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**No. 99
NATIONAL SAND DUNE VEGETATION SURVEY
SITE REPORT NO. 49
PORT-EYNON TO HORTON
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

Port-Eynon to Horton 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 Port-Eynon to Horton is to be considered in a broader geographical and ecological context.

2. METHODS

Port-Eynon to Horton 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

Port-Eynon to Horton (Swansea, West Glamorgan) is located in South Gower (Fig. 1). It is not an SSSI but forms part of the more extensive South Gower Coast site of national nature conservation and is within the Gower AONB. The dunes are owned by Swansea City Council and permission for access was sought from Mr TM Osborne, Director of Development, Swansea City Council.

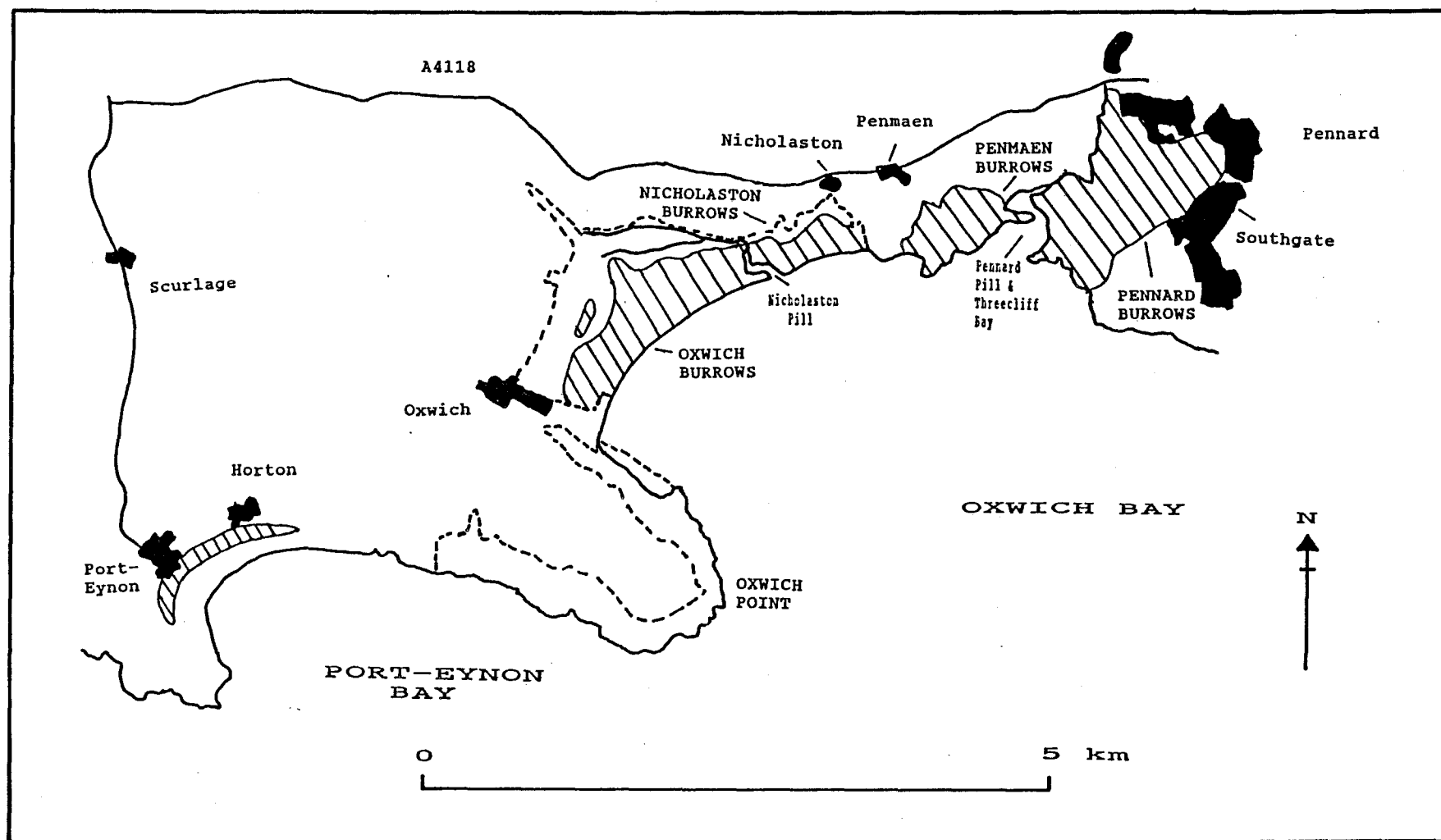


Figure 1 Survey and SSSI boundaries for South Gower study area

Dashed lines are Oxwich Bay SSSI boundaries
Hatching denotes surveyed dune areas

Geomorphology

Port-Eynon to Horton represents a bay dune system developed on top of shingle.

Dune sand is derived from Devensian till and outwash materials deposited in Swansea Bay and south of the Gower peninsula by piedmont glaciers fed from high land further east. A submerged offshore shingle bar was probably created by a rising Flandrian sea level and this migrated landward. A slight fall in sea level and tidal exposure then probably led to coverage by sand which was then vegetated.

