and occasional *Cynosurus cristatus* (Q30,35,73). Well grazed stands which have escaped past agricultural improvement (Q19,48) have some *Hypochoeris radicata*, *Pilosella officinarum* or *Thymus polytrichus* but many stands are impoverished through neglect, with *Rubus caesius* and bracken invasion well advanced to the west of the Warren (Q37) and *Clematis vitalba* and bracken smothering much of the vegetation behind Barafundle. Extensively invaded stands have been distinguished on the accompanying maps by overlaying a dominant invasive species code. Attempts were made to distinguish between stands which retained the key elements of fixed dune grassland below the scrub or bracken, and those in which the sand dune flora had disappeared, but in practice this could not always be accurately determined.

The ***Prunella vulgaris*** **sub-community (SD8e)** is widely distributed across the site, and reflects a degree of base-enrichment to the sandy substrate. The presence of frequent *Prunella vulgaris*, *Linum catharticum* and *Carex flacca* was used to assign stands to this sub-community. It tends to be more species-rich than the SD8b, with species such as *Gentianella amarella* and *Centaurium erythraea* appearing alongside an abundance of *Thymus polytrichus* and *Euphrasia officinalis*. Grassier swards, retaining a good representation of sub-community preferential but less species-rich and with abundant *Holcus lanatus* and *Trifolium repens*, are typical of the agriculturally modified northern part of Stackpole Warren, Compartment 47b (Q67). Better quality stands occur in a mosaic with SD8b towards one edge of this

compartment (Q70), close-cropped swards with an abundance of *Carex flacca*, *Ononis repens* and *Helicotrichon pubescens*. The latter grass is characteristic of the ranker swards in the Mere Pool Valley (Q102), where frequent *Dactylis glomerata* and abundant *Rosa pimpinellifolia* signal transitions to SD9 fixed dune grassland (see below). The highest quality SD8e occurs in Compartment 41a on the west side of the Warren (Q6), where the short, open sward supports drought-tolerant species such as *Sedum acre*, *Catapodium marinum* and *Cerastium semidecandrum*, as well as mosses such as *Homalothecium lutescens* and a scattering of lichens, including *Cladonia rangiformis* and *Agonimia tristicula*. The free-draining dune hollows in this compartment support what appears to be a variant of SD8e, termed by this survey as **SD8e 'dry slack'**. Apart from *Lotus corniculatus*, the community constants, notably *Festuca rubra*, are at much reduced cover here, and dominance is shared by *Agrostis stolonifera*, *Pilosella officinalis*, *Thymus polytrichus*, *Euphrasia officinalis* and *Prunella vulgaris*. Notable is the presence of a more typical plant of slack vegetation - *Equisetum variegatum* – appearing as frequent small shoots. The abundance of *Gentianella amarella* is striking, and this is accompanied in places by *Gentianella anglica* in a short, open, species-rich turf.

Another variant of SD8e appears with sufficient regularity to be considered as a distinct sub-community, not currently accommodated within the current NVC framework. This has been termed **SD8 'Calcareous Grassland variant' (SD8CG)**, and it is characterised by the frequent occurrence together of several strong calcicoles which are not listed within the published description of SD8. The presence of frequent *Asperula cynanchica*, together with one or more of *Blackstonia perfoliata*, *Carlina vulgaris* or *Sanguisorba minor* was used to differentiate this vegetation. Stands generally show a strong representation of all these calcicoles, together with an absence or much reduced frequency of more mesotrophic species such as *Trifolium repens* and *Holcus lanatus*. *Carex arenaria* becomes particularly infrequent. Amongst the lower plants, *Cladonia rangiformis* becomes constant but *Scleropodium purum* and *Hypnum lacunosum* remain the only frequent pleurocarpous mosses. Some stands, notably in Compartment 47a, have open lichen-rich patches (Q9) which sit more comfortably within the CG7c / '*Fulgensia* vegetation' described below. Most examples of the community are found in Compartment 41a, where it occurs in mosaic with SD8e (Q56, Q59), and between stands of SD8e and CG2a (Q66). The latter community has been distinguished by the dominance of *Festuca ovina* rather than *Festuca rubra*, but the SD8CG shares a very similar floristic composition and clearly has the feel of a calcareous grassland turf. An alternative treatment which could be considered for monitoring purposed would be to unite the two communities as a single 'calcareous fixed dune grassland', transitional between SD8 and CG2. This could also encompass the species-rich '**Other Calcareous Dune Grassland**' in

the Mere Pool Valley (Q84), where the two fescues both occur at low cover in a damp, slack-edge turf with *Sagina nodosa*, *Erigeron acer* and a rich lower plant flora. *Ononis repens* is additionally abundant and *Ammophila arenaria* persists as sparse shoots in the slightly more tussocky stand nearby stands.

Another anomalous type of fixed dune grassland – termed '**Other Fixed Dune Grassland**' - was mapped in one of the recently scraped plots on the west side of Compartment 48a. This comprises vegetation with abundant *Agrostis capillaris*, *Carex flacca* and *Lotus corniculatus*, and with frequent *Festuca ovina*, *Festuca rubra* and *Carex arenaria*. *Galium verum* is lacking, but there are a few open ground associates such as *Carlina vulgaris*, *Echium vulgare*, *Centaurium erythraea* and *Anagallis arvensis*. Lower plants are poorly represented, with only *Scleropodium purum* frequent. The closest NVC fit would appear to be SD12, however, the absence of *Ammophila arenaria* and calcifuges such as *Galium saxatile* would appear to preclude referral of this or any of the more leached dune grassland at Stackpole to this community. SD12 was recorded on Stackpole Warren by Ashall et al (1991), but their samples lack both these two species and *Carex arenaria*. Similar vegetation was mapped by our survey as 'other acid grassland'.

***Ammophila arenaria* – *Arrhenatherum elatius* dune grassland (SD9)** dominates the leeward side of the Broadhaven Dunes (Q81,104). Absent from the SD8, *Arrhenatherum elatius* (var. *bulbosus*) here becomes frequent. It is generally accompanied by *Dactylis glomerata*, abundant *Helicotrichon pubescens* and a scattering of *Ammophila arenaria* in a tall sward. Other associates tend to be robust plants such as *Ononis repens*, *Eupatorium cannabinum* and *Torilis japonica* or scramblers such as *Rubia peregrina*, *Hedera hibernica* and *Lonicera periclymneum*. This vegetation is fairly species-poor, and referable to the **Typical sub-community SD9a**. A low scrub of *Clematis vitalba*, *Rubus caesius* and *Rosa pimpinellifolia* is prevalent in most stands, and bracken is generally abundant. Broadly similar grassland occurs on the less grazed western part of the Warren, lacking *Arrhenatherum* but with *Dactylis* and *Helicotrichon pubescens* generally abundant in a similarly coarse sward with *Rosa pimpinellifolia* and bracken (Q60,63). These stands differ in that they retain an element of the SD8 from which they are presumably derived. *Galium verum* and *Lotus corniculatus* are frequent here, while patchily abundant *Sanguisorba minor* and a little *Thymus polytrichus* indicate a degree of base-enrichment. An example on the south-facing slope of the Mere Pool Valley (Q86) has a similar array of calcicoles, but also an atypical representation of open ground species associated with patches of bare sand. The calcicolous associates indicate affinities with the *Geranium sanguineum* sub-community (SD9b), but the

lack of the eponymous preferential make this a poor-fit. These stands have instead been mapped as **SD9 'other sub-community'**.

