No. 101

# NATIONAL SAND DUNE VEGETATION SURVEY
# SOUTH WALES DUNE SURVEY
# SITE REPORT NO. 51
# WHITEFORD BURROWS
# 1989

T C DARGIE

Contract HF3-03-434

Nominated Officer: G. Radley, CSD

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## NCC COASTAL ECOLOGY RESEARCH PROGRAMME

The Coastal Ecology Branch of the Chief Scientist Directorate was established in August 1979. One of the functions of the branch is to co-ordinate a programme of research and survey in the field of terrestrial coastal conservation. To this end a research programme has been developed with four main aims:

1. To describe the size, location and quality of the main coastal habitats in Great Britain (saltmarshes, sand-dunes, vegetated shingle, sea cliffs, strandlines, 'reclaimed' land and maritime islands).

2. To assess the impact of major development projects on sites of national importance for nature conservation.

3. To provide guidance on the management of the main coastal habitats for nature conservation.

4. To investigate the role of physical and biological processes in the maintenance of natural and semi-natural coastal habitats.

The results are disseminated in a variety of Nature Conservancy Council publications.

a. *CSD Contract reports*: limited numbers with specialist interest are produced. Copies are usually prepared by the contractor and made available as a Chief Scientist Directorate Report in microfiche through the Nature Conservancy Council's Information and Library Services.

b. *Contract survey reports*

c. *Research and survey in nature conservation*

d. *Focus on nature conservation*

If you would like any further information on this report or on the research programme please contact Dr Doody in Peterborough.

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# 1. BACKGROUND AND OBJECTIVES

Whiteford Burrows was surveyed as part of the Sand Dune Survey of Great Britain. This project is one of a series of strategic surveys of coastal habitats currently being undertaken by the Nature Conservancy Council. The Survey has two aims:

i. To produce a vegetation map and description for each sand dune system which will be useful to those involved directly in its conservation;

ii. To produce a national inventory of the range and extent of sand dune habitats in Great Britain. Such an inventory will then allow the interest of any particular site or group of sites to be placed in its national context.

This contract (HF3-03-434) involved a survey of dunes in South Wales. The specification involved the production of a vegetation map(s) and a botanical survey report for **each** of the following sites or site sets:

i. Pembrey Coast

ii. Whiteford Burrows

iii. Hillend-Llangennith-Broughton-Delvid-Hills Tor Burrows

iv. Port-Eynon to Horton

v. Oxwich-Nicholaston-Penmaen-Pennard Burrows

vi. Black Pill to Bryn Mill

vii. Crymlyn Burrows

This document is one of the above site reports. In addition, the overall information is synthesized in a Regional Report which reviews the following points: dune distribution, type, size, vegetation communities and relationships, management and special characteristics. This report should be read in conjunction with the regional document if Whiteford Burrows is to be considered in a broader geographical and ecological context.

## 2. METHODS

Whiteford Burrows was surveyed using the standard techniques of the Sand Dune Survey of Great Britain. Collecting data in a consistent manner will thus enable valid comparisons to be made between sites on a national basis.

The field survey technique and subsequent analysis of the data were carried out using methods similar to those of the National Vegetation Classification (NVC).

Further details of the field techniques, data analysis and vegetation mapping are included in Annex 1. The quadrat data set (in coded format) is presented in Annex 7. Quadrat membership of vegetation types is given in Annex 4.

## 3. SITE DESCRIPTION

### Location, conservation status and land ownership

Whiteford Burrows forms the northwestern point of the Gower Peninsula in South Wales (Fig. 1). The dune area falls within two SSSIs: Cwm Ivy Marsh, Dunes & Tor (76.3ha) and Whiteford Burrows - Landimore Marsh (842ha), both in Swansea District, West Glamorgan. The area is managed as an NNR. Whiteford Burrows is within the Gower AONB and is an integral part of the more extensive Burry Inlet site of international nature conservation importance.

Ownership/management lies with the National Trust/NCC and permission for access was obtained from both organisations.

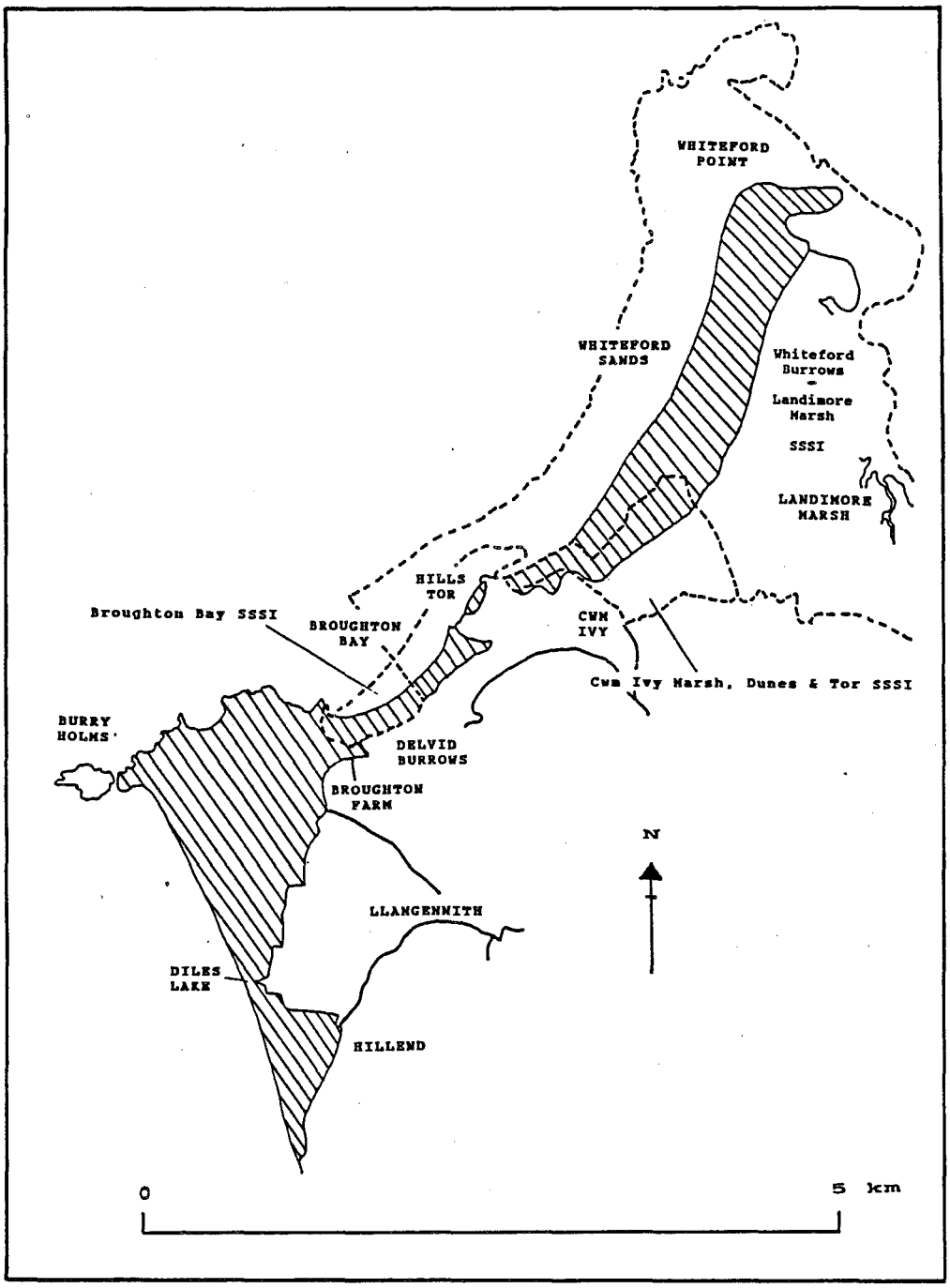


Figure 1 Survey and SSSI boundaries for Northwest Gower study area.

Dashed lines are SSSI boundaries
Hatching denotes surveyed dune areas

## Geomorphology

Whiteford Burrows is a large (3 km length, 400-600m wide) barrier beach with a core of Devensian end moraine, deposited by ice in the adjoining Loughor Valley (Bridges 1987). As a spit it has several outstanding features (Baye 1981):

i. seaward deflection of distal end;
ii. northeastern net longshore transport;
iii. large mobile dune ridge on west side with parallel line of steep-sided slacks to immediate east, plus secondary blowout system at distal end with young slacks;
iv. two complex spit recurves of sand and shingle (NB three in 1989);
v. shallow arcuate dune ridges at distal end giving ridge and swale topography, truncated by recession at proximal end in recent decades (NB truncation at centre in 1989);
vi. recurved intertidal sand ridge (foreshore spit) which usually dissipates stormwave energy;
vii. extensive backdune field with slack blowouts and parabolic dunes;
viii. much evidence of alternating phases of erosion and accretion, the accretion phase leading to a spit recurve and not spit progradation;
ix. possible tombolo structure if Berges Island (the distal end) was once a detached till island.

The southern sectors contain sand banked against steep Carboniferous Limestone cliff slopes. In other parts of Gower this feature was deposited during stormy conditions between the 14th and 18th centuries. These dates probably also apply to Whiteford.

## Soils

Almost all samples from dune, slack, scrub and woodland were probably calcareous because pH ranged between 6.8 and 8.0. These results show that most environments have been influenced by calcareous beach sand or by an alkaline/brackish watertable.

## Management

Whiteford is managed as an NNR by NCC. Some management responsibility in the south is devolved to the National Trust for maintaining fencing to exclude pony grazing from Corsican Pine plantations. There is no close car park and access has to be on foot from Hills Tor or from Cwm Ivy. This restricts visitor numbers but the southern beach sectors are popular, as is a walk to Whiteford Point and return through the dunes along the eastern sand edge. In general recreational pressure is not great.

Grazing is maintained by ponies (though rabbits are plentiful too in the south). Numbers have varied over time, e.g. 50 ponies and 30-100 sheep (Ranwell 1967), 78-90 ponies (Glyn 1975). Grazing exclosure experiments have been reported (Bray 1977). In the past grazing might have been responsible for much erosion in the back dunes where most old parabolic blowouts are restricted in a variety of positions (Baye 1981).

Selective clearance of Corsican Pine has taken place in northern sectors to reduce shade impacts on slack and dune. These areas are still monitored but recovery is slow. The growth of deciduous trees under a Corsican Pine canopy in the south is also being monitored. Sea Buckthorn (*Hippophae rhamnoides*) was previously a problem but clearance was started in July 1967 and the area has been largely clear of this invasive shrub for almost a decade (Davies 1981).

## 4. VEGETATION OF WHITEFORD BURROWS

This section contains a general description of the vegetation of Whiteford Burrows. The characteristic species composition of each community is outlined and the mapping legend number and equivalent NVC code(s) are included in brackets. An explanation of the NVC codes can be found in Annex 3 together with further information on the NVC communities, local variations and non-NVC vegetation types. The vegetation map(s) is provided at the end of the report and area data for vegetation is given in Annex 8.

### Strandline

The strandline is poorly developed on the exposed outer dune edges and sand burial transforms it into a foredune. In more sheltered locations to leeward, on the transition between saltmarsh and dune, there is a species-rich community dominated by the foredune grass Sand Couch (*Elymus farctus*), and upper saltmarsh grasses Red Fescue (*Festuca rubra*) and Creeping Bent (*Agrostis stolonifera*). There are also additional indicators of strandline, saltmarsh and foredune/mobile dune: Sea Sandwort (*Honkenya peploides*), Spear-leaved Orache (*Atriplex prostrata*), Prickly Saltwort (*Salsola kali*), Sea Beet (*Beta vulgaris maritima*), Marram Grass (*Ammophila arenaria*) and Sea Holly (*Eryngium maritimum*). This is an intermediate community type which does not fit the NVC. It is mapped as 1 and coded as X1.

### Foredune

On the western side there is a good belt of foredunes for a distance of c. 1.5km from the relative shelter of Hills Tor. Close to the position of the strandline there is a fragmented line of embryo foredunes dominated by Sand Couch (*Elymus farctus*). Additional infrequent species suggest that the sand has buried a strandline: Spear-leaved Orache, Sea Rocket (*Cakile maritima*), Sea Sandwort and Sea Beet. This is mapped as 2 and the NVC code is SD4. Above this position the foredunes contain both Sand Couch and Marram grass. The strandline indicators above are often present if the foredunes are close to the drift line but higher up the beach additional species suggest mobile dune elements: Sea Holly (*Eryngium maritimum*), Sea Spurge (*Euphorbia paralias*), Evening Primrose (*Oenothera erythrosepala*) and Common Ragwort (*Senecio jacobaea*). This is mapped as 3 and the NVC code is SD6a.

In the shelter of Whiteford Point the two types of foredune are separated. Type 3 occupies the foot of the northern dune scarp but Type 2 merges with the strandline transition below the recurved spits which run on to saltmarsh.

## Dune grassland

The distribution of dune grassland is made up of three spatial patterns. First, the exposed western edge has a relatively thin (50-100m) outer band of mobile dunes. Second, to leeward, there is a complex mosaic of semi-fixed and fixed grassland related to old and modern blowout distribution, slack presence, afforestation and the stage of dune stabilization attained. Third, at Whiteford Point, there is a mosaic of mobile and semi-fixed dune grassland types related to the exposure, current systems and active blowouts in that area.

The western mobile dunes are a species-poor Marram Grass (*Ammophila arenaria*) dune ridge (4 - NVC SD6d), with a thin strip of Marram - Red Fescue (*Festuca rubra*) mobile dune (5 -NVC SD6e) immediately to leeward on ridge backslopes and basal depressions. Despite exposure there can be shrub invasion in this zone and both Traveller's Joy (*Clematis vitalba*) and Dewberry (*Rubus caesius*) can form extensive patches.

In the more easterly backdunes the most common feature is a mosaic of two semi-fixed dune grassland types. On the gentler slopes there is a mix of Marram, Red Fescue and Common Restharrow (*Ononis repens*) - Type 6 NVC SD7c. This changes to a lower cover of Marram and Red Fescue on steeper dune slopes which were formerly the sides of active blowout systems. A moss sward is usually dominant (*Tortula ruralis* ssp. *ruraliformis*) and annual species are very common: Sand Cat's Tail (*Phleum arenarium*), Thyme-leaved Sandwort (*Arenaria serpyllifolia*), Sea Mouse-ear Chickweed (*Cerastium diffusum diffusum*) and the grass *Vulpia fasciculata*. This is mapped as 7 - NVC SD7d.

In areas of relative shelter, especially close to Hills Tor, a fixed dune grassland (8 - NVC SD8) is found with dominant Red Fescue and frequent Lady's Bedstraw (*Galium verum*). In a few places this shows leaching indicators (the moss *Dicranum scoparium* and the lichens *Cladonia rangiformis* and *C. impexa*) but there is no clear acidic grassland. In the south there are a few patches of very rank grassland with much False-oat Grass (*Arrhenatherum elatius*) mixed with Red Fescue. This is usually heavily invaded by either Blackberry (*Rubus fruticosus*) or Bracken (*Pteridium aquilinum*).

The third area, at Whiteford Point, has several large expanses of Type 4 Marram mobile dune and one large expanse of bare sand. This active blowout system has a fringe mosaic of Type 6 and Type 7 semi-fixed grassland. The recurved spits have a thin sand cover which is generally a mix of Type 6 and Type 7 grassland. This semi-fixed status is maintained by sand inputs from adjacent intertidal exposure and from the nearby active blowout system.