When close to shore this barrier beach may have created a poorly-drained depression to landward but organic deposits in this were probably overrun by sand once the beach reached shore.

In March 1978 the west coast of Wales suffered severe damage from storms and at Port-Eynon the village was filled with sand (Cole 1985). Damage to the dunes by visitor pressure might have been a contributory factor. Roads were filled with several feet of sand, some properties were buried and drains became blocked. Restoration work was started immediately to prevent landward movement of the dunes and the loss of the barrier beach as a coastal defence. The entire dune frontage was divided into nine separate compartments bordered by stock-proof fencing. Long lines of plastic mesh ('Monomesh') were set in the dunes to trap sand (these are visible on the 1979 survey photographs), marram grass was planted, and wooden boardwalk or concrete slab was put down on lines of access to the beach. There has been an excellent recovery, though intense visitor pressure severely limits further natural development of the area as a geomorphological system.

Soils

All soils sampled were young and probably very calcareous (pH range 7.4 - 8.1). These results reflect the impact of blown beach sand and inadequate time for leaching to have effect on a stable surface.

Management

The dunes between Port-Eynon and Horton are an important recreational resource for the local population and large numbers of visitors using the large car parks and very many static caravans positioned immediately behind the dunes. The fencing and pathways keep the majority of people off sensitive and recovering dune areas. Up to 20,000 people per day on a good summer bank holiday can use the beach (Cole 1985) and the resulting litter and organic debris are scraped clear by tractor on a regular basis. This, plus trampling, probably destroys embryo foredunes. All management is carried out by Swansea City Council.

4. VEGETATION OF PORT-EYNON TO HORTON

This section contains a general description of the vegetation of Port-Eynon to Horton. 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 types is given in Annex 8.

Strandline

There is no strandline - beach scraping by tractor removes material left by tidal deposition.

Foredune

There are no foredunes - beach scraping by tractor removes material left by tidal deposition and prevents sand burial which is essential for foredune construction.

Dune grassland

A restricted variety of young grassland types is present. These are related to various stages of recolonisation and shelter conditions established after the massive erosion in 1978. There is a broad zonation going northwest and inland from the beach.

There are mobile dunes forming the dune front and these contain a mosaic of two types: Marram (*Ammophila arenaria*) with few other species (4 - NVC SD6d) on the highest and most exposed sites, and a mix of Marram and Red Fescue (*Festuca rubra*) in more sheltered locations behind the outer dune ridge (5 - NVC SD6e).

Two types of semi-fixed dune community are found. Gentle slopes or areas with recent trampling have a turf (6 - NVC SD7c) of Marram, Red Fescue and Common Restharrow (*Ononis repens*). On steeper slopes there is a sparser cover of Marram and Red Fescue, with much moss (*Tortula ruralis* ssp. *ruraliformis*). Annual species grow between Marram tufts: 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 code SD7d.

The dominant vegetation type in young Port-Eynon to Horton dunes, and the most distant from the beach, is a fixed grassland (8, NVC code SD8) with much Red Fescue and some Lady's Bedstraw (*Galium verum*). It is quite rank and often forms a mosaic with Type 7 grassland. At the rear of the dunes, close to paths used for dog-walking, there are pockets of tall rank grassland with False-oat Grass (*Arrhenatherum elatius*) and Cock's-foot Grass (*Dactylis glomerata*), suggesting enrichment from excreta.

Woodland and scrub

There is little scrub at Port-Eynon to Horton. It has no Sea Buckthorn (*Hippophae rhamnoides*). There is some Blackthorn scrub (*Prunus spinosa*, Type 26 NVC W22) and Bracken (*Pteridium aquilinum*) is invading in a small area (29 - NVC W25). There are occasional bushes of Privet (*Ligustrum vulgare*) present in the outer and inner dunes but never in enough quantity to warrant mapping.

A small area of young Sycamore (*Acer pseudoplatanus*) is growing on the edge of Port-Eynon village.

Other habitats

No other vegetation types were recorded at Port-Eynon to Horton. There are no dune slacks or dune heath.

Recent changes in vegetation

No air photos other than those used in survey (1979) are available to examine change. The overall impression gained during survey is that much re-vegetation has, and is continuing, to take place. It is also probable that there has been a long-term reduction in grazing pressure upon the dune grasslands, leading to formation of a rank turf in many places and allowing some shrub invasion.

5. RARE PLANTS

No rare species were found but in the southwest of the dune system a few individuals of the local Sea Stock (*Matthiola sinuata*) were found, plus Rock Samphire (*Crithmum maritimum*) growing on sand.

6. SITE ASSESSMENT

Port-Eynon to Horton is limited in interest. A young set of grasslands is present and much is the direct result of artificial dune stabilisation and continued close management. There is no accretion at the dune front. The range of community types is not large and the area of dune is small. It has an important educational role as an example of successful revegetation. There is a very high degree of impact but given the number of visitors to the area it is kept in good condition.

7. COMMENTS AND SUGGESTIONS

The educational possibilities of the site could be stressed to Swansea City Council if a demonstration of Gower dune types (and their management problems) is required.