One further type of dune vegetation was mapped on an extended dune – scrub interface behind Barafundle (Q75). This anomalous vegetation has been termed '**Dune Scrub Margin Vegetation**'. It has abundant *Ononis repens* and *Hedera hibernica*, frequent *Carex arenaria*, *Euphorbia portlandica*, *Dactylis glomerata*, *Orobanche hederae* and *Rubia peregrina*, and occasional *Hypericum montanum* imparting a distinctive stamp. It is similar to some of the stands mapped as 'Calcareous Scrub Margin vegetation' (described below), but was distinguished here by the frequent *Carex arenaria* and abundant *Ononis repens* that typify deeper sand.

Calcicolous Grassland

The most widespread calcicolous grassland community at Stackpole is the ***Festuca ovina* – *Avenula pratensis* grassland (CG2)**. This generally comprises a closed sward, with *Festuca ovina*, *Thymus polytrichus*, *Lotus corniculatus* and *Pilosella officinarum* usually the more abundant species. *Briza media*, *Carex flacca* and *Sanguisorba minor* are abundant in some stands, whilst *Koeleria macrantha*, *Linum catharticum* and *Plantago lanceolata* are frequent at lower cover. As is typical of Welsh examples (Stevens et al, 2010) *Helicotrichon* (*Avenula*) *pratensis* itself is absent.

The ***Cirsium acaule* – *Asperula cynanchica* sub-community (CG2a)** is marked by the presence of frequent *Asperula cynanchica*, and the scarcity of preferential for the other sub-communities. All stands are of high quality. It is best developed in association with the limestone ridges of Compartment 4, behind Barafundle (Q24,25). Here, there is an abundance of *Cladonia rangiformis* and a scattering of *Hypnum lacunosum* and *Scleropodium purum* in the turf, and a little *Scilla verna* and *Plantago coronopus*. Smaller areas are present on the west side of the Warren in Compartment 41a (Q61), and around the monument in Compartment 61 (Q64). The former has patchily abundant *Briza media*, which disappears in the gradual upslope transition to SD8. The latter has an abundance of *Anthyllis vulneraria* and retains frequent *Asperula cynanchica*, but has a poorer representation of calcicoles which, together with a little *Agrostis vinealis* and *Hypericum pulchrum*, suggest a transition to more calcifugous vegetation. The sand here appears to be several feet deep, but is perhaps strongly leached with age. There are tiny patches of poorly characterised CG7b and the '*Fulgensia* vegetation' within this stand (see below).

Small stands in the Mere Pool Valley (Q62) and in Compartment 17, Lattice Windows (Q72) are referable to the ***Succisa pratensis* - *Leucanthemum vulgare* sub-community** (**CG2b**). This species-rich sub-community is characterised by a suite of colourful forbs, here represented by frequent *Succisa*, *Leucanthemum vulgare* and *Prunella vulgaris*, whilst *Trifolium pratense* and *Centaurea nigra* are occasional. Although not always strongly marked at the sub-community level, all of the **CG2b** recorded was considered to be of high floristic quality. The stands in Compartment 17 have a maritime element, with a little *Scilla verna*, and *Festuca rubra* replacing *Festuca ovina*. The switch in fescues, the occasional *Anthoxanthum odoratum*, *Agrostis capillaris* and tussocks of *Brachypodium sylvaticum* and the slightly heathy feel, with frequent *Potentilla erecta* and *Viola riviniana*, also suggest transitions to the ***Dicranum scoparium* sub-community (CG2d)**. The only stands of this sub-community were found near the monument in Compartment 61 (Q52), where the absence of *Asperula cynanchica*, *Succisa* or *Leucanthemum vulgare*, coupled to the presence of the weakly preferential *Agrostis capillaris, Anthoxanthum odoratum* and *Dicranum scoparium* in a rather coarse sward suggested this sub-community by default.

More modified CG2 is present on the coastal fringe, most extensively along the east side of Stackpole Head, Compartment 16 (Q13,74). This is the ***Holcus lanatus* – *Trifolium repens* sub-community (CG2c)**. Stands have frequent *Trifolium repens* and *Holcus lanatus*, and little or no *Asperula cynanchica*. They are generally still species-rich, and are often transitional to the more maritime form of CG2 described below. Q74 provides a good example of this transition, with *Gentianella campestris* abundant in the stand.

Much of the more coastal CG2 fits the sub-community which has been described elsewhere in Wales as **CG2 'maritime'** (Stevens et al, 2010). This sometimes occupies a zone between maritime grassland communities and more modified calcareous grassland on the landward side, as shown on the Box Beach – Raming Hole coast, Compartment 11 (Q45). It has been distinguised by the presence of frequent *Scilla verna* or *Plantago maritima*, and it is sometimes also a little heathy with *Calluna vulgaris*, *Erica cinerea* and *Potentilla erecta* occasional in the sward. The maritime element is further expressed through the partial replacement of *Festuca ovina* by *Festuca rubra*, sometimes of the ssp. *pruinosa*, and by frequent *Agrostis stolonifera*. CG2 maritime shares affinities with some maritime communities, notably *Festuca rubra – Dacus carota* maritime grassland, *Sanguisorba minor* sub-community (MC11c), and that community appears to have been mapped more extensively by previous surveys. *Daucus carota* and *Dactylis glomerata* were lacking in our samples, and the stronger maritime element of *Armeria maritima* or *Silene uniflora* which further characterises MC11 was generally absent. However, the two communities appear to be

closely associated on Saddle Point, Compartment 40 (Q78), where *Daucus carota* appears at the top of the slope. A particularly lichen-rich variant of the CG2 maritime occurs on the Saddle Point coast, Compartment 10 (Q57), comprising a more open rocky sward somewhat transitional to the nearby CG1f. It is here that the Nationally Rare *Heterodermia leucomela* is found, along with *Pertusaria albescens*, *Placidiopsis squamlosum* and several *Cladonia* species. The distinctive and unusual red colour form of kidney vetch, *Anthyllis vulneraria* ssp. *vulneraria* var. *coccinea* is also a feature of this stand.