## Dune slack

Slack environments relate closely to recent geomorphological change and the underlying till bedrock. On the western side of the dune system there is an impressive north-south line of sub-circular and steep-sided slacks just inside the outer dune ridge. All appear to have originated as wind breaches of the mobile dune ridge, followed by rapid dune reconstruction on the western side. In the backdunes further east there are much larger slacks with a topography related to old parabolic dune blowouts. These have considerable floor microtopography including 'baby' dunes and 'hedgehogs' capped with Creeping Willow (*Salix repens*). The third and final type of slack is a long linear wetland stretching most of the eastern side north from Cwm Ivy Marsh. It marks water moving over the underlying till and flushing onto the surface in places (even forming swamp), and grading downslope into saltmarsh.

The youngest slacks have been created in the rear of an active blowout close to Whiteford Point. A very species-rich sward contains Glaucous Sedge (*Carex flacca*), Fiorin (*Agrostis stolonifera*), Variegated Horsetail (*Equisetum variegatum*), Self-heal (*Prunella vulgaris*), Red Fescue, patches of Creeping Willow, the mosses *Bryum pseudotriquetrum* and *Campylium stellatum*, and the liverwort *Aneura pinguis*. There are also indicators of brackish conditions (e.g. Sea Milkwort *Glaux maritima*). This is Type 12a, mapped as 12, NVC SD14c.

Most western slacks are dominated by Creeping Willow and a carpet of the moss *Calliergon cuspidatum* (Type 12b, mapped as 12, NVC SD15). There are plentiful occurrences of the orchid Marsh Helleborine (*Epipactis palustris*).

The extensive backdune slacks (mainly 14 - NVC SD16) represent slacks formed by parabolic blowouts but then partly infilled with sand from dune erosion further west. They are therefore generally drier than other slack types. The sward is dominated by Red Fescue, Yorkshire Fog (*Holcus lanatus*), Bird's-foot Trefoil (*Lotus corniculatus*), Fiorin, Sand Sedge (*Carex arenaria*) and Creeping Willow. There is often a scatter of Common Restharrow.

The most eastern slack (13 - NVC SD15c) extends for almost 1.5km. It is a tall-herb community dominated by a mix of Fleabane (*Pulicaria dysenterica*), Yorkshire Fog, Water Mint (*Mentha aquatica*), Silverweed (*Potentilla anserina*), Sea Rush (*Juncus maritimus*), Yellow Iris (*Iris pseudacorus*), Marsh Pennywort (*Hydrocotyle vulgaris*) and the moss *Calliergon cuspidatum*. Towards its northern end there are stands with Marsh Mallow (*Althaea officinalis*).

## Woodland and scrub

There is little scrub at Whiteford. It no longer has Sea Buckthorn (*Hippophae rhamnoides*) in any quantity. There are several stands of Blackthorn (*Prunus spinosa*, Type 26 NVC W22) in the southern dunes on steep blowout sides. Grasslands on the slopes of Hills Tor and Cwm Ivy Tor are often shrub-invaded, especially close to Sycamore (*Acer pseudoplatanus*) woodland (32 - Non-NVC X4).

There are several blocks of planted Corsican Pine (some also contain Scots Pine *Pinus sylvestris*) and the southernmost have grazing excluded. All are mapped as 31 (non-NVC X3). Soil moisture is the main determinant of ground flora in the southern stands, reflecting the dune and slack topography before planting. Hawthorn (*Crataegus monogyna*) and Common Oak (*Quercus robur*) are sporadically present in ungrazed pine woodland. Unthinned plantings of pine are very species-poor and shading effects on slack areas are often pronounced even with much thinning.

Wet ground supports two further woodland types. Thickets of Common Sallow (*Salix cinerea*) are common in backdune slacks and all were mapped as 23 - NVC W1, though many samples still retained more of a slack flora due to relative immaturity. There is one stand of mature Alder (*Alnus glutinosa*) at the distal end, occupying part of the slack-saltmarsh transition. This is not a clear NVC type and was mapped as 30 - non-NVC X2. It resembles in part W6 *Alnus glutinosa - Urtica dioica* woodland.

## Other habitats

There are large areas of saltmarsh and some swamp in the eastern part of Whiteford Burrows. These were not surveyed in detail but close to the strandline there is Sea Rush (*Juncus maritimus*) saltmarsh (SM18b) in wet areas. The main swamp (20 - NVC S12b) former is Bulrush (*Typha latifolia*), found in transition zones with much surface water flushing. Grazing by ponies might also have eradicated a Common Reed (*Phragmites australis*) swamp from these areas. Calcicolous grassland probably exists on the slopes of Cwm Ivy Tor but none was found in a very rapid reconnaissance of cliff slopes.

### Recent changes in vegetation

No early air photos were available to compare with 1989 survey material for an analysis of change. Field observations suggested that dunes were in a stable phase and recovering after at least one period of high dune mobility. This would explain much of the vegetation mosaic patterning and the different successional status of much dune grassland.

## 5. RARE PLANTS

The SSSI descriptions cite the following dune species with local and rare distribution: *Anacamptis pyramidalis, Dactylorhiza incarnata, D. praetermissa, Gentianella uliginosa, Mibora minima, Rumex maritimus* and *Liparis loeselii* (most abundant location in county).

## 6. SITE ASSESSMENT

Whiteford Burrows is important as a high-quality site of geomorphological and biological interest. It is a large dune system and most communities are natural types with little anthropological influence. It has a good range of community diversity in its dune vegetation, including actively accreting foredunes and a range of mobile, semi-fixed and fixed grasslands. It lacks only acidic grassland and dune heath. Unlike most dune systems in South Wales it still maintains a resonable level of grazing by pony stock. There are also several local or rare species, most of which are present in reasonable numbers.

There are no severe problems affecting site quality. Trampling by walkers has created a small path network but recreational pressure is slight. There is some scrub encroachment taking place in the southern dune sectors but this is not serious.

## 7. COMMENTS AND SUGGESTIONS

The present survey has confirmed that the site still retains high-quality dune vegetation and that there are few immediate problems. A full monitoring programme on a variety of research projects is maintained, backed up by several baseline surveys. There appear to be few gaps though the link between grazing, management and possible erosion (past and future) is still not fully clear.

# ANNEX 1

# METHODS

## AERIAL PHOTOGRAPHY

Air photos were used for field navigation and vegetation mapping in all but one site. The following material was supplied or purchased:

| | |
|---|---|
| Crymlyn Burrows | Cambridge University RC8K 27 May 1987<br>Colour (poor quality) c. 1:6000<br>Prints 88-92, 97-105, 121-125 |
| Black Pill to Bryn Mill | None available - field positioning and mapping done by pacing in relation to features on 1:10000 OS map. |
| Pennard and Penmaen | Hunting Surveys HSL UK 86 023 19 March 1986<br>Panchromatic (excellent quality) c. 1:5000<br>Run 17 Prints 2563-2566<br>Run 18 Prints 2478-2482 |
| Oxwich and Nicholaston | Cambridge University RC8KW 20 June 1983<br>Colour (fair quality) c. 1:5000<br>Prints 201-207, 209-213 (212 missing), 218-222. |
| Port-Eynon to Horton | Cambridge University RC8DA 26 June 1979<br>Panchromatic (good quality) c. 1:10000<br>Prints 268-270 |
| Hillend to Whitford | MAFF/ADAS Hasselblad 7 May 1989<br>Colour (good quality) c. 1:10000<br>Run 89-18 Prints 43-51, 66-68<br>Run 89-27 Prints 08-09 |
| Pembrey Coast | MAFF/ADAS 15 June 1986<br>Panchromatic (excellent quality) c. 1:11000<br>Film 291 Prints 24-36, 86-98, 157-8 |

## FIELD SURVEY

All major types of vegetation at each site were located by a rapid reconnaissance. Each type was then visited and a visually homogeneous stand was picked out. Vegetation was recorded within 2m x 2m (strand, dune grassland, dune slack, dune heath), 5m x 5m (scrub) and 10m x 10m (woodland) quadrats. The quadrat position and number was located precisely on an acetate overlay fixed to air photos.

The recommended procedure for the National Vegetation Classification (NVC) was followed as often as possible. Most dune vegetation types in each site were recorded with a minimum of five quadrats. Transitional habitats to saltmarsh, swamp and scrub/woodland were sampled less intensively.

Each quadrat was recorded on a standard record sheet (see Annex 2) which incorporated species and special variable number codes for use in later rapid computer data entry. All vascular plants, bryophytes and lichens in a quadrat were recorded on the Domin cover/abundance scale, together with community structure data (strata height and cover). Occasional soil samples (0-10 cm) were collected for most vegetation types and were then air dried prior to pH analysis.

Target notes (see Annex 6) were used for several purposes:

a. To note particular features;
b. To comment on land use;
c. To supplement quadrat records.

Target note positions were also marked in the field upon air photo overlays. Less emphasis was placed on these notes than in other National Sand Dune Survey studies because quadrat data was more intensive in this case.

A total of 640 quadrats was achieved for all sites, numbered as follows:

| | |
|---|---|
| Crymlyn Burrows | 1 - 146 |
| Black Pill to Bryn Mill | 147 - 169 |
| Tywyn (Pembrey Coast) | 170 - 271 |
| Pembrey Burrows | 272 - 347 |
| Pembrey Country Park and Pembrey Forest | 348 - 354, 627 - 640 |
| Port-Eynon to Horton | 355 - 390 |
| Whiteford Burrows | 391 - 468 |
| Nicholaston Burrows | 469 - 495 |
| Penmaen Burrows | 496 - 522 |
| Oxwich Burrows | 523 - 565 |
| Pennard Burrows | 566 - 596 |
| Hillend and Llangennith Burrows | 597 - 626 |

Access problems prevented any quadrat collection from Broughton, Delvid and Hills Tor Burrows. In traversing sites obvious vegetation boundaries were marked on air photo overlays and simple codes were marked for vegetation types, both to aid later photo-interpretation. Survey took place in two phases: June/early July and August/early September.

## ANALYSIS

Quadrat records were entered into an IBM-XT compatible microcomputer using the RECORD program in the VESPAN2 suite devised by Andrew Malloch of Lancaster University.

An initial classification of all quadrats using the TWINSPAN program enabled the clear separation of samples into three sub-sets: strand, dry dune and transitions; wet dune and transitions; scrub, woodland and transitions. Each sub-set of quadrats was then classified by TWINSPAN to produce end groups of samples. Each end group was listed in full using the TABLE program to detail all quadrats and species.

These tables enabled a comparison with the keys, tables and descriptions of vegetation types in the various NVC chapters. In many cases there was a direct correspondence with an NVC community, but often not to sub-community level. Some non-NVC groups were found and required separate description. More importantly, the classifications were not perfect and several NVC vegetation types (notably swamp, scrub and woodland transitions represented by low quadrat totals) were scattered amongst other end groups. Once recognised these community samples were aggregated using the SELECT program in VESPAN2.

Several dune vegetation types with large quadrat totals had distinct non-NVC sub-goups and these were described as variants of the NVC community. This important scale of variability is covered under PROBLEMS (see below).

## MAP PREPARATION

Following analysis and the recognition of vegetation types, a set of mapping units was created (see vegetation legend sheet in map pocket). For Black Pill to Bryn Mill those mapping units present were marked with approximate boundaries upon a 1:10000 OS map, given that air photos were not available. For all other sites fresh acetate overlays were mounted over field overlays and air photos. The mapping units were then marked on the top overlay using an Old Delft Scanning Mirror Stereoscope to position boundaries. In areas of small-scale rapid transition between communities (usually due to microtopography in slacks and around old small blowouts) the communities were mapped as a mosaic.

Features marked on 1:10000 OS maps were also accurately marked. The top overlay was then removed and OS map features were used to reproduce the photo-map at c. 1:7500 using a Zeiss Sketchmaster. All 1:7500 maps were then mosaiced and drawn as a final vegetation map on Permatrace at c. 1:7500 scale. This was then reduced to 1:10000 on an accurate zoom photocopier for reproduction on A3 paper.

A total of 14 final maps was involved. The legend was too lengthy to reproduce on each map and it is presented separately on A4 sheets in the map pocket of site reports.

## AREA MEASUREMENT

One copy of each vegetation map was carefully dissected by cutting around vegetation boundaries with fine scissors. Excised polygons were aggregated into map units and weighed on an accurate balance. The weights were converted to area (hectares) using the known paper weight of a 1 km square (100 ha). Mosaic types had the area allocated equally between component types.

## GENERAL INFORMATION

Additional information on sites was obtained from SSSI site descriptions (if an SSSI), discussions with regional staff of NCC and the National Trust, and by consulting reports held at the Oxwich Information Centre.

## PROBLEMS

1. **Access** No permission was sought for the Broughton area due to local difficulties. This led to no quadrat recording but the area was visited by public footpaths and reasonable mapping was achieved.

2. **Photo availability** Stereoscopic cover of several sites was not available during survey. Additional cover was purchased for the Pembrey Coast and Pennard-Penmaen. Some cover for Oxwich-Nicholaston was out on loan and was returned late despite repeated requests from local NCC staff. This lack of stereoscopy prevented more emphasis on field boundary identification and slowed down accurate field navigation.

3. **Nomenclature** NVC dune community types and nomenclature changed in the course of survey. Details of the revision (new nomenclature and floristic tables, but no information on slacks) were received between the two field survey periods and required some revision of the first phase results, plus a little re-survey. Detailed descriptions (but only nomenclature and floristic tables for slack types) were received as an NVC strand/dune chapter in November 1989. A wholesale revision of slack types had taken place, to the extent that field mapping could not in most cases be accurately assigned to new units. To make matters worse, the computer groupings of slack communities in this survey did not closely agree with new or old types. All mapping of slack communities should therefore be regarded as very approximate.

**4. NVC Community variability** Several dune communities, notably *Festuca rubra - Galium verum* dune grassland and most slack types, were thoroughly sampled with a large number of quadrats. Classification produced distinct sub-types but these were not readily assigned to NVC sub-communities. The problem lies in continuous variation which is dissected in a parsimonious manner by TWINSPAN analysis, both for this quadrat data set and for the more comprehensive set (in a geographical sense) on which NVC types are based.

The solution (i.e. extraction of readily-recognised and spatially recurrent vegetation types) can probably only come from a more rigorous analysis using ordination (to handle continuity) and sound interpretative methods to link continuous variation in several dimensions (succession, habitat gradients, geographical trends), e.g. seriation or canonical correspondence analysis. This was beyond the scope of this study but would be a very desirable feature of the complete national survey.

# ANNEX 2

# FIELD RECORDING SHEET

The sheet below is a reduced-size version of that used in the field. Space at the top and bottom was used for the field notes and listing of species not covered in the printed table. The NVC codes for species and special variables are present to aid rapid computer entry after fieldwork.