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 Colour (poor quality) c. 1:6000 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 Panchromatic (excellent quality) c. 1:5000 Run 17 Prints 2563-2566 Run 18 Prints 2478-2482
Oxwich and Nicholaston	Cambridge University RC8KW 20 June 1983 Colour (fair quality) c. 1:5000 Prints 201-207, 209-213 (212 missing), 218-222.
Port-Eynon to Horton	Cambridge University RC8DA 26 June 1979 Panchromatic (good quality) c. 1:10000 Prints 268-270
Hillend to Whitford	MAFF/ADAS Hasselblad 7 May 1989 Colour (good quality) c. 1:10000 Run 89-18 Prints 43-51, 66-68 Run 89-27 Prints 08-09
Pembrey Coast	MAFF/ADAS 15 June 1986 Panchromatic (excellent quality) c. 1:11000 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-groups 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	Ainu glut 153	Alth offi 2656	Anno aren 159	Anec pyra 160
Anag tene 163	Anth odor 171	Anth vuln 174	Aren serp 194	Arne aari 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	Card prat 295	Care aren 304	Care flac 323
Care nigr 333	Care pani 339	Carl vulg 362	Cent cryt 373	Cera diff 381
Cera font 384	Cera scai 385	Cirs arve 415	Cirs vulg 419	Coch dani 425
Coch offi 427	Cory cane 3075	Crep capi 447	Crit aari 452	Cyti scop 1193
Dact glom 465	Dact inca 467	Dact saja 2828	Dant decu 1249	Dauc caro 475
Desc cesp 477	Desc flex 478	Eleo palu 509	Elya farc 116	Elya oycn 117
Elya 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 aari 555	Euph offi 568	Euph para 565	Euph port 567
Fest ovin 574	Fest rubr 576	Fili ulna 583	Gali apar 605	Gali palu 609
Gali veru 613	Gent ulig 3052	Glau flav 635	Glau aari 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 aari 734
Junc aqua 736	Koel aacr 746	Leon autu 768	Leon tara 770	Lepi lati 3702
Lino bine 778	Linu cath 786	Lipa loes 3074	Lotu corn 800	Lotu ulig 802
Luzu camp 807	Lych flos 813	Lycu euro 823	Matr aari 1355	Matt sinu 841
Medi lupu 844	Ment aqua 855	Nibo mini 3183	Myos arve 884	Oena lach 911
Oeno bien 912	Onon repe 914	Ophr apif 918	Orob mino 928	Pedi palu 946
Phle aren 958	Phra aust 961	Plan coro 972	Plan lanc 973	Plan aari 975
Poa prat 988	Poa triv 990	Poly orys 1010	Poly vulg 995	Popu trem 1022
Pote anse 1043	Prun vulg 1059	Pter aequi 1066	Puli dyse 1069	Pyro rotu 1073
Ranu acri 1081	Ranu flou 1089	Ranu repe 1095	Rhin mino 1106	Rubu frut 1136
Rume acet 1139	Rume cris 1143	Rume ells 1140	Rume aari 1146	Savi proc 1158
Sali repe 1179	Sais kali 1184	Samb nigr 1187	Samo vale 1189	Scir aari 1213
Scir seta 1214	Sedu acre 1225	Sene jaco 1239	Sene vulg 1243	Sile conl 3235
Sile vulg 1259	Sola dulc 1268	Soli virg 1270	Sonc arve 1271	Sonc aspe 1272
Stel aedi 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 aari 1353
Trig palu 1354	Ulex euro 1363	Vero chae 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 algo 1545	Bryum sp. 2807	Call cusp 1445
Camp stel 1571	Cera purp 1586	Clad arbu 2340	Clad furc 2362	Clad rang 2381
Clin dend 1593	Corn acul 2410	Dier scop 1638	Eury prae 1677	Hosa lule 1562
Hypn cupr 1766	Hypo phys 2416	Looph bide 2167	Pelt cani 2486	Plag undu 1807
Poly pill 1897	Pseu puru 1914	Rhyt squa 1940	Rhyt triq 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 cusped 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* - *Campylum 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 psammose 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 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*.

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

These dunes are usually dominated in Britain by Marram, plus substantial amounts of *Festuca rubra* and *Ononis repens*. Reduced sand deposition compared to other communities to seaward enables high vegetation cover and the start of dune stabilisation.

This vegetation type is very extensive in the dunes of this study and it is possible to recognise four variants (6v1-4).

6v1 variant *Ononis repens* is less common (frequency class III) and is often replaced by an alternative legume (*Anthyllis vulneraria* or *Lotus corniculatus*). Small gaps in the turf are frequent and these are often occupied by winter annuals (*Phleum arenarium*, *Sedum acre*, *Arenaria serpyllifolia*). This is the dominant type at Crymlyn Burrows and is transitional from SD6c to SD7d (*Tortula ruralis* ssp. *ruraliformis* sub-community).

6v2 variant *Ononis repens* is very common and achieves a reasonable cover. Other species suggest this is a community of damper ground (hollows and slack margins, especially at Crymlyn), with *Holcus lanatus* and *Agrostis stolonifera* the main moisture indicators. Mesic conditions in some stands may be created by shading from *Rubus fruticosus* agg..

6v3 variant This is the most typical form found, with high cover and a tall sward being invaded by *Rubus caesius*, *R. fruticosus* agg. or *Arrhenatherum elatius*. These successional transitions to shrub or mesotrophic grassland seem in part due to a lack of grazing in most large dune systems.