Outcrops of limestone occur behind Barafundle and Broadhaven, and in the Mere Pool Valley. The thin soils associated with these support ***Festuca ovina – Carlina vulgaris*** **grassland (CG1)**. The community constants *Festuca ovina*, *Sanguisorba minor*, *Thymus praecox*, *Pilosella officinarum*, *Lotus corniculatus*, *Carlina vulgaris* and *Plantago lanceolata* are well represented in all stands, but, in common with other Welsh examples (Stevens et al, 2010) *Dactylis glomerata* is of sparse occurrence. Most of the CG1 is referable to the ***Koeleria macrantha*** **sub-community (CG1e)**. This is characterised largely by the absence of preferential for the other sub-communities, although two weakly diagnostic species – *Linum catharticum* and *Asperula cynanchica* - are typically frequent in the Stackpole examples. The most extensive stands occur in Compartment 53 on the west side of Stackpole Warren (Q2,3) and in Compartment 3 behind Barafundle (Q23,27). Further small stands occur on the Warren in Compartment 41b (Q51) and on the south facing slope of the Mere Pool Valley in Compartment 5 (Q83). All of the CG1e is of high quality, with no signs of agricultural modification. However, *Ulex europaeus* may be invading some stands, particularly behind Barafundle, and the Mere Pool valley stands suffer a little from *Ligustrum vulgare*, *Rosa pimpinellifolia* and *Clematis vitalba* encroachment. *Quercus ilex* seedlings are fairly frequent in Compartment 53.

Many of the CG1e stands have occasional *Euphorbia portlandica* which, together with frequent *Echium vulgare* and occasional *Plantago coronopus*, indicates transitions to the ***Festuca rubra – Scilla verna*** **sub-community (CG1f)**. However, one or other of the eponymous preferentials was additionally required to be frequent before stands were assigned to this sub-community. The only good example of CG1f was considered to be the slope on the west side of the Saddle Point coast (Q58). This has frequent *Scilla verna* and *Plantago coronopus*, together with occasional *Cerastium diffusum* and *Plantago maritima*. *Festuca ovina*, *Thymus polytrichus* and *Anthyllis vulneraria* dominate, and the extensive areas of bare rock and soil allow acrocarpous mosses such as *Trichostomum crispulum* and a wide variety of lichens to flourish. The more open parts of '**other Calcareous Maritime Grassland**' mapped in Compartment 1, Box Beach (Q41) closely resemble CG1f, but the *Festuca rubra*

ssp. *pruinosa*, *Armeria maritima*, *Silene uniflora* and abundant *Agrostis stolonifera* are somewhat atypical and indicate transitions to a more maritime community.

Festuca ovina – Hieracium pilosella – Thymus praecox **grassland (CG7)** is another calcareous grassland community of shallow soils, quite closely related to CG1. The stands in Compartment 53 (Q1, Q99) occurs on the same slope as the CG1e, but differ in their generally closed turf, the increased abundance of *Pilosella officinarum* and the reduced contribution from strong calcicoles such as *Sanguisorba minor*, *Asperula cynanchica* and *Blackstonia perfoliata.* There are also subtle differences in the lower plants, with frequent *Dicranum scoparium*, *Frullania tamarisci* and the turf crunchy underfoot with the abundance of *Cladonia*, including *Cladonia portentosa* dominant in some patches. The latter characteristic would seem to allow placement within the ***Cladonia*** **spp. sub-community (CG7b)**. This would appear to be the only such example within Wales of a community almost confined to the Breckland of East Anglia. The few other Welsh examples of CG7, including those at the neighbouring Castlemartin Ranges, have but a little *Cladonia rangiformis* and have been left unassigned at the sub-community level (Stevens et al, 2010).

A rather different type of short calcareous vegetation occurs on Stackpole Warren, most extensively in front of the dune ridge in Compartment 41b (Q94,95,96,97,98,100) where exposure and thin soils combine with trampling pressure and presumably rabbit grazing to suppress the sward. This was mapped as **'*Fulgensia* vegetation'**, as NVC placement is somewhat equivocal. It retains the constant *Thymus polytrichus* and *Pilosella officinarum* of the CG7, although the latter is at much lower cover here. *Agrostis stolonifera* replaces *Festuca ovina* as the dominant grass. *Sanguisorba minor* and *Asperula cynanchica* are also constant here, together with *Linum catharticum*, *Euphrasia officinalis*, *Leontodon saxatilis*, *Lotus corniculatus*, *Centaurium erythraea*, *Anagallis arvensis*, *Plantago lanceolata* and *Plantago coronopus*. Much of the distinctive character of this vegetation comes from the lower plants, with acrocarpous mosses often accounting for over 50% of the cover. *Trichostomum crispulum* dominates, but *Ditrichum flexicaule* is also constant, *Gymnostomum viridulum* is frequent, and further enrichment is provided by species such as *Trichostomum brachydontium*, *Pleurochaete squarrosa*, *Encalypta streptocarpa* and the Nationally Scarce *Didymodon acutus*. The eye-catching feature though is the sparse but constant occurrence of the scrambled egg lichen *Fulgensia fulgens*, which appears sufficiently associated with this vegetation type to be used as the primary indicator species for mapping purposes. *Cladonia poccillum* is another constant, and a further seventeen lichen species were recorded in our samples. This vegetation bears some resemblance to descriptions of the *Ditrichum flexicaule – Diploschistes scruposus* var. *bryophilus* sub-community of CG7, CG7c, which is known to

feature *Fulgensia fulgens* in the few Breckland stands. However, the Stackpole examples are perhaps closer to a form of CG1, and for monitoring purposes could be classed as a CG1 '*Fulgensia'* sub-community.

***Brachypodium pinnatum* grassland (CG4)** occurs on the north facing slope of the Mere Pool Valley, Compartment 5 (Q101), and on the gorse dominated slope on the south side of Broadhaven, Compartment 18 (unsampled). *Brachypodium pinnatum* has been known from here since 1968, and its potential spread has been countered by control measures. The Mere Pool Valley stand is strongly dominated by tussocks of the grass, and the associated flora comprises a suite of slightly calcifugous species rather than the calcicoles typical of the community. *Viola riviniana* and *Teucrium scorodonia* are frequent, whilst *Potentilla erecta*, *Stachys officinalis* and *Agrostis vinealis* appear in more open patches towards the western edge. *Molinia caerulea* and *Eupatorium cannabinum* are occasional, and there is some *Hedera hibernica*, *Ulex europaeus* and *Rubus fruticosus* growing through the sward. With *Holcus lanatus* frequent and *Arrhenatherum elatius* occasional, the ***Holcus lanatus* sub-community, CG4c**, would appear the closest fit, but this stand has been left unassigned at this level. To the south of Broadhaven, the stand is better characterised at the community level, with a few calcicoles appearing between the tussocks of *Brachypodium pinnatum*, *Dactylis glomerata* and *Festuca arundinacea*. Among the associates here are *Carex flacca*, *Sanguisorba minor*, *Briza media*, *Centaurea scabiosa*, *Anthyllis vulneraria*, *Galium verum*, *Agrimonia eupatorium* and *Pimpinella saxifraga*. Sub-community placement here is again unclear, although this stand shows more affinities to the ***Centaurea nigra – Leontodon hispidus* sub-community, CG4b.**