SITE DUNE SURVEY SHEET

| | | | | |
|---|---|---|---|---|
| Tree hite 9 | Shrb hite 10 | Herb hite 11 | Moss hite 12 | Bare grnd 22 |
| Tree covr 13 | Shrb covr 14 | Herb covr 15 | Moss covr 16 | |
| Achi mill 104 | Achi ptar 105 | Agro capi 123 | Agro stol 122 | Aira cary 124 |
| Aira prae 125 | Alnu glut 153 | Alth offi 2656 | Ammo aren 159 | Anac pyra 160 |
| Anag tene 163 | Anth odor 171 | Anth vuln 174 | Aren serp 194 | Arte mari 195 |
| Arrh elat 197 | Atri hast 217 | Atri laci 218 | Atri patu 220 | Aven prat 655 |
| Aven pube 656 | Bell pere 230 | Beta vulg 2801 | Caki marit 268 | Call vulg 278 |
| Caly sold 283 | Camp rotu 288 | Care aren 304 | Care arve 323 | Care flac 323 |
| Care nigr 333 | Care pani 339 | Carl vulg 362 | Cent eryt 373 | Cera diff 381 |
| Cera font 384 | Cera semi 385 | Cirs arve 415 | Cirs vulg 419 | Coch dani 425 |
| Coch offi 427 | Cory cane 3075 | Crep capi 447 | Crit mari 452 | Cyti scop 1193 |
| Dact glom 465 | Dact inca 467 | Dact maja 2828 | Dant decu 1249 | Dauc caro 475 |
| Desc cesp 477 | Desc flex 478 | Eleo palu 509 | Elym farc 116 | Elym pycn 117 |
| Elym repe 118 | Epil angu 391 | Epip palu 531 | Equi arve 532 | Equi hyem 534 |
| Equi palu 535 | Equi vari 539 | Erig acer 543 | Erio lati 547 | Erod cicu 549 |
| Erop vern 552 | Eryn mari 555 | Euph offi 568 | Euph para 565 | Euph port 567 |
| Fest ovin 574 | Fest rubr 576 | Fili ulma 583 | Gali apar 605 | Gali palu 609 |
| Gali veru 613 | Gent ulig 3052 | Glau flav 635 | Glau mari 636 | Hera spho 661 |
| Hier pilo 965 | Hippo rham 678 | Hole lana 680 | Honk pepl 682 | Horn petr 686 |
| Hydr vulg 690 | Hypo glab 704 | Hypo radi 706 | Iris pseu 715 | Junc acut 720 |
| Junc arti 722 | Junc bufo 725 | Junc bulb 726 | Junc gera 732 | Junc mari 734 |
| Junc squa 736 | Koel macr 746 | Leon autu 768 | Leon tara 770 | Lepi lati 3702 |
| Limo bine 778 | Linu cath 786 | Lipa loes 3074 | Lotu corn 800 | Lotu ulig 802 |
| Luzu camp 807 | Lych flos 813 | Lyco euro 823 | Matr mari 1355 | Matt sinu 841 |
| Medi lupu 844 | Ment aqua 855 | Mibo mini 3183 | Myos arve 884 | Oena lach 911 |
| Oeno bien 912 | Onon repe 914 | Ophr apif 918 | Orob nino 928 | Pedi palu 946 |
| Phle aren 958 | Phra aust 961 | Plan coro 972 | Plan lanc 973 | Plan mari 975 |
| Poa prat 988 | Poa triv 990 | Poly oxys 1010 | Poly vulg 995 | Popu trem 1022 |
| Pote anse 1043 | Prun vulg 1059 | Pter aqui 1066 | Puli dyse 1069 | Pyro rotu 1073 |
| Ranu acri 1081 | Ranu flam 1089 | Ranu repe 1095 | Rhin nino 1106 | Rubu frut 1136 |
| Rume acet 1139 | Rume cris 1143 | Rume ella 1140 | Rume mari 1146 | Sagi proc 1158 |
| Sali repe 1179 | Sals kali 1184 | Samb nigr 1187 | Samo vale 1189 | Scir mari 1213 |
| Scir seta 1214 | Sedu acre 1225 | Sene jaco 1239 | Sene vulg 1243 | Sile coni 3235 |
| Sile vulg 1259 | Sola dulc 1268 | Soli virg 1270 | Sonc arve 1271 | Sonc aspe 1272 |
| Stel medi 1298 | Tara offi 2982 | Tees nudi 1320 | Teuc scor 1321 | Thym prae 1333 |
| Trif camp 1342 | Trif dubi 1343 | Trif prat 1349 | Trif repe 1350 | Trig mari 1353 |
| Trig palu 1354 | Ulex euro 1363 | Vero cham 1396 | Vero offi 1401 | Vici sati 2707 |
| Viol cani 1422 | Viol rivi 1429 | Viol tric 1432 | Vulp fasc 1434 | |
| Brac albi 1510 | Brac ruta 1519 | Bryu alpo 1545 | Bryum sp. 2807 | Call cusp 1445 |
| Camp stel 1571 | Cera purp 1586 | Clad arbu 2340 | Clad furc 2362 | Clad rang 2381 |
| Clim dend 1593 | Corn acut 2410 | Dicr scop 1638 | Eury prae 1677 | Hosa jute 1562 |
| Hypn cupr 1766 | Hypo phys 2416 | Loph bide 2167 | Pelt cani 2486 | Plag undu 1807 |
| Poly pili 1897 | Pseu puru 1914 | Rhyt squa 1940 | Rhyt trig 1941 | Tort rura 2023 |

# ANNEX 3

## VEGETATION TYPES

This section contains a description of each vegetation type (NVC and non-NVC) found in this survey of South Wales dunes. Some types may not be present in this site - see Annex 4 and the vegetation map(s) for details of community presence. The account includes variants of NVC dune communities which do not correspond with NVC sub-community types. Particular features of sites are given in some descriptions.

The account is partly based on the relevant chapters of the NVC written by John Rodwell. The codes mainly relate to the different NVC chapters as follows:

SD Shingle, strandline and sand-dune communities

S Swamps and tall-herb fens

SM Saltmarsh communities

W Woodland and scrubs

H Heaths

X Non-NVC or transition types identified in this survey.

One other chapter, mesotrophic grasslands (MG), was not consulted and cases were only mapped in terms of principal dominant (*Arrhenatherum elatius* or *Lolium perenne*).

Most emphasis is placed on SD communities and other vegetation descriptions are abbreviated, reflecting less-intensive quadrat sampling.

## 1 X1 Dry foredune/saltmarsh/strandline transition community

Strandline vegetation is normally found at the extreme high water mark where washed-up debris becomes buried by blown sand. The normal strandline community within the NVC (SD2 *Honkenya peploides - Cakile maritima* strandline) was not found in this survey.

Instead, on exposed shores, the strandline is rapidly buried and a foredune environment persists (see 2 SD4 *Elymus farctus* foredune community). In sheltered environments, to leeward of cuspate spits, there is this distinct species-rich strandline transition. The species combination involves a mix of foredune (*Elymus farctus*), saltmarsh (*Festuca rubra, Agrostis stolonifera, Limonium binervosum*) and strandline (*Honkenya peploides, Atriplex prostrata*) indicators. *Cakile maritima* is rare in this environment. Unlike SD2 it is dominated by perennials and it is probably more persistent and less variable than the usual strandline community.

It grades upwards in wet areas to young salt-influenced slacks (see 12(a) SD14c *Salix repens - Campylium stellatum* dune slack, *Bryum pseudotriquetrum - Aneura pinguis* sub-community) and to a variety of dune grassland types in dry zonations. Downslope it usually grades into SM24 *Elymus pycnanthus* saltmarsh.

As a community type it perhaps deserves recognition in any revised NVC classification of strandline environments. In this survey it was repeatedly found in suitable locations at Crymlyn Burrows, Tywyn (Pembrey Coast) and Pembrey Burrows.

## 2 SD4 *Elymus farctus* foredune community

*Elymus farctus* normally dominates this community which is species-poor. Strandline species (notably *Salsola kali, Atriplex prostrata, Cakile maritima* and *Honkenya peploides*) are also frequent and suggest that in many localities these low dunes are ephemeral summer features forming on the drift line, usually extending by movement a short distance upslope. They are probably destroyed in autumn and winter storms.

In more sheltered locations, particularly at Crymlyn and Pembrey Burrows, the community is persistent and forms the initial phase of sand colonisation which then leads on to a rapid classic psammosere via SD6 *Ammophila arenaria* dune. At Pembrey Burrows there has been a recent increase in sand supply (probably from dune erosion in the centre of the Pembrey Coast system) and there has been a very large increase in this community since aerial photography in 1986. The foredunes even extend well downslope into saltmarsh and can include *Puccinellia maritima* and other saline indicators in the species list, though these are rare.

## 3 SD6a *Ammophila arenaria* mobile dune community *Elymus farctus* sub-community

This type of mobile dune community normally occurs closest to the sea. It is very open (70% bare sand) and usually has only *Ammophila arenaria* and *Elymus farctus* as dominants. Two variants (3v1, 3v2) were recognised after analysis. These show gradation within the the sub-community which itself grades downbeach into SD4 and, upwards, into SD6d *Ammophila arenaria* mobile dune, Typical sub-community.

**3v1 variant** This is usually located above the position of the strandline and often contains *Eryngium maritimum* and *Euphorbia paralias*.

**3v2 variant** This is usually located on the position of the strandline and often contains strand indicators (*Salsola kali, Cakile maritima, Rumex crispus* and *Beta vulgaris maritima*). It is more species-rich than 3v1.

## 4 SD6d *Ammophila arenaria* mobile dune community Typical sub-community

This community has a high cover of *Ammophila arenaria* (Marram) and occurs in areas that have a very high rate of sand deposition, in part the effect of the grass itself in modifying windflow to induce sand burial through which it then grows, often in profusion. Areas recently planted with Marram look very similar to this natural community.

In many British systems the community is very species-poor but in this survey there are reasonable numbers of additional species in most samples. Only one monodominant sample (quadrat 270 at Tywyn) was recorded. This enhanced diversity suggests that sand accumulation rates in the South Wales area are lower than normal, allowing invasion by annuals and suitable perennials.

## 5 SD6e *Ammophila arenaria* mobile dune community *Festuca rubra* sub-community

*Festuca rubra* normally forms an open understorey beneath Marram in this sub-community. Sand accumulation is low but still significant, producing vegetation which is still species-poor.

As a mapping unit this community is not very extensive and is best developed on dunes with heavy recreational impact, as at Crymlyn, Black Pill, Port-Eynon and Hillend/Broughton. Trampling, sand burial and litter may make this type more nitrogen-rich than usual, allowing enhanced species diversity compared to the NVC description.

Floristic composition suggests that this vegetation is part of a gradation from SD6a and SD6d to SD7c *Ammophila arenaria - Festuca rubra* semi-fixed dune community (*Ononis repens* sub-community). Shrubs can invade (notably *Rubus caesius*) and, at Black Pill, *Populus tremula*.

## 10 SD12 *Carex arenaria - Festuca ovina - Agrostis capillaris* grassland
No clear NVC sub-community

This grassland is typical of grazed acidic sands in Britain and in systems which are initially calcareous it is found on older dunes where leaching has been effective. The rear of most South Wales dune systems, where such swards are likely, has been highly altered in most cases (often to provide golf courses). Reasonable examples of the community type can be found in the fringes of rough around fairways, notably at Crymlyn and Pennard Burrows (the latter system is also grazed by ponies). Further pony grazing by ponies at Penmaen probably also helps maintain the community. Elsewhere the dune systems are either too young or lack of grazing has allowed SD9 rank near-mesotrophic grassland to develop.

There is no very close agreement with NVC sub-communities but two local variants can be recognised.

**10v1 variant** This resembles in part the SD12a *Anthoxanthum odoratum* sub-community but lacks Marram and shows early bracken invasion. There is also floristic evidence of sufficient leaching to allow heath indicators (e.g. *Calluna vulgaris*) into the sward.

**10v2 variant** This is bracken-invaded and much more species-poor as a result of shading and litter accumulation. It is restricted to leached acidic sands on the cliff tops at Penmaen and Pennard. As in 9v1 there is strong floristic evidence of a trend towards heath vegetation.

## 11 H11 *Calluna vulgaris - Carex arenaria* heath

Some good examples of heath developed on sand were found but in general these were rare. Communities with *Calluna vulgaris* dominant (and, less commonly, *Erica cinerea* and *Vaccinium myrtillus*) are restricted to leached sands banked against the old seacliff at the rear of Crymlyn Burrows, and to the thinner sands deposited on top of cliffs at Penmaen and Pennard. At Crymlyn the community grades into normal H10 *Calluna vulgaris - Erica cinerea* heath on the top of the cliff as the sand rapidly thins.

## SLACK COMMUNITIES

Low-lying areas under the influence of the dune water table (slacks) are usually markedly different from dry dune grasslands. A major revision in NVC slack types took place after field mapping (though description of the new types was not provided). Computer analysis of quadrat data found end groups which did not closely fit old or new NVC classifications (see Annex 1 - Problems). The five quadrat groupings (12a, 12b, 13, 14, 15) are therefore presented as a series with what are probably their closest types in the revised NVC system of November 1989. The fit is far from perfect and all slack classification must be considered approximate.

**12a SD14c** *Salix repens - Campylium stellatum* dune slack
*Bryum pseudotriquetrum - Aneura pinguis* sub-community

This community probably represents young slacks formed by the enclosure of depressions by spit extension (as at Tywyn) or in deflation hollows left after the passage of a parabolic dune blowout (north Whiteford). There is a slight saline influence at Tywyn shown by the low frequency of *Glaux maritima*. The community has patches of bare ground and *Salix repens* often shows a pattern of small circular and coalescing colonies, a feature of early succession. The community is very rich in species.

**12b SD15a/b** *Salix repens - Calliergon cuspidatum* dune slack
*Carex nigra* sub-community (a)
*Equisetum variegatum* sub-community (b)

There is abundant *Salix repens* over a carpet of *Hydrocotyle vulgaris* and the moss *Calliergon cuspidatum*. *Equisetum hyemale* is very common in this turf and orchids (commonly *Epipactis palustris* and *Dactylorhiza majalis*) are abundant. There is still a saline element in some slacks, shown by *Juncus maritimus, J. acutus* and *Oenanthe lachenalii*.

**13 SD15c** *Salix repens - Calliergon cuspidatum* dune slack
*Carex flacca - Pulicaria dysenterica* sub-community

This slack community is one of the most distinctive due to the prominence of tall herbs, with much *Juncus maritimus, Pulicaria dysenterica, Eupatorium cannabinum, Filipendula ulmaria, Lotus uliginosus* and *Lychnis flos-cuculi*. It often features the start of slack woodland by *Salix cinerea* and *Alnus glutinosa* at Tywyn. At Whiteford it is very extensive on the eastern side, grading into saltmarsh. It seems to prefer steeper slack gradients and may reflect lateral subsurface water flow.

**14 SD16a/b** *Salix repens - Holcus lanatus* dune slack
*Ononis repens* sub-community (a)
*Rubus caesius* sub-community (b)

**14 SD16c/d** *Salix repens - Holcus lanatus* dune slack
*Prunella vulgaris - Equisetum variegatum* sub-community (c)
*Agrostis stolonifera* sub-community (d)

A heterogeneous set of slack and slack transition habitats is represented in this group. The topographic differences within the quadrat set are not clearly distinguished by species composition which overall suggest relatively dry slack conditions. Three main types of topography are involved:

a. drier slack margins receiving sand input from adjacent dunes (common at Whiteford in western slacks).

b. clustered large hummocks ('hedgehogs') up to 2m high and 4-5m in diameter, usually with a strong cover of *Salix repens*. These are believed to be due to dune building controlled by upward growth by *Salix* in areas suffering sand burial in the past. These are present at Pembrey Burrows and Whiteford.

c. a transition involving damp grassland at Tywyn which runs for much of the length of the dune system along its eastern side.

**15 SD17** *Potentilla anserina - Carex nigra* dune slack
No clear NVC sub-community

This slack type is the least common in samples and in Britain is believed to be older and less calcareous than others. *Carex nigra* is usually a prominent feature but only *Mentha aquatica* is consistently present. Other species offer few clues to more precise habitat or successional relationships.

## SALTMARSH

16 SM18b *Juncus maritimus* saltmarsh
*Oenanthe lachenalii* sub-community

This is common at Crymlyn, Oxwich (unsampled), Whiteford and Tywyn. It represents the highest saltmarsh community in areas which are also flushed by fresh and brackish water draining from dune slacks. It grades upwards into 13-SD15c dune slack, especially at Whiteford.