6v4 variant This is a small quadrat set which is difficult to interpret and may represent rather heterogeneous conditions. It is species-rich and this vegetation is either trampled dune being invaded by *Rubus caesius* (at Oxwich and Hillend), or is developed on thin sand over limestone on cliffs at Pennard.

The extensive quantities of type 6-SD7c vegetation reflect in part the rapid stabilisation of mobile dunes (and perhaps even foredunes at Crymlyn and Pembrey Burrows) which tend to be low in height and inextensive. In addition their extent shows stabilisation of dune systems with extensive parabolic dune blowouts which were recently mobile (Oxwich, Whiteford).

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

The usual characteristics of this community in Britain are similar to 6-SD7c: abundant Marram and frequent *Festuca rubra* and *Ononis repens*. It is normally distinguished from SD7c by common *Hieracium pilosella* agg., several species of annual, and often an abundant moss carpet of *Tortula ruralis* ssp. *ruraliformis*. Many of these features are found in South Wales dunes but there are local differences because *Festuca rubra* is comparatively rare and *H. pilosella* has a very weak presence. Winter annuals are a prominent component, especially *Phleum arenarium*, *Arenaria serpyllifolia*, *Cerastium diffusum*, *Vulpia fasciculata*, *Sedum acre* and *Aira praecox*. More rarely *Viola tricolor*, *Cerastium semidecandrum*, *Arabis hirsuta* and *Desmazeria rigida* can be found.

The community is very common in several locations, colonising SD6 mobile dunes either near actively extending foreshores (Crymlyn, Nicholaston, Tywyn) or on the steep slopes and flanks of vegetated blowouts (Oxwich, Llangennith/Broughton). It is rare at Pembrey Burrows, suggesting that dune orientation in that system is sheltered, not creating the sand burial rates which favour this community. It is very rare at Penmaen and Pennard, occurring only as very isolated and small coverage on thin sandy rendzinas overlying limestone. It was not mapped in these two latter places.

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

This community in Britain usually consists of a closed sward made up of grasses, dicotyledons and mosses. Marram may be only occasional and often lacks vigour. There is very little sand accumulation and the first signs of leaching impact are often found here in terms of indicators of soil acidity.

There are three potential sub-communities likely to be found in South Wales but none can be proposed with confidence. Instead, five variants can be recognised and related to local succession and moisture conditions. The absence of clear sub-communities is probably the result of no intensive grazing, a finding in studies elsewhere in Britain.

8v1 variant Marram and *Festuca rubra* are dominant, with appreciable quantities of the moss *Homalothecium lutescens* in the turf. *Ononis repens* and *Galium verum* are fairly common (frequency class III) and the variant is probably an early SD8 type emerging in succession from 7-SD7c.

8v2 variant There is little Marram and most cover is contributed by *Festuca rubra* and the moss *Homalothecium lutescens*. There is virtually no *Ononis repens*, *Galium verum* is infrequent and early leaching indicators are quite common (the moss *Dicranum scoparium* and the lichens *Cladonia rangiformis* and *C. impexa*). Soil samples had some of the lowest pH values of SD8 samples. It is probably the oldest SD8 grassland type, grading into 10-SD12 *Carex arenaria* - *Festuca ovina* - *Agrostis capillaris* grassland over time.

8v3 variant Both Marram and *Festuca rubra* are frequent but *Galium verum* is low (class II) in frequency. There is a high moss cover involving pleurocarps (*Homalothecium lutescens* and *Eurynchium praelongum*) and the acrocarp *Dicranum scoparium* to suggest a trend towards acidity. A large proportion of quadrats also shows shrub invasion by *Rubus caesius*. The high frequency of *Holcus lanatus* (class IV) suggests that moisture is an important determinant of the variant.

8v4 variant This is closest to the SD8a Typical sub-community and many quadrats did show signs of close rabbit grazing. It has abundant *Festuca rubra* and *Galium verum*, with plentiful *Plantago lanceolata*. There are, however, significant quantities of shrubs (notably *Rosa pimpinellifolia* and *Rubus caesius*) and other indicators of shading and invasion (*Pteridium aquilinum*, *Geranium sanguineum*). These suggest a former SD8a community in early transition towards scrub, probably following a relaxation in grazing pressure.

8v5 variant This variant is a more extreme form of 8v4. There is a high degree of invasion by *Pteridium aquilinum* and species typical of early scrub and rank growth: *Geranium sanguineum*, *Rubus caesius* and *Rosa pimpinellifolia*. This community is particularly common between Port-Eynon and Horton where there are a few more nitrophilous species to suggest trampling and dog-walking effects.

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

In Britain this community is found on less-heavily grazed stretches of fixed calcareous dune systems. There is no clear fit with NVC sub-communities because Marram is rare in variant 9v1 and infrequent in 9v2. The species composition of the two variants suggests that the community is seral in character and that it is undergoing rapid change towards scrub development.