***Avenula pubescens* grassland (CG6)** is found in four small stands to the north and west edges of the Warren (Compartments 45, 68 and 41b) usually in transitions to a scrub edge. It was not sampled. *Avenula pubsecens* is locally abundant in the CG2, SD8 and SD9, but here it becomes dominant in a sward lacking many of the associates of those communities. The small area in Compartment 45 is rank and species-poor, with bracken and *Rubus fruticosus* invading, and associates generally limited to a few taller species such as *Crepis capillaris* and *Senecio jacobaea*. These stands show some affinities to the ***Potentilla reptans – Tragopogon pratensis* sub-community (CG6b)**, but have been left unassigned. The Compartment 41b stands are richer with *Dactylis glomerata*, *Festuca rubra*, *Origanum vulgare*, *Rosa pimpinellifolia*, *Briza media*, *Lotus corniculatus* and *Carex flacca* noted among the associates. These would appear to fit the ***Dactylis glomerata – Briza media* sub-community (CG6a).**

A patch in Compartment 41b dominated by *Brachypodium sylvaticum* was mapped as '***Brachypodium sylvaticum* grassland**' (unsampled). One further calcicolous grassland community was mapped in a few places, which bears some relation to CG2 and the richer CG6 described above. This has been termed **Calcareous Scrub Margin vegetation**, in line with similar vegetation described in Stevens et al (2010). Associates were recorded from a stand in Compartment 3, where it forms a transition between CG2 and scrub over limestone boulders (perhaps referable to *Crataegus monogyna – Hedera helix* scrub, *Mercurialis perennis* sub-community, W21b). These comprise species such as *Mercurialis perennis, Rubia peregrina, Linaria repens, Orobanche hederae* and *Glechoma hederacea* alongside typical CG2 plants such as *Thymus polytrichus, Blackstonia perfoliata* and *Centaurea scabiosa*. Elsewhere, it occurs predominantly around the margins of CG2 stands in Compartment 41b and 4b, and here tends to differ from that grassland in the strong representation of taller, grazing-sensitive forbs such as *Origanum vulgare, Inula conyza, Hypericum montanum, H. perforatum* and *Eupatorium cannabinum* alongside taller grasses such as *Brachypodium sylvaticum* and *Helicotrichon pubescens*. The scrub species *Ligustrum vulgare, Hedera hibernica* and *Clematis vitalba* penetrate the stands, and boundary delimitation is somewhat arbitrary as a result. The mapped area of (?ha) should be viewed as a conservative estimate, as small patches of transitional vegetation such as this are inevitably under-mapped during NVC survey.

Neutral and Acid Grassland

On Stackpole Head and towards the back of the Warren, the semi-improved grassland often takes on the appearance of a neutral grassland sward rather than fixed dune grassland. The two characteristic grasses of the semi-improved SD8b are not as well represented in these swards - *Festuca rubra* is generally at lower cover, and *Poa* cf. *humilis* no more than occasional. Instead *Holcus lanatus, Agrostis capillaris* and *Anthoxanthum odoratum* rival the fescue for dominance, *Lolium perenne* is locally frequent, and *Cynosurus cristatus* appears sporadically. These grasses are typical of ***Cynosurus cristatus – Centaurea nigra* grassland (MG5)**, and the presence of frequent *Lotus corniculatus* would normally allow referral to that community. However, the Stackpole examples are rather weakly characterised – *Cynosurus* is occasional at best, *Centaurea nigra* is virtually absent and *Trifolium pratense* rarely abundant. This perhaps reflects the sand-dune origin of these stands, and the cessation of the inputs necessary to maintain mesotrophic conditions in the swards. A typical example is provided in Compartment 42 (Q69), where some of the mildly calcicolous SD8 associates have persisted or reappeared at low frequency. All the mapped stands have been assigned to '**Other Neutral Grassland**' with no clear NVC equivalent, although the suffix '**MG5-type**' has been applied

to help assess quality. Furthermore, the three MG5 sub-communities were occasionally distinguished within these stands. The regularly cut area on the Stackpole Head plateau (Q76) perhaps shows the best fit to MG5, with the ***Lathyrus pratensis* sub-community (MG5a)** providing the closest match. *Trifolium pratense*, *Ranunculus acris*, *Hypochaeris radicata* and *Rhinanthus minor* are abundant here in a flowery, 'hay-meadow' sward. The surrounding uncut swards, by contrast, are mapped as semi-improved 'Other Neutral Grassland'; they are particularly grass-dominated and floristically dull (Q77), and provide a useful comparison of management techniques. Swards also come close to MG5a in Compartments 46 (Q31), 45 (Q33) and 48b (Q34) towards the back of the Warren, where *Trifolium pratense* is only occasional but a little *Lathyrus pratensis* appears as an alternative marker for MG5. The latter species is abundant in the stand sampled near the scraped heathland plot in Compartment 48b (Q38), but the dominance of *Agrostis capillaris* and *Anthoxanthum odoratum*, coupled to the appearance of *Potentilla erecta* and *Viola riviniana*, signal a transition to '**Other Acid Grassland**' by way of a poorly-characterised example of the ***Danthonia decumbens* sub-community (MG5c)**. Small areas of this '**Other Neutral Grassland, MG5c-type**' were mapped in the Devil's Quoit Field, along with a little '**Other Neutral Grassland, MG5b-type**' where *Galium verum* and *Linum catharticum* are suggestive of the ***Galium verum* sub-community, MG5b**.

An area of coarse grassland with abundant *Arrhenatherum elatius* on the landward boundary of Compartment 40, Saddle Point, was mapped as ***Arrhenatherum elatius* (MG1)**. Dense bracken areas are interspersed with this.

'**Other Acid Grassland**' forms a discontinuous belt across several compartments on the back of the Warren, perhaps associated with a deposit of more acidic loess soils (B. Haycock, pers. comm.). As well as the shift in grass dominance, ericoids appear in the more strongly marked examples of this grassland (Q32). Similar stands elsewhere in Wales have been assigned to the *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland, *Holcus lanatus – Trifolium repens* sub-community (U4b), but with both *Festuca ovina* and *Galium saxatile* absent, this approach has not been taken here. The area mapped in mosaic in Compartment 68 (unsampled) is somewhat different, having apparently been derived recently from cleared scrub. This has a coarse *Agrostis capillaris*, *Anthoxanthum* and *Holcus lanatus* dominated sward, with *Danthonia decumbens*, *Teucrium scorodonia*, *Hypericum pulchrum*, *Carex flacca* and *Cirsium palustre* among the associates. Regrowth of scrub is evident, with species such as *Ulex europaeus*, *Prunus spinosa* and *Hypericum calcynium*.