17 SM24 *Elymus pycnanthus* saltmarsh

This was noted (but not accurately mapped in terms of full extent) at Crymlyn, Pennard (very restricted), Oxwich-Nicholaston (not recorded), Whiteford, Pembrey and Tywyn. It represents the highest saltmarsh community in areas which are reasonably dry and uninfluenced by slack water. It also contains strandline indicators.

## SWAMP COMMUNITIES

18 S4a *Phragmites australis* swamp and reed-beds
*Phragmites australis* sub-community

This tall reed-bed community is present in restricted quantity at Crymlyn Burrows and is abundant at Oxwich. Grazing by ponies at Whiteford has probably excluded it as a component of the wet eastern transition from slack to wet saltmarsh.

19 S4d *Phragmites australis* swamp and reed-beds
*Atriplex hastata* sub-community

19 S21b *Scirpus maritimus* swamp
*Atriplex hastata* sub-community

The sheltered strandline at Pembrey Burrows above saltmarsh is the only mapped location for a *Phragmites australis - Scirpus maritimus* mosaic (hence the presence of *Atriplex prostratus* and *Elymus pycnanthus*). Discharges from an adjacent sewage outfall pipe probably helps explain the thick growth in this area and the absence of these types from equivalent positions in other parts of the Pembrey Burrows marsh.

20 S12b *Typha latifolia* swamp
*Mentha aquatica* sub-community

This is rather restricted. At Whiteford it is found in a concentrated zone of flushing below a large slack on the transition to saltmarsh. At Tywyn it is found in two man-made slacks adjacent to targets, the sand having been excavated to provide a raised surface for the target zone. A reasonable aquatic flora (including *Chara* sp.) is developing in these excavated hollows.

## SCRUB AND WOODLAND COMMUNITIES

21 SD18a *Hippophae rhamnoides* scrub
*Festuca rubra* sub-community

This sub-community did not appear as an end-group in computer analysis and was obtained by selecting all quadrats containing *Hippophae rhamnoides* and then rejecting those belonging to the 22-SD18b set. This vegetation type represents the early stage of dune scrub invasion, most cases coming from the Pembrey Coast where this process is very frequent. Associated species suggest that 4-SD6d, 5-SD6e and 7-SD7d are the initial invaded communities. This is clear in Pembrey Coast vegetation maps.

22 SD18b *Hippophae rhamnoides* scrub
*Urtica dioica - Arrhenatherum elatius* sub-community

In this community *Hippophae rhamnoides* is the major dominant. Shading and excreta from birds feeding on berries helps produce a flora characteristic of soils enriched with nitrogen and phosphorus (e.g. *Urtica dioica, Galium aparine*). *Sambucus nigra* is occasional and suggests shrub diversification is taking place in larger and older stands. The sub-community is not fully typical of the NVC because *Arrhenatherum elatius* is rare.

23 W1 *Salix cinerea - Galium palustre* woodland

This community is dominated by *Betula pubescens*, with reasonable quantities of *Salix cinerea* in places. *Galium palustre* and *Iris pseudacorus* are consistently present. All small thickets of *Salix cinerea* were mapped as this category and a reasonable number of quadrats were recorded for this type. However, only seven quadrats formed this clear end-group. A larger number was scattered in various slack end-groups (especially 13), suggesting that such willow scrub is recent and that it has not developed a very distinct flora. Some stands of *Salix cinerea* showed signs of sand burial, notably at Llangennith and Whiteford.

24 W10c *Quercus robur - Pteridium aquilinum - Rubus fruticosus* agg. woodland
*Hedera helix* sub-community

This community is dominated by *Quercus robur* and has a scattered tall-shrub understorey of *Crataegus monogyna* over a floor often dominated by *Rubus fruticosus* agg. Shading is effective and there is little *Pteridium aquilinum*. This category was not an end-group in analysis and was obtained by selection of high-cover *Quercus robur* stands. Only five such stands were found, scattered in end-groups representing well-developed scrub.

25 W21a *Crataegus monogyna - Hedera helix* scrub
*Hedera helix - Urtica dioica* sub-community

This is the commonest form of non-*Hippophae* scrub quadrat recorded in survey and shows active succession. The tall shrub or tree component rarely forms a continuous canopy and thick *Rubus fruticosus* agg. is the most consistent woody species present. A mix of trees and tall shrubs is present in the group in addition to *Crataegus*: *Quercus robur, Prunus spinosa, Acer pseudoplatanus, Fraxinus excelsior, Corylus avellana, Pinus nigra*. It seems a clear precursor to a variety of woodland types.

26 W22 *Prunus spinosa* - *Rubus fruticosus* agg. scrub
No clear NVC sub-community

A small number of samples was dominated by *Prunus spinosa* but these quadrats were scattered amongst scrub end-groups (especially 25-W21a) and were found by selection. One stand on the Pembrey Coast contained dead *Hippophae rhamnoides* beneath the closed *Prunus* canopy and this provides some evidence of active succession towards non-dune scrub and woodland types. No clear NVC sub-community can be distinguished within the small quadrat total (9) separated by selection.

27 W23 *Ulex europaeus* - *Rubus fruticosus* agg. scrub
No clear NVC sub-community

*Ulex europaeus* is a fairly common scrub type at the rear of the Crymlyn and Pembrey Burrows dune systems, and upon steep cliff slopes at Nicholaston, Penmaen and Pennard. It usually contains sizeable quantities of *Rubus fruticosus* agg. and sometimes *Pteridium aquilinum* or *Arrhenatherum elatius*. In some locations it seems to have developed from a lower scrub cover of *Rosa pimpinellifolia*. Several stands in cliffed sites showed regeneration after burning, especially at Pennard. This vegetation type did not form an end-group in analysis and had to be selected from other scrub-dominated end-groups.

28 W24 *Rubus fruticosus* agg. - *Holcus lanatus* underscrub
No clear NVC sub-community

*Rubus fruticosus* agg. is very widespread in a variety of dune, scrub and woodland communities. In analysis it forms one heterogeneous end-group which has other shrub species patchily present (*Rosa pimpinellifolia, Ulex europaeus, Crataegus monogyna*). At Black Pill the community contains much *Populus tremula* and is dominant at the rear of the dune system.

29 W25 *Pteridium aquilinum* - *Rubus fruticosus* agg. underscrub
No clear NVC sub-community

Bracken-invasion of dune and cliff vegetation is widespread in South Wales and *Pteridium aquilinum* is usually accompanied by a large cover of *Rubus fruticosus* agg.. A shaded community results which has woodland elements (e.g. *Geranium robertianum, Glechoma hederacea, Silene dioica*). Other shrub species are few (*Ulex europaeus* is rare) and *Acer pseudoplatanus* is the only (infrequent) tree to be recorded. Seral progression beyond this community stage may not therefore be very active.

30 X2 *Alnus glutinosa* slack woodland

This community represents the commonest woodland type found in damp habitats. It probably represents the most mature community development in slack conditions. *Alnus glutinosa* is the usual dominant but *Salix cinerea* is also present in large quantity. It probably develops from type 23-W1 woodland. There is no close affinity with other NVC alder woodland types.

*Iris pseudacorus, Galium palustre* and *Rubus fruticosus* agg. are frequent beneath the canopy, with a scatter of shade-tolerant herbs (notably *Oenanthe crocata, Berula erecta, Lycopus europaeus* and *Carex remota*).

In several locations the community is developed adjacent to saltmarsh (at Crymlyn, Oxwich and Whiteford). Young alder thickets are particularly common at Tywyn where rapid scrub succession is taking place. Old inland examples are found as scattered remnants within Pembrey Forest.

31 X3 *Pinus nigra/sylvestris* woodland

Pembrey Forest and Pembrey Country Park are dominated by very large expanses of *Pinus nigra* plantation, some dating back to the 1930's. Old and thinned stands support a reasonable woodland groundflora with some shrub development (a scatter of *Crataegus monogyna, Prunus spinosa* or *Ligustrum vulgare*, occasionally *Hippophae rhamnoides* in well-thinned places). Several small stands are also present at Whiteford where there is some regeneration from seed. In addition there has been removal and thinning at Whiteford designed to improve shaded dune communities beneath.

This category did not form a clear end-group in analysis and had to be selected. Of seventeen samples, twelve are represented here and the remaining five are shaded slacks which were classified correctly and were thus retained in slack classes. Shading effects were, however, very clear in each case.

32 X4 *Acer pseudoplatanus* woodland

Sycamore woodland did not form a classification end-group but five quadrats could be selected. The vegetation type is found at Whiteford on sand blown on to a hillslope at the south of the survey area, and it is present in small quantity at the Pembrey Coast. Young stands are developing between Port-Eynon and Horton. The community is rather species-poor and lacks much ecological interest.

# ANNEX 4

## QUADRAT MEMBERSHIP OF VEGETATION TYPES

Quadrat membership of vegetation types at this site is listed below. Some quadrats appear in more than one vegetation type. These are transitional samples identified in classification and placed in more than one end group of the three main TWINSPAN hierarchies.

Only mapping unit numbers (plus variant type) are listed against quadrats. For full NVC nomenclature consult Annex 3 and the vegetation legend in the rear map pocket.

The floristic characteristics of each vegetation type are given in Annex 5. Descriptions of each vegetation type, plus notable characteristics of this site, are given in Annex 3.

| Q | VT | Q | VT | Q | VT | Q | VT |
|---|---|---|---|---|---|---|---|
| 391 | 3v2 | 392 | 4 | 393 | 6v1 | 394 | 6v1 |
| 395 | 9v1 | 396 | 8v1 | 397 | 8v5 | 398 | 8v4 |
| 399 | 8v5 | 400 | 9v1 | 401 | 8v4 | 402 | 8v4 |
| 403 | 29 32 | 404 | 29 32 | 405 | 29 | 406 | 8v4 9v1 |
| 407 | 29 | 408 | 29 | 409 | 9v1 | 410 | 13 15 |
| 411 | 25 31 | 412 | 25 31 | 413 | 25 31 | 414 | 25 31 |
| 415 | 25 31 | 416 | 31 | 417 | 25 31 | 418 | 25 26 |
| 419 | 25 26 | 420 | 31 | 421 | 9v1 14 | 422 | 14 |
| 423 | 8v1 | 424 | 7 | 425 | 3v1 4 | 426 | 6v3 |
| 427 | 7 | 428 | 10v1 | 429 | 14 | 430 | 12(a) |
| 431 | 12(a) | 432 | 13 15 | 433 | 13 15 | 434 | 15 16 |
| 435 | 16 | 436 | 14 | 437 | 7 | 438 | 10v1 |
| 439 | 6v3 | 440 | 14 | 441 | 7 | 442 | 14 |
| 443 | 14 | 444 | 14 | 445 | 14 | 446 | 10v1 |
| 447 | 13 15 23 | 448 | 13 15 | 449 | 13 15 | 450 | 12(b) |
| 451 | 13 15 | 452 | 16 | 453 | 16 | 454 | 14 |
| 455 | 12(a) | 456 | 12(a) | 457 | 4 7 | 458 | 4 5 |
| 459 | 7 | 460 | 3v2 | 461 | 3v1 | 462 | 3v1 |
| 463 | 2 | 464 | 1 | 465 | 16 | 466 | 17 |
| 467 | 30 | 468 | 15 16 | | | | |

# ANNEX 5

## FLORISTIC DETAILS OF VEGETATION TYPES

The following pages include the vegetation types present in the site(s). Community structure data on height and cover are provided, plus information on bare ground, pH and mean species diversity. Species are listed in order of decreasing frequency:

| | | |
|---|---|---|
| V | = | >80% |
| IV | = | >60% - 80% |
| III | = | >40% - 60% |
| II | = | >20% - 40% |

Very infrequent species are excluded to restrict table length. Domin values are the most common (i.e. they are modal scores).

MAP UNIT: 1 | VEGETATION UNIT: X1 | Dry foredune/saltmarsh/strandline transition community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 20 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 40 |
| Cryptogam cover (%) | - |
| Bare surface (%) | 60 |
| pH | 8.3 |
| Mean species per quadrat | 9.7 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Elymus farctus* | V | 4 |
| *Festuca rubra* | V | 5 |
| *Agrostis stolonifera* | IV | 5 |
| *Honkenya peploides* | III | 5 |
| *Limonium binervosum* | III | 4 |
| *Plantago maritima* | III | 3 |
| *Ammophila arenaria* | III | 2 |
| *Eryngium maritimum* | III | 1 |
| *Halimione portulacoides* | III | 4 |
| *Plantago coronopus* | III | 3 |
| *Atriplex prostrata* | II | 1 |
| *Sagina procumbens* | II | 2 |
| *Beta vulgaris maritima* | II | 2 |
| *Desmazeria marina* | II | 3 |
| *Parapholis strigosa* | II | 3 |
| *Carex arenaria* | II | 3 |
| *Salsola kali* | II | 1 |

MAP UNIT: 2 | VEGETATION UNIT: SD4 | *Elymus farctus* foredune community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 25 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 20 |
| Cryptogam cover (%) | - |
| Bare surface (%) | 80 |
| pH | 8.1-8.5 |
| Mean species per quadrat | 5.2 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Elymus farctus* | V | 5 |
| *Salsola kali* | III | 4 |
| *Atriplex prostrata* | III | 4 |
| *Cakile maritima* | II | 1 |
| *Honkenya peploides* | II | 3 |
| *Beta vulgaris maritima* | II | 3 |

MAP UNIT: 3 | VEGETATION UNIT: SD6a | *Ammophila arenaria* mobile dune community *Elymus farctus* sub-community Variant 2

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 30 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 30 |
| Cryptogam cover (%) | - |
| Bare surface (%) | 70 |
| pH | 7.9-8.1 |
| Mean species per quadrat | 6.0 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Ammophila arenaria* | V | 3 |
| *Elymus farctus* | V | 4 |
| *Salsola kali* | V | 3 |
| *Cakile maritima* | IV | 2 |
| *Eryngium maritimum* | II | 1 |
| *Euphorbia paralias* | II | 1 |
| *Rumex crispus* | II | 1 |
| *Beta vulgaris maritima* | II | 3 |

MAP UNIT: 3 | VEGETATION UNIT: SD6a | *Ammophila arenaria* mobile dune community *Elymus farctus* sub-community Variant 1

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 50 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 30 |
| Cryptogam cover (%) | - |
| Bare surface (%) | 70 |
| pH | 7.9-8.2 |
| Mean species per quadrat | 4.6 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Elymus farctus* | V | 5 |
| *Ammophila arenaria* | V | 4 |
| *Eryngium maritimum* | III | 2 |
| *Euphorbia paralias* | III | 4 |
| *Oenothera erythrosepala* | II | 1 |
| *Senecio jacobaea* | II | 2 |

MAP UNIT | VEGETATION UNIT

6 SD6d *Ammophila arenaria* mobile dune community
Typical sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 70 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 50 |
| Cryptogam cover (%) | - |
| Bare surface (%) | 50 |
| pH | 7.8-8.2 |
| Mean species per quadrat | 7.1 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Ammophila arenaria* | V | 7 |
| *Senecio jacobaea* | III | 3 |
| *Hypochaeris radicata* | III | 3 |
| *Eryngium maritimum* | III | 3 |
| *Sonchus asper* | III | 2 |
| *Euphorbia paralias* | II | 3 |
| *Elymus farctus* | II | 3 |
| *Cerastium diffusum diffusum* | II | 3 |
| *Oenothera erythrosepala* | II | 2 |
| *Arenaria serpyllifolia* | II | 3 |
| *Rubus caesius* | II | 3 |