9v1 variant *Arrhenatherum elatius* is relatively infrequent in a rank *Festuca rubra* and *Holcus lanatus* sward which contains large quantities of *Rubus caesius*. There are reasonable quantities of both *Ononis repens* and *Galium verum*, suggesting that the community has developed rapidly from SD7 and SD8 categories. The high quantity of *Holcus lanatus* and occasional presence of *Salix repens* suggest that moist conditions may be a characteristic of sites which have also had a relaxation in grazing.

9v2 variant This variant shows a more advanced stage of scrub development in SD9 communities. There is both a tree and shrub presence in many samples, with quadrats located in a grassland/scrub mosaic at the rear of several systems (notably Crymlyn Burrows, Black Pill, Hillend/Broughton, Pembrey Burrows).

Where both variants occur in a single system, 9v1 tends to be more seaward suggesting the community is currently extending towards younger dune grassland types.

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.

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* - *Calliargon 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 *Calliargon 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* - *Calliargon 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:

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

- 26 W22 *Prunus spinosa* - *Rubus fruticosus* agg. scrub
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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
355	2	356	8v5	357	7	358	8v5
359	4	360	7	361	26	362	4
363	7	364	26	365	8v5	366	8v5
367	8v5	368	8v5	369	8v4	370	8v4
371	8v5	372	29	373	8v5 26	374	8v5
375	8v4	376	8v4	377	7	378	6v1
379	7 21	380	7 21	381	29 32	382	6v1
383	5	384	7	385	6v3	386	7
387	4	388	8v5	389	6v3	390	8v5

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 VEGETATION
UNIT UNIT

2 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

FREQ- DOMIN
UENCY VALUE

Elymus farctus V 5
Salsola kali III 4
Atriplex prostrata III 4
Cakile maritima II 1
Horkensya peploides II 3
Beta vulgaris maritima II 3

MAP VEGETATION
UNIT UNIT

4 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

FREQ- DOMIN
UENCY 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 VEGETATION
UNIT 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

FREQ- DOMIN
UENCY 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 VEGETATION
UNIT 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

FREQ- DOMIN
UENCY 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 VEGETATION
UNIT UNIT

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

Tree height (m) -
Shrub/bracken height (m) 0.4
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

FREQ- DOMIN
UENCY 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
Hypochaeris 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 VEGETATION
UNIT 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

	FREQ- UENCY	DOMIN VALUE
<i>Phleum arenarium</i>	V	3
<i>Ammophila arenaria</i>	IV	5
<i>Arenaria serpyllifolia</i>	IV	3
<i>Cerastium diffusum diffusum</i>	IV	3
<i>Hypochaeris radicata</i>	IV	3
<i>Carex arenaria</i>	IV	3
<i>Oenothera erythrosepala</i>	IV	3
<i>Tortula ruralis</i> ssp. <i>ruraliformis</i>	III	5
<i>Leontodon hispidus</i>	III	3
<i>Vulpia fasciculata</i>	III	4
<i>Senecio jacobaea</i>	III	2
<i>Sedum acre</i>	III	3
<i>Ononis repens</i>	III	4
<i>Festuca rubra</i>	II	4
<i>Ceratodon purpureus</i>	II	5
<i>Holcus lanatus</i>	II	4
<i>Rubus caesius</i>	II	4
<i>Aira praecox</i>	II	3

MAP VEGETATION
UNIT UNIT

8 SDB *Festuca rubra* - *Galium verum* fixed
dune community
No clear MVC 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

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

MAP VEGETATION
UNIT UNIT

8 SDB *Festuca rubra* - *Galium verum* fixed
dune community
No clear MVC 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

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

MAP VEGETATION
UNIT UNIT

21 SD18a Hippophae rhamnoides scrub
Festuca rubra sub-community

Tree height (m) -
Shrub/bracken height (m) 0.4-2
Herb height (cm) 40
Tree cover (%) -
Shrub cover (%) 40
Herb cover (%) 60
Cryptogam cover (%) 20

Bare surface (%) 10
pH 7.4-7.8
Mean species per quadrat 14.4

	FREQ- UENCY	DOMIN VALUE
Hippophae rhamnoides	V	5
Ammodendron arbuscula	IV	5
Carex arenaria	III	3
Festuca rubra	III	6
Holcus lanatus	III	5
Rubus caesius	III	6
Hypochaeris radicata	III	3
Senecio jacobaea	III	3
Rubus fruticosus agg.	II	4
Cerastium diffusum diffusum	II	3
Oenothera erythrosepala	II	3
Agrostis stolonifera	II	4
Arenaria serpyllifolia	II	3
Leontodon hispidus	II	3
Lotus corniculatus	II	4

MAP VEGETATION
UNIT UNIT

26 W22 Prunus spinosa - Rubus fruticosus agg. scrub
No clear MVC 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

	FREQ- UENCY	DOMIN VALUE
Prunus spinosa	V	8
Eurynochium 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
Tamus communis	II	1

MAP VEGETATION
UNIT UNIT

29 W25 Pteridium aquilinum - Rubus fruticosus
agg. underscrub
No clear MVC 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

	FREQ- UENCY	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 VEGETATION
UNIT 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

	FREQ- UENCY	DOMIN VALUE
Acer pseudoplatanus	V	9
Rubus fruticosus	IV	4
Hyacinthoides non-scripta	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 TNn.