Heath

Areas of high quality ***Calluna vulgaris* - *Scilla verna* heath (H7)**, totalling nearly ? ha, are present on the Saddle Point coast and to the east of Stackpole Head. The stand between Saddle Point and Broadhaven (Q79) is strikingly well characterised, with abundant low bushes of *Calluna vulgaris* and *Erica cinerea* accompanied by frequent *Scilla verna*, *Festuca ovina*, *Potentilla erecta*, *Thymus polytrichus* and *Lotus corniculatus.* The distinctive suite of *Viola riviniana, Carex flacca, Carex caryophyllea, Polygala vulgaris, Koeleria macrantha, Galium verum, Stachys officinalis and Succisa pratensis* clearly place this within the ***Viola riviniana* sub-community, H7b**. *Sanguisorba minor* and *Linum catharticum* add to the calcicolous feel. Elsewhere on this slope, the ericoid cover is sometimes patchy and the sub-community preferentials less well represented as the heath grades into calcicolous grassland (CG2). The stand on the east side of Stackpole Head (unsampled) has locally abundant *Calluna vulgaris* and frequent *Erica cinerea*, with *Plantago maritima* and a similar range of mild calcicoles, including *Koeleria macrantha*, *Stachys officinalis*, *Sanguisorba minor* and *Carlina vulgaris*.

On the landward side of the path is some less well characterised maritime heath (Q80), with a high grass cover, infrequent *Calluna*, and several species more typical of modified swards such as *Trifolium repens, Cerastium fontanum* and *Ranunculus acris*. NVC placement is more equivocal here, but it is perhaps best classed as **H7b semi-improved**. (Past surveys have mapped this area as SD8, and it is possible that the recent light pony grazing regime has favoured increasing ericoid cover).

Calluna vulgaris is patchily abundant in areas mapped as CG2 'maritime', described above. This community is floristically similar to H7b, but with a lower ericoid cover. These stands, for example on the coastal slope of Compartment 18, could alternatively represent a more open example of the latter community.

Towards the back of the Warren, there are small but significant areas of heath vegetation which fit well with the **Calcareous Grass Heath** vegetation encountered by the CCW Phase II Grassland Survey at Great Orme and three other sites in North Wales, described in Stevens et al (2010). They share the ericoid abundance of the H7, the lack of *Ulex gallii*, and a similar suite of mild calcicoles, but they lack the *Scilla verna* or *Plantago maritima* typical of that community. They also lack the *Stachys officinalis* and *Succisa pratensis*, but are marked instead by constant *Pilosella officinarum.* The lichen flora is generally richer, with *Cladonia portentosa*, *C. furcata* and *Bacidia bagliettoana* on shallower soils. The most extensive stand occurs on the settlement site (?ha), where the varying micro-topography creates more

droughted, lichen-rich areas with *Asperula cynanchica* and *Thymus polytrichus* (Q4); patches with abundant *Erica cinerea* and *Danthonia decumbens* (Q5) and grassier, bracken invaded areas (Q68). Other small but reasonably well characterised patches occur in Compartments 51 and 52 (Q10), and between the two on the edge of Compartment 48b (Q39). In Compartment 52 it is associated with a fragment of degraded limestone pavement. Despite evident scrub management work, much of this is still rather coarsely grassy and suffering from *Ulex europaeus* and *Rubus fruticosus* invasion. The trial scraping of an area at the end of this ridge of pavement suggests that this technique holds promise.

Scraping of top-soil has also been trialled in three larger plots, with heathland vegetation quickly coming to dominate two of these. Although the plot in Compartment 48b (Q11) does show a small number of calcicoles appearing alongside the Calluna and Erica cinerea, it lacks the distinctive associates characteristic of the Calcareous Grass Heath and, having no other clear NVC affinities, has been classed instead as '**Other Heath**'. *Radiola linoides* is present on the damp open ground here too. The scraped plot on the west side of Compartment 49 has developed into grassland, but the plot further out on to Stackpole Head (Q12) is again dominated by ericoids and referable to 'other heath'.

Cliff and Crevice Vegetation

Accurate mapping of cliff and crevice vegetation was not attempted by this survey. Boat access and the use of oblique aerial photography would perhaps be required to properly describe the vegetation on the steeper cliff sections of Stackpole Head. Nevertheless, more accessible areas were sampled and mapped, and binoculars allowed provisional assessment of some cliff sections.

The most exposed cliff areas display good examples of the ***Crithmum maritimum* – *Spergularia rupicola* maritime rock-crevice community, *Inula crithmoides* sub-community (MC1b).** The south and west facing cliffs of the Saddle Point coast have the most extensive areas (unsampled). Further stretches occur between Box Beach and Raming Hole (Q44) where *Limonium binervosum* agg. or *Armeria maritima* dominate, with varying amounts of *Crithmum maritimum*, *Festuca rubra* ssp. *pruinosa*, *Plantago coronopus*, *Silene uniflora* and *Inula crithmoides*. Although not noted by this survey, *Parapholis incurva* occurs in these stands (S. Evans, pers. comm.). Stands on the south side of Stackpole Head (Compartments 13,14 and 15) were generally inaccessible, although exposures around Gun Cliff could be seen to have *Inula crithmoides*, *Crithmum maritimum*, *Armeria maritima* and

Limonium binervosum agg. as the principal species, as well as a little *Sedum telephium* in more sheltered patches.

Although not possible to sample or map, patches of the ***Atriplex prostrata – Beta vulgaris* ssp. *maritima* sea-bird cliff community (MC6)** predominate on the cliff sections from Stackpole Head to Lattice Windows, and patches occur westwards as far as Raming Hole. A small accessible example below Gun Cliff had the two eponymous preferentials conspicuous amongst the *Festuca rubra* ssp. *pruinosa*, *Spergularia rupicola*, *Armeria maritima*, gull feathers and guano.

The category '**Exposed Rock community**' was used to describe sparsely vegetated exposures of limestone, for example on under-cliffs in Compartment 16 and 17. Species noted on these cliffs included *Sedum telephium*, *Echium vulgare*, *Centaurea scabiosa*, *Catapodium marinum* and *Armeria maritima*.

Maritime Grassland

***Festuca rubra – Armeria maritima* maritime grassland (MC8)** is the typical grassland community occurring on the more maritime slopes. At least three sub-communities appear to be represented at Stackpole, but placement of individual stands is sometimes equivocal.

The **Typical sub-community, MC8a**, was straightforward to partition, with well characterised examples occurring near Raming Hole (Q46) and on the point at Mowingword (unsampled). A thick turf of *Festuca rubra* (some of it ssp. *pruinosa*), *Agrostis stolonifera* and *Armeria maritima* typifies this vegetation – *Plantago lanceolata* and *P. coronopus* are occasional at best, but *Lotus corniculatus* is abundant and there is sometimes a little *Silene uniflora*, *Rumex acetosa* or *Sonchus oleraceus*. One further stand to the north of Stackpole Head was not accessed.