MAP UNIT | VEGETATION UNIT

5 SD6e *Ammophila arenaria* mobile dune community
*Festuca rubra* sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 50 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 70 |
| Cryptogam cover (%) | - |
| Bare surface (%) | 30 |
| pH | 7.8 |
| Mean species per quadrat | 9.4 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Ammophila arenaria* | V | 6 |
| *Festuca rubra* | IV | 7 |
| *Hypochaeris radicata* | IV | 2 |
| *Elymus farctus* | III | 3 |
| *Carex arenaria* | III | 3 |
| *Calystegia soldanella* | II | 3 |
| *Ononis repens* | II | 2 |
| *Rubus caesius* | II | 3 |
| *Senecio jacobaea* | II | 2 |
| *Taraxacum* sp. | II | 2 |
| *Euphorbia paralias* | II | 2 |

MAP UNIT | VEGETATION UNIT

6 SD7c *Ammophila arenaria - Festuca rubra* semi-fixed dune community
*Ononis repens* sub-community
Variant 1

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 50 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 70 |
| Cryptogam cover (%) | 20 |
| Bare surface (%) | 10 |
| pH | 7.6-8.1 |
| Mean species per quadrat | 13.8 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Ammophila arenaria* | V | 5 |
| *Festuca rubra* | V | 6 |
| *Hypochaeris radicata* | IV | 3 |
| *Leontodon hispidus* | III | 3 |
| *Ononis repens* | III | 4 |
| *Eryngium maritimum* | III | 2 |
| *Carex arenaria* | III | 3 |
| *Oenothera erythrosepala* | III | 3 |
| *Rubus caesius* | III | 3 |
| *Anthyllis vulneraria* | II | 4 |
| *Cerastium diffusum diffusum* | II | 2 |
| *Senecio jacobaea* | II | 3 |
| *Eurynchium praelongum* | II | 4 |
| *Phleum arenarium* | II | 2 |
| *Brachythecium rutabulum* | II | 3 |
| *Sedum acre* | II | 3 |
| *Barbula vinealis* | II | 4 |
| *Arenaria serpyllifolia* | II | 2 |
| *Poa pratensis* | II | 3 |
| *Brachythecium albicans* | II | 4 |
| *Taraxacum* sp. | II | 3 |
| *Rhynchosinapis cheiranthos* | II | 2 |

MAP UNIT | VEGETATION UNIT

6 SD7c *Ammophila arenaria - Festuca rubra* semi-fixed dune community
*Ononis repens* sub-community
Variant 3

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.6 |
| Herb height (cm) | 40 |
| Tree cover (%) | - |
| Shrub cover (%) | 10 |
| Herb cover (%) | 90 |
| Cryptogam cover (%) | 20 |
| Bare surface (%) | 5 |
| pH | 6.8-8.1 |
| Mean species per quadrat | 14.0 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Festuca rubra* | V | 7 |
| *Ammophila arenaria* | V | 5 |
| *Carex arenaria* | IV | 4 |
| *Poa pratensis* | IV | 3 |
| *Holcus lanatus* | IV | 3 |
| *Ononis repens* | IV | 5 |
| *Eurynchium praelongum* | III | 5 |
| *Plantago lanceolata* | III | 3 |
| *Senecio jacobaea* | III | 2 |
| *Lotus corniculatus* | II | 3 |
| *Anthyllis vulneraria* | II | 3 |
| *Arrhenatherum elatius* | II | 4 |
| *Dactylis glomerata* | II | 3 |
| *Galium verum* | II | 4 |
| *Hypochoeris radicata* | II | 2 |
| *Rubus caesius* | II | 5 |
| *Rubus fruticosus* agg. | II | 5 |
| *Polypodium vulgare* | II | 3 |
| *Taraxacum* sp. | II | 2 |
| *Oenothera erythrosepala* | II | 2 |
| *Hieracium pilosella* agg. | II | 3 |

MAP UNIT | VEGETATION UNIT

7 SD7d *Ammophila arenaria - Festuca rubra* semi-fixed dune community
*Tortula ruralis* ssp. *ruraliformis* sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.3 |
| Herb height (cm) | 20 |
| Tree cover (%) | - |
| Shrub cover (%) | 5 |
| Herb cover (%) | 40 |
| Cryptogam cover (%) | 30 |
| Bare surface (%) | 30 |
| pH | 7.3-8.1 |
| Mean species per quadrat | 16.2 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Phleum arenarium* | V | 3 |
| *Ammophila arenaria* | IV | 5 |
| *Arenaria serpyllifolia* | IV | 3 |
| *Cerastium diffusum diffusum* | IV | 3 |
| *Hypochoeris radicata* | IV | 3 |
| *Carex arenaria* | IV | 3 |
| *Oenothera erythrosepala* | IV | 3 |
| *Tortula ruralis* ssp. *ruraliformis* | III | 5 |
| *Leontodon hispidus* | III | 3 |
| *Vulpia fasciculata* | III | 4 |
| *Senecio jacobaea* | III | 2 |
| *Sedum acre* | III | 3 |
| *Ononis repens* | III | 4 |
| *Festuca rubra* | II | 6 |
| *Cerastodon purpureus* | II | 5 |
| *Holcus lanatus* | II | 4 |
| *Rubus caesius* | II | 6 |
| *Aira praecox* | II | 3 |

MAP UNIT | VEGETATION UNIT

8 SD8 *Festuca rubra - Galium verum* fixed dune community
No clear NVC sub-community
Variant 1

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.3 |
| Herb height (cm) | 20 |
| Tree cover (%) | - |
| Shrub cover (%) | 10 |
| Herb cover (%) | 90 |
| Cryptogam cover (%) | 40 |
| Bare surface (%) | 5 |
| pH | 6.8-7.6 |
| Mean species per quadrat | 19.0 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Ammophila arenaria* | V | 5 |
| *Festuca rubra* | V | 7 |
| *Hypochaeris radicata* | V | 3 |
| *Homalothecium lutescens* | V | 6 |
| *Ononis repens* | IV | 4 |
| *Anthyllis vulneraria* | IV | 5 |
| *Rubus caesius* | IV | 5 |
| *Carex arenaria* | III | 3 |
| *Galium verum* | III | 5 |
| *Hieracium pilosella agg.* | III | 4 |
| *Crepis capillaris* | III | 3 |
| *Leontodon hispidus* | III | 2 |
| *Luzula campestris* | III | 3 |
| *Sedum acre* | III | 2 |
| *Senecio jacobaea* | III | 2 |
| *Poa pratensis* | III | 3 |
| *Cladonia pocillum* | III | 3 |
| *Polypodium vulgare* | II | 4 |
| *Anacamptis pyramidalis* | II | 1 |
| *Centaurium erythraea* | II | 3 |
| *Cerastium fontanum triviale* | II | 2 |
| *Avenula pubescens* | II | 4 |
| *Oenothera erythrosepala* | II | 2 |
| *Phleum arenarium* | II | 2 |
| *Thymus praecox arcticus* | II | 4 |
| *Viola tricolor* | II | 2 |
| *Peltigera canina* | II | 3 |
| *Aira praecox* | II | 3 |
| *Hieracium vulgatum agg.* | II | 1 |
| *Lotus corniculatus* | II | 4 |
| *Plantago lanceolata* | II | 3 |
| *Polygala vulgaris* | II | 2 |
| *Rhinanthus minor* | II | 3 |
| *Sonchus oleraceus* | II | 1 |
| *Brachythecium albicans* | II | 6 |

MAP UNIT | VEGETATION UNIT

8 SD8 *Festuca rubra - Galium verum* fixed dune community
No clear NVC sub-community
Variant 4

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.4 |
| Herb height (cm) | 30 |
| Tree cover (%) | - |
| Shrub cover (%) | 20 |
| Herb cover (%) | 90 |
| Cryptogam cover (%) | 20 |
| Bare surface (%) | 1 |
| pH | 7.0-7.4 |
| Mean species per quadrat | 15.0 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Festuca rubra* | V | 7 |
| *Galium verum* | IV | 4 |
| *Plantago lanceolata* | IV | 4 |
| *Poa pratensis* | IV | 3 |
| *Carex arenaria* | IV | 3 |
| *Dactylis glomerata* | III | 4 |
| *Rosa pimpinellifolia* | III | 5 |
| *Anthoxanthum odoratum* | III | 4 |
| *Agrostis capillaris* | III | 4 |
| *Sanguisorba minor* | III | 4 |
| *Holcus lanatus* | II | 4 |
| *Rubus caesius* | II | 5 |
| *Avenula pubescens* | II | 4 |
| *Ononis repens* | II | 3 |
| *Pteridium aquilinum* | II | 5 |
| *Thymus praecox arcticus* | II | 4 |
| *Veronica chamaedrys* | II | 3 |
| *Achillea millefolium* | II | 4 |
| *Lotus corniculatus* | II | 4 |
| *Pseudoscleropodium purum* | II | 5 |
| *Geranium sanguineum* | II | 5 |

MAP UNIT | VEGETATION UNIT

8 SD8 *Festuca rubra - Galium verum* fixed dune community
No clear NVC sub-community
Variant 5

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.6 |
| Herb height (cm) | 60 |
| Tree cover (%) | - |
| Shrub cover (%) | 40 |
| Herb cover (%) | 90 |
| Cryptogam cover (%) | 10 |
| Bare surface (%) | 1 |
| pH | 6.9 |
| Mean species per quadrat | 10.2 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Pteridium aquilinum* | IV | 6 |
| *Carex arenaria* | IV | 3 |
| *Geranium sanguineum* | IV | 6 |
| *Rubus caesius* | IV | 6 |
| *Ammophila arenaria* | IV | 5 |
| *Festuca rubra* | IV | 5 |
| *Rosa pimpinellifolia* | III | 6 |
| *Convolvulus arvensis* | II | 3 |
| *Galium verum* | II | 4 |
| *Holcus lanatus* | II | 4 |
| *Poa pratensis* | II | 3 |
| *Sanguisorba minor* | II | 3 |
| *Brachythecium rutabulum* | II | 5 |
| *Eurynchium praelongum* | II | 3 |
| *Dactylis glomerata* | II | 4 |

MAP UNIT | VEGETATION UNIT

9 SD9 *Ammophila arenaria - Arrhenatherum elatius* dune grassland
No clear NVC sub-community
Variant 1

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.4 |
| Herb height (cm) | 40 |
| Tree cover (%) | - |
| Shrub cover (%) | 20 |
| Herb cover (%) | 90 |
| Cryptogam cover (%) | 20 |
| Bare surface (%) | 1 |
| pH | 5.8-6.5 |
| Mean species per quadrat | 16.6 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Festuca rubra* | V | 6 |
| *Holcus lanatus* | V | 5 |
| *Carex arenaria* | IV | 3 |
| *Rubus caesius* | IV | 5 |
| *Arrhenatherum elatius* | III | 5 |
| *Dactylis glomerata* | III | 4 |
| *Ononis repens* | III | 3 |
| *Plantago lanceolata* | III | 3 |
| *Poa pratensis* | III | 3 |
| *Centaurea nigra* | III | 3 |
| *Galium verum* | III | 3 |
| *Heracleum sphondylium* | III | 3 |
| *Lophoclea bidentata* | III | 3 |
| *Oenothera erythrosepala* | II | 2 |
| *Senecio jacobaea* | II | 2 |
| *Eurynchium praelongum* | II | 5 |
| *Rumex acetosa* | II | 3 |
| *Salix repens agg.* | II | 8 |
| *Pseudoscleropodium purum* | II | 5 |
| *Vicia sativa* | II | 3 |
| *Anthyllis vulneraria* | II | 3 |
| *Equisetum arvense* | II | 3 |
| *Hieracium vulgatum agg.* | II | 3 |
| *Hypochoeris radicata* | II | 2 |

MAP UNIT | VEGETATION UNIT

10 SD12 *Carex arenaria - Festuca ovina - Agrostis capillaris* grassland
No clear NVC sub-community
Variant 1

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.4 |
| Herb height (cm) | 30 |
| Tree cover (%) | - |
| Shrub cover (%) | 20 |
| Herb cover (%) | 70 |
| Cryptogam cover (%) | 50 |
| Bare surface (%) | 1 |
| pH | 6.1-7.1 |
| Mean species per quadrat | 17.3 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Hypochoeris radicata* | V | 3 |
| *Carex arenaria* | IV | 3 |
| *Festuca ovina* | IV | 5 |
| *Agrostis capillaris* | IV | 5 |
| *Anthoxanthum odoratum* | IV | 5 |
| *Hypnum cupressiforme* | III | 6 |
| *Luzula campestris* | III | 3 |
| *Thymus praecox arcticus* | III | 4 |
| *Galium verum* | III | 4 |
| *Plantago lanceolata* | III | 4 |
| *Pteridium aquilinum* | III | 5 |
| *Dicranum scoparium* | III | 5 |
| *Cladonia impexa* | III | 3 |
| *Aira praecox* | III | 3 |
| *Hieracium pilosella agg.* | III | 3 |
| *Poa pratensis* | II | 3 |
| *Cladonia furcata* | II | 4 |
| *Festuca rubra* | II | 4 |
| *Ononis repens* | II | 4 |
| *Holcus lanatus* | II | 5 |
| *Pseudoscleropodium purum* | II | 5 |
| *Crepis capillaris* | II | 3 |
| *Leontodon hispidus* | II | 2 |
| *Lotus corniculatus* | II | 3 |
| *Senecio jacobaea* | II | 2 |
| *Calluna vulgaris* | II | 5 |
| *Rubus caesius* | II | 6 |
| *Teucrium scorodonia* | II | 3 |
| *Peltigera canina* | II | 4 |

MAP UNIT | VEGETATION UNIT

12 SD14c *Salix repens - Campylium stellatum* dune slack
*Bryum pseudotriquetrum - Aneura pinguis* sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.3 |
| Herb height (cm) | 20 |
| Tree cover (%) | - |
| Shrub cover (%) | 30 |
| Herb cover (%) | 80 |
| Cryptogam cover (%) | 30 |
| Bare surface (%) | 5 |
| pH | 7.7-8.2 |
| Mean species per quadrat | 24.6 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Carex flacca* | V | 4 |
| *Campyllium stellatum* | V | 4 |
| *Agrostis stolonifera* | V | 6 |
| *Ranunculus acris* | V | 4 |
| *Trifolium pratense* | V | 3 |
| *Aneura pinguis* | V | 3 |
| *Festuca rubra* | IV | 4 |
| *Prunella vulgaris* | IV | 4 |
| *Salix repens agg.* | IV | 5 |
| *Equisetum variegatum* | IV | 4 |
| *Holcus lanatus* | IV | 4 |
| *Bryum pseudotriquetrum* | IV | 3 |
| *Hydrocotyle vulgaris* | III | 2 |
| *Hypochoeris radicata* | III | 2 |
| *Juncus articulatus* | III | 3 |
| *Lotus corniculatus* | III | 4 |
| *Mentha aquatica* | III | 3 |
| *Potentilla anserina* | III | 3 |
| *Calliergon cuspidatum* | III | 6 |
| *Anagallis tenella* | III | 4 |
| *Cynosurus cristatus* | III | 4 |
| *Euphrasia officinalis agg.* | III | 4 |
| *Radiola linoides* | III | 3 |
| *Trifolium repens* | III | 3 |
| *Taraxacum sp.* | III | 3 |
| *Blackstonia perfoliata* | II | 3 |
| *Carex arenaria* | II | 3 |
| *Carex distans* | II | 3 |
| *Epipactis palustris* | II | 4 |
| *Glaux maritima* | II | 4 |
| *Lotus uliginosus* | II | 4 |
| *Pulicaria dysenterica* | II | 3 |
| *Ranunculus flammula* | II | 4 |
| *Dactylorhiza majalis* | II | 2 |