PORT-EYNON TO HORTON

- 1 Local erosion by trampling now controlled by exclosure fencing and controlled beach access along boardwalk or concrete slab pathways.
- 2 Frontal dunes removed (or perhaps eroded) to provide seating and access for tractor to reach beach and scrape litter (plus strandline and foredunes?).
- 3 Large dune area with exclosure fencing.
- 4 Temporary dump for organic material and litter removed by tractor on beach.
- 5 Stream comes through dune front and erosion of dune front at this point protected by sloped gabirons which have only strandline and foredune flora on this site.
- 6 Steep dune front merges into cliff with shingle exposed at base. Scrub developing on dune top also extends on to top of cliff.

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.

355 9 0 10 0 11 20 13 0 14 0 15 30 16 0 22 70 116 2 159 1
 355 217 5 268 31143 11184 22801 3
 356 9 0 10 1 11 40 13 0 14 60 15 50 16 10 22 0 159 4 283 3
 356 304 3 433 2 465 2 576 3 631 71066 41123 81519 4
 357 9 0 10 0 11 50 13 0 14 0 15100 16 30 22 0 103 1 159 6
 357 283 3 304 3 576 7 613 4 631 6 706 31066 31205 31239 11519 4
 357 1586 42023 4
 358 9 0 10 1 11 60 13 0 14 90 15 20 16 0 22 0 159 4 776 9
 358 1066 4
 359 9 0 10 0 11 50 13 0 14 0 15 30 16 0 22 75 159 5 283 3
 359 555 1 706 31272 1
 360 9 0 10 0 11 20 13 0 14 0 15 60 16 50 22 10 159 4 283 2
 360 304 3 706 1 769 3 800 3 913 1 914 4 958 31205 31434 41586 8
 360 2023 4
 361 9 0 10 2 11 30 13 0 14 70 15 5 16 10 22 20 576 31136 8
 361 1187 81519 4
 362 9 0 10 0 11 60 13 0 14 0 15 80 16 90 22 10 159 9 283 4
 362 706 3 913 21127 41205 31586 81677 4
 363 9 0 10 0 11 20 13 0 14 0 15 70 16 25 22 30 116 4 159 4
 363 381 4 565 2 769 3 841 3 913 2 914 7 958 31205 31586 5
 364 9 0 10 2 11 20 13 0 14100 15 5 16 10 22 0 465 11136 5
 364 1187 71677 42936 8
 365 9 0 10 0 11 60 13 0 14 0 15 90 16 30 22 10 159 8 304 3
 365 433 3 585 51239 41519 51677 4
 366 9 0 10 1 11 40 13 0 14 30 15 70 16 0 22 0 159 3 304 3
 366 433 3 465 4 576 6 631 81053 31123 61127 4
 367 9 0 10 1 11 70 13 0 14 40 15 70 16 50 22 0 304 3 433 3
 367 576 5 613 4 631 61053 31066 71123 71127 41519 51677 6
 368 9 0 10 0 11100 13 0 14 0 15100 16 0 22 0 433 4 631 4
 368 680 2 988 2 990 21053 41066 91127 62982 1
 369 9 0 10 0 11 20 13 0 14 0 15 60 16 70 22 0 171 4 202 3
 369 251 2 304 4 433 2 465 3 576 3 613 4 631 4 656 4 746 3 973 4
 369 1053 41066 41123 41205 31333 41914 8
 370 9 0 10 1 11 30 13 0 14 20 15 80 16 70 22 0 304 3 433 2
 370 465 3 576 6 613 4 631 5 973 4 988 41053 31066 41123 51333 3
 370 1914 8
 371 9 0 10 1 11 70 13 0 14 30 15 80 16 30 22 0 104 1 197 4
 371 304 4 433 3 465 4 613 3 631 5 988 31053 21066 61123 51127 4
 371 1519 61801 22936 5
 372 9 0 10 3 11 40 13 0 14100 15 10 16 40 22 0 433 2 631 3
 372 637 4 990 31066 41123 51127 21136 91519 41677 51801 41914 4
 372 2936 3
 373 9 0 10 2 11 70 13 0 14 30 15 80 16 15 22 0 304 4 433 3
 373 465 4 576 4 613 4 631 6 973 3 990 41053 31066 71123 51127 4
 373 1239 21519 52936 6
 374 9 0 10 2 11170 13 0 14 90 15 20 16 5 22 0 103 3 304 3
 374 433 2 631 4 776 9 988 3 990 31066 41123 51677 32936 4
 375 9 0 10 1 11 40 13 0 14 10 15100 16 0 22 0 122 3 304 4
 375 433 3 465 6 613 4 973 4 988 61053 41239 32936 4
 376 9 0 10 1 11 70 13 0 14 15 15100 16 70 22 0 103 3 304 4
 376 433 2 465 4 576 8 613 4 800 3 914 4 973 4 988 41053 41066 5
 376 1123 3
 377 9 0 10 0 11 10 13 0 14 0 15 30 16 70 22 25 194 3 381 3
 377 576 3 706 3 800 3 913 5 958 41205 31239 21434 31510 31586 8
 377 2023 3
 378 9 0 10 0 11 30 13 0 14 0 15100 16 15 22 0 159 4 304 4
 378 576 7 706 3 913 31127 51519 5
 379 9 0 10 1 11 20 13 0 14 20 15 30 16 45 22 50 159 4 194 4