The ***Crithmum maritimum* sub-community, MC8b**, is strongly transitional to the MC1b described above, and occurs in association with it to the south-west of Saddle Point (Compartment 10) and from Box Beach to Raming Hole (Compartment 11). Stands were generally referred to MC1b if *Limonium binervosum* was abundant in sparser vegetation, and to MC8b where *Festuca rubra* or *Agrostis stolonifera* were more abundant. The structure of the sward, coupled to the local abundance of *Plantago coronopus*, could alternatively place these MC8 stands in the ***Plantago coronopus* sub-community, MC8e**. Clearer examples of

MC8e occur on the flat top of Mowingword (Q15) and between Box Beach and Raming Hole (Q43). *Plantago coronopus* is abundant here and *Cerastium diffusum* is frequent. Various other therophytes occur in the more open swards, and a few lichens and acrocarpous mosses take advantage of bare soil patches.

No clear examples of the *Armeria*-dominated sub-community, MC8g, were noted by this survey, with the small stands mapped in Cooper, Doody and Malloch (1987) perhaps now having lost their *Armeria* dominance following the introduction of pony gazing. Ponies were seen to be favouring the top of the Mowingword headland, now referable to MC8e rather than MC8g. Small patches of the rather ill-defined *Holcus lanatus* sub-community, MC8d were also mapped by Cooper; these were not noted within the MC8e and MC9 mapped by our survey.

Stands of the ***Armeria maritima – Cerastium diffusum* ssp. *diffusum* maritime therophyte community (MC5)** occur over shallow soils around the cliff-tops between Box Beach and Stackpole Head (Compartments 11-15). The vegetation cover is rather sparse, droughted and open here, and various small annuals are frequent. The ***Desmazeria marina* sub-community, MC5a**, is prevalent on the cliff edge from Raming Hole (Q47) to Stackpole Head. This tends to have abundant *Festuca rubra* ssp. *pruinosa*, *Plantago coronopus* and *Armeria maritima*, together with frequent *Cerastium diffusum* and a range of annuals including *Catapodium (Desmazeria) marinum*, *Sagina maritima*, *Sedum anglicum*, *Bromus hordeaceus* cf. ssp. *ferronii*, *Erodium maritimum* and *Spergularia rupicola*. The cliff-tops to the west of Raming Hole, by contrast, carry stands of the ***Arenaria serpyllifolia* sub-community, MC5d**. *Trifolium scabrum* is frequent near Raming Hole, but it is towards Box Beach (Q17) that stands take on a distinctly richer flora, somewhat transitional to CG1f. *Agrostis stolonifera* and *Festuca ovina* replace *F. rubra* here, and the associates include various mild calcicoles alongside the typical therophytes – *Thymus polytrichus* is abundant, and *Linum catharticum*, *Echium vulgare*, *Euphrasia officinalis* and *Centaurium erythraea* are frequent. Lower plants are well represented on these rocky slopes, with some *Cladonia rangiformis*, *C. foliacea*, *Didymodon acutus* and *Amblystegium serpens* var. *salinum*. Further west again, a stand on the south-east side of Saddle Point was mapped as the ***Anthyllis vulneraria* sub-community**, **MC5b**, due to the abundance of *Anthyllis*.

The less obviously maritime swards of the ***Festuca rubra – Holcus lanatus* maritime grassland (MC9)** are most extensively developed on the fringes of the Stackpole Head plateau, where they merge into semi-improved 'other neutral grassland' in an extended, ill-defined transition. Q50 is typical of this, with the maritime element apparently reduced to just

a little *Festuca rubra* ssp. *pruinosa*, and *Armeria maritima* as an occasional in the stand. *Festuca rubra* is joined by other grasses here, including *Agrostis capillaris*, *Holcus lanatus*, *Dactylis glomerata* and *Lolium perenne*. Some enrichment is provided by abundant *Koeleria macrantha*, *Carex caryophyllea* and *Euphrasia officinalis*. The stand is poorly characterised at the sub-community level, but is perhaps best classed as a semi-improved form of the ***Achillea millefolium* sub-community, MC9c**. Under-cliffs to the west of Mowingword have a more luxuriant growth, with a little *Silene uniflora* and *Viola riviniana*, but *Lolium* is still frequent and *Trifolium repens* abundant. An unimproved but somewhat atypical stand near Box Beach has *Festuca rubra* subordinate to other grasses such as *Anthoxanthum* and *Dactylis glomerata* in a tussocky sward with locally frequent *Scilla verna* and *Armeria maritima* and a scattering of calcicoles including *Sanguisorba minor* and *Thymus polytrichus*.

Most stands near the cliffs at Lattice Windows are better placed within the ***Plantago maritima* sub-community, MC9a**, having frequent *Plantago maritima* alongside the *Scilla verna* and *Armeria maritima*. *Carex distans* forms small patches lower down. *Plantago maritima* drops out higher up the slope, whilst the enrichment provided by abundant *Potentilla erecta*, *Lotus corniculatus* and *Rumex acetosa* are suggestive of a transition to the ***Anthoxanthum odoratum* sub-community, MC9e**. The complex patterning of maritime communities along this section of low cliffs may also include a small area of the ***Dactylis glomerata* sub-community, MC9b**, where two of the sub-community preferential – *Dactylis* and *Anthyllis vulneraria* – are particularly abundant. This stand also shows fine-scale transitions to MC5 and Calcareous Grass Heath. *Dactylis* is also abundant in a further weakly characterised example of the sub-community in Sandy Pit. The under-cliffs to the north-east of Stackpole Head have been classed as an impoverished form of MC9b (as they were by Cooper, Doody and Malloch in 1987). However, the maritime element is all but absent here with *Armeria maritima* confined to the few outcropping rocks within the stand. The swards are effectively a rank example of the semi-improved 'other neutral grassland' that dominates the plateau above. They are *Dactylis* dominated, with abundant *Holcus lanatus* and *Agrostis stolonifera*, and frequent *Anthoxanthum odoratum* and *Festuca rubra*. Amongst the few forbs, *Lotus uliginosus* and *Rumex acetosa* appear to be the most frequent, whilst *Trifolium pratense*, *Ranunculus acris*, *Centaurea nigra*, *Hypochearis radicata*, *Achillea millefolium* and *Rumex obtusifolium* were all occasional. Some areas have *Urtica dioica*, *Lolium perenne*, *Galium aparine* and *Cirsium arvense*, perhaps indicating sheltering and dunging areas used by stock over the years. No seed heads were seen, but it is likely that *Hyacinthoides non-scripta* was still present under the *Dactylis* in the patches mapped by Cooper, Doody and Malloch in 1987, which would indicate transitions to the ***Festuca rubra – Hyacinthoides non-scripta* maritime bluebell community (MC12)**.