MAP UNIT | VEGETATION UNIT

12 SD15a/b *Salix repens - Calliergon cuspidat* dune slack
*Carex nigra* sub-community (a)
*Equisetum variegatum* sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.4 |
| Herb height (cm) | 40 |
| Tree cover (%) | - |
| Shrub cover (%) | 30 |
| Herb cover (%) | 40 |
| Cryptogam cover (%) | 70 |
| Bare surface (%) | - |
| pH | 7.6-7.9 |
| Mean species per quadrat | 16.8 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Hydrocotyle vulgaris* | V | 6 |
| *Salix repens agg.* | V | 6 |
| *Epipactis palustris* | IV | 4 |
| *Equisetum variegatum* | IV | 4 |
| *Calliergon cuspidatum* | IV | 8 |
| *Agrostis stolonifera* | III | 4 |
| *Carex nigra* | III | 5 |
| *Holcus lanatus* | III | 3 |
| *Juncus maritimus* | III | 5 |
| *Mentha aquatica* | III | 4 |
| *Potentilla anserina* | III | 4 |
| *Galium palustre* | III | 3 |
| *Iris pseudacorus* | III | 3 |
| *Oenanthe lachenalii* | III | 3 |
| *Ranunculus acris* | III | 3 |
| *Dactylorhiza majalis* | III | 2 |
| *Carex arenaria* | II | 3 |
| *Carex flacca* | II | 3 |
| *Pulicaria dysenterica* | II | 4 |
| *Ranunculus flammula* | II | 3 |
| *Salix cinerea* | II | 4 |
| *Carex otrubae* | II | 3 |
| *Festuca arundinacea* | II | 3 |
| *Juncus acutus* | II | 4 |
| *Poa pratensis* | II | 3 |
| *Rubus fruticosus agg.* | II | 4 |
| *Trifolium pratense* | II | 4 |

MAP UNIT | VEGETATION UNIT

13 SD15c *Salix repens - Calliergon cuspidatum* dune slack
*Carex flacca - Pulicaria dysenterica* sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.6 |
| Herb height (cm) | 80 |
| Tree cover (%) | - |
| Shrub cover (%) | 40 |
| Herb cover (%) | 80 |
| Cryptogam cover (%) | 30 |
| Bare surface (%) | - |
| pH | 7.6-8.3 |
| Mean species per quadrat | 15.6 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Pulicaria dysenterica* | IV | 6 |
| *Holcus lanatus* | IV | 4 |
| *Mentha aquatica* | IV | 4 |
| *Potentilla anserina* | III | 4 |
| *Juncus maritimus* | III | 5 |
| *Salix repens agg.* | III | 7 |
| *Rubus caesius* | III | 5 |
| *Equisetum arvense* | III | 3 |
| *Eupatorium cannabinus* | III | 5 |
| *Festuca rubra* | III | 5 |
| *Hydrocotyle vulgaris* | III | 5 |
| *Agrostis stolonifera* | II | 4 |
| *Carex nigra* | II | 4 |
| *Filipendula ulmaria* | II | 5 |
| *Calliergon cuspidatum* | II | 9 |
| *Lotus uliginosus* | II | 4 |
| *Carex flacca* | II | 3 |
| *Lychnis flos-cuculi* | II | 3 |
| *Angelica sylvestris* | II | 2 |
| *Cirsium palustre* | II | 3 |
| *Oenanthe lachenalii* | II | 2 |
| *Plantago lanceolata* | II | 4 |
| *Salix cinerea* | II | 4 |
| *Trifolium pratense* | II | 3 |

MAP UNIT | VEGETATION UNIT

16 SD16a/b *Salix repens - Holcus lanatus* dune slack
*Ononis repens* sub-community (a)
*Rubus caesius* sub-community (b)
*Prunella vulgaris - Equisetum variegatum* sub-community (c)
*Agrostis stolonifera* sub-community (d)

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0.4 |
| Herb height (cm) | 40 |
| Tree cover (%) | - |
| Shrub cover (%) | 40 |
| Herb cover (%) | 80 |
| Cryptogam cover (%) | 25 |
| Bare surface (%) | 1 |
| pH | 7.5-7.9 |
| Mean species per quadrat | 17.0 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Holcus lanatus* | IV | 6 |
| *Festuca rubra* | IV | 6 |
| *Lotus corniculatus* | IV | 5 |
| *Agrostis stolonifera* | IV | 5 |
| *Carex arenaria* | IV | 3 |
| *Salix repens agg.* | IV | 7 |
| *Carex flacca* | III | 4 |
| *Equisetum variegatum* | III | 4 |
| *Poa pratensis* | III | 4 |
| *Trifolium pratense* | II | 4 |
| *Plantago lanceolata* | II | 4 |
| *Epipactis palustris* | II | 3 |
| *Euphrasia officinalis agg.* | II | 3 |
| *Hypochoeris radicata* | II | 3 |
| *Ononis repens* | II | 4 |
| *Taraxacum sp.* | II | 3 |
| *Blackstonia perfoliata* | II | 1 |
| *Mentha aquatica* | II | 3 |
| *Phragmites australis* | II | 3 |
| *Prunella vulgaris* | II | 4 |
| *Juncus maritimus* | II | 4 |
| *Potentilla anserina* | II | 6 |
| *Radiola linoides* | II | 3 |
| *Rhinanthus minor* | II | 3 |
| *Rubus caesius* | II | 4 |
| *Calliergon cuspidatum* | II | 6 |

MAP UNIT | VEGETATION UNIT

15 SD17 *Potentilla anserina - Carex nigra* dune slack
No clear NVC sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 0-3 |
| Herb height (cm) | 80 |
| Tree cover (%) | - |
| Shrub cover (%) | 30 |
| Herb cover (%) | 90 |
| Cryptogam cover (%) | 30 |
| Bare surface (%) | - |
| pH | 6.8-7.9 |
| Mean species per quadrat | 14.6 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Mentha aquatica* | V | 5 |
| *Carex nigra* | III | 4 |
| *Hydrocotyle vulgaris* | III | 6 |
| *Pulicaria dysenterica* | III | 5 |
| *Iris pseudacorus* | III | 4 |
| *Equisetum arvense* | III | 3 |
| *Filipendula ulmaria* | III | 5 |
| *Holcus lanatus* | III | 4 |
| *Potentilla anserina* | III | 4 |
| *Salix repens agg.* | III | 6 |
| *Juncus maritimus* | II | 5 |
| *Lythrum salicaria* | II | 4 |
| *Calliergon cuspidatum* | II | 9 |
| *Agrostis stolonifera* | II | 4 |
| *Eupatorium cannabinum* | II | 5 |
| *Lotus uliginosus* | II | 4 |
| *Salix cinerea* | II | 4 |
| *Oenanthe lachenalii* | II | 2 |
| *Rubus caesius* | II | 3 |
| *Rubus fruticosus agg.* | II | 5 |
| *Angelica sylvestris* | II | 2 |
| *Arrhenatherum elatius* | II | 4 |
| *Eleocharis palustris* | II | 4 |
| *Lychnis flos-cuculi* | II | 3 |
| *Juncus subnodulosus* | II | 5 |

MAP UNIT | VEGETATION UNIT

16 SM18b *Juncus maritimus* saltmarsh
*Oenanthe lachenalii* sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 50 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 80 |
| Cryptogam cover (%) | 30 |
| Bare surface (%) | 10 |
| pH | 7.8-8.3 |
| Mean species per quadrat | 12.3 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Oenanthe lachenalii* | V | 3 |
| *Agrostis stolonifera* | V | 6 |
| *Juncus maritimus* | III | 4 |
| *Juncus gerardi* | III | 5 |
| *Glaux maritima* | III | 5 |
| *Festuca rubra* | III | 6 |
| *Potentilla anserina* | III | 5 |
| *Juncus acutus* | II | 5 |
| *Carex distans* | II | 3 |
| *Carex otrubae* | II | 4 |
| *Plantago maritima* | II | 3 |
| *Carex extensa* | II | 3 |
| *Rumex crispus* | II | 2 |
| *Samolus valerandi* | II | 3 |
| *Scirpus maritimus* | II | 5 |
| *Eleocharis palustris* | II | 4 |
| *Hydrocotyle vulgaris* | II | 4 |
| *Mentha aquatica* | II | 3 |
| *Phragmites australis* | II | 4 |
| *Drepanocladus aduncus* | II | 6 |
| *Plantago coronopus* | II | 5 |
| *Triglochin maritima* | II | 2 |

MAP UNIT | VEGETATION UNIT

17 SM24 *Elymus pycnanthus* saltmarsh

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | - |
| Herb height (cm) | 30 |
| Tree cover (%) | - |
| Shrub cover (%) | - |
| Herb cover (%) | 50 |
| Cryptogam cover (%) | 10 |
| Bare surface (%) | 40 |
| pH | 7.7-8.2 |
| Mean species per quadrat | 9.2 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Elymus pycnanthus* | IV | 5 |
| *Festuca rubra* | IV | 6 |
| *Agrostis stolonifera* | IV | 6 |
| *Plantago coronopus* | II | 4 |
| *Carex extensa* | II | 3 |
| *Limonium binervosum* | II | 4 |
| *Atriplex prostrata* | II | 4 |
| *Carex arenaria* | II | 2 |
| *Centaurium erythraea* | II | 3 |
| *Hypochoeris radicata* | II | 3 |
| *Leontodon hispidus* | II | 3 |
| *Lotus corniculatus* | II | 4 |
| *Plantago maritima* | II | 2 |

MAP UNIT | VEGETATION UNIT

18 S4a *Phragmites australis* swamp and reed-beds
*Phragmites australis* sub-community

19 S4d *Phragmites australis* swamp and reed-beds
*Atriplex hastata* sub-community

19 S21b *Scirpus maritimus* swamp
*Atriplex hastata* sub-community

20 S12b *Typha latifolia* swamp
*Mentha aquatica* sub-community

| | S4a | S4d | S21b | S12b |
|---|---|---|---|---|
| Tree height (m) | - | - | - | - |
| Shrub/bracken height (m) | - | - | - | - |
| Herb height (cm) | 200 | 200 | 100 | 40-100 |
| Tree cover (%) | - | - | - | - |
| Shrub cover (%) | - | - | - | - |
| Herb cover (%) | 100 | 100 | 100 | 20-40 |
| Cryptogam cover (%) | - | - | - | 80 |
| Bare surface (%) | - | - | - | - |
| pH | - | - | - | - |
| Mean species per quadrat | 2.7 | 2.5 | 3.0 | 11.3 |
| | DOMIN VALUES | | | |
| *Phragmites australis* | 10 | 10 | - | - |
| *Lythrum salicaria* | 1 | - | - | - |
| *Rubus fruticosus agg.* | 4 | - | - | - |
| *Scirpus maritimus* | - | - | 8 | 4 |
| *Atriplex prostrata* | - | 4 | 4 | - |
| *Elymus pycnanthus* | - | 8 | 8 | - |
| *Juncus maritimus* | - | - | 6 | - |
| *Typha latifolia* | - | - | - | 5 |
| *Mentha aquatica* | - | - | - | 4 |
| *Chara sp.* | - | - | - | 9 |
| *Carex nigra* | - | - | - | 3 |
| *Eleocharis palustris* | - | - | - | 3 |
| *Galium palustre* | - | - | - | 3 |
| *Hydrocotyle vulgaris* | - | - | - | 3 |
| *Juncus articulatus* | - | - | - | 3 |
| *Ranunculus flammula* | - | - | - | 3 |
| *Salix repens agg.* | - | - | - | 4 |
| *Scirpus lacustris tabernaem.* | - | - | - | 4 |
| *Drepanocladus aduncus* | - | - | - | 6 |

MAP UNIT | VEGETATION UNIT

23 W1 *Salix cinerea - Galium palustre* woodland

| | |
|---|---|
| Tree height (m) | 4-8 |
| Shrub/bracken height (m) | 0-6 |
| Herb height (cm) | 20-150 |
| Tree cover (%) | 30-80 |
| Shrub cover (%) | 0-80 |
| Herb cover (%) | 30 |
| Cryptogam cover (%) | 40 |
| Bare surface (%) | - |
| pH | 6.7 |
| Mean species per quadrat | 10.3 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Betula pubescens* | V | 6 |
| *Galium palustre* | V | 5 |
| *Iris pseudacorus* | V | 4 |
| *Agrostis stolonifera* | IV | 4 |
| *Ophioglossum vulgatum* | IV | 3 |
| *Phragmites australis* | IV | 6 |
| *Rubus fruticosus agg.* | IV | 2 |
| *Salix cinerea* | IV | 5 |
| *Calliergon cuspidatum* | IV | 5 |
| *Juncus effusus* | III | 4 |
| *Solanum dulcamara* | III | 2 |
| *Epilobium palustre* | II | 3 |
| *Equisetum sylvaticum* | II | 3 |
| *Eriophorum angustifolium* | II | 2 |
| *Hydrocotyle vulgaris* | II | 3 |
| *Salix repens agg.* | II | 4 |

MAP UNIT | VEGETATION UNIT

25 W21 *Crataegus monogyna - Hedera helix* scrub
*Hedera helix - Urtica dioica* sub-community

| | |
|---|---|
| Tree height (m) | 0-4 |
| Shrub/bracken height (m) | 1-5 |
| Herb height (cm) | 20-100 |
| Tree cover (%) | 0-80 |
| Shrub cover (%) | 30-100 |
| Herb cover (%) | 60 |
| Cryptogam cover (%) | 10 |
| Bare surface (%) | - |
| pH | 6.1-7.2 |
| Mean species per quadrat | 13.3 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Crataegus monogyna* | IV | 5 |
| *Geranium robertianum* | IV | 3 |
| *Hedera helix* | IV | 6 |
| *Rubus fruticosus agg.* | IV | 7 |
| *Urtica dioica* | III | 4 |
| *Quercus robur* | III | 4 |
| *Silene dioica* | II | 3 |
| *Fraxinus excelsior* | II | 4 |
| *Prunus spinosa* | II | 4 |
| *Phyllitis scolopendrium* | II | 3 |
| *Rosa pimpinellifolia* | II | 3 |
| *Solanum dulcamara* | II | 4 |
| *Taxus communis* | II | 3 |
| *Acer pseudoplatanus* | II | 3 |
| *Brachypodium sylvaticum* | II | 4 |
| *Epilobium montanum* | II | 2 |
| *Galium aparine* | II | 4 |

MAP UNIT | VEGETATION UNIT

26 W22 *Prunus spinosa* - *Rubus fruticosus* agg. scrub
No clear NVC sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 2-5 |
| Herb height (cm) | 30 |
| Tree cover (%) | - |
| Shrub cover (%) | 60-100 |
| Herb cover (%) | 5-80 |
| Cryptogam cover (%) | 10-40 |
| Bare surface (%) | - |
| pH | 7.4 |
| Mean species per quadrat | 12.6 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Prunus spinosa* | V | 8 |
| *Eurynchium praelongum* | IV | 6 |
| *Urtica dioica* | IV | 3 |
| *Crataegus monogyna* | III | 5 |
| *Dactylis glomerata* | III | 3 |
| *Rosa pimpinellifolia* | III | 5 |
| *Rubus fruticosus* agg. | III | 4 |
| *Festuca rubra* | II | 4 |
| *Geranium robertianum* | II | 3 |
| *Glechoma hederacea* | II | 4 |
| *Hedera helix* | II | 9 |
| *Quercus robur* | II | 4 |
| *Sambucus nigra* | II | 6 |
| *Silene dioica* | II | 3 |
| *Arrhenatherum elatius* | II | 2 |
| *Athyrium filix-femina* | II | 1 |
| *Brachypodium sylvaticum* | II | 3 |
| *Carex arenaria* | II | 3 |
| *Dryopteris filix-mas* | II | 4 |
| *Epilobium montanum* | II | 2 |
| *Fraxinus excelsior* | II | 4 |
| *Galium verum* | II | 4 |
| *Phyllitis scolopendrium* | II | 4 |
| *Plantago lanceolata* | II | 3 |
| *Pteridium aquilinum* | II | 4 |
| *Rubus caesius* | II | 4 |
| *Senecio jacobaea* | II | 2 |
| *Stachys sylvatica* | II | 3 |
| *Taxus communis* | II | 1 |