379 304 2 381 3 678 5 706 3 800 4 913 4 958 41127 21205 21434 4
 379 1586 7
 380 9 0 10 1 11 40 13 0 14 40 15 50 16 60 22 30 159 5 194 3
 380 283 4 304 3 381 3 576 2 585 1 678 6 706 4 776 5 800 4 913 4
 380 958 31434 41586 8
 381 9 4 10 0 11 40 13 95 14 0 15 40 16 15 22 0 103 10 151 2
 381 167 1 197 3 652 61066 21127 51272 21510 31519 51677 3
 382 9 0 10 0 11 40 13 0 14 0 15 95 16 2 22 5 159 5 433 2
 382 576 9 706 2 913 2 914 6 958 21127 31239 11519 3
 383 9 0 10 0 11 50 13 0 14 0 15 70 16 60 22 10 104 3 159 7
 383 283 4 376 4 576 5 585 1 706 31239 21510 41519 81940 4
 384 9 0 10 0 11 30 13 0 14 0 15 40 16 60 22 20 104 1 159 5
 384 194 3 304 3 381 2 465 2 565 2 706 3 958 31239 11434 21510 5
 384 1519 41586 72023 42982 1
 385 9 0 10 0 11 40 13 0 14 0 15100 16 35 22 0 159 5 304 4
 385 433 3 576 8 585 4 613 4 706 2 914 6 988 41519 51677 6
 386 9 0 10 0 11 20 13 0 14 0 15 30 16 0 22 70 116 2 159 3
 386 304 3 555 3 565 1 576 4 706 3 800 5 841 4 913 4 958 31225 3
 386 1239 31434 3
 387 9 0 10 0 11100 13 0 14 0 15100 16 0 22 0 159 10 452 2
 387 1239 3
 388 9 0 10 1 11100 13 0 14 20 15 80 16 0 22 0 159 2 304 3
 388 433 31066 81123 51127 71187 3
 389 9 0 10 0 11100 13 0 14 0 15100 16 0 22 0 304 4 433 4
 389 465 2 576 8 613 6 706 1 914 5 958 2 988 41239 11272 2
 390 9 0 10 1 11100 13 0 14 90 15 30 16 0 22 0 159 3 304 3
 390 433 31066 61123 91127 5

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	PORT-EYNON
1	X1	-
2	SD4	-
3	SD6a	-
4	SD6d	2.43
5	SD6e	1.92
6	SD7c	2.56
7	SD7d	2.05
8	SD8	3.21
9	SD9	0.64
10	SD12	-
11	H11	-
12	SD14c-SD15a/b	-
13	SD15c	-
14	SD16a/b-SD16c/d	-
15	SD17	-
16	SM18b	-
17	SM24	-
18	S4a	-
19	S4d-S21b	-
20	S12b	-
21	SD18a	-
22	SD18b	-
23	W1	-
24	W10c	-
25	W21a	-
26	W22	0.64
27	W23	-
28	W24	-
29	W25	1.02
30	X2	-
31	X3	-
32	X4	0.77
1-11 (strand/ grassland/heath)		12.81
12-15 (dune slacks)		-
16-20 (saltmarsh/ swamp)		-
21-32 (scrub/ woodland)		2.43
Other:		-
Total		15.24

ANNEX 9

SITE BIBLIOGRAPHY

Very little information on Port-Eynon to Horton is available at the Oxwich Information Centre. One dissertation comparing these dunes with Oxwich NNR is the sum total.

Cole, S.M. (1985) An investigation into the effects of recreation and management on the sand dunes at Oxwich and Port-Eynon Bays, Gower, S. Wales. Undergraduate dissertation, Plymouth Polytechnic.