The ***Festuca rubra – Plantago* spp. maritime grassland (MC10)** is characterised by *Festuca rubra*, often ssp. *pruinosa*, together with varying quantities of *Agrostis stolonifera*, *Plantago maritima*, *P. coronopus* and sometimes *P. lanceolata* in a short turf. The ***Armeria maritima* sub-community, MC10a**, forms a belt on the more exposed south-west facing cliff-tops of Stackpole Head (Q14), and Saddle Point (Q88). A smaller stand also occurs on the coast west of Raming Hole where salt-laden spray funnels up a south-west facing gully. Community constants are well represented in these stands, with *Plantago maritima* strongly dominating the Stackpole Head example. *Lotus corniculatus* is also abundant here. Sub-community preferentials such as *Armeria maritima*, *Silene uniflora*, *Leontodon saxatilis* and *Cerastium diffusum* are occasional to frequent. *Carex flacca* is present in the Stackpole Head stand, but *Carex panicea* appears to be absent. A scattering of lichens and acrocarpous mosses is found in the sward, including *Trichostomum brachydontium*, *Romjularia lurida* and *Placidiopsis squamulosum*.

A more unusual form of the community is found on open rocky slopes on the east side of Saddle Point (Q87), at Lattice Windows (Compartment 17), and to the west of Broadhaven (Compartment 18). These retain abundant *Festuca rubra* ssp. *pruinosa* and frequent to abundant *Plantago maritima*, but *P. coronopus* is more occasional and sometimes replaced by *P. lanceolata* here. *Scilla verna* is additionally frequent. Although *Carex panicea* is still absent, other preferentials for the ***Carex panicea* sub-community, MC10b**, are well represented – *Thymus polytrichus* is abundant, *Euphrasia officinalis*, *Leontodon autumnalis* and *Lotus corniculatus* are frequent, and *Viola riviniana*, *Luzula campestris* and *Bellis perennis* are occasional. However, the high quality stands are generally further enriched by calcicoles including *Blackstonia perfoliata* and *Carlina vulgaris* and a striking abundance of *Cladonia rangiformis*. Species such as *Festuca ovina*, *Centaurea scabiosa*, *Leucanthemum vulgare* and *Anthyllis vulneraria* are also found in the Compartment 18 stand, and a small damp flush here brings additional *Carex distans*. The Lattice Windows stand has frequent *Linum catharticum* and a little *Cerastium diffusum* and *Catapodium marinum*, suggesting affinities to MC5. These stands do not fit well with the published description of the sub-community, and we have assigned them to a **MC10b 'CG variant'.**

The ***Festuca rubra – Daucus carota* ssp. *gummifer* maritime grassland (MC11)** was widely mapped by Cooper, Doody and Malloch in 1987, despite the general lack of *Daucus carota* itself in their samples. The maritime element is small in this community, and the *Sanguisorba minor* sub-community, MC11c is characterised by many of the calcicoles familiar at

Stackpole. We have generally mapped these coastal calcicolous swards as CG2 ‘maritime’, in keeping with the approach taken by CCW elsewhere (Stevens et al, 2010). These are described in the calcicolous grassland chapter above. MC11 has been reserved for stands with *Daucus carota* at least occasional, and these were only encountered near the Broadhaven car-park, and in mosaic with CG2 maritime on the south-eastern slope of Saddle Point. The former has *Festuca rubra*, *Holcus lanatus*, *Agrostis stolonifera*, *Dactylis glomerata* and *Briza media* variously abundant in a rather coarse, tussocky sward, together with frequent *Daucus carota*, *Centaurea nigra*, *Crepis capillaris*, *Senecio jacobaea*, *Trifolium pratense* and locally frequent *Centaurea scabiosa*. The ***Sanguisorba minor* sub-community, MC11c**, would seem to provide the closest fit, but *Lolium perenne* and *Cynosurus cristatus* indicate a degree of improvement here.

Bracken, Scrub, Trees and Woodland

Dense scrub and woodland together cover a little over ?% of the total site area (about ? ha). No attempt was made to map the different areas to NVC communities, but the main dominant species was recorded. Stands of scrub over much of the Warren comprised just a few large bushes of *Ulex europaeus*, with *Crataegus monogyna* appearing in places towards the northern edge. Individual ash trees and small sycamore copses were mapped here too. Dense *Rubus fruticosus* was mapped comparatively rarely. *Rubus caesisus* is abundant on the western side of the Warren, invading much of the under-grazed fixed dune grassland in Compartment 41b. *Clematis vitalba* invades much of the dune grassland behind Barafundle and Broadhaven. If not smothered by the *Clematis,* much of the dune vegetation at Barafundle has a canopy of bracken. In places this forms dense patches, sometimes alongside *Rubus fruticosus*.

Tall Ruderal, Modified and Disturbed Vegetation

Aside from dense bracken, the only other tall ruderal vegetation mapped comprised small stands of the ***Urtica dioica – Cirsium arvense* community, *Holcus lanatus – Poa annua* sub-community** (**OV25a**). This was usually associated with piles of cut bracken and other vegetation, tipped on the margins of the Warren. As well as the nettle, *Holcus lanatus*, *Cirsium arvense*, *C. vulgare*, *Arcticum minus* and *Galium aparine* were noted.

Many paths cross the site. These have occasionally been mapped as bare sand, where they are particularly distinct and wide, but narrow paths have been left unmapped. They generally comprise trampled, grassy, impoverished versions of the adjoining communities, sometimes

with abundant *Plantago coronopus* and frequent *Bellis perennis*. The gravel surfaced track in the Mere Pool valley has various small annual plants, and a few interesting species including *Carex otrubaea, Sagina nodosa* and *Juncus foliosus* along its margins.

Invasive / non-native species

Bracken is a significant feature of the site, but seems to be kept naturally in check on the seaward parts of the site, with many exposed stands completely browned by salt spray.

Hippophae rhamnoides has largely been removed from the Barafundle and Broadhaven dunes, but persists as occasional young shoots on the latter. Removal of this scrub has encouraged the spread of *Clematis vitalba* (B. Haycock pers. comm.), and this species smothers large areas of dune vegetation.

The Mere Pool valley has frequent *Centranthus ruber* on the rocky slopes, and there is a patch of *Sedum album* on the valley floor at SR9785294304. This latter species has markedly increased in Britain in recent years, and it has the potential to expand its range at Stackpole.

As described in the calcicolous grassland chapter, *Brachypodium pinnnatum* is not a native plant here. Its spread at Stackpole is monitored and checked; no new stands were found by this survey.

Uncommon plant species and their community associations

Several notable plants were seen during the survey, although intensive searches for rarities were not undertaken. CCW files contain detailed information on distribution of the SSSI feature plants, and the Pembrokeshire Rare Plant Register (Evans, 2007) contains provisional information on various other notable plants on the NNR. Rare bryophyte locations have recently been described in detail by Bosanquet (2005).

- ***Asparagus officinalis* ssp. *prostratus*** was seen in one of its known localities near Box Beach (Compartment 11), but could not be re-found on the west side of Saddle Point (Compartment 10). In the former location, it is associated with a rather transitional '**other calcareous maritime grassland community**'. In the latter location it apparently occupies a position near the upper edge of a stand of **MC1b**.