MAP UNIT | VEGETATION UNIT

29 W25 *Pteridium aquilinum* - *Rubus fruticosus* agg. underscrub
No clear NVC sub-community

| | |
|---|---|
| Tree height (m) | - |
| Shrub/bracken height (m) | 1-3 |
| Herb height (cm) | 40-120 |
| Tree cover (%) | - |
| Shrub cover (%) | 80-100 |
| Herb cover (%) | 30 |
| Cryptogam cover (%) | - |
| Bare surface (%) | - |
| pH | 6.8-7.4 |
| Mean species per quadrat | 9.7 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Pteridium aquilinum* | V | 7 |
| *Rubus fruticosus* | V | 7 |
| *Urtica dioica* | III | 4 |
| *Geranium robertianum* | II | 4 |
| *Glechoma hederacea* | II | 4 |
| *Holcus lanatus* | II | 4 |
| *Silene dioica* | II | 3 |
| *Acer pseudoplatanus* | II | 4 |
| *Arrhenatherum elatius* | II | 4 |
| *Festuca rubra* | II | 4 |

MAP UNIT | VEGETATION UNIT

30 X5 *Alnus glutinosa* slack woodland

| | |
|---|---|
| Tree height (m) | 2-12 |
| Shrub/bracken height (m) | 1-3 |
| Herb height (cm) | 30-50 |
| Tree cover (%) | 70-100 |
| Shrub cover (%) | 0-40 |
| Herb cover (%) | 50 |
| Cryptogam cover (%) | 20 |
| Bare surface (%) | - |
| pH | 5.9-6.5 |
| Mean species per quadrat | 11.7 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Iris pseudacorus* | IV | 5 |
| *Rubus fruticosus* agg. | IV | 5 |
| *Galium palustre* | IV | 3 |
| *Alnus glutinosa* | IV | 9 |
| *Salix cinerea* | III | 7 |
| *Solanum dulcamara* | III | 4 |
| *Calliergon cuspidatum* | III | 6 |
| *Phragmites australis* | II | 3 |
| *Oenanthe crocata* | II | 4 |
| *Holcus lanatus* | II | 4 |
| *Lycopus europaeus* | II | 3 |
| *Agrostis stolonifera* | II | 3 |
| *Berula erecta* | II | 2 |
| *Carex remota* | II | 4 |
| *Filipendula ulmaria* | II | 3 |
| *Geranium robertianum* | II | 4 |

MAP UNIT | VEGETATION UNIT

31 X6 *Pinus nigra/sylvestris* woodland

| | |
|---|---|
| Tree height (m) | 10-18 |
| Shrub/bracken height (m) | 1-4 |
| Herb height (cm) | 30 |
| Tree cover (%) | 40-80 |
| Shrub cover (%) | 5-100 |
| Herb cover (%) | 10-30 |
| Cryptogam cover (%) | - |
| Bare surface (%) | - |
| pH | 5.6-6.4 |
| Mean species per quadrat | 12.0 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Pinus nigra/sylvestris* | V | 7 |
| *Crataegus monogyna* | IV | 4 |
| *Dryopteris filix-mas* | IV | 4 |
| *Geranium robertianum* | IV | 4 |
| *Rubus caesius* | III | 4 |
| *Rubus fruticosus* agg. | III | 7 |
| *Epilobium angustifolium* | II | 3 |
| *Rosa pimpinellifolia* | II | 3 |
| *Solanum dulcamara* | II | 4 |
| *Hedera helix* | II | 9 |
| *Phyllitis scolopendrium* | II | 4 |
| *Silene dioica* | II | 3 |
| *Urtica dioica* | II | 5 |
| *Prunus spinosa* | II | 1 |

MAP UNIT | VEGETATION UNIT

32 X7 *Acer pseudoplatanus* woodland

| | |
|---|---|
| Tree height (m) | 4-16 |
| Shrub/bracken height (m) | 0-6 |
| Herb height (cm) | 20-40 |
| Tree cover (%) | 60-95 |
| Shrub cover (%) | 0-50 |
| Herb cover (%) | 20-50 |
| Cryptogam cover (%) | 10 |
| Bare surface (%) | - |
| pH | 6.3 |
| Mean species per quadrat | 12.0 |

| | FREQUENCY | DOMIN VALUE |
|---|---|---|
| *Acer pseudoplatanus* | V | 9 |
| *Rubus fruticosus* | IV | 4 |
| *Hyacinthoides nonscripta* | III | 3 |
| *Geranium robertianum* | III | 3 |
| *Hedera helix* | III | 6 |
| *Arum maculatum* | II | 1 |
| *Crataegus monogyna* | II | 3 |
| *Glechoma hederacea* | II | 4 |
| *Pteridium aquilinum* | II | 2 |
| *Rubus caesius* | II | 4 |
| *Silene dioica* | II | 2 |
| *Brachythecium rutabulum* | II | 4 |

# ANNEX 6

# TARGET NOTES

These are marked on the site map sheet(s) as TN*n*.

## WHITEFORD BURROWS

1 Self-sown Corsican Pine.

2 Woodland rides shaded (frequent *Brachypodium sylvaticum*) and quite heavily scrubbed (*Rosa canina, R. pimpinellifolia, Rubus fruticosus* agg.).

3 Little Bracken found north of this approximate suggesting it has invaded from the south where it is frequent in type 8 grassland and in scrub of woodland fringe.

4 Large rabbit population in this area.

5 Scattered Norway Spruce (*Picea abies*) in area.

6 Well-developed *Salix repens* 'hedgehog' dunes.

7 Remains of concrete structure.

8 Large quantities of prostrate *Clematis vitalba* in young dunes of this area.

9 Several rabbit-proof exclosures scattered in various communities in this area.

# ANNEX 7

## QUADRAT DATA

## (COMPUTER FORMAT)

Full tabulation of all quadrat data as sample-species tables is too costly in terms of space. A reduced version of the data in NVC format for use in the VESPAN2 package is given here. A copy of this data aggregated for all sites has been supplied to the NCC Nominated Officer on floppy diskette. For readers with access to VESPAN2 it is thus possible to obtain the data and display individual quadrats in full format.