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	<i>Elymus farctus</i> foredune community
3	SD6a	<i>Ammophila arenaria</i> mobile dune community <i>Elymus farctus</i> sub-community
4	SD6d	<i>Ammophila arenaria</i> mobile dune community Typical sub-community
5	SD6e	<i>Ammophila arenaria</i> mobile dune community <i>Festuca rubra</i> sub-community
6	SD7c	<i>Ammophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community <i>Ononis repens</i> sub-community
7	SD7d	<i>Ammophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community <i>Tortula ruralis</i> ssp. <i>ruraliformis</i> sub-community
8	SD8	<i>Festuca rubra</i> - <i>Galium verum</i> fixed dune community No clear NVC sub-community
9	SD9	<i>Ammophila arenaria</i> - <i>Arrhenatherum elatius</i> dune grassland No clear NVC sub-community
10	SD12	<i>Carex arenaria</i> - <i>Festuca ovina</i> - <i>Agrostis capillaris</i> grassland No clear NVC sub-community
11	H11	<i>Calluna vulgaris</i> - <i>Carex arenaria</i> 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	<i>Salix repens</i> - <i>Campylum stellatum</i> dune slack <i>Bryum pseudotriquetrum</i> - <i>Aneura pinguis</i> sub-community
12	SD15a/b	<i>Salix repens</i> - <i>Calliergon cuspidatum</i> dune slack <i>Carex nigra</i> sub-community (a) <i>Equisetum variegatum</i> sub-community (b)
13	SD15c	<i>Salix repens</i> - <i>Calliergon cuspidatum</i> dune slack <i>Carex flacca</i> - <i>Pulicaria dysenterica</i> sub-community
14	SD16a/b	<i>Salix repens</i> - <i>Holcus lanatus</i> dune slack <i>Ononis repens</i> sub-community (a) <i>Rubus caesius</i> sub-community (b)
14	SD16c/d	<i>Salix repens</i> - <i>Holcus lanatus</i> dune slack <i>Prunella vulgaris</i> - <i>Equisetum variegatum</i> sub-community (c) <i>Agrostis stolonifera</i> sub-community (d)
15	SD17	<i>Potentilla anserina</i> - <i>Carex nigra</i> dune slack No clear NVC sub-community
16	SM18b	<i>Juncus maritimus</i> saltmarsh <i>Oenanthe lachenalii</i> sub-community
17	SM24	<i>Elymus pycnanthus</i> saltmarsh
18	S4a	<i>Phragmites australis</i> swamp and reed-beds <i>Phragmites australis</i> sub-community
19	S4d	<i>Phragmites australis</i> swamp and reed-beds <i>Atriplex hastata</i> sub-community
19	S21b	<i>Scirpus maritimus</i> swamp <i>Atriplex hastata</i> sub-community
20	S12b	<i>Typha latifolia</i> swamp <i>Mentha aquatica</i> sub-community

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

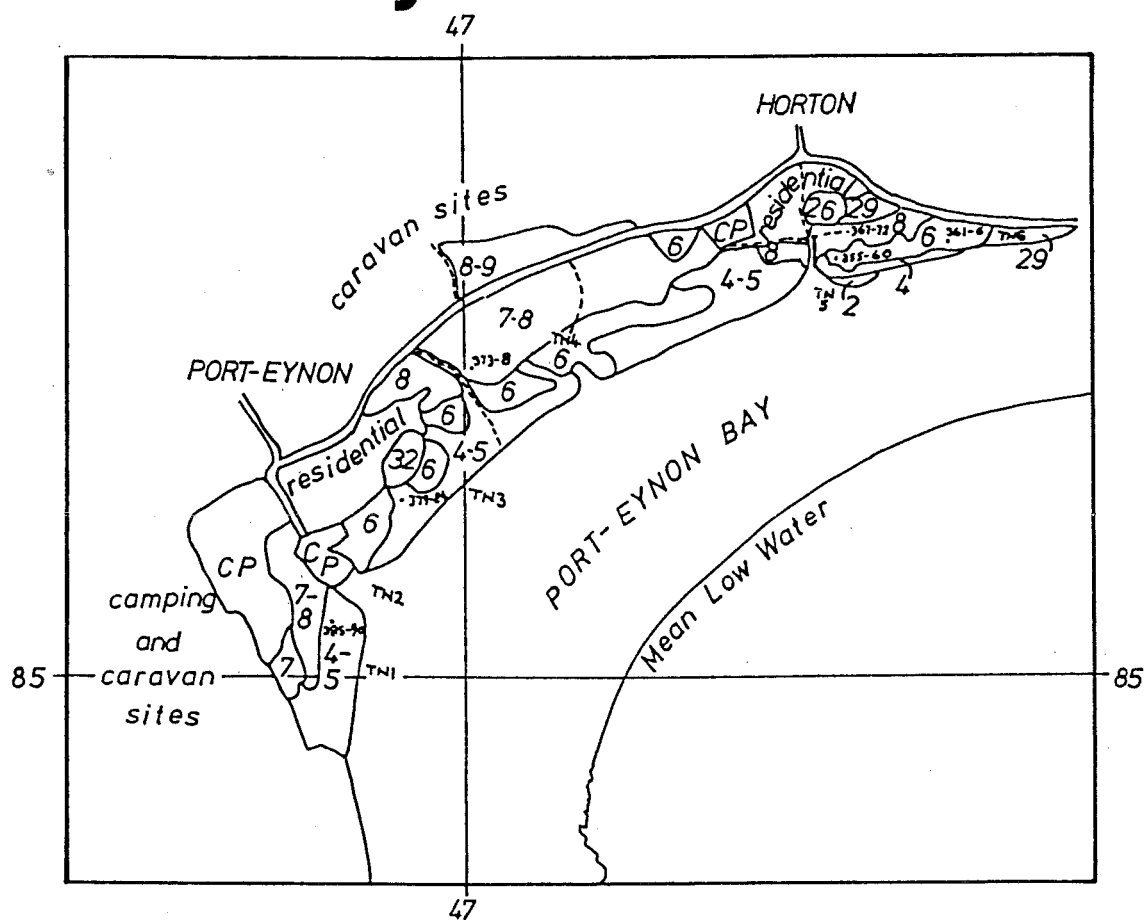
MAPPING AND VEGETATION UNITS FOR 1989 SOUTH WALES DUNE SURVEY

WOODLAND AND SCRUB

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

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

Port-Eynon to Horton



•n Quadrat location TNn Target note location CP Car park

Vegetation legend on separate sheet

Surveyed 1989 by T.C.D. Dargie

0 500 1000 metres