- Plants showing characters of ***Asperula cynanchica* ssp. *cynanchica* var. *densiflora*** (formerly recorded as *Asperula cynanchica* ssp. *occidentalis*) were noted in **CG1** behind Barafundle, presumably in the area where it was located by Tim Rich.
- One or two plants of the increasingly scarce ***Bromus lepidus***, perhaps a relic of past cultivation, were noted in the '**other acid grassland'** in compartment 68. This grass was recorded from the Warren in the 1960s, but has not been looked for since (S. Evans, pers. comm.)
- ***Centaurium pulchellum*** is frequent in '**damp slack vegetation**' in the Mere Pool Valley.
- Numerous small, scattered shoots of ***Equisetum variegatum*** were seen in SD8 ' dry slack' vegetation on the west side of the Warren around Q7, and in 'wet slack vegetation' in the Mere Pool Valley around Q103.
- A single plant of ***Erodium lebelii*** found on the edge of the large blowout SR9868594644 represents the only recent Pembrokeshire record.
- Scattered plants of ***Erodium maritimum*** were noted in **MC5** on the cliff edge in Compartments 13 and 14.
- A large population of ***Euphorbia exigua*** was noted on the limestone ridge behind Barafundle, mostly in association with the **CG1e** here. At least 350 plants were counted from SR9871895211, back a hundred metres or so along the ridge towards the sea.
- ***Euphorbia portlandica*** is frequent in many dune and calcicolous grassland communities across the site, and it was not recorded except within quadrats.
- ***Gentianella anglica*** was recorded in several of its known locations on the west side of the Warren. It was generally associated with the SD8 'CG' and SD8 'dry slack' types. No detailed population assessments were made, but an estimate of numbers in one location – CCW monitoring Plot B – suggested a figure in the low hundreds. A single plant of probable *Gentianella anglica* was recorded in CG2a (Q61), a short distance from a known population at CCW monitoring plot A.
- A moderate-sized population (400-500 plants) of ***Gentianella campestris*** (unknown to the BSBI county recorder) was recorded in **CG2 maritime** near Stackpole Head. Previously recorded population on Saddle Point was noted, and also numbers into the low hundreds.
- One plant of ***Glaucium flavum*** was seen on a patch of open dune mapped as **bare sand** with bracken at SR98499442.
- ***Hypericum montanum*** is frequent in scrub-edge transitions, for example in the '**Dune Scrub Margin vegetation**' behind Barafundle (Q75), in **SD9 'other'** on the

Broadhaven Dunes around SR97659427, and in '**Calcareous Scrub Margin vegetation**' on the western edge of the Warren around SR97769457.

- ***Inula crithmoides*** is frequent on coastal limestone outcrops, and is particularly associated with the **MC1b**.
- ***Ononis reclinata*** was noted in its classic locality below the outcrop at the back of Broadhaven. The vegetation here is somewhat transitional between **CG2a** and **CG1e/f**.
- ***Orobanche hederae*** was encountered on the Barafundle dunes, with a few dozen dead spikes seen on the limestone ridge around SR99009520 in '**Calcareous Scrub Margin vegetation**', and more lower down in '**Dune Scrub Margin vegetation**' around Q75. The host ivy is *Hedera hibernica*, not *H. helix* here. Further spikes were noted on an unidentified ivy on the southern cliffs of Barafundle, above Q72.
- Dozens of dead spikes of ***Orobanche minor***, presumably var. *minor* are apparently associated with *Ononis repens* in the large stand of '**Calcareous Grey Dune**' at the eastern end of the Mere Pool Valley.
- *Limonium parvum* and other critical *Limonium* taxa were not recorded, but the aggregate '***Limonium binervosum***' is particularly frequent in the MC8b in Compartment 11, Box Beach to Raming Hole cliffs.
- Approximately 30 plants of ***Parentucellia viscosa*** were noted in SD8b on the Warren near Q30.
- ***Spiranthes spiralis*** started appearing above ground towards the end of the survey, and was seen frequently in various calcicolous grassland and fixed dune grassland communities.
- A clump of a clover showing some characteristics of ***Trifolium occidentale*** was found in association with *Trifolium scabrum* in **MC5d** at SM9870994373. This may be similar to plants found previously near Newgale, which were determined by the BSBI referee as an unusual 'ecotype' of *Trifolium repens* (S. Evans pers.comm.). Confirmation would require expert determination of fresh specimens.

Bryophytes

- The nationally scarce acrocarpous moss ***Didymodon acutus*** was recorded from quadrats in the '***Fulgensia* community**' on the west side of Stackpole Warren, with one additional record from the calcareous grey dune (Q55) in the same area. This confirms a known former location for this species (Bosanquet, pers. comm.).

Lichens

- ***Fulgensia fulgens*** was a feature of the '*Fulgensia* vegetation' mapped in Compartment 41b, but was also found in small quantity in much of the CG1e behind Barafundle and on the western side of the Devil's Quoit field. It was also in vegetation on the Warren mapped as SD8 'CG' (Q9).
- ***Heteroderma leucomela*** was noted at its known locality, which appears to be a zone of specific humidity and salt exposure within vegetation mapped as CG2 'maritime' on the south-west side of Saddle Point. It is locally frequent here over an area of approximately 20m x 10m.
- ***Solorina spongiosa***, collected from (Q83) and determined by Brian Coppins is the first Pembrokeshire record of this uncommon lichen.
- The SSSI feature lichen ***Teloschistes flavicans*** was noted at its known location on Saddle Point by Ray Woods during the FSC lichen course in July.
- ***Bacidia herbarum*** was not noted during this survey.

Conclusion and conservation assessment

Stackpole NNR has long been known as a site of very high conservation importance for its vegetation. This survey helps to refine the understanding of this significance, and assess it within a Welsh context.

The stands of calcicolous grassland appear not to have been assessed by previous vegetation surveys. The areas of CG1 and CG2 are of high quality and both exceed the 0.5ha threshold required for SSSI notification. The small area of **CG7** is also of note, as this community has only been noted at three other sites during Phase II lowland grassland survey in Wales, two of which are in the north-east of the principality, and one of which is on the neighbouring Castlemartin Ranges. The '*Fulgensia* vegetation' appears to be unique within a Welsh and probably UK context, and is of intrinsically high conservation interest as a result.

Sand dune communities are extensive and varied, and clearly of high conservation interest. Two particular communities of interest appear not to have been described by previous surveys – the calcicolous fixed dune grassland mapped here as SD8 'CG', and the 'calcareous grey dune'. The extensive areas of SD8b and SD8e are notable within a Welsh context, although the past agricultural modification in places, and the low levels of grazing in others, has meant that some areas are rather impoverished.

Maritime communities are generally little modified, although seaward transitions to heath, dune or calcicolous grasslands are largely obscured by past improvements. An increasing focus of restoration management through cutting or grazing of these transitions zones would be desirable.

Heath vegetation, although not extensive, is of high conservation interest as much of it is species-rich and of a distinctive 'calcareous grass heath' type, previously only recorded from Great Orme and three smaller sites in North Wales (Stevens et al, 2010). The maritime heath provides similar interest, with a small but significant area of H7b, rarely encountered in a Welsh context.

Matt Sutton
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