The species characteristics of vegetation types are presented in great detail in Annex 5 (apart from infrequent species), based on data from all sites. Particular characteristics of this site are emphasised under descriptions of vegetation types in Annex 3. Quadrat membership of vegetation types is listed in Annex 4. This organisation of information should satisfy most readers.

```
391      9  0  10  0  11 90  13  0  14  0  15 40  16  0  22 60 116  4 159  6
391    268  11184  3
392      9  0  10  0  11100  13  0  14  0  15 80  16  0  22 20 159  9 565  1
392   1239  11272  1
393      9  0  10  0  11 20  13  0  14  0  15 60  16  0  22 40 159  5 174  5
393    195  4 241  1 304  2 576  7 706  1 769  2 800  5 995  11239  11434  3
394      9  0  10  0  11 30  13  0  14  0  15100  16  5  22  0 124  3 159  5
394    174  4 304  3 576  8 631  3 680  3 706  3 769  3 800  5 914  5 988  4
394   1259  31562  21677  4
395      9  0  10  0  11 70  13  0  14  0  15100  16 80  22  0 103  1 159  5
395    288  2 304  3 421  1 465  3 522  1 576  7 589  1 674  3 680  5 706  2
395    786  1 800  1 968  4 988  41059  31066  51396  41429  31914  82167  4
396      9  0  10  0  11 10  13  0  14  0  15 60  16 40  22 20 124  2 125  3
396    159  5 304  4 369  2 576  5 613  5 631  2 680  3 706  2 786  1 914  5
396    958  2 988  4 995  21127  11239  11272  11432  31510  7
397      9  0  10  0  11 50  13  0  14  0  15100  16  2  22  0 159  4 304  3
397    576  6 613  3 631  6 680  3 973  1 988  31053  41066  71123  61127  6
397   1324  41677  3
398      9  0  10  0  11 10  13  0  14  0  15100  16 10  22  0 123  4 159  4
398    171  3 202  2 288  2 304  3 568  1 576  7 613  3 631  5 680  3 769  2
398    800  3 973  3 988  4 995  11053  41123  51127  61333  21396  41519  4
399      9  0  10  0  11 40  13  0  14  0  15100  16  0  22  0 159  5 304  2
399    576  6 613  2 631  4 680  3 800  3 973  3 988  31053  31123  41127  8
399   1324  31429  21677  2
400      9  0  10  1  11 50  13  0  14 70  15 40  16 10  22  0 113  3 304  3
400    465  2 558  3 576  3 680  3 988  31123  31127  71169  11179  81519  4
400   1914  2
401      9  0  10  0  11  5  13  0  14  0  15100  16 30  22  0 171  3 202  4
401    304  3 576  7 613  3 631  5 680  3 800  4 973  3 988  31053  41123  5
401   1333  51638  21941  6
402      9  0  10  0  11 25  13  0  14  0  15 90  16 10  22 10 123  4 171  4
402    202  3 251  3 304  3 576  8 613  4 631  5 968  2 973  3 988  41053  4
402   1066  21123  51333  31396  31914  4
403      9 12  10  0  11 25  13 90  14  0  15 80  16 10  22  0 103  9 201  1
403    455  3 465  4 516  4 630  3 634  2 637  71095  41136  11254  41396  3
403   1807  4
404      9 10  10  0  11130  13 80  14  0  15 70  16  0  22  0 103  9 122  3
404    201  1 421  7 516  2 576  3 630  5 652  71066  41136  41187  51268  3
404   1368  5
405      9  3  10  0  11 40  13 10  14  0  15100  16  0  22  0 103  4 421  8
405    455  2 516  2 522  3 630  4 634  3 637  4 680  31066  81136  51254  3
405   1268  31368  4
406      9  0  10  1  11 90  13  0  14 20  15 80  16  0  22  0 455  3 465  3
406    576  5 613  3 630  3 680  3 988  31066  51136  5
407      9  0  10  2  11150  13  0  14100  15 20  16 10  22  0 637  3 680  2
407   1066  41136 101254  41368  41519  41677  4
408      9  0  10  2  11150  13  0  14100  15 30  16 10  22  0 465  3 680  3
408   1066  31136  91254  51519  41677  4
409      9  0  10  0  11 30  13  0  14  0  15100  16  0  22  0 104  4 113  3
409    197  6 371  4 455  4 465  3 576  6 587  3 968  2 973  4 988  41056  4
409   1059  31066  41081  31127  41136  31139  41349  31396  32982  3
410      9  0  10  0  11 60  13  0  14  0  15100  16  0  22  0 333  3 336  1
410    510  4 715  4 733  6 855  6 988  41043  41069  61127  31139  3
411      9 12  10  1  11 20  13 50  14 30  15100  16  0  22  0 103  1 421  4
411    445  1 630  4 652  91123  21127  41136  61187  41254  31268  21313  4
411   1368  32920  7
412      9 14  10  0  11 20  13 50  14  0  15100  16  0  22  0 103  1 201  1
412    414  4 421  4 445  1 500  4 630  5 652 10 681  3 962  41187  51220  1
```

```
412   1254  31368  52920  72936  1
413      9 14  10  0  11 20  13 60  14  0  15 30  16  0  22  0 203  3 391  3
413    445  4 500  5 522  2 630  4 652  3 962  51123  42920  8
414      9 14  10  0  11 20  13 40  14  0  15100  16  0  22  0 201  2 391  5
414    421  9 445  4 500  4 522  1 630  3 652  7 681  3 962  31136  41187  4
414   1254  31313  31360  31368  32920  5
415      9 12  10  0  11 30  13 40  14  0  15100  16  0  22  0 500  4 521  5
415    526  3 583  5 630  5 681  4 701  3 715  5 802  5 855  4 962  4 971  6
415   1095  41136  71137  41170  51254  51268  31368  4
416      9 12  10  0  11 30  13 40  14  0  15100  16  0  22  0 279  3 415  4
416    526  4 558  4 630  4 701  4 715  5 823  3 855  6 971  61095  51127  4
416   1136  41169  41254  31268  41368  4
417      9 12  10  1  11 20  13 60  14 60  15 30  16 15  22  0 445  4 500  4
417    558  4 630  5 681  4 776  8 962  41123  31127  31254  21268  41368  5
417   2920  82936  1
418      9 12  10  3  11 20  13 90  14 60  15 40  16 60  22  0 103  5 201  2
418    589  9 630  3 637  6 652  51254  31293  41368  21677  82936  7
419      9  0  10  2  11 20  13  0  14 60  15 60  16 60  22  0 247  3 445  6
419    500  4 526  2 630  3 637  4 681  3 962  41078  41123  61127  41254  5
419   1293  31368  21677  82936  6
420      9 10  10  1  11 20  13 80  14 30  15 10  16  0  22  0 391  1 637  3
420   1015  41123  61127  42920  9
421      9  0  10  1  11 30  13  0  14 85  15 20  16  0  22 10 174  2 304  3
421    530  1 576  5 680  3 706  2 769  2 855  2 914  3 988  41127  31179  9
422      9  0  10  1  11 30  13  0  14 50  15 60  16 20  22  0 171  3 323  5
422    460  3 531  3 539  3 576  5 680  4 690  2 706  3 734  4 769  3 800  5
422    855  4 973  3 988  31043  61059  41095  41179  71349  41350  31445  5
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423    504  1 576  5 613  5 674  1 706  3 807  3 914  5 965  5 973  3 988  2
423    995  31106  41127  21272  21333  41432  31510  6 447  2
424      9  0  10  0  11 20  13  0  14  0  15 50  16 80  22 10 159  4 174  3
424    185  2 194  3 304  3 369  2 504  1 613  5 706  3 807  3 913  2 914  4
424    958  31127  71225  51239  21333  52023  9 447  3
425      9  0  10  0  11 90  13  0  14  0  15 60  16  0  22 40 116  4 159  7
425    555  31127  31239  2
426      9  0  10  0  11 30  13  0  14  0  15 90  16  0  22 10 159  6 421  5
426    576  6 914  5 988  31127  8
427      9  0  10  1  11 30  13  0  14 50  15 60  16  0  22 10 174  4 185  2
427    194  3 304  4 445  4 465  2 613  3 706  3 913  31127  81179  71239  3
427   1434  3
428      9  0  10  0  11  5  13  0  14  0  15 70  16 60  22  0 304  4 310  2
428    576  6 613  5 625  2 706  4 807  3 914  3 973  41127  21333  61510  4
428   1766  72362  52486  4
429      9  0  10  1  11 10  13  0  14 50  15100  16 40  22  0 122  4 171  4
429    251  3 304  2 323  5 460  4 539  2 576  5 680  4 706  3 720  5 800  5
429    855  3 973  6 988  31106  41127  41179  71239  21349  41422  11445  4
429   1519  31914  61940  52982  3
430      9  0  10  1  11  5  13  0  14 25  15 90  16 30  22 10 122  6 163  3
430    241  1 304  2 316  3 323  4 339  4 460  4 539  4 568  4 576  4 619  2
430    680  3 690  2 706  2 722  3 800  4 855  21059  41080  21081  31106  3
430   1179  51349  31445  61546  41571  52256  32982  4
431      9  0  10  1  11100  13  0  14 20  15 90  16 30  22 10 122  6 163  3
431    241  3 304  3 316  3 323  3 339  4 460  3 531  2 539  4 568  4 576  4
431    619  3 680  3 690  2 706  1 722  3 800  4 855  41043  21059  31069  2
431   1080  31081  31089  41179  61349  31445  61571  12982  4
432      9  0  10  1  11100  13  0  14 20  15 90  16  0  22  0 122  4 415  4
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432   1127  51169  41179  5
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433      9  0 10  0 11100 13  0 14  0 15100 16  0 22  0 197  3 333  5
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434      9  0 10  0 11 30 13  0 14  0 15100 16  0 22  0 122  5 197  3
434    279  2 333  7 336  1 509  3 532  3 690  4 715  5 722  4 802  4 813  3
434    855  5 911  2 961 31043 41089 31189 31223 21344 31349 51354  3
434   2732  5
435      9  0 10  0 11 20 13  0 14  0 15 80 16  0 22 20 122  8 333  3
435    336  3 636  2 722  4 725  3 911  4 961 11080 31189 51354 42732  1
436      9  0 10  1 11  5 13  0 14 50 15 50 16 10 22 15 122  5 163  3
436    174  2 241  3 339  4 539  4 568  3 619  3 680  3 706  4 800 41059  4
436   1080 31106 41179 71349 41434 41546 42982  3
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437   1239 11249 31432 42023  7
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438    421  2 574  7 613  3 706  3 807  3 914  5 988  3 995 21106 31123  3
438   1127 61225 31239 31249 31333 21510 51766 82486  4
439      9  0 10  0 11 10 13  0 14  0 15 90 16 30 22 10 159  2 174  2
439    304  3 385  2 421  8 576  7 914  3 988 31249 31510 62982  2
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440    304  3 323  3 391  2 576  7 674  4 680  3 706  4 786  3 800  3 914  5
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441   1239 31249 31333 41432 41434 41510 22023  9 447  2
442      9  0 10  1 11 20 13  0 14 60 15 60 16 60 22  0 122  5 197  2
442    304  4 323  4 539  3 568  3 609  2 680  4 690  3 701  4 800  4 855  3
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447    973 21043 51069 51169 81349 51360  2
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448    418  3 530  4 532  3 558  5 583  5 680  3 690  5 701  2 734  7 823  2
448    855  5 917  3 973 31043 31069 51127 31169 41179 61349 21445  9
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449    917  3 973 41043 41069 51127 21179 41349 31445  9
450      9  0 10  1 11 15 13  0 14 20 15100 16 30 22  0 333  7 339  3
450    531  3 532  3 539  3 636  4 680  3 690  6 706  2 855  5 911  3 917  2
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451    532  3 576  4 680  3 690  6 715  4 720  4 734  5 813  3 855  5 973  4
451   1043 31059 31069 51081 31179 71445  9
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452   1214 31344 51354  4
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453    336  3 576  5 636  4 734  8 911  4 975 11043 31069 11189 31344  3
453   1353  3
454      9  0 10  1 11 10 13  0 14 60 15 40 16 20 22  0 241  1 304  3
454    323  4 362  1 384  2 531  2 539  4 568  5 576  4 680  4 706  3 800  4
454    914  5 965 51059 41080 31127 11179 81485 41766 52982  4
455      9  0 10  1 11  5 13  0 14  5 15 40 16  0 22 60 122  6 163  5
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455   1571 32256 32982  3
456      9  0 10  1 11 10 13  0 14 50 15 70 16 60 22  5 122  6 163  4
456    230  1 323  4 531  4 539  4 568  3 609  3 636  3 690  3 706  3 800  3
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458    565  5
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461    565  4
462      9  0 10  0 11 15 13  0 14  0 15 40 16  0 22 60 116  4 159  3
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466      9  0 10  0 11 10 13  0 14  0 15 40 16 50 22 10 117  3 122  6
466    304  3 576  7 778  1 972 42023 72256  5
467      9  8 10  0 11 70 13 90 14  0 15 70 16  0 22 30 153  9 909  6
467    680  3 715  3 823 31043 21127 71268 41293 31298 31368  2 232  3
468      9  0 10  0 11120 13  0 14  0 15100 16  0 22  0 509  4 715  3
468    911 51069 31189 41362 62732  6
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# ANNEX 8

## AREAS OF VEGETATION TYPES

The table below lists the area (in hectares) of vegetation types at this site(s). Results are based on weighing on a balance accurate to 10mg - small categories may not be fully accurate.

| Map Unit | NVC or non-NVC Unit | WHITEFORD |
|---|---|---|
| 1 | X1 | 1.86 |
| 2 | SD4 | 2.88 |
| 3 | SD6a | 3.20 |
| 4 | SD6d | 7.70 |
| 5 | SD6e | 3.85 |
| 6 | SD7c | 27.75 |
| 7 | SD7d | 29.75 |
| 8 | SD8 | 9.61 |
| 9 | SD9 | 3.20 |
| 10 | SD12 | - |
| 11 | H11 | - |
| 12 | SD14c-SD15a/b | 15.00 |
| 13 | SD15c | 11.54 |
| 14 | SD16a/b-SD16c/d | 5.77 |
| 15 | SD17 | 0.26 |
| 16 | SM18b | - |
| 17 | SM24 | - |
| 18 | S4a | - |
| 19 | S4d-S21b | - |
| 20 | S12b | 1.03 |
| 21 | SD18a | - |
| 22 | SD18b | - |
| 23 | W1 | 2.56 |
| 24 | W10c | - |
| 25 | W21a | - |
| 26 | W22 | 1.92 |
| 27 | W23 | - |
| 28 | W24 | - |
| 29 | W25 | - |
| 30 | X2 | 1.28 |
| 31 | X3 | 24.55 |
| 32 | X4 | 1.28 |
| 1-11 | (strand, grassland and heath) | 89.80 |
| 12-15 | (dune slacks) | 32.57 |
| 16-20 | (saltmarsh and swamp) | 1.03 |
| 21-32 | (scrub and woodland) | 31.59 |
| Other: | Woodland ride | 1.28 |
| Total | | 156.27 |

# ANNEX 9

## SITE BIBLIOGRAPHY

A running list of reports relating to Whiteford Burrows is kept at Oxwich Reserve Centre. The following items are those cited in this report. A more comprehensive listing is given in the Regional Report.


Baye, P. (1981) A study of dune morphology and the effects of a storm on 13 December 1981. Report, Oxwich Reserve Centre.

Bray, G.C. (1977) A study of the grazing exclosures on Whiteford Burrows NNR. University College of Cardiff.

Bridges, M. (1987) Classic Landforms of the Gower Coast. Geographical Association, Sheffield.

Davies, M. (1981) Sea Buckthorn (*Hippophae rhamnoides*) and tree species survey at Whiteford NNR. Report, Oxwich Reserve Centre.

Glyn, P.J. (1975) A study of the effects of pony grazing. Zoology Department, Royal Holloway College.

Hughes, M.R. (1981) Whiteford National Nature Reserve: Description and classification of dune slacks and their vegetation.

Ranwell, D.S. (1967) Visit to Whiteford Burrows NNR. Report, Oxwich reserve Centre.

## MAPPING AND VEGETATION UNITS FOR 1989 SOUTH WALES DUNE SURVEY

### STRAND, DUNE AND TRANSITIONS

| a | b | |
|---|---|---|
| 1 | X1 | Dry foredune/saltmarsh/strandline transition community |
| 2 | SD4 | *Elymus farctus* foredune community |
| 3 | SD6a | *Ammophila arenaria* mobile dune community<br>*Elymus farctus* sub-community |
| 4 | SD6d | *Ammophila arenaria* mobile dune community<br>Typical sub-community |
| 5 | SD6e | *Ammophila arenaria* mobile dune community<br>*Festuca rubra* sub-community |
| 6 | SD7c | *Ammophila arenaria* - *Festuca rubra* semi-fixed dune community<br>*Ononis repens* sub-community |
| 7 | SD7d | *Ammophila arenaria* - *Festuca rubra* semi-fixed dune community<br>*Tortula ruralis* ssp. *ruraliformis* sub-community |
| 8 | SD8 | *Festuca rubra* - *Galium verum* fixed dune community<br>No clear NVC sub-community |
| 9 | SD9 | *Ammophila arenaria* - *Arrhenatherum elatius* dune grassland<br>No clear NVC sub-community |
| 10 | SD12 | *Carex arenaria* - *Festuca ovina* - *Agrostis capillaris* grassland<br>No clear NVC sub-community |
| 11 | H11 | *Calluna vulgaris* - *Carex arenaria* heath |

a = mapping unit  b = vegetation unit
X = Major non-NVC category or transitional type

## MAPPING AND VEGETATION UNITS FOR 1989 SOUTH WALES DUNE SURVEY

### SLACK, SALTMARSH AND SWAMP

| a | b | |
|---|---|---|
| 12 | SD14c | *Salix repens* - *Campylium stellatum* dune slack<br>*Bryum pseudotriquetrum* - *Aneura pinguis* sub-community |
| 12 | SD15a/b | *Salix repens* - *Calliergon cuspidatum* dune slack<br>*Carex nigra* sub-community (a)<br>*Equisetum variegatum* sub-community (b) |
| 13 | SD15c | *Salix repens* - *Calliergon cuspidatum* dune slack<br>*Carex flacca* - *Pulicaria dysenterica* sub-community |
| 14 | SD16a/b | *Salix repens* - *Holcus lanatus* dune slack<br>*Ononis repens* sub-community (a)<br>*Rubus caesius* sub-community (b) |
| 14 | SD16c/d | *Salix repens* - *Holcus lanatus* dune slack<br>*Prunella vulgaris* - *Equisetum variegatum* sub-community (c)<br>*Agrostis stolonifera* sub-community (d) |
| 15 | SD17 | *Potentilla anserina* - *Carex nigra* dune slack<br>No clear NVC sub-community |
| 16 | SM18b | *Juncus maritimus* saltmarsh<br>*Oenanthe lachenalii* sub-community |
| 17 | SM24 | *Elymus pycnanthus* saltmarsh |
| 18 | S4a | *Phragmites australis* swamp and reed-beds<br>*Phragmites australis* sub-community |
| 19 | S4d | *Phragmites australis* swamp and reed-beds<br>*Atriplex hastata* sub-community |
| 19 | S21b | *Scirpus maritimus* swamp<br>*Atriplex hastata* sub-community |
| 20 | S12b | *Typha latifolia* swamp<br>*Mentha aquatica* sub-community |

a = mapping unit  b = vegetation unit
X = Non-NVC category or transitional type

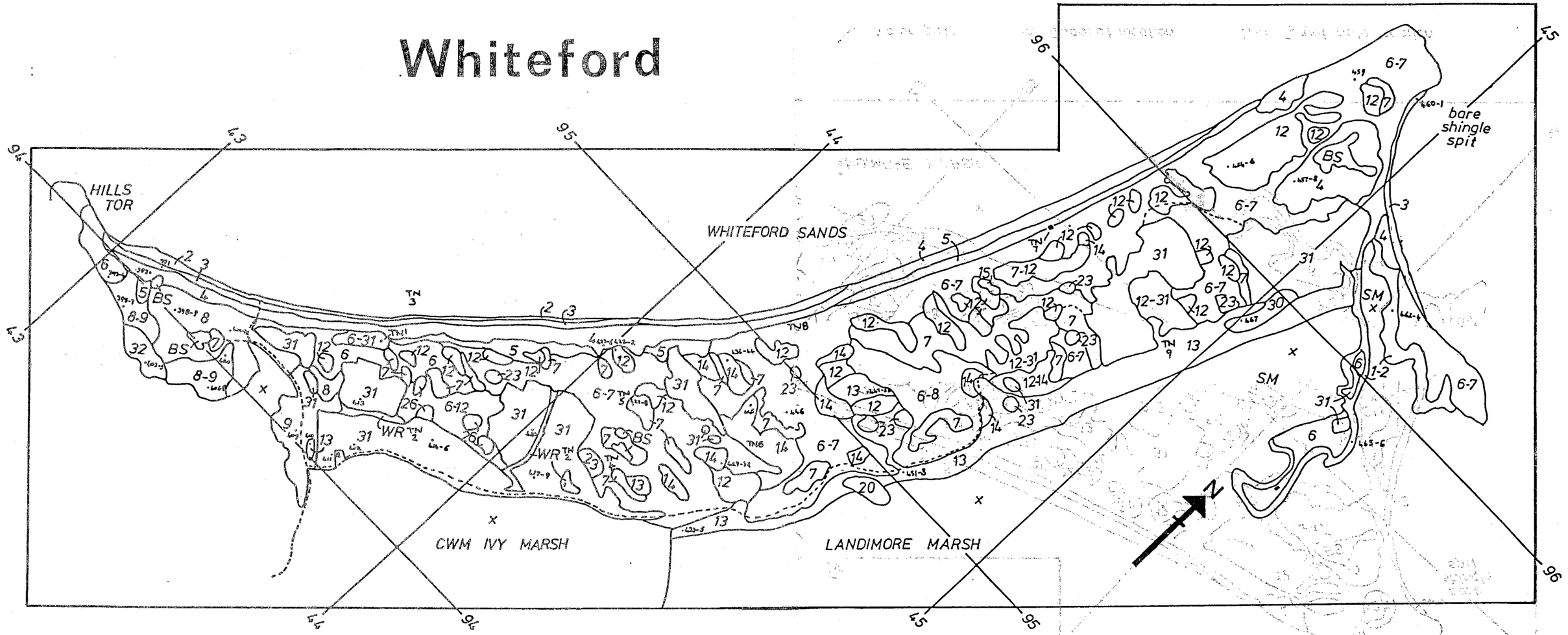
## MAPPING AND VEGETATION UNITS FOR 1989 SOUTH WALES DUNE SURVEY

### WOODLAND AND SCRUB

| a | b | |
|---|---|---|
| 21 | SD18a | *Hippophae rhamnoides* scrub<br>*Festuca rubra* sub-community |
| 22 | SD18b | *Hippophae rhamnoides* scrub<br>*Urtica dioica - Arrhenatherum elatius* sub-community |
| 23 | W1 | *Salix cinerea - Galium palustre* woodland |
| 24 | W10c | *Quercus robur - Pteridium aquilinum - Rubus fruticosus* agg. woodland<br>*Hedera helix* sub-community |
| 25 | W21 | *Crataegus monogyna - Hedera helix* scrub<br>*Hedera helix - Urtica dioica* sub-community |
| 26 | W22 | *Prunus spinosa - Rubus fruticosus* agg. scrub<br>No clear NVC sub-community |
| 27 | W23 | *Ulex europaeus - Rubus fruticosus* agg. scrub<br>No clear NVC sub-community |
| 28 | W24 | *Rubus fruticosus* agg. - *Holcus lanatus* underscrub<br>No clear NVC sub-community |
| 29 | W25 | *Pteridium aquilinum - Rubus fruticosus* agg. underscrub<br>No clear NVC sub-community |
| 30 | X2 | *Alnus glutinosa* slack woodland |
| 31 | X3 | *Pinus nigra/sylvestris* woodland |
| 32 | X4 | *Acer pseudoplatanus* woodland |

a = mapping unit  b = vegetation unit
X = Non-NVC category or transitional type

# Whiteford




x No survey  BS Bare sand  WR Woodland ride  ■ Building  ·-·-· Major path  ·n Quadrat location  TNn Target note location

Vegetation legend on separate sheet

Surveyed 1989 by T.C.D. Dargie

0 500 1000 